

Updated Hydrogeological Assessment Report 272 Innisfil Street, Barrie, Ontario



2022-03-22

Prepared for:
20667340 Ontario Inc., c/o The Typhon Group
Ltd.

Cambium Reference: 8707-003

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Executive Summary

Cambium Inc. was retained by 20667340 Ontario Inc., c/o The Typhon Group Ltd., to complete a hydrogeological assessment at 272 Innisfil Street, Barrie, Ontario. The client intends to redevelop the Site as a condominium structure and associated parking areas.

The hydrogeological assessment yielded the following conclusions:

- The overburden was comprised of sand sediments. Groundwater was encountered between 2.85 mbgs and 4.93 mbgs. The direction of groundwater flow was directed to the northeast.
- The hydraulic conductivity of the sand sediments was determined to be typical of those reported in literature.
- Although groundwater quality reported only a few exceedances for Total Suspended Solids and copper per the City of Barrie Sewer Use Bylaw, since no dewatering was anticipated at the Site, a treatment and discharge plan is not required for the Site.
- Construction dewatering is not expected as no underground parking being proposed at the Site and all structures will be finished as slab-on-grade structures. With the depth of foundation excavation at a maximum of 3 mbgs, it is highly unlikely to have a significant amount of dewatering, except a small to negligible amounts for the elevator pits.
- The pre-development/existing water balance indicates that approximately 0 m³/year of groundwater infiltration occurs at the Site. The post-development water balance indicates infiltration will be increased to at least 271 m³/year without considering stormwater management or Low Impact Development measures. Additionally, the runoff rate of the Site will decrease upon development. As a result the policies outlined for WHPA-Q2 should be satisfied. The Lake Simcoe Region Conservation Authority should be consulted regarding appropriate groundwater recharge sources.



Respectfully submitted,

Cambium Inc.

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1.0 Introduction

Numbered company 20667340 Ontario Inc. (Client), c/o The Typhon Group Ltd. retained Cambium Inc. (Cambium) to complete a hydrogeological assessment at 272 Innisfil Street, Barrie, Ontario (hereafter referred to as the Site). The Client intends to redevelop the Site as a condominium structure and associated parking areas.

Geotechnical and hydrogeological investigations were completed at the Site in 2019 and the results were summarized in respective reports. The results of the geotechnical assessment were summarized in the report titled “Geotechnical Investigation Report - 272 Innisfil Street, Barrie, Ontario” (Cambium Inc., 2019) and the results of the hydrogeological assessment were summarized in the report entitled “Hydrogeological Assessment, 272 Innisfil Street, Barrie, Ontario” (Cambium Inc., 2019).

As the design conditions have changed and review comments from the City and Lake Simcoe Region Conservation Authority (LSRCA) have been received; both the geotechnical investigation and hydrogeological assessment reports were revised and updated.

1.1 Site Description

The Site is irregularly shaped and is approximately 7,027 m² in area. The Site is currently developed with commercial/industrial use and associated raised parking areas.

The Client intends to demolish the existing structure and construct a 17 storey condominium building. The development will also include at grade and above grade parking areas from level 1 to level 4 accommodating a total of 391 parking spaces. The proposed development does not include underground parking. The combined footprint of the proposed condominium structure is approximately 1,750 m², a total parking area is approximately 13,198 m² and landscaped area of approximately 1,030 m². Regional Site location plan, and Site Plan are shown in Figure 1 and Figure 2, respectively. A proposed development plan is attached in Appendix A.

2.0 Methodology

The methodologies followed to complete the field investigation are outlined in this section.

2.1 Drilling Program - 2019

Cambium completed a geotechnical investigation at the Site on July 4, 5, 8 and August 14 2019. A total of Four (4) boreholes, designated as BH101-19 through BH104-19, were advanced into the subsurface at predetermined locations throughout the Site. BH101-19 was terminated at depths of 34.0 m below ground surface (mbgs). BH102-19 was terminated at depth of 31.0 mbgs. BH103-19 and BH104-19 were terminated at depth of 6.7 mbgs. The location of the boreholes was obtained from a handheld GPS unit while the elevation of the boreholes was surveyed relative to BM. The elevation of the benchmark has a geodetic elevation of 228.64 masl according to the survey plan provided by the client. A borehole locations and benchmark are appended as Figure 3 of this report.

Drilling and sampling was completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid or hollow stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals in the upper 3.0 m depth and in 1.5 m intervals below 3.0 m depth. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage.

Open boreholes were checked for groundwater and general stability prior to backfilling. Borehole BH101-19 and BH102-19 were outfitted as monitoring wells in order to understand the groundwater conditions at the site (these wells were installed to a depth of approximately 9 mbgs). All other boreholes were backfilled and sealed in accordance with Ontario Regulation



(O.Reg.) 903, as amended, and the property was reinstated to pre-existing conditions.

Borehole logs are provided in Appendix B.

2.2 Drilling Program - 2022

Cambium completed a supplementary geotechnical investigation at the Site from February 7-10, 2022. A total of two boreholes, designated as BH101-22 and BH102-22, were advanced into the subsurface at predetermined locations throughout the Site. Both boreholes were terminated at a depth of 31.0 mbgs and no wells were installed in the drilled boreholes.

2.3 Physical Laboratory Testing

Physical laboratory testing, including five (5) particle size distribution analyses (LS-702,705), was completed on selected soil samples to confirm textural classification. Testing results are presented in Appendix C and are discussed in Section 3.0.

2.4 Hydrogeological Field Tasks

On July 29, 2019 Cambium staff were on-site to complete hydraulic testing of monitoring wells BH101-19 and BH102-19. A groundwater sample was also collected from BH101-19.

The hydraulic testing of the monitoring wells was completed by inducing an instantaneous change in water level in monitoring wells BH101-19 and BH102-19. Water level recovery was monitored using an automated water level logging device and validated with manual measurements. Hydraulic parameters of the water bearing units were estimated using AquiferTest Pro™ software, the results of which are attached in Appendix D.

A groundwater sample was collected from well BH101-19. The water sample was collected from well BH101-19 and analyzed for the parameters outlined in the City of Barrie Sewer Use-Bylaw 2012-172. The samples were submitted to Caduceon Laboratories in Barrie, Ontario (Caduceon) for analysis. Caduceon is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Samples were stored at a temperature between 0 °C and 10 °C prior and during transport to Caduceon. The groundwater analyses result from historical and current sampling programs are attached as in Appendix E.

3.0 Geological and Hydrogeological Setting

The Site is located within the physiographic region known as the Simcoe Lowlands. The Simcoe Lowlands physiographic region extends from Lake Couchiching, southward along the western edge of Lake Simcoe, continuing southward toward the community of Bolton. Morphologically, this region is characterised by flat, low-lying plains composed of silts, clays and fine to medium grained sands deposited within glacial Lake Algonquin. Evidence of glacial Lake Algonquin and its successors is provided by numerous shorelines, wave-cut notches, terraces and beach ridges located throughout the study area (Chapman, L.J. and D.F. Putnam, 1984) (Lake Simcoe Region Conservation Authority, 2015).

According to Map 2556 of the Ontario Geological Survey (Barnett, P.J., Cowan, W.R. and Henry, A.P., 1991), the Site is located in an area where coarse-textured glaciolacustrine deposits (sand, gravel, minor silt and clay, foreshore and basinal deposits) are located.

The Site and surrounding area are characterized by one bedrock region composed of Upper Ordovician limestone, dolostone, shale, arkose, and sandstone of the Trenton and Black River Groups (Formerly Simcoe Group).

Based on the results of the borehole investigation, subsurface conditions at the Site generally consist of fill overlying thick layer of sand soils, bedrock was not encountered during this geotechnical investigation.

Laboratory particle size distribution analyses were completed on four (4) samples of the native soil taken from the boreholes and depths shown in Embedded Table 1. The grain size distribution results are provided in Appendix C.

Embedded Table 1 Particle Size Distribution Results

Borehole	Depth (mbgs)	Material	% Gravel	% Sand	% Silt	% Clay
BH101-19-SS5	3.0 – 3.7	Sand, some silt trace clay	0	86	11	3
BH102-19-SS3	1.5 – 2.1	Silty Sand, trace clay, trace gravel	1	74	23	3
BH102-19-SS16	24.4 – 24.8	Silty Sand, trace clay	0	63	35	2
BH104-19-SS4	2.3 – 2.7	Sand, some silt trace clay	0	81	16	3

3.1.1 Regulated and Vulnerable Areas

As per the LSRCA the Site is not located within a regulated area. The nearest regulated area is located approximately 150 m north of the Site.

As per the Ministry of Environment, Conservation and Parks (MECP) Source Water Protection Information Atlas (SPIA) the Site is located within the following areas:

- Wellhead Protection Area (WHPA) C. The Client will require confirmation from the City of Barrie and the LSRCA regarding restrictions to development within this WHPA.
- Issue Contributing Area (ICA). The Client will require confirmation from the city of Barrie and the LSRCA regarding restrictions to development within this WHPA.
- WHPA Q1 and Q2. The WHPA Q1 is where groundwater use will influence nearby municipal supply wells. The proposed development will be supplied water by the municipality and not by a private on-site supply well. However, the construction of the proposed development will likely require dewatering efforts. The client should discuss dewatering efforts with the LSRCA prior to the commencement of work.
- The WHPA Q2 is where a reduction to ground groundwater recharge may influence nearby municipal supply wells. In these areas, groundwater recharge must be maintained (as reasonably possible) to the pre-development recharge rate by the use of Low Impact Development (LID) measures and other best management practices. Further discussion of the water balance is outlined in Section 6.0.
- Highly Vulnerable Aquifer.

Mapping provided from the LSRCA and the SPIA is included in Appendix A.

These vulnerable areas and mitigation measures were further discussed in Section 7.0.

3.2 Water Well Records

The MECP's Water Well Information System (WWIS) was accessed to review water well records located within 500 m of the Site. Water well records located within 500 m of the Site boundaries are outlined on Figure 4.



There are approximately 169 water well records located within 500 m of the Site boundaries. Most of the water well records were for monitoring or dewatering wells and provided little to no specific information pertaining to the depth at which groundwater was encountered or local soil stratigraphy.

Those records that did provide water level and soil stratigraphy information indicated that overburden was primarily comprised of sand sediments, however lenses of finer grained (silt and clay) sediments were encountered, on occasion.

The water level of the shallow overburden aquifer (when present) was typically recorded at or within 3 mbgs to 5 mbgs.

The deepest well was installed to a depth 88.4 mbgs in gravel and exhibited a static water level of 3.35 mbgs. The flow rate of the well was estimated to be 180 gallons per minute.

3.3 Hydrogeological Conditions

The overburden at the Site consists primarily of sand. The MECP WWIS records indicate that bedrock is deep in the area and that some lenses of finer grained materials are encountered within the overburden column at varying depths. There was no evidence to suggest the presence of any confined aquifer on-site, or in the area of the Site.

As discussed above, Cambium installed two monitoring wells to a depth of 9 mbgs (i.e., wells BH101-19 and BH102-19). Four (4) previously existing wells were located at the Site. At the time this report was prepared, water levels had been measured from on-site wells on three occasions. The direction of groundwater flow was determined to be primarily towards the northeast. The water level measurement results and other monitoring well information is outlined below in Embedded Table 2.



Embedded Table 2 Monitoring Well and Groundwater Elevation Information

Well		BH101-19	BH102-19	MW101	MW102	MW103	MW104
Easting ⁽¹⁾		604027	604019	604049	603984	604005	603985
Northing ⁽¹⁾		4914105	4914051	4914111	4914094	4914034	4914054
Top of Pipe (TOP) Elevation (masl) ⁽²⁾		192.86	193.79	192.59	192.97	194.02	193.79
Ground Surface Elevation (masl) ⁽²⁾		192.97	193.87	-	-	-	-
Depth (mtop) ⁽³⁾		8.86	8.97	5.75	5.93	6.08	5.77
Depth (mbgs) ⁽⁴⁾		8.75	8.89	-	-	-	-
Stick-up (m)		-0.11	-0.08	-	-	-	-
July 23, 2019	Water Level (mtop) ⁽³⁾	3.25	3.88	N/A	N/A	N/A	N/A
	Water Level (mbgs) ⁽⁴⁾	3.36	3.96	-	-	-	-
	Groundwater Elevation (masl) ⁽²⁾	189.61	189.91	-	-	-	-
July 29, 2019	Water Level (mtop) ⁽³⁾	N/A	N/A	3.08	3.28	4.05	3.88
	Water Level (mbgs) ⁽⁴⁾	-	-	-	-	-	-
	Groundwater Elevation (masl) ⁽²⁾	-	-	189.51	189.69	189.98	189.91
August 14, 2019	Water Level (mtop) ⁽³⁾	3.36	3.97	3.17	3.30	4.13	3.98
	Water Level (mbgs) ⁽⁴⁾	3.47	4.05	-	-	-	-
	Groundwater Elevation (masl) ⁽²⁾	189.50	189.82	189.42	189.67	189.90	189.81
Sep. 17, 2019	Water Level (mtop) ⁽³⁾	3.46	4.85	3.24	3.42	-	4.1
	Water Level (mbgs) ⁽⁴⁾	3.57	4.93	-	-	-	-
	Groundwater Elevation (masl) ⁽²⁾	189.40	188.94	189.35	189.55	-	189.69

1. Universal Transverse Mercator (Zone 17T)
2. Metres Above Sea Level
3. Metres Below Top Of Pipe
4. Metres Below Ground Surface

3.4 Long Term Water Level Monitoring

As per the LSRCA requirements on the previously submitted hydrogeological report, a long-term, twelve (12) month water level measurements were made between July 23, 2019 and June 17 2020 to obtain seasonal high water table depths and elevations across the Site area.

Cambium has recorded the static water levels in the monitoring wells on a monthly basis over the duration of a year. In addition to the two (2) monitoring wells installed in 2019 (BH101-19



through BH102-19), four (4) existing monitoring wells (MW101 through MW104) were also measured during the monitoring program.

The details of the monitoring well measurements are provided within Appendix F. Results of the monitoring are tabulated below.

Groundwater Elevations Measured During July 2019 to June 2020 (masl)

Date	BH101-19	BH102-19	MW101	MW102	MW103	MW104
July 23/19	225.62	225.92	-	-	-	-
July 29/19	-	-	225.37	225.66	225.92	225.85
Aug 14/19	225.51	225.83	225.28	225.64	225.84	225.75
Sept 17/19	225.41	224.95	225.21	225.52	-	225.63
Oct 25/19	225.42	225.90	225.22	224.51	225.71	225.61
Nov 19/19	225.55	225.84	-	-	225.83	225.74
Dec 12/19	225.57	-	-	224.99	-	225.75
Jan 10/20	225.64	225.94	-	224.95	225.85	-
Feb 24/20	-	225.98	-	225.07	-	225.78
Mar 12/20	-	-	-	224.98	-	226.03
Apr 15/20	225.97	226.28	225.75	226.11	226.29	226.20
May 8/20	225.95	226.11	225.68	225.55	225.98	225.84
Jun 17/20	225.85	225.99	225.66	225.53	225.87	225.74

Groundwater Depths Measured During July 2019 to June 2020 (mbgs)

Date	BH101-19	BH102-19	MW101	MW102	MW103	MW104
July 23/19	3.36	3.96	-	-	-	-
July 29/19	-	-	3.23	3.39	4.13	3.98
Aug 14/19	3.47	4.05	3.32	3.41	4.21	4.08
Sept 17/19	3.57	4.93	3.39	3.53	-	4.2
Oct 25/19	3.56	3.98	3.38	4.54	4.34	4.22
Nov 19/19	3.43	4.04	-	-	4.22	4.09
Dec 12/19	3.41	-	-	4.06	-	4.08
Jan 10/20	3.34	3.94	-	4.1	4.2	-
Feb 24/20	-	3.9	-	3.98	-	4.05
Mar 12/20	-	-	-	4.07	-	3.80
Apr 15/20	3.01	3.60	2.85	2.94	3.76	3.63
May 8/20	3.03	3.77	2.92	3.5	4.07	3.99
Jun 17/20	3.13	3.89	2.94	3.52	4.18	4.09

Based on the monitoring well observations to date, the groundwater levels were found to vary from 2.85 mbgs to 4.93 mbgs, with elevations between 224.51 masl to 226.29 masl.

Accordingly, the highest seasonal water table elevation for the entire Site was measured at 226.29 masl, while depth to water level was 2.85 mbgs.

Groundwater flow configuration map (Figure 5) was constructed based on the spring water levels measured on April 15, 2020 and accordingly the groundwater flow direction was found to be towards northeast.

4.0 Results

4.1 Single Well Hydraulic Testing

SWHTs were completed on wells BH101-19 and BH102-19 on July 7, 2019. The data generated from the bail tests was processed by AquiferTest Pro™ software, the results of which are summarized in Embedded Table 3.

The results of the SWHTs were consistent ranging from 1.39×10^{-5} m/s to 2.77×10^{-5} m/s. These hydraulic conductivity results are typical of sand sediments (J.P.Powers, 2007) (Fetter, 2001).

Embedded Table 3 SWHT Hydraulic Conductivity Results (all units in m/s)

Test #		BH101-19	
		Slug In	Slug Out
Slug Test 1		1.41×10^{-5}	2.77×10^{-5}
Slug Test 2		1.74×10^{-5}	2.77×10^{-5}
Slug Test 3		1.70×10^{-5}	2.60×10^{-5}
Test #		BH102-19	
		Slug In	Slug Out
Slug Test 1		1.50×10^{-5}	2.75×10^{-5}
Slug Test 2		1.50×10^{-5}	2.70×10^{-5}
Slug Test 3		1.50×10^{-5}	2.65×10^{-5}
Slug Test 4		1.45×10^{-5}	2.65×10^{-5}
Slug Test 5		1.39×10^{-5}	2.65×10^{-5}

4.2 Groundwater Quality

The analytical results of the groundwater sampling from well BH101-19 were compared against the discharge water quality criteria outlined in the City of Barrie Sewer Use By-Law (2012-172). The parameters reported in excess of the City of Barrie Sewer Use By-Law criteria are outlined below in Embedded Table 4.

The concentration of total suspended solids was greater than the sanitary and storm sewer use criteria. In addition, the concentration of total copper was greater than the storm sewer use criteria. Discharge water directed to sewers for disposal should be treated to applicable standards. A water sample should be collected after the treatment system to confirm water



quality. The comparison of dissolved and total copper indicate that the exceedance is related to sediment in the sample, as such sediment treatment such as filtering or settling should be adequate to meet the Storm Sewer discharge criteria.

Embedded Table 4 Groundwater Quality Summary

Parameter	Concentration in Sample (mg/L)	Sanitary Sewer Use Criteria (mg/L)
Total Suspended Solids	18,800	350
Parameter	Concentration in Sample (mg/L)	Storm Sewer Use Criteria (mg/L)
Total Suspended Solids	18,800	15
Total Copper	0.042	0.01
Dissolved Copper	<0.002	0.01

1. Bold values indicates parameter concentration reported greater than comparison criteria

5.0 Dewatering Estimates

The proposed development does not include any underground parking. Geotechnical investigation completed by Cambium has recommended that the construction excavation for the structure will be advanced to a maximum depth of approximately 3.0 mbgs, with deeper excavations for elevator shafts likely required within the excavation footprint. Based on the observed water levels during drilling and subsequent site visits to measure water table elevations in the monitoring wells, the depth to seasonal high water level was recorded at 2.85 mbgs, while the highest water table elevation was at 226.29 masl (Appendix F). Therefore potential dewatering efforts during construction will not likely be required, although the excavation for the elevator pits may likely intersect the water table requiring a small amount of short-term dewatering. Cambium recommends that any dewatering that takes place for any deep excavations that intersect the groundwater table be estimated and reported.

6.0 Water Balance

Cambium completed pre- and post-development water balances to assess the potential impact of the development on local groundwater and surface water resources. To complete the assessment the following equations were utilized:

$$QI = A \times S \times I$$

Where: QI - Infiltration Volume (m³/yr)
A - Area (m²)
S - Water surplus (m/yr)
I - Infiltration factor
(dimensionless)

$$QR = A \times S \times (1-I)$$

Where: QR - Runoff Volume (m³/yr)
A - Area (m²)
S - Water surplus (m/yr)
I - Infiltration factor
(dimensionless)

The Site is 7,027 m² and is currently developed as an existing structure and parking areas. 100% of the existing Site is developed as impervious surfaces (Figure 6), such as roof and paved areas.

The Client intends to demolish the existing structure and build a 17 storey condominium building. The development will also include at grade parking areas and four (4) levels of above grade parking platforms.

A summary of the water balance calculations is outlined in the following sections of this report. A detailed analysis of the pre- and post-development water balance of the Site is attached as Appendix G.

6.1 Surplus Water

To determine the pre-development water balance, the volume of water that is typically available as a surplus to the on-Site hydraulic system must be calculated. For the calculations outlined herein, surplus water is defined as being the difference between precipitation and evapotranspiration. Once calculated, the volume of surplus water is further sub-divided into portions that infiltrate into the soil on-Site and are directed off-Site as runoff.

According to the Environment Canada Climatic Normals (1981-2010) for the Barrie WPCC station (Environment Canada, 2018), the average annual precipitation depth was recorded as 933 mm/year. A copy of the long-term climatic normal data is attached in Appendix G.

To determine the amount of evapotranspiration that will occur at the Site, the Thornthwaite method was used (as described in the text titled *Physical Hydrology, Second Edition* (S. Lawrence Dingman, 2008)). The equivalent depth of evapotranspiration was calculated to be 557 mm/year. The evapotranspiration calculations have been attached as Appendix G. The water surplus of the Site (i.e., the difference between annual precipitation and evapotranspiration) was calculated to be 376 mm/year.

6.2 Infiltration Factor

To determine the fraction of surplus water that infiltrates into the soil on-Site, the volume of surplus water was multiplied by an infiltration factor. The infiltration factor varies between 0 and 1 and can be estimated based on topography, soils and cover (as per the Stormwater Management Planning and Design Manual, (Ministry of the Environment, 2003)).

The Site is relatively flat but exhibits an estimated topographic grade of 0.008 m/m downwards to the northeast. The Site is currently developed with 100% impervious surfaces.

Upon development of the Site, the structures and paved areas will be considered impervious surface. The landscaped areas will allow infiltration of the water surplus. The calculations for the infiltration factor of the pre- and post- development conditions of the Site have been outlined in Embedded Table 5. The infiltration factor of the landscaped areas was estimated to be 0.7.

Embedded Table 5 Infiltration Factor

Infiltration Factor Calculations			
	Pre-Development Impervious Surfaces	Post-Development	
		Landscaped Areas	Impervious Surfaces
Topography	-	Minor Slope – 0.2	-
Soil	-	Sandy – 0.4	-
Cover	-	Open Land – 0.1	-
Infiltration Factor (I)	0	0.7	0

6.3 Pre-Development Water Balance

The results of the pre-development water balance are included in Embedded Table 6. It was assumed that 10% of precipitation falling on rooftops and paved areas is lost directly to

evaporation. The remaining depth (i.e., 90% of precipitation) was considered surplus and converted to infiltration and/or runoff. The equivalent surplus depth from impervious surfaces was estimated to be 840 mm/yr. The groundwater infiltration rate of the existing development of the Site was assumed to be 0 m³/year since the property is entirely developed with impervious surfaces. The annual runoff rate was estimated to be 5,901 m³/year.

Embedded Table 6 Pre-Development Water Balance

Portion	Area (m ²)	Surplus (m/yr)	Infiltration Factor (dimensionless)	Groundwater Infiltration (QI) (m ³ /yr)	Surface Water Runoff (QR) (m ³ /yr)
Existing Conditions	7,027	0.840	0	0	5,901
Sum of QI and QR (m ³ /year)					5,901

6.4 Post-Development Water Balance

The results of the post-development water balance are included in Embedded Table 7. It was assumed that 10% of precipitation falling on rooftops and paved areas is lost directly to evaporation. The remaining depth (i.e., 90% of precipitation) was considered surplus and converted to infiltration and/or runoff. The equivalent surplus depth from impervious surfaces was estimated to be 840 mm/yr. We assume that the proposed landscaped areas are to be built as continuous soil column extending downwards after ripping off paved areas.

The post-development Site statistics are shown on Figure 7.

