Hydrogeological Assessment - 220 Bradford Street, Barrie, Ontario

2020-02-05

Prepared for:
Chayell Hotels Ltd.

CAMBIUM INC.
866.217.7900
cambium-inc.com

Peterborough | Barrie | Oshawa | Kingston

Executive Summary

Chayell Hotels Ltd. retained Cambium Inc. to complete a hydrogeological assessment at 220 Bradford Street in Barrie, Ontario. The client intends to redevelop the Site as a condominium structure with residential units above four levels of parking. All levels will be developed above ground. The hydrogeological assessment yielded the following conclusions:

- The overburden consisted of sand. Groundwater was encountered within 1 mbgs and 4 mbgs. The direction of groundwater flow in the shallow overburden aquifer was eastward, with a minor component to the west.
- The hydraulic conductivity of the sand was typical of those reported in literature.
- Shallow surficial infiltration rates ranged between 141 mm/hr and 182 mm/hr, and were considered typical of sand sediments. A safety correction factor was not incorporated into the infiltration rates. The infiltration rates outlined herein should be used to screen for applicable Low Impact Development features and not for detailed design. Additional infiltration testing may be required at a later date for detailed design of any Low Impact Development features.
- Due to the shallow groundwater level in some areas of the Site and the relatively coarse grained, highly permeable soil, potential dewatering rates could be in excess of 50 m^3/day if the construction excavation is extended a significant depth into the water table. Dewatering rates should be monitored to determine if water taking permitting (i.e., registration on the Environmental Activity and Sector Registry or procurement of a Permit To Take Water) is required. Dewatering and discharge plans should be prepared, as required, which outline potential influences and mitigation measures for dewatering activities. The fate and treatment of discharge water should also be discussed, as required.
- Groundwater quality reported some exceedances of the City of Barrie Sewer Use Bylaw. If groundwater discharge to sewers occurs, treatment of discharge water for total suspended solids, trichloroethylene, and copper will be required. A sample of the discharge water, after treatment, should be collected and analysed to determine treatment efficacy. The treatment

and discharge plan (if required) should be discussed with the City of Barrie and the Lake Simcoe Region Conservation Authority.

- Comparisons of the pre- and post-development water balances indicate that there will be an infiltration deficit upon development of the Site. If runoff generated from the balconies is returned to the subsurface via Low Impact Development features then the pre-development infiltration rate can be maintained (at least). The post-development runoff rate was anticipated to reduce by 17%. A large portion of the runoff deficit is due to the loss of Site area that will be conveyed to the City of Barrie for the widening of Bradford Street. The runoff reduction is not anticipated to influence downstream surface water receivers.

Respectfully submitted,

Cambium Inc.

Cameron MacDougall, P.Geo.
Project Coordinator

CJM

P:\9300 to 9399\9326-002 Chayell Hotels Ltd - Geotech & Hydro-G - 220 Bradford Street, Barrie\Deliverables\REPORT - Hydro G\Final\2020-02-03 Hydrogeological Assessment, 220 Bradford St .docx

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 Introduction

Chayell Hotels Ltd. (Client) retained Cambium Inc. (Cambium) to conduct a hydrogeological assessment of the property at 220 Bradford Street in Barrie, Ontario (the Site). The client intends to redevelop the Site as a condominium structure with residential units above four levels of parking. All levels will be developed above ground.

The hydrogeological assessment was required to characterize the hydrogeological setting of the Site and assess impact (if any) to sensitive receptors upon development. A Phase Two environmental site assessment (Cambium, 2019a) was previously completed at the Site. A geotechnical assessment (Cambium, 2019b) was completed concurrently with the hydrogeological assessment.

This report presents the methodology and findings of the hydrogeological investigation and addresses requirements and constraints for the design and construction of the proposed structure and facilities.

1.1 Site Description

The Site is 3,555 m² and irregularly shaped. The property boundaries extend between and behind properties on Bradford Street and Sanford Street. The southern and eastern portions of the Site are relatively flat and the northern portion of the Site slopes upward at a slight grade. A concrete pad exists in the southern and eastern area of the Site. The concrete pad was used historically as a parking area and was where a structure (now demolished) was located. Ground surface elevations ranged from approximately 222 m above sea level (masl) to 225 masl. Surrounding land use north, south and west of the Site is a mix of commercial and residential development. Land use east of the Site is industrial. A Site plan is included on Figure 1. The proposed development includes a 14 storey condominium building. There will be four levels of parking, all of which will be above ground. The proposed development must account for widening of Bradford St. The lands included in the widening will be conveyed to the City of Barrie. The post-development area of the Site will be reduced to 3,370 m². A draft of the proposed development plan is provided in Appendix A.

2.0 Methodology

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

2.1 Drill Program

Cambium completed a geotechnical investigation at the Site from October 16 to 21, 2019. A total of four boreholes, designated as BH301-19 through BH304-19, were advanced into the subsurface at predetermined locations throughout the Site. Boreholes BH301-19 and BH304-19 were terminated at depth of 9.6 m below ground surface (bgs). Boreholes BH302-19 and BH303-19 were terminated at a depth of 30.9 mbgs. Borehole locations were mapped using a handheld GPS unit. Ground surface elevation at the boreholes was surveyed relative to a temporary benchmark (TBM). The TBM included existing boreholes BH207 (222.09 masl) and BH201 (220.848 masl) for vertical reference. The geotechnical borehole locations are shown on Figure 2.

Drilling and sampling was completed using a D-52 truck-mounted drilling rig operated by Walker Drilling. The boreholes were advanced to the sampling depths by means of continuous flight, hollow-stem augers. Given the encountered soil conditions, mud rotary techniques were utilised to stabilise the boreholes.

Soil samples were collected at approximately 0.75 m intervals in the upper 3.0 m, 1.5 m intervals between 3.0 mbgs and 16.0 mbgs and 3.0 m intervals below 16.0 mbgs. 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.

Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a 50 mm outside diameter (O.D.) 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.

Open boreholes were checked for groundwater and general stability prior to backfilling. Borehole BH301-19 was instrumented with a 50 mm diameter monitoring well that extended to a depth of 5 mbgs. All other boreholes were backfilled and sealed consistent with R.R.O. 1990 Regulation 903, and the property was reinstated to pre-existing conditions.

Pertinent soil and groundwater information obtained from monitoring wells BH201 to BH208 installed as part of the environmental site assessment was used to characterize the hydrogeological conditions at the Site. Well locations are shown on Figure 1. With the exception of BH301-19, top of casing elevations for the monitoring wells referenced herein were surveyed with a Hyper II Topcon Survey Unit.

Borehole logs are provided in Appendix B. Site soil and groundwater conditions are described and hydrogeological recommendations are discussed in the following sections of this report.

2.2 Physical Laboratory Testing

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

2.3 Hydrogeological Field Tasks

2.3.1 Single Well Hydraulic (Slug) Tests

On October 2, 2019, Cambium staff visited the Site to complete Single Well Hydraulic Tests (SWHTs) on three monitoring wells: BH202, BH204 and BH207.

Hydraulic testing or slug tests involved inducing an instantaneous change in groundwater head (level) in the well and monitoring the water level response as it recovered to static conditions. Water level recovery was monitored using an automated water level logging device (pressure transducer) which were validated with manual measurements. All equipment used in the wells was decontaminated prior to inserting into the wells.

The saturated hydraulic conductivity of water bearing units screened in each well was estimated using AquiferTest Pro™ software, the results of which are attached in Appendix D and discussed in Section 4.1.

2.3.2 Permeameter (Surface Infiltration) Tests

On October 9, 2019, Cambium staff visited the Site to complete infiltration testing of the shallow surficial soils. Infiltration testing was completed using a Guelph Permeameter. The results of the infiltration testing are discussed in Section 4.2.

2.3.3 Groundwater Quality

Groundwater quality has been characterized at the Site by sampling programs in 2016, 2017, and 2019. The previous sampling programs included analysis of variety of parameters, including petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals. The previous sampling programs included many of the parameters required for characterization by the City of Barrie Sewer Use-Bylaw 2012-172 for discharge water.

A water sample was collected from BH204 to analyze for those parameters not previously characterized. The sample was 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 certificates of analysis for the groundwater analyses included in this assessment are attached as in Appendix E.

3.0 Geological and Hydrogeological Setting

The Site is 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 & Putnam, 2007; LSRCA, 2015).

According to Map 2556 of the Ontario Geological Survey (Barnett, P.J.,Cowan, W.R., Henry, A.P., 1991), the Site is 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 a thick layer of native sand to silty sand/sandy silt glacial till soils, bedrock was not encountered during this geotechnical investigation.

Laboratory particle size distribution analyses were completed on four 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
BH301-19-SS3	1.5 - 2	Sand some Gravel trace Silt trace Clay	10	83	5	2
BH302-19-SS20	25.9 – 26.4	Silt trace Sand trace Clay	0	7	88	5
BH303-19-SS1	0 – 0.6	Sand some Silt trace Gravel trace Clay	5	77	13	4
BH304-19-SS9	9.5 – 9.6	Silty sand trace Gravel trace Clay	1	67	25	7

3.1.1 Regulated and Vulnerable Areas

As per the Lake Simcoe Region Conservation Authority (LSRCA) mapping, the southern portion of the Site is located within regulated areas.

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

- Wellhead Protection Area (WHPA) B - 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. The construction of the proposed development may require dewatering efforts. If required, 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 6.0. A screening form (Section 59, *Clean Water Act*.) will be requested by the Planning Authority to identify proposed activities that could have policy implications with the local Source Protection Act.

Cambium has completed a draft Section 59 Screening Form, on behalf of the Client. The screening form is included in Appendix F and should be reviewed for accuracy and provided to the City upon request.

3.2 Water Well Records

The Ministry's Water Well Information System (WWIS) was accessed to review water well records mapped as being within 500 m of the Site. Water wells identified within 500 m of the Site boundaries are shown on Figure 3.

There are about 230 water wells records mapped within 500 m of the Site boundaries. Most of the wells are identified as monitoring or dewatering wells and the records provided little 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 coarse-grained sandy sediments; however, lenses of finer grained (silt and clay) sediments were encountered.

Bedrock was encountered in three wells at depths ranging from 81.4 mbgs to 88.4 mbgs. The static water level (1.2 mbgs) was reported for only one well.

The depth of the overburden well installations ranged from 3.5 mbgs to 93.3 mbgs. Most of the reported well installations were shallow (i.e., within 10 mbgs) in an unconfined sandy aquifer. The static water level of the shallow well installations ranged from 0 mbgs to 4 mbgs. The static water levels of the deeper well installations ranged from 0 mbgs to 7.8 mbgs

3.3 Hydrogeological Conditions

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

A shallow, unconfined, aquifer was identified within the overburden. As of October 2019, groundwater levels were ranged from 1 mbgs to 3.5 mbgs. Groundwater elevations ranged from 222 masl to 220 masl. A groundwater flow divide was identified in the area of BH102 and likely extends northward through the Site. The groundwater flow divide directs flow to the east

and west across the Site. Measured groundwater levels and elevations are attached in Table 1.

4.0 Results

4.1 Single Well Hydraulic Testing

On October 2, 2019, SWHTs were completed at wells BH202, BH204 and BH207. The data generated from the SWHTs was processed by AquiferTest Pro ™ software, the results of which are summarized in Embedded Table 2.

The tests provided information from the lowering heads (responding to the slug inserton) and rising heads (responding to the slug removal). The screens of each well only partially penetrated the aquifer, therefore the rising head slug tests were considered more representative of aquifer conditions. The results of the rising head tests are included below.

The hydraulic conductivity of the sand sediments varied from 7.72 x 10^{-5} m/s to 2.83 x 10^{-4} m/s and were considered typical of sand sediments. The hydraulic conductivity results were similar to results outlined in literature (Fetter, 2001; Powers, 2007).

Embedded Table 2 Hydraulic Conductivity Results (m/s)

Test #	**BH202** Slug Out	**BH204** Slug Out	**BH207** Slug Out
Slug Test 1	8.65 x 10^{-5}	2.53 x 10^{-4}	1.01 x 10^{-4}
Slug Test 2	7.72 x 10^{-5}	2.67 x 10^{-4}	1.00 x 10^{-4}
Slug Test 3	8.46 x 10^{-5}	2.82 x 10^{-4}	1.15 x 10^{-4}
Slug Test 4	8.28 x 10^{-5}	2.83 x 10^{-4}	1.10 x 10^{-4}

4.2 Infiltration Testing

Infiltration testing was completed at three locations across the Site. The average hydraulic conductivity and infiltration rate of the tests are outlined in Embedded Table 3. The results of the infiltration testing corroborate the results of the SWHTs and are typical of infiltration rates for sand. As per the grain size analyses, sand was found in the surficial soils. A safety correction factor has not been incorporated into the infiltration rates in Embedded Table 3. The infiltration rates in Embedded Table 3 should be referenced for LID technology selection, and not for design purposes as the testing was not necessarily completed at the depth

corresponding to the base of the LID facility. Additional infiltration testing may be required for the detailed design of any LID features.

Embedded Table 3 Average Infiltration Testing Results

Test #	IT1	IT2	IT3
Hydraulic Conductivity (m/s)	1.40×10^{-4}	1.88×10^{-4}	6.78×10^{-5}
Infiltration Rate (mm/hr)	170	182	141

4.3 Groundwater Quality

Groundwater quality samples were collected from several on-site wells on February 26, May 26, and October 25, 2017, and August 29, 2019 as part of previous work programs. Several parameters (but not all) outlined in the City of Barrie Sewer Use-By-Law were analyzed as part of the previous work programs.

On October 2, 2019 a groundwater sample was collected from BH204 and analyzed for those parameters outlined in the City of Barrie Sewer Use By-Law that were not included in previous groundwater sampling programs.

The results of the historical groundwater sampling programs and the groundwater sampling program included as part of this assessment are summarized in Table 2 and Table 3 and compared against the criteria in the City of Barrie Sewer Use By-Law. Pesticides were not summarized in either Table 2 or Table 3 since their concentrations were all less than the laboratory reportable detection limit (RDL).

Parameters reported at concentrations in excess of the City of Barrie Sewer Use By-Law are listed below:

- The concentration of total dissolved solids (TDS) reported at BH204 (51,000 mg/L) during the October 2, 2019 sampling event.
- The concentration of trichloroethylene reported at BH1 during four previous sampling events (ranging from 70.3 µg/L to 172 µg/L).
- The concentration of trichloroethylene reported at BH2 during the May 26, 2019 sampling event.

- The concentration of dissolved copper reported at BH2 during the February 26, 2019 sampling event.

If dewatering occurs at the Site and discharge water is directed to sewers, then treatment for the above parameters may be required. A sample of the discharge water should be collected after treatment to confirm treatment efficacy. If required, dewatering and discharge plans should be drafted which outline the fate and treatment of discharge water.

5.0 Dewatering Estimates

The proposed development does not include an underground parking structure or other underground facilities. Details pertaining to the size and depth of excavation required for construction of the structure were not known at the time this document was prepared. Measured groundwater levels range from 0.81 mbgs to 3.91 mbgs.

As a conservative measure it was assumed that the water table would require 1 m of lowering to facilitate construction efforts. An equivalent radius (area of excavation represented by a circular well of equivalent radius) of 35 m was assumed for the construction excavation.

The highest (2.83×10^{-4} m/s) and lowest (7.72×10^{-5} m/s) hydraulic conductivities derived from the SWHTs were included in the dewatering estimates.

To calculate inflow into the excavation, the methods outlined in the *Construction Dewatering and Groundwater Control* (Powers, 2007) were utilized. The estimated groundwater inflow rate (into the construction excavation as described above), ranged from 50 m³/day to 132 m³/day. Dewatering calculations are attached as Appendix G.

The calculations indicate that dewatering rates could be in excess of 50 m³/day if the water table is lowered by 1 m; therefore, if construction dewatering occurs, daily dewatering rates should be monitored. If daily dewatering rates are anticipated to be between 50 m³/day and 400 m³/day the dewatering efforts must be registered on the Environmental Activity and Sector Registry (EASR). If daily dewatering rates are greater than 400 m³/day then a Permit To Take Water (PTTW) will be required. Potential dewatering efforts, if anticipated, should be reviewed with the City of Barrie and the LSRCA.

Dewatering and discharge plans should be prepared, as required, which outline potential influences and mitigation measures for dewatering activities. The fate and treatment of discharge water should also be discussed, as required.

5.1.1 Zone of Influence

Significant construction dewatering efforts are not anticipated during the construction of the proposed development. If significant dewatering efforts are required, the zone of influence should be calculated and influences on sensitive receptors surrounding the Site should be quantified.

There are not likely any surrounding potable water supply wells in proximity of the Site since it was assumed that surrounding residences, commercial and industrial facilities are provided potable water by the City of Barrie.

The southern portion of the Site is located within a regulated area, as outlined by LSRCA mapping. If dewatering efforts are to occur at the Site, the dewatering and discharge plan should be reviewed in consultation with the LSRCA (regardless of whether the discharge rate is greater or less than 50 m^3/day).

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. 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 pre-development area of the Site is 3,555 m². At the time this document was prepared, ground surfaces at the Site consisted of a concrete pad and vegetated areas. The area of the existing concrete pad was estimated to be 2,197 m². The remaining vegetated areas were 1,358 m².

The proposed development must account for road widening. The road widening will include approximately 180 m² of land that will be conveyed to the City of Barrie. It is assumed that these lands will be constructed as impervious surfaces. The post-development area of the Site is 3,370 m². The roof area of the proposed development will be approximately 1,642 m² and balconies will be 271 m². Asphalt and sidewalk areas will be 430 m². Pervious landscaped areas will be 1,027 m². 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 H.

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 (Water Pollution Control Centre) station the average annual precipitation depth was recorded as 933 mm/year. A copy of the long-term climatic normal data is attached in Appendix H.

