12197 Hurontario Street, Brampton and 12211, 12213 and 12231 Hurontario Street, Caledon, Ontario

Hydrogeological Investigation and Water Balance Assessment

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1 Introduction

1.1 Project Description

EXP Services Inc. (EXP) was retained by Argo Summer Valley Limited to prepare a Hydrogeological Investigation and Water Balance Assessment Report associated with the proposed development located at 12197 Hurontario Street, Brampton and 12211, 12213 and 12231 Hurontario Street, Caledon, Ontario (hereinafter referred to as the 'Site').

The Site is irregular in shape and covers an area of approximately 3.6 hectare (8.9 acres). The Site previously developed as a truck sales and repair facility and is presently vacant and has been remediated. It is our understanding that the proposed brownfield redevelopment will comprise construction of a residential subdivision inclusive of roads, sidewalks, sewers, watermains, and single-family dwellings. The Site location plan is shown on Figure 1.

EXP conducted a Preliminary Geotechnical Investigation and Environmental Site Assessment in conjunction with this 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;
- Provide recommendations on construction and long-term dewatering;
- Assess groundwater quality; and
- Prepare a Hydrogeological Investigation and Water Balance Assessment Report.

1.3 Scope of Work

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

- Reviewed available geological and hydrogeological information for the Site including source water protection (WHPA, SGRA, IPZ).
- Developed and conducted Single Well Response Tests (SWRT) on four (4) newly installed monitoring wells in geotechnical boreholes during the combined drilling program and previously installed monitoring wells to evaluate hydraulic properties of the saturated stratigraphic units at the Site.
- Complete one year of groundwater monitoring with bimonthly events of water level measurements (ongoing and will be included under an updated report).
- Collected one (1) groundwater sample for laboratory testing of the Region of Peel Sewer Use By-Law parameters.
- Completed three (3) shallow infiltration test holes by hand augering to less that 1 mbgs to support design of Low Impact Development features.
- Evaluated the information collected during the field investigation program, including borehole geological information, SWRT results, groundwater level measurements, existing foundation drainage investigation and groundwater quality.
- Prepared site plans, cross sections, geological mapping, and groundwater contour mapping for the Site.
- Estimated construction dewatering flow raters (construction).
- Assessed potential impacts and recommend mitigation measures.

- Assessed pre and post development water balance and infiltration levels and provided preliminary sizing of LIDs as required by TRCA.
- 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.

1.4 Review of Previous Reports

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

- EXP Services Inc. (February 7, 2022), Preliminary Geotechnical Investigation, 12197 Hurontario Street, Brampton and 12211- 12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Argo Development Corporation.
- EXP Services Inc. (January 27, 2022), Phase Two Environmental Site Assessment Update, 12197 Hurontario Street, Brampton and 12211- 12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Argo Summer Valley Ltd..
- EXP Services Inc. (January 5, 2022), Phase One Environmental Site Assessment Update, 12197 Hurontario Street, Brampton and 12211- 12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Argo Summer Valley Ltd.
- EXP Services Inc. (July 29, 2021), Remediation Report, 12197 Hurontario Street, Brampton and 12211- 12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Sobeys Capital Incorporated.
- EXP Services Inc. (May 22, 2020), Phase Two Environmental Site Assessment, 12197 Hurontario Street, Brampton and 12211- 12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Sobeys Capital Incorporated.
- EXP Services Inc. (January 20, 2020), Phase One Environmental Site Assessment, 12197 Hurontario Street, Brampton and 12211- 12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Sobeys Capital Incorporated.
- EXP Services Inc. (June 11, 2019), Subsurface Environmental Investigation, 12197 Hurontario Street, Brampton and 12211-12233 Hurontario Street, Caledon, Ontario, Toronto, ON, prepared for Sobeys Capital Incorporated.

Any past and/or future geotechnical, hydrogeological, environmental and risk assessments, and updated development/architectural plans should be provided to update this hydrogeological report prior to submission of permits and approvals by the municipalities and agencies.

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). Part of the South Slope is drumlinized. The South Slope is the southern slope of the Oak Ridges Moraine, which also includes the strip south of the Peel Plain. The South Slope lies to the north of the Iroquois Plain (Chapman & Putnam, 2007). It rises approximately 100 to 130 m in an average width of 10 to 11 kms.

2.1.2 Regional Geology and Hydrogeology

The surficial geology can be described as coarse textured (foreshore-basinal) glaciolacustrine deposits consisting of sand, gravel, minor silt, and clay (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).

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.	256.52
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.	243.59
Thorncliffe Formation (Aquifer)	This geology formation generally consists of glaciofluvial (sand, silty sand) or glaciolacustrine deposits (silt, sand, pebbly silt, and clay).	222.02
Queenston Formation	Bedrock primarily consists of shale, and siltstone. It belongs to the Upper Ordovician, (Ministry of Northern Development and Mines, 2012).	217.62

Regional groundwater across the area flows southeast, towards Lake Ontario (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 3. A summary of the WWR is included in Appendix A.

The MECP WWR database indicates that thirty-four (34) records within a 500 m radius from the Site centroid where two (2) well record are identified onsite (Figure 3 and Appendix A). Well distances are calculated relative to the Site centroid, therefore some distances in Appendix A exceed 500 m.

The database indicates that the offsite wells are at an approximate distance of twenty-nine (29) m or greater from the Site centroid. 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 Well Identification Numbers (Well ID No.) of the offsite water supply wells are 4901103, 4901104, 4901105, 4901108, 4901109, 4901609, 4901610, 4901611, 4901612, 4901613, 4901614, 4901617, 4901618, and 4902890.

The reported water levels ranged from depths of 2.0 m to 44.0 meters below ground surface (mbgs).

Based on the date of installation of the water supply wells (1950s-1970s) and since the area is municipally serviced, it is unlikely that the noted water supply wells are still active.

2.2 Site Setting

2.2.1 Site Topography

The Site is between residential and rural areas. The topography is considered relatively flat with a regional gradual southeasterly slope towards Etobicoke Creek and Lake Ontario.

As indicated on the borehole logs included in Appendix B, the surface elevation of the Site ranges between approximately 256.94 to 258.48 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. The nearest surface water feature is Etobicoke Creek, approximately located 295 meters east of the Site boundary. Lake Ontario is approximately 29 km from the Site boundary to the southeast.

2.2.3 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, 2022). 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

Approximately 120 mm thick layer of topsoil was encountered from ground surface in boreholes BH21-1, BH21-2, BH21-5, and BH21-6. It should be noted that the topsoil quantity should not be established from the information provided at the borehole locations only. As the site is highly disturbed with significant areas with no topsoil or asphalt surfaces, if required, a more

detailed analysis which involves shallow test pits should be carried out to accurately quantify the amount of topsoil to be removed for construction purpose.

Fill

Fill was encountered from ground surface in boreholes BH21-3 and BH21-4 and underlies the topsoil layer in remaining boreholes. The fill extends to depths of approximately 1.0 to 2.5 m below existing grade. The fill generally appeared to be reworked on-site material with the exception of near surface fill comprising sandy silt to silty sand with some sand and gravel pockets in Boreholes BH21-3 and BH21-4. Moisture contents in the fill ranged from approximately 8 to 27% indicating moist to wet conditions.

Sandy Silt Till

Sandy silt till exists below the fill in Boreholes BH21-1, BH21-2, BH21-4 and BH21-6. The sandy silt till extends to depths of approximately 4.2 to 8.1 m. The sandy silt till contains some clay, trace gravel and occasional oxidized zones. At depths between 6.0 to 6.6 m below grade, a wet silty sand layer was noted within the till in Borehole BH21-6 and a silt layer was noted in Borehole BH21-1. Borehole BH21-6 was terminated in sandy silt till at depth of 8.1 m below grade. The sandy silt till is generally brown in colour changing to grey below 4.5 m in Borehole BH21-6. The sandy silt till exists in a compact to dense state of compactness. Moisture contents in the sandy silt till were recorded between approximately 9 and 17% indicating moist conditions. The presence of cobbles and boulders should always be anticipated in the glacial till deposits, owing to their mode of deposition.

Clayey Silt Till

Clayey silt till exists below the sandy silt till in Boreholes BH21-1, BH21-2, BH21-4, and below the fill in Boreholes BH21-3 and BH21-5. Boreholes BH21-1 to BH21-5 in were terminated in the clayey silt till at approximately 8.1 m depth. The clayey silt till contains trace sand and trace gravel. The clayey silt till generally grey below 4.5 m depth. The consistency of the clayey silt till varies with depth and varies from one borehole location to another and generally assessed to be stiff to hard. Moisture contents in the clayey silt till were recorded between approximately 10 and 23% indicating moist to very moist conditions. The presence of cobbles and boulders should always be anticipated in the glacial till deposits, owing to their mode of deposition.

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 and Environmental Investigations at the Site. It consists of the following:

- Eleven (11) shallow overburden monitoring wells (BH103, TH201, TH202, MW301, MW302, MW303, MW304, BH21-1, BH21-2, BH21-3, and BH21-4) were installed;
- One (1) deep overburden monitoring well (TH203) was installed.

The diameter of all monitoring wells is 50 mm. All wells were installed with a stick up mount 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 seven (7) monitoring events, including January 5 and 12, April 11, May 19, July 21, September 30, and November 16, 2022. A summary of all static water level data as it relates to the elevation survey is given in Table 3-1 below.

The groundwater elevation recorded in the shallow wells ranged from 251.02 masl (6.78 mbgs at BH21-4 on November 16, 2022) to 257.92 masl (0.56 mbgs at BH21-2 on January 5, 2022). The groundwater elevation recorded for the deep wells ranged from 249.11 masl (9.03 mbgs at TH203 on September 30, 2022) to 249.71 masl (8.43 mbgs at TH203 on January 5, 2022).

Table 3-1: Summary of Measured Groundwater Elevations

Monitoring Well ID	Ground Surface Elevation (masl)	Approximate Full Well Depth (mbgs)	Depth	5-Jan-22	12-Jan-22	11-Apr-22	19-May-22	21-Jul-22	30-Sep-22	16-Nov-22
BH 103	258.14	9.05	mbTOP	7.94	7.95	7.52	7.39	8.06	7.88	7.98
			mbgs	6.88	6.89	6.46	6.33	7.00	6.82	6.92
			masl	251.26	251.25	251.68	251.81	251.14	251.32	251.22
TH201	257.84	0.92	mbTOP	1.64	1.83	1.77	2.00	2.65	2.41	2.82
			mbgs	0.72	0.91	0.85	1.08	1.73	1.49	1.90
			masl	257.12	256.93	256.99	256.76	256.11	256.35	255.94
TH202	257.28	0.97	mbTOP	1.74	2.12	2.00	2.13	2.73	2.60	2.95
			mbgs	0.77	1.15	1.03	1.16	1.76	1.63	1.98
			masl	256.51	256.13	256.25	256.12	255.52	255.65	255.30
TH203	258.14	0.80	mbTOP	9.23	9.36	9.33	9.31	9.70	9.83	9.81
			mbgs	8.43	8.56	8.53	8.51	8.90	9.03	9.01
			masl	249.71	249.58	249.61	249.63	249.24	249.11	249.13
MW301	257.27	1.09	mbTOP	1.64	1.98	1.84	2.13	3.19	3.08	3.60
			mbgs	0.55	0.89	0.75	1.04	2.10	1.99	2.51
			masl	256.72	256.38	256.52	256.23	255.17	255.28	254.76
MW302	258.14	1.01	mbTOP	3.20	3.11	2.46	2.55	3.33	3.43	3.77
			mbgs	2.19	2.10	1.45	1.54	2.32	2.42	2.76

Monitoring Well ID	Ground Surface Elevation (masl)	Approximate Full Well Depth (mbgs)	Depth	5-Jan-22	12-Jan-22	11-Apr-22	19-May-22	21-Jul-22	30-Sep-22	16-Nov-22
			masl	255.95	256.04	256.69	256.60	255.82	255.72	255.38
MW303	257.85	0.99	mbTOP	1.79	2.09	1.98	2.31	2.86	2.67	2.96
			mbgs	0.80	1.10	0.99	1.32	1.87	1.68	1.97
			masl	257.05	256.75	256.86	256.54	255.99	256.17	255.88
MW304	256.94	0.93	mbTOP	1.72	2.25	2.11	2.23	2.78	2.47	2.65
			mbgs	0.79	1.32	1.18	1.30	1.85	1.54	1.72
			masl	256.15	255.62	255.76	255.64	255.09	255.40	255.22
BH21-1	257.91	0.88	mbTOP	7.47	7.37	6.17	6.16	6.85	7.32	7.65
			mbgs	6.59	6.49	5.29	5.28	5.97	6.44	6.77
			masl	251.32	251.42	252.62	252.63	251.94	251.47	251.14
BH21-2	258.48	0.81	mbTOP	1.37	2.35	1.73	1.98	2.97	2.67	2.66
			mbgs	0.56	1.54	0.92	1.17	2.16	1.86	1.85
			masl	257.92	256.94	257.56	257.31	256.32	256.62	256.63
BH21-3	258.30	0.82	mbTOP	2.05	2.37	2.20	2.12	2.65	2.73	2.90
			mbgs	1.23	1.55	1.38	1.30	1.83	1.91	2.08
			masl	257.07	256.76	256.92	257.00	256.47	256.39	256.22
BH21-4	257.80	0.74	mbTOP	6.82	6.94	6.92	6.83	7.23	7.40	7.52
			mbgs	6.08	6.20	6.18	6.09	6.49	6.66	6.78
			masl	251.72	251.60	251.62	251.71	251.31	251.14	251.02

One map was created for the Site to show groundwater contours of the shallow water-bearing zone (Figures 6). Accordingly, the groundwater flow direction is interpreted to be east-southeast of the Site, towards Etobicoke Creek.

For the design of foundations without perimeter and foundation drainage systems, shallower wells need to be considered to evaluate the shallow groundwater table. The hydrogeologist needs to be consulted during the design process.

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. Seasonal groundwater level measurements are ongoing in order 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 BH21-1, BH21-2, BH21-3, and BH21-4 on January 12, 2022. The tests were completed to estimate the saturated hydraulic conductivity (K) of the soils at the well screen depths.

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		
BH21-1	257.91	254.91	257.91	Sandy Silt Till to Clayey Silt Till	1.2E-7
BH21-2	258.48	255.48	258.48	Clayey Silt Till	9.4E-9
BH21-3	258.30	255.30	258.30	Clayey Silt Till	1.3E-7
BH21-4	257.80	254.80	257.80	Clayey Silt Till	2.2E-7
Highest K Value					2.2E-7
Arithmetic Mean of K Values					1.2E-7
Geometric Mean of K Values					7.5E-8

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 2.2E-7 m/s. The arithmetic and the geometric mean of the K-values are 1.2E-7 m/s and 7.6E-8 m/s, respectively.

3.4 Groundwater Quality

To assess the suitability for discharging pumped groundwater into the sewers owned by the Peel Region during dewatering activities, one (1) groundwater sample was collected from monitoring well BH21-2, on January 12, 2022 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 AGAT Laboratories, 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 Peel Sanitary and Combined Sewer Discharge Criteria (Table 1), there were no parameter exceedances to be reported.

When comparing the chemistry of the collected groundwater samples to the Peel Storm Sewer Discharge Criteria (Table 2), only Manganese (Mn) reported an exceedance.

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	Region of Peel Sanitary and Combined Sewer Discharge Limit (Table 1)	Region of Peel Storm Sewer Discharge Limit (Table 2)	Concentration BH21-2 12-01-2022
Total Manganese (Mn)	µg/L	5	0.05	**0.056**

Bold – Exceeds Region of Peel Storm Sewer Discharge Limit (Table 2).
Bold & underlined – Exceeds Region of Peel Sanitary and Combined Sewer Discharge Limit (Table 1).

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 either or 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 discharged without a treatment system. 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 Region of Peel.

An agreement to discharge into the sewers owned by the Region of Peel will be required prior to releasing dewatering effluent.

The Subsurface Environmental Investigation (2019) was reviewed and determined the following exceedances to Table 4 SCS: Petroleum Hydrocarbons (PHC), Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR).

The Phase Two Environmental Site Assessment Report (2020) was reviewed and determined the following exceedances to MECP (2011) Table 4 SCS: EC and SAR in surficial soil and Sodium and Chloride in groundwater.

The Remediation Report (2021) was reviewed and determined through confirmatory wall and floor samples that soil PHC concentrations now met Table 4 SCS post-remediation. Soil EC and SAR concentrations were found to be within the PSS post-remediation.

The Phase Two ESA Update (2022) was reviewed and determined that no exceedances of the Table 4 SCS were identified in soil or groundwater.

The Modified Generic Risk Assessment (2022) was reviewed and determined that the parameters carried forward for consideration in the MGRA are: EC and SAR in soil, and sodium and chloride in groundwater.

3.5 Infiltration Testing

EXP completed four (4) infiltration rate tests (INF 21-3, INF 301, INF 303, and INF 203) within the Site area on April 11 and May 19, 2022. These tests were conducted in proximity of selected monitoring wells: BH/MW 21-3, BH/MW 301, BH/MW 303 and BH/MW 203.

Infiltration tests (IT) were conducted at depths ranged from 0.6 mbgs to 0.72 mbgs, depending on the measured groundwater elevation at the testing location. The reported water levels at these wells on May 19, 2022 are 1.30 mbgs (BH 21-3), 1.04 mbgs (BH 301), and 1.32 mbgs (BH 303) and 8.51 (BH 203). Table 3.3 below shows a summary of field saturated hydraulic conductivity (K) testing and design infiltration rates, as per the Low Impact Development (LID) Stormwater Management Planning and Design Guide, CVC – TRCA, 2010, Appendix F. 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 F.

Table 3.4: Summary of Infiltration Testing Results

Infiltration Test Location/ MW ID	Depth of Hole (mbgs)	Formation tested	Field Saturated Hydraulic Conductivity, K_{fs} (cm/s)	Infiltration Rates (mm/hr)
INF 21-3	0.60	Clayey silt till	6.3E-07	12
INF 301	0.72	Silt till	4.3E-06	20
INF 303	0.75	Silt and sand	1.4E-05	27
INF 203-Redo	0.83	Silt and sand	6.2E-05	41
Geometric Mean			**6.7E-06**	**23**
Design Infiltration Rate*				**9**

Notes:
*Safety Factor of 3.5 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 9 mm/hr.

4 Water Balance Study

4.1 Background Information

The Site is surrounded by existing residential areas and highways. The topography is considered relatively flat with a regional gradual southeasterly slope towards Etobicoke Creek and Lake Ontario. As indicated on the borehole logs included in Appendix B, the surface elevation of the Site ranges between approximately 256.94 to 258.48 meters above sea level (masl).