Embedded Table 7 Post-Development Water Balance

Portion	Area (m ²)	Surplus (m/yr)	Infiltration Factor (dimensionless)	Groundwater Infiltration (QI) (m ³ /yr)	Surface Water Runoff (QR) (m ³ /yr)
Structure Roof Area	5,048	0.840	0	0	4,240
Paved Area	949	0.840	0	0	797
Landscaped Area	1,030	0.376	0.70	271	116
Totals	7,027	-	-	271	5,153
Sum of QI and QR (m ³ /year)					5,424

Upon development of the Site groundwater infiltration will increase to 271 m³/year from 0 m³/year in the post-development scenario. In addition, the runoff will lower to 5,153 m³/year from 5,901 m³/year.

6.5 Water Balance Comparison

The water balances of the pre-development and post-development scenarios have been summarized in Embedded Table 8.

Embedded Table 8 Water Balance Comparison

Scenario	QI (m ³ /yr)	QI Difference From Pre-Development Scenario	QR (m ³ /yr)	QR Difference From Pre-Development Scenario
Pre-Development	0	-	5,901	-
Post-Development	271	+271	5,153	-13%

At present, the Site does not allow for any degree of groundwater infiltration since the entire property has been developed with impervious surfaces. The proposed re-development includes several landscaped areas that will increase the infiltration rate of the Site to about 271 m³/year (from 0 m³/year). The runoff rate of the Site will decrease by approximately 13% upon redevelopment. The water balance described above did not incorporate further improvements from stormwater management or Low Impact Development features.

The water balance described herein indicates that the proposed development will increase the infiltration rate of the Site upon re-development.

Per LSRCA, runoff from impervious surfaces such as parking areas, is not permitted. Runoff from vegetated surfaces as well as roof top drainage is considered clean water and infiltration of these sources is encouraged. However restrictions on allowable recharge sources should be confirmed with the LSRCA.

6.6 Discussions on LID Measures

It is known that low impact development (LID) practices have received increasing attention as these strategies attempt to capture the runoff and mimic the natural hydrologic cycle.

Infiltration decrease reduces groundwater recharge and soil moisture replenishment and also reduces stream baseflow needed for sustaining aquatic life. Therefore it is important to maintain the natural hydrologic cycle as much as possible.

The implementation of infiltration LIDs allows capture and slow release of the water to the groundwater system through the process of storage and filtration.



The conceptual water balance indicated that there will be an infiltration surplus of about 271 m³/annum in the post-development infiltration upon development of the Site. Therefore, Cambium does not recommend the implementation of LIDs at the Site. However, infiltration measures could be considered to reduce or offset the phosphorus loading through the use of Low Impact Development (LID) techniques.

7.0 Source Water Protection and Mitigation Plan

Land Use Planning (LUP) Policies to manage or eliminate a threat activity were implemented through land use planning decisions (such as Official Plans, Zoning By-laws, and Site Plan Controls).

As per the South Georgian Bay LSRCA Source Protection Plan (SPP), and as discussed in Section 3.1.1, the Subject Site is in the following groundwater vulnerable areas:

- ***Wellhead Protection Area (WHPA) C.***

A wellhead protection area (WHPA) is an area around the wellhead where land use activities have the potential to affect the quality of water that flows into the well. The activities undertaken in this area may release pollutants that could seep into the soil and contaminate the groundwater used by both domestic and municipals wells.

Since the development is for residential purposes and the potential land uses at the property are highly unlikely to cause any significant threat to the municipal water supply aquifer, either qualitatively or quantitatively.

- ***Issue Contributing Area (ICA).***

The ICA's specific to sodium and chloride were delineated under the Clean Water Act (2006). The issues contributing areas are the land areas where road salt has already affected drinking water supplies and that the elevated level of sodium and chloride in the source water are attributed to the road salt-related activities.

The major land use practices at the proposed development do not include or likely does not require the storage & handling of huge quantities of road salt. Therefore, the development of Salt Management Plans is not required for the proposed development.

- ***WHPA Q1 and Q2. a groundwater recharge management area.***

The lands are within the Recharge Management Area (WHPA Q2) per the Lake Simcoe Source Protection Plan, a pre-and post-development water balance assessment will be required in support of the application.

A climate based water balance assessment was completed for the pre- and post-development scenarios for the Site as described in Section 6. A climate based water balance assessment is the first step to identify the post-development infiltration deficit and then utilize the Best Management Practices (BMPs) to minimize any infiltration deficit.

Accordingly, as per the water balance assessment completed above, it was estimated that there is a net surplus infiltration in the post-development scenario, compared to the pre-development in the order of 271 m³/year, therefore, the policies outlined in WHPA-Q2 should be satisfied. In addition, we recommend exploring all the BMPs such as infiltration trenches, infiltration galleries or other suitable measures to encourage the roof water run-off infiltration in order to increase on-site infiltration as a pro-active measure.

- ***Highly Vulnerable Aquifer (HVA) area.***

HVAs are aquifers that are more sensitive to contamination. In general, a HVA will consist of granular materials (e.g., sand and/or gravel) or fractured rock that has a high permeability and is near the surface of the ground. A very clear benefit of protecting highly vulnerable areas is preventing drinking water contamination.

The site exists in an area of groundwater vulnerability with a score of 6 and threat activities are moderate, but not significant. Impervious surfaces such as parking lots, pedestrian walkways and other related surfaces that may receive salt application were not considered as significant. Therefore, the land use practices at the proposed development Site are not expected to cause any contamination to the potable ground supplies. The Site will be under municipal sewage and water service and as such is not expected to cause any groundwater contamination by nitrates.

7.1 Mitigation Measures

Deep construction activities such as deep drilling, installation of deep foundation supports like piles, caissons; underground parking, dewatering etc. have the potential to impact or intercept the municipal supply aquifer including development in areas of known or suspected groundwater contamination.



Based on the water level monitoring and the information from the architect/structural engineer, the construction excavation information is as below:

- Depth to seasonally high water table 2.85 m.
- Maximum Expected Depth of Excavation 3 m.
- Maximum Expected Depth of Foundation 3 m.

As there is no construction dewatering anticipated at the Site, and as the foundational supports will not extend below the seasonally high groundwater level; the construction dewatering management plan, and/or a contaminant management plan are not required at the proposed development. However, Cambium recommends to estimate the any dewatering that takes place for elevator pits and reported.

8.0 Conclusions and Recommendations

Numbered company 20667340 Ontario Inc., c/o The Typhon Group Ltd. retained Cambium Inc. to update the hydrogeological assessment report of the property located at 272 Innisfil Street, Barrie, ON due to a recently updated Site plan, and to address review comments from local regulators.

The Client proposes to re-develop the Site as a condominium tower and elevated parking areas along with several landscaped areas. To support the proposed re-development Cambium completed various field investigations in 2019 and 2022. The following conclusions are provided due to changes to Site Plan and based on comments made by the City and LSRCA on the 2019 report:

- The overburden was comprised of sand sediments. Groundwater was encountered between 2.85 mbgs and 4.93 mbgs. The direction of groundwater flow was directed to the northeast.
- The hydraulic conductivity of the sand sediments was determined to be typical of those reported in literature.
- Groundwater quality reported only a few exceedances of the City of Barrie Sewer Use Bylaw. Some treatment of discharge water for Total Suspended Solids and copper will be required (typical sediment removal). A sample of the discharge water, after treatment, should be collected to determine treatment efficacy. The treatment and discharge plan should be discussed with the City of Barrie and the LSRCA, if need be.
- Based on the revised Site plan, no dewatering either short- and or long-term was anticipated as no basement or underground parking being proposed at the Site. Therefore, groundwater discharge management plan or a contaminant management plan were not required for the proposed development. Any dewatering that takes place for elevator pits should be estimated and reported.
- The pre-development / existing water balance indicates that approximately 0 m³/year of groundwater infiltration occurs at the Site. The post-development water balance indicates infiltration will be increased to at least 271 m³/year without considering stormwater



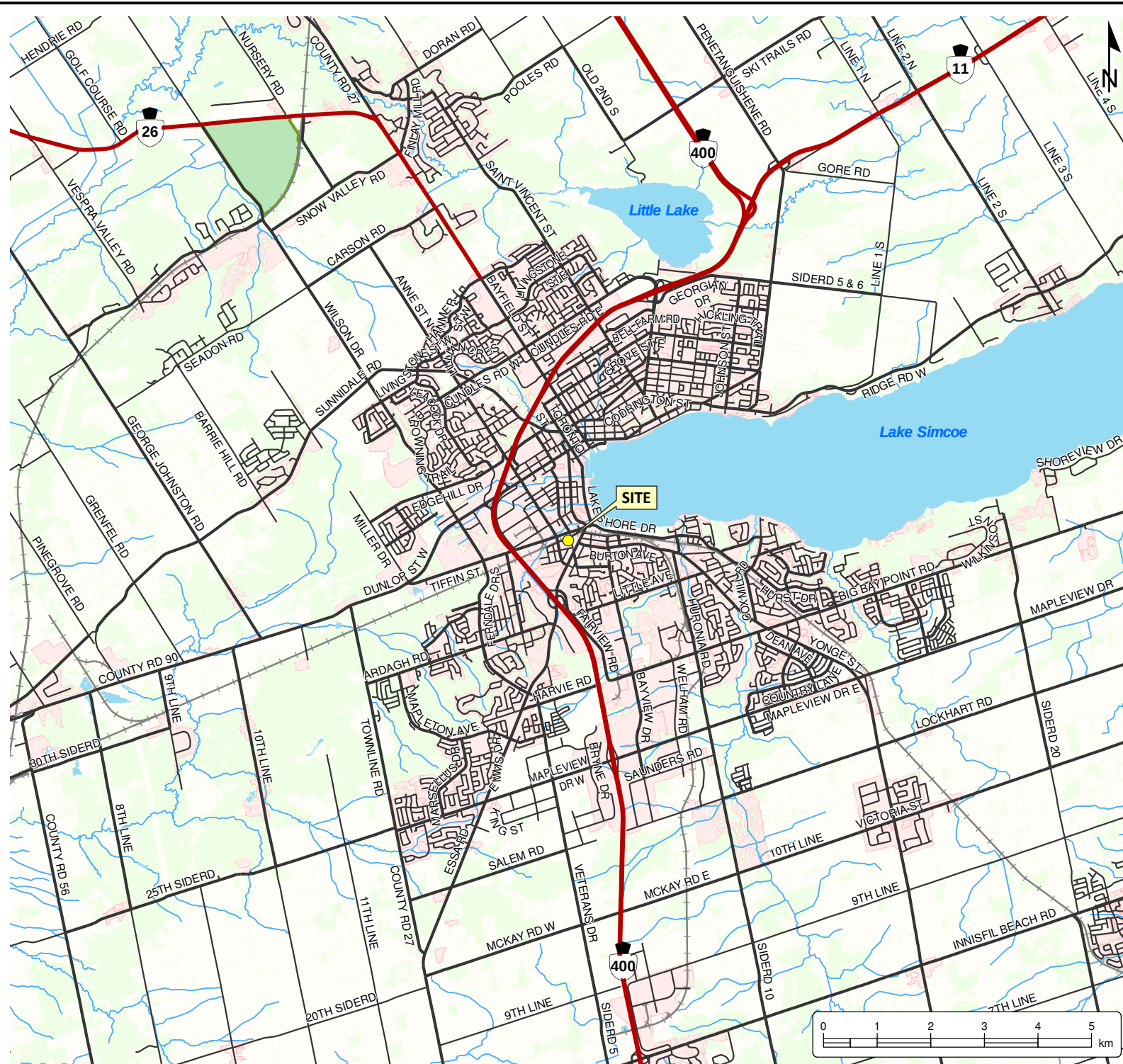
management or LID. Additionally, the runoff rate of the Site will decrease upon development. As a result the policies outlined for WHPA-Q2 should be satisfied.

9.0 References

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Appended Figures



HYDROGEOLOGICAL ASSESSMENT

OLLIE SWITCH DEVELOPMENTS
272 Innisfil Street,
Barrie, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- + Railroad
- Watercourse
- Water Area
- Provincial Park
- Wooded Area
- Built Up Area

Notes:
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 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
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SITE LOCATION MAP

Project No.: 8707-003	Date: March 2022
Scale: 1:100,000	Projection: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: SK
Figure: 1	



HYDROGEOLOGICAL ASSESSMENT OLLIE SWITCH DEVELOPMENTS 272 Innisfil Street, Barrie, Ontario

LEGEND

Site (approximate)

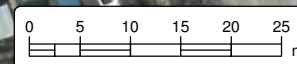
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SITE PLAN

Project No.: 8707-003	Date: March 2022
Scale: 1:750	Projection: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: SK
Figure: 2	





HYDROGEOLOGICAL ASSESSMENT

OLLIE SWITCH DEVELOPMENTS
272 Innisfil Street,
Barrie, Ontario

LEGEND

- Borehole Location
(Cambium Inc,
February 2022)
- CPT Location
(Cambium inc,
February 2022)
- Borehole Location
(Cambium Inc, August 2019)
- Borehole Location
(HLV2K Engineering Limited,
August 2018)
- Site (approximate)

Notes:

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BOREHOLE LOCATION PLAN

Project No.: 8707-003	Date: March 2022
Scale: 1:750	Rev.: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: SK
Figure: 3	



HYDROGEOLOGICAL ASSESSMENT OLLIE SWITCH DEVELOPMENTS 272 Innisfil Street, Barrie, Ontario

LEGEND

- Water Well Records
- 500m Study Area
- Site (approximate)

Notes:
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WATER WELL RECORDS WITHIN 500m OF SITE

Project No.: 8707-003	Date: March 2022
Scale: 1:6,000	Rev.: Rev.
Created by: MAT	Projection: NAD 1983 UTM Zone 17N
Checked by: SK	Figure: 4

O:\GISMXD\8700 to 8799\8707-003 Ollie Switch Developments - Updated Geo & HydroG - 272 Innisfil St. Barrie\2022-03-04 Hydro G FIG 5- Groundwater Configuration Map.mxd



HYDROGEOLOGICAL ASSESSMENT

OLLIE SWITCH DEVELOPMENTS
272 Innisfil Street,
Barrie, Ontario

LEGEND

- Borehole Location
(Cambium Inc,
February 2022)
- CPT Location
(Cambium inc,
February 2022)
- Borehole Location
(Cambium Inc, August 2019)
- Borehole Location
(HLV2K Engineering Limited,
August 2018)
- Groundwater Contours
(0.1m intervals)
- Site (approximate)
- (226.15) Groundwater Elevation
(masl) (April 15, 2020)
- Groundwater Flow Direction

Notes:
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GROUNDWATER CONFIGURATION MAP

Project No.: 8707-003	Date: March 2022
Scale: 1:750	Rev.: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: SK
Figure: 5	

O:\GIS\MXDs\8700 to 8799\8707-003 Ollie Switch Developments - Updated Geo & HydroG - 272 Innisfil St. Barrie\2022-03-04 Hydro G FIG 6 - Pre-Development Site Map.mxd



	Area (m ²)
Roof:	2,980
Paved:	4,047
Total Area:	7,027

HYDROGEOLOGICAL ASSESSMENT OLLIE SWITCH DEVELOPMENTS 272 Innisfil Street, Barrie, Ontario

LEGEND

-  Roof Area
-  Paved Area
-  Site (approximate)

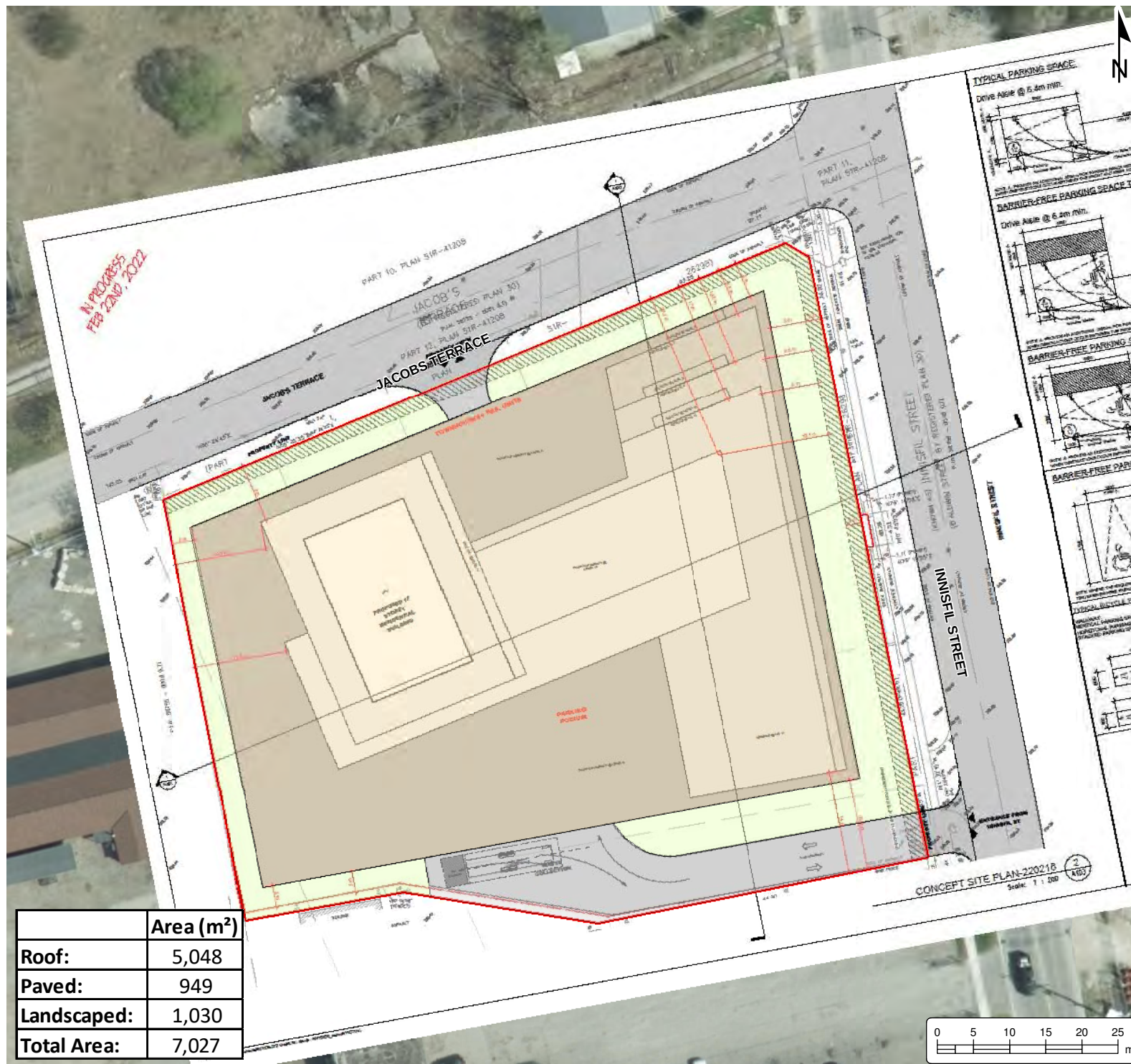
Notes:
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PRE-DEVELOPMENT SITE PLAN

Project No.: 8707-003	Date: March 2022
Scale: 1:750	Projection: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: SK
Figure: 6	



HYDROGEOLOGICAL ASSESSMENT

OLLIE SWITCH DEVELOPMENTS
272 Innisfil Street,
Barrie, Ontario

LEGEND

- Roof Area
- Paved Area
- Landscaped Area
- Site (approximate)

Notes:

- Overlay imagery is titled Site Plan, by SRN Architects for Typhon Group LTD. Project no. S21028, drawing no. A103.
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
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- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

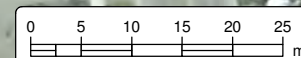


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POST-DEVELOPMENT SITE PLAN

Project No.:	8707-003	Date:	March 2022
Scale:	1:750	Rev.:	
Created by:	MAT	Checked by:	SK
Figure:	7		

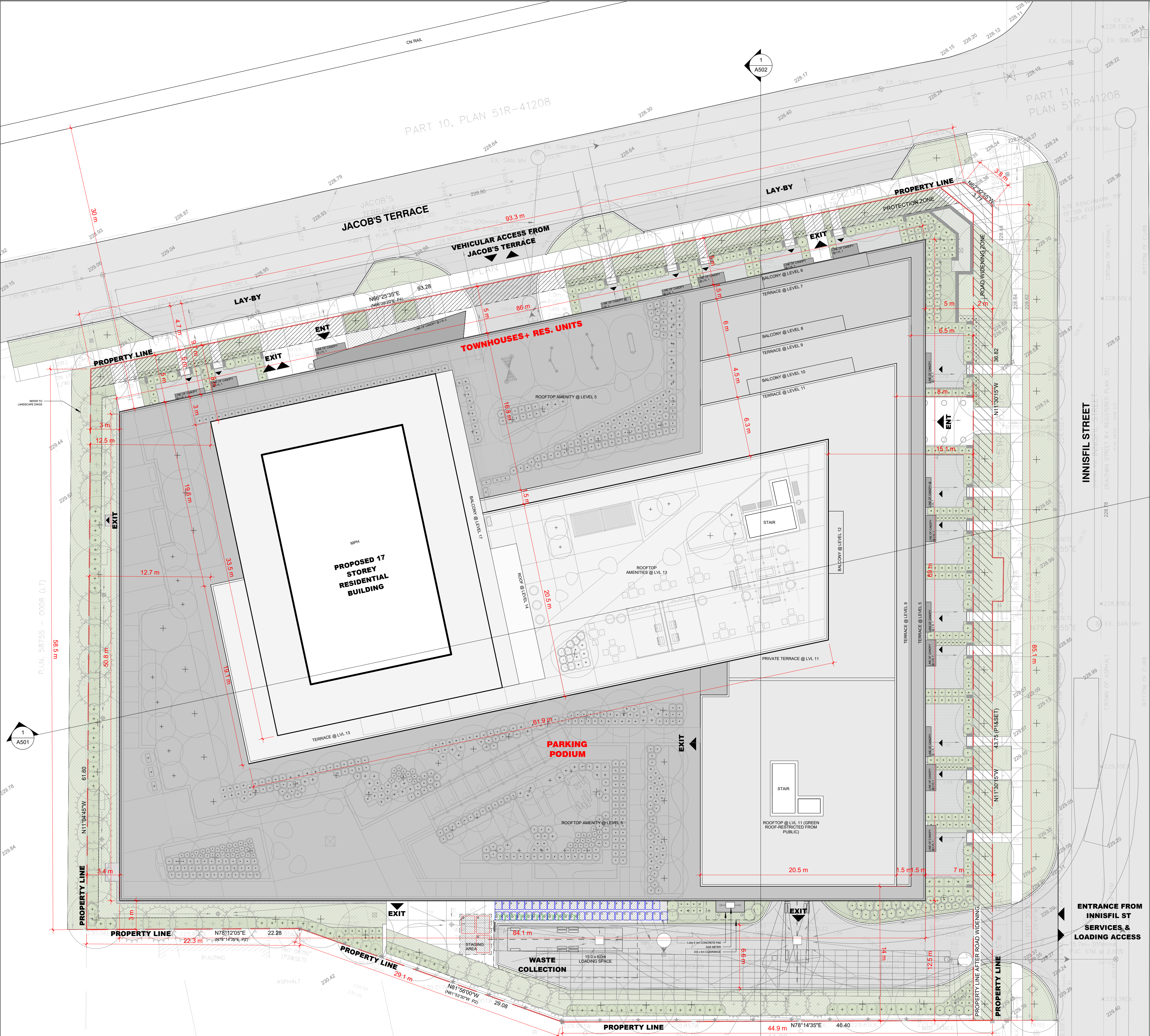
	Area (m ²)
Roof:	5,048
Paved:	949
Landscaped:	1,030
Total Area:	7,027





Appendix A

Proposed Development Plan and Land Information



SITE PLAN - CONCEPT PLAN

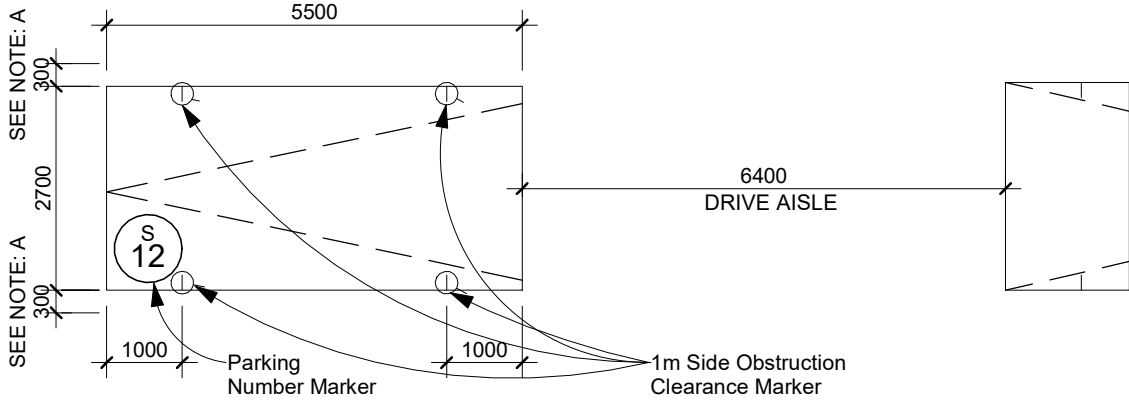
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Scale: 1 : 200

A103

TYPICAL PARKING SPACE:

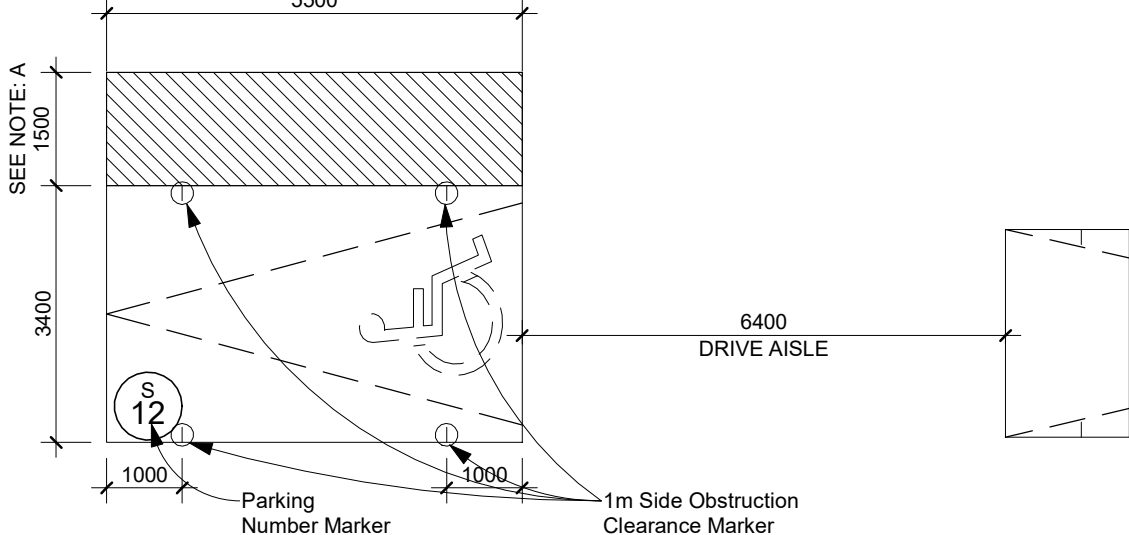
Drive Aisle @ 6.4m min.