To determine the amount of evapotranspiration that will occur at the Site, the Thorthwaite method was used, as described in *Physical Hydrology, Second Edition* (S. Lawrence Dingman, 2008). The calculated equivalent depth of evapotranspiration was 557 mm/year. The evapotranspiration calculations are attached as Appendix H. The calculated water surplus of the Site (i.e., the difference between annual precipitation and evapotranspiration) was 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 zero and one and can be estimated based on topography, soils and cover, as per the *Stormwater Management Planning and Design Manual* (MOE, 2003).

The southern portion of the Site is flat, but mostly covered in impervious surfaces. The northern portion of the Site is vegetated but exhibits a hilly slope. 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 4. The estimated infiltration factor of the landscaped and existing vegetated areas was 0.7.

Embedded Table 4 Infiltration Factor

Infiltration Factor Calculations			
	Pre-Development Vegetated Surfaces	Post- Development	
		Landscaped Areas	Impervious Surfaces
Topography	Hilly – 0.1	Assumed to be the same a pre-development conditions	-
Soil	Sandy Soil – 0.4		-
Cover	Vegetated – 0.2		-
Infiltration Factor (I)	**0.7**	**0.7**	**0**

6.3 Pre-Development Water Balance

The results of the pre-development water balance are included in Embedded Table 5. It was assumed that 10% of precipitation falling on impervious surfaces (i.e., asphalt/paved/roof 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 estimated equivalent surplus depth from impervious surfaces was 840 mm/yr. The pre-development water balance conditions result in 357 m³/year of infiltration and 1,998 m³/year of runoff.

Embedded Table 5 Pre-Development Conditions

Portion	Area (m^2)	Surplus (m/yr)	Infiltration Factor (dimensionless)	Groundwater Infiltration (QI) (m^3/yr)	Surface Water Runoff (QR) (m^3/yr)
Vegetated Areas	1,358	0.376	0.7	357	153
Impervious Surfaces	2,197	0.840	0.0	0	1,845
Total	3,555	-	-	357	1,998
				Sum of QI and QR (m^3/year)	2,355

6.4 Post-Development Water Balance

The results of the post-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 estimated equivalent surplus depth from impervious surfaces was 840 mm/yr. The post-development water balance conditions result in 270 m³/year of infiltration and 1,856 m³/year of runoff.

The runoff generated from the land conveyed to the City of Barrie for the road widening was calculated to be 151 m³/year. It was assumed that the runoff from these lands will be managed by the City of Barrie storm sewer infrastructure (and is therefore not included in the post-development water balance).

Embedded Table 6 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)
Landscaped Areas	1,027	0.376	0.7	270	116
Roof Areas	1,642	0.840	0.0	0	1,379
Balconies	271	0.840	0.0	0	228
Paved Surfaces	430	0.376	0.0	0	361
Total	3,370	-	-	270	1,856
				Sum of QI and QR (m^3/year)	2,126

6.5 Water Balance Comparison

The water balances of the pre-development and post-development scenarios are summarized in Embedded Table 7.

Embedded Table 7 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	357	-	1,998	-
Post-Development	270	-24% (-87 m^3/yr)	1,856	-7% (-142 m^3/yr)

Upon development, groundwater infiltration and runoff will decrease by approximately 24% and 7%, respectively. The water balance described above did not incorporate improvements from stormwater management or LID features.

Roof runoff is considered “clean” and can, therefore, be re-infiltrated into the subsurface to compensate for the infiltration deficit. Runoff generated from balconies was calculated to be 228 m^3/year. If roof runoff is captured and re-infiltrated (and assuming an efficiency of 90%), the groundwater recharge rate will increase by 205 m^3/year. The corresponding runoff rate will decrease by this same amount. The influence that re-infiltration of balcony runoff will induce of the post-development water balance is summarized below in Embedded Table 8.

Embedded Table 8 Water Balance Comparison (Including LID)

Scenario	QI (m^3/yr)	QI Difference From Pre-Development Scenario	QR (m^3/yr)	QR Difference From Pre-Development Scenario
Pre-Development	357	-	1,998	-
Post-Development	475	+30% (+118 m^3/yr)	1,651	-17% (-347 m^3/yr)

If all runoff generated from balconies is returned to the subsurface via LID measures, the post-development infiltration rate could increase by 30%, when compared with pre-development

conditions. These results indicate that the pre-development infiltration rate can be maintained (at least) if runoff generated from the balconies is re-infiltrated into the subsurface.

The Site runoff rate was 17% less than pre-development rates. A large portion of the runoff deficit was due to the loss of Site area to account for the widening of Bradford St. A runoff rate reduction of 17% will not likely influence down-stream surface water receivers.

All LID and stormwater management features should be designed by a qualified individual. The document titled “Low Impact Development Stormwater Management Planning and Design Guide” (Credit Valley Conservation, 2010), should be referenced during the design stage of the LID features.

7.0 Conclusions and Recommendations

The Client proposes to re-develop the Site as a condominium tower with an above-ground parking structure. To support the proposed re-development Cambium completed various field investigations which yielded the following conclusions:

- The overburden consists primarily of sand. Groundwater was encountered within 1 mbgs and 4 mbgs. The direction of groundwater flow in the shallow overburden aquifer was eastward, with a minor component to the west.
- The hydraulic conductivity of the sand was of those reported in literature.
- Shallow surficial infiltration rates ranged between 141 mm/hr and 182 mm/hr, and were considered typical of sand sediments. A safety correction factor was not incorporated into the infiltration rates. The infiltration rates outlined herein should be used to screen for applicable LID features and not for detailed design. Additional infiltration testing may be required at a later date for detailed design of any LID features.
- Due to the shallow groundwater level in some areas of the Site and the relatively coarse grained, highly permeable soil, potential dewatering rates could be in excess of 50 m^3/day if the construction excavation is extended a significant depth into the water table. Dewatering rates should be monitored to determine if water taking permitting (i.e., registration on the EASR or procurement of a PTTW) is required. Dewatering and discharge plans should be prepared, as required, which outline potential influences and mitigation measures for dewatering activities. The fate and treatment of discharge water should also be discussed, as required.
- Groundwater quality reported some exceedances of the City of Barrie Sewer Use Bylaw. If groundwater discharge to sewers occurs some treatment of discharge water for Total Suspended Solids, trichloroethylene and copper will be required. A sample of the discharge water, after treatment, should be collected and analysed to determine treatment efficacy. The treatment and discharge plan (if required) should be discussed with the City of Barrie and the LSRCA.

- Comparisons of the pre- and post-development water balances indicate that there will be an infiltration deficit upon development of the Site. If runoff generated from the balconies is returned to the subsurface via LID features then the pre-development infiltration rate can be at least maintained. The post-development runoff rate was anticipated to reduce by 17%. A large portion of the runoff deficit is due to the loss of Site area that will be conveyed to the City of Barrie for the widening of Bradford Street. The runoff reduction is not anticipated to influence downstream surface water receivers.

8.0 References

Barnett, P.J.,Cowan, W.R., Henry, A.P. (1991). *Quaternary geology of Ontario, southern sheet; Ontario.*

Cambium. (2019a). *Phase Two Environmental Site Assessment - 220 Bradford Street, Barrie, Ontario.* Cambium Inc.

Cambium. (2019b). *Preliminary Geotechnical Investigation Report - 220 Bradford Street, Barrie, Ontario.* Cambium Inc.

Chapman, L., & Putnam, D. (2007). *The Physiographic Regions of Southern Ontario; MIscellaneous Release--Data 228.* Ontario Geological Survey.

Credit Valley Conservation. (2010). *Low Impact Development Stormwater Management Planning and Design Guide.*

Fetter, C. (2001). *Applied Hydrogeology.*

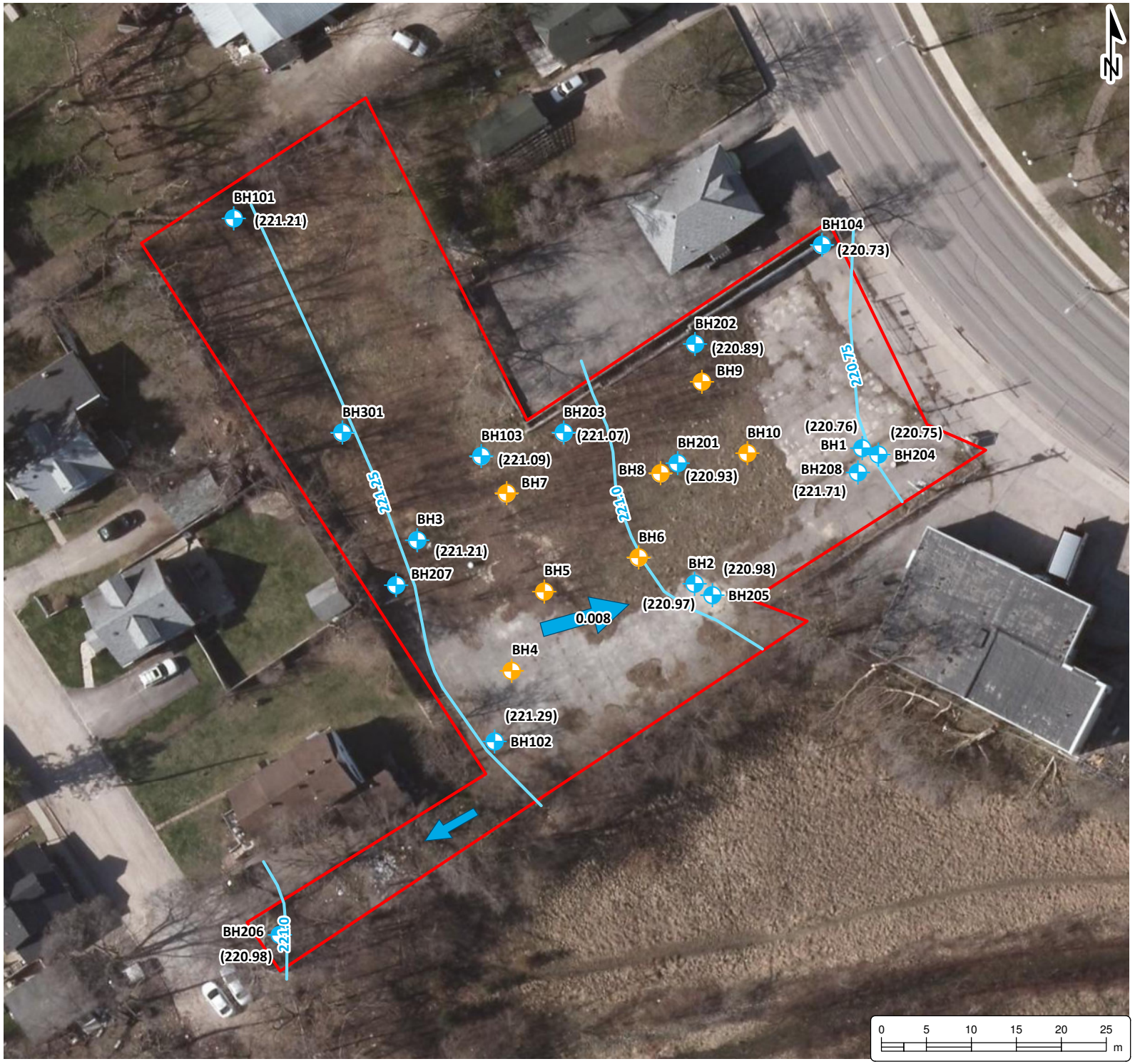
LSRCA. (2015). *Lake Simcoe and Couchiching-Black River SPA.* Lake Simcoe Region Conservation Authority.

MOE. (2003). *Stormwater Management Planning and Design Manual.* Ministry of the Environment.

Powers, J. C. (2007). *Construction Dewatering and Groundwater Control, New Methods and Applications.*

S. Lawrence Dingman. (2008). *Physical Hydrology, Second Edition.*

Figures



HYDROGEOLOGICAL ASSESSMENT

CHAYELL HOTELS LTD.
220 Bradford Street,
Barrie, Ontario

LEGEND

- Borehole
- Borehole with Monitoring Well
- Groundwater Contours (October 3, 2019)
- Site (approximate)
- (220.75) Groundwater Elevation (October 3, 2019)
- Groundwater Flow Direction (October 3, 2019)

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

CAMBIUM
P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE PLAN

Project No.:	9326-002	Date:	November 2019
		Rev.:	
Scale:	1:600	Projection:	NAD 1983 UTM Zone 17N
Created by:	TLC	Checked by:	CM
Figure:	1		

O:\GIS\project_MXDs\9300-9399\9326-002 Chayell Hotels Ltd. - Geotech & Hydro-G - 220 Bradford Street, Barrie\2019-11-20 HydroG FIG 1 - Site Plan.mxd

HYDROGEOLOGICAL ASSESSMENT

CHAYELL HOTELS LTD

220 Bradford Street,
Barrie, Ontario

LEGEND

- Borehole Location
- Infiltration Test Location
- Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- 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.

CAMBIUM
P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

GEOTECHNICAL INVESTIGATION
BOREHOLE PLAN AND
INFILTRATION TESTS

Project No.: 9326-002		Date: November 2019	
		Rev.:	
Scale: 1:750		Projection: NAD 1983 UTM Zone 17N	
Created by: TLC	Checked by: CM	Figure:	2

O:\GIS\project_MXDs\9300-9399\9326-002 Chayell Hotels Ltd. - Geotech & Hydro-G - 220 Bradford Street, Barrie\2019-11-20 HydroG FIG 2 - BH Plan and Infiltration Tests.mxd

HYDROGEOLOGICAL ASSESSMENT

CHAYELL HOTELS LTD

220 Bradford Street,
Barrie, Ontario

LEGEND

- Water Well Record
- 500m Buffer
- Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- 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.

CAMBIUM

P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

WATER WELL RECORDS
WITHIN 500 m OF SITE

Project No.: 9326-002		Date: November 2019 Rev.:	
Scale: 1:6,000		Projection: NAD 1983 UTM Zone 17N	
Created by: TLC	Checked by: CM	Figure:	3

O:\GIS\project_MXDs\9300-9399\9326-002 Chayell Hotels Ltd. - Geotech & Hydro-G - 220 Bradford Street, Barrie\2019-11-20 HydroG FIG 3 - Water Wells within 500m.mxd

Tables

Table 1: Water Levels and Elevations

Installed By	Monitoring Well	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Riser Stickup (m)	Water Level (mbtop)	Water Level (mbgs)	Groundwater Elevation (masl)	Water Level (mbtop)	Water Level (mbgs)	Groundwater Elevation (masl)	Water Level (mbtop)	Water Level (mbgs)	Groundwater Elevation (masl)
					24-Aug-18			27-Aug-18			29-Aug-19		
THEM	BH1	222.52	222.43	-0.10	1.56	1.65	220.87	1.57	1.66	220.86	1.68	1.77	220.75
	BH2	222.83	222.73	-0.09	1.67	1.75	221.06	1.66	1.74	221.07	1.78	1.86	220.95
	BH3	-	-	-	2.62	2.71	-	2.59	2.68	-	-	-	-
Pinchin	BH101	225.12	225.79	0.67	4.46	3.77	221.33	4.45	3.76	221.34	-	-	-
	BH102	222.87	222.85	-0.08	1.50	1.58	221.35	1.48	1.56	221.37	-	-	-
	BH103	224.45	225.06	0.61	3.87	3.25	221.19	3.87	3.25	221.19	-	-	-
	BH104	222.76	222.62	-0.13	1.77	1.89	220.85	1.76	1.88	220.86	-	-	-
Cambium	BH201	223.02	222.88	-0.14	-	-	-	-	-	-	1.95	2.09	220.93
	BH202	223.95	223.82	-0.14	-	-	-	-	-	-	1.92	2.07	221.90
	BH203	224.11	223.97	-0.13	-	-	-	-	-	-	2.90	3.04	221.07
	BH204	222.46	222.26	-0.20	-	-	-	-	-	-	1.52	1.72	220.74
	BH205	222.79	222.71	-0.09	-	-	-	-	-	-	1.76	1.85	220.95
	BH206	222.05	221.91	-0.14	-	-	-	-	-	-	1.03	1.18	220.88
	BH207	224.26	224.16	-0.09	-	-	-	-	-	-	1.93	2.03	222.23
	BH208	222.51	222.44	-0.08	-	-	-	-	-	-	1.82	1.91	220.62
	BH301-19	224.91	226.10	1.19	-	-	-	-	-	-	-	-	-

Notes: The top of pipe elevation for well BH301-19 is approximate. Corresponding groundwater elevations for well BH301-19 are also approximate.

Table 1: Water Levels and Elevations

Installed By	Monitoring Well	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Riser Stickup (m)	Water Level (mbtop)	Water Level (mbgs)	Groundwater Elevation (masl)	Water Level (mbtop)	Water Level (mbgs)	Groundwater Elevation (masl)
					3-Oct-19			24-Oct-19		
THEM	BH1	222.52	222.43	-0.10	1.67	1.76	220.76	-	-	-
	BH2	222.83	222.73	-0.09	1.77	1.85	220.97	-	-	-
	BH3	-	-	-	-	-	-	-	-	-
Pinchin	BH101	225.12	225.79	0.67	4.58	3.91	221.21	-	-	-
	BH102	222.87	222.85	-0.08	1.56	1.64	221.29	-	-	-
	BH103	224.45	225.06	0.61	3.98	3.37	221.09	-	-	-
	BH104	222.76	222.62	-0.13	1.89	2.02	220.73	-	-	-
Cambium	BH201	223.02	222.88	-0.14	1.95	2.09	220.93	-	-	-
	BH202	223.95	223.82	-0.14	2.93	3.07	220.89	-	-	-
	BH203	224.11	223.97	-0.13	2.92	3.05	221.05	-	-	-
	BH204	222.46	222.26	-0.20	1.51	1.71	220.75	-	-	-
	BH205	222.79	222.71	-0.09	1.73	1.82	220.98	-	-	-
	BH206	222.05	221.91	-0.14	0.93	1.07	220.98	-	-	-
	BH207	224.26	224.16	-0.09	2.95	3.05	221.21	-	-	-
	BH208	222.51	222.44	-0.08	0.73	0.81	221.71	-	-	-
	BH301-19	224.91	226.10	1.19	-	-	-	4.63	3.44	221.47

Notes: The top of pipe elevation for well BH301-19 is approximate. Corresponding groundwater elevations for well BH301-19 are also approximate.