It is our understanding that the proposed development will comprise construction of a residential subdivision inclusive of roads, sidewalks, sewers, watermains, and single-family dwellings. The Site location plan is shown on Figure 1.

The surficial geology can be described as coarse textured (foreshore-basinal) glaciolacustrine deposits consisting of sand, gravel, minor silt, and clay (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

The Site is within the Etobicoke Creek watershed. No surface water features exist onsite. The nearest surface water feature is Etobicoke Creek, which lies approximately 295 meters east of the Site boundary. Lake Ontario is approximately 29 km from the Site boundary to the southeast.

4.2 Methodology

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is a counting method used to analyze the allocation of water among various components of the hydrologic cycle. This methodology was applied 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-transpire (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. The method is based on the United Stated Geological Survey (USGS) graphical user interface (Thornthwaite Monthly Water-Balance program, 2007). For ease of calculation, a spreadsheet was used for the computation.

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.

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 Woodbridge (Station ID No. 6159575) climatic station (elevation 164.0 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 irregular in shape and covers an area of approximately 3.6 hectare (8.9 acres). The Site was previously developed as a truck sales and repair facility and is presently vacant. It is our understanding that the proposed development will comprise construction of a residential subdivision inclusive of roads, sidewalks, sewers, watermains, and single-family dwellings. 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	8,439	24%
Paved Surfaces	24,663	66%
Site Area Available for Infiltration (Agricultural lands)	3,582	10%
Total Site Area	35,884	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 aerial photographs 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 10% 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
Building Roofs	11,885	0	11,885
ROW (roads, sidewalks, parking) - Paved	7,186	0	7,186
Open Areas/Landscaped Areas (Public)	0	16,813	16,813
Totals	19,070	16,813	35,884
Percentage %	53.1%	46.9%	100.0

Under post-development conditions, the total pervious area is increased from 10% to 46.9% of the total Site area (Tables 4.1 and 4.2 and Figure 8).

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 Georgetown WWTP (Station ID No. 6152695).

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 43^0, 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	877.30	542.00	335.30

Note: ET = Evapotranspiration

The results of climatic water balance analysis for the Site suggest that a surplus of 335.30 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 and 7). 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 0.42 (or 42%) represents the fraction of the water surplus available for infiltration. The complementary fraction of the available water for runoff is 0.58. 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 0.42 and a water surplus of 335.30 mm/yr, the estimated pre-development infiltration rate of the whole Site is 141.83 mm/yr.

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	36,245	8,439	31,481	19,449	10,835	1,197
Percentage of Total Precipitation			100%	62%	34%	4%

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: 69.0% of the total precipitation is subject to evapotranspiration, 15.0% to runoff, and 15.0% to infiltration.

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

$$P\ (31{,}481) = ET\ (19{,}449) + R\ (10{,}835) + I\ (1{,}197) + ST\ (0)$$

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 16,813 m^2, representing approximately 46.9% of the total Site area of 35,884 m^2 (Table 4.2). The remaining 19,070 m^2 is not available to contribute to infiltration during the post-development stage (approximately 53.1% 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 F-3). The estimated post-development total infiltration factor of 0.50 (or 50.0%).

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	35,884	16,813	31,481	9,113	19,549	2,819
Percentage of Total Precipitation			100%	28.95%	62.10%	8.95%

In post development phase due to an increase in landscape areas, the annual infiltration volume will be increased from approximately 1,197 m^3/year to 2,819 m^3/year in post-development, resulting in a surplus of 1,622 m^3/year (Appendix F-4).

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

$$P\ (877.3) = ET\ (254) + R\ (544.79) + I\ (78.55) + ST\ (0)$$

4.7 Impact and Proposed Mitigation Measures

Due to an increase in landscaped areas in post-development phase compared to pre-development conditions, there will be an infiltration surplus in post-development and therefore no mitigation measures are required for the hydrogeological water budget. As such, no mitigation measures are required at the Site for the hydrogeological water balance.

However, mitigation measures are required for stormwater design to retain 5mm; the following measures are proposed by Burnside:

- Extra depth topsoil in all rear yards
- Roof leader discharge to rear yards (50% of rooftops)
- Soakaway pits sized for 5mm runoff from 50% rooftops, with overflow to rear yard, for the noted lots on the attached plan.

These mitigation measures consist of low impact development (LID) and will be installed as per the plan enclosed in Appendix G as prepared by Burnside.

5 Dewatering Assessment

It is our understanding that the proposed development will comprise construction of a residential subdivision inclusive of roads, sidewalks, sewers, watermains, recreational areas and single-family dwellings. Table 4-1 presents the assumptions used to calculate the dewatering rate for the individual units making up the Site.

Table 5-1 Construction Dewatering Estimate Assumptions

Input Parameter	Single Unit	Underground Services	Units	Notes
Ground Surface Elevation	258		masl	Approximate elevation based on the borehole logs and Site
Number of Subgrade Levels	1 Level		-	Single dwelling basements proposed
Top of Slab Elevation	255		masl	Approximately 3.5 masl per underground level
Lowest Footing Elevation	253.5		masl	Assumed to be approximately 1.5 m below the top of slab elevation
Excavation Area (Length x Width)	Basement Excavation : 20 x 20 m Trench Excavation : 50 x 2 m		m^2	Approximate average area for a given lot and trench excavation.
Hydraulic Conductivity (K)	1.2E-7		m/s	Average K-value of the tested water-bearing zone

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 for the units. 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:

Qw = Rate of pumping (m^3/s)
X = Length of excavation (m)
K = Hydraulic conductivity (m/s)
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's 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 Trench Excavation Flow Rate Estimate

The analytical solution for estimating plane flow from an unconfined aquifer to a fully-penetrating excavation was used to obtain a flow rate estimate for the underground services trench. Dewatering flow rate is expressed as follows:

$$Q = \frac{\pi K(H^2-h^2)}{ln\, R_o/r_s} + 2[\frac{xK(H^2-h^2)}{2L}]$$

Where:

Qw = Construction dewatering rate (m^3/s)
K = saturated and horizontal hydraulic conductivity (m/s)
H = hydraulic head beyond R0 (m)
h = hydraulic head within A (m)
s = drawdown (=H-h)
rs = equivalent well radius of A (m)
RS = distance of influence of construction dewatering/pumping from equivalent well border (m)
R0 = radius of influence of construction dewatering/pumping from equivalent well center (m)
x = length of the trench (m)
w = width (m)
L = distance of influence of construction dewatering/pumping from equivalent well center (m)
π = Pi (1)
Sy = specific yield

5.3 Radius of Influence

The radius of influence (Rcj) for the construction dewatering of residential units was calculated based on Cooper-Jacob's 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's formula as follows:

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

Where:

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

The radius of influence (Rs) for the construction dewatering of underground services was calculated based on Sichardt's equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This empirical formula was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

The estimated radius of influence due to pumping is based on Sichardt's formula as follows:

$$R_s = C(H - h)\sqrt{(K)}$$

Where:

Rs = Estimated Sichardt's radius of influence (m)
H = Hydraulic head in aquifer (static water level or saturated depth) (m)
h = Dynamic water level (m)
K = Hydraulic conductivity (m/sec)
C = Constant (3,000)

Based on Sichardt's formula and the highest K-value, the calculated distance of influence (Lo = Ro/2) is provided in Appendix E.

5.4 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 E.

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 which originated 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 event over a 24-hour period are 57.5 and 125.5 mm, respectively.

5.5 Results of Dewatering Rate Estimates

5.5.1 Construction Dewatering Rate Estimate

For this assessment, it was assumed that the proposed construction plans include an excavation with shoring extending to the Site boundaries. EXP should be retained to review the assumptions outlined in this section, should the assumed shoring design change. Short-term (construction) dewatering calculations are presented in Appendix E.

Pits (elevator, sump pits) are assumed to have the same excavation depth and dewatering target as the main excavation; deeper pits may require localized dewatering and revised dewatering estimates. Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Table 5-2A Summary of Construction Dewatering Rate – Residential Units

Description	Single Unit (L/day)
Estimated Short Term Dewatering Rate (without safety factor or precipitation)	3,050
With Factor of Safety of 2 (excluding precipitation) for permit	6,100
With Factor of Safety of 2 (including precipitation)	12,110

Table 5-2B Summary of Construction Dewatering Rate – Underground Services

Description	Underground Services (L/day)
Estimated Construction Dewatering Rate (including trench, ends, and precipitation)	25,750

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), if these extend deeper than the dewatering target. Local dewatering is not considered to be part of this assessment. 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 shoring the systems and ramp/site access to redirect runoff away from excavation.

The contractor is responsible for the design of the dewatering systems (depth of wells, screen length, number of wells, spacing sand pack around screens, prevent soil loss etc.) to ensure that dry conditions are always maintained within the excavation at all costs.

Dewatering should be monitored using dedicated monitoring wells within and around the perimeter of the excavation, and these wells should be monitored using manual measurements and with electronic data loggers; records should be maintained on site to track dewatering progress. Discharge rates should be monitored using calibrated flow meters and records of dewatering progress, and daily precipitation as per MECP requirements should be maintained.

5.5.2 Post-Construction Dewatering Rate Estimate

It is our understanding that the development plan includes permanent foundation sub-drain systems that will ultimately discharge to the municipal sewer system if conventional footings are installed.

The long-term dewatering was based on the same equations as construction dewatering shown in Section 5.1.

The calculation for the estimated flow to the future sub-drain system (with no cutoff walls) is provided in Appendix E. The dewatering target for the foundation drainage system is taken at 0.5 m below the lowest slab elevation.

The foundation drain analysis provides a flow rate estimate. Once the foundation drain is built, actual flow rate measurements of the sump discharge will be required to confirm the estimated flow rate.

Based on the assumptions provided in this report, the estimated sub-drain discharge volumes are summarized in Appendix E. Seasonal and daily fluctuations are expected. These estimates may be affected by hydrogeological conditions beyond those

encountered at this time, fluctuations in groundwater regimes, surrounding Site alterations, and existing and future infrastructures.

For the design of foundations without perimeter and/or foundation drainage system, shallower wells need to be considered to evaluate the shallow groundwater table. The hydrogeologist needs to be consulted during the design process.

Table 4-3: Summary of Long-Term Dewatering Rate – Residential Units

Description	Single Unit (L/day)
Long-Term Dewatering Rate without Safety Factor	1,000
Long-Term Dewatering Rate with Safety Factor of 2 for design, budgeting and permitting	2,000

Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. A safety factor was applied to the flow rate to account for water level fluctuations due to seasonal changes.

These estimates assume that pits (elevator and/or sump pits) are made as watertight structures (without drainage), if their depths extend below the dewatering target, as previously stated. The dewatering assumptions are based on using shoring system without open cuts. Open cuts can act as preferential groundwater pathways in the long-term and cause foundation drainage volumes to increase.

The sub-drain rate estimate is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this investigation may significantly influence the sub-drain discharge volumes.

5.6 MECP Water Taking Permits

5.6.1 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 EASR water taking limit of 400,000 L/day would apply to groundwater takings of each dewatered work area only, excluding stormwater. Based on the dewatering rates described above, construction dewatering is anticipated to be below 50,000 L/day, and so an EASR will not be required.
A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. Monitoring of both water quantity and water quality must be carried out for the entire duration of the construction dewatering phase. During this phase, the Discharge Plan and the daily water taking records must be available onsite.

The Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must also be available at the construction Site during the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design, since the EASR will need to be updated to reflect these modifications. Altogether, the hydrogeological report, EASR, Discharge Plan and geotechnical assessment constitute the Water Taking Plan which needs to be available onsite during the construction dewatering.

6 Environmental Impact

6.1 Surface Water Features

The Site is within the Etobicoke Creek watershed. No surface water features exist onsite. The nearest surface water feature is Etobicoke Creek, approximately located 295 meters east of the Site boundary. Lake Ontario is approximately 29 km from the Site boundary to the southeast.

Due to the limited extent of zone of influence and the wide distance to the nearest surface water feature, 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.

6.3 Geotechnical Considerations

As per the MECP technical requirement for PTTW and EASRs, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence, etc.) is required. 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 Region 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.

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.

An agreement to discharge into the sewers owned by the Town of Caledon will be required prior to releasing dewatering effluent. The Phase Two Environmental Site Assessment Report (2020) was reviewed and determined the following exceedances to MECP (2011) Table 4 SCS: Sodium and Chloride in groundwater. The Phase Two ESA Update (2022) was reviewed and determined that no exceedances of the Table 4 SCS were identified in soil or groundwater.

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 Peel Sanitary and Combined Sewer Discharge Criteria (Table 1), there were no parameter exceedances to be reported. When comparing the chemistry of the collected groundwater samples to the Peel Storm Sewer Discharge Criteria (Table 2), only Manganese (Mn) reported an exceedance.
- In post development phase due to an increase in landscape areas, the annual infiltration volume will be increased from approximately 1,197 m^3/year to 2,819 m^3/year in post-development, resulting in a surplus of 1,622 m^3/year (Appendix F-4).
- Based on the assumptions outlined in this report, the estimated peak dewatering rate for proposed construction activities is approximately 12,110 L/day for a single unit and 25,750 L/day for underground services. These are the rates which will be required to be discharged to the municipal sewer system. Based on the dewatering rates described above, construction dewatering is anticipated to be below 50,000 L/day, and so an EASR will not be required.
- The long-term flow rate of the foundation sub-drain is estimated to be approximately 2,000 L/day. It is recommended that once the sub-drain system is in place, a flow meter be installed at the sump(s) to record daily discharge volumes during the commissioning stage of the system. Regular maintenance/cleaning of the sub-drain system is recommended to ensure its proper operation.
- The construction dewatering volume 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.
- 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.
- As per the MECP technical requirement for EASRs, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence etc.) is required. 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.
- An agreement to discharge into the sewers owned by the Town of Caledon will be required prior to releasing dewatering effluent.
- The EASR registration allows construction dewatering discharge of up to 400,000 L/day. A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. The Discharge Plan and monitoring for both water quantity and water quality must be carried at the Site during the entire construction dewatering phase. The daily water taking records must be maintained onsite for the entire construction dewatering phase. The EASR, Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must always also be available at the construction Site for the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design, since EASR will need to be updated to reflect these modifications. The hydrogeological report, EASR, Discharge Plan and geotechnical assessment constitutes the Water Taking Plan which needs to be available onsite for the duration of construction dewatering.

- 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.

Nicolas Sabo, B.Sc., M.E.S.
Environmental Scientist
Environmental Services

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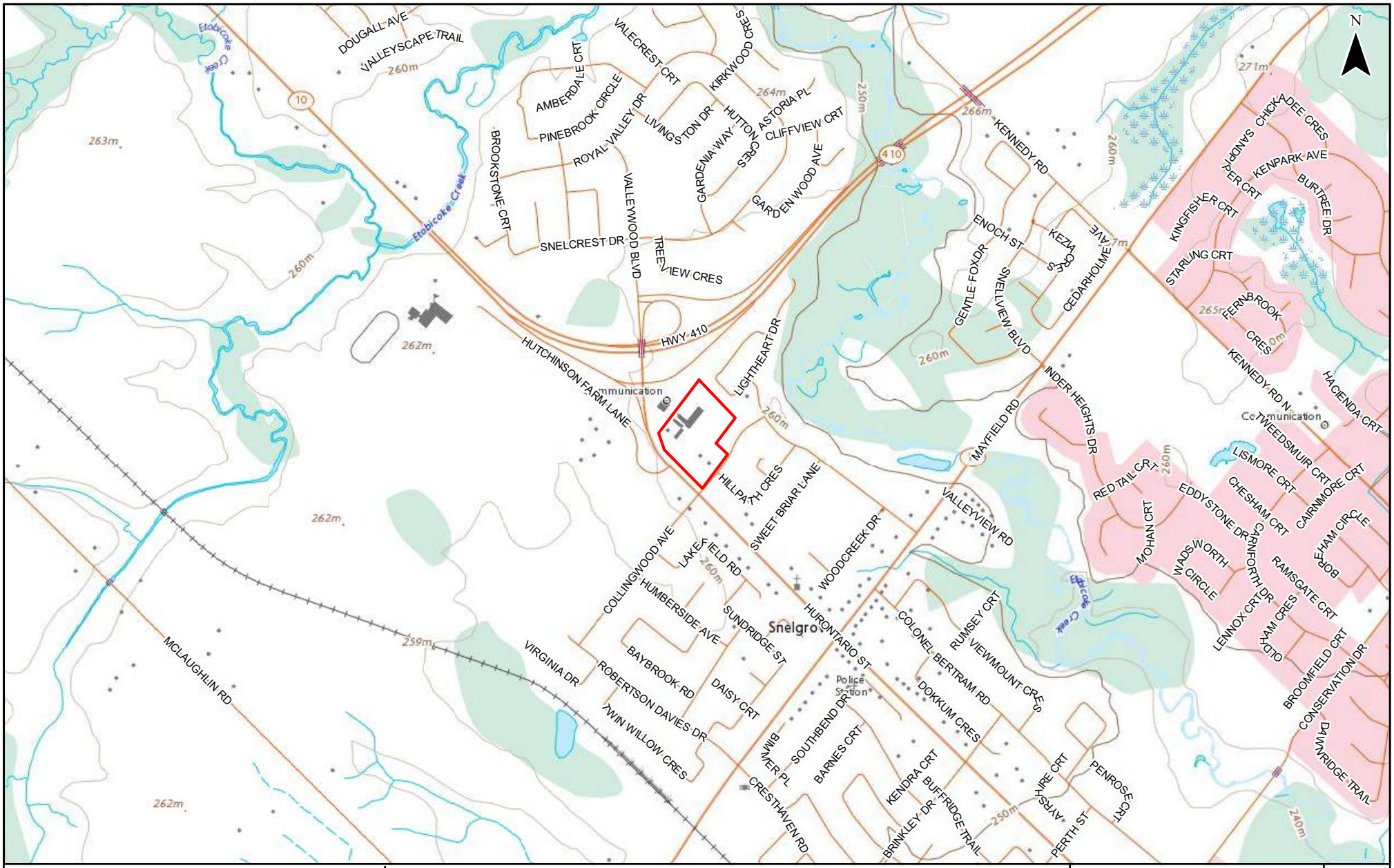
Figures



SCALE:

0 150 300 450 600 750 m

LEGEND:

APPROXIMATE SITE BOUNDARY

SITE LOCATION PLAN

FIGURE: 1

exp.