NOTE: A- PROVIDE AN ADDITIONAL 300mm FOR PARKING SPACE WIDTH WHEN OBSTRUCTIONS OCCUR BETWEEN THE FRONT AND REAR 1000mm

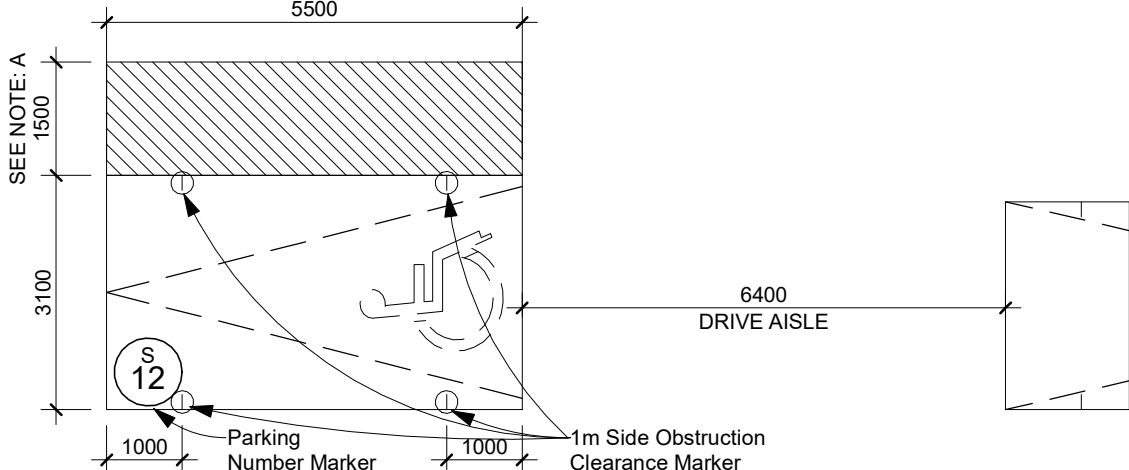
BARRIER-FREE PARKING SPACE TYPE A:

Drive Aisle @ 6.4m min.



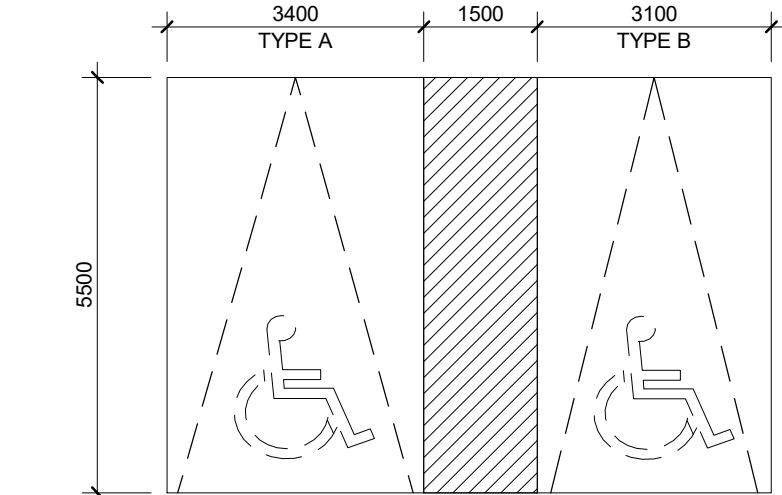
NOTE: A- PROVIDE AN ADDITIONAL 1500mm FOR PARKING SPACE WIDTH WHEN OBSTRUCTIONS OCCUR BETWEEN THE FRONT AND REAR 1000mm

BARRIER-FREE PARKING SPACE TYPE B:



NOTE: A- PROVIDE AN ADDITIONAL 1500mm FOR PARKING SPACE WIDTH WHEN OBSTRUCTIONS OCCUR BETWEEN THE FRONT AND REAR 1000mm

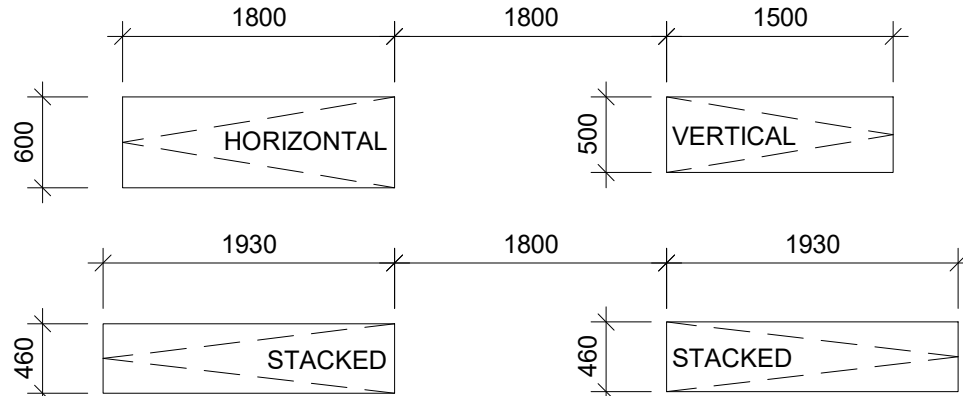
BARRIER-FREE PARKING SPACE TYPE A & B:



NOTE: WHERE THE REQUIRED 1500mm ACCESS AISLE IS PROVIDED BETWEEN TWO BARRIER-FREE PARKING SPACES, THE AISLE WIDTH CAN BE SHARED.

TYPICAL BICYCLE PARKING SPACE:

WALKWAY: MINIMUM 1800mm
VERTICAL PARKING SPACE: 1500mm (L) x 500mm (W)
HORIZONTAL PARKING SPACE: 1800mm (L) x 600mm (W)
STACKED PARKING SPACE: 1930mm (L) x 460mm (W)



THESE DRAWINGS ARE NOT TO BE SCALED:
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RELEVANCE OF THE INFORMATION IN RESPECT TO THEIR
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BUILDING LEVEL 1 FFE = 229.50 GEODETIC
ELEVATION
BUILDING LEVEL 1 TOP = 229.45 GEODETIC
ELEVATION

NO.	DATE	REVISION	COMMENT

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ARCHITECTS
8395 JANE ST, SUITE 202
VAUGHAN, ONTARIO, L4K 5Y2
PHONE: 905.417.5515 FAX: 905.417.5517

STAMP:
CLIENT:
TYPHON GROUP LTD.

PROJECT:
RESIDENTIAL DEVELOPMENT
272 INNISFIL STREET
BARRIE, ON, L4N 3G1

DRAWING TITLE:
SITE PLAN

DATE: SCALE: As indicated
DRAWN BY: CHECKED BY: Checker

PROJECT NUMBER: DRAWING NUMBER:

S21028 A103

RESIDENTIAL DEVELOPMENT - 272 INNISFIL STREET

Barrie, Ontario

Project Statistics

March 4, 2022

Project No. S21028

1.0 Site Area

	Hectare	acres	sq.m.	sq.ft.
Site Area	0.70	1.74	7,027.42	75,643
Road Widening	0.02	0.05	182.72	1,967
Total Site Area (after road widening)	0.70	1.69	6,844.70	73,676

2.0 GFA

(excludes storage, parking, stairwell, elevator, trash chute, trash room, storage for mechanical / electrical equipments & amenity areas.)

2.1 New Proposed Building GFA

	floors	sq.m.	sq.m.	sq.ft.
Level 1	1 x	1,469.00	1,469.00	15,812
Level 2	1 x	1,303.00	1,303.00	14,025
Levels 3 to 4	2 x	1,521.00	3,042.00	32,744
Levels 5 to 6	2 x	2,470.00	4,940.00	53,174
Levels 7 to 8	2 x	2,351.00	4,702.00	50,612
Levels 9 to 10	2 x	2,187.00	4,374.00	47,081
Levels 11 to 12	2 x	1,473.00	2,946.00	31,710
Level 13	1 x	400.00	400.00	4,306
Levels 14 to 17	4 x	750.00	3,000.00	32,292
Total GFA			26,176.00	281,756

2.2	Total GFA	+	Site Area	FSI
	26,176.00 sq.m.		6,844.70 sq.m.	3.82

3.0 Unit Count

(*15% of suites to be fully accessible)

3.1	New Proposed Building Units	floors	TH	1BR	1BR+D	2BR	2BR+D	Units
	Level 1	1 x	15	0	0	0	0	15
	Levels 3 to 4	2 x	0	12	6	0	3	42
	Levels 5 to 6	2 x	0	3	15	5	10	66
	Levels 7 to 8	2 x	0	3	14	5	9	62
	Levels 9 to 10	2 x	0	8	10	4	8	60
	Levels 11 to 12	2 x	0	4	7	4	5	40
	Level 13	1 x	0	0	3	0	2	5
	Levels 14 to 17	4 x	0	0	6	0	4	40
	Total Units		15	60	131	36	88	330

3.2	Total Units Mix	15	60	131	36	88	330
		5%	18%	40%	11%	27%	100%

3.3	Density Units Per Hectare	470
-----	----------------------------------	------------

4.0 Amenity Area

4.1	New Proposed Indoor Amenity@ lvl 13	sq.m.	sq.f.
		325	3,493

4.2	Proposed Outdoor Amenity @ lvl 5 & 13 rooftop	sq.m.	sq.f.
		2,820	30,354

4.3	sq.m./unit	Total Units		
	Total Proposed Amenity	9.53	330	3,145
				33,847

5.0 Saleable Area

5.1 New Proposed Building Saleable Area

	floors	sq.m.	sq.m.	sq.ft.
Level 1	1 x	966.61	966.61	10,405
Level 2	1 x	1,215.00	1,215.00	13,078
Levels 3 to 4	2 x	1,253.00	2,506.00	26,974
Levels 5 to 6	2 x	2,202.00	4,404.00	47,404
Levels 7 to 8	2 x	2,067.00	4,134.00	44,498
Levels 9 to 10	2 x	1,968.00	3,936.00	42,367
Levels 11 to 12	2 x	1,319.00	2,638.00	28,395
Level 13	1 x	320.00	320.00	3,444
Levels 14 to 17	4 x	640.00	2,560.00	27,556
Total Saleable			22,679.61	244,121

6.0 Vehicular Parking

Proposed Parking Spaces Rate

	<i>Prop. Rate</i>	<i>units</i>	<i>Parking Spaces</i>
Proposed Residential Parking Rate	1.10	x 330	363
Proposed Visitor Parking Rate	0.10	x 330	32
Total	1.20		395

Net Parking Spaces Provided

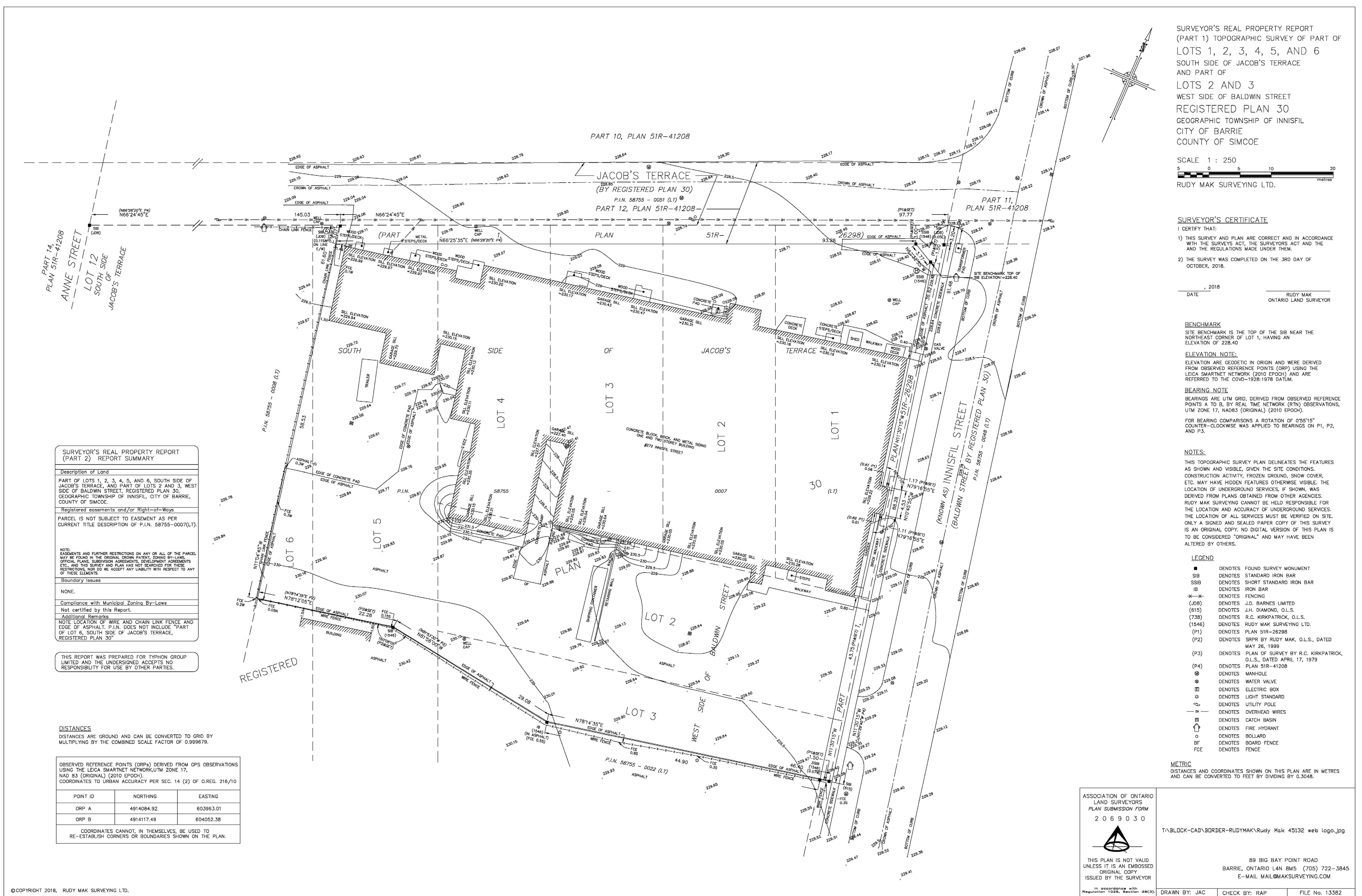
	<i>Residential</i>	<i>Visitor</i>	<i>Accessible</i>	<i>Parking Spaces</i>
Level 1 (Visitors & Residence Parking)	61	33	TBD	94
Level 2 - 4	303	0	TBD	303
Total Net Parking Spaces Provided	364	33	TBD	397

Proposed Parking Area

	<i>floors</i>	<i>sq.m.</i>	<i>sq.m.</i>	<i>sq.ft.</i>
Level 1	1 x	3,238.00	3,238.00	34,854
Level 2	1 x	3,334.00	3,334.00	35,887
Levels 3 to 4	2 x	3,313.00	6,626.00	71,322
Total Parking Area			13,198.00	142,063

8.0 Lot Coverage

	<i>sq.m.</i>	<i>sq.ft.</i>	<i>%</i>
Proposed Building Coverage	5,048.00	54,336	74%
Proposed Paver	767.00	8,256	11%
Landscape Coverage	1,029.70	11,084	15%
Site Area	6,844.70	73,676	100%



SURVEYOR'S REAL PROPERTY REPORT
 (PART 1) TOPOGRAPHIC SURVEY OF PART
 LOTS 1, 2, 3, 4, 5, AND 6
 SOUTH SIDE OF JACOB'S TERRACE
 AND PART OF
 LOTS 2 AND 3
 WEST SIDE OF BALDWIN STREET
 REGISTERED PLAN 30
 GEOGRAPHIC TOWNSHIP OF INNISFIL
 CITY OF BARRIE
 COUNTY OF SIMCOE

SCALE 1 : 250
 RUDY MAK SURVEYING LTD.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:
 1) THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE AND THE REGULATIONS MADE UNDER THEM.
 2) THE SURVEY WAS COMPLETED ON THE 3RD DAY OF OCTOBER, 2018.
 DATE 2018 RUDY MAK ONTARIO LAND SURVEYOR

BENCHMARK

SITE BENCHMARK IS THE TOP OF THE SIB NEAR THE NORTHEAST CORNER OF LOT 1, HAVING AN ELEVATION OF 228.40

ELEVATION NOTE:

ELEVATION ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM OBSERVED REFERENCE POINTS (ORP) USING THE LEICA SMARTNET NETWORK (2010 EPOCH) AND ARE REFERRED TO THE CGVD-1928/1978 DATUM.

BEARING NOTE

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A TO B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL) (2010 EPOCH).
 FOR BEARING COMPARISONS A ROTATION OF 0°55'15" COUNTER-CLOCKWISE WAS APPLIED TO BEARINGS ON P1, P2, AND P3.

NOTES:

THIS TOPOGRAPHIC SURVEY PLAN DELINEATES THE FEATURES AS SHOWN AND VISIBLE, GIVEN THE SITE CONDITIONS. CONSTRUCTION ACTIVITY, FROZEN GROUND, SNOW COVER, ETC. MAY HAVE HIDDEN FEATURES OTHERWISE VISIBLE. THE LOCATION OF UNDERGROUND SERVICES, IF SHOWN, WAS DERIVED FROM PLANS OBTAINED FROM OTHER AGENCIES. RUDY MAK SURVEYING CANNOT BE HELD RESPONSIBLE FOR THE LOCATION AND ACCURACY OF UNDERGROUND SERVICES. THE LOCATION OF ALL SERVICES MUST BE VERIFIED ON SITE. ONLY A SIGNED AND SEALED PAPER COPY OF THIS SURVEY IS AN ORIGINAL COPY. NO DIGITAL VERSION OF THIS PLAN IS TO BE CONSIDERED "ORIGINAL" AND MAY HAVE BEEN ALTERED BY OTHERS.

LEGEND

- DENOTES FOUND SURVEY MONUMENT
 SIB DENOTES STANDARD IRON BAR
 SSIB DENOTES SHORT STANDARD IRON BAR
 IB DENOTES IRON BAR
 X-X DENOTES FENCING
 (JOB) DENOTES J.D. BARNES LIMITED
 (B15) DENOTES J.H. DIAMOND, O.L.S.
 (738) DENOTES R.C. KIRKPATRICK, O.L.S.
 (1546) DENOTES RUDY MAK SURVEYING LTD.
 (P1) DENOTES PLAN 51R-26298
 (P2) DENOTES SRPR BY RUDY MAK, O.L.S., DATED MAY 26, 1999
 (P3) DENOTES PLAN OF SURVEY BY R.C. KIRKPATRICK, O.L.S., DATED APRIL 17, 1979
 (P4) DENOTES PLAN 51R-41208
 ⊗ DENOTES MANHOLE
 ⊙ DENOTES WATER VALVE
 □ DENOTES ELECTRIC BOX
 ☆ DENOTES LIGHT STANDARD
 ⌂ DENOTES UTILITY POLE
 —H— DENOTES OVERHEAD WIRES
 ⌊ DENOTES CATCH BASIN
 ⚡ DENOTES FIRE HYDRANT
 ○ DENOTES BOLLARD
 BF DENOTES BOARD FENCE
 FCE DENOTES FENCE

METRIC
 DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

THESE DRAWINGS ARE NOT TO BE SCALED:
 ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR
 PRIOR TO COMMENCEMENT OF ANY WORK. ANY
 DISCREPANCIES MUST BE REPORTED DIRECTLY TO SRN
 ARCHITECTS INC.

ADDITIONAL NOTES:
 THE DRAWING, AS AN INSTRUMENT OF SERVICE, IS PROVIDED BY AND IS THE PROPERTY OF SRN ARCHITECTS INC. THE CONTRACTOR MUST VERIFY AND ACCEPT RESPONSIBILITY FOR ALL DIMENSIONS AND CONDITIONS ON SITE AND MUST NOTIFY SRN ARCHITECTS INC. OF ANY VARIATIONS FROM THE SUPPLIED INFORMATION. SRN ARCHITECTS INC. IS NOT RESPONSIBLE FOR THE ACCURACY OF SURVEY, STRUCTURAL, MECHANICAL, ELECTRICAL ETC. ENGINEERING INFORMATION SHOWN ON THIS DRAWING REFER TO APPROPRIATE ENGINEERS DRAWINGS BEFORE PROCEEDING WITH ANY WORK. CONSTRUCTION MUST CONFORM TO ALL APPLICABLE CODES AND REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION (UNDETAILED OTHERWISE NOTED). NO INVESTIGATION HAS BEEN OR REPORTED ON BY THIS OFFICE IN REGARDS TO THE ENVIRONMENTAL CONDITION OF THIS SITE.
 CONDITIONS FOR ELECTRONIC INFORMATION TRANSFER:
 ELECTRONIC INFORMATION IS SUPPLIED TO THE OTHER ASSOCIATED FIRMS TO ASSIST THEM IN THE REVIEW OF THEIR WORK/REVIEW. THE RECIPIENT FIRMS MUST DETERMINE THE COMPLETENESS/APPROPRIATENESS/RELEVANCE OF THE INFORMATION IN RESPECT TO THEIR PARTICULAR RESPONSIBILITY.

NO.	DATE	REVISION COMMENT

SRN ARCHITECTS INC SHALL NOT BE RESPONSIBLE FOR:
 1. ERRORS, OMISSIONS, INCOMPLETENESS DUE TO LOSS OF INFORMATION IN WHOLE OR PART WHEN INFORMATION IS TRANSFERRED
 2. TRANSMISSIONS OF ANY VIRUS OR DAMAGE TO RECEIVING ELECTRONIC SYSTEM WHEN INFORMATION IS TRANSFERRED

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 8395 JANE ST, SUITE 202
 VAUGHAN, ONTARIO. L4K 5Y2
 PHONE: 905.417.5515 FAX: 905.417.5517

STAMP:

CLIENT:
TYPHON GROUP LTD.