Table 1: Water Levels and Elevations

Installed By	Monitoring Well	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Riser Stickup (m)	Water Level (mbtop)	Water Level (mbgs)	Groundwater Elevation (masl)
					19-Nov-19		
THEM	BH1	222.52	222.43	-0.10	1.54	1.64	220.89
	BH2	222.83	222.73	-0.09	-	-	-
	BH3	-	-	-	-	-	-
Pinchin	BH101	225.12	225.79	0.67	4.43	3.76	221.36
	BH102	222.87	222.85	-0.08	1.43	1.51	221.42
	BH103	224.45	225.06	0.61	3.81	3.21	221.25
	BH104	222.76	222.62	-0.13	1.85	1.98	220.77
Cambium	BH201	223.02	222.88	-0.14	1.81	1.95	221.07
	BH202	223.95	223.82	-0.14	2.78	2.92	221.04
	BH203	224.11	223.97	-0.13	2.77	2.90	221.20
	BH204	222.46	222.26	-0.20	1.38	1.58	220.88
	BH205	222.79	222.71	-0.09	1.58	1.67	221.13
	BH206	222.05	221.91	-0.14	0.87	1.01	221.04
	BH207	224.26	224.16	-0.09	2.79	2.89	221.37
	BH208	222.51	222.44	-0.08	1.26	1.34	221.18
	BH301-19	224.91	226.10	1.19	4.46	3.27	221.64

Notes: The top of pipe elevation for well BH301-19 is approximate. Corresponding groundwater elevations for well BH301-19 are also approximate.

CAMBIUM

Table 2 - Summary of Groundwater Quality for VOCs and PHCs

Sample Location	Note	Units	RDL	City of Barrie - Sanitary Sewer Use Bylaw Criteria	City of Barrie Sanitary Sewer Use Bylaw Criteria	BH1				BH2				BH3			BH101
Sample ID						**MW1**	**MW1**	**MW/BH1**	**MWBH1**	**MW2**	**MW2**	**MW/BH2**	**MWBH2**	**MW3**	**MW3**	**MW/BH3**	**MW101**
Sample Date (dd-mmm-yy)						26-Feb-16	26-May-16	25-Oct-17	29-Aug-19	26-Feb-16	26-May-16	25-Oct-17	29-Aug-19	26-Feb-16	26-May-16	25-Oct-17	25-Oct-17
Sampled By						THEM	THEM	Pinchin	Cambium	THEM	THEM	Pinchin	Cambium	THEM	THEM	Pinchin	Pinchin
pH @25°C		pH Units		6.0 - 9.5	6.0 - 9.5	-	-	-	-	-	-	-	-	-	-	-	-
BOD(5 day)		mg/L	3	300	15	-	-	-	-	-	-	-	-	-	-	-	-
COD		mg/L	5	600	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen		mg/L	0.1	100	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids		mg/L	3	350	15	-	-	-	-	-	-	-	-	-	-	-	-
Oil and Grease-Mineral		mg/L	1	15	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil and Grease-Anim/Veg.		mg/L	1	150	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus-Total		mg/L	0.01	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride		mg/L	0.5	1500	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride		mg/L	0.1	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate		mg/L	1	1500	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide		mg/L	0.01	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (Total)		mg/L	0.005	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenolics		mg/L	0.002	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)																	
Dichloromethane		mg/L	0.005	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene		µg/L	0.5	10	-	<0.5	<0.5	<0.50	< 0.5	<0.5	<0.5	<0.20	< 0.5	<0.5	<0.5	<0.10	<0.10
Dichlorobenzene,1,2-		µg/L	0.5	50	-	-	<0.4	<1.0	< 0.5	<0.4	<0.4	<0.40	< 0.5	<0.4	<0.4	<0.20	<0.20
Dichlorobenzene,1,4-		µg/L	0.5	80	-	-	<0.4	<1.0	< 0.5	<0.4	<0.4	<0.40	< 0.5	<0.4	<0.4	<0.20	<0.20
Ethylbenzene		µg/L	0.5	60	-	<0.5	<0.5	<0.50	< 0.5	<0.5	<0.5	<0.20	< 0.5	<0.5	<0.5	<0.10	<0.10
Tetrachloroethane,1,1,2,2-		µg/L	0.5	60	-	<0.5	<0.5	<1.0	< 0.5	<0.5	<0.5	<0.40	< 0.5	<0.5	<0.5	<0.20	<0.20
Tetrachloroethylene		µg/L	0.5	60	-	<0.3	<0.3	<0.50	< 0.5	<0.3	<0.3	<0.20	< 0.5	<0.3	<0.3	<0.10	<0.10
Toluene		µg/L	0.5	20	-	<0.5	<0.5	<1.0	< 0.5	<0.5	<0.5	<0.40	< 0.5	0.6	<0.5	<0.20	0.23
Trichloroethylene		µg/L	0.5	50	-	***132***	***172***	***89***	***70.3***	24.7	***139***	39	39.9	4.7	35.2	4.9	<0.10
Xylene, m,p-	2	µg/L	1	300	-	<0.4	<0.4	<0.50	< 1.0	<0.4	<0.4	<0.20	< 1.0	<0.4	<0.4	<0.10	0.11
Xylene, o-	2	µg/L	0.5	300	-	<0.4	<0.4	<0.50	< 0.5	<0.4	<0.4	<0.20	< 0.5	<0.4	<0.4	<0.10	<0.10
Xylene, m,p,o-		µg/L	1.1	300	-	<0.5	<0.5	<0.50	< 1.1	<0.5	<0.5	<0.20	< 1.1	<0.5	<0.5	<0.10	0.11
Petroleum Hydrocarbons (PHCs)																	
PHC F1 (C6-C10)	3	µg/L	50	< 50	< 50	30	-	-	-	<20	-	-	-	<20	-	-	-
PHC F2 (>C10-C16)	4	µg/L	50	< 50	< 50	<20	-	-	-	<20	-	-	-	<20	-	-	-
PHC F3 (>C16-C34)	5	µg/L	400	< 400	< 400	<50	-	-	-	<50	-	-	-	<50	-	-	-
PHC F4 (>C34-C50)		µg/L	400	< 400	< 400	<50	-	-	-	<50	-	-	-	<50	-	-	-

Notes:

Table 8 Standards - Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Ground Water Condition - All Types of Property Use
N/A - not applicable
NC - The duplicate RPD was not calculated. One or both samples < 5x RDL.
NV - no value
"-" not analyzed
Bold, shaded, and italicized - value exceeds the Table 6 standard
Bold and shaded - value exceeds the Table 6 and Table 8 standard
Bold and underline - RDL exceeds standard
1 - Standard is applicable to 1,3-Dichloropropene, and the individual isomers (cis + trans) should be added for comparison.
2 - Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
3 - Standard is applicable to PHC in the F1 range minus BTEX.
4 - Standard is applicable to PHC F2 minus naphthalene. If naphthalene is not analyzed, the standard is applied to F2.
5 - Standard is applicable to PHC F3 minus PAHs (other than naphthalene). If PAHs have not been measured, the standard is applied to F3

CAMBIUM

Table 2 - Summary of Groundwater Quality for VOCs and PHCs

Sample Location	Note	Units	RDL	City of Barrie - Sanitary Sewer Use Bylaw Criteria	City of Barrie Sanitary Sewer Use Bylaw Criteria	BH102				BH103	BH104	BH201				BH202	BH203	BH204	
Sample ID						**MW102**	**BH102**	**QA/QC 3**		**MW103**	**MW104**	**BH201**	**QA/QC #2**		**BH201**	**BH202**	**BH203**	**BH204**	**BH204**
Sample Date (dd-mmm-yy)						25-Oct-17	29-Aug-19	29-Aug-19	**RPD (%)**	25-Oct-17	25-Oct-17	29-Aug-19	29-Aug-19	**RPD (%)**	12-Sep-19	29-Aug-19	29-Aug-19	29-Aug-19	02-Oct-19
Sampled By						Pinchin	Cambium	Cambium		Pinchin	Pinchin	Cambium	Cambium		Cambium	Cambium	Cambium	Cambium	Cambium
pH @25°C		pH Units		6.0 - 9.5	6.0 - 9.5	-	-	-	-	-									7.71
BOD(5 day)		mg/L	3	300	15	-	-	-	-	-									< 3
COD		mg/L	5	600	-	-	-	-	-	-									81
Total Kjeldahl Nitrogen		mg/L	0.1	100	-	-	-	-	-	-									1.3
Total Suspended Solids		mg/L	3	350	15	-	-	-	-	-									**51000**
Oil and Grease-Mineral		mg/L	1	15	-	-	-	-	-	-									< 1.0
Oil and Grease-Anim/Veg.		mg/L	1	150	-	-	-	-	-	-									< 1.0
Phosphorus-Total		mg/L	0.01	10	-	-	-	-	-	-									5.2
Chloride		mg/L	0.5	1500	-	-	-	-	-	-									360
Fluoride		mg/L	0.1	10	-	-	-	-	-	-									< 0.1
Sulphate		mg/L	1	1500	-	-	-	-	-	-									33
Sulphide		mg/L	0.01	1	-	-	-	-	-	-									< 0.1
Cyanide (Total)		mg/L	0.005	1.2	-	-	-	-	-	-									< 0.005
Phenolics		mg/L	0.002	0.1	-	-	-	-	-	-									<0.002
Volatile Organic Compounds (VOCs)																			
Dichloromethane		mg/L	0.005	0.09	-	-	-	-	-	-									<0.005
Benzene		µg/L	0.5	10	-	1.5	1.9	1.8	NC	<0.10	<0.10	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Dichlorobenzene,1,2-		µg/L	0.5	50	-	<0.20	-	-	-	<0.20	<0.20	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Dichlorobenzene,1,4-		µg/L	0.5	80	-	<0.20	-	-	-	<0.20	<0.20	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Ethylbenzene		µg/L	0.5	60	-	<0.10	< 0.5	< 0.5	NC	0.13	0.22	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Tetrachloroethane,1,1,2,2-		µg/L	0.5	60	-	<0.20	-	-	-	<0.20	<0.20	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Tetrachloroethylene		µg/L	0.5	60	-	<0.10	-	-	-	<0.10	<0.10	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Toluene		µg/L	0.5	20	-	<0.20	< 0.5	< 0.5	NC	0.37	0.63	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Trichloroethylene		µg/L	0.5	50	-	1.5	-	-	-	0.41	36	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	16.4	-
Xylene, m,p-	2	µg/L	1	300	-	<0.10	< 1.0	< 1.0	NC	0.21	0.37	< 1.0	< 1.0	NC	-	< 1.0	< 1.0	< 1.0	-
Xylene, o-	2	µg/L	0.5	300	-	<0.10	< 0.5	< 0.5	NC	<0.10	0.11	< 0.5	< 0.5	NC	-	< 0.5	< 0.5	< 0.5	-
Xylene, m,p,o-		µg/L	1.1	300	-	<0.10	< 1.1	< 1.1	NC	0.21	0.48	< 1.1	< 1.1	NC	-	< 1.1	< 1.1	< 1.1	-
Petroleum Hydrocarbons (PHCs)																			
PHC F1 (C6-C10)	3	µg/L	50	< 50	< 50	-	< 50	-	-	-	-	< 50	< 50	NC	-	< 50	-	< 50	-
PHC F2 (>C10-C16)	4	µg/L	50	< 50	< 50	-	< 50	-	-	-	-	< 50	< 50	NC	-	< 50	-	< 50	-
PHC F3 (>C16-C34)	5	µg/L	400	< 400	< 400	-	< 400	-	-	-	-	< 400	< 400	NC	-	< 400	-	< 400	-
PHC F4 (>C34-C50)		µg/L	400	< 400	< 400	-	< 400	-	-	-	-	< 400	< 400	NC	-	< 400	-	< 400	-

Notes:

Table 8 Standards - Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Ground Water Condition -
N/A - not applicable
NC - The duplicate RPD was not calculated. One or both samples < 5x RDL.
NV - no value
"-" not analyzed
Bold, shaded, and italicized - value exceeds the Table 6 standard
Bold and shaded - value exceeds the Table 6 and Table 8 standard
Bold and underline - RDL exceeds standard
1 - Standard is applicable to 1,3-Dichloropropene, and the individual isomers (cis + trans) should be added for comparison.
2 - Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
3 - Standard is applicable to PHC in the F1 range minus BTEX.
4 - Standard is applicable to PHC F2 minus naphthalene. If naphthalene is not analyzed, the standard is applied to F2.
5 - Standard is applicable to PHC F3 minus PAHs (other than naphthalene). If PAHs have not been measured, the standard is app

CAMBIUM

Table 2 - Summary of Groundwater Quality for VOCs and PHCs

Sample Location	Note	Units	RDL	City of Barrie - Sanitary Sewer Use Bylaw Criteria	City of Barrie Sanitary Sewer Use Bylaw Criteria	BH205	BH206	BH207	BH208			
Sample ID						BH205	BH206	BH207	BH208	BH208	QA/QC	RPD (%)
Sample Date (dd-mmm-yy)						29-Aug-19	29-Aug-19	29-Aug-19	29-Aug-19	12-Sep-19	12-Sep-19	
Sampled By						Cambium	Cambium	Cambium	Cambium	Cambium	Cambium	
pH @25°C		pH Units		6.0 - 9.5	6.0 - 9.5	-	-	-	-	-	-	-
BOD(5 day)		mg/L	3	300	15	-	-	-	-	-	-	-
COD		mg/L	5	600	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen		mg/L	0.1	100	-	-	-	-	-	-	-	-
Total Suspended Solids		mg/L	3	350	15	-	-	-	-	-	-	-
Oil and Grease-Mineral		mg/L	1	15	-	-	-	-	-	-	-	-
Oil and Grease-Anim/Veg.		mg/L	1	150	-	-	-	-	-	-	-	-
Phosphorus-Total		mg/L	0.01	10	-	-	-	-	-	-	-	-
Chloride		mg/L	0.5	1500	-	-	-	-	-	-	-	-
Fluoride		mg/L	0.1	10	-	-	-	-	-	-	-	-
Sulphate		mg/L	1	1500	-	-	-	-	-	-	-	-
Sulphide		mg/L	0.01	1	-	-	-	-	-	-	-	-
Cyanide (Total)		mg/L	0.005	1.2	-	-	-	-	-	-	-	-
Phenolics		mg/L	0.002	0.1	-	-	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)												
Dichloromethane		mg/L	0.005	0.09	-	-	-	-	-	-	-	-
Benzene		µg/L	0.5	10	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Dichlorobenzene,1,2-		µg/L	0.5	50	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Dichlorobenzene,1,4-		µg/L	0.5	80	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Ethylbenzene		µg/L	0.5	60	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Tetrachloroethane,1,1,2,2-		µg/L	0.5	60	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Tetrachloroethylene		µg/L	0.5	60	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Toluene		µg/L	0.5	20	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Trichloroethylene		µg/L	0.5	50	-	8.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Xylene, m,p-	2	µg/L	1	300	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NC
Xylene, o-	2	µg/L	0.5	300	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NC
Xylene, m,p,o-		µg/L	1.1	300	-	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	NC
Petroleum Hydrocarbons (PHCs)												
PHC F1 (C6-C10)	3	µg/L	50	< 50	< 50	< 50	-	< 50	< 50	-	-	-
PHC F2 (>C10-C16)	4	µg/L	50	< 50	< 50	< 50	-	< 50	< 50	-	-	-
PHC F3 (>C16-C34)	5	µg/L	400	< 400	< 400	< 400	-	< 400	< 400	-	-	-
PHC F4 (>C34-C50)		µg/L	400	< 400	< 400	< 400	-	< 400	< 400	-	-	-

Notes:

Table 8 Standards - Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Ground Water Condition -
N/A - not applicable
NC - The duplicate RPD was not calculated. One or both samples < 5x RDL.
NV - no value
"-" not analyzed
Bold, shaded, and italicized - value exceeds the Table 6 standard
Bold and shaded - value exceeds the Table 6 and Table 8 standard
Bold and underline - RDL exceeds standard
1 - Standard is applicable to 1,3-Dichloropropene, and the individual isomers (cis + trans) should be added for comparison.
2 - Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
3 - Standard is applicable to PHC in the F1 range minus BTEX.
4 - Standard is applicable to PHC F2 minus naphthalene. If naphthalene is not analyzed, the standard is applied to F2.
5 - Standard is applicable to PHC F3 minus PAHs (other than naphthalene). If PAHs have not been measured, the standard is app