DRAWN BY:	CHECKED BY:
AC	JS

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON,
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0

DATE: FEBRUARY 2022

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
- 19: MODERN ALLUVIAL DEPOSITS
- 5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL

SURFICIAL GEOLOGY

FIGURE: 2

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0

DATE: FEBRUARY 2022

SCALE:
0 100 200 300 400 500 m

SOURCE:
BASED ON GOOGLE EARTH IMAGERY DATED 2021,
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: 3

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0 | DATE: FEBRUARY 2022

SCALE:

0 25 50 75 100 125 m

LEGEND:

- BOREOLE (EXP, 2021)
- BOREHOLE / MONITORING WELL (EXP 2020)
- BOREHOLE / MONITORING WELL (EXP, 2021)
- CROSS SECTION AXIS
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	JS

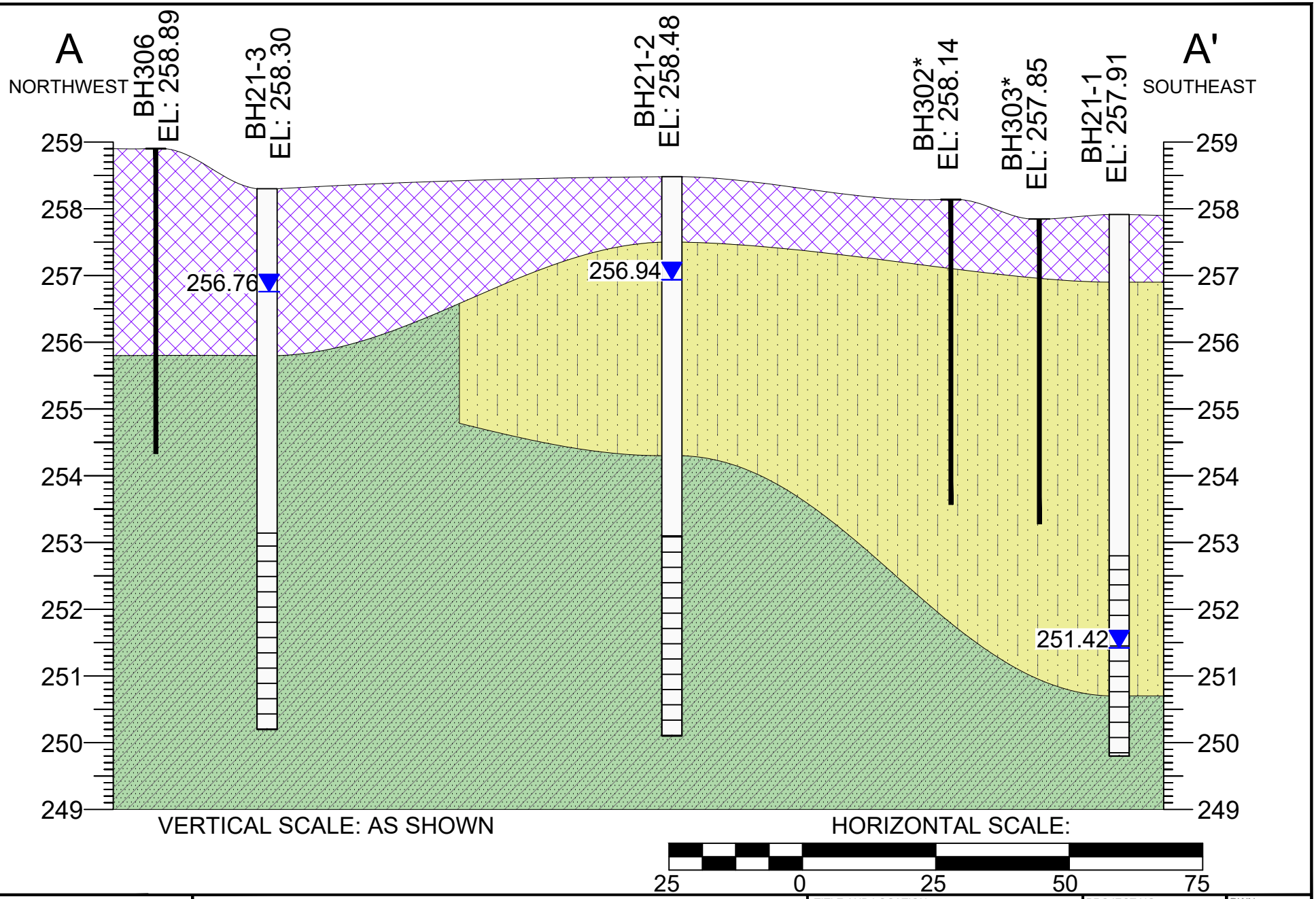
BOREHOLE / MONITORING WELL LOCATION PLAN

FIGURE: 4

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0

DATE: FEBRUARY 2022



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

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY • INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- ASPHALT / CONCRETE
- FILL
- SANDY SILT TILL
- CLAYEY SILT TILL
- * STRAIGHT AUGER TO FINAL DEPTH
- GROUNDWATER ELEVATION ON JANUARY 12, 2022

TITLE AND LOCATION:

CROSS SECTION A-A'
12197 HURONTARIO STREET, BRAMPTON AND 12221- 12233 HURONTARIO STREET, CALEDON, ONTARIO

PROJECT NO.: BRM-00257876-D0	DWN.: NS
SCALE: AS NOTED	CK: FC
DATE: MARCH 2022	FIG. NO.: 5A

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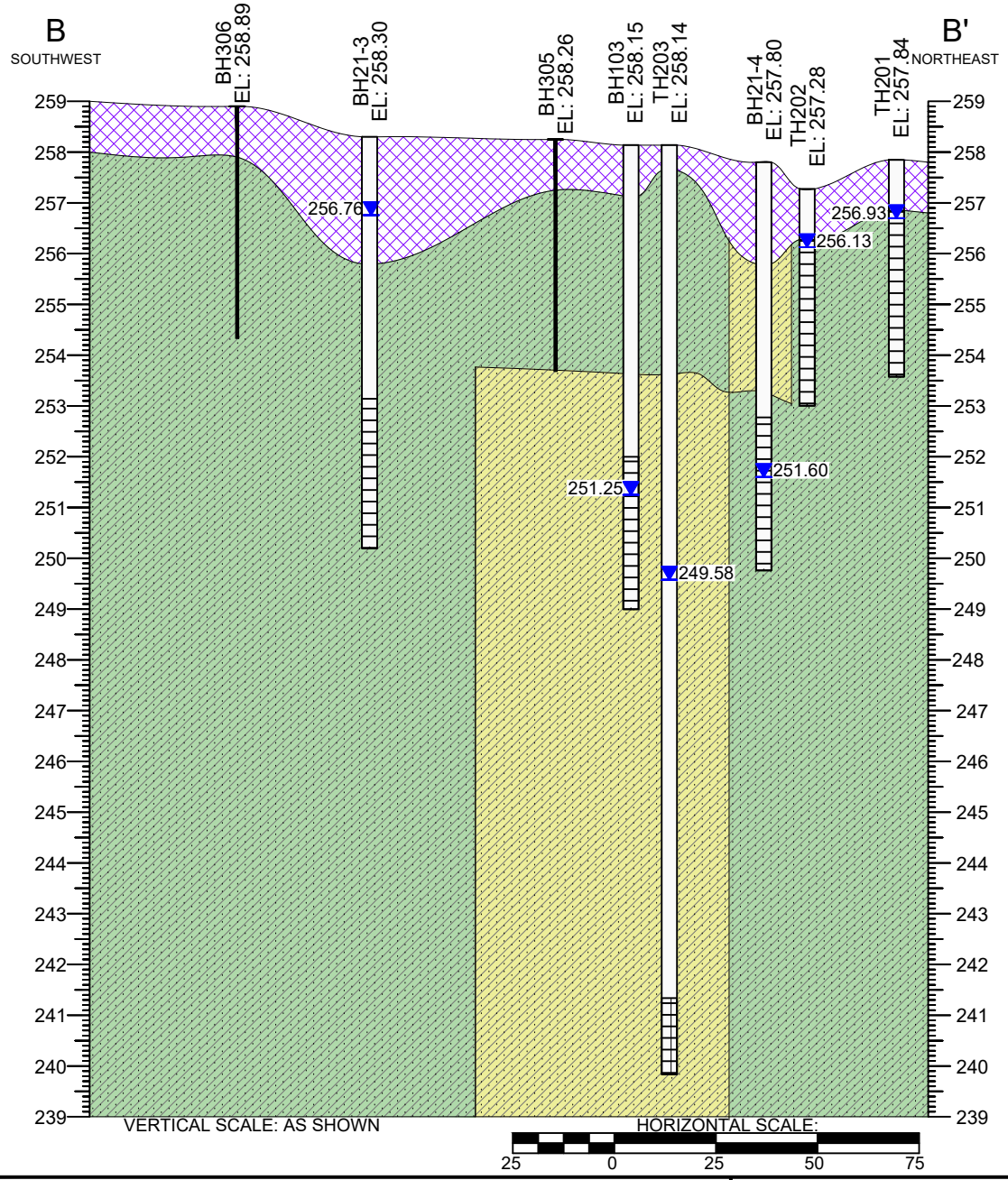

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- ASPHALT / CONCRETE
- FILL
- SANDY SILT TILL
- CLAYEY SILT TILL
- GROUNDWATER ELEVATION ON JANUARY 12, 2022

TITLE AND LOCATION:

CROSS SECTION B-B'

12197 HURONTARIO STREET, BRAMPTON AND 12221- 12233 HURONTARIO STREET, CALEDON, ONTARIO

PROJECT NO.:	DWN.:
BRM-00257876-D0	NS
SCALE:	CK:
AS NOTED	FC
DATE:	FIG. NO.:
MARCH 2022	5B

J:\2003-Brampton\Projects\Environmental Sciences\Brampton Jobs\BRM\00200000\250000\257876-D0 - 12197 Hurontario St, Caledon\3 - Deliverables\Figures\Draft Figures\Figures.dwg

SCALE:

0 25 50 75 100 125 m

DRAWN BY: AC

CHECKED BY: JS

LEGEND:

- BOREHOLE / MONITORING WELL (EXP, 2021)
- XX.XX GROUNDWATER ELEVATION (m asl) AS MEASURED ON JANUARY 12, 2022
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- APPROXIMATE SITE BOUNDARY

GROUNDWATER CONTOUR PLAN

FIGURE: 6

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0

DATE: MARCH 2022

SCALE:

0 25 50 75 100 125 m

LEGEND:

OPEN SPACE

APPROXIMATE SITE BOUNDARY

DRAWN BY:	CHECKED BY:
AC	JS

EXISTING LAND USE

FIGURE: 7

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0

DATE: FEBRUARY 2022

SCALE:
0 25 50 75 100 125 m

SOURCE:
BASED ON SITE PLAN - SUMMER VALLEY.
CAIVAN, NOVEMBER 2021. DRAWING # SK-05.

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:
- RESIDENTIAL
- LANDSCAPE
- PAVED ROAD
- APPROXIMATE SITE BOUNDARY

PROPOSED LAND USE

FIGURE: 8

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0 | DATE: FEBRUARY 2022

SCALE:
0 25 50 75 100 125 m

SOURCE:
TOPOGRAPHIC CONTOURS (2021) BASED ON PUBLIC SECTOR INFORMATION MADE AVAILABLE UNDER THE CITY OF BRAMPTON GEOHUB OPEN DATA

exp.

DRAWN BY:	CHECKED BY:
AC	JS

LEGEND:
TOPOGRAPHIC CONTOUR (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
12197 HURONTARIO STREET, BRAMPTON
AND 12211-12233 HURONTARIO STREET, CALEDON
ONTARIO

PROJECT NUMBER: BRM-00257876-D0
DATE: FEBRUARY 2022

Appendix A – MECP WWR Summary Table

On-Site

BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	STREET	CITY	DISTANCE TO SITE BOUNDARY (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
10315957	4901111	1/16/1961	594183	4843461	259.3				Boring	16.8	13.4	16.8	Domestic		Water Supply
11765486	7043038	4/3/2007	594170	4843626	258.1	12231, 1223, 12233 HURONTARIO ST	CALEDON		Boring	6.0	3.6	3.0			Observation Wells

Off-Site

BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	STREET	CITY	DISTANCE TO SITE BOUNDARY (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
10315949	4901103	5/18/1954	594348	4843310	255.4			143	Boring	16.8	15.2	15.2	Domestic		Water Supply
10315950	4901104	11/1/1961	594373	4843281	255.7			181	Boring	19.8	14.6	10.7	Domestic		Water Supply
10315951	4901105	7/4/1962	594522	4843112	255.0			405	Cable Tool	41.1	41.1	5.5	Domestic		Water Supply
10315954	4901108	6/1/1967	594550	4843077	255.0			450	Boring	15.8	12.8	15.8	Domestic		Water Supply
10315955	4901109	6/12/1954	594192	4843770	258.8			69	Boring	15.2	13.7	13.7	Domestic		Water Supply
10316454	4901609	9/18/1953	594371	4842987	255.0			434	Boring	14.9	13.4	14.9	Domestic		Water Supply
10316455	4901610	6/20/1954	594298	4843282	256.1			133	Boring	17.4	17.4	17.4	Domestic		Water Supply
10316456	4901611	7/3/1954	594459	4842983	254.9			472	Boring	18.3	16.5	18.3	Domestic		Water Supply
10316457	4901612	12/18/1955	594143	4843426	258.4			49	Boring	18.9	16.5	18.9	Domestic		Water Supply
10316458	4901613	9/19/1961	594371	4843208	256.2			234	Boring	18.6	15.2	18.6	Domestic		Water Supply
10316459	4901614	4/4/1962	594411	4843208	255.9			259	Cable Tool	44.5	43.9	39.3	Domestic		Water Supply
10316462	4901617	8/23/1961	594260	4843269	256.7			133	Cable Tool	45.7	44.2	42.7	Domestic		Water Supply
10316463	4901618	11/16/1963	593847	4843508	261.4			269	Cable Tool	48.8	39.6	39.3	Livestock	Domestic	Water Supply
10317731	4902890	6/3/1968	594405	4843213	256.0			251	Cable Tool	16.8	15.2	16.8	Domestic		Water Supply
1001497608	7101921	1/24/2008	594116	4843613	259.3	HURONTARIO, N. OF MAYFIELD	BRAMPTON	29			2.0	6.1			Abandoned-Other
11323491	4909758	5/25/2005	594350	4843643	255.4	57 LIGHTHESRT ROAD	BRAMPTON	44	Digging		11.0	16.5	Not Used		Abandoned-Other
11760760	7034881	8/21/2006	594324	4843313	255.4	12197 HURONTARIO	CALEDON	123	Other Method	5.2		2.1			Abandoned-Other
11763712	7041219	1/12/2007	594429	4843164	255.7	12197 HURONTARIO ST	BRAMPTON	304	Other Method	4.9		1.5	Not Used		Observation Wells
11177200	4909572	11/16/2004	594714	4843223	251.2			489	Other Method			1.8			Observation Wells
1001547985	7102926	12/17/2007	594100	4843619	259.4	12267 HURONTARIO ST.	BRAMPTON	45							Abandoned-Other
1007307017	7321773	9/24/2018	593970	4843159		HUTCHINSON FARM LN	CALEDON	361	Boring	4.5	3.3		Monitoring		Observation Wells
1007307023	7321775	9/25/2018	593944	4843589		HUTCHINSON FARM LN.	CALEDON	170	Boring	7.0	4.2		Monitoring		Observation Wells
1007309453	7322190	10/18/2018	593916	4843834		HWY 10 & HWY 410	BRAMPTON	324	Boring	15.2	12.2		Monitoring		Observation Wells
1007360863	7327350	12/7/2018	594047	4843521		Hutchinson Farm Line	Brampton	74	Boring	6.1			Monitoring		Monitoring and Test Hole
1007360866	7327351	12/7/2018	593877	4843717		Hutchinson Farm Line	Brampton	282	Boring	6.1			Monitoring		Monitoring and Test Hole
1007360875	7327354	12/7/2018	594238	4843355		Hurontario Street	Brampton	45	Boring	6.1			Monitoring		Monitoring and Test Hole
1007360878	7327355	12/7/2018	594396	4843194		Hurontario Street	Brampton	260	Boring	6.1			Monitoring		Monitoring and Test Hole
1007360881	7327356	12/7/2018	594540	4843072		Hurontario Street	Brampton	446	Boring	6.1			Monitoring		Monitoring and Test Hole
10322846	4908310	7/15/1997	594448	4842977	254.7			473	Not Known				Not Used		Abandoned-Other
10526896	4908963	3/27/2002	593776	4843904	263.2			477	Digging				Not Used		Abandoned-Other
1004197602	7188750	5/4/2012	593846	4843992	261.8			475							
1005904094	7259060	4/23/2015	594586	4843079	254.7			474							

Appendix B – Borehole Logs

Log of Borehole BH103

Project No. MRK-00257876-A0 Drawing No. 3

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: February 27, 2020

Drill Type: B57-Track Mount

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20, 40, 60)	Combustible Vapour Reading (ppm) (25, 50, 75)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Brown sand and gravel **FILL**, moist, no odour, no staining.	258.15	0		ND			AUG1	
		Brown clayey **SILT**, trace gravel, moist, no odour, no staining.	~257.7							
		-Reworked Native.		1						
		Brown clayey **SILT TILL**, moist, no odour, no staining.	~256.6	2		ND			AUG2	
				3					AUG3	
				4		ND				
		Grey sandy **SILT TILL**, moist, no odour, no staining.	~253.6	5		ND			AUG4	
				6					AUG5	
▼			~249.9	7		ND				
				8					AUG6	
		End of Test hole at 9.14 mbgs.	~249.0	9		ND				
				10						
				11						
				12						

ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

Time	Water Level (m)	Depth to Cave (m)
March 5, 2020	8.19m	
May 7 , 2020	8.226m	

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole TH201

Project No. MRK-00257876-A0 Drawing No. 12

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

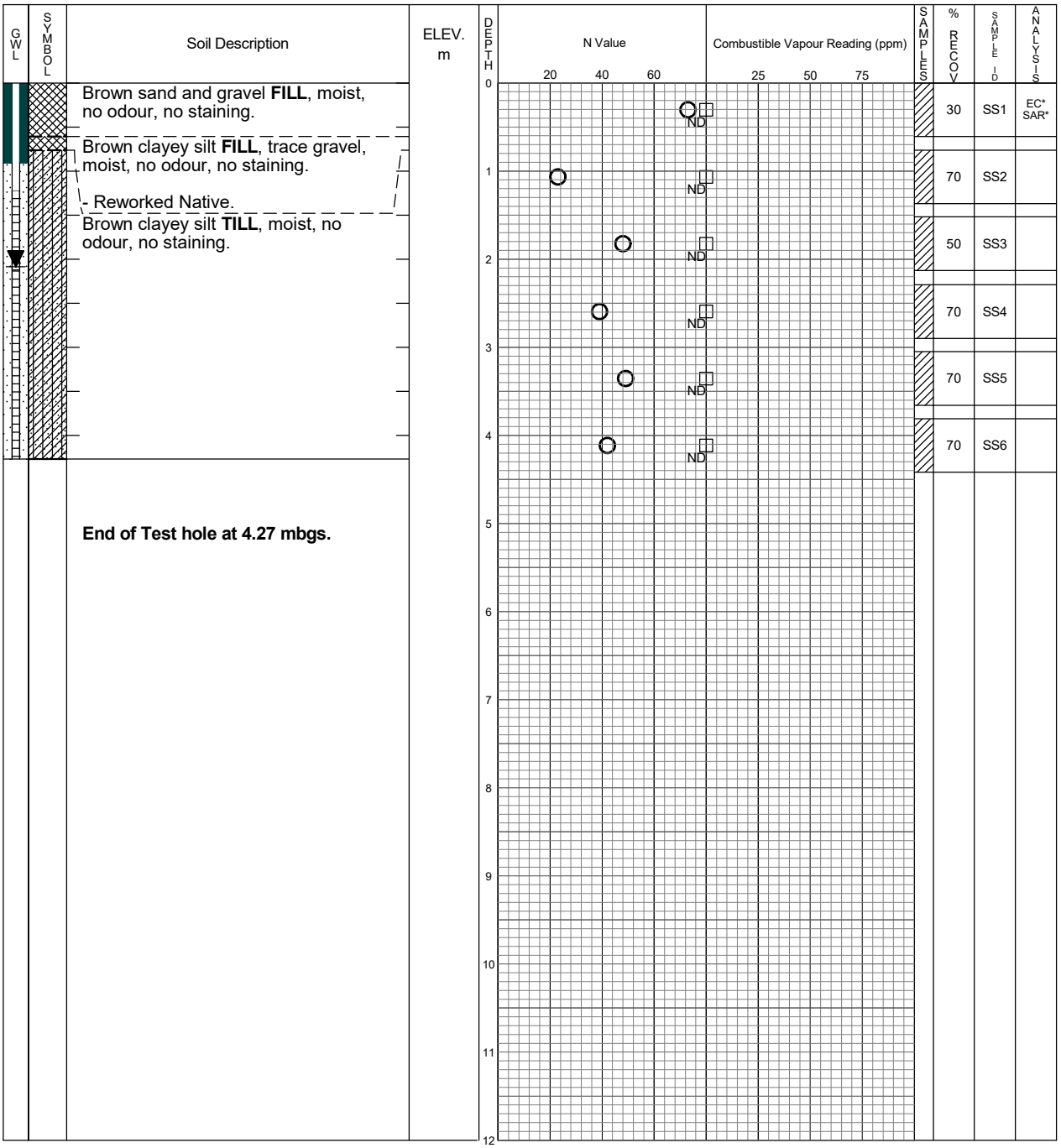
Date Drilled: April 30, 2020

Drill Type: CME 55-Track Mount

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		



ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

Time	Water Level (m)	Depth to Cave (m)
May 7 , 2020	2.122m	

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole TH202

Project No. MRK-00257876-A0 Drawing No. 13

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

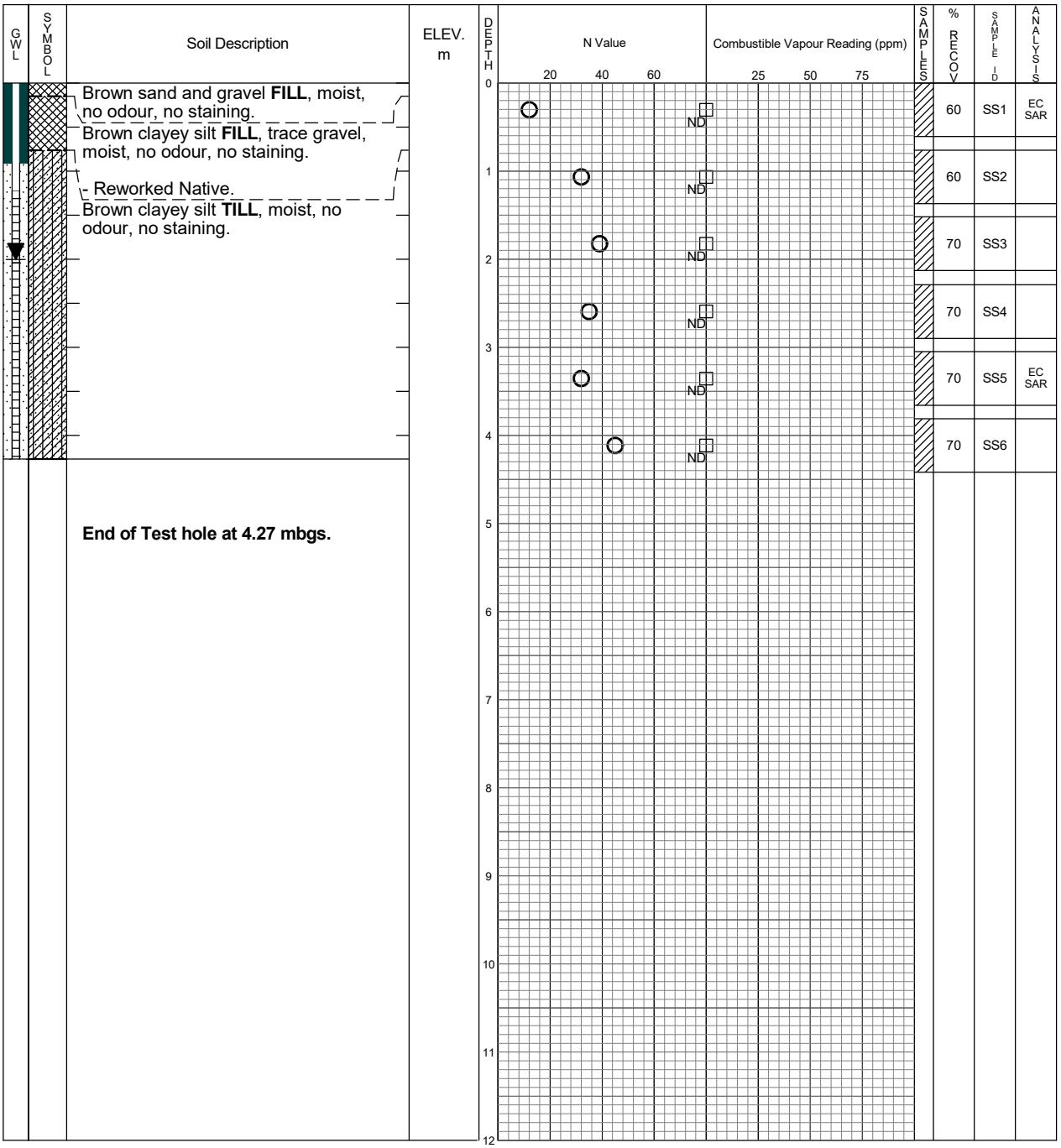
Date Drilled: May 1, 2020

Drill Type: CME 55-Track Mount

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		



ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

Time	Water Level (m)	Depth to Cave (m)
May 7 , 2020	2.041m	

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole TH203

Project No. MRK-00257876-A0 Drawing No. 14

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 2

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: May 1, 2020

Drill Type: CME 55-Track Mount

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20, 40, 60)	Combustible Vapour Reading (ppm) (25, 50, 75)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Brown sand and gravel **FILL**, moist, no odour, no staining.		0						
		Brown clayey **SILT**, trace gravel, moist, no odour, no staining. -Reworked Native.		1						
		Brown clayey **SILT TILL**, moist, no odour, no staining.		2						
				3						
				4						
		Grey sandy **SILT TILL**, moist, no odour, no staining.		5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

Continued Next Page

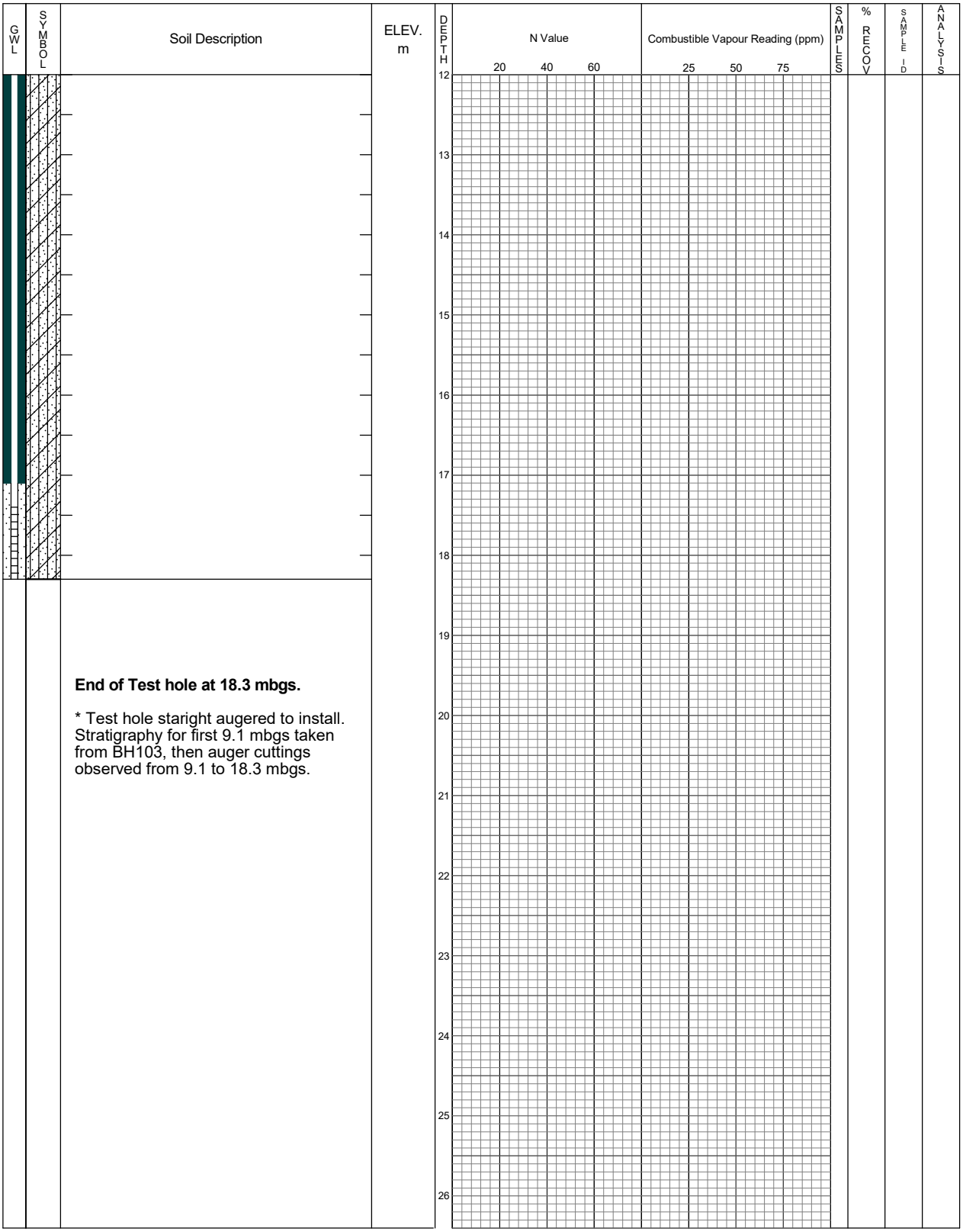
Time	Water Level (m)	Depth to Cave (m)
May 7 , 2020	9.727m	

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole TH203

Project No. MRK-00257876-A0 Drawing No. 14

Project: Phase Two Environmental Site Assessment Sheet No. 2 of 2



ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Time	Water Level (m)	Depth to Cave (m)
May 7 , 2020	9.727m	

Log of Borehole TH204

Project No. MRK-00257876-A0 Drawing No. 15

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: May 1, 2020

Drill Type: CME 55-Track Mount

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value	Combustible Vapour Reading (ppm)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Brown sand and gravel **FILL**, moist, no odour, no staining.		0	20 40 60	25 50 75		70	SS1	EC SAR
		Brown clayey silt **FILL**, trace sand and gravel, moist, no odour, no staining.		1				70	SS2	
		- Reworked Native. Brown clayey **SILT TILL**, moist, no odour, no staining.		2				70	SS3	
				3				70	SS4	
		End of Test hole at 3.66 mbgs.		4				70	SS5	EC SAR
				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

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

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole TH205

Project No. MRK-00257876-A0 Drawing No. 16

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: April 30, 2020

Drill Type: CME 55-Track Mount

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value	Combustible Vapour Reading (ppm)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Brown clayey silt **FILL**, trace sand and gravel, moist, no odour, no staining.		0		ND		70	SS1	EC SAR
		- Reworked Native.		1		ND		70	SS2	
		Brown clayey **SILT TILL**, moist, no odour, no staining.		2		ND		70	SS3	
						ND		70	SS4	
				3		ND		70	SS5	EC
		End of Test hole at 3.66 mbgs.		4						
				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						

N Value: 20, 40, 60

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

ENVIRONMENTAL-EXP TH LOGS.GPJ 5/12/20

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

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole BH21-1

Project No. BRM-00257876-D0 Drawing No. 2

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: NE Corner of Hurontario Street and Highwood Road, Brampton/Caledon

Date Drilled: December 21, 2021

Drill Type: CME-55, track mount machine

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)
~ 120 mm TOPSOIL over **FILL:** clayey silt to sandy silt, trace rootlets, minor organics, brown, moist	257.91	0
	~256.9	1
SANDY SILT TILL: some clay, trace gravel, brown, oxidized seams, moist, compact to very dense		2
		3
		4
		5
Silt layer, some clay, between~ 6.0 to 6.6 m depth		6
	~251.3	
	~250.7	7
CLAYEY SILT TILL: some sand, trace gravel, grey, moist		
	~249.8	8
END OF BOREHOLE		

SPT (N Value): 7, 14, 21, 25, 38, 57, 32, 22

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

Natural Unit Weight kN/m³: 22.9

Date	Water Level (m)	Hole Open to (m)
On completion	Dry	
January 5, 2022	6.59	
January 12, 2022	6.49	

EXPLOGBRAMPTON BOREHOLE LOGS.GPJ NEW.GDT 2/2/22

Log of Borehole BH21-2

Project No. BRM-00257876-D0 Drawing No. 3

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: NE Corner of Hurontario Street and Highwood Road, Brampton/Caledon

Date Drilled: December 21, 2021

Drill Type: CME-55, track mount machine

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 ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~ 120 mm TOPSOIL over **FILL:** clayey silt to sandy silt, some gravel, trace organics, brown, moist	258.48	0
			~257.9	
		SANDY SILT TILL: some clay, trace gravel, brown, oxidized seams, moist, compact to very dense	~257.5	1
				2
				3
			~254.3	4
		CLAYEY SILT TILL: trace sand, trace gravel, brown to grey, moist		5
		- becoming grey below ~5.0 m depth		6
		-becoming hard		7
		-becoming very stiff		8
			~250.1	
		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: 10, 20, 29, 24, 29, 18, 56, >, 27

Sample | Natural Unit Weight kN/m³: 21.0

Date	Water Level (m)	Hole Open to (m)
On completion	8.0	
January 5, 2022	0.56	
January 12, 2022	1.72	

exp.

Log of Borehole BH21-3

Project No. BRM-00257876-D0 Drawing No. 4

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: NE Corner of Hurontario Street and Highwood Road, Brampton/Caledon

Date Drilled: December 20, 2021

Drill Type: CME-55, track mount machine

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
FILL: sandy silt to silty sand, some gravel, trace rootlets, brown, moist	258.30	0		
-changing to clayey silt (disturbed material)	~257.7			
- becoming wet	~257.1	1		
CLAYEY SILT TILL: some sand, trace gravel, brown to grey below ~4.5 m, moist	~255.8	2		
		3		22.8
-sandy silt till layer between ~4.5 to 5.2 m depth		4		
		5		
		6		23.6
		7		
	~250.2	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: 14, 5, 18, 29, 64, 41, 28, 30

Date	Water Level (m)	Hole Open to (m)
On completion	7.9	
January 5, 2022	1.23	
January 12, 2022	1.55	

EXPLOGBRAMPTON BOREHOLE LOGS.GPJ NEW.GDT 2/5/22

Log of Borehole BH21-4

Project No. BRM-00257876-D0 Drawing No. 5

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: NE Corner of Hurontario Street and Highwood Road, Brampton/Caledon

Date Drilled: December 21, 2021

Drill Type: CME-55, track mount machine

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)	Sample	Natural Unit Weight kN/m³
FILL: sandy silt with sand & gravel pockets, brown, moist	257.80			
-Brown sandy silt, some gravel (reworked on-site material)	~257.2			
SANDY SILT TILL: some sand, trace gravel, brown, oxidized seams, moist	~255.8			
CLAYEY SILT TILL: some sand, trace gravel, grey , moist	~253.3			23.2
	~251.7			21.1
END OF BOREHOLE	~249.7			

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: 31, 11, 27, 33, 31, 25, 21, 16

Date	Water Level (m)	Hole Open to (m)
On completion	8.0	
January 5, 2022	6.08	
January 12, 2022	6.20	

EXPLOGBRAMPTON BOREHOLE LOGS.GPJ NEW.GDT 2/2/22

Log of Borehole BH21-5

Project No. BRM-00257876-D0 Drawing No. 6

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: NE Corner of Hurontario Street and Highwood Road, Brampton/Caledon