PROJECT:
RESIDENTIAL DEVELOPMENT
 272 INNISFIL STREET
 BARRIE, ON, L4N 3G1

DRAWING TITLE:
PROJECT SURVEY

DATE: SCALE: 1 : 3

DRAWN BY: Author CHECKED BY: Checker

PROJECT NUMBER: DRAWING NUMBER:

S21028 A102

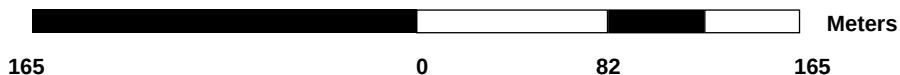


Features

- Regulation Map Index
- LSRCA Watershed Boundary
- Watercourse
- Regulated Area Boundary
- Regulated Area
- Address Labels
- Assessment Parcel
- Lot and Concession
- Roads
 - Hwy 400 Series
 - Highway, Arterials
 - Local Road
- Railway



Scale 1: 3,246



Printed On:
8/20/2019

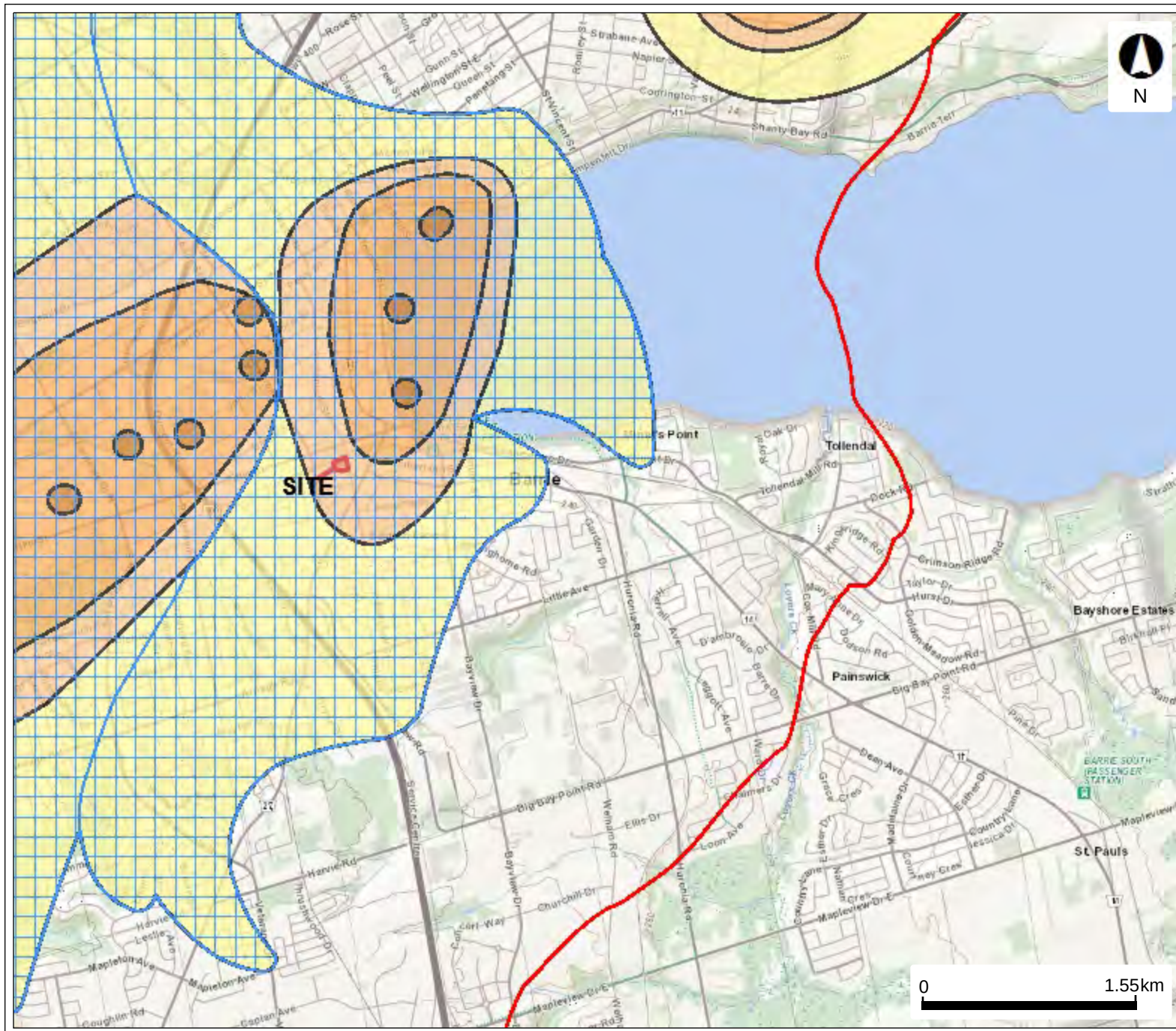


WGS_1984_Web_Mercator_
Auxiliary_Sphere

Mapped By:

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Source Protection Areas



Legend

- Intake Protection Zone Q
 - Wellhead Protection Area Q1
 - Wellhead Protection Area Q2
 - Issue Contributing Areas
- Wellhead Protection Area
- A
 - B
 - C
 - C1
 - D
 - F

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



Hydrogeological Assessment, 272 Innisfil Street, Barrie, Ontario
20667340 Ontario Inc., c/o The Typhon Group Ltd.

Ref. No.: 8707-003

2022-03-15

Appendix B

Borehole Logs



Peterborough
Barrie
Oshawa
Kingston
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www.cambium-inc.com

Log of Borehole:

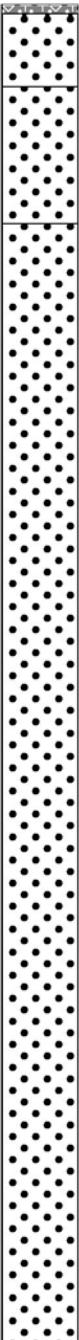
BH101-19

Page 1 of 5

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604026, 4914100

Project No.: 8707-001
Date Completed: July 4-5, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE													
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks	
								25	50	75	10	20	30	40			
0	0		Asphalt: asphalt												Cap		
			Sand: Brown crushed sand, with gravel, trace silt, moist, compact												Bentonite Plug		
			Sand: Brown sand, trace gravel, trace silt, moist, loose, FILL														
-1	1			2	SS	75	9										
			Sand: Brown sand, trace gravel, trace silt, moist, loose														Cuttings
-2	2			3	SS	100	5										
				4	SS	100	8										Bentonite Plug
-3	3		Wet														PVC Standpipe
			Saturated, compact														
			5	SS	100	18											
-4	4																
-5	5			6	SS	70	26										
-6	6																
-7	7			7	SS	50	28								Caving		

Switched drilling method to mud rotary at 3.0 mbgs

Switched drilling method to mud rotary at 3.0 mbgs

Logged By: JB

Input By: CM



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Log of Borehole:

BH101-19

Page 2 of 5

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
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Project No.: 8707-001
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Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
-8	8		Very dense, increased silt content, gravel seam	8	SS	55	50/255 mm									
-9	9		Dense													
-10	10		Compact	9	SS	80	36									
-11	11															
-12	12		Dense	10	SS	70	28									
-13	13															
-14	14			11	SS	65	33									
				12	SS	55	41									

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Input By: CM



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Log of Borehole:

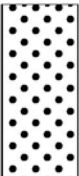
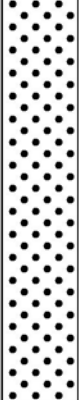
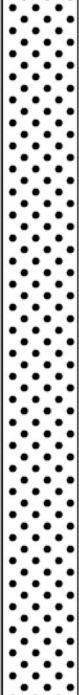
BH101-19

Page 3 of 5

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604026, 4914100

Project No.: 8707-001
Date Completed: July 4-5, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE										
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)		Well Installation	Remarks
								25	50	75	10	20	30	40
-15	15		Compact	13	SS	65	29							
-16	16													
-17	17		Very dense	14	SS	60	50/ 280 mm							
-18	18													
-19	19		Dense	15	SS	70	34							
-20	20													
-21	21													
-22	22													

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Input By: CM



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Log of Borehole:

BH101-19

Page 4 of 5

Client: Innovative Planning Solution

Project Name: Geotech Investigation - 272 Innisfil St

Project No.: 8707-001

Contractor: Walker Drilling

Method: Hollow Stem Augers + Mud Rotary

Date Completed: July 4-5, 2019

Location: 272 Innisfil Street, Barrie, ON

UTM: 17T 604026, 4914100

Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
-23	23															
-24	24															
-25	25		16	SS	60	40										
-26	26															
-27	27															
-28	28		17	SS	65	40										
-29	29															

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Log of Borehole:

BH101-19

Page 5 of 5

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604026, 4914100

Project No.: 8707-001
Date Completed: July 4-5, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
-30	30	Loose		18	SS	60	5									
-31	31															
-32	32	Dense														
-33	33															
-34	34		Borehole terminated at 34 mbgs													
-35	35															

Logged By: JB

Input By: CM



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Barrie
Oshawa
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Log of Borehole:

BH102-19

Page 1 of 4

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604017, 4914048

Project No.: 8707-001
Date Completed: July 5 & 8, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
0	0		Asphalt: asphalt													Cap
			Gravelly Sand: Brown crushed gravelly sand, trace silt													Bentonite Plug
-1	1		Sand: Brown sand, trace gravel, trace silt, moist, very loose, FILL	2	SS	0	1									Cuttings
			Loose													
-2	2			3	SS	70	9									Bentonite Plug
			Sand: Brown sand, trace gravel, trace silt, moist, loose													PVC Standpipe
-3	3		Wet Moist, compact													
				5	SS	75	15									
-4	4															
			Saturated, trace gravel													
-5	5			6	SS	50	22									
																
-6	6															
			Dense													Caving
-7	7															
																
-8	8			8	SS	60	47									PVC Screen
																
-9	9															
				9	SS	55	30									Cap

Switched drilling method to mud rotary at 3.0 mbgs

Logged By: JB

Input By: CM



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Log of Borehole:

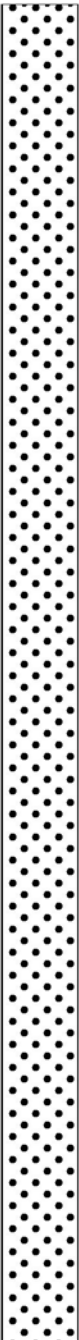
BH102-19

Page 2 of 4

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604017, 4914048

Project No.: 8707-001
Date Completed: July 5 & 8, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
-10	10															
-11	11		10	SS	70	34										
-12	12															
-13	13		11	SS	50	41										
-14	14															
-15	15															
-16	16		Grey fine sand,no gravel, increased silt content,	13	SS	75	37									
-17	17															
-18	18															
-19	19			14	SS	65	34									

Logged By: JB

Input By: CM



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Log of Borehole:

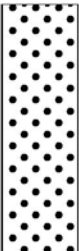
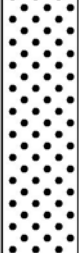
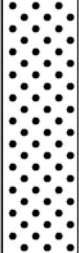
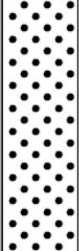
BH102-19

Page 3 of 4

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604017, 4914048

Project No.: 8707-001
Date Completed: July 5 & 8, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE													
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks	
								25	50	75	10	20	30	40			
-20	20		Compact	15	SS	70	35										
-21	21																
-22	22																
-23	23		Compact	16	SS	65	25										
-24	24																
-25	25																
-26	26		Dense	17	SS	60	38										
-27	27																
-28	28																
-29	29																

Logged By: JB

Input By: CM



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Log of Borehole:

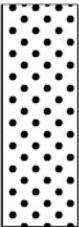
BH102-19

Page 4 of 4

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604017, 4914048

Project No.: 8707-001
Date Completed: July 5 & 8, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
-30	30		Borehole terminated at 31 mbgs	18	SS	55	42									
-31	31															
-32	32															
-33	33															
-34	34															
-35	35															

Logged By: JB

Input By: CM



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Log of Borehole:

BH103-19

Page 1 of 1

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers
UTM: 17T 604052, 4914058

Project No.: 8707-001
Date Completed: August 14, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
0	0		Asphalt: asphalt	1	GS	-	-									
			Sand: Dark brown sand, some gravel, trace silt, trace asphalt fragments, moist, FILL													
-1	1		Sand: Brown sand, trace silt, trace gravel, trace fragments, moist, loose, FILL	2	SS	40	7									
		3		SS	80	8										
-2	2		Sand: Brown sand, trace silt, trace gravel, moist, compact	4	SS	85	12									
				5	SS	100	18									
-3	3															
-4	4			6	SS	100	28									
-5	5															
-6	6		Dense	7	SS	100	35									
-7	7		Borehole terminated at 6.7 mbgs													Groundwater first observed at 3.4 mbgs, caving at 3.7 mbgs and groundwater at 3.7 mbgs upon completion

Logged By: CM

Input By: CM



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Log of Borehole:

BH104-19

Page 1 of 1

Client: Innovative Planning Solution
Contractor: Walker Drilling
Location: 272 Innisfil Street, Barrie, ON

Project Name: Geotech Investigation - 272 Innisfil St
Method: Hollow Stem Augers
UTM: 17T 604041, 4914034

Project No.: 8707-001
Date Completed: August 14, 2019
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
0	0		Asphalt: asphalt	1	GS	-	-									
			Sand: Brown sand, trace silt, trace gravel, some asphalt fragments, moist, loose, FILL													
-1	1			2	SS	40	4									
			Trace asphalt fragments													
-2	2		3	SS	50	5										
			Sand: Brown sand, trace silt, trace gravel, moist, compact	4	SS	90	13									
-3	3															
			Dense	5	SS	70	20									
-4	4															
				6	SS	70	25									
-5	5															
-6	6															
			Very dense	7	SS	100	50/ 279 mm									
-7	7															
			Borehole terminated at 6.7 mbgs													Groundwater first observed at 4.0 mbgs, caving at 4.0 mbgs and groundwater at 4.0 mbgs upon completion

Logged By: CM

Input By: CM



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Log of Borehole:

BH101-22

Page 1 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie, ON

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 603990, 4914068

Project No.: 8707-003
Date Completed: Feb. 7, 2022
Elevation: 229.86 mASL

SUBSURFACE PROFILE				SAMPLE										
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)	Well Installation	Remarks	
								25	50	75	10	20	30	40
0			ASPHALT: Asphalt 50mm											
			SAND: Brown sand, some gravel, moist [FILL]	1	GS	-	-							
229				2A										
1			SAND: Brown sand, moist, loose	2B	SS	50	32							
228				3	SS	30	7							
2														
			-trace silt	4	SS	30	8							
227														
3			-compact	5	SS	30	23							
226														
4														
			-grey, saturated	6	SS	60	28							
225														
5														
224														
6			-trace gravel, dense	7	SS	40	42							
223														
7														
222			-brown, fine gravel seam between 7.6m and 7.7m	8	SS	50	50							
221														

Switched drilling method to mud rotary at 2.3 mbgs

Logged By: J. Schweighofer

Input By: J. Schweighofer



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Log of Borehole:

BH101-22

Page 2 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie, ON

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 603990, 4914068

Project No.: 8707-003
Date Completed: Feb. 7, 2022
Elevation: 229.86 mASL

SUBSURFACE PROFILE				SAMPLE										
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)	Well Installation	Remarks	
								25	50	75	10	20	30	40
220	9		-more silt	9	SS	50	43							
219	10													
218	11		SAND: Brown sand, trace silt, trace clay, trace gravel, dense	10	SS	60	30							
217	12													
216	13		SAND: Brown sand, trace silt, trace clay, trace gravel, dense	11	SS	70	38							
215	14													
214	15		SAND: Grey sand, some silt, trace gravel, very dense	12	SS	60	50							
213	16													
	17			13	SS	70	50 / 250 mm							

GSA SS11:
2% Gravel
83% Sand
8% Silt
7% Clay

GSA SS11:
2% Gravel
83% Sand
8% Silt
7% Clay

Logged By: J. Schweighofer

Input By: J. Schweighofer



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Log of Borehole:

BH101-22

Page 3 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie, ON

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 603990, 4914068

Project No.: 8707-003
Date Completed: Feb. 7, 2022
Elevation: 229.86 mASL

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
212	18		-no gravel, dense	14	SS	60	44									
211	19															
210	20															
209	21		-trace gravel, more silt, very dense	15	SS	60	50 / 225 mm									
208	22															
207	23															
206	24		-dense	16	SS	50	50									
205	25															
204	26															

Logged By: J. Schweighofer

Input By: J. Schweighofer



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Log of Borehole:

BH101-22

Page 4 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie, ON

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 603990, 4914068

Project No.: 8707-003
Date Completed: Feb. 7, 2022
Elevation: 229.86 mASL

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
203	27		-very dense	17	SS	30	50 / 150 mm									
202	28															
201	29															
200	30															
199	31		-trace gravel, increased silt content, trace clay	18	SS	50	50 / 150 mm									
198	32		Borehole terminated in SAND at 31 mbgs due to target exploration depth achieved.													

Logged By: J. Schweighofer

Input By: J. Schweighofer



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Log of Borehole:

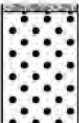
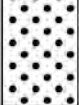
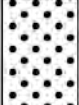
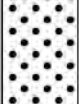
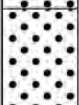
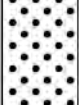
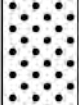
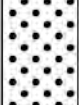
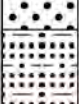
BH102-22

Page 1 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604054, 4914058

Project No.: 8707-003
Date Completed: Feb. 8, 2022
Elevation: 229.26 mASL

SUBSURFACE PROFILE				SAMPLE										
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)	Well Installation	Remarks	
								25	50	75	10	20	30	40
229	0		ASPHALT: Asphalt 50mm											
			SAND: Dark brown sand, trace gravel, moist [FILL]	1	GS	-	-							
			-orange, some gravel, dense	2	SS	70	33							
228	1		SAND: Orange to brown sand, trace silt, moist, loose	3	SS	70	8							
			-brown, increased silt content, compact	4	SS	40	13							
227	2		SAND: Brown to grey sand, trace silt, saturated, compact	5	SS	40	23							
			-dense	6	SS	60	45							
226	3													
225	4													
224	5													
223	6													
222	7													
221	8													
														
														
														
														
														

Switched drilling method to mud rotary at 2.3 mbgs

GSA SS7:
0% Gravel
54% Sand
42% Silt
4% Clay

Logged By: J. Schweighofer

Input By: J. Schweighofer



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Log of Borehole:

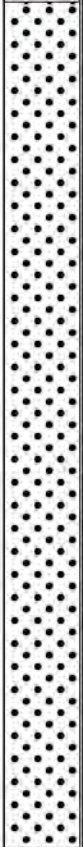
BH102-22

Page 2 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604054, 4914058

Project No.: 8707-003
Date Completed: Feb. 8, 2022
Elevation: 229.26 mASL

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks
								25	50	75	10	20	30	40		
220	9		-dense	9	SS	70	42									
219	10															
218	11		-less silt	10	SS	60	44									
217	12		SAND: Brown sand, some gravel, dense	11	SS	70	50									
216	13															
215	14			12	SS	80	49									
214	15															
213	16		-very dense	13	SS	70	50 / 250 mm									
212	17															

Logged By: J. Schweighofer

Input By: J. Schweighofer



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Log of Borehole:

BH102-22

Page 3 of 4

Client: Typhon Group Limited
Contractor: Walker Drilling
Location: 272 Innisfil St., Barrie

Project Name: 272 Innisfil St., Barrie, ON
Method: Hollow Stem Augers + Mud Rotary
UTM: 17T 604054, 4914058

Project No.: 8707-003
Date Completed: Feb. 8, 2022
Elevation: 229.26 mASL

SUBSURFACE PROFILE				SAMPLE										
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)	Well Installation	Remarks	
								25	50	75	10	20	30	40
211	18		SILTY CLAY: Grey silty clay, stiff	14	SS	70	20							
210	19													
209	20													
208	21		SAND: Grey sand, some silt, some clay, trace gravel, dense	15	SS	70	44							
207	22													
206	23													
205	24		SAND: Grey sand, trace silt, trace gravel, dense	16	SS	50	47							
204	25													
203	26													

Atterberg SS14:
LL 24.2%
PL 16.7%
PI 7.5%

Auger shaking
observed between
24.4 mbgs and 27.4
mbgs

Atterberg SS14:
LL 24.2%
PL 16.7%
PI 7.5%

Auger shaking
observed between
24.4 mbgs and 27.4
mbgs

Logged By: J. Schweighofer

Input By: J. Schweighofer



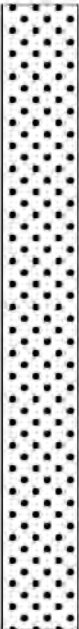
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Log of Borehole:

BH102-22

Page 4 of 4

Client: Typhon Group Limited **Project Name:** 272 Innisfil St., Barrie, ON **Project No.:** 8707-003
Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** Feb. 8, 2022
Location: 272 Innisfil St., Barrie **UTM:** 17T 604054, 4914058 **Elevation:** 229.26 mASL

SUBSURFACE PROFILE				SAMPLE													
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture			SPT (N)				Well Installation	Remarks	
								25	50	75	10	20	30	40			
202	27		more gravel	17	SS	30	50										
201	28																
200	29																
199	30																
			trace gravel, very dense	18	SS	40	50 / 175 mm										
198	31			Borehole terminated in SAND at 31 mbgs due to target exploration depth achieved.													
	32																

Logged By: J. Schweighofer

Input By: J. Schweighofer



Hydrogeological Assessment, 272 Innisfil Street, Barrie, Ontario
20667340 Ontario Inc., c/o The Typhon Group Ltd.