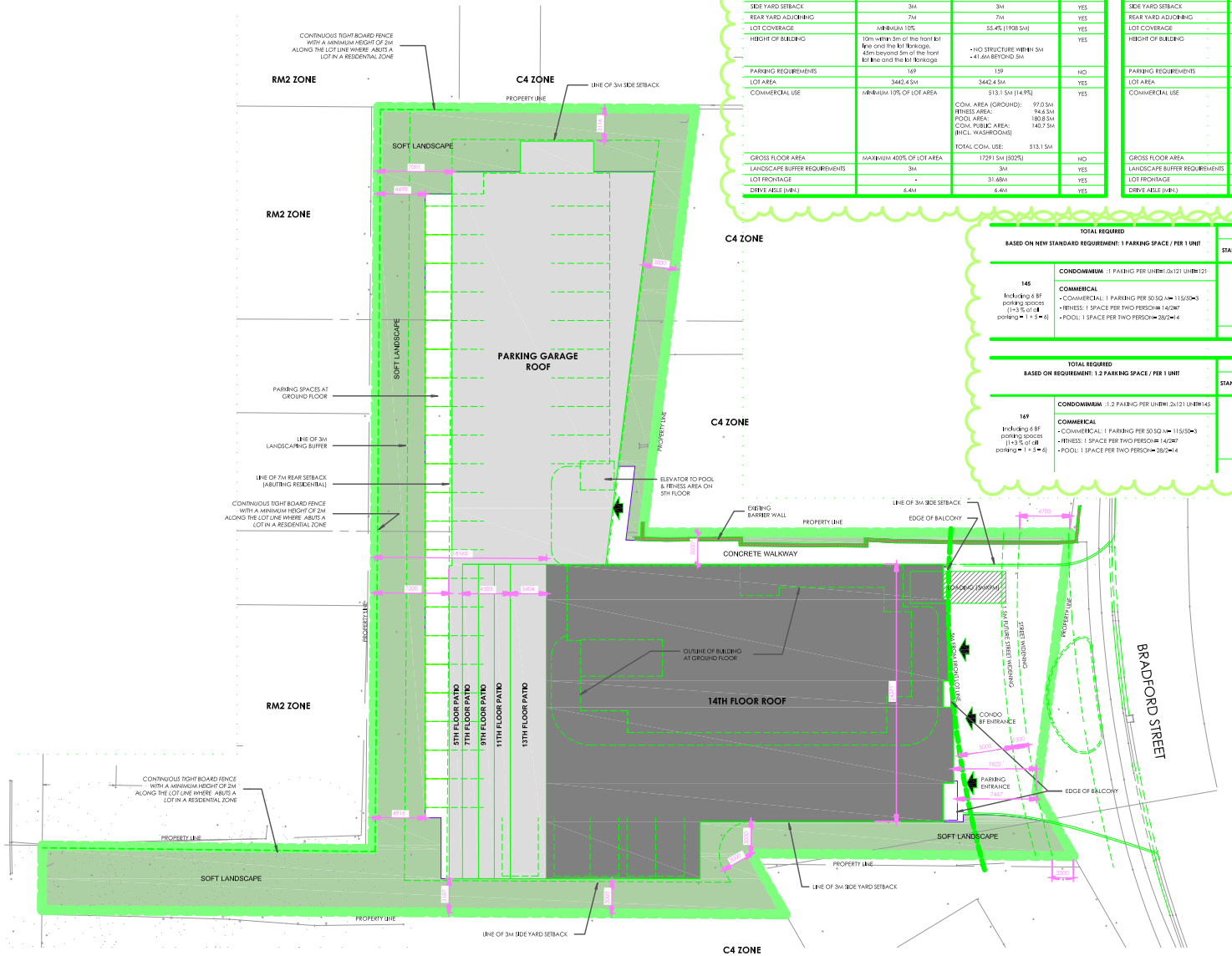
CAMBIUM

Table 3 - Summary of Groundwater Quality for PAHs, PCBs, and Metals

Sample Location	Note	Units	RDL	City of Barrie - Sanitary Sewer Use Bylaw Criteria	City of Barrie Sanitary Sewer Use Bylaw Criteria	MW/BH1		BH2		BH201				BH204			BH204		BH205	BH208
Sample ID						**MW1**	**MWBH1**	**MW2**	**MWBH2**	**BH201**	**QA/QC #2**	**RPD (%)**	**BH201**	**BH204**	**QA/QC #1**	**RPD (%)**	**BH204**	**BH204**	**BH205**	**BH208**
Sample Date (dd-mmm-yy)						26-Feb-16	29-Aug-19	26-Feb-16	29-Aug-19	29-Aug-19	29-Aug-19		12-Sep-19	29-Aug-19	29-Aug-19		02-Oct-19	02-Oct-19	29-Aug-19	29-Aug-19
Sampled By						THEM	Cambium	THEM	Cambium	Cambium	Cambium		Cambium	Cambium	Cambium		Cambium	Cambium	Cambium	Cambium
Polycyclic Aromatic Hydrocarbons (PAHs)																				
Acenaphthene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Acenaphthylene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Anthracene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Benzo(a)anthracene		µg/L	0.05	5	-	0.03	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Benzo(a)pyrene		µg/L	0.01	5	-	<0.05	< 0.01	-	-	-	-	-	< 0.01	< 0.01	< 0.01	NC	-	-	-	-
Benzo(b)fluoranthene	1	µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Benzo(g,h,i)perylene		µg/L	0.05	5	-	<0.05	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Benzo(k)fluoranthene		µg/L	0.05	5	-	<0.05	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Chrysene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Dibenzo(a,h)anthracene		µg/L	0.05	5	-	<0.2	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Fluoranthene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Fluorene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Indeno(1,2,3-cd)pyrene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Methylnaphthalene,1-	2	µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Methylnaphthalene,2-	2	µg/L	0.08	5	-	<0.1	< 0.08	-	-	-	-	-	< 0.08	< 0.08	< 0.08	NC	-	-	-	-
Methylnaphthalene, 2-(1-)	2	µg/L	1	5	-	-	< 1	-	-	-	-	-	< 1	< 1	< 1	NC	-	-	-	-
Naphthalene		µg/L	0.05	5	-	0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Phenanthrene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
Pyrene		µg/L	0.05	5	-	<0.1	< 0.05	-	-	-	-	-	< 0.05	< 0.05	< 0.05	NC	-	-	-	-
PCBs																				
Polychlorinated Biphenyls	3	µg/L	0.05	<0.05	-	-	-	-	-	< 0.05	< 0.05	NC	-	< 0.05	< 0.05	NC	-	-	-	-
Metals																	(Total Metals)	(Dissolved Metals)		
Aluminum (total)		µg/L	10	50000	-	-	-	-	-	-	-	-	-	-	-	-	18900	1910	-	-
Bismuth		µg/L	20	5000	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	-	-
Gold		µg/L	0.7	5000	-	-	-	-	-	-	-	-	-	-	-	-	<0.7	<0.7	-	-
Iron		µg/L	5	50000	-	-	-	-	-	-	-	-	-	-	-	-	36500	3930	-	-
Manganese (Total)		µg/L	1	5000	-	-	-	-	-	-	-	-	-	-	-	-	1970	446	-	-
Platinum		µg/L	0.04	5000	-	-	-	-	-	-	-	-	-	-	-	-	<0.04	<0.04	-	-
Rhodium		µg/L	0.02	5000	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.02	-	-
Tin		µg/L	50	5000	-	-	-	-	-	-	-	-	-	-	-	-	50	50	-	-
Titanium		µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	846	129	-	-
Zirconium		µg/L	3	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3	-	-
Antimony		µg/L	0.1	5000	-	-	-	<0.5	< 0.1	0.2	0.2	NC	-	0.2	-	-	-	-	0.4	< 0.1
Arsenic		µg/L	0.1	1000	-	-	-	3	0.4	0.2	0.2	NC	-	0.3	-	-	-	-	0.2	< 0.1
Barium		µg/L	1	5000	-	-	-	1100	150	62	63	2	-	86	-	-	-	-	90	525
Cadmium		µg/L	0.015	700	1	-	-	0.4	0.022	< 0.015	0.015	NC	-	0.038	-	-	-	-	0.042	< 0.015
Chromium		µg/L	2	2000	80	-	-	2	< 2	< 2	< 2	NC	-	< 2	-	-	-	-	< 2	< 2
Chromium (VI)		µg/L	10	-	-	-	-	<10	< 10	< 10	< 10	NC	-	< 10	-	-	-	-	< 10	< 10
Cobalt		µg/L	0.1	5000	-	-	-	10.4	0.2	0.7	0.7	0	-	0.5	-	-	-	-	0.4	< 0.1
Copper		µg/L	2	2000	10	-	-	**17**	< 2	< 2	< 2	NC	-	< 2	-	-	-	-	< 2	< 2
Lead		µg/L	0.02	700	50	-	-	3	0.1	< 0.02	< 0.02	NC	-	< 0.02	-	-	-	-	< 0.02	< 0.02
Mercury		µg/L	0.02	10	-	-	-	<0.1	< 0.02	< 0.02	< 0.02	NC	-	< 0.02	-	-	-	-	< 0.02	< 0.02
Molybdenum		µg/L	0.1	5000	-	-	-	<5	0.8	4.8	4.7	2	-	2.2	-	-	-	-	4.7	0.5
Nickel		µg/L	0.2	2000	50	-	-	9	1.9	3.7	3.7	0	-	2.8	-	-	-	-	2.1	1.8
Selenium		µg/L	1	1000	-	-	-	3	< 1	< 1	< 1	NC	-	< 1	-	-	-	-	< 1	< 1
Silver		µg/L	0.1	400	-	-	-	<0.1	< 0.1	< 0.1	< 0.1	NC	-	< 0.1	-	-	-	-	< 0.1	< 0.1
Vanadium		µg/L	0.1	5000	-	-	-	12	0.6	0.3	0.3	NC	-	0.3	-	-	-	-	0.6	< 0.1
Zinc		µg/L	5	2000	40	-	-	20	< 5	< 5	< 5	NC	-	< 5	-	-	-	-	< 5	< 5

Notes:
Table 8 Standards - Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Ground Water Condition - All Types of Property Use
N/A - not applicable
NC - The duplicate RPD was not calculated. One or both samples < 5x RDL.
NV - no value
"-" not analyzed
Bold, shaded, and italicized - value exceeds the Table 6 standard
Bold and shaded - value exceeds the Table 6 and Table 8 standard
Bold and underline - RDL exceeds standard
1 - Standard is for benzo(b)fluoranthene; however, the laboratory can not distinguish between benzo(b)fluoranthene and benzo(j)fluoranthene.
2 - Standard is applicable to 1-methylnaphthallene and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
3 - Standard is applicable to total PCBs, and the individual Aroclors should be added for comparison.

Appendix A
Proposed Development Plan



220 Bradford St. Barrie - Zoning requirements (BASED ON NEW STANDARD REQUIREMENT: 1.2 PARKING SPACE / PER 1 UNIT)

	REQUIRED	PROVIDED	COMPLIANCE
ZONING CATEGORY	C2-2(SP-492)(H-124)	CONDOMINIUM	YES
FRONT YARD SETBACK	-	5.0M FROM FUTURE WIDENING	YES
SIDE YARD SETBACK	3M	3M	YES
REAR YARD ADJOINING	7M	7M	YES
LOT COVERAGE	MINIMUM 10%	55.4% (1908 SM)	YES
HEIGHT OF BUILDING	10m within 5m of the front lot line and the lot flankage, 45m beyond 5m of the front lot line and the lot flankage	- NO STRUCTURE WITHIN 5M - 41.6M BEYOND 5M	YES
PARKING REQUIREMENTS	169	159	NO
LOT AREA	3442.4 SM	3442.4 SM	YES
COMMERCIAL USE	MINIMUM 10% OF LOT AREA	513.1 SM (14.9%) COM. AREA (GROUND): 97.0 SM FITNESS AREA: 94.6 SM POOL AREA: 180.8 SM COM. PUBLIC AREA: 140.7 SM (INCL. WASHROOMS) TOTAL COM. USE: 513.1 SM	YES
GROSS FLOOR AREA	MAXIMUM 400% OF LOT AREA	17291 SM (502%)	NO
LANDSCAPE BUFFER REQUIREMENTS	3M	3M	YES
LOT FRONTAGE	-	31.68M	YES
DRIVE AISLE (MIN.)	6.4M	6.4M	YES

220 Bradford St. Barrie - Zoning requirements (BASED ON NEW STANDARD REQUIREMENT: 1 PARKING SPACE / PER 1 UNIT)

	REQUIRED	PROVIDED	COMPLIANCE
ZONING CATEGORY	C2-2(SP-492)(H-124)	CONDOMINIUM	YES
FRONT YARD SETBACK	-	5.0M FROM FUTURE WIDENING	YES
SIDE YARD SETBACK	3M	3M	YES
REAR YARD ADJOINING	7M	7M	YES
LOT COVERAGE	MINIMUM 10%	55.4% (1908 SM)	YES
HEIGHT OF BUILDING	10m within 5m of the front lot line and the lot flankage, 45m beyond 5m of the front lot line and the lot flankage	- NO STRUCTURE WITHIN 5M - 41.6M BEYOND 5M	YES
PARKING REQUIREMENTS	145	159	YES
LOT AREA	3442.4 SM	3442.4 SM	YES
COMMERCIAL USE	MINIMUM 10% OF LOT AREA	513.1 SM (14.9%) COM. AREA (GROUND): 97.0 SM FITNESS AREA: 94.6 SM POOL AREA: 180.8 SM COM. PUBLIC AREA: 140.7 SM (INCL. WASHROOMS) TOTAL COM. USE: 513.1 SM	YES
GROSS FLOOR AREA	MAXIMUM 400% OF LOT AREA	17291 SM (502%)	NO
LANDSCAPE BUFFER REQUIREMENTS	3M	3M	YES
LOT FRONTAGE	-	31.68M	YES
DRIVE AISLE (MIN.)	6.4M	6.4M	YES

TOTAL REQUIRED BASED ON NEW STANDARD REQUIREMENT: 1 PARKING SPACE / PER 1 UNIT		PROVIDED: STANDARD PARKING 2.7M X 5.5M	PARALLEL PARKING 2.7M X 6.7M	ACC PARKING	SUB-TOTAL	COMPLIANCE
145 Including 6 BF parking spaces (1+3 % of all parking = 1 + 5 = 6)	CONDOMINIUM : 1 PARKING PER UNIT=1.0x121 UNITS=121	145	6	5 TYPE A (3.4M X 5.5M + 1.5M ACCESS AISLE) 3 TYPE B (3.1M X 5.5M + 1.5M ACCESS AISLE)	CONDO 135	YES
	COMMERICAL - COMMERCIAL: 1 PARKING PER 50 SQ.M= 115/50=3 - FITNESS: 1 SPACE PER TWO PERSON= 142/2=7 - POOL: 1 SPACE PER TWO PERSON= 28/2=14				COMMERCIAL 24 LOCATED ON GROUND LEVEL	YES
				TOTAL	159	

TOTAL REQUIRED BASED ON REQUIREMENT: 1.2 PARKING SPACE / PER 1 UNIT		PROVIDED: STANDARD PARKING 2.7M X 5.5M	PARALLEL PARKING 2.7M X 6.7M	ACC PARKING 3.4M X 5.5M + 1.5M ACCESS AISLE	SUB-TOTAL	COMPLIANCE
169 Including 6 BF parking spaces (1+3 % of all parking = 1 + 5 = 6)	CONDOMINIUM : 1.2 PARKING PER UNIT=1.2x121 UNITS=145	145	6	5 TYPE A (3.4M X 5.5M + 1.5M ACCESS AISLE) 3 TYPE B (3.1M X 5.5M + 1.5M ACCESS AISLE)	CONDO 135	NO (SHORTAGE OF 10 SPACES)
	COMMERICAL - COMMERCIAL: 1 PARKING PER 50 SQ.M= 115/50=3 - FITNESS: 1 SPACE PER TWO PERSON= 142/2=7 - POOL: 1 SPACE PER TWO PERSON= 28/2=14				COMMERCIAL 24 LOCATED ON GROUND LEVEL	YES
				TOTAL	159	

PARKING SPACES

TYPES	TOTAL
2D GROUND FLOOR	
2500 X 3400 ACC TYPE A	2
2500x2700	33
	35
2D 2ND FLOOR	
2500 X 3100 ACC TYPE B	1
2500 X 3400 ACC TYPE A	1
2500x2700	36
2500x2700 parallel	2
	40
2D 3RD FLOOR	
2500 X 3100 ACC TYPE B	1
2500 X 3400 ACC TYPE A	1
2500x2700	37
2500x2700 parallel	2
	41
2D 4TH FLOOR	
2500 X 3100 ACC TYPE B	1
2500 X 3400 ACC TYPE A	1
2500x2700	39
2500x2700 parallel	2
	43
Grand total: 159	159

ROOM MIX

2D 5TH FLOOR		
ONE BEDROOM	5	
ONE BEDROOM + DEN	0	
TWO BEDROOM	4	
	9	
2D 6TH FLOOR		
ONE BEDROOM	7	
ONE BEDROOM + DEN	2	
TWO BEDROOM	0	
	9	
2D 7TH FLOOR		
ONE BEDROOM	6	
ONE BEDROOM + DEN	2	
THREE BEDROOM	2	
TWO BEDROOM	0	
	10	
2D 8TH FLOOR		
ONE BEDROOM	6	
ONE BEDROOM + DEN	2	
THREE BEDROOM	2	
TWO BEDROOM	0	
	10	
2D 9TH FLOOR		
ONE BEDROOM	6	
ONE BEDROOM + DEN	2	
TWO BEDROOM	0	
	8	
2D 10TH FLOOR		
ONE BEDROOM	6	
ONE BEDROOM + DEN	2	
THREE BEDROOM	2	
TWO BEDROOM	0	
	10	
2D 11TH FLOOR		
ONE BEDROOM	5	
ONE BEDROOM + DEN	1	
THREE BEDROOM	2	
TWO BEDROOM	0	
	8	
2D 12TH FLOOR		
ONE BEDROOM	5	
ONE BEDROOM + DEN	1	
THREE BEDROOM	2	
TWO BEDROOM	0	
	8	
2D 13TH FLOOR		
ONE BEDROOM	6	
ONE BEDROOM + DEN	2	
TWO BEDROOM	0	
	8	
2D 14TH FLOOR		
ONE BEDROOM	6	
ONE BEDROOM + DEN	1	
TWO BEDROOM	4	
	11	
Grand total: 132	132	

FLOOR AREA SUMMARY

LEVEL	Area (sf)	Area (Metric)
1st FLOOR	5223 SF	485 m²
2ND FLOOR	20120 SF	870 m²
3RD FLOOR	20330 SF	891 m²
4TH FLOOR	20337 SF	889 m²
5TH FLOOR	16444 SF	528 m²
6TH FLOOR	12637 SF	1174 m²
7TH FLOOR	12159 SF	1130 m²
8TH FLOOR	12159 SF	1130 m²
9TH FLOOR	11794 SF	1096 m²
10TH FLOOR	11794 SF	1096 m²
11TH FLOOR	11316 SF	1051 m²
12TH FLOOR	11316 SF	1051 m²
13TH FLOOR	10250 SF	950 m²
14TH FLOOR	10250 SF	950 m²
Grand Total	183113 SF	17021 m²

Project North: | True North:

SPA FILE NO. -

REV.	DESCRIPTION	REV. DATE
1	---	---

Drawing Issues/Revisions:

Note:
ALL DIMENSIONS AND INFORMATION SHOWN ON THESE DRAWINGS MUST BE CHECKED AND VERIFIED ON SITE AND ANY DISCREPANCIES REPORTED TO THE ARCHITECT PRIOR TO CONSTRUCTION AND FABRICATION OF ANY COMPONENTS. SHOULD EXISTING CONDITIONS OR SERVICES BE FOUND TO VARY FROM THAT INDICATED ON THE DRAWINGS, THE ARCHITECT MUST BE NOTIFIED IMMEDIATELY.