Date Drilled: December 21, 2021

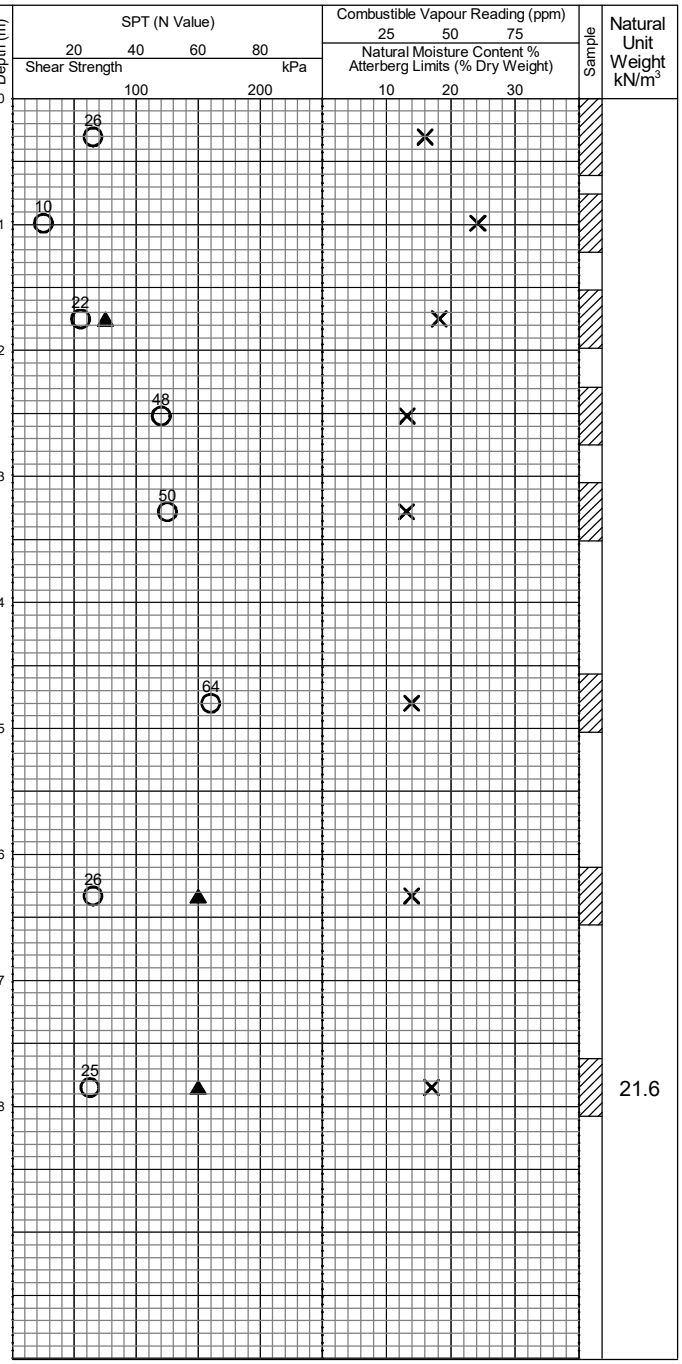
Drill Type: CME-55, track mount machine

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
~ 120 mm TOPSOIL over **FILL:** sandy silt to clayey silt, some sand, trace gravel, brown to brown-grey, moist possible fill or disturbed native	257.03
CLAYEY SILT TILL: trace sand, trace gravel, brown to grey below 4.5 m, moist	~255.2
Silt layer, some clay, between~ 4.5 to 5.0 m depth	~248.9
END OF BOREHOLE	



Date	Water Level (m)	Hole Open to (m)
On completion	8.0	

EXPLOGBRAMPTON BOREHOLE LOGS.GPJ NEW.GDT 2/2/22

Log of Borehole BH21-6

Project No. BRM-00257876-D0 Drawing No. 7

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: NE Corner of Hurontario Street and Highwood Road, Brampton/Caledon

Date Drilled: December 21, 2021

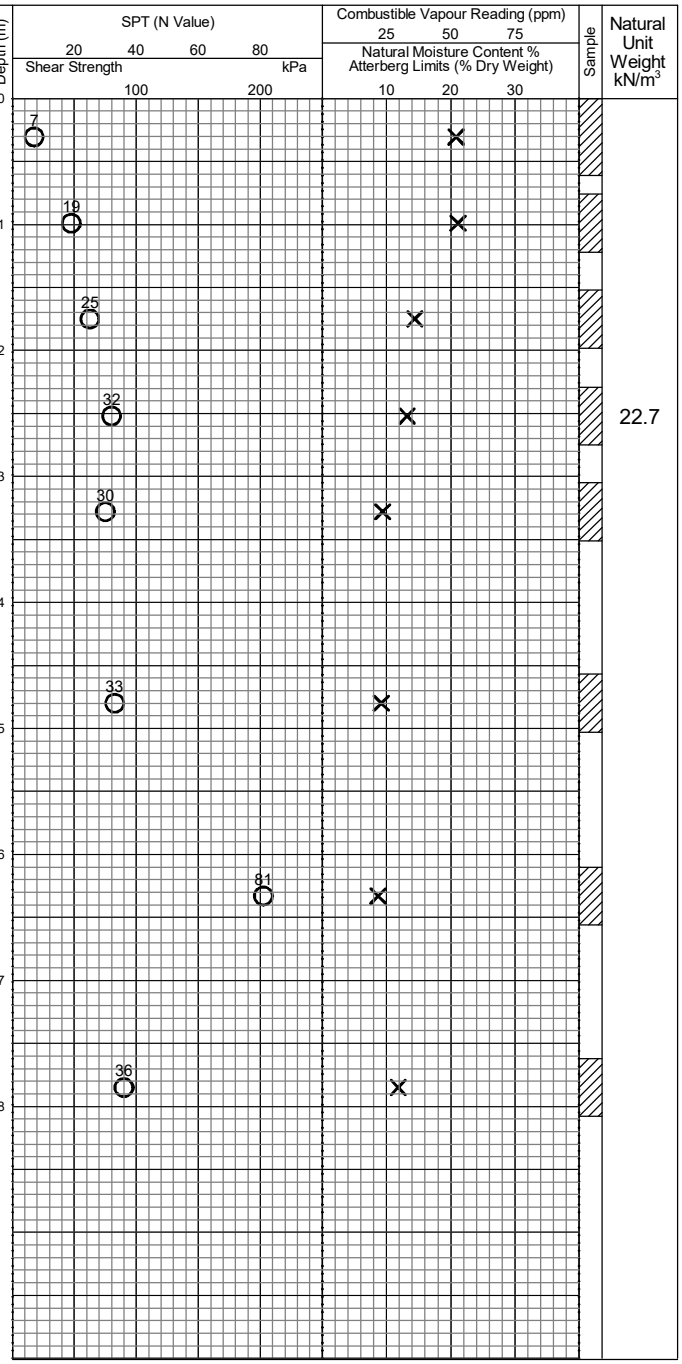
Drill Type: CME-55, track mount machine

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
~ 120 mm TOPSOIL over **FILL:** clayey silt, trace gravel, trace rootlets, brown, moist	257.93
	~256.8
SANDY SILT TILL: some clay, trace gravel, brown to grey below 4.5 m, moist	
- - - - - - - - - - - - - silty sand layer between ~6.0 to 6.5m depth - - - - - - - - - - - - -	
- becoming wet	
	~249.8
END OF BOREHOLE	



Date	Water Level (m)	Hole Open to (m)
On completion	7.0	

EXPLOGBRAMPTON BOREHOLE LOGS.GPJ NEW.GDT 2/2/22

Log of Borehole BH301

Project No. MRK-00257876-A0 Drawing No. 1

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: December 13, 2021

Drill Type: CME 45

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20, 40, 60)	Combustible Vapour Reading (ppm) (25, 50, 75)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Straight auger to 4.57 mbgs.	257.27	0						
			~256.6	1						
				2						
				3						
				4						
			~252.7	5						
		End of Borehole at 4.57 mbgs.		6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP BH LOGS - 300 SERIES.GPJ 1/7/22

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Time	Water Level (m)	Depth to Cave (m)
December 14, 2021	255.18	
December 19, 2021	256.58	

Log of Borehole BH302

Project No. MRK-00257876-A0 Drawing No. 2

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: December 13, 2021

Drill Type: CME 45

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20, 40, 60)	Combustible Vapour Reading (ppm) (25, 50, 75)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Straight auger to 4.57 mbgs.	258.14	0						
				1						
				2						
			~254.9	3						
				4						
			~253.6	5						
		End of Borehole at 4.57 mbgs.		6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP BH LOGS - 300 SERIES.GPJ 1/7/22

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Time	Water Level (m)	Depth to Cave (m)
December 14, 2021 December 19, 2021	254.87	

Log of Borehole BH303

Project No. MRK-00257876-A0 Drawing No. 3

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: December 13, 2021

Drill Type: CME 45

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20, 40, 60)	Combustible Vapour Reading (ppm) (25, 50, 75)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Straight auger to 4.57 mbgs.	257.85	0						
			~257.1	1						
				2						
				3						
				4						
			~253.3	5						
		End of Borehole at 4.57 mbgs.		6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP BH LOGS - 300 SERIES.GPJ 1/7/22

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Time	Water Level (m)	Depth to Cave (m)
December 14, 2021	254.45	
December 19, 2021	257.06	

Log of Borehole BH304

Project No. MRK-00257876-A0 Drawing No. 4

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

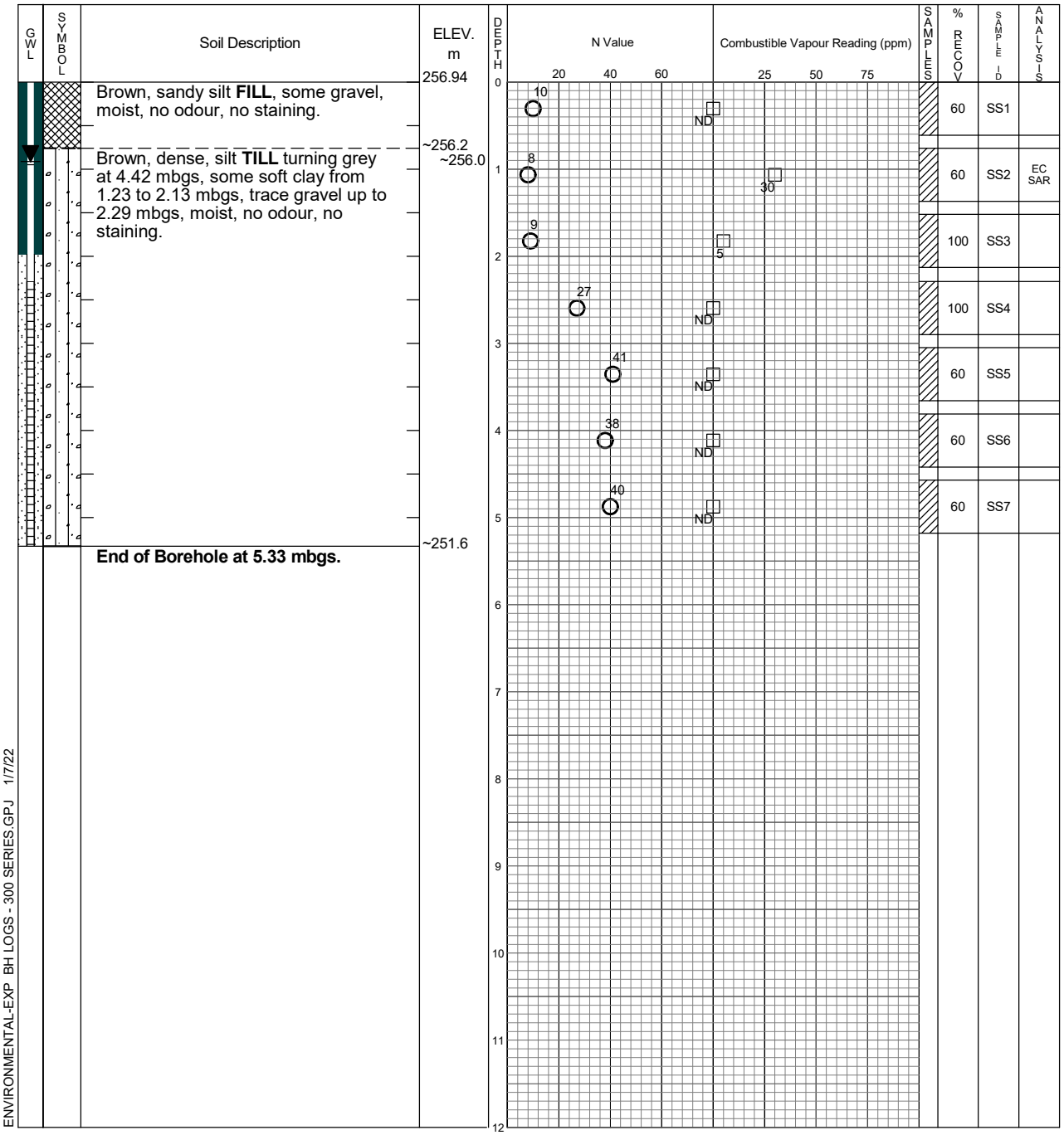
Date Drilled: December 14, 2021

Drill Type: CME 45

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		



ENVIRONMENTAL-EXP BH LOGS - 300 SERIES.GPJ 1/7/22

Time	Water Level (m)	Depth to Cave (m)
December 14, 2021	254.13	
December 19, 2021	255.99	

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole BH305

Project No. MRK-00257876-A0 Drawing No. 5

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: December 14, 2021

Drill Type: CME 45

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value	Combustible Vapour Reading (ppm)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Brown, loose, sandy silt **FILL** with trace rootlets, moist, no odour, no staining.	258.26	0	4	ND		80	SS1	
		Brown, loose to firm, silt **TILL**, moist, no odour, no staining.	~257.5	1	8	ND		80	SS2	EC SAR
				2	19	ND		100	SS3	
				3	22	ND		100	SS4	
				4	37	ND		60	SS5	
				5	40	ND		60	SS6	
		End of Borehole at 4.57 mbgs.	~253.7	6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP BH LOGS - 300 SERIES.GPJ 1/7/22

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

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

Log of Borehole BH306

Project No. MRK-00257876-A0 Drawing No. 6

Project: Phase Two Environmental Site Assessment Sheet No. 1 of 1

Location: 12197 Hurontario Street, Brampton and 12211, 12213, 12231 and 12233 Hurontario Street, Caledon, Ontario

Date Drilled: December 14, 2021

Drill Type: CME 45

Datum:

Chemical Analysis

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	*	Duplicate Sample
ING	Metals and Inorganics	PCB	Polychlorinated Biphenyls
MET	Metals	PHC	Petroleum Hydrocarbons (F1-F4)
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compounds
PEST	Organochlorine Pesticides		

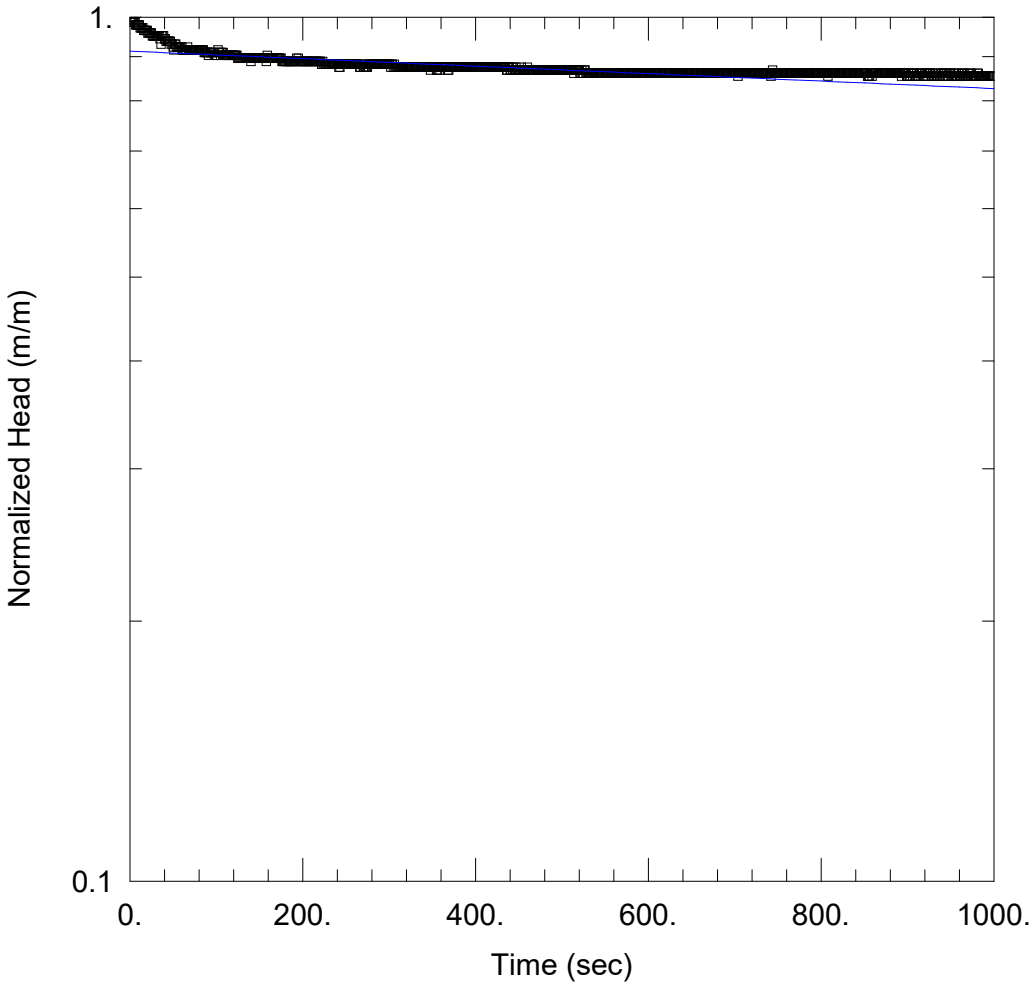
GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value	Combustible Vapour Reading (ppm)	SAMPLES	% RECOV	SAMPLE ID	ANALYSIS
		Brown, loose, sandy silt **FILL** with trace rootlets and gravel, moist, no odour, no staining.	258.89	0	3	ND		80	SS1	
		Brown, loose, silt **TILL**, turns grey from 1.68 to 2.59 mbgs, trace sand from 2.59 mbgs, moist, no odour, no staining.	~258.1	1	7	ND		80	SS2	EC SAR
				2	9	ND		60	SS3	
				3	13	ND		80	SS4	
				4	11	ND		100	SS5	
				5	20	ND		100	SS6	
		End of Borehole at 4.57 mbgs.	~254.3	6						
				7						
				8						
				9						
				10						
				11						
				12						

ENVIRONMENTAL-EXP BH LOGS - 300 SERIES.GPJ 1/7/22

exp Services Inc.
Markham, Ontario
Telephone: 905.695.3217

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

Appendix C – SWRT Procedures and Results



WELL TEST ANALYSIS

Data Set: I:\...\BH 21-1.aqt
Date: 02/24/22 Time: 14:34:47

PROJECT INFORMATION

Company: EXP
Client: Argo Development Corporation
Project: BRM-00257876-D0
Location: 12197 Hurontario St, Caledon
Test Date: 12 January 2022