Ref. No.: 8707-003

2022-03-15

Appendix C

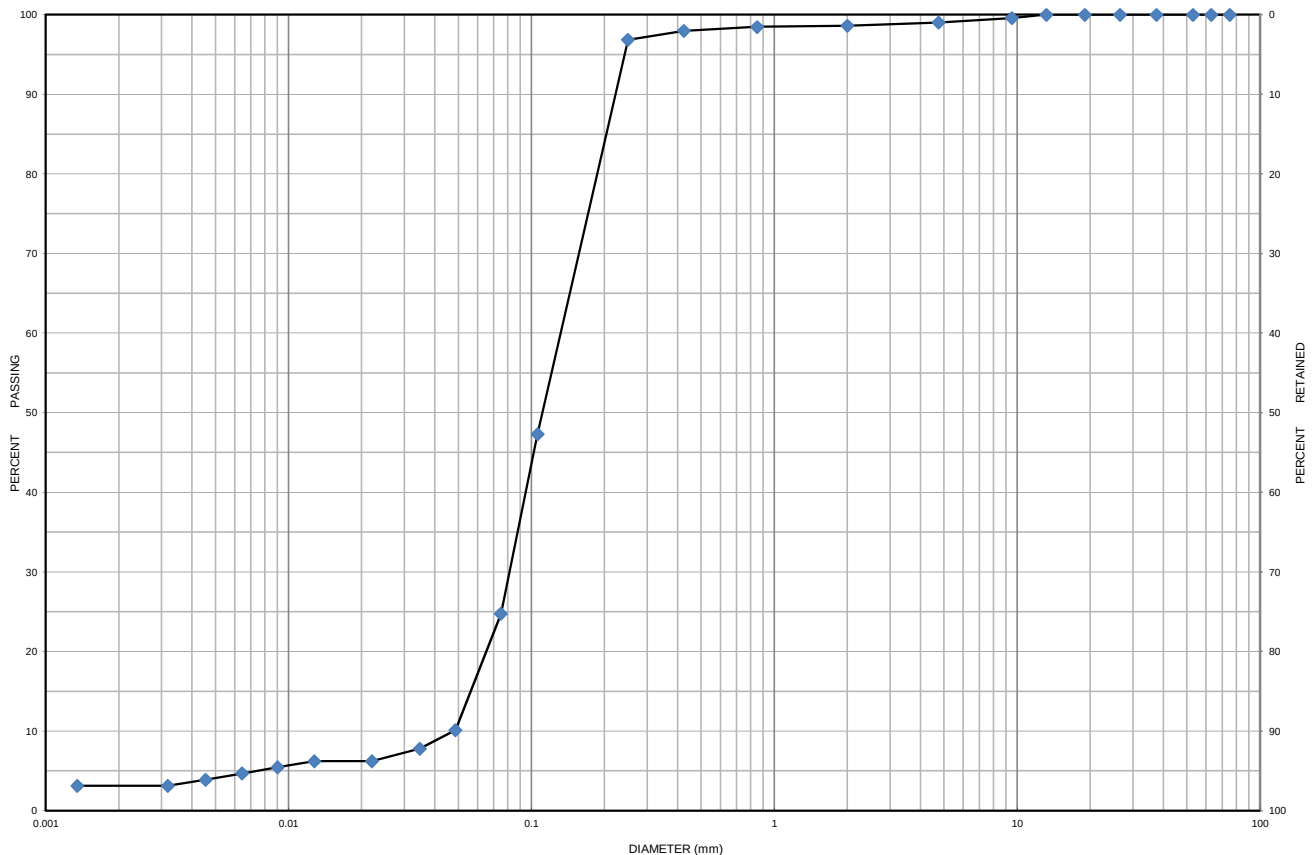
Grain Size Analyses



Grain Size Distribution Chart

Project Number: 8707-001 **Client:** Innovative Planning Solutions
Project Name: 272 Innisfil St., Barrie, ON
Sample Date: July 4, 2019 **Sampled By:** Jacob Bell - Cambium Inc.
Location: BH 102-19 SS 3 **Depth:** 1.5 m to 2.1 m **Lab Sample No:** S-19-0676

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-19	SS 3	1.5 m to 2.1 m	1	74	25		12.9
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silty Sand trace Clay trace Gravel		SM	0.140	0.082	0.048	2.92	1.00

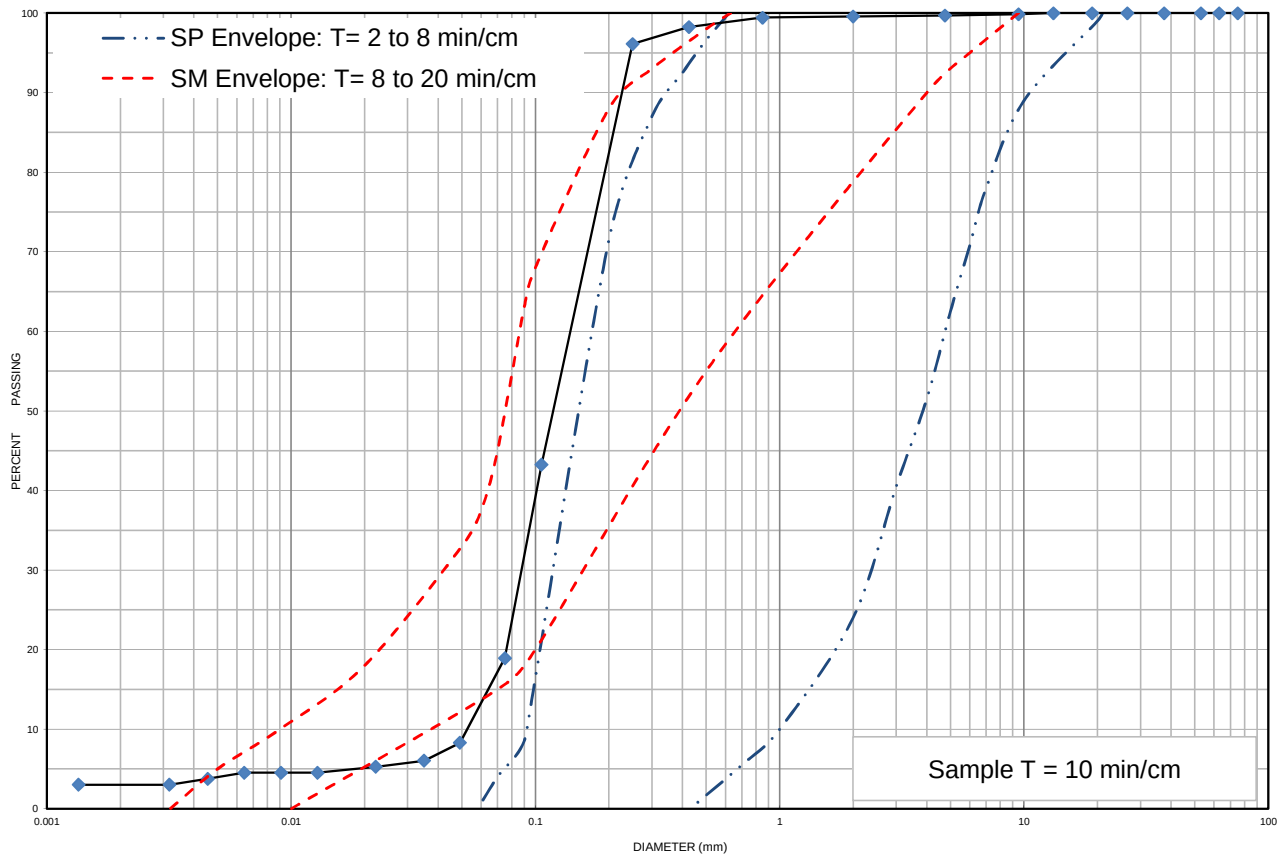
Issued By:  (Senior Project Manager) **Date Issued:** August 29, 2019



Grain Size Distribution Chart

Project Number: 8707-001 **Client:** Innovative Planning Solutions
Project Name: 272 Innisfil St., Barrie, ON
Sample Date: July 4, 2019 **Sampled By:** Jacob Bell - Cambium Inc.
Location: BH 104-19 SS 4 **Depth:** 2.3 m to 2.7 m **Lab Sample No:** S-19-0677

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDER
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 104-19	SS 4	2.3 m to 2.7 m	0	81	19		8.2
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sand some Silt trace Clay		SP	0.140	0.087	0.053	2.64	1.02

Issued By:  (Senior Project Manager) **Date Issued:** August 29, 2019

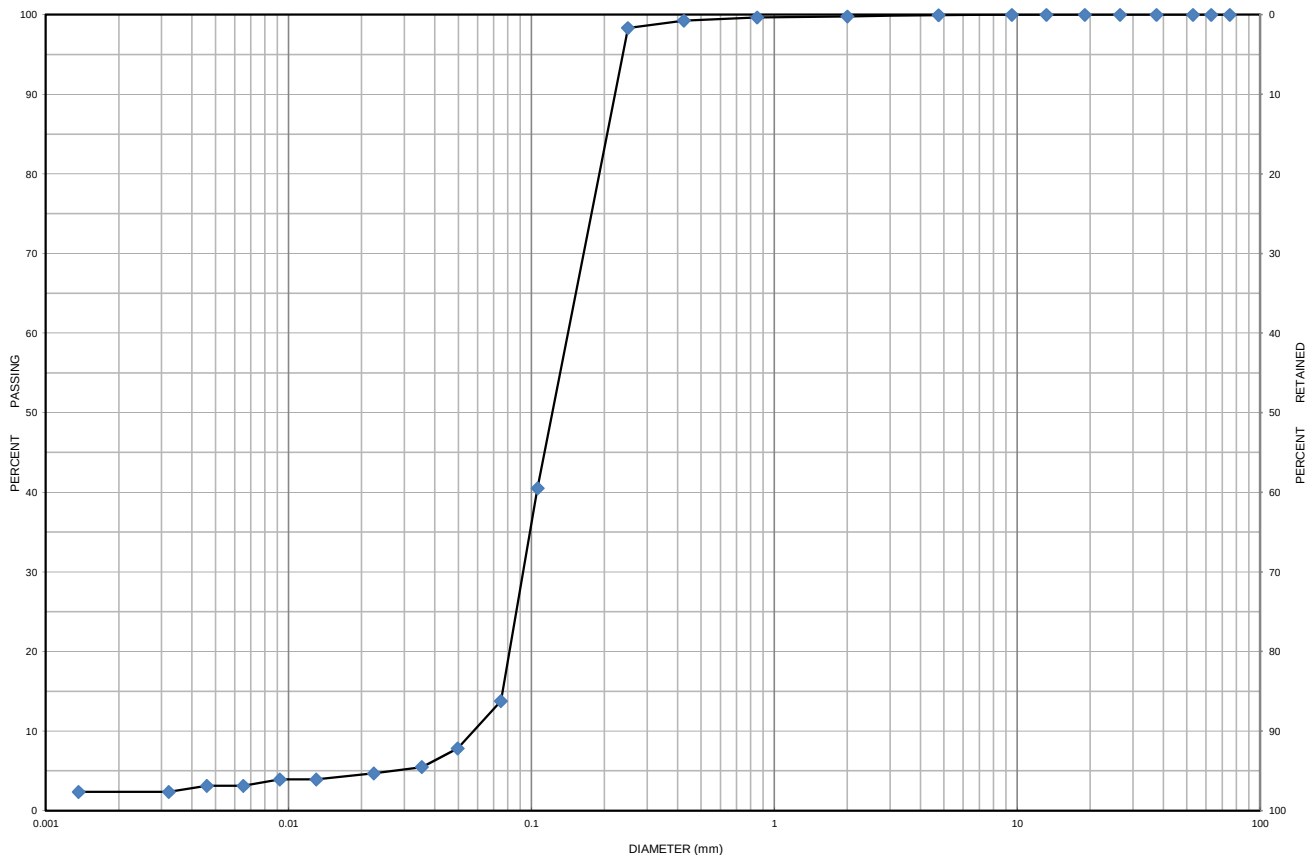


Grain Size Distribution Chart

Project Number: 8707-001 **Client:** Innovative Planning Solutions
Project Name: 272 Innisfil St., Barrie, ON
Sample Date: July 4, 2019 **Sampled By:** Jacob Bell - Cambium Inc.
Location: BH 101-19 SS 5 **Depth:** 3 m to 3.7 m **Lab Sample No:** S-19-0674

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM

MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDER
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-19	SS 5	3 m to 3.7 m	0	86	14		21.8
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sand some Silt trace Clay		SP	0.150	0.092	0.057	2.63	0.99

Issued By:

(Senior Project Manager)

Date Issued:

August 29, 2019

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

Form: L6V.2 - Grad.Hydo

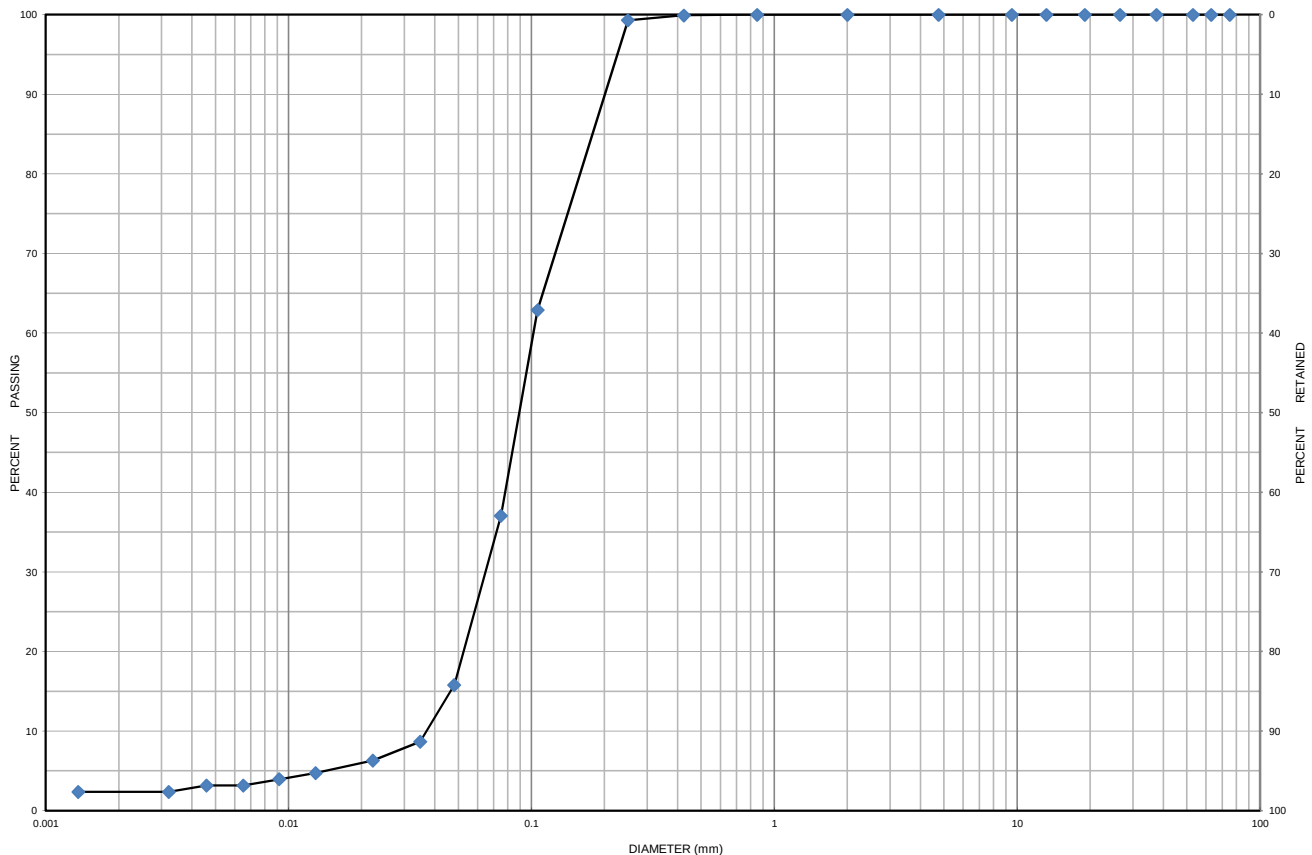


Grain Size Distribution Chart

Project Number: 8707-001 **Client:** Innovative Planning Solutions
Project Name: 272 Innisfil St., Barrie, ON
Sample Date: July 4, 2019 **Sampled By:** Jacob Bell - Cambium Inc.
Location: BH 102-19 SS 16 **Depth:** 24.4 m to 24.8 m **Lab Sample No:** S-19-0675

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM

MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDER
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-19	SS 16	24.4 m to 24.8 m	0	63	37		19.7
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silty Sand trace Clay		SM	0.110	0.065	0.038	2.89	1.01

Issued By:

(Senior Project Manager)

Date Issued:

August 29, 2019

Cambium Inc. (Laboratory)

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Form: L6V.2 - Grad.Hydo



Hydrogeological Assessment, 272 Innisfil Street, Barrie, Ontario
20667340 Ontario Inc., c/o The Typhon Group Ltd.

Ref. No.: 8707-003

2022-03-15

Appendix D

Aquifer Test Results



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH101-19

Test Conducted by:

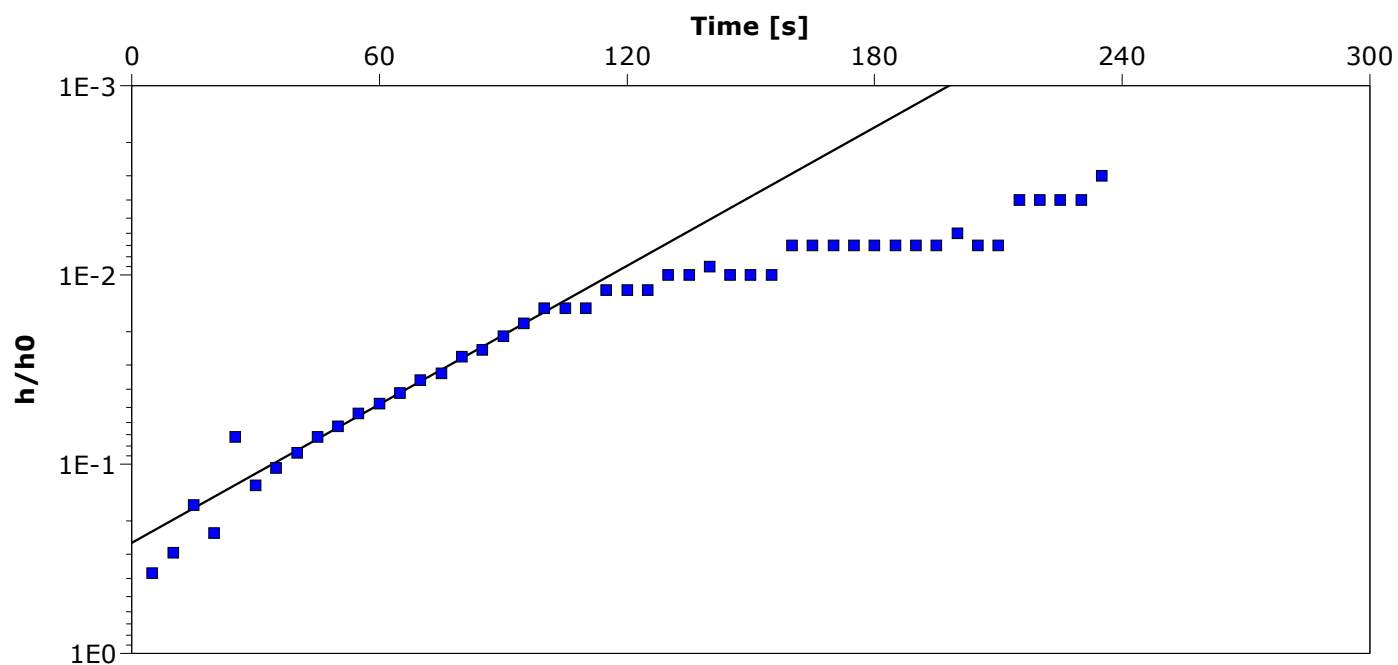
Test Date: 7/29/2019

Analysis Performed by: M.Francis

1st Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 34.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH101-19

1.41×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH101-19

Test Conducted by:

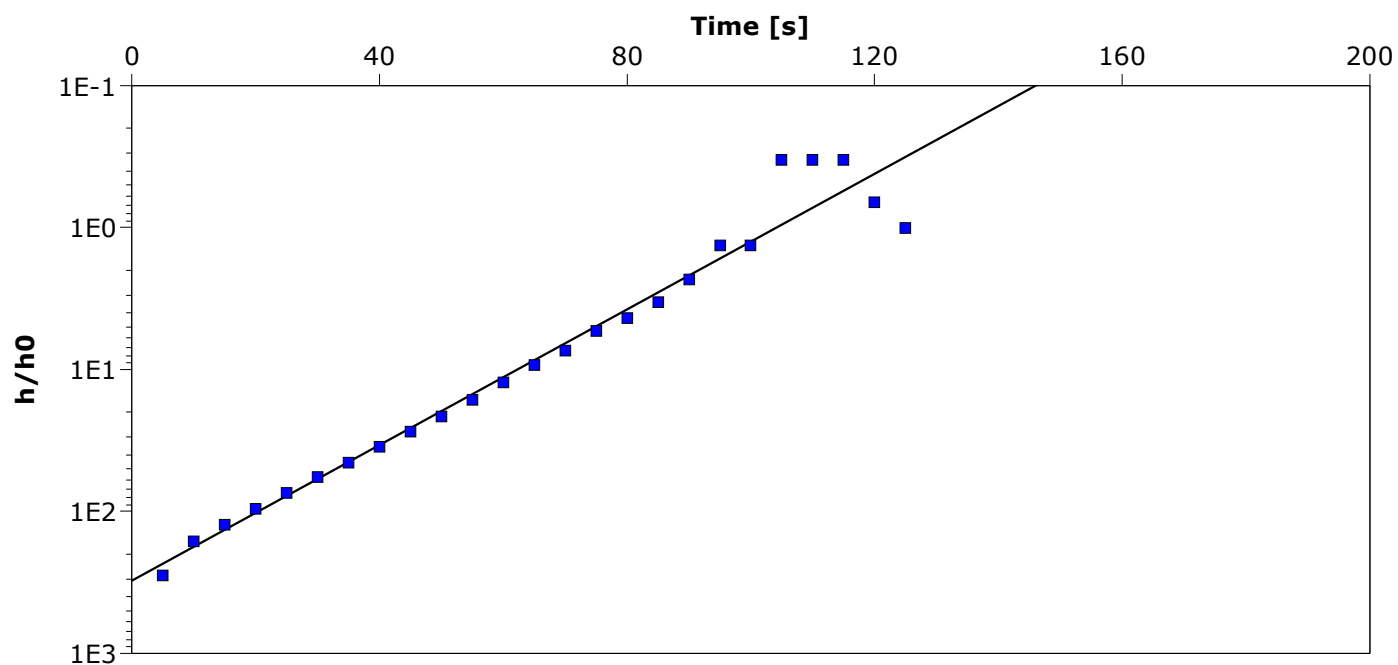
Test Date: 7/29/2019

Analysis Performed by: M.Francis

1st Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 34.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH101-19

2.77×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH101-19

Test Conducted by:

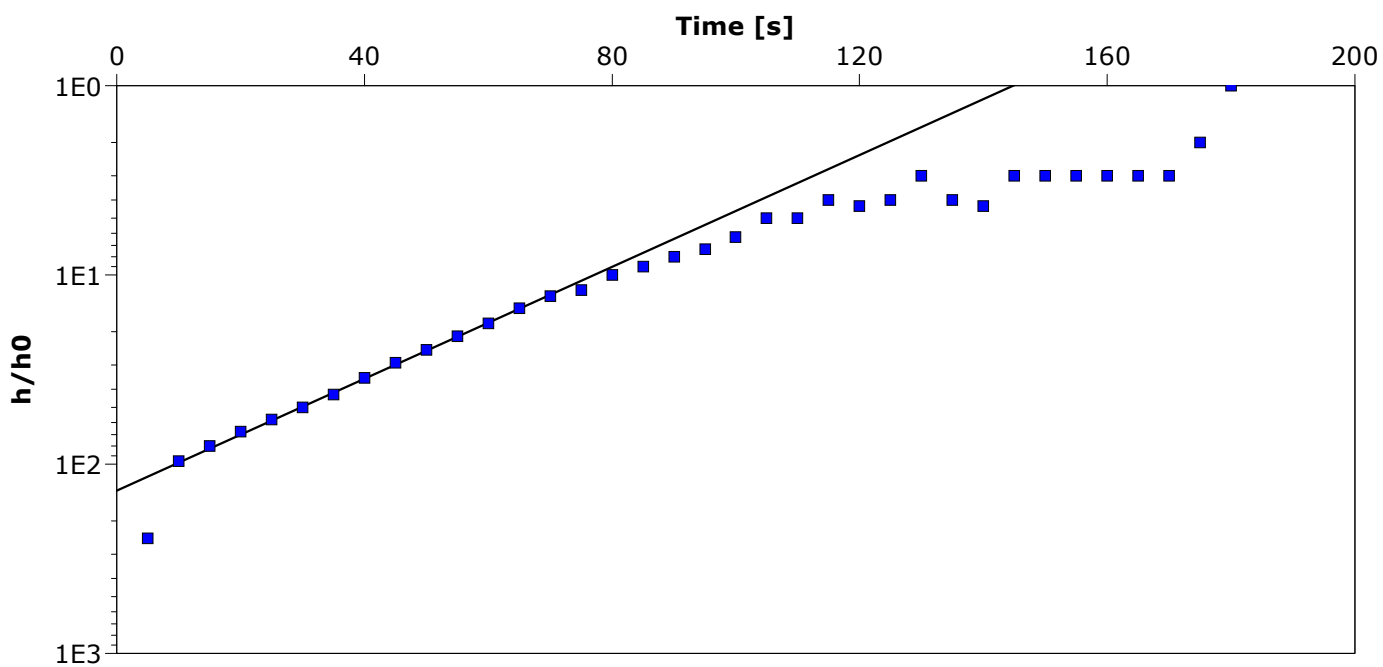
Test Date: 7/29/2019

Analysis Performed by: M.Francis

2nd Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 34.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH101-19

1.71×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH101-19

Test Conducted by:

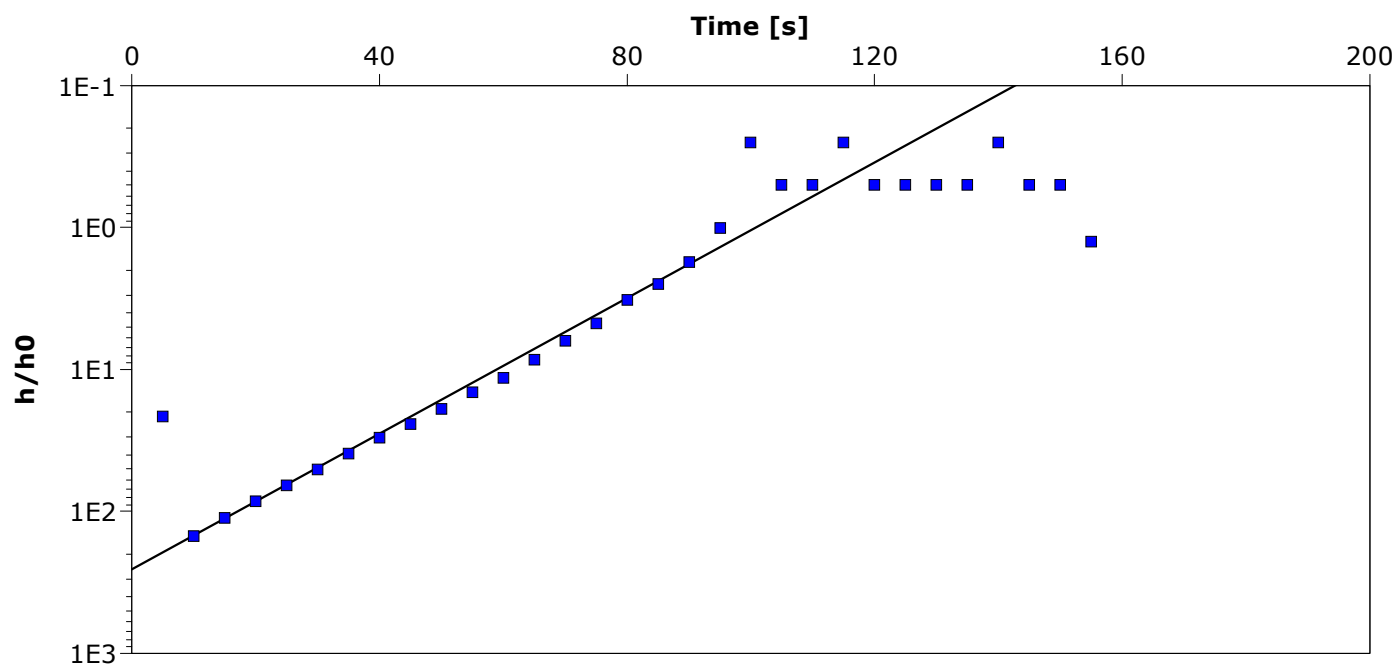
Test Date: 7/29/2019

Analysis Performed by: M.Francis

2nd Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 34.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH101-19

2.77×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH101-19

Test Conducted by:

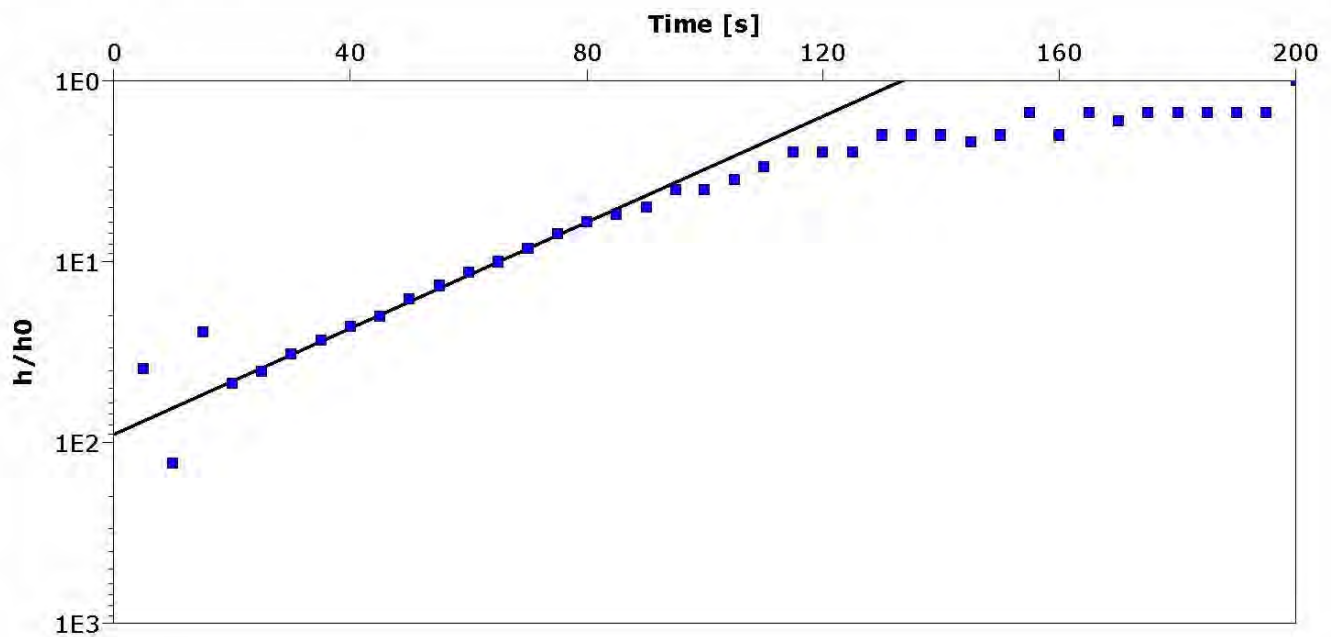
Test Date: 7/29/2019

Analysis Performed by: M.Francis

3rd Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 34.00 m



Calculation using Hvorslev

Observation Well Hydraulic Conductivity
[m/s]

BH101-19 1.70×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH101-19

Test Conducted by:

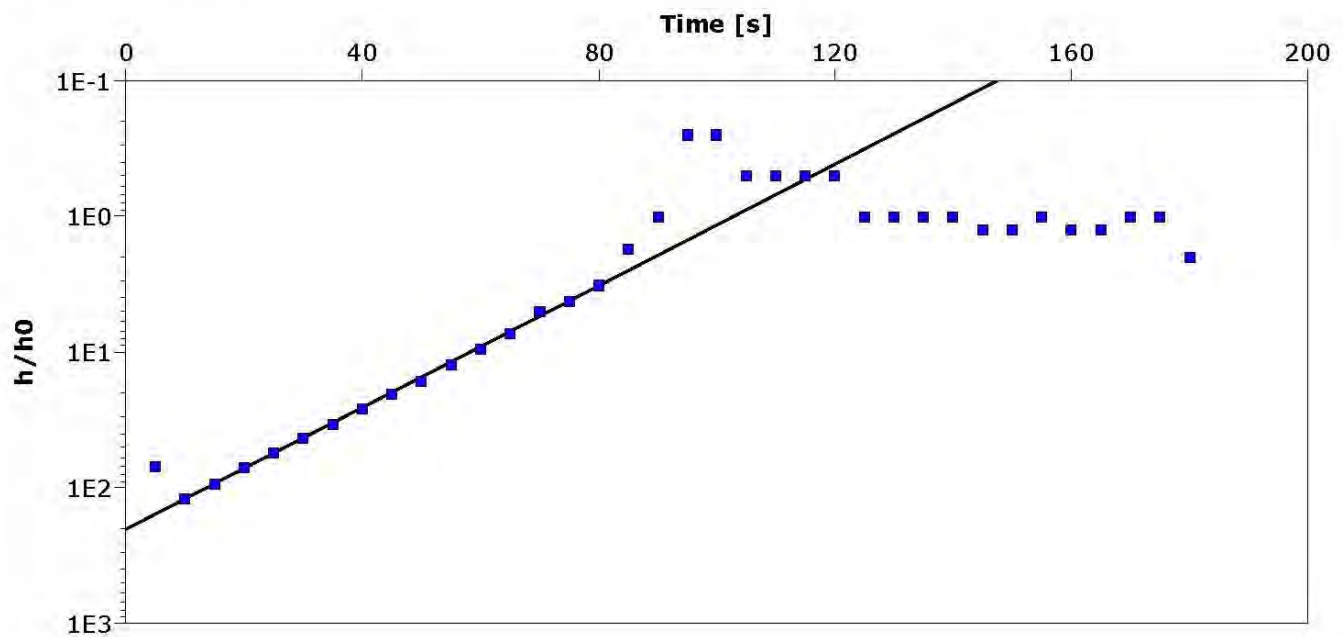
Test Date: 7/29/2019

Analysis Performed by: M.Francis

3rd Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well Hydraulic Conductivity
 [m/s]