FEATURES OF CONSTRUCTION NOT FULLY SHOWN ARE ASSUMED TO BE THE SAME CHARACTER AS THOSE NOTED FOR SIMILAR CONDITIONS.

UNLESS SPECIFICALLY NOTED OTHERWISE ON THE DRAWINGS, NO PROVISION HAS BEEN MADE IN THE DESIGN FOR CONDITIONS OCCURRING DURING CONSTRUCTION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE ALL NECESSARY BRACING, SHEETING, SHEET PILING OR OTHER TEMPORARY SUPPORTS, TO SAFEGUARD ALL EXISTING OR ADJACENT STRUCTURES AFFECTED BY THE WORK.

ALL DRAWINGS AND RELATED DOCUMENTS SHALL REMAIN THE PROPERTY AND COPYRIGHT OF MATAJ ARCHITECTS INC.
SEE LATEST REVISED DRAWINGS. DO NOT SCALE DRAWINGS.

Architect's Stamp

MATAJ ARCHITECTS INC.
96 Fiesta Way Street
Downsview, Ontario
M3J 3L8
T 905.761.4444

Project:
220 Bradford st. Condominium
220 Bradford st.- Barrie, Ontario

Sheet Title:
SITE PLAN

Design By:	Drawn By:	Approved By:
Designer	Author	Approver
Scale: As Indicated	Date: Issue Date	Project No.: XXX

Drawing No:
A200 Of:

Drawing Series:

Wellhead Protection Map

Legend

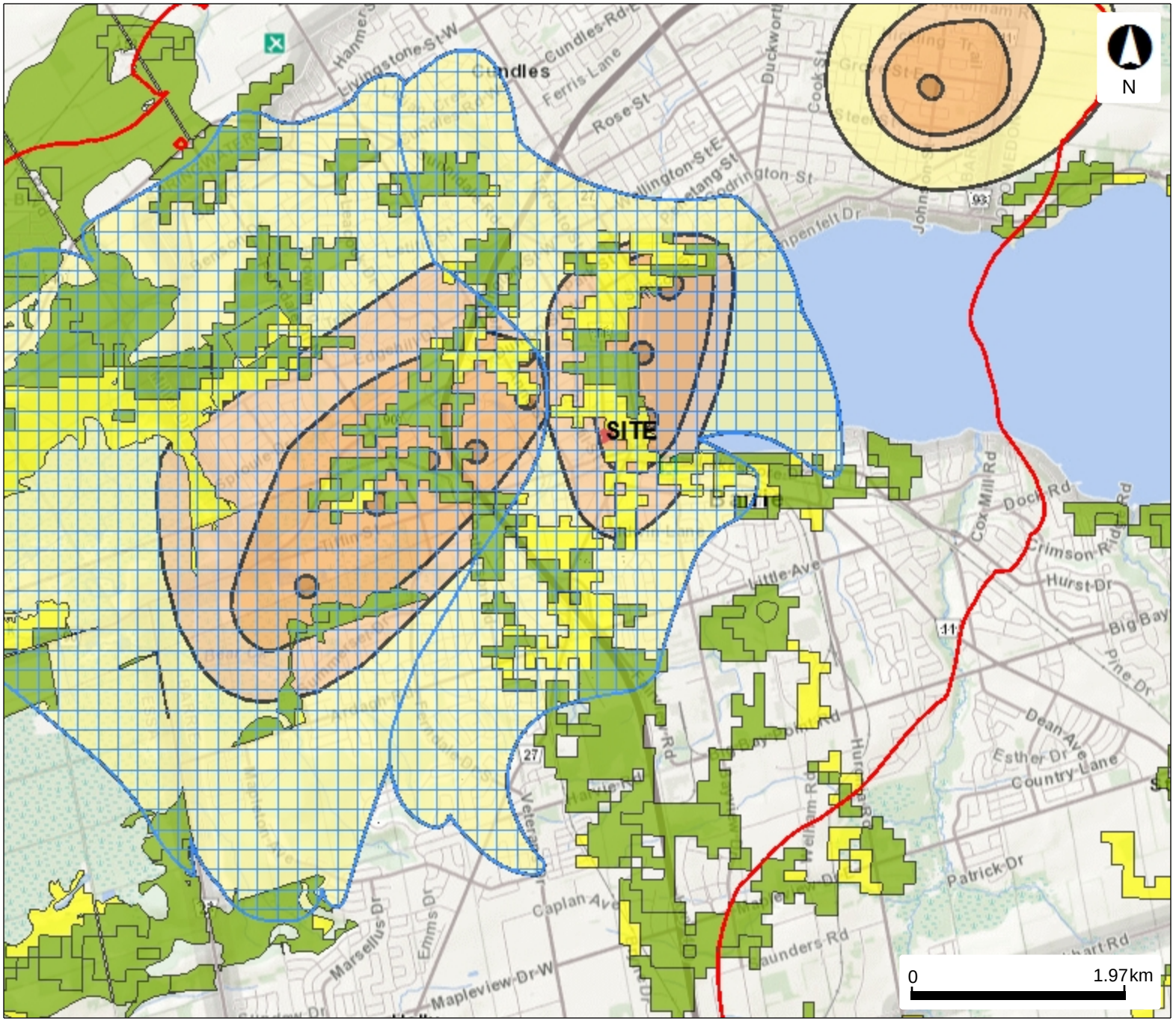
- Wellhead Protection Area Nam
- Issue Contributing Areas
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Assessment Parcel

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

Ontario

Map Created: 10/16/2019
Map Center: 44.37594 N, -79.69092 W

Wellhead Protection Map 2



Legend

- Intake Protection Zone Q
- Wellhead Protection Area Q1
- Wellhead Protection Area Q2
- Issue Contributing Areas

Significant Groundwater Recharge Area

- 2
- 4
- 6

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.

Ontario

Map Created: 10/16/2019
Map Center: 44.36956 N, -79.69534 W

Lake Simcoe Region conservation authority

Regulated Areas Mapping

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

Printed On:
10/16/2019

WGS_1984_Web_Mercator_Auxiliary_Sphere

Mapped By:

Scale 1: 1,145

58 0 29 58 Meters

Appendix B
Borehole Logs

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH301-19

Client: Chayell Hotels Ltd.
Project Name: Geotech Investigation - 220 Bradford St.
Project No.: 9326-002
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 21, 2019
Location: 220 Bradford Street, Barrie ON
UTM: 17T 604094, 4914446
Elevation: 224.91 mASL

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
0		Sand: Brown sand, with organics, trace gravel, trace clay, moist, very loose, FILL	1	SS	40	1			Cap	Top of Standpipe (TOS) Elevation : 226.10 mASL
224 — 1		Sand: Brown sand, some gravel, trace organics, moist, loose	2	SS	50	5			Grout	Groundwater measured at 3.27 mbgs (221.64 mASL) on November 19th, 2019
		Compact	3	SS	70	13			Bentonite Plug	
223 — 2									PVC Standpipe	
			4	SS	80	17				GSA SS1: 5% Gravel 77% Sand 13% Silt 4% Clay
222 — 3			5	SS	80	12			Sand Pack	
									PVC Screen	
221 — 4										
		Saturated	6	SS	80	12				
220 — 5										
219 — 6		Sandy Silt: Grey sandy silt, trace gravel, trace clay, saturated, compact	7	SS	90	13			Cap	

Logged By: BW
Input By: CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH301-19

Client: Chayell Hotels Ltd.
Project Name: Geotech Investigation - 220 Bradford St.
Project No.: 9326-002
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 21, 2019
Location: 220 Bradford Street, Barrie ON
UTM: 17T 604094, 4914446
Elevation: 224.91 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
218 / 7										
		Loose	8	SS	90	8				
217 / 8										
216 / 9		Compact	9	SS	100	15				
215 / 10		Borehole terminated at 9.6 mbgs								Groundwater first observed at 2.3 mbgs.

Logged By: BW
Input By: CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH302-19

Client: Chayell Hotels Ltd.
Project Name: Geotech Investigation - 220 Bradford St.
Project No.: 9326-002
Contractor: Walker Drilling
Method: Hollow Stem Augers + Mud Rotary
Date Completed: October 17-18, 21, 2019
Location: 220 Bradford Street, Barrie ON
UTM: 17T 604119, 4914426
Elevation: 223.27 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
223 / 0		Asphalt: (50 mm)								
		Concrete: (150 mm)								
		Sand: Brown sand, trace gravel, trace silt, moist, compact, FILL								
222 / 1			2	SS	60	11				
		Sand: Brown sand, some silt, trace gravel, saturated, compact	3	SS	60	14				
221 / 2			4	SS	70	14				
220 / 3			5	SS	70	12				
219 / 4			6	SS	70	13				
218 / 5										
217 / 6		Sandy Silt: Grey sandy silt, trace clay, saturated, loose	7	SS	40	7				Switched drilling method to mud rotary at 6.1 mbgs

Logged By: BW
Input By: CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH302-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** October 17-18, 21, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604119, 4914426 **Elevation:** 223.27 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
216 / 7										
		Compact	8	SS	50	22				
215 / 8										
214 / 9		With clay, firm, wet	9	SS	100	5				
213 / 10										
212 / 11		Trace clay, trace gravel, saturated, very dense	10	SS	90	50/ 140 mm				
211 / 12		Dense	11	SS	60	46				
210 / 13										

Logged By: BW **Input By:** CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH302-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** October 17-18, 21, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604119, 4914426 **Elevation:** 223.27 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
14 / 209			12	SS	70	42				
15 / 208		Some gravel, very dense	13	SS	40	50/ 280 mm				
16 / 207										
17 / 206			14	SS	50	50/ 290 mm				
18 / 205		Trace gravel	15	SS	60	50/ 230 mm				
19 / 204										
20 / 203			16	SS	60	50/ 300 mm				

Logged By: BW **Input By:** CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH302-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** October 17-18, 21, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604119, 4914426 **Elevation:** 223.27 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
21 / 202										
			17	SS	70	50/ 240 mm				
22 / 201										
23 / 200		Silty Sand: Grey silty sand, trace clay, saturated, dense	18	SS	90	47				
24 / 199										
		Dense	19	SS	70	44				
25 / 198										
26 / 197		Silt: Grey silt, trace sand, trace clay, very dense	20	SS	80	50/ 255 mm				GSA SS20: 0% Gravel 7% Sand 88% Silt 5% Clay
27										

Logged By: BW **Input By:** CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH302-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** October 17-18, 21, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604119, 4914426 **Elevation:** 223.27 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
196 / 28		Dense	21	SS	60	43				
195 / 29		Compact	22	SS	50	28				
194 / 30										
193 / 31		Very dense	23	SS	40	50/ 255 mm				
192 / 32		Borehole terminated at 30.9 mbgs								Borehole caving at 5.6 mbgs upon completion.

Logged By: BW **Input By:** CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH303-19

Client:	Chayell Hotels Ltd.	**Project Name:**	Geotech Investigation - 220 Bradford St.	**Project No.:**	9326-002
Contractor:	Walker Drilling	**Method:**	Hollow Stem Augers + Mud Rotary	**Date Completed:**	October 16-17, 2019
Location:	220 Bradford Street, Barrie ON	**UTM:**	17T 604143, 4914448	**Elevation:**	222.82 mASL

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
0		Asphalt: (50 mm)								
		Concrete: (150 mm)								
		Sand: Brown sand, some gravel, trace silt, moist, very loose FILL								
222 / 1			2	SS	80	3				
		Sand: Brown sand, some gravel, trace silt, trace clay, occasional cobble, moist, very loose	3	SS	70	3				GSA SS3: 10% Gravel 83% Sand 5% Silt 2% Clay
221 / 2			4	SS	70	12				
220 / 3			5	SS	50	8				
219 / 4										
		Silty Sand: Grey silty sand, some gravel, trace clay moist, very loose	6	SS	80	6				
218 / 5										
217 / 6			7	SS	80	4				Switched drilling method to mud rotary at 6.1 mbgs

Logged By: CM **Input By:** SB

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH303-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** October 16-17, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604143, 4914448 **Elevation:** 222.82 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
216 / 7										
215 / 8		Some clay, wet, loose	8	SS	100	4				
214 / 9		Dense	9	SS	90	36				
213 / 10										
212 / 11		Trace clay, saturated	10	SS	80	31				
211 / 12										
210 / 13			11	SS	100	30				

Logged By: CM **Input By:** SB

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH303-19

Client: Chayell Hotels Ltd.
Project Name: Geotech Investigation - 220 Bradford St.
Project No.: 9326-002
Contractor: Walker Drilling
Method: Hollow Stem Augers + Mud Rotary
Date Completed: October 16-17, 2019
Location: 220 Bradford Street, Barrie ON
UTM: 17T 604143, 4914448
Elevation: 222.82 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
209 / 14										
			12	SS	70	31				
208 / 15										
			13	SS	50	33				
207 / 16										
			14	SS	90	34				
206 / 17										
205 / 18		Very dense	15	SS	80	50/200 mm				
204 / 19										
203 / 20		Dense	16	SS	80	41				

Logged By: CM
Input By: SB

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH303-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers + Mud Rotary **Date Completed:** October 16-17, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604143, 4914448 **Elevation:** 222.82 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
202 / 21										
			17	SS	60	48				
201 / 22										
200 / 23			18	SS	60	44				
199 / 24		Very dense								
			19	SS	50	50/200 mm				
198 / 25										
197 / 26			20	SS	50	50/200 mm				
196 / 27										

Logged By: CM **Input By:** SB

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH303-19

Client: Chayell Hotels Ltd.
Project Name: Geotech Investigation - 220 Bradford St.
Project No.: 9326-002
Contractor: Walker Drilling
Method: Hollow Stem Augers + Mud Rotary
Date Completed: October 16-17, 2019
Location: 220 Bradford Street, Barrie ON
UTM: 17T 604143, 4914448
Elevation: 222.82 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
195 / 28										
			21	SS	60	50/ 280 mm				
194 / 29		Dense								
			22	SS	40	30				
193 / 30										
		Compact								
192 / 31			23	SS	50	22				
		Borehole terminated at 30.9 mbgs								Borehole caving at 3.0 mbgs upon completion.
191 / 32										

Logged By: CM
Input By: SB

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH304-19

Client: Chayell Hotels Ltd. **Project Name:** Geotech Investigation - 220 Bradford St. **Project No.:** 9326-002

Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** October 21, 2019

Location: 220 Bradford Street, Barrie ON **UTM:** 17T 604093, 4914460 **Elevation:** 225.10 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
225 / 0		Sand: Brown sand, with organics, some gravel, moist, very loose, FILL	1	SS	10	3				
224 / 1		Sand: Brown sand, some gravel, trace organics, moist, loose	2	SS	40	8				
		Trace silt	3	SS	40	8				
223 / 2										
		Some silt, less organics, compact	4	SS	50	20				
222 / 3			5	SS	60	25				
221 / 4										
		Saturated	6	SS	60	20				
220 / 5										
219 / 6			7	SS	90	17				

Logged By: BW **Input By:** CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH304-19

Client: Chayell Hotels Ltd.
Project Name: Geotech Investigation - 220 Bradford St.
Project No.: 9326-002
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 21, 2019
Location: 220 Bradford Street, Barrie ON
UTM: 17T 604093, 4914460
Elevation: 225.10 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
218 / 7										
		Silty Sand: Grey silty sand, trace gravel, saturated, loose	8	SS	90	9				
217 / 8										
216 / 9			9	SS	90	15				GSA SS9: 1% Gravel 67% Sand 26% Silt 6% Clay Caving at 4.6 mbgs and water level at 4.0 mbgs upon completion
215 / 10		Borehole terminated at 9.6 mbgs								

Logged By: BW
Input By: CM

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH201

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 26-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604128.4, 4914440.5 **Elevation:** 223.02 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft) / Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0 / 0		Fill: Medium brown sand and gravel, moist	0	1	DP	75%	<5	<1	Cap	Water Level Oct 3, 2019
1		Medium brown silty sand, trace gravel, trace asphalt, moist							Flush Mount	
2		Sand: Brown, medium grained, moist		1	DP		<5	<1	Bentonite Plug	
3 / 1			-1						PVC Riser	
4				2	DP	65%	<5	<1		
5		Wet								
6 / 2			-2	2	DP		<5	1	Sand Pack	
7									PVC Screen	
8										
9				3	DP	90%	>600	1		
10 / 3			-3							
11										
12				3	DP		<5	<1		
13 / 4			-4						Cap	
14										
15		Borehole terminated at 4.57 mbgs in sand								
16										
17 / 5			-5							
18										
19										
20 / 6			-6							