AQUIFER DATA

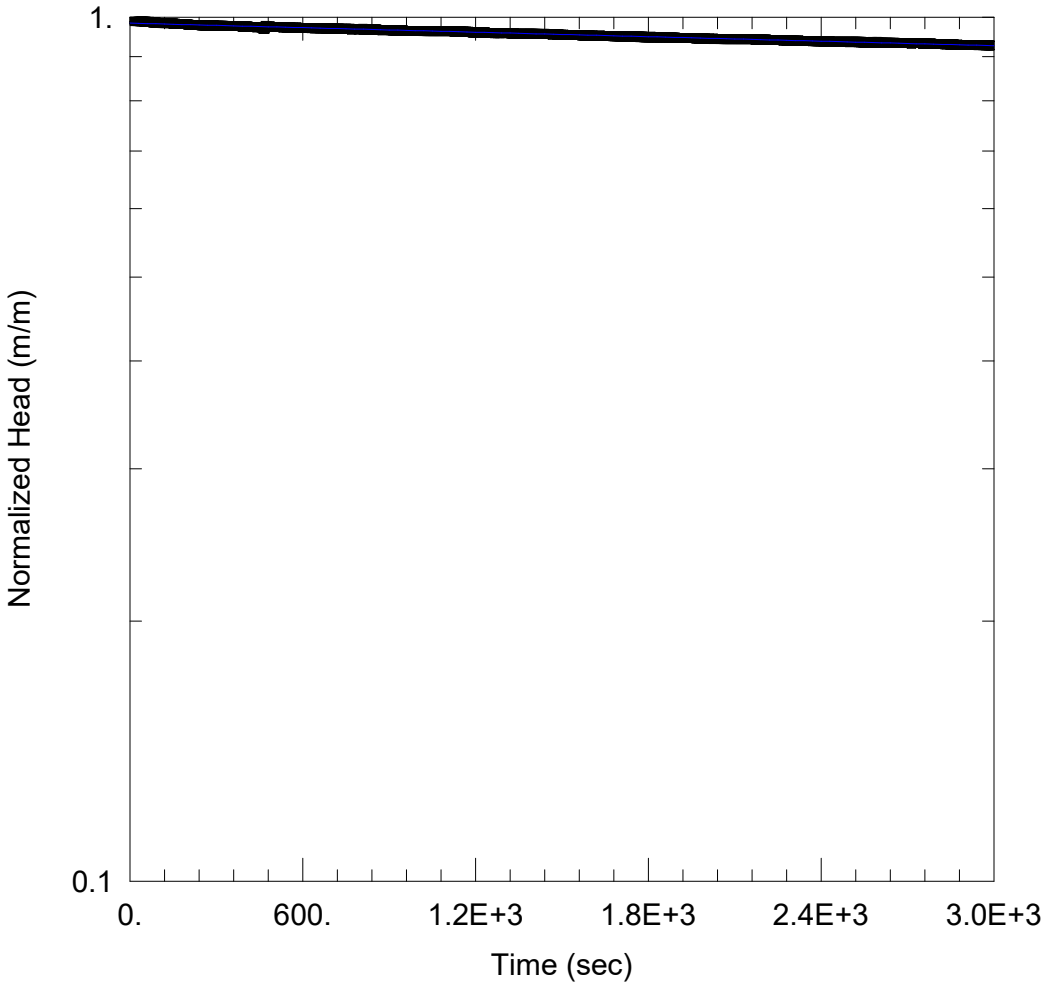
Saturated Thickness: 1.4 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 21-1)

Initial Displacement: 0.432 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.4 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.217E-7 m/sec
y0 = 0.3945 m



WELL TEST ANALYSIS

Data Set: I:\...\BH 21-2.aqt
Date: 02/24/22 Time: 14:35:11

PROJECT INFORMATION

Company: EXP
Client: Argo Development Corporation
Project: BRM-00257876-D0
Location: 12197 Hurontario St, Caledon
Test Date: 14 January 2022

AQUIFER DATA

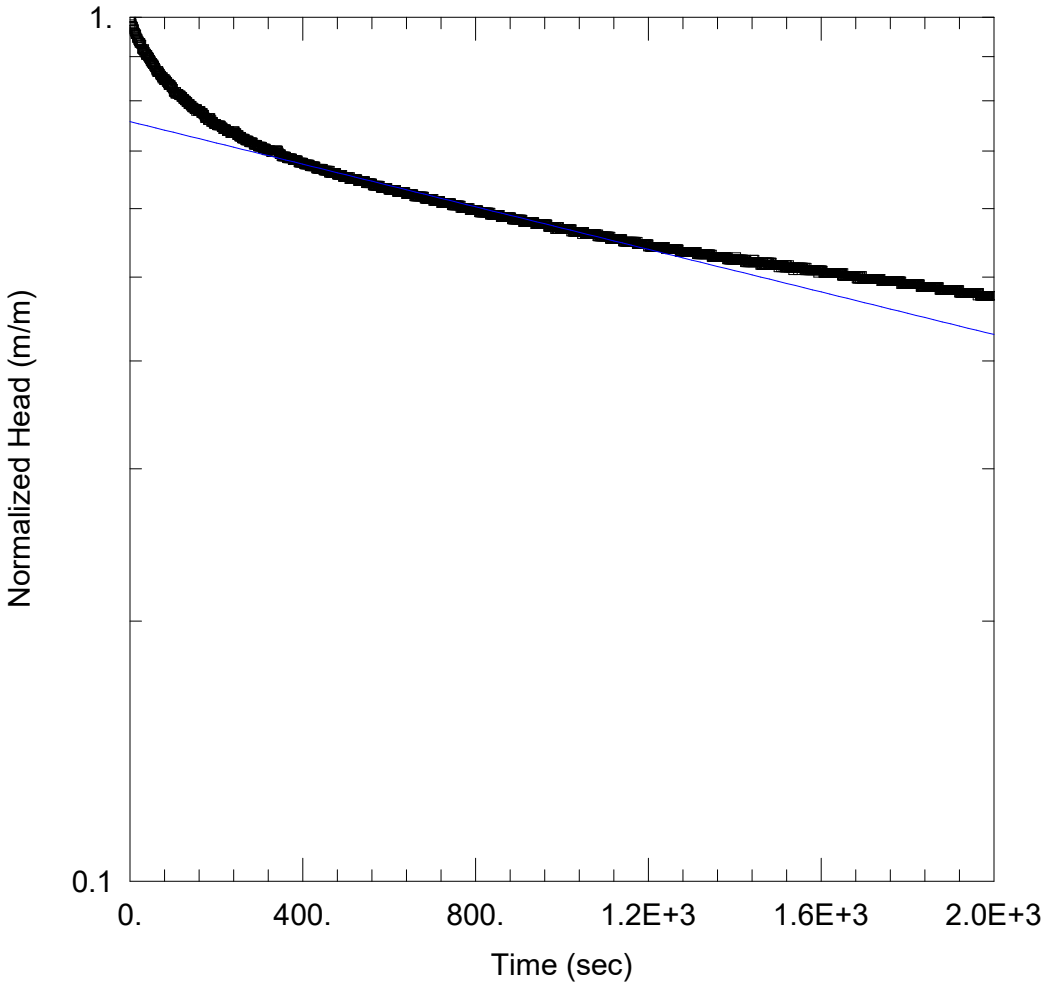
Saturated Thickness: 5.04 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 21-2)

Initial Displacement: 1.605 m
Total Well Penetration Depth: 5.04 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.04 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 9.412E-9 m/sec
y0 = 1.579 m



WELL TEST ANALYSIS

Data Set: I:\...\BH 21-3.aqt
Date: 02/24/22 Time: 14:36:08

PROJECT INFORMATION

Company: EXP
Client: Argo Development Corporation
Project: BRM-00257876-D0
Location: 12197 Hurontario St, Caledon
Test Date: 12 January 2022

AQUIFER DATA

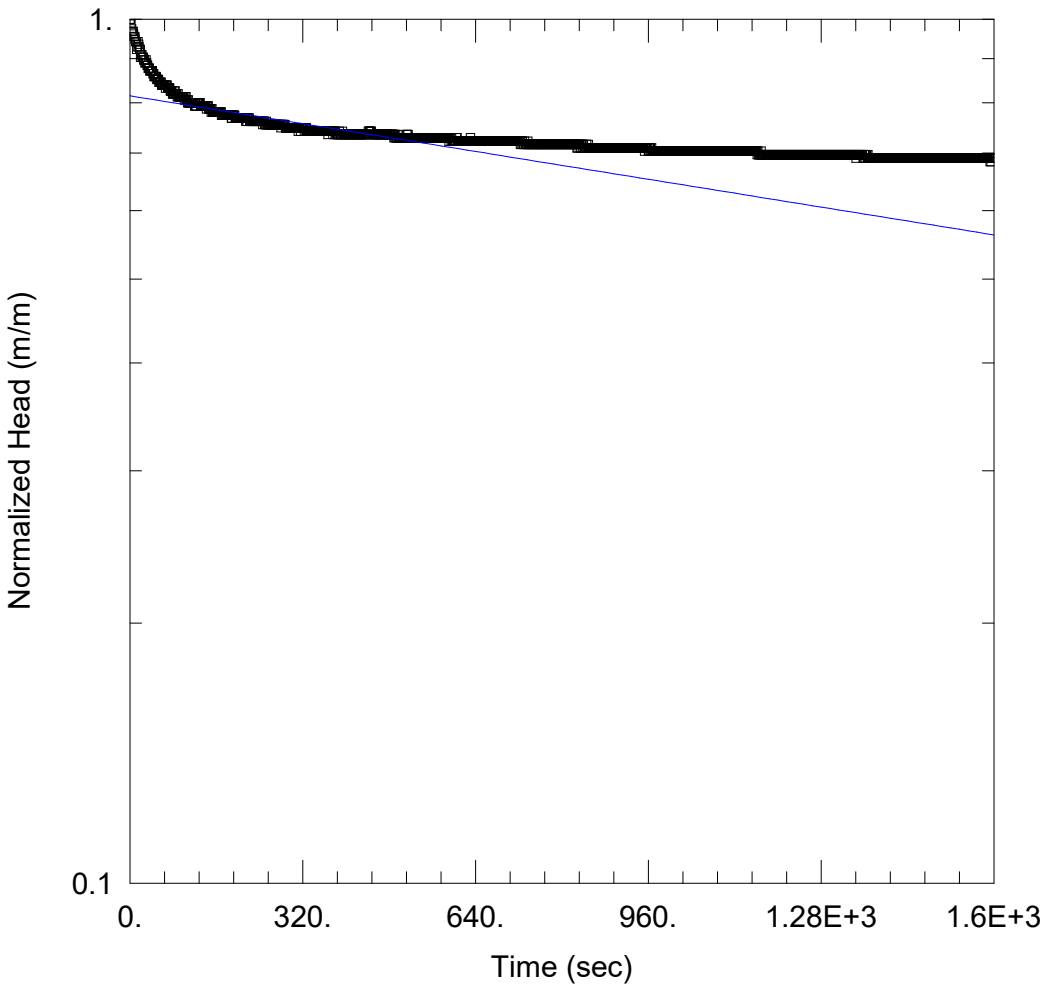
Saturated Thickness: 6.425 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 21-3)

Initial Displacement: 0.813 m Static Water Column Height: 6.425 m
Total Well Penetration Depth: 6.425 m Screen Length: 3. m
Casing Radius: 0.0254 m Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
K = 1.332E-7 m/sec y0 = 0.6154 m



WELL TEST ANALYSIS

Data Set: I:\...\BH 21-4.aqt
Date: 02/24/22 Time: 14:36:32

PROJECT INFORMATION

Company: EXP
Client: Argo Development Corporation
Project: BRM-00257876-D0
Location: 12197 Hurontario St, Caledon
Test Date: 12 January 2022

AQUIFER DATA

Saturated Thickness: 1.84 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 21-4)

Initial Displacement: 0.465 m Static Water Column Height: 1.84 m
Total Well Penetration Depth: 3. m Screen Length: 3. m
Casing Radius: 0.0254 m Well Radius: 0.0762 m

SOLUTION

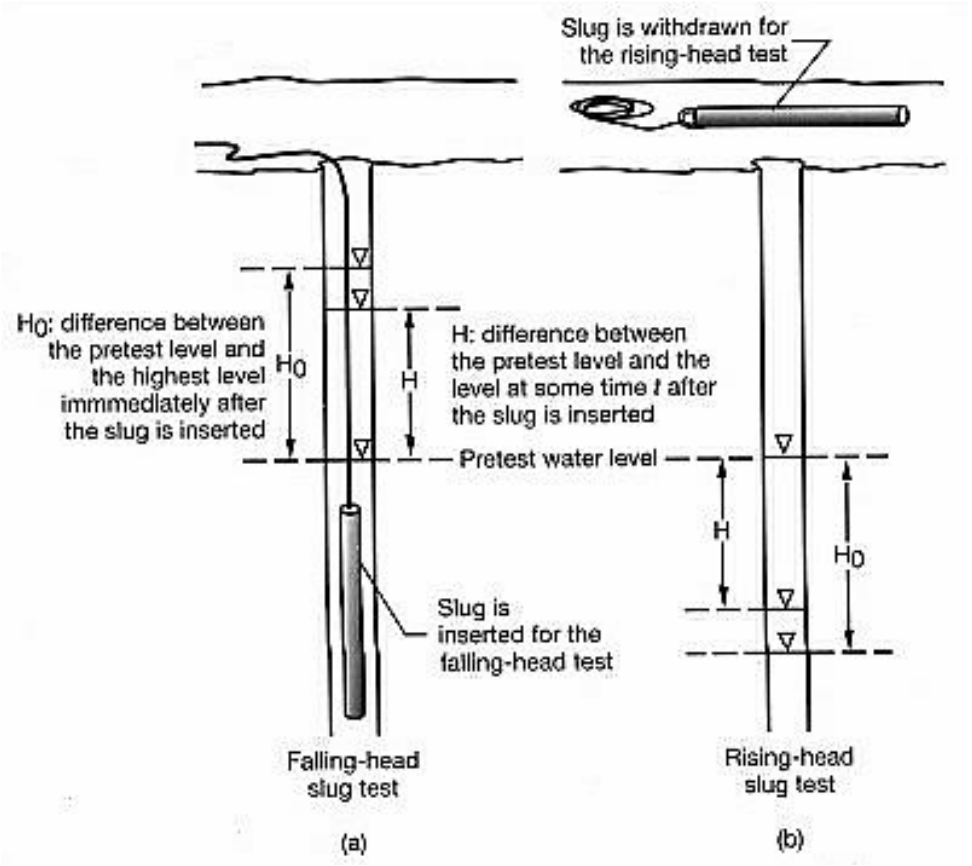
Aquifer Model: Unconfined Solution Method: Hvorslev
K = 2.151E-7 m/sec y0 = 0.379 m

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's Certificates of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: EXP SERVICES INC
1595 CLARK BLVD.
BRAMPTON, ON L6T4V1
(905) 793-9809
ATTENTION TO: Francois Chartier
PROJECT: BRM-00257876-D0
AGAT WORK ORDER: 22T853125
MICROBIOLOGY ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Lab Manager
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
ULTRA TRACE REVIEWED BY: Marc Paquet, Chimiste, AGAT Québec
WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer
DATE REPORTED: Jan 20, 2022
PAGES (INCLUDING COVER): 18
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

E. Coli (Using MI Agar)

DATE RECEIVED: 2022-01-12

DATE REPORTED: 2022-01-20

				SAMPLE DESCRIPTION:	BH21-2
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2022-01-12 13:00
Parameter	**Unit**	**G / S**	**RDL**	**3421373**	
Escherichia coli	CFU/100mL	200		0	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3421373 Escherichia coli, Total Coliforms RDL = 1 CFU/100mL.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Amanjot Bhela

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
AMANJOT BHELA
CHEMIST

AGAT Laboratories

5835 COOPERS AVENUE
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Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Fecal Coliforms in Water

DATE RECEIVED: 2022-01-12

DATE REPORTED: 2022-01-20

				SAMPLE DESCRIPTION:	BH21-2
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2022-01-12 13:00
Parameter	**Unit**	**G / S**	**RDL**	**3421373**	
Fecal Coliform	CFU/100mL	0		0	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3421373 Fecal Coliforms RDL = 1 CFU/100mL

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Peel Region Sanitary/Storm - Organics

DATE RECEIVED: 2022-01-12

DATE REPORTED: 2022-01-20

					SAMPLE DESCRIPTION:	BH21-2
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2022-01-12 13:00
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**	**3421373**	
Oil and Grease (animal/vegetable) in water	mg/L	150		0.5	<0.5[<A]	
Oil and Grease (mineral) in water	mg/L	15		0.5	<0.5[<A]	
Methylene Chloride	mg/L	2	0.0052	0.0003	<0.0003[<B]	
Methyl Ethyl Ketone	mg/L	8.0		0.0009	<0.0009[<A]	
cis-1,2-Dichloroethylene	mg/L	4	0.0056	0.0002	<0.0002[<B]	
Chloroform	mg/L	0.04	0.002	0.0002	<0.0002[<B]	
Benzene	mg/L	0.01	0.002	0.0002	<0.0002[<B]	
Trichloroethylene	mg/L	0.4	0.008	0.0002	0.0003[<B]	
Toluene	mg/L	0.27	0.002	0.0002	<0.0002[<B]	
Tetrachloroethene	mg/L	1	0.0044	0.0002	<0.0002[<B]	
trans-1,3-Dichloropropene	mg/L	0.14	0.0056	0.0003	<0.0003[<B]	
Ethylbenzene	mg/L	0.16	0.002	0.0001	<0.0001[<B]	
1,1,2,2-Tetrachloroethane	mg/L	1.4	0.017	0.0001	<0.0001[<B]	
Styrene	mg/L	0.2		0.0001	<0.0001[<A]	
1,2-Dichlorobenzene	mg/L	0.05	0.0056	0.0001	<0.0001[<B]	
1,4-Dichlorobenzene	mg/L	0.08	0.0068	0.0001	<0.0001[<B]	
m & p-Xylene	mg/L			0.0002	<0.0002	
o-Xylene	mg/L			0.0001	<0.0001	
Xylenes (Total)	mg/L	1.4	0.0044	0.0001	<0.0001[<B]	
PCBs	mg/L	0.001	0.0004	0.0002	<0.0002[<B]	
Di-n-butyl phthalate	mg/L	0.08	0.015	0.0005	<0.0005[<B]	
Bis(2-Ethylhexyl)phthalate	mg/L	0.012	0.0088	0.0005	<0.0005[<B]	

Certified By: N Popnikolof

AGAT Laboratories

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CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Peel Region Sanitary/Storm - Organics