BH102-19 2.60×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

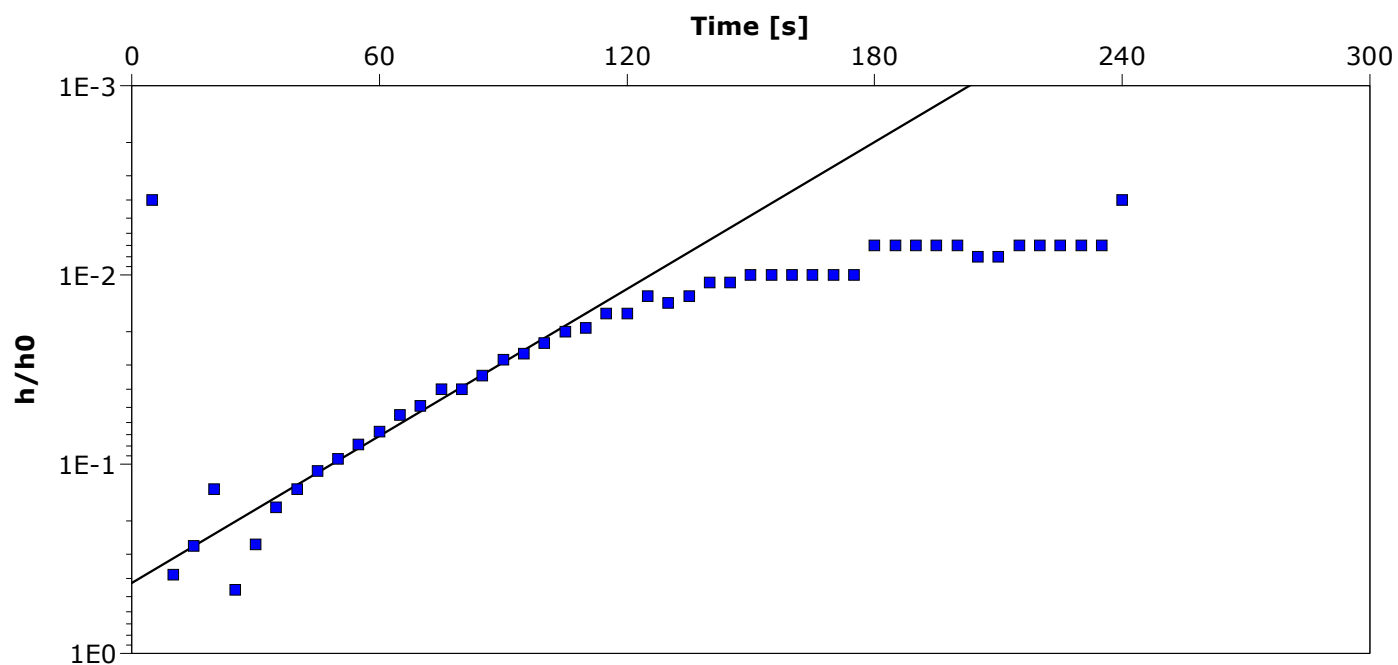
Test Date: 7/29/2019

Analysis Performed by: M.Francis

1st Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

1.50×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

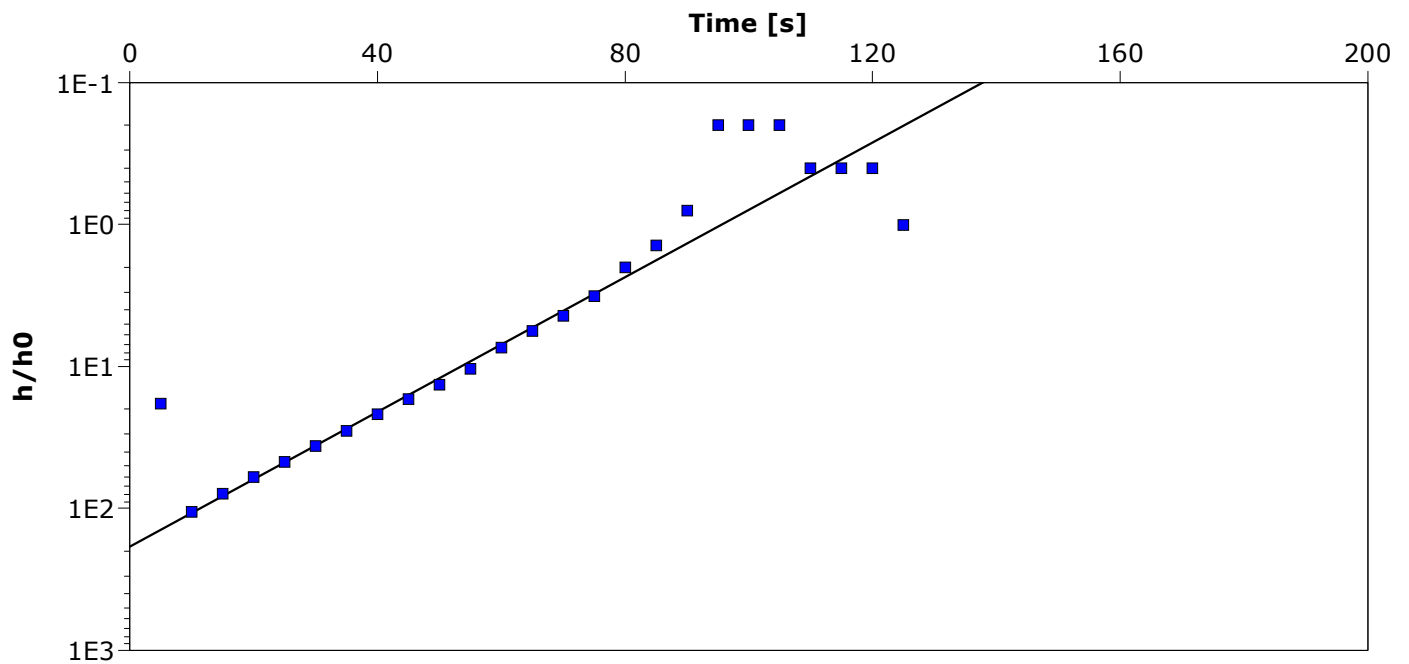
Test Date: 7/29/2019

Analysis Performed by: M.Francis

1st Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

2.75×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

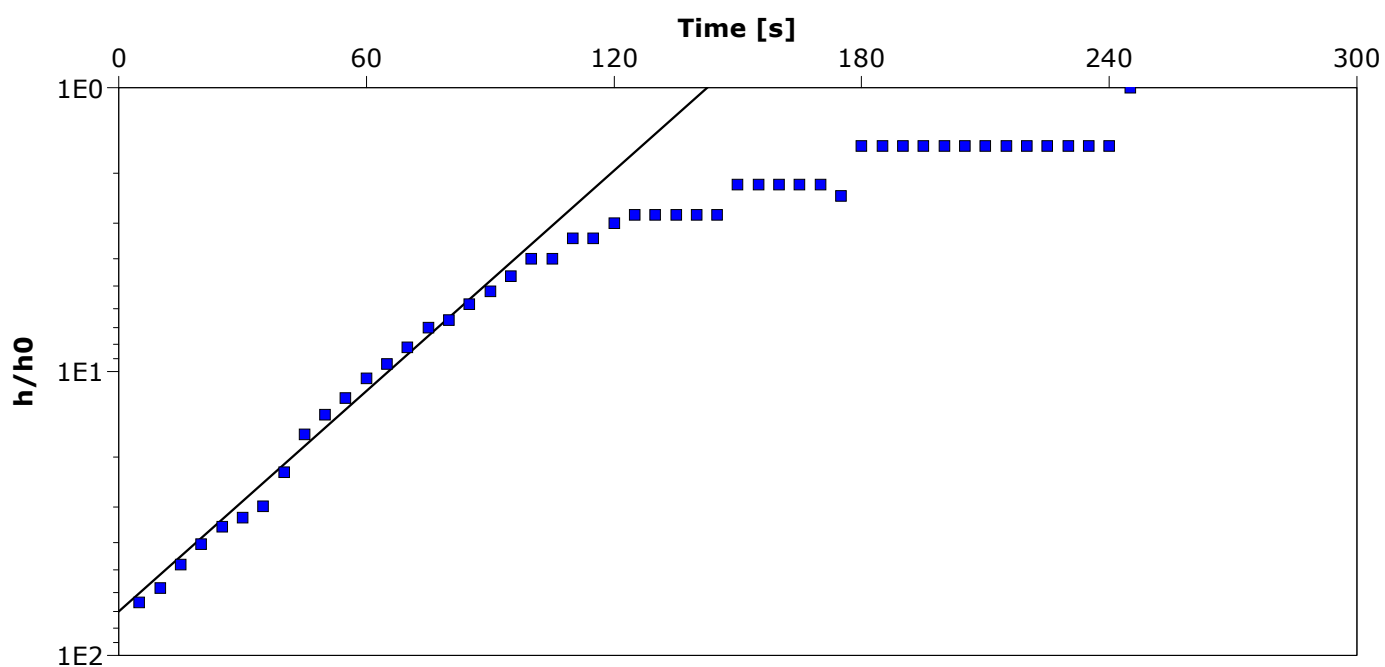
Test Date: 7/29/2019

Analysis Performed by: M.Francis

2nd Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

1.50×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

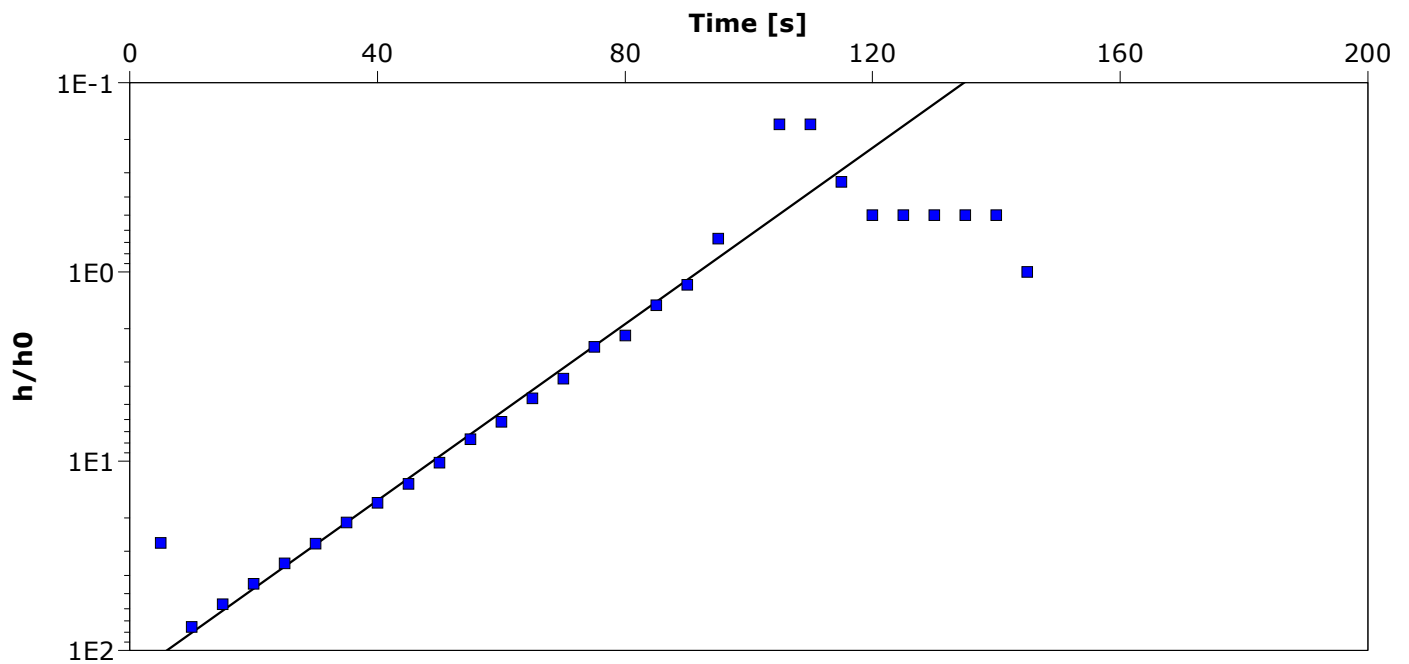
Test Date: 7/29/2019

Analysis Performed by: M.Francis

2nd Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

2.70×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

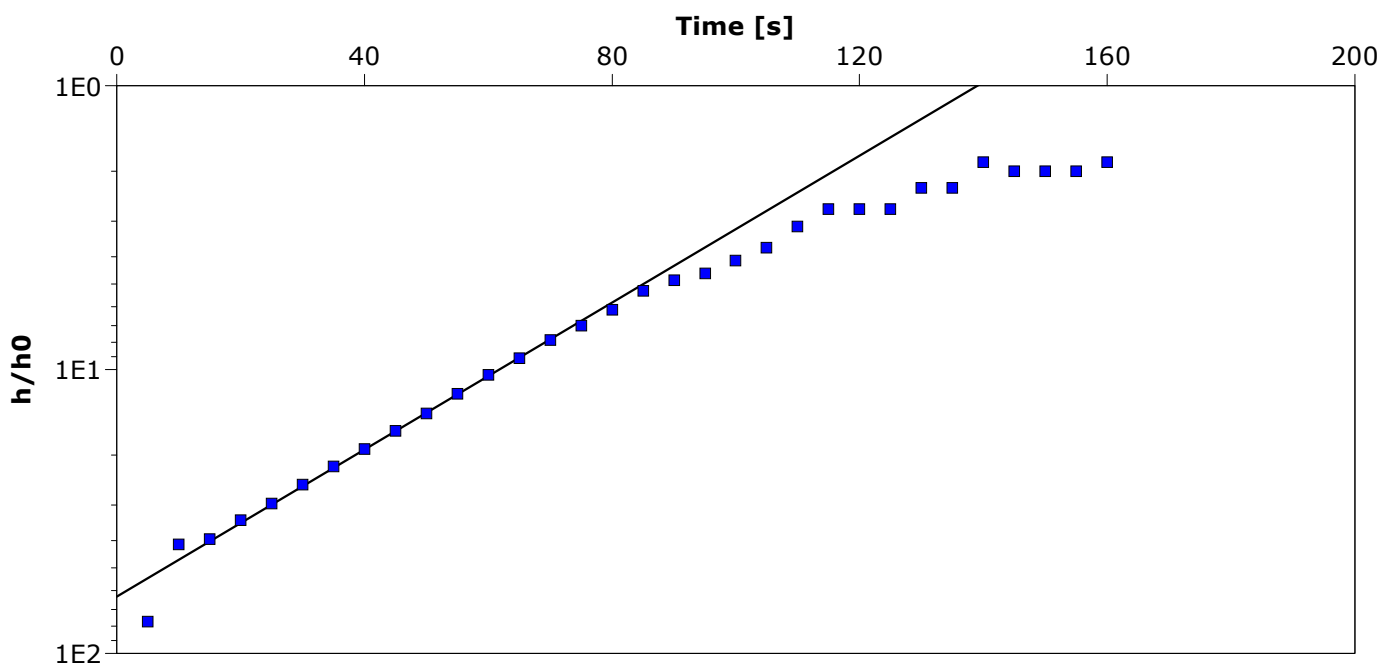
Test Date: 7/29/2019

Analysis Performed by: M.Francis

3rd Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

1.50×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

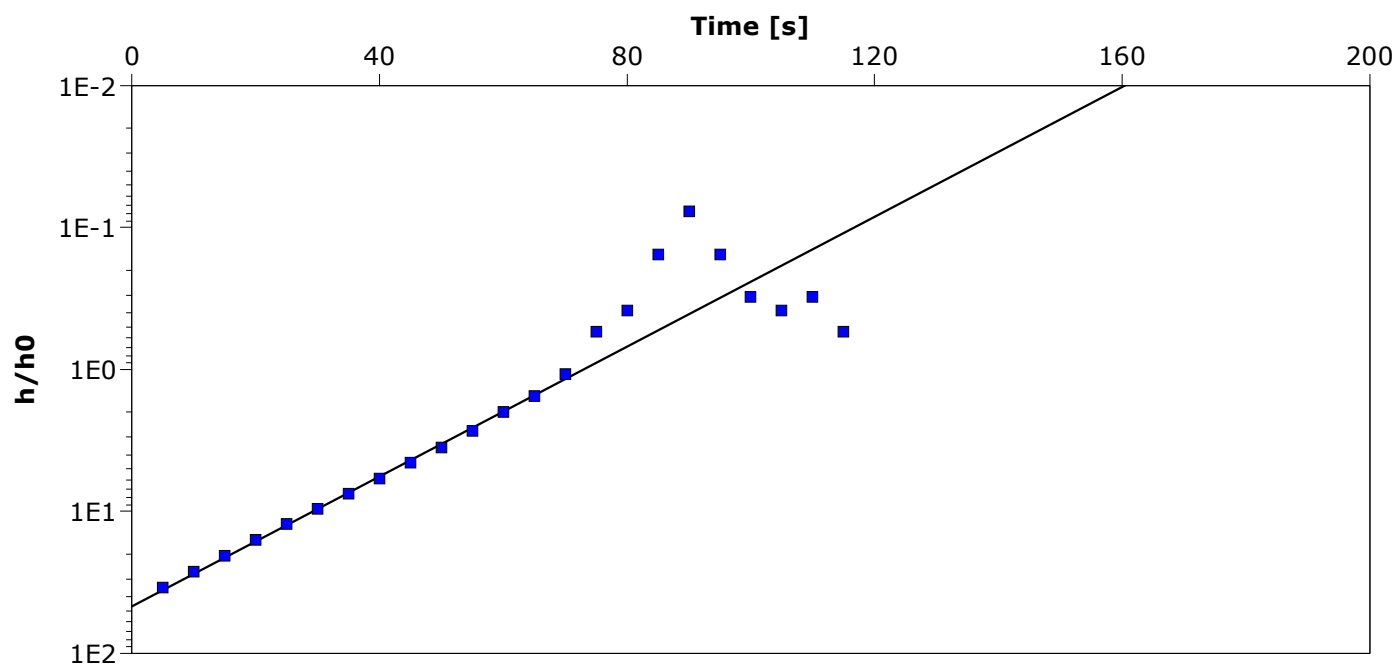
Test Date: 7/29/2019

Analysis Performed by: M.Francis

3rd Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

2.65×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

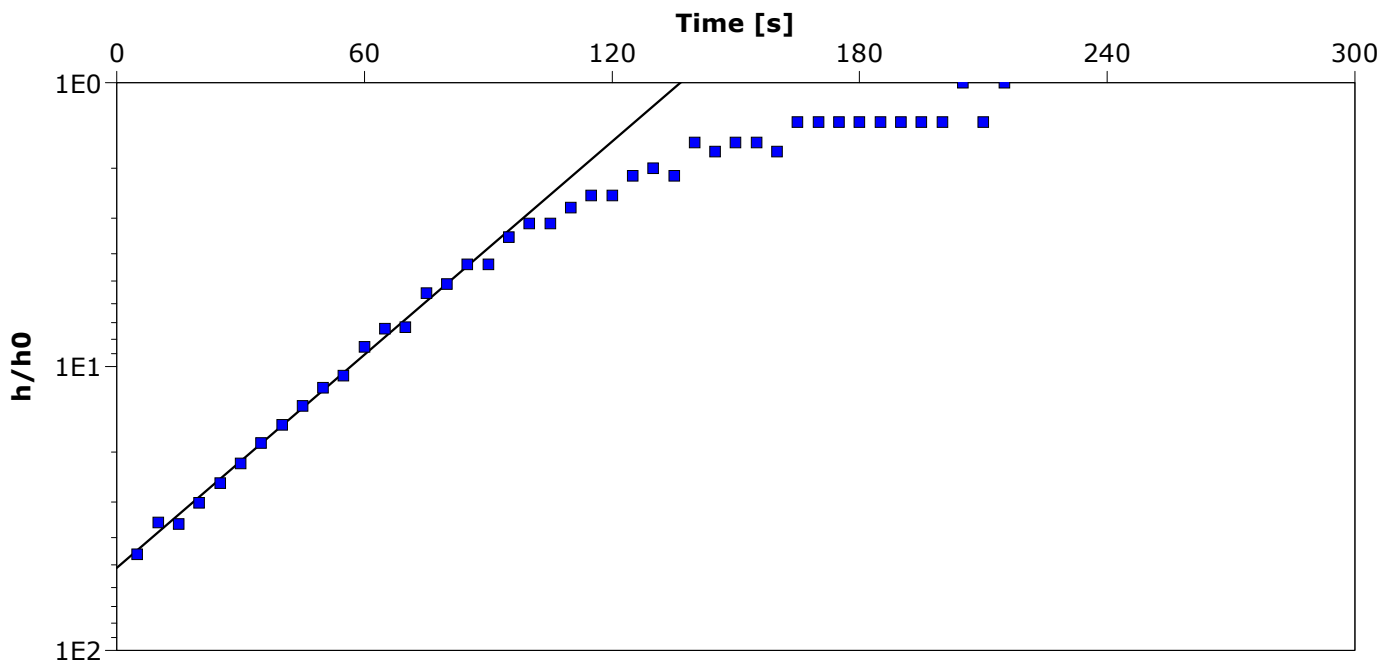
Test Date: 7/29/2019

Analysis Performed by: M.Francis

4th Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

1.45×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

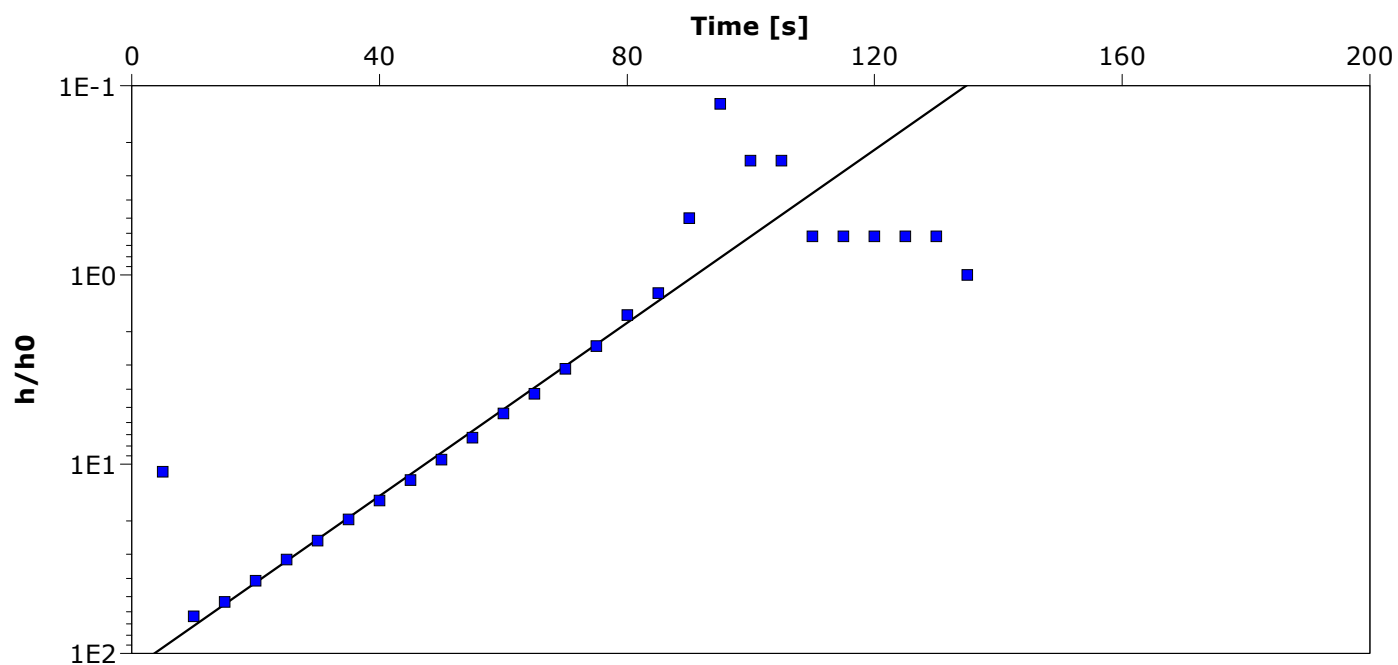
Test Date: 7/29/2019

Analysis Performed by: M.Francis

4th Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

2.65×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

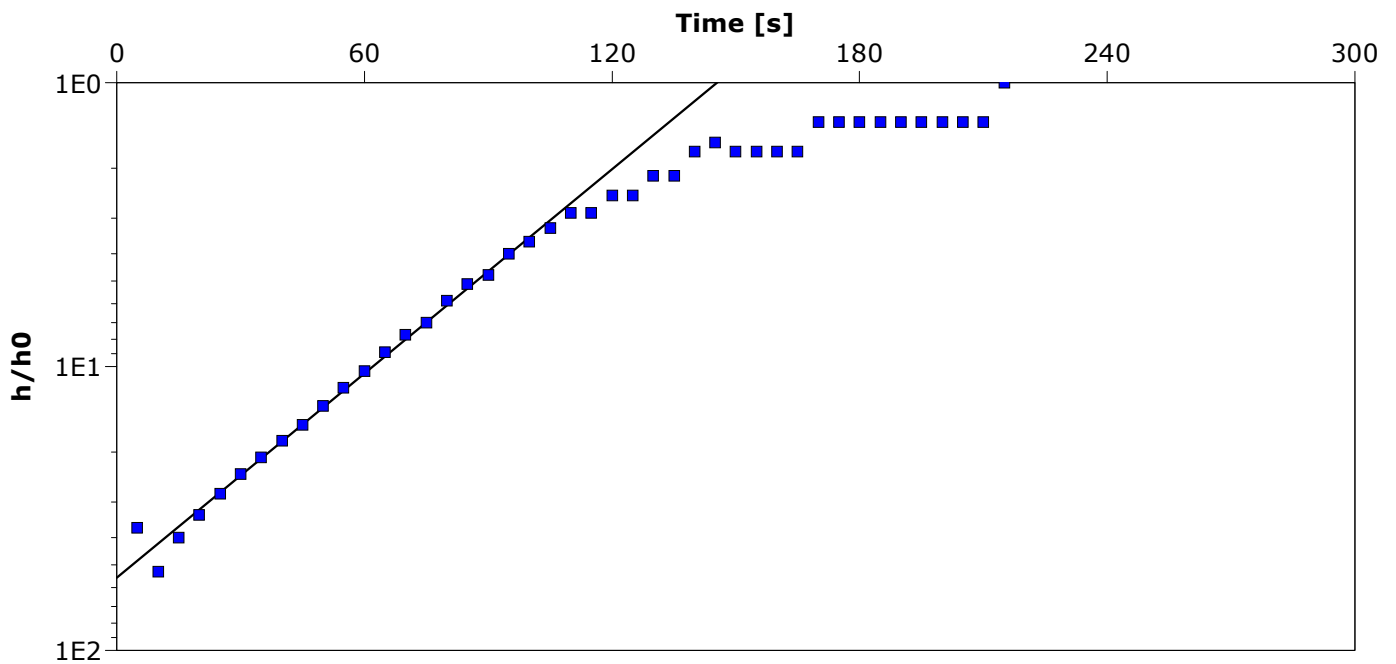
Test Date: 7/29/2019

Analysis Performed by: M.Francis

5th Slug In

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

1.39×10^{-5}



Cambium Inc.
52 Hunter Street East
Peterborough, ON
K9H 1G5

Slug Test Analysis Report

Project: Geotech Investigation - 272 Innisfil St.

Number: 8707-001

Client: Innovative Planning Solution

Location: 272 Innisfil Street, Barrie, ON

Slug Test: Slug Test 1

Test Well: BH102-19

Test Conducted by:

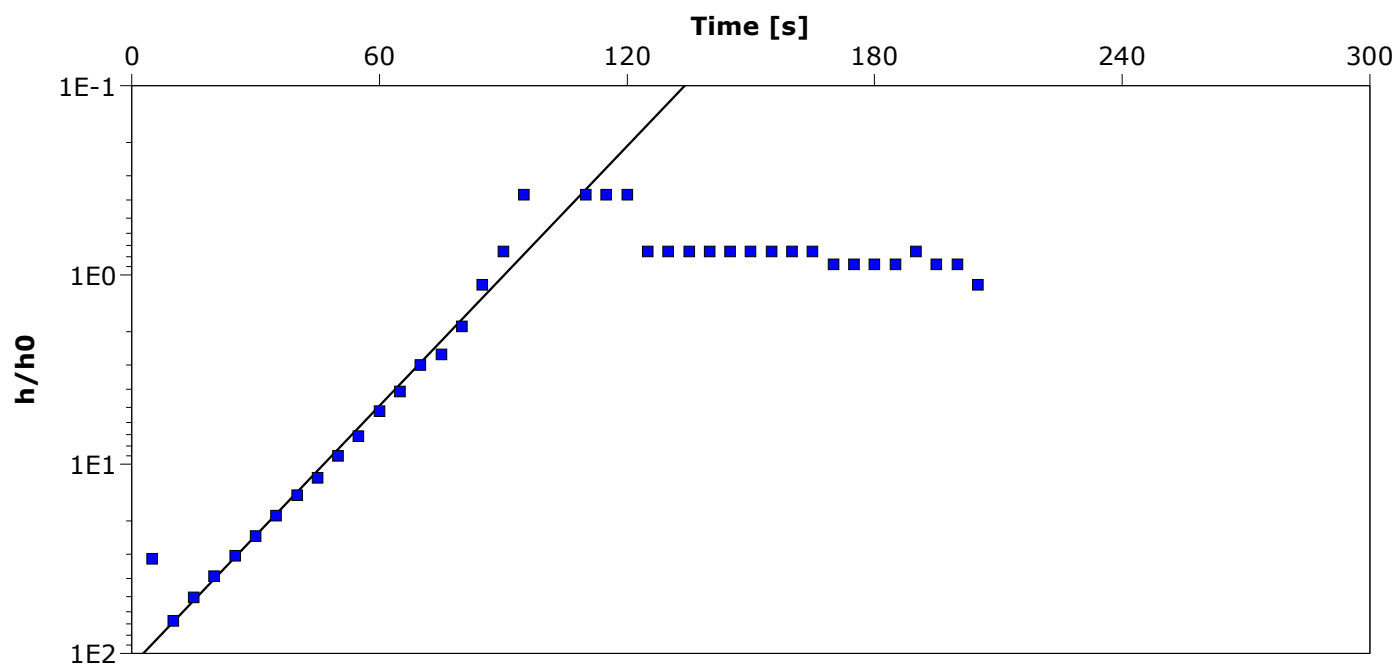
Test Date: 7/29/2019

Analysis Performed by: M.Francis

5th Slug Out

Analysis Date: 8/13/2019

Aquifer Thickness: 31.00 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

BH102-19

2.65×10^{-5}



Appendix E

Certificates of Analysis

C.O.C.: G70053

REPORT No. B19-23358 (i)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
pH @25°C	pH Units		SM 4500H	31-Jul-19/O	7.71		
BOD(5 day)	mg/L	3	SM 5210B	01-Aug-19/K	< 3		
COD	mg/L	5	SM 5220D	01-Aug-19/O	94		
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	01-Aug-19/K	1.7		
Total Suspended Solids	mg/L	3	SM2540D	31-Jul-19/K	18800		
Oil and Grease-Mineral	mg/L	1.0	SM 5520	02-Aug-19/K	< 1.0		
Oil and Grease-Anim/Veg.	mg/L	1.0	SM 5520	02-Aug-19/K	< 1.0		
Phosphorus-Total	mg/L	0.01	E3199A.1	01-Aug-19/K	8.84		
Cyanide (Total)	mg/L	0.005	SM 4500CN	01-Aug-19/K	< 0.005		
Chloride	mg/L	0.5	SM4110C	01-Aug-19/O	204		
Fluoride	mg/L	0.1	SM4110C	31-Jul-19/O	< 0.1		
Sulphate	mg/L	1	SM4110C	31-Jul-19/O	33		
Aluminum (total)	mg/L	0.01	SM 3120	02-Aug-19/O	0.04		
Antimony	mg/L	0.0001	EPA 200.8	02-Aug-19/O	0.0002		
Arsenic	mg/L	0.0001	EPA 200.8	02-Aug-19/O	0.0042		
Barium	mg/L	0.001	SM 3120	02-Aug-19/O	0.029		
Bismuth	mg/L	0.02	SM 3120	02-Aug-19/O	< 0.02		
Cadmium	mg/L	0.00015	EPA 200.8	02-Aug-19/O	0.000349		
Chromium	mg/L	0.002	SM 3120	02-Aug-19/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	02-Aug-19/O	< 0.005		
Copper	mg/L	0.002	SM 3120	02-Aug-19/O	0.042		
Gold	mg/L	0.0007	EPA 200.8	06-Aug-19/O	< 0.0007		
Hexachlorobenzene	mg/L	0.0001	EPA 8270	02-Aug-19/K	< 0.0001		
Iron	mg/L	0.005	SM 3120	02-Aug-19/O	0.025		
Lead	mg/L	0.02	SM 3120	02-Aug-19/O	< 0.02		



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

C.O.C.: G70053

REPORT No. B19-23358 (i)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Manganese (Total)	mg/L	0.001	SM 3120	02-Aug-19/O	0.002		
Mercury	mg/L	0.00002	SM 3112 B	06-Aug-19/O	0.00002		
Molybdenum	mg/L	0.01	SM 3120	02-Aug-19/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	02-Aug-19/O	< 0.01		
Total PAH	mg/L	0.0001	EPA 8270	02-Aug-19/K	0.00022		
Acenaphthene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Acenaphthylene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Anthracene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Benzo(a)anthracene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Benzo(a)pyrene	µg/L	0.01	EPA 8270	02-Aug-19/K	< 0.01		
Benzo(b+k)fluoranthene	µg/L	0.1	EPA 8270	02-Aug-19/K	< 0.1		
Benzo(g,h,i)perylene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Dibenzo(a,h)anthracene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Chrysene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Fluoranthene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Fluorene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Indeno(1,2,3,-cd)pyrene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Methylnaphthalene,1-	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Methylnaphthalene,2-	µg/L	0.08	EPA 8270	02-Aug-19/K	< 0.08		
Naphthalene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Phenanthrene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Pyrene	µg/L	0.05	EPA 8270	02-Aug-19/K	< 0.05		
Phenolics	mg/L	0.002	MOEE 3179	01-Aug-19/K	< 0.002		
Platinum	mg/L	0.00004	EPA 200.8	06-Aug-19/O	< 0.00004		
Rhodium	mg/L	0.00002	EPA 200.8	06-Aug-19/O	< 0.00002		



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke

Lab Manager

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C.O.C.: G70053

REPORT No. B19-23358 (i)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Selenium	mg/L	0.001	EPA 200.8	02-Aug-19/O	0.003		
Silver	mg/L	0.005	SM 3120	02-Aug-19/O	< 0.005		
Sulphide	mg/L	0.01	SM4500-S2	01-Aug-19/K	< 0.1 ¹		
Tin	mg/L	0.05	SM 3120	02-Aug-19/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	02-Aug-19/O	< 0.005		
Vanadium	mg/L	0.005	SM 3120	02-Aug-19/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	02-Aug-19/O	0.028		
Zirconium	mg/L	0.003	SM 3120	02-Aug-19/O	< 0.003		

¹ Elevated detection limit due to dilution



Christine Burke
Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

C.O.C.: G70053

REPORT No. B19-23358 (ii)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Acetone	µg/L	30	EPA 8260	02-Aug-19/R	< 30		
Benzene	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Bromodichloromethane	µg/L	2	EPA 8260	02-Aug-19/R	< 2		
Bromoform	µg/L	5	EPA 8260	02-Aug-19/R	< 5		
Bromomethane	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Carbon Tetrachloride	µg/L	0.2	EPA 8260	02-Aug-19/R	< 0.2		
Monochlorobenzene (Chlorobenzene)	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Chloroform	µg/L	1	EPA 8260	02-Aug-19/R	< 1		
Dibromochloromethane	µg/L	2	EPA 8260	02-Aug-19/R	< 2		
Dichlorobenzene,1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichlorobenzene,1,3-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichlorobenzene,1,4-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichlorodifluoromethane	µg/L	2	EPA 8260	02-Aug-19/R	< 2		
Dichloroethane,1,1-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloroethane,1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloroethylene,1,1-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloroethene, cis-1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloroethene, trans-1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloropropane,1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloropropene, cis-1,3-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloropropene, trans-1,3-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Dichloropropene 1,3-cis+trans	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Ethylbenzene	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke

Lab Manager

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C.O.C.: G70053

REPORT No. B19-23358 (ii)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Dibromoethane,1,2-(Ethylene Dibromide)	µg/L	0.2	EPA 8260	02-Aug-19/R	< 0.2		
Hexane	µg/L	5	EPA 8260	02-Aug-19/R	< 5		
Methyl Ethyl Ketone	µg/L	20	EPA 8260	02-Aug-19/R	< 20		
Methyl Isobutyl Ketone	µg/L	20	EPA 8260	02-Aug-19/R	< 20		
Methyl-t-butyl Ether	µg/L	2	EPA 8260	02-Aug-19/R	< 2		
Dichloromethane (Methylene Chloride)	µg/L	5	EPA 8260	02-Aug-19/R	< 5		
Styrene	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Tetrachloroethane,1,1,1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Tetrachloroethane,1,1,2,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Tetrachloroethylene	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Toluene	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Trichloroethane,1,1,1-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Trichloroethane,1,1,2-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Trichloroethylene	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Trichlorofluoromethane	µg/L	5	EPA 8260	02-Aug-19/R	< 5		
Vinyl Chloride	µg/L	0.2	EPA 8260	02-Aug-19/R	< 0.2		
Xylene, m,p-	µg/L	1.0	EPA 8260	02-Aug-19/R	< 1.0		
Xylene, o-	µg/L	0.5	EPA 8260	02-Aug-19/R	< 0.5		
Xylene, m,p,o-	µg/L	1.1	EPA 8260	02-Aug-19/R	< 1.1		
PHC F1 (C6-C10)	µg/L	50	MOE E3421	02-Aug-19/R	< 50		
PHC F2 (>C10-C16)	µg/L	50	MOE E3421	02-Aug-19/K	< 50		
PHC F3 (>C16-C34)	µg/L	400	MOE E3421	02-Aug-19/K	< 400		
PHC F4 (>C34-C50)	µg/L	400	MOE E3421	02-Aug-19/K	< 400		



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

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C.O.C.: G70053

REPORT No. B19-23358 (iii)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Aldrin	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
Chlordane (alpha)	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Chlordane (Gamma)	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Chlordane Total (alpha+gamma)	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
DDD, 2,4-	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
DDD, 4,4-	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
DDD Total Water	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
DDE, 2,4-	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
DDE, 4,4-	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
DDE Total water	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
DDT, 2,4-	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
DDT, 4,4-	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
DDT Total water	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Dieldrin	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Lindane (Hexachlorocyclohexane, Gamma)	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
Endosulfan I	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Endosulfan II	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Endosulfan I/II	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Endrin	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Heptachlor	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
Heptachlor Epoxide	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
Hexachlorobenzene	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		
Hexachlorobutadiene	µg/L	0.01	EPA 8080	06-Aug-19/K	< 0.01		



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Christine Burke

Lab Manager

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C.O.C.: G70053

REPORT No. B19-23358 (iii)

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 08-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.	BH 101-19			
			Sample I.D.	B19-23358-1			
			Date Collected	29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Hexachloroethane	µg/L	0.02	EPA 8080	06-Aug-19/K	< 0.02		
Methoxychlor	µg/L	0.05	EPA 8080	06-Aug-19/K	< 0.05		
Poly-Chlorinated Biphenyls (PCB's)	µg/L	0.05	EPA 8082	06-Aug-19/K	< 0.05		
Aroclor	-		-	06-Aug-19	-		



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Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke

Lab Manager

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C.O.C.: G70053

REPORT No. B19-24378

Report To:

Cambium Environmental

74 Cedar Pointe Drive, Unit 1009

Barrie ON L4N 5R7

Attention: Cameron MacDougall

Caduceon Environmental Laboratories

110 West Beaver Creek Rd Unit 14

Richmond Hill ON L4B 1J9

Tel: 289-475-5442

Fax: 289-562-1963

DATE RECEIVED: 30-Jul-19

JOB/PROJECT NO.: 272 Innisfil Street

DATE REPORTED: 09-Aug-19

P.O. NUMBER: 8707-001

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

			Client I.D.		BH 101-19 filtered			
			Sample I.D.		B19-24378-1			
			Date Collected		29-Jul-19			
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Aluminum	mg/L	0.01	SM 3120	09-Aug-19/O	0.09			
Antimony	mg/L	0.0001	EPA 200.8	08-Aug-19/O	0.0001			
Arsenic	mg/L	0.0001	EPA 200.8	08-Aug-19/O	< 0.0001			
Barium	mg/L	0.001	SM 3120	09-Aug-19/O	0.106			
Bismuth	mg/L	0.02	SM 3120	09-Aug-19/O	< 0.02			
Cadmium	mg/L	0.000015	EPA 200.8	08-Aug-19/O	< 0.000015			
Chromium	mg/L	0.002	SM 3120	09-Aug-19/O	< 0.002			
Cobalt	mg/L	0.005	SM 3120	09-Aug-19/O	< 0.005			
Copper	mg/L	0.002	SM 3120	09-Aug-19/O	< 0.002			
Iron	mg/L	0.005	SM 3120	09-Aug-19/O	< 0.005			
Lead	mg/L	0.00002	EPA 200.8	08-Aug-19/O	0.00009			
Manganese	mg/L	0.001	SM 3120	09-Aug-19/O	0.020			
Molybdenum	mg/L	0.01	SM 3120	09-Aug-19/O	< 0.01			
Nickel	mg/L	0.01	SM 3120	09-Aug-19/O	< 0.01			
Tin	mg/L	0.05	SM 3120	09-Aug-19/O	< 0.05			
Selenium	mg/L	0.001	EPA 200.8	08-Aug-19/O	0.002			
Silver	mg/L	0.0001	EPA 200.8	08-Aug-19/O	< 0.0001			
Titanium	mg/L	0.005	SM 3120	09-Aug-19/O	< 0.005			
Vanadium	mg/L	0.005	SM 3120	09-Aug-19/O	< 0.005			
Zinc	mg/L	0.005	SM 3120	09-Aug-19/O	0.012			
Zirconium	mg/L	0.003	SM 3120	09-Aug-19/O	< 0.003			



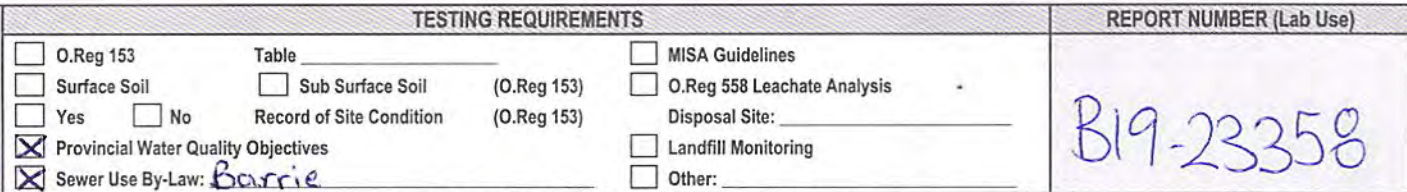
Christine Burke
Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Indicate Laboratory Samples are submitted to: ☐ Kingston ☐ Ottawa ☐ Richmond Hill ☐ Windsor ☒ Barrie ☐ London

Organization: Cambium	Address and Invoicing Address (if different) 74 Cedar Pointe Drive, Unit 1004 Barris, ON L4N 5R7		ANALYSES REQUESTED (Print Test in Boxes)										TURNAROUND SERVICE REQUESTED (see back page)		
Contact: Cameron MacDougall			See attached quote											Suspected Highly Contaminated	☐ Platinum 200% Surcharge**
Tel: 705-742-7400 ext. 212															☐ Gold 100% Surcharge
Fax:	Quote No.: P190206-CM	Project Name: 8707-001 272 Innisfil Street													☐ Silver 50% Surcharge
Email: Cameron.macdougall@ Cambium-intel.com	P.O. No.:	Additional Info:													☐ Bronze 25% Surcharge
															☒ Standard 5-7 days
															☐ Specific Date: _____

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

[illegible]

SAMPLE SUBMISSION INFORMATION			SHIPPING INFORMATION		REPORTING / INVOICING	SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)	
	Sampled by:	Submitted by:	Client's Courier ☐	Invoice ☒	Report by Fax ☐	Received By (print): <i>S. Teal</i>	Signature: <i>[Signature]</i>
Print:	<i>Chris Malliaros</i>	<i>Chris Malliaros</i>	Caduceon's Courier ☐		Report by Email ☒	Date Received (yy-mm-dd): <i>19/07/30</i>	Time Received: <i>11:53</i>
Sign:	<i>C. Malliaros</i>	<i>C. Malliaros</i>	Drop Off ☒	# of Pieces	Invoice by Email ☒	Laboratory Prepared Bottles: ☒ Yes ☐ No	
	<i>19-07-29</i>	<i>19-07-30</i>	Caduceon (Pick-up) ☐	<i>1</i>	Invoice by Mail ☐	Sample Temperature °C: <i>12.6</i>	Labeled by: <i>ES</i>
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:					

Comments:	* Dissolved metals sample filtered - please run Reg 153 metals including hydride-forming. Second metals sample provided UNFILTERED for total metals per attached quote (Hg sample not filtered)	Page 1 of 1
		70053



Appendix F

Long Term Monitoring Data



Environmental

Geotechnical

Building Sciences

Construction
Monitoring

Telephone

(866) 217.7900
(705) 742.7900

Facsimile

(705) 742.7907

Website

cambium-inc.com

Office Address

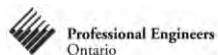
135 Bayfield Street,
Suite 102,
Barrie, ON, L4M 3B3

Locations

Barrie
Peterborough
Kingston
Oshawa

Laboratory

Peterborough



July 28, 2020

20667340 Ontario Inc.
Typhon Group Ltd.
#110 5409 Eglinton Avenue West
Etobicoke, Ontario, M9C 5Kc

Attn: Craig Mull

Re: Groundwater Monitoring Investigation, 272 Innisfil Street – Barrie, Ontario
Cambium Reference Number: 8707-001

Dear Mr. Mull,

Cambium Inc. (Cambium) was retained by Typhon Group Ltd. (Client) c/o Innovative Planning Solutions to complete a groundwater monitoring program at 272 Innisfil St. Barrie, ON. Regular water level measurements were made between July 2019 and June 2020.

Following discussions with the Client, two (2) boreholes equipped with monitoring wells, identified as BH101-19 and BH102-19 were advanced in the proposed 15-storey residential building and commercial space area. The monitoring wells were installed on July 5 and 8, 2019 by Walker Drilling Ltd. under the supervision of a Cambium Geotechnical Analyst. The monitoring well locations are provided in Figure 1, with the relevant information summarized in Table 1.

Table 1 Monitoring Well Observations

Monitoring Well	Top of Standpipe Elevation (masl)	Ground Elevation (masl)	Well Depth (mbgs)	Bottom of Well Elevation (masl)	Screen Height (m)
BH101-19	228.87	228.98	8.75	220.23	3.0
BH102-19	229.80	229.87	8.89	220.98	3.0

As per the LSRCA requirements, Cambium has recorded the static water levels in the monitoring wells on a monthly basis over the duration of a year. In addition to the two (2) monitoring wells installed in 2019 (BH101-19 through BH102-19), four (4) existing monitoring wells (MW101 through MW104) were also measured during the monitoring program.

The following letter report includes a summary of the measured groundwater levels at the monitoring well locations.

GROUNDWATER OBSERVATIONS

Cambium visited the Site monthly between July 23, 2019 and June 17, 2020 to measure the groundwater levels within monitoring wells. The monitoring well measurements are provided within Appended Table 1 (metres above sea level (masl)) and Appended Table 2 (metres below ground surface (mbgs)).



Environmental

Geotechnical

Building Sciences

Construction
Monitoring

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Suite 102,
Barrie, ON, L4M 3B3

Locations

Barrie
Peterborough
Kingston
Oshawa

Laboratory

Peterborough

July 28, 2020

Based on the monitoring well observations to date, the groundwater levels were found to vary from 2.85 mbgs to 4.93 mbgs, with elevations between 224.51 masl to 226.29 masl.

It should be noted that soil moisture and groundwater levels at the Site may fluctuate seasonally and in response to seasonal conditions and climatic events.

CLOSING

We trust that the information contained in this letter meets your current requirements. If you have questions or comments regarding, please do not hesitate to contact the undersigned at (705)719-0700 extension 405.

Best regards,

Rob Gethin, P.Eng.
Senior Project Manager

APPENDED: Figure 1. Site Plan

Appended Table 1 – Groundwater Elevations Measured During Monitoring Period

Appended Table 2 – Groundwater Depths Measured During Monitoring Period



Appended Table 1 - Groundwater Elevations Measured During Monitoring Period (masl)

Date	BH101-19	BH102-19	MW101	MW102	MW103	MW104
July 23/19	225.62	225.92	-	-	-	-
July 29/19	-	-	225.37	225.66	225.92	225.85
Aug 14/19	225.51	225.83	225.28	225.64	225.84	225.75
Sept 17/19	225.41	224.95	225.21	225.52	-	225.63
Oct 25/19	225.42	225.90	225.22	224.51	225.71	225.61
Nov 19/19	225.55	225.84	-	-	225.83	225.74
Dec 12/19	225.57	-	-	224.99	-	225.75
Jan 10/20	225.64	225.94	-	224.95	225.85	-
Feb 24/20	-	225.98	-	225.07	-	225.78
Mar 12/20	-	-	-	224.98	-	226.03
Apr 15/20	225.97	226.28	225.75	226.11	226.29	226.20
May 8/20	225.95	226.11	225.68	225.55	225.98	225.84
Jun 17/20	225.85	225.99	225.66	225.53	225.87	225.74

Note

Wells with no measurements from September to March is due car parked over the well at time of measurement, snow/ice over monitoring well, etc.

Appended Table 2 - Groundwater Depths Measured During Monitoring Period (mbgs)

Date	BH101-19	BH102-19	MW101	MW102	MW103	MW104
July 23/19	3.36	3.96	-	-	-	-
July 29/19	-	-	3.23	3.39	4.13	3.98
Aug 14/19	3.47	4.05	3.32	3.41	4.21	4.08
Sept 17/19	3.57	4.93	3.39	3.53	-	4.20
Oct 25/19	3.56	3.98	3.38	4.54	4.34	4.22
Nov 19/19	3.43	4.04	-	-	4.22	4.09
Dec 12/19	3.41	-	-	4.06	-	4.08
Jan 10/20	3.34	3.94	-	4.10	4.20	-
Feb 24/20	-	3.90	-	3.98	-	4.05
Mar 12/20	-	-	-	4.07	-	3.80
Apr 15/20	3.01	3.60	2.85	2.94	3.76	3.63
May 8/20	3.03	3.77	2.92	3.50	4.07	3.99
Jun 17/20	3.13	3.89	2.94	3.52	4.18	4.09

Note

Wells with no measurements from September to March is due car parked over the well at time of measurement, snow/ice over monitoring well, etc.



Appendix G

Detailed Water Balance Analysis

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID
STATION_N PROVINCE LATITUDE LONGITUDE ELEVATION CLIMATE_ID WMO_ID TC_ID
BARRIE WP ON 44°22'33.0 79°41'23.0 221.0 m 6110557

Legend
A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)
B = At least 25 years
C = At least 20 years
D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Temperature														
Daily Avera	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	6.9	C
Standard D	3.4	2.6	2.2	1.6	1.9	1.4	1.3	1.5	1.4	1.2	1.6	3	1.4	C
Daily Maxim	-2.9	-1.5	3.2	11	18.1	23.6	26.3	25.1	20.7	13.5	6.5	0.4	12	C
Daily Minin	-12.4	-11.7	-7.4	0.2	6.5	12.3	15.3	14.3	10	3.9	-1	-7.3	1.9	C
Extreme M	14	14	24	30.5	35	35	36	36.5	34.5	30	21.5	19.5		
Date (yyyy/ 1995/14	1984/23	1998/30	2002/16	2006/30	1994/17	1988/06	2006/01	2002/09	2005/05	1978/05	1982/03			
Extreme M	-35	-33	-30.5	-15	-4	1	6	0	-1.5	-6.5	-19.5	-33		
Date (yyyy/ 1981/04	1979/18	1984/08	2003/07	2006/07	1980/09	1984/08	2004/22	1993/30	1988/31	1989/29	2004/20			
Precipitation														
Rainfall (m	16.6	16	29.2	56.6	82.3	84.8	77.2	89.9	94	75.2	66	22.2	709.9	C
Snowfall (c	65.9	45.9	29	5.7	0.1	0	0	0	0	2.3	22.8	51.4	223	C
Precipitatic	82.5	61.8	58.1	62.2	82.4	84.8	77.2	89.9	94	77.5	88.9	73.6	932.9	C
Average Sn	16	17	8	1	0	0	0	0	0	0	2	9	4	D
Median Sn	17	17	8	0	0	0	0	0	0	0	1	8	4	D
Snow Dept	17	15	1	0	0	0	0	0	0	0	4	11	4	C
Extreme D	27	35	43	40	54.4	96	75	79	80	48.8	50	28.6		
Date (yyyy/ 1998/05	1997/21	1990/11	1995/21	2004/23	1995/02	1980/20	1995/31	1986/11	1995/05	1999/02	1979/24			
Extreme D	65	32.4	22	17	2	0	0	0	0	12	27	44		
Date (yyyy/ 1978/09	1984/29	1984/10	1979/04	1989/07	1978/01	1978/01	1978/01	1977/01	1997/26	2000/21	1995/10			
Extreme D	65	35	43	40	54.4	96	75	79	80	48.8	52	44		
Date (yyyy/ 1978/09	1997/21	1990/11	1995/21	2004/23	1995/02	1980/20	1995/31	1986/11	1995/05	1999/02	1995/10			
Extreme Sn	57	59	50	21	0	0	0	0	0	8	29	54		
Date (yyyy/ 1981/07	2001/09	2003/05	1987/01	1981/01	1981/01	1981/01	1981/01	1981/01	1997/27	1995/28	1995/11			
Days with Maximum Temperature														
<= 0 °C	21	16.6	10	0.92	0	0	0	0	0	0	3.5	14.6	66.6	C
> 0 °C	10	11.6	21	29.1	31	30	31	31	30	31	26.5	16.4	298.6	C
> 10 °C	0.36	0.48	3.8	14.9	28.2	29.9	31	31	29.5	21.8	6.4	1	198.2	C
> 20 °C	0	0	0.54	3.1	10.6	22.6	29.1	27.3	15.6	3.6	0.08	0	112.5	C
> 30 °C	0	0	0	0.04	0.4	2.5	4.4	2.4	0.63	0	0	0	10.4	C
> 35 °C	0	0	0	0	0	0	0.04	0.04	0	0	0	0	0.08	C
Days with Minimum Temperature														
> 0 °C	0.84	1	2.9	13.9	29	30	31	31	29.8	24.8	10.6	3	207.8	C
<= 2 °C	30.9	28.1	30.2	21.7	5.2	0.12	0	0.09	0.96	12.3	23.7	29.9	183	C
<= 0 °C	30.2	27.2	28.1	16.1	2	0	0	0.04	0.21	6.3	19.4	28	157.5	C
< -2 °C	27	24.6	22.9	7.1	0.12	0	0	0	0	0.92	10.6	22.6	115.8	C
< -10 °C	17	15.6	9.1	0.52	0	0	0	0	0	0	0.79	9.6	52.6	C
< -20 °C	6	3.9	0.96	0	0	0	0	0	0	0	0	1.3	12.2	C
< -30 °C	0.56	0.13	0.04	0	0	0	0	0	0	0	0	0.04	0.77	C
Days with Rainfall														
>= 0.2 mm	2.8	3	5.4	11.3	12.9	11.4	11.1	11.8	13.3	15.5	11.3	4.6	114.4	C
>= 5 mm	1	1.2	2.2	3.9	5.8	4.4	4.7	5.1	5.4	5.5	4.6	1.9	45.5	C
>= 10 mm	0.64	0.58	0.88	1.6	2.7	2.9	2.5	3.4	3	1.9	2.2	0.46	22.8	C
>= 25 mm	0.04	0.08	0.04	0.27	0.36	0.73	0.62	0.81	0.73	0.15	0.28	0.04	4.2	C
Days With Snowfall														
>= 0.2 cm	12.4	10	6.8	1.5	0.04	0	0	0	0	0.54	4.5	9.6	45.5	C
>= 5 cm	5	3.4	2.2	0.35	0	0	0	0	0	0.19	1.6	3.8	16.5	C
>= 10 cm	1.8	1	0.64	0.12	0	0	0	0	0	0.04	0.46	1.6	5.7	C
>= 25 cm	0.08	0.15	0	0.04	0	0	0	0	0	0	0.08	0.08	0.43	C
Days with Precipitation														
>= 0.2 mm	14.9	12.3	11.6	12.2	12.9	11.4	11.1	11.8	13.3	15.6	15.4	13.8	156.1	C
>= 5 mm	6	4.5	4.3	4.2	5.8	4.4	4.7	5.1	5.4	5.7	6.2	5.8	62	C
>= 10 mm	2.4	1.8	1.6	1.7	2.7	2.9	2.5	3.4	3	2	2.7	2.1	28.9	C
>= 25 mm	0.12	0.23	0.04	0.31	0.36	0.73	0.62	0.81	0.73	0.19	0.44	0.13	4.7	C
Degree Days														
Above 24 °i	0	0	0	0	0.1	2.5	8.3	4.2	0.4	0	0	0	15.5	C
Above 18 °i	0	0	0	0.8	8	45.5	95.8	71.4	19.6	1	0	0	242	C
Above 15 °i	0	0	0	3.4	25.6	103.1	180.5	149.2	56.1	5.1	0	0	523	C
Above 10 °i	0	0	1.5	16.8	97.6	239.8	334.6	301.4	165.9	36.1	2.2	0.3	1196.3	C
Above 5 °C	0.4	0.5	10.1	66.1	227.7	389.2	489.6	456.3	310.6	126.9	26.1	3.9	2107.4	C
Above 0 °C	7.7	10.1	44.4	176.1	381.7	539.2	644.6	611.3	460.5	272.9	101.1	25.4	3274.9	C
Below 0 °C	245.7	194.9	110	7.9	0	0	0	0	0	0	21.7	132.5	712.8	C
Below 5 °C	393.4	326.4	230.8	47.9	1.1	0	0	0	0.1	9.1	96.6	266	1371.3	C
Below 10 °i	548	466.9	377.1	148.6	25.9	0.6	0	0.1	5.4	73.2	222.8	417.4	2286.2	C
Below 15 °i	703	608	530.7	285.3	108.9	14	0.9	2.8	45.6	197.2	370.6	572.1	3439.1	C
Below 18 °i	796	692.6	623.7	372.6	184.3	46.3	9.1	18	99	286.2	460.6	665.1	4253.7	C

1981 to 2010 Canadian Climate Normals station data (Frost-Free)

Frost-Free: Code														
Average Da	07-May	D												
Average Da	09-Oct	D												
Average Le 153 Days	D													
Probability	10%	25%	33%	50%	66%	75%	90%							
Date	19-May	16-May	12-May	05-May	03-May	30-Apr	27-Apr							
Probability	10%	25%	33%	50%	66%	75%	90%							
Date	20-Sep	02-Oct	07-Oct	10-Oct	14-Oct	18-Oct	23-Oct							
Probability	10%	25%	33%	50%	66%	75%	90%							
Days	126	147	154	156	159	161	169							

Barrie

THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL													
Location	Barrie, Ontario												
Latitude	44.4												
Declination (deg)	-21.30	-13.30	-2.00	9.80	18.90	23.30	21.30	13.70	3.00	-9.00	-18.60	-23.30	
Declination (rad)	-0.37	-0.23	-0.03	0.17	0.33	0.41	0.37	0.24	0.05	-0.16	-0.32	-0.41	
DayLength (hr)*	9.02	10.22	11.74	13.29	14.60	15.31	14.98	13.83	12.39	10.81	9.44	8.69	
													Total
Precipitation (mm)	82.5	61.8	58.1	62.2	82.4	84.8	77.2	89.9	94	77.5	88.9	73.6	933
Temperature (°C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	-
Potential Evapotranspiration (mm)	0	0	0	40.1	67.7	99.9	116	100	69.1	39.9	23.5	0	557
Surplus	376	mm/yr											
PET Calc													
IF(T>0,924*DayLength*0.611*EXP(17.3*T/(T+237.3))/(T+273.2),0)													



Pre-Development Water Balance

Catchment Designation	Impervious surfaces	Total
Area (m ²)	7,027	21,728
Pervious Area (m ²)	0	
Impervious Area (m ²)	7,027	
Infiltration Factors		
Topography	0.00	
Soil	0.00	
Land Cover	0.00	
Infiltration Factor	0.00	
Run-Off Coefficient	1.00	
Inputs		
Precipitation (mm/year)	933	
Outputs (per Unit Area)		
Evapotranspiration (mm/year)	0	
Evaporation (mm/year)(assumed to be 10% of Precipitation)	93	
Precipitation Surplus (mm/year)	840	
Infiltration (mm/year)	0	
Rooftop Infiltration (mm/year)	0	
Total Infiltration (mm/year)	0	
Runoff Pervious Area (mm/year)	0	
Runoff Impervious Areas (mm/year)	840	
Total Outputs (mm/year)	933	
Difference (Inputs-Outputs)	0	
Inputs (Volumes)		
Precipitation (m ³ /year)	6,556	
Total Inputs (m ³ /year)	6,556	6556
Outputs (Volumes)		
Evapotranspiration (m ³ /year)	0	0
Evaporation (m ³ /year)	656	656
Precipitation Surplus (m ³ /year)	5,901	5901
Infiltration (m ³ /year)	0	0
Rooftop Infiltration (m ³ /year)	0	0
Total Infiltration (m³/year)	0	0
Runoff Pervious Area (m ³ /year)	0	0
Runoff Impervious Areas (m ³ /year)	5,901	5901
<i>Runoff To Storm Sewer (m³/year)</i>	<i>0</i>	<i>0</i>
Total Runoff (m³/year)	5,901	5901
Total Outputs (m ³ /year)	6,556	6556
Difference (Inputs-Outputs)	0	
Total Infiltration		
	0	
Total Runoff		
	5901	



Post-Development Water Balance

Catchment Designation	Structure	Pavement	Landscaped Area	Total
Area (m ²)	5,048	949	1,030	7,027
Pervious Area (m ²)	0	0	1,030	1,979
Impervious Area (m ²)	5,048	949	0	
Infiltration Factors				
Topography	0.00	0.00	0.30	
Soil	0.00	0.00	0.30	
Land Cover	0.00	0.00	0.10	
Infiltration Factor	0.00	0.00	0.70	
Run-Off Coefficient	1.00	1.00	0.30	
Inputs				
Precipitation (mm/year)	933	933	933	
Outputs (per Unit Area)				
Evapotranspiration (mm/year)	0	0	557	
Evaporation (mm/year)(assumed to be 10% of Precipitation if evapotranspiration does not occur)	93	93	0	
Precipitation Surplus (mm/year)	840	840	376	
Infiltration (mm/year)	0	0	263	
Rooftop Infiltration (mm/year)	0	0	0	
Total Infiltration (mm/year)	0	0	263	
Runoff Pervious Area (mm/year)	0	0	113	
Runoff Impervious Areas (mm/year)	840	840	0	
Total Outputs (mm/year)	933	933	933	
Difference (Inputs-Outputs)	0	0	0	
Inputs (Volumes)				
Precipitation (m ³ /year)	4,710	885	961	
Total Inputs (m ³ /year)	4,710	885	961	6556
Outputs (Volumes)				
Evapotranspiration (m ³ /year)	0	0	574	574
Evaporation (m ³ /year)	471	89	0	560
Precipitation Surplus (m ³ /year)	4,239	797	387	5423
Infiltration (m ³ /year)	0	0	271	271
Rooftop Infiltration (m ³ /year)	0	0	0	0
Total Infiltration (m³/year)	0	0	271	271
Runoff Pervious Area (m ³ /year)	0	0	116	116
Runoff Impervious Areas (m ³ /year)	4,239	797	0	5036
Runoff To Storm Sewer (m ³ /year)	0	0	0	0
Total Runoff (m³/year)	4,239	797	116	5152
Total Outputs (m ³ /year)	4,710	885	961	6556
Difference (Inputs-Outputs)	0	0	0	
Total Infiltration	271			
Total Runoff	5152			