Logged By: Natalie Wright **Input By:** Brenden Hnatiw

CAMBIUM
Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH202

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001
Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 26-08-2019
Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604134.2, 4914456.3 **Elevation:** 223.95 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft) / Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0 / 0		Fill: Medium brown sand, trace silt, some organics, moist	0	1	DP		<5	5	Cap	
1		Light brown, some silt, trace gravel							Flush Mount	
2				1	DP	55%	<5	1	Bentonite Plug	
3 / 1			-1						PVC Riser	
4										
5				2	DP		<5	<1		
6 / 2		Sand: Medium brown, medium grained, moist	-2			60%				
7				2	DP		<5	<1		
8										
9		Wet							Sand Pack	
10 / 3			-3						PVC Screen	Water Level Oct 3, 2019
11				3	DP		165	1		
12						90%				
13 / 4			-4	3	DP		<5	1		
14										
15		Borehole terminated at 4.57 mbgs in sand							Cap	
16 / 5			-5							
17										
18										
19										
20 / 6			-6							

Logged By: Natalie Wright **Input By:** Brenden Hnatiw

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH203

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 26-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604118.6, 4914444.6 **Elevation:** 224.11 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft) / Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0 / 0		Fill: Medium brown sand, trace silt, some organics, moist	0	1	DP		<5	<1	Cap	
1									Flush Mount	
2		Light brown sand, some silt, trace gravel, moist		1	DP	50%	<5	<1	Bentonite Plug	
3 / 1			-1						PVC Riser	
4										
5				2	DP		<5	<1		
6 / 2		Sand: Medium brown, medium grained, moist	-2			70%				
7				2	DP		<5	<1		
8		Wet								
9										
10 / 3			-3						Sand Pack	
11				3	DP		210	<1	PVC Screen	Water Level Oct 3, 2019
12						70%				
13 / 4			-4	3	DP		<5	<1		
14										
15		Terminated at 4.57 mbgs in sand							Cap	
16 / 5			-5							
17										
18										
19										
20 / 6			-6							

Logged By: Natalie Wright **Input By:** Brenden Hnatiw

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH204

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 22-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604148.3, 4914446 **Elevation:** 222.46 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft) / Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0 / 0		Asphalt	0						Cap	
1		Fill: Brown sand, moist		1	DP		<5	<1	Flush Mount	
2									Bentonite Plug	
3 / 1			-1			30%			PVC Riser	
4										
5		Black banding Brick fragments, wet								
6 / 2			-2	2	DP		<5	<1		Water Level Oct 3, 2019
7										
8						42%			Sand Pack	
9									PVC Screen	
10 / 3			-3							
11		Sand: Brown, wet								
12				3	DP		<5	<1		
13 / 4			-4			72%			Cap	
14										
15		Black striations								
16		Borehole terminated at 4.57 mbgs in sand								
17 / 5			-5							
18										
19										
20 / 6			-6							

Logged By: Matt Cunnigham **Input By:** Brenden Hnatiw

CAMBIUM
Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH205

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 22-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604131.6, 4914427.8 **Elevation:** 222.79 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft)	Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0	0		Asphalt: Asphalt	0						Cap	
1			Fill: Brown sand, trace gravel, moist		1	DP		<5	<1	Flush Mount	
2			Black Banding							Bentonite Plug	
3	1			-1			40%			PVC Riser	
4											
5			Wood Chips								
6	2		Sand: Reddish brown, wet	-2	2	DP		<5	<1		Water Level Oct 3, 2019
7											
8							42%				
9										Sand Pack	
10	3			-3						PVC Screen	
11			Brown, trace silt, wet								
12					3	DP		155	<1		
13	4			-4			67%				
14										Cap	
15			Borehole terminated at 4.57 mbgs in sand								
16	5			-5							
17											
18											
19											
20	6			-6							

Logged By: Matt Cunnigham **Input By:** Brenden Hnatiw

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH206

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 22-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604085.3, 4914392.4 **Elevation:** 222.05 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft) / Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0 / 0		Sand: Dark brown, trace gravel, moist	0	1	DP	27%	<5	<1	Cap, Flush Mount, Bentonite Plug, PVC Riser	Water Level Oct 3, 2019
5 / 2		Coarse grained, some organics	-2	2	DP	43%	<5	<1	Sand Pack, PVC Screen	
10 / 3		Trace silt	-3	3	DP	58%	<5	<1	Cap	
15 / 4.57		Borehole terminated at 4.57 in sand	-4.57							

Logged By: Matt Cunnigham **Input By:** Brenden Hnatiw

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH207

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 22-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604096.9, 4914428.6 **Elevation:** 224.26 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft)	Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0	0		Asphalt	0						Cap	
1			Sand: Light brown. moist							Flush Mount	
2					1	DP		15	<1		
3	1			-1			47%			Bentonite Plug	
4										PVC Riser	
5											
6	2			-2	2	DP		20	<1		
7							68%				
8											
9											
10	3			-3						Sand Pack	
11					3	DP		115	<1	PVC Screen	Water Level Oct 3, 2019
12			Wet								
13	4			-4	4	DP	73%	20	<1		
14											
15			Borehole terminated at 4.57 mbgs in sand							Cap	
16	5			-5							
17											
18											
19											
20	6			-6							

Logged By: Matt Cunnigham **Input By:** Brenden Hnatiw

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH208

Client: Chayell Hotels Ltd. **Project Name:** Phase Two Environmental Site Assesment **Project No.:** 9326-001

Contractor: Strata Drilling Group **Method:** Direct Push **Date Completed:** 22/26-08-2019

Location: 220 Bradford Street, Barrie, ON **UTM:** 17T, 604147.8, 4914443 **Elevation:** 222.51 masl

SUBSURFACE PROFILE				SAMPLING INFO						
Depth (ft) / Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0 / 0		Asphalt	0						Cap	
1 / 0		Fill: Medium brown sand, trace gravel, moist	0	1	DP	40%	<5	<1	Flush Mount	Water Level Oct 3, 2019
2 / 1			-1							
3 / 1		Wet	-1	2	DP	47%	<5	<1		
4 / 2			-2							
5 / 2			-2							
6 / 2			-2							
7 / 2			-2							
8 / 2			-2							
9 / 3			-3							
10 / 3		Sand: Medium brown, wet	-3	3	DP	83%	230	<1		
11 / 3			-3							
12 / 4		Grey	-4	4	DP		4	<1		
13 / 4			-4							
14 / 4			-4							
15 / 4			-4						Bentonite Plug	
16 / 5		Trace silt	-5						PVC Riser	
17 / 5			-5	5	DP	100%	250	<1		
18 / 5			-5							
19 / 6		Silty Sand: Dark grey, trace gravel, wet	-6	6	DP		<5	<1		
20 / 6			-6							
21 / 6		Silt: Grey, some sand, wet	-6	7	DP		<5	<1		
22 / 7			-7							
23 / 7		Clay: Grey, some silt	-7	8	DP	70%	<5	<1		
24 / 7			-7							
25 / 7			-7							
26 / 8		Sand: Grey, medium grained, wet	-8	9	DP	85%	<5	<1		
27 / 8			-8							
28 / 8			-8	10	DP	100%	<5	<1		
29 / 9			-9							
30 / 9			-9							
31 / 9			-9	11	DP		<5	<1		
32 / 10		Silty Sand: Grey, wet	-10			100%			Sand Pack	
33 / 10			-10	12	DP		<5	<1	PVC Screen	
34 / 10		Silt: Grey, some fine sand, wet	-10							
35 / 10			-10						Cap	
36 / 11		Borehole terminated at 10.66 mbgs in silt	-11							
37 / 11			-11							
38 / 11			-11							
39 / 12			-12							
40 / 12			-12							

Logged By: Matt Cunnigham **Input By:** Brenden Hnatiw

Log of Borehole: MW101

Project #: 227626 **Logged By:** KK

Project: Phase II Environmental Site Assessment

Client: Chayell Hospitality Group Inc.

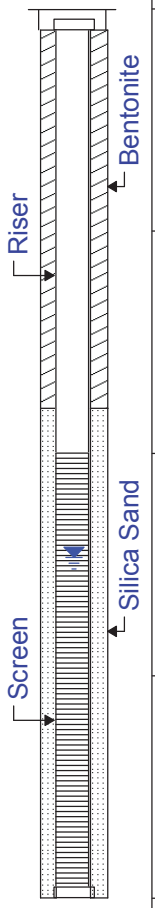
Location: 220 Bradford Street, Barrie, Ontario

Drill Date: August 23, 2018

SUBSURFACE PROFILE

Depth (ft / m)	Symbol	Description	Measured Depth (m)
0 / 0		Ground Surface	0.00
0–2 / 0–0.61		***Topsoil*** Black sandy silt, with organics.	0.61
2–20 / 0.61–6.10		***Sand*** Brown to light brown, damp. Grey-brown, wet below 3.81 mbgs. Some silt, wet below 4.88 mbgs.	6.10
20 / 6.10		End of Borehole	

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).



Water level measured at 3.76 mbgs on August 27, 2018.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
50	BH101-1	0/0	
	BH101-2	0/0	
90	BH101-3	0/0	
	BH101-4	0/0	
100	BH101-5	0/0	
	BH101-6	0/0	Grain Size
100	BH101-7	0/0	
	BH101-8	0/1	VOCs

Contractor: Strata

Drilling Method: Direct Push

Well Casing Size: 5.1 cm

Grade Elevation: NM

Top of Casing Elevation: NM

Sheet: 1 of 1

Log of Borehole: MW102

Project #: 227626 **Logged By:** KK

Project: Phase II Environmental Site Assessment

Client: Chayell Hospitality Group Inc.

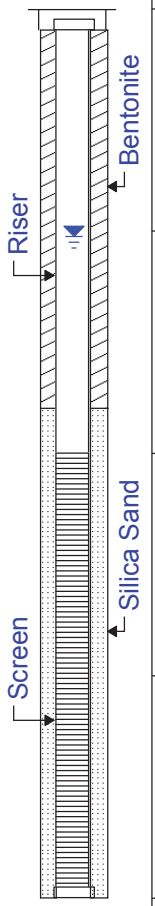
Location: 220 Bradford Street, Barrie, Ontario

Drill Date: August 23, 2018

SUBSURFACE PROFILE

Depth (ft / m)	Description	Measured Depth (m)
0 / 0	Ground Surface	0.00
0 / 0	***Sand and Gravel*** Brown to black, some silt, damp.	0.46
1 / 0	***Silty Sand*** Brown to light brown, some gravel, damp.	
4 / 1		
6 / 2	Dark brown, wet below 1.83 mbgs.	
7 / 2	Grey-brown wet below 2.29 mbgs.	
10 / 3		
13 / 4		
16 / 5		
19 / 6		6.10
20 / 6	End of Borehole	

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).



Water level measured at 1.56 mbgs on August 27, 2018.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
30	BH102-1	0/0	
	BH102-2	0/0	
80	BH102-3	0/0	
	BH102-4	0/0	
95	BH102-5	5/0	
	BH102-6	0/0	Grain Size
100	BH102-7	0/0	
	BH102-8	0/0	VOCs

Contractor: Strata

Drilling Method: Direct Push

Well Casing Size: 5.1 cm

Grade Elevation: 100.441 mREL

Top of Casing Elevation: 100.366 mREL

Sheet: 1 of 1

Log of Borehole: MW103

Project #: 227626 **Logged By:** KK

Project: Phase II Environmental Site Assessment

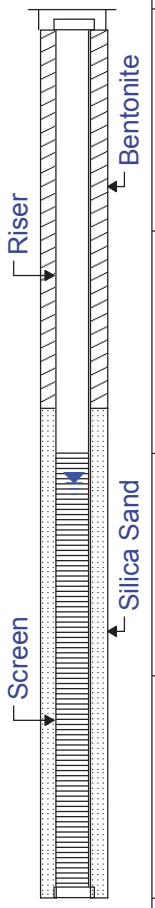
Client: Chayell Hospitality Group Inc.

Location: 220 Bradford Street, Barrie, Ontario

Drill Date: August 23, 2018

SUBSURFACE PROFILE

Depth (ft / m)	Symbol	Description	Measured Depth (m)
0 / 0		Ground Surface	0.00
0 – 1		***Topsoil*** Dark brown, with organics, damp.	
1 – 3		***Sand*** Brown to grey-brown, damp.	
3 – 6		Grey-brown, wet below 3.66 mbgs.	
6			6.10
6		End of Borehole	
7		Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).	



Water level measured at 3.25 mbgs on August 27, 2018.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
55	BH103-1	0/0	
	BH103-2	0/0	pH
75	BH103-3	0/0	
	BH103-4	0/0	
85	BH103-5	0/0	
	BH103-6	0/0	pH
95	BH103-7	0/9	VOCs
	BH103-8	0/0	

Contractor: Strata

Drilling Method: Direct Push

Well Casing Size: 5.1 cm

Grade Elevation: 101.996 mREL

Top of Casing Elevation: 102.619 mREL

Sheet: 1 of 1

Log of Borehole: MW104

Project #: 227626 **Logged By:** KK

Project: Phase II Environmental Site Assessment

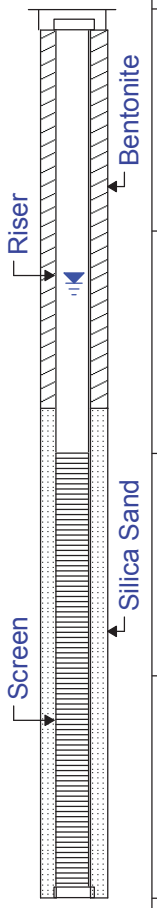
Client: Chayell Hospitality Group Inc.

Location: 220 Bradford Street, Barrie, Ontario

Drill Date: August 23, 2018

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Description	Measured Depth (m)
0	0	Ground Surface	0.00
		Sand and Gravel Dark brown, with asphalt pieces, damp.	
		Sand Brown to grey-brown, damp.	
		Grey-brown, wet below 1.83 mbgs.	
20	6		6.10
		End of Borehole	
		Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).	



Water level measured at 1.88 mbgs on August 27, 2018.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
55	BH104-1	0/0	
	BH104-2	0/0	
75	BH104-3	0/0	
	BH104-4	0/0	
100	BH104-5	0/0	
	BH104-6	0/2	
100	BH104-7	1000/2	BTEX, PHCs
	BH104-8	730/2	VOCs

Contractor: Strata

Drilling Method: Direct Push

Well Casing Size: 5.1 cm

Grade Elevation: 101.996 mREL

Top of Casing Elevation: 102.619 mREL

Sheet: 1 of 1

Log of Borehole: MW1/BH1

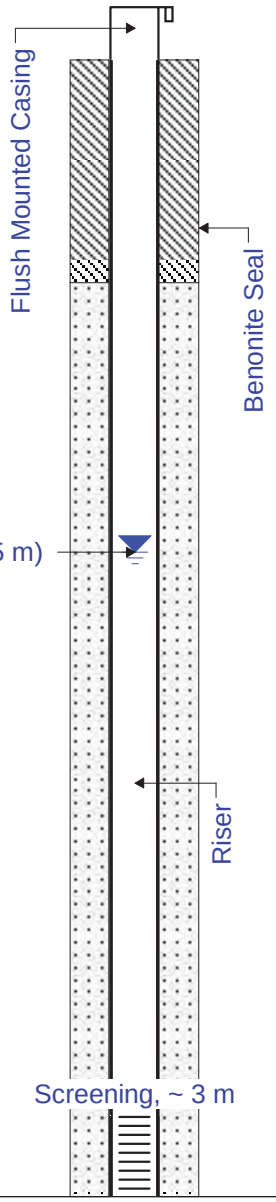
T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Project No.: THEM # T16-16418-00
Project: Limited Phase II ESA
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

Enclosure:
Project Manager: Raj Kundu

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
		Fill Materials Granular fill materials with inclusions of pea gravel	0.0	1-1		50%	ppm	
			-4.0					
		Sand Loose, damp, brown sand	4.0					
				1-2		75%	ppm	
			-8.0					
		Sand Loose, damp, brown sand	8.0					
				1-3		100%	ppm	

Water Level February 26, 2016 (1.5 m)



Drilled By: Strata Soil Sampling Inc.
Drill Method: Geoprobe 6620 DT
Drill Date: February 23, 2016

Hole Size: 5 cm
Datum: Grade
Sheet: 1 of 2

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: MW1/BH1

Project No.: THEM # T16-16418-00
Project: Limited Phase II ESA
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

Enclosure:
Project Manager: Raj Kundu

SUBSURFACE PROFILE				SAMPLE				
Depth	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
			-12.0					
12		***Sand*** Loose, wet, brown sand	12.0					
14				1-4		100%	ppm	
			-16.0					
16		***Clayey Sand*** Medium dense, wet, grey clayey sand	16.0					
	5							
18				1-5		100%	ppm	
			-20.0					
20			20.0					End of Borehole 6.1 m

#2 Silica Sand

Drilled By: Strata Soil Sampling Inc.
Drill Method: Geoprobe 6620 DT
Drill Date: February 23, 2016

Hole Size: 5 cm
Datum: Grade
Sheet: 2 of 2

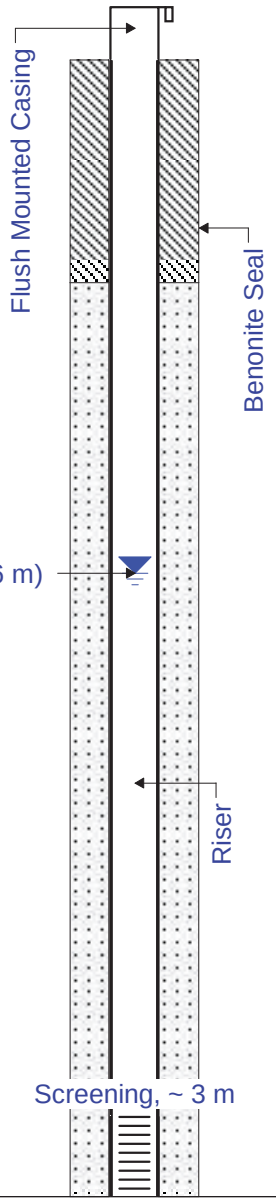
Log of Borehole: MW2/BH2

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Project No.: THEM # T16-16418-00
Project: Limited Phase II ESA
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