DATE RECEIVED: 2022-01-12

DATE REPORTED: 2022-01-20

		SAMPLE DESCRIPTION:	BH21-2
		SAMPLE TYPE:	Water
		DATE SAMPLED:	2022-01-12 13:00
Surrogate	**Unit**	**Acceptable Limits**	**3421373**
Toluene-d8	% Recovery	50-140	102
4-Bromofluorobenzene	% Recovery	50-140	80
Decachlorobiphenyl	%	50-140	107
2,4,6-Tribromophenol	%	50-140	78
2-Fluorophenol	%	50-140	85
Chrysene-d12	%	50-140	88
phenol-d6 surrogate	%	50-140	90

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Peel Sanitary By-Law 53-2010, B Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3421373 Oil and Grease animal/vegetable is a calculated parameter. The calculated value is the difference between Total O&G and Mineral O&G.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)

DATE RECEIVED: 2022-01-12

DATE REPORTED: 2022-01-20

				SAMPLE DESCRIPTION:	BH21-2
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2022-01-12 13:00
Parameter	**Unit**	**G / S**	**RDL**	**3421373**	
Total Nonylphenol	mg/L	0.001	0.001	<0.001	
NP1EO	mg/L		0.001	<0.001	
NP2EO	mg/L		0.0003	<0.0003	
Total Nonylphenol Ethoxylates	mg/L	0.01	0.001	<0.001	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to CIty of Toronto Storm Sewer Discharge
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Montréal (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

CBOD5

DATE RECEIVED: 2022-01-12

DATE REPORTED: 2022-01-20

				SAMPLE DESCRIPTION:	BH21-2
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2022-01-12 13:00
Parameter	**Unit**	**G / S**	**RDL**	**3421373**	
Biochemical Oxygen Demand, Carbonaceous	mg/L		2.00	<2.00	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Peel Sanitary/Storm Sewer Use By-Law - Inorganics

DATE RECEIVED: 2022-01-12

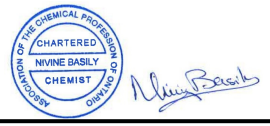
DATE REPORTED: 2022-01-20

					SAMPLE DESCRIPTION:	BH21-2
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2022-01-12 13:00
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**		**3421373**
pH	pH Units	5.5-10	6.0-9.0	NA		7.80
Total Suspended Solids	mg/L	350	15	10		<10[<B]
Fluoride	mg/L	10		0.05		<0.05[<A]
Sulphate	mg/L	1500		0.10		71.8[<A]
Total Cyanide	mg/L	2	0.02	0.002		<0.002[<B]
Phenols	mg/L	1.0	0.008	0.002		0.005[<B]
Total Phosphorus	mg/L	10	0.4	0.02		<0.02[<B]
Total Kjeldahl Nitrogen	mg/L	100	1	0.10		<0.10[<B]
Total Aluminum	mg/L	50		0.010		0.028[<A]
Total Antimony	mg/L	5		0.020		<0.020[<A]
Total Arsenic	mg/L	1	0.02	0.015		<0.015[<B]
Total Cadmium	mg/L	0.7	0.008	0.010		<0.010[<A]
Total Chromium	mg/L	5	0.08	0.015		<0.015[<B]
Total Cobalt	mg/L	5		0.020		<0.020[<A]
Total Copper	mg/L	3	0.05	0.010		<0.010[<B]
Total Lead	mg/L	3	0.120	0.020		<0.020[<B]
Total Manganese	mg/L	5	0.05	0.020		0.056[B-A]
Total Mercury	mg/L	0.01	0.0004	0.0002		<0.0002[<B]
Total Molybdenum	mg/L	5		0.020		<0.020[<A]
Total Nickel	mg/L	3	0.08	0.015		<0.015[<B]
Total Selenium	mg/L	1	0.02	0.002		<0.002[<B]
Total Silver	mg/L	5	0.12	0.010		<0.010[<B]
Total Tin	mg/L	5		0.025		<0.025[<A]
Total Titanium	mg/L	5		0.010		<0.010[<A]
Total Zinc	mg/L	3	0.04	0.020		<0.020[<B]

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Peel Sanitary By-Law 53-2010, B Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Exceedance Summary

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Francois Chartier

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3421373	BH21-2	ON Peel SM	Peel Sanitary/Storm Sewer Use By-Law - Inorganics	Total Manganese	mg/L	0.05	0.056

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Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Microbiology Analysis

RPT Date: Jan 20, 2022			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
E. Coli (Using MI Agar)															
Escherichia coli	3421373	3421373	0	0	NA	<									
Comments: NA - % RPD Not Applicable.															
Fecal Coliforms in Water															
Fecal Coliform	3421373	3421373	0	0	NA	<									
Comments: NA - % RPD Not Applicable															

Certified By:

Amanjot Bhela

CHARTERED CHEMIST AMANJOT BHELA — ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO

AGAT Laboratories

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Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Jan 20, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Peel Region Sanitary/Storm - Organics															
Oil and Grease (animal/vegetable) in water	3418162		< 0.5	< 0.5	NA	< 0.5	106%	70%	130%	110%	70%	130%	104%	70%	130%
Oil and Grease (mineral) in water	3418162		< 0.5	< 0.5	NA	< 0.5	78%	70%	130%	78%	70%	130%	80%	70%	130%
Methylene Chloride	3421373	3421373	<0.0003	<0.0003	NA	< 0.0003	105%	50%	140%	106%	60%	130%	109%	50%	140%
Methyl Ethyl Ketone	3421373	3421373	<0.0009	<0.0009	NA	< 0.0009	115%	50%	140%	100%	50%	140%	103%	50%	140%
cis-1,2-Dichloroethylene	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	111%	50%	140%	75%	60%	130%	93%	50%	140%
Chloroform	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	126%	50%	140%	76%	60%	130%	99%	50%	140%
Benzene	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	105%	50%	140%	74%	60%	130%	87%	50%	140%
Trichloroethylene	3421373	3421373	0.0003	0.0002	NA	< 0.0002	98%	50%	140%	94%	60%	130%	96%	50%	140%
Toluene	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	99%	50%	140%	95%	60%	130%	79%	50%	140%
Tetrachloroethene	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	93%	50%	140%	101%	60%	130%	106%	50%	140%
trans-1,3-Dichloropropene	3421373	3421373	<0.0003	<0.0003	NA	< 0.0003	106%	50%	140%	112%	60%	130%	93%	50%	140%
Ethylbenzene	3421373	3421373	<0.0001	<0.0001	NA	< 0.0001	89%	50%	140%	73%	60%	130%	89%	50%	140%
1,1,2,2-Tetrachloroethane	3421373	3421373	<0.0001	<0.0001	NA	< 0.0001	108%	50%	140%	93%	60%	130%	105%	50%	140%
Styrene	3421373	3421373	<0.0001	<0.0001	NA	< 0.0001	94%	50%	140%	85%	60%	130%	101%	50%	140%
1,2-Dichlorobenzene	3421373	3421373	<0.0001	<0.0001	NA	< 0.0001	116%	50%	140%	74%	60%	130%	84%	50%	140%
1,4-Dichlorobenzene	3421373	3421373	<0.0001	<0.0001	NA	< 0.0001	115%	50%	140%	100%	60%	130%	104%	50%	140%
m & p-Xylene	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	95%	50%	140%	93%	60%	130%	104%	50%	140%
o-Xylene	3421373	3421373	<0.0001	<0.0001	NA	< 0.0001	79%	50%	140%	92%	60%	130%	102%	50%	140%
PCBs	3424917		< 0.0002	< 0.0002	NA	< 0.0002	104%	50%	140%	94%	50%	140%	107%	50%	140%
Di-n-butyl phthalate	3222492		< 0.0005	< 0.0005	NA	< 0.0005	78%	50%	140%	90%	50%	140%	111%	50%	140%
Bis(2-Ethylhexyl)phthalate	3222492		< 0.0005	< 0.0005	NA	< 0.0005	105%	50%	140%	90%	50%	140%	98%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

AGAT Laboratories
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FAX (905)712-5122
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Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Ultra Trace Analysis

RPT Date: Jan 20, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)															
Total Nonylphenol	1	3416235	0.025	0.022	12.8%	< 0.001	NA	60%	140%	88%	60%	140%	NA	60%	140%
NP1EO	1	3416235	0.001	0.001	NA	< 0.001	NA	60%	140%	82%	60%	140%	NA	60%	140%
NP2EO	1	3416235	0.0009	0.0009	NA	< 0.0003	NA	60%	140%	77%	60%	140%	NA	60%	140%

Certified By:

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Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jan 20, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Peel Sanitary/Storm Sewer Use By-Law - Inorganics															
pH	3421528		7.83	7.84	0.1%	NA	102%	90%	110%						
Total Suspended Solids	3433463		<10	<10	NA	< 10	100%	80%	120%						
Fluoride	3422145		<0.05	<0.05	NA	< 0.05	92%	70%	130%	102%	80%	120%	94%	70%	130%
Sulphate	3422145		69.6	69.6	0.0%	< 0.10	99%	70%	130%	106%	80%	120%	107%	70%	130%
Total Cyanide	3415604		<0.002	<0.002	NA	< 0.002	75%	70%	130%	96%	80%	120%	96%	70%	130%
Phenols	3425068		<0.002	<0.002	NA	< 0.002	98%	90%	110%	99%	90%	110%	106%	80%	120%
Total Phosphorus	3421373	3421373	<0.02	<0.02	NA	< 0.02	100%	70%	130%	103%	80%	120%	94%	70%	130%
Total Kjeldahl Nitrogen	3421528		0.24	0.25	NA	< 0.10	98%	70%	130%	108%	80%	120%	100%	70%	130%
Total Aluminum	3421373	3421373	0.028	0.031	NA	< 0.010	100%	70%	130%	100%	80%	120%	97%	70%	130%
Total Antimony	3421373	3421373	<0.020	<0.020	NA	< 0.020	93%	70%	130%	95%	80%	120%	92%	70%	130%
Total Arsenic	3421373	3421373	<0.015	<0.015	NA	< 0.015	99%	70%	130%	107%	80%	120%	104%	70%	130%
Total Cadmium	3421373	3421373	<0.010	<0.010	NA	< 0.010	90%	70%	130%	97%	80%	120%	94%	70%	130%
Total Chromium	3421373	3421373	<0.015	<0.015	NA	< 0.015	99%	70%	130%	101%	80%	120%	106%	70%	130%
Total Cobalt	3421373	3421373	<0.020	<0.020	NA	< 0.020	96%	70%	130%	101%	80%	120%	104%	70%	130%
Total Copper	3421373	3421373	<0.010	<0.010	NA	< 0.010	98%	70%	130%	103%	80%	120%	102%	70%	130%
Total Lead	3421373	3421373	<0.020	<0.020	NA	< 0.020	99%	70%	130%	103%	80%	120%	101%	70%	130%
Total Manganese	3421373	3421373	0.056	0.058	NA	< 0.020	102%	70%	130%	106%	80%	120%	106%	70%	130%
Total Mercury	3421373	3421373	<0.0002	<0.0002	NA	< 0.0002	104%	70%	130%	101%	80%	120%	96%	70%	130%
Total Molybdenum	3421373	3421373	<0.020	<0.020	NA	< 0.020	99%	70%	130%	105%	80%	120%	105%	70%	130%
Total Nickel	3421373	3421373	<0.015	<0.015	NA	< 0.015	97%	70%	130%	99%	80%	120%	101%	70%	130%
Total Selenium	3421373	3421373	<0.002	0.003	NA	< 0.002	107%	70%	130%	113%	80%	120%	110%	70%	130%
Total Silver	3421373	3421373	<0.010	<0.010	NA	< 0.010	99%	70%	130%	101%	80%	120%	100%	70%	130%
Total Tin	3421373	3421373	<0.025	<0.025	NA	< 0.025	94%	70%	130%	95%	80%	120%	95%	70%	130%
Total Titanium	3421373	3421373	<0.010	<0.010	NA	< 0.010	94%	70%	130%	106%	80%	120%	114%	70%	130%
Total Zinc	3421373	3421373	<0.020	<0.020	NA	< 0.020	101%	70%	130%	102%	80%	120%	104%	70%	130%
CBOD5															
Biochemical Oxygen Demand, Carbonaceous	3421812		27.0	27.0	0.0%	< 2	102%	70%	130%						

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Fecal Coliform	MIC-93-7000	SM 9222 D	MF/INCUBATOR

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Method Summary

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AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Oil and Grease (animal/vegetable) in water	VOL-91-5011	EPA SW-846 3510C & SM5520	BALANCE
Oil and Grease (mineral) in water	VOL-91-5011	EPA SW-846 3510C & SM 5520	BALANCE
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis-1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans-1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	CALCULATION
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
PCBs	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW846 3510C & 8082A	GC/ECD
Di-n-butyl phthalate	ORG-91-5114	modified from EPA SW-846 3510C & 8270E	GC/MS
Bis(2-Ethylhexyl)phthalate	ORG-91-5114	modified from EPA SW-846 3510C & 8270E	GC/MS
2,4,6-Tribromophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
2-Fluorophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene-d12	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS

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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
phenol-d6 surrogate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Ultra Trace Analysis			
Total Nonylphenol	TOX-151-19003F	ASTM D7065-6	LCMSMS
NP1EO	TOX-151-19003F	ASTM D7065-6	LCMSMS
NP2EO	TOX-151-19003F	ASTM D7065-6	LCMSMS
Total Nonylphenol Ethoxylates	TOX-19003F	ASTM D7065-6	LCMSMS

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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22T853125

PROJECT: BRM-00257876-D0

ATTENTION TO: Francois Chartier

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Biochemical Oxygen Demand, Carbonaceous	INOR-121-6023	SM 5210 B	INCUBATOR
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Total Suspended Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Total Cyanide	INOR-93-6051	modified from MOECC E3015; SM 4500-CN- A, B, & C	TECHNICON AUTO ANALYZER
Phenols	INOR-93-6072	modified from SM 5530 D	LACHAT FIA
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Kjeldahl Nitrogen	INOR-93-6048	modified from EPA 351.2 and SM 4500-NORG D	LACHAT FIA
Total Aluminum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

AGAT Laboratories

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: EXP Services Inc
Contact: Francois Chartier
Address: 1595 Clark Blvd
Phone: Thabiso.Modise@exp.com Fax:
Reports to be sent to:
1. Email: Francois.Chartier@exp.com
2. Email: Jeffrey.Leon@exp.com

Project Information:

Project: BRM-00257876-DO
Site Location: 12197 Hurontario St
Sampled By: Thabiso Modise
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table _____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Excess Soils R406
Table _____ *Indicate One*
☐ Regulation 558
☐ CCME

☑ Sewer Use
☑ Sanitary ☑ Storm
Peel
Region
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Indicate One

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Laboratory Use Only

Work Order #: 22T853125
Cooler Quantity: 1 Large
Arrival Temperatures: 4.6 | 5.2 | 3.9
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: Free Pet

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Peel Sanitary & Storm	Potentially Hazardous or High Concentration (Y/N)
BH 21-2	12 Jan 22	1:00 AM (PM)	26	GW		N											✓	
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																
		AM PM																

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
THABISO MODISE	12 Jan 22	17:30	NEAL		
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

22 JAN 12 5:25PM

Page _____ of _____

No: T 129948

Appendix E – Construction and Post-Construction Flow Rate Calculations

APPENDIX E: Short and Long Term Flow Rate

12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
BRM-00257876-D0

Table E-1: Dewatering Flow rate for construction and from Under-Slab Drain System

Parameters	Symbols	Unit	Construction	Post Construction
Geological Formation	-	-	Glacial Deposit	Glacial Deposit
Ground Elevation	-	mASL	258.00	258.00
Lowest Top Slab Elevation	-	mASL	255.00	255.00
Highest Groundwater Elevation	-	mASL	257.92	257.92
Lowest Footing Elevation	-	mASL	253.50	253.50
Base of the Water-Bearing Zone	-	mASL	250.00	250.00
Height of Static Water Table Above the Base of the Water-Bearing Zone	**H**	m	7.92	7.92
Dewatering Target Elevation	-	mASL	252.50	254.50
Height of Target Water Level Above the Base of Water-Bearing Zone	**h_w**	m	2.50	4.50
Dupuit Criteria	**hw/H**	%	32	57
Hydraulic Conductivity	**K**	m/s	1.2E-07	1.2E-07
Length of Excavation	-	m	20.00	20.00
Width of Excavation	-	m	20.00	20.00
Equivalent Radius (equivalent perimeter)	**r_e**	m	12.73	12.73
Method to Calculate Radius of Influence	-	-	**Cooper-Jacob**	**Cooper-Jacob**
Time (30 days)	**t**	s	2592000	31536000
Specific Yield	**Sy**		0.05	0.05
Cooper-Jacob's Radius of Influence from Sides of Excavation	**Rcj**	m	10.53	36.73
Radius of Influence	**Ro**	m	23.26	49.46
Dewatering Flow Rate (unconfined radial flow component)	**Q**	m^3/day	3.05	1.02
Factor of Safety	**fs**	-	2.00	2.00
Dewatering Flow Rate (multiplied by factor of safety)	**Q.fs**	m^3/day	6.11	2.04
Precipitation Event	-	mm/day	15	0
Volume from Precipitation	-	m^3/day	6.00	0
Dewatering Flow Rate **Without Safety Factor** (including stormwater collection)	-	m^3/day	9.05	1
Dewatering Flow Rate **With Safety Factor** (including stormwater collection)	-	m^3/day	12.11	2

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_w = Flow rate per unit length of excavation (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)

APPENDIX E: Construction Dewatering Calculations

12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
BRM-00257876-D0

Table E-2: Unconfined Flow into Long Excavation

Parameters	Symbols	Unit	Value
Groundwater Elevation	-	m ASL	257.92
Construction Dewatering Elevation Target	-	m ASL	253.84
Bottom Elevation of Water-Bearing Zone	-	m ASL	250.00
Length of Trench	**x**	m	50.00
Width of Trench	**w**	m	2.00
Area of Trench	**A**	m^2	100.00
Hydraulic Conductivity	**K**	m/s	1.2E-07
Drawdown	**s**	m	4.08
Equivalent Well Radius of A	**rs**	m	16.55
Distance of Influence of Construction Dewatering from Equivalent Well Border	R_S	m	4.24
Radius of Influence of Construction Dewatering from Equivalent Well Center	$R_0=r_s+R_S$	m	20.79
Distance of Influence of Construction Dewatering from Equivalent Well Center	**L=R0/2**	m	10.40
Hydraulic Head Beyond R0	H_{sat}	m	7.92
Hydraulic Head within A	$h=H_{sat}-s$	m	3.84
Construction Dewatering Rate - Ends	Q_{ends}	m^3/d	6.85
Construction Dewatering Rate - Trench	Q_{trench}	m^3/d	2.39
Construction Dewatering Rate - Stormwater	Q_{IDF}	m^3/d	1.50
Construction Dewatering Rate - MECP (excludes rainwater)	Q_{MECP}	m^3/d	10.75
Precipitation Event	**P**	mm/24hrs	15.00
Construction Dewatering Rate - Total	Q_{Total}	m^3/d	25.75