Enclosure:
Project Manager: Raj Kundu

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
		Asphalt	0.0					
		Sand Loose, moist, brown sand		2-1		75%	0.3ppm	
			-4.0					
		Sand Loose, damp, brow-red sand	4.0					
				2-2		75%	0.2ppm	
			-8.0					
		Sand Loose, wet, brow-grey sand	8.0					
				2-3		100%	0.3ppm	



Drilled By: Strata Soil Sampling Inc.
Drill Method: Geoprobe 6620 DT
Drill Date: February 23, 2016

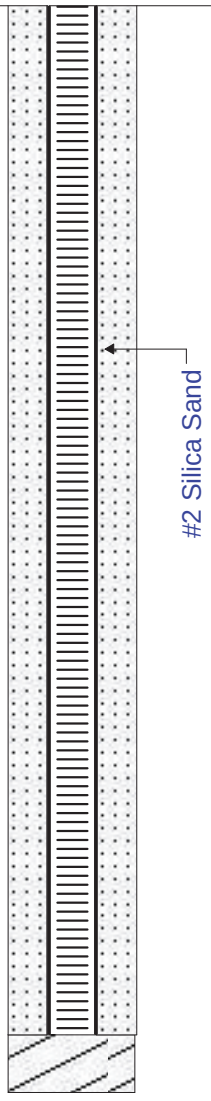
Hole Size: 5 cm
Datum: Grade
Sheet: 1 of 2

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: MW2/BH2

Project No.: THEM # T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
			-12.0					
12		***Sand*** Loose, wet, brown sand	12.0					
14			-16.0					
16	5	***Clayey Sand*** Medium dense, wet, grey clayey sand	16.0					
18			-20.0					
20			20.0					End of Borehole 6.1 m



Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 2 of 2

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: MW3/BH3

Project No.: THEM # T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
		Topsoil	0.0					
		Sand Loose, damp, brown-grey sand				75%		
			-4.0					
4		***Sand*** Loose, damp, grey sand	4.0					
								Water Level February 26, 2016 (1.51 m)
6 / 2				3-2		75%	0.1ppm	
			-8.0					
8		***Sand*** Loose, wet, brown-grey sand	8.0					
10				3-3		100%	0.1ppm	

Flush Mounted Casing
Benonite Seal
Riser
Screening, ~ 3 m

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 2

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: MW3/BH3

Project No.: THEM # T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
			-12.0					
12		***Sand*** Loose, wet, brown sand	12.0					
14			-16.0					
16		***Clayey Sand*** Medium dense, wet, grey clayey sand	16.0					
	5							
18			-20.0					
20			20.0					End of Borehole 6.1 m

#2 Silica Sand

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 2 of 2

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH4

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
		Sand Loose, damp, brown sand	0.0	4-1		10%		Not applicable
4			-4.0 4.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH5

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					No samples were submeted to the Lab –
		Sand 0-2 Granular fill materials 2-4 Loose, moist, brown sand	0.0					
2								
			-4.0					
4			4.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH6

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
0		***Sand*** 0-2 Granular fill materials 2-4 Loose, damp, brown sand	0.0					
2								
			-4.0					
4		***Sand*** Loose, damp, brown sand	4.0					Not applicable
6				6-2		75%	0.3ppm	
2								
			-8.0					
8			8.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH7

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
		Sand 0-2 Granular fill materials 2-4 Loose, moist, brown sand	0.0	7-1		70%		
			-4.0					
4		***Sand*** Loose, moist, brown sand	4.0					Not applicable
6 / 2						70%		
			-8.0					
8			8.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH8

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
0		***Sand*** 0-2 Granular fill materials 2-4 Loose, moist, brown sand	0.0 -4.0					Not applicable
4		***Sand*** Loose, damp, brown sand	4.0	8-2				
6 / 2								
8			-8.0 8.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH9

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
		Sand 0-2 Granular fill materials 2-4 Loose, moist, brown sand	0.0 -4.0					
4		***Sand*** Loose, moist, grey sand	4.0	9-2			0.2ppm	Not applicable
6 / 2			-8.0					
8			8.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

T. Harris Environmental Management Inc.
93 Skyway Avenue, Suite 101

Log of Borehole: BH10

Project No.: THEM# T16-16418-00
Enclosure:
Project: Limited Phase II ESA
Project Manager: Raj Kundu
Client: Mr. Joseph Tascona
Location: 220 Bradford Street, Barrie

SUBSURFACE PROFILE				SAMPLE				
Depth (ft / m)	Symbol	Description	Depth/Elev.	Number	Type	Recovery, %	Vapour, ppm	Well Completion Details
0 / 0		**Ground Surface**	0.0					
0		***Sand*** 0-2 Granular fill materials 2-4 Loose, moist, brown-red sand	0.0	10-1				Not applicable
2								
4		***Sand*** Loose, moist, brown sand	-4.0 4.0					
6 / 2								
8			-8.0 8.0					

Drilled By: Strata Soil Sampling Inc.
Hole Size: 5 cm
Drill Method: Geoprobe 6620 DT
Datum: Grade
Drill Date: February 23, 2016
Sheet: 1 of 1

Appendix C
Grain Size Analyses

Grain Size Distribution Chart

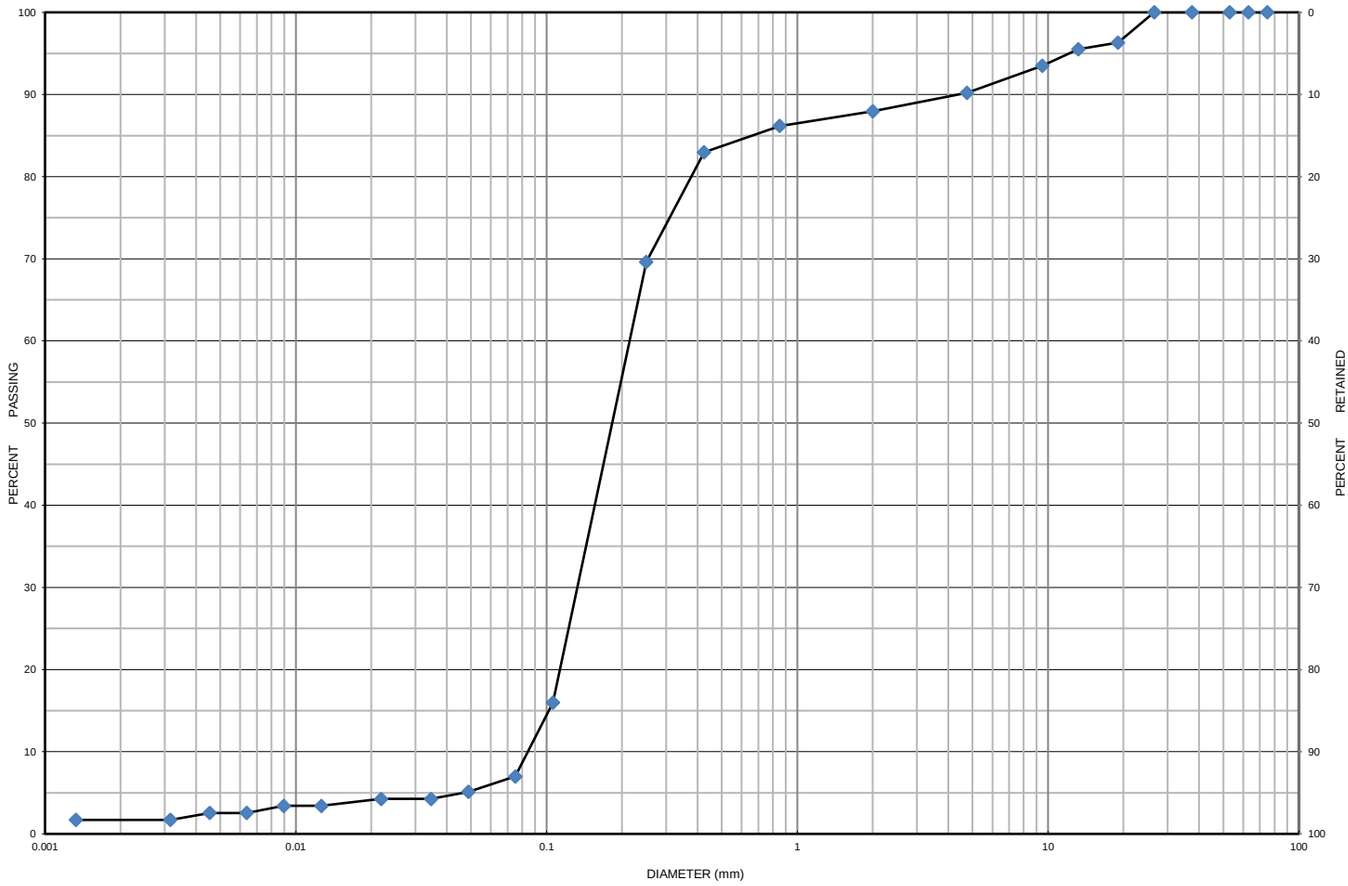
Project Number: *9326-002* **Client:** *ChayHotels Ltd.*

Project Name: *Geotech & Hydro-G - 220 Bradford Street, Barrie, ON*

Sample Date: *October 16-18 & 21, 2019* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 301-19 SS 3* **Depth:** *1.5 m to 2 m* **Lab Sample No:** *S-19-0932*

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 301-19	SS 3	1.5 m to 2 m	10	83	7		16.4

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand some Gravel trace Silt trace Clay	SP	0.2200	0.1400	0.0840	2.62	1.06

Issued By: _____ *Date Issued:* *November 11, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

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

Grain Size Distribution Chart

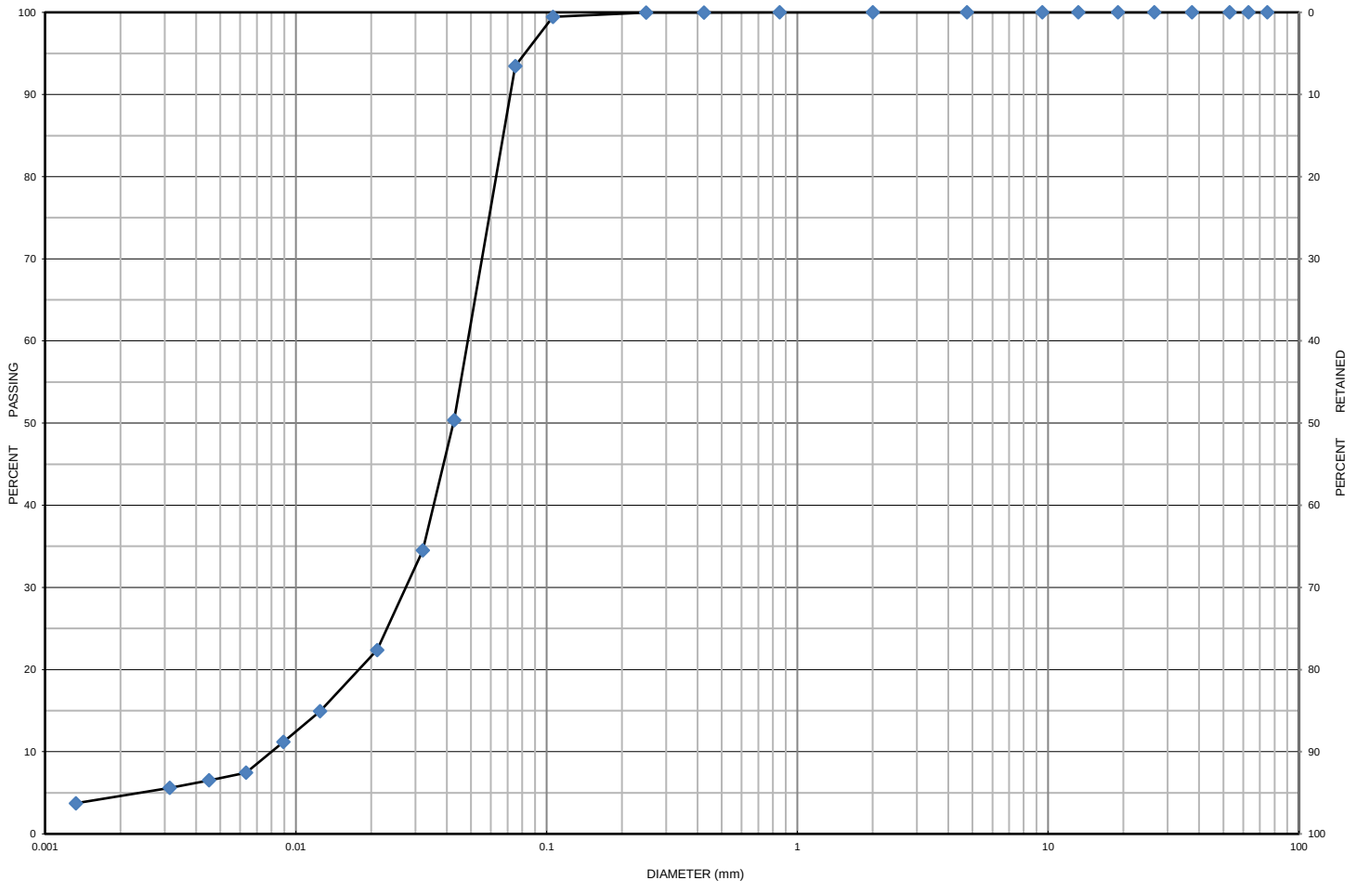
Project Number: *9326-002* **Client:** *ChayHotels Ltd.*

Project Name: *Geotech & Hydro-G - 220 Bradford Street, Barrie, ON*

Sample Date: *October 16-18 & 21, 2019* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 302-19 SS 20* **Depth:** *25.9 m to 26.4 m* **Lab Sample No:** *S-19-0929*

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 302-19	SS 20	25.9 m to 26.4 m	0	7	93		21.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt trace Sand trace Clay	ML	0.0490	0.0275	0.0025	19.60	6.17

Issued By: _____ *Date Issued:* *November 11, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

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

Grain Size Distribution Chart

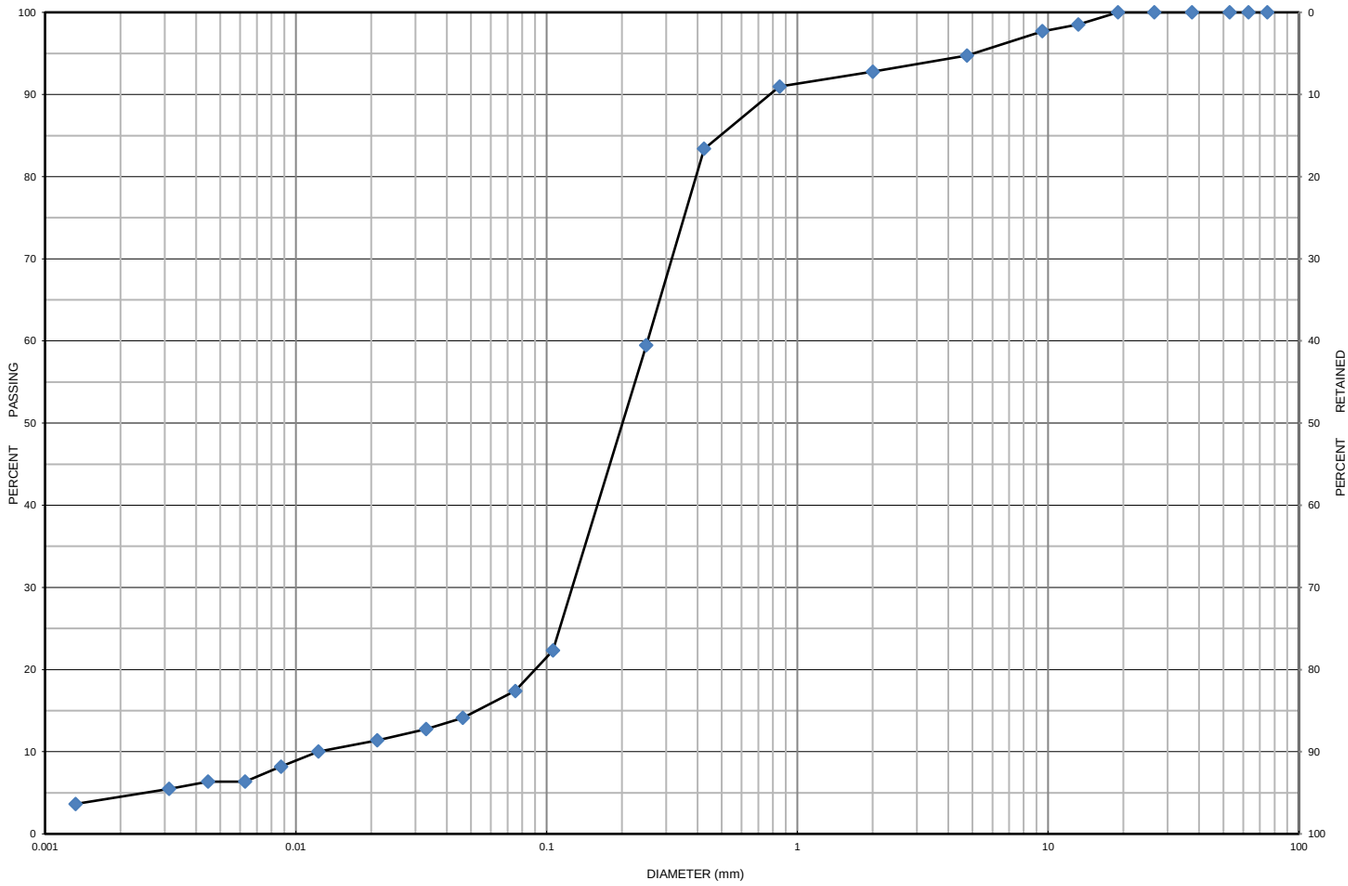
Project Number: *9326-002* **Client:** *ChayHotels Ltd.*