Notes:

mASL - meters above sea level

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

$$Q = \underbrace{\frac{\pi K(H^2-h^2)}{\ln R_o/r_s}}_{\boldsymbol{ends}} + 2\underbrace{[\frac{xK(H^2-h^2)}{2L}]}_{\boldsymbol{trench}}$$

(Based on the Dupuit Equation)

Where:

Q = construction dewatering rate (m^3/sec)

K = saturated and horizontal hydraulic conductivity (m/s)

H = hydraulic head beyond R_0 (m)

h = hydraulic head within A (m)

s = drawdown (=H-h)

r_s = equivalent well radius of A (m)

R_S = distance of influence of construction dewatering/pumping from equivalent well border (m)

R_0 = radius of influence of construction dewatering/pumping from equivalent well center (m)

x = length of the trench (m)

w = width (m)

L = distance of influence of construction dewatering/pumping from equivalent well center (m)

π = Pi (1)

S_y = specific yield

Appendix F – Water Balance

Project Address 12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
Project Number BRM-00257876-D0

Station Name	GEORGETOWN WWTP	
Station ID	ONTARIO	
Longitude	43.64	
Latitude	-79.88	
Elevation	221.0	masl
Climate Identifier	6152695	

Appendix F-1: Model Input

12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
BRM-00257876-D0

Period	Month	Average Temperature (^{0}C)	Average Precipitation (mm)
1977-2006	1	-6.30	67.80
1977-2006	2	-5.20	60.00
1977-2006	3	-0.90	57.20
1977-2006	4	6.00	76.50
1977-2006	5	12.30	79.30
1977-2006	6	17.40	74.80
1977-2006	7	20.00	73.50
1977-2006	8	19.00	79.30
1977-2006	9	14.80	86.20
1977-2006	10	8.40	68.30
1977-2006	11	2.80	88.50
1977-2006	12	-2.90	65.90

Note:

Station Name	Georgetown	
Station ID	ONTARIO	
Longitude	43.64	
Latitude	-79.88	
Elevaion	221.0	masl

Appendix F-2: Model Output

12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
BRM-00257876-D0

Month	PET	P	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus
January	8.4	67.8	24.7	135.0	8.4	0.0	34.7	39.7
February	10.3	60.0	38.7	135.0	10.3	0.0	45.8	38.7
March	19.2	57.2	64.8	135.0	19.2	0.0	18.9	64.8
April	36.8	76.5	58.6	135.0	36.8	0.0	0.0	58.6
May	67.7	79.3	11.6	135.0	67.7	0.0	0.0	11.6
June	98.6	74.8	-23.8	111.2	98.6	0.0	0.0	0.0
July	114.6	73.5	-41.1	77.3	107.4	7.2	0.0	0.0
August	91.6	79.3	-12.3	70.3	86.3	5.2	0.0	0.0
September	54.0	86.2	32.2	102.6	54.0	0.0	0.0	0.0
October	28.7	68.3	39.6	135.0	28.7	0.0	0.0	7.1
November	15.1	88.5	73.4	135.0	15.1	0.0	0.0	73.4
December	9.5	65.9	42.8	135.0	9.5	0.0	13.6	42.8
Annual rate (mm/yr)	**554.50**	**877.30**			**542.00**		**113.00**	**335.30**

Note:

Station Name	Georgetown	
Station ID	ONTARIO	
Longitude	43.64	
Latitude	-79.88	
Elevaion	221.0	masl

APPENDIX F-3
Average Infiltration Factors

12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
BRM-00257876-D0

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

Un-Mitigated

Category	Weighted Infiltration Factor
Topography/Slope	0.12
Soil Type Glaciolacustrine deposits (Silty to Clayey)	0.20
Cover Landscaped Areas	0.10
Total weighted Infiltration factor	**0.42**

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

Un-Mitigated

Category	Weighted IInfiltration Factor
Topography/Slope	0.200
Soil Type Glaciolacustrine deposits (Silty to Clayey)	0.20
Cover Landscaped areas	0.10
Total weighted Infiltration factor	**0.50**

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

12197 Hurontario Street, Brampton and 12221- 12233 Hurontario Street, Caledon, Ontario
BRM-00257876-D0

F-4-1. Climate Data

Item	Pre-Development mm/a		Post-Development mm/a
Precipitation	877.30		877.30
Evapotranspiration	542.00		542.00
Water Surplus	335.30		335.30
Infiltration Rate	141.83		167.65
Runoff	193.47		167.65

F-4-2. Pre-Developed Area Statistics

Open spaces/Landscaped	8,439	sq.m.
Paved Surfaces	23,863	sq.m.
Existing Buildings	3,582	sq.m.
TOTAL	35,884	sq.m.

F-4-3. Post Development Area Statistics

Residential Development

Building Roofs	11,885	sq.m.
ROW (roads, sidewalks, parking) - Paved	7,186	sq.m.
Open Areas/Landscaped Areas	16,813	sq.m.
TOTAL	35,884	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)	27,445	24,077	14,875	0	9,202
Open Spaces	8,439	7,404	4,574	1,197	1,633
TOTAL	35,884	31,481	19,449	1,197	10,835
Pre-development Infiltration Water Balance		**877.3**	**542.0**	**33.36**	**301.94**
		100	62	4	34

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	11,885	10,426			10,426
ROW (roads, sidewalks, parking) - Paved	7,186	6,304	0	0	6,304
Landscaped Areas	16,813	14,750	9,113	2,819	2,819
TOTAL	35,884	31,481	9,113	2,819	19,549
Post-development Infiltration Rate Not-Corrected		**877.3**	**254.0**	**78.55**	**544.79**
		100	28.95	8.95	62.10

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	31,481	19,449	10,835	1,197
Post Development	31,481	9,113	19,549	2,819
			Pre-development Infiltration Rate	**33.4**
			Post-development Infiltration Rate Not-Corrected	**78.6**
			Deficit Post Development Not-Corrected	**-1,622**

12197 Hurontario St
BRM-00257876-D0
Low Impact Design (LID) Calculations for Infiltration Gallery

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 21-3	6.3E-07	12	5	126
INF 301	4.3E-06	20	8	75
INF 303	1.4E-05	27	11	55
INF 203-Redo	6.2E-05	41	16	37

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	6.96E-06	23	1.0	2.5
Underlying Geology Unit (1.5 m below the bottom of trench)	6.96E-06	23		

Design Infiltration Rate(DIR) (mm/hr)	Minimum	5	**Percolation Time (min/cm)**	37
	Maximum	16		126
	Geometric Mean	**9**		**66**

Note:
Analytical Solutions (CVC and TRCA 2010)

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

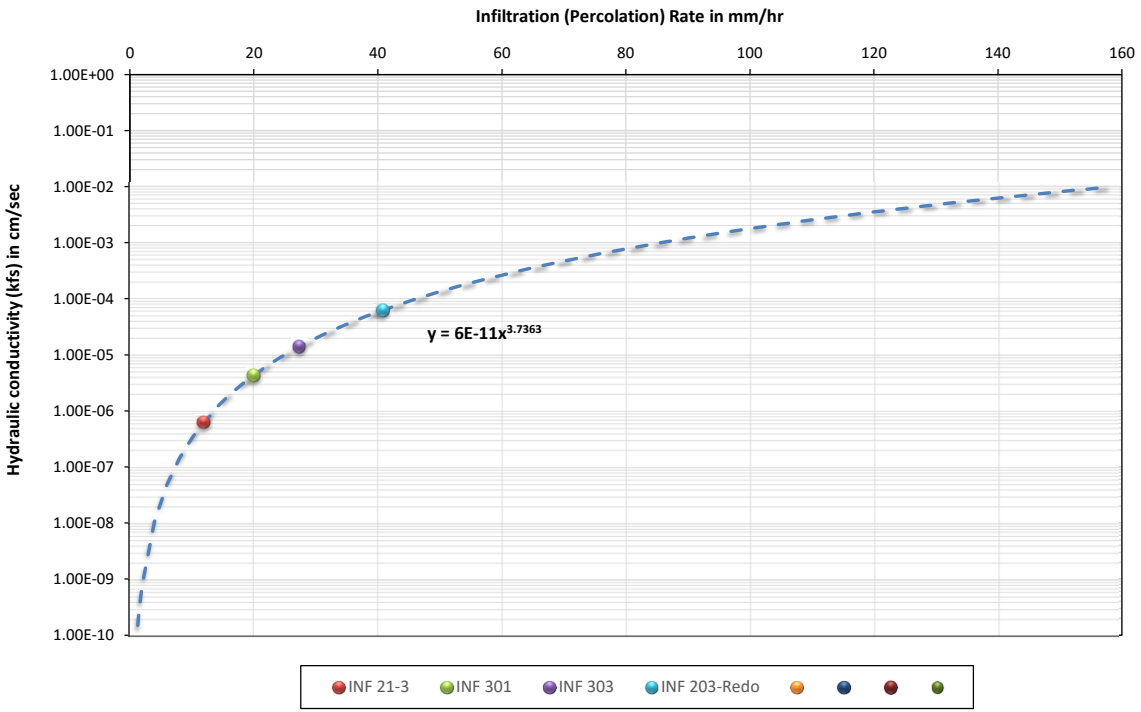
Kfs: hydraulic conductivity (cm/sec)

IR: infiltration rate (mm/hr)

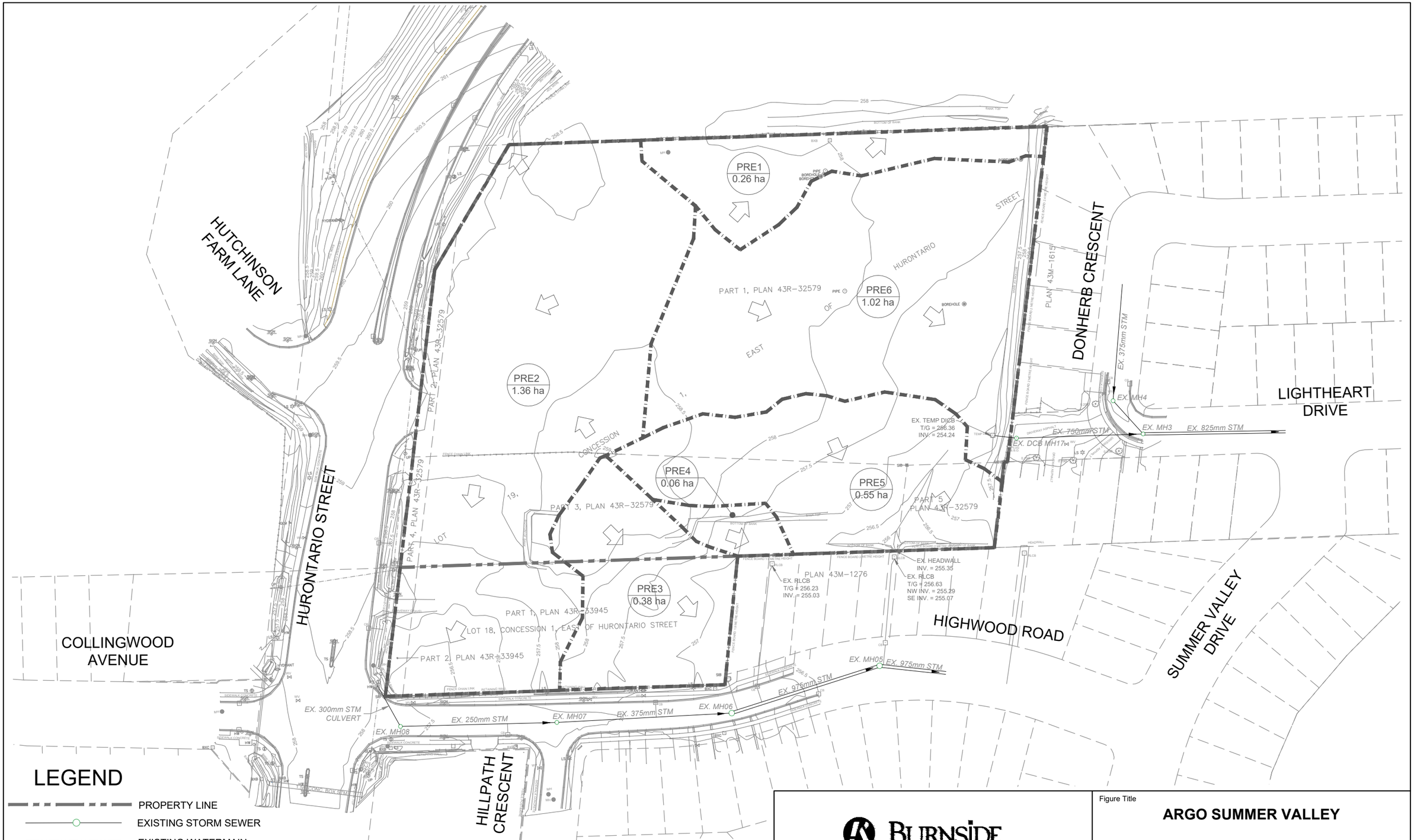
DIR: design infiltration rate (mm/hr)

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 G – Drainage Plan



LEGEND

- PROPERTY LINE
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- EXISTING OVERLAND FLOW
- PRE-DEVELOPMENT DRAINAGE BOUNDARY
- PRE1 / 1.00 ha — CATCHMENT ID / DRAINAGE AREA

0 25 50 75 100
Metres

CITY OF BRAMPTON FILE NUMBER : 0ZS-2022-0030

BURNSIDE

Figure Title
ARGO SUMMER VALLEY
EXISTING SITE DRAINAGE

Client
ARGO SUMMER VALLEY LIMITED

Drawn	Checked	Date	Figure No.
KT	LN	23/05/17	**FIG 7**
Scale		Project No.	
1:1250		300054371	

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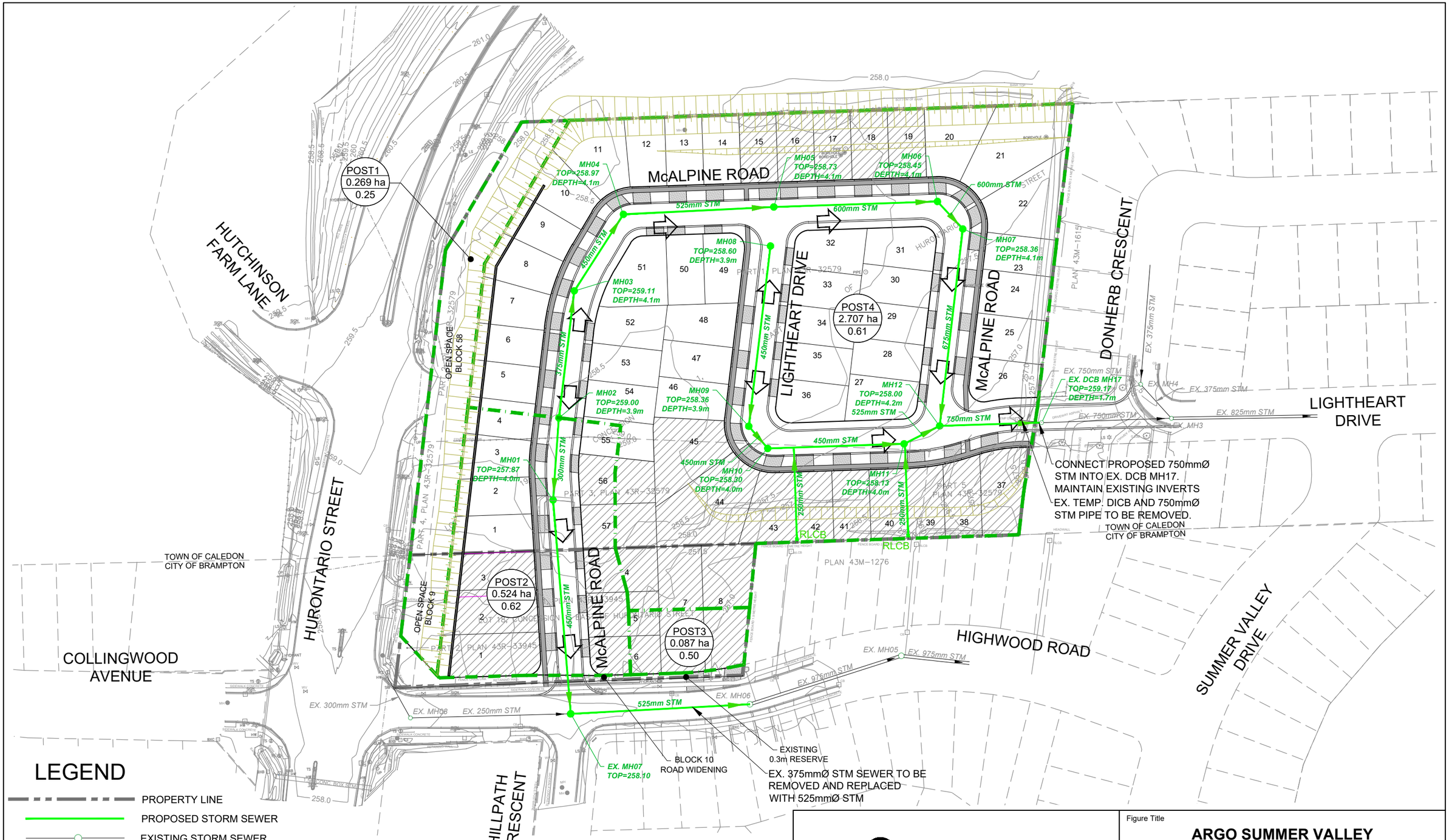

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- MAJOR OVERLAND FLOW ROUTE
- POST -DEVELOPMENT DRAINAGE BOUNDARY
- LOTS WITH SOAK AWAY PITS FOR 5mm RETENTION

POST1 / 1.00 ha / 0.50 — CATCHMENT ID / DRAINAGE AREA (HECTARES) / RUNOFF COEFFICIENT

0 25 50 75 100 Metres

CITY OF BRAMPTON FILE NUMBER : 0ZS-2022-0030

BURNSIDE

Figure Title

ARGO SUMMER VALLEY

PROPOSED DRAINAGE AND STORM SERVICING PLAN

Client

ARGO SUMMER VALLEY LIMITED

Drawn	Checked	Date	Figure No.
KT	LN	23/05/17	**FIG 8**
Scale		Project No.	
1:1250		300054371	

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