Project Name: *Geotech & Hydro-G - 220 Bradford Street, Barrie, ON*

Sample Date: *October 16-18 & 21, 2019* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 303-19 SS 1* **Depth:** *0 m to 0.6 m* **Lab Sample No:** *S-19-0931*

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 303-19	SS 1	0 m to 0.6 m	5	77	17		13.2

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand some Silt trace Gravel trace Clay	SM	0.2600	0.1400	0.0130	20.00	5.80

Issued By: _____ *Date Issued:* *November 11, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

Grain Size Distribution Chart

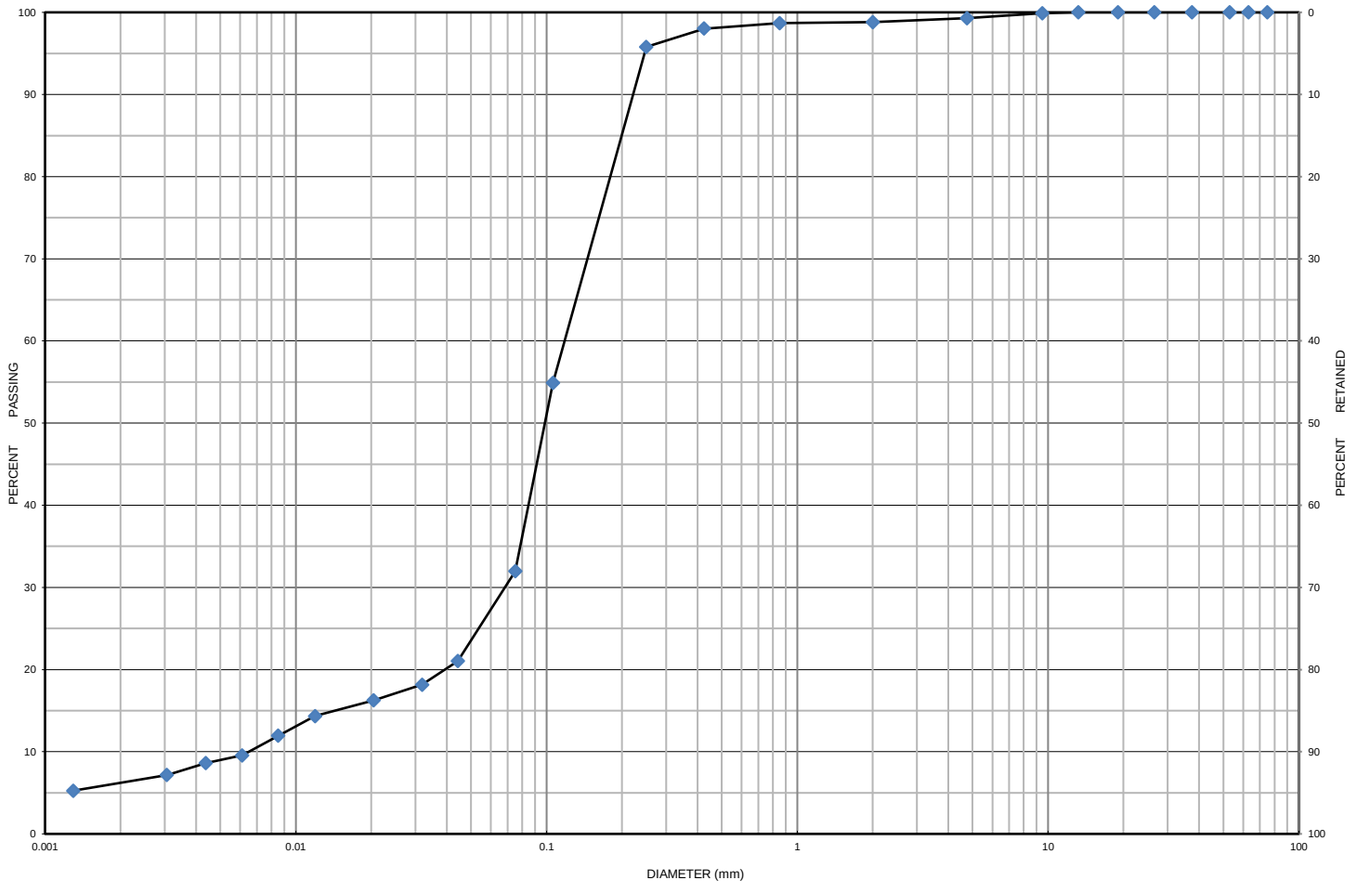
Project Number: *9326-002* **Client:** *ChayHotels Ltd.*

Project Name: *Geotech & Hydro-G - 220 Bradford Street, Barrie, ON*

Sample Date: *October 16-18 & 21, 2019* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 304-19 SS 9* **Depth:** *9.5 m to 9.6 m* **Lab Sample No:** *S-19-0930*

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 304-19	SS 9	9.5 m to 9.6 m	1	67	32		19.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace Gravel trace Clay	SM	0.1250	0.0690	0.0065	19.23	5.86

Issued By: _____ *Date Issued:* *November 11, 2019*

(Senior Project Manager)

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

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

Appendix D
Aquifer Test Results

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

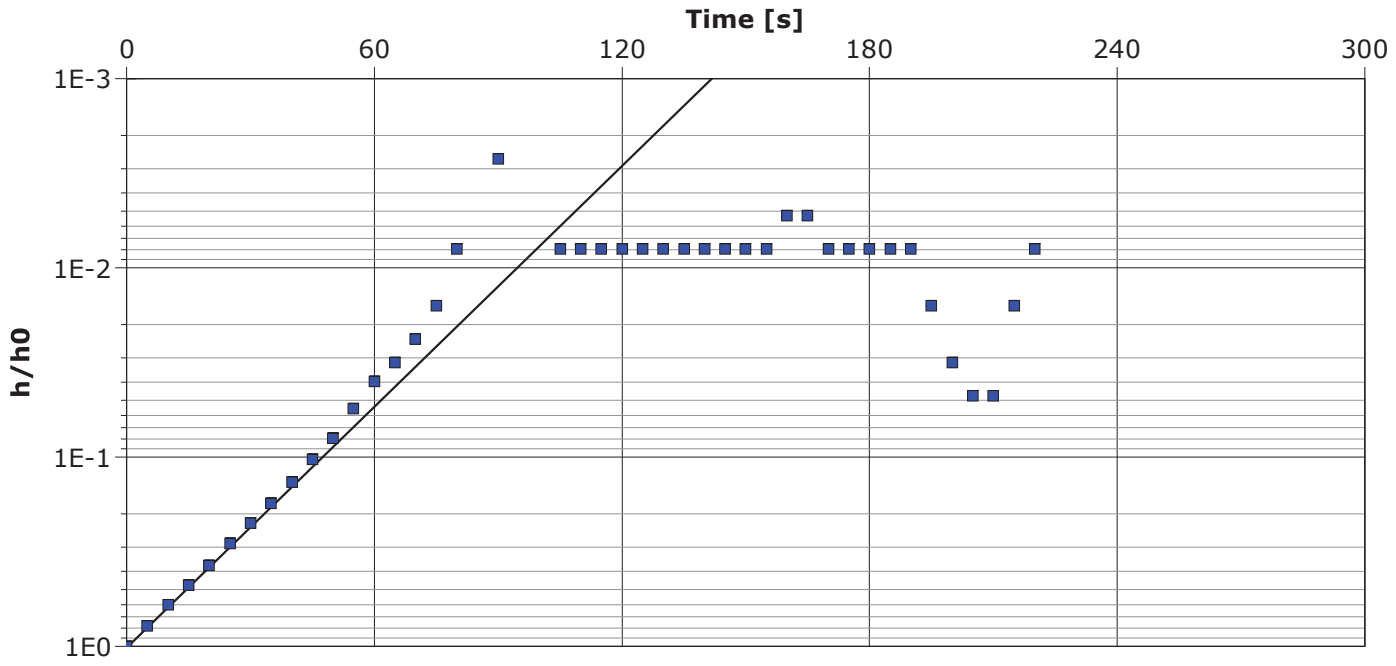
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 1 (Slug out)	Test Well: BH202
Test Conducted by: Chirs M.		Test Date: 10/02/19
Analysis Performed by: M.Francis	Slug 1 out	Analysis Date: 10/16/19
Aquifer Thickness: 1.65 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH202	8.65×10^{-5}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

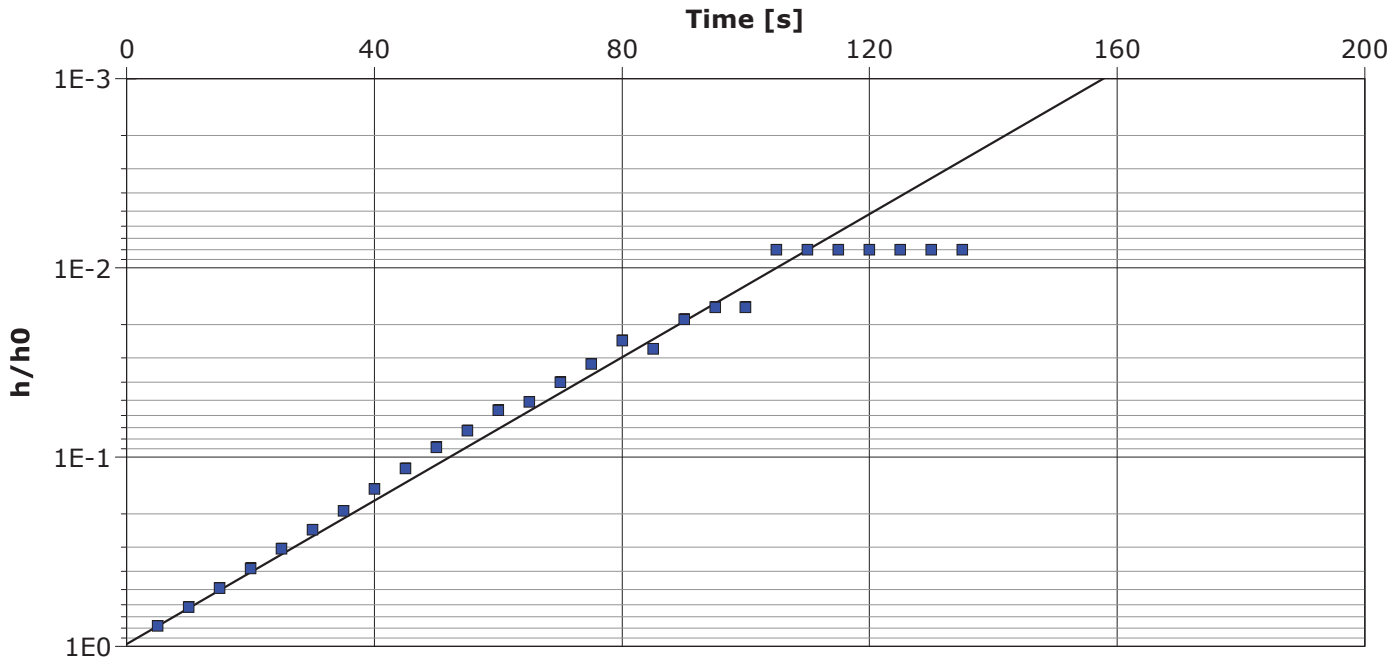
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 2 (Slug Out)	Test Well: BH202
Test Conducted by: Chirs M.		Test Date: 10/02/19
Analysis Performed by: M.Francis	Slug 2 Out	Analysis Date: 10/16/19
Aquifer Thickness: 1.65 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH202	7.72×10^{-5}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

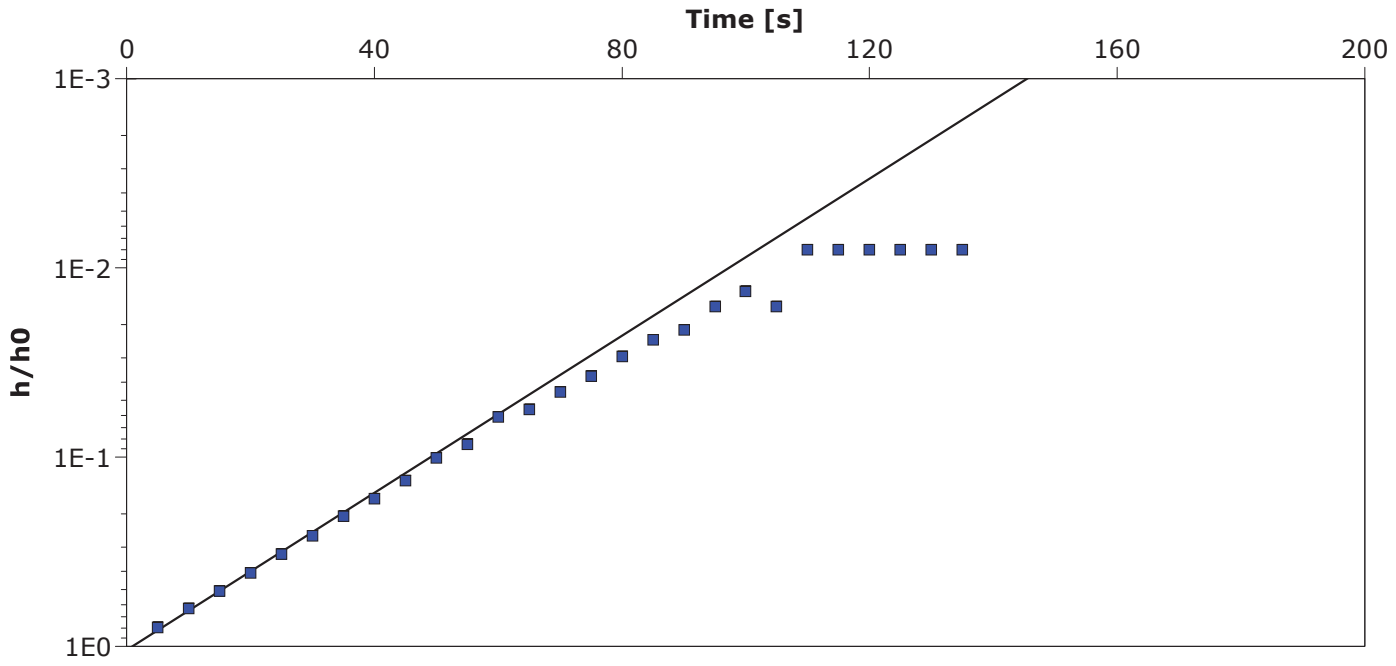
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 3 (Slug Out)	Test Well: BH202
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M.Francis	Slug 3 Out	Analysis Date: 10/16/19
Aquifer Thickness: 1.65 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH202	8.46×10^{-5}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

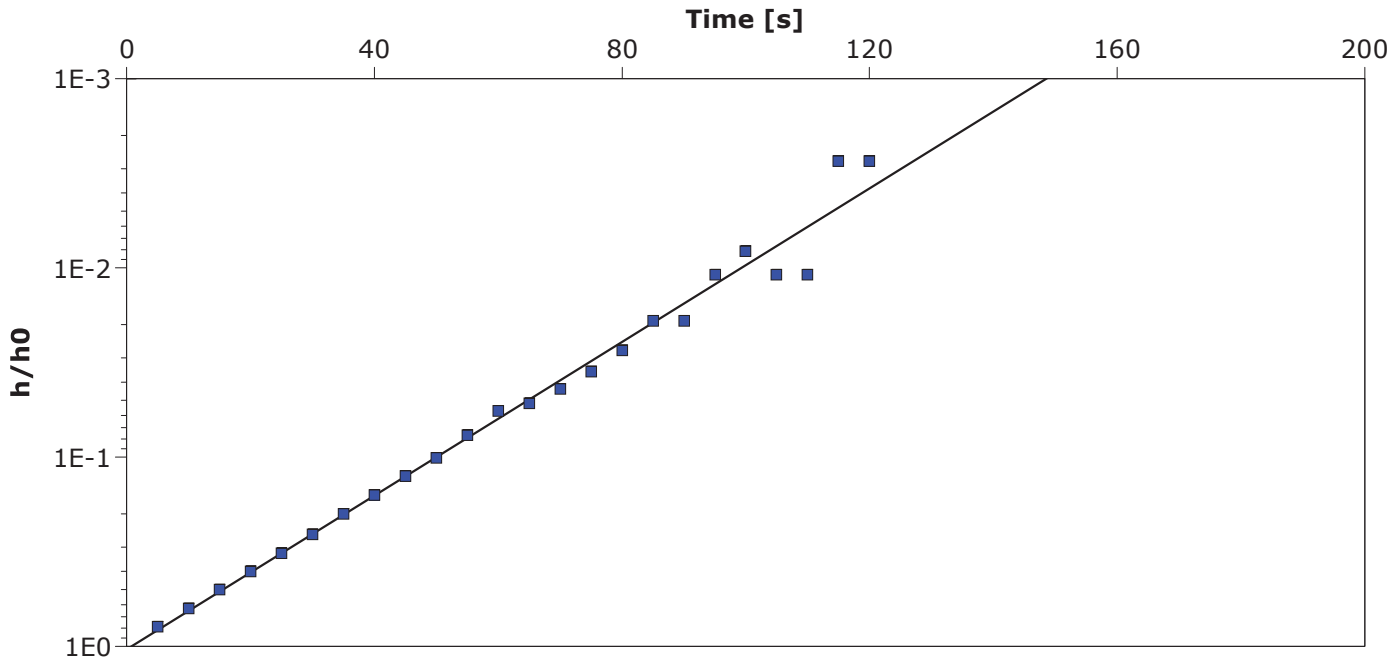
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 4 (Slug Out)	Test Well: BH202
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M.Francis	Slug 4 Out	Analysis Date: 10/16/19
Aquifer Thickness: 1.65 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH202	8.28×10^{-5}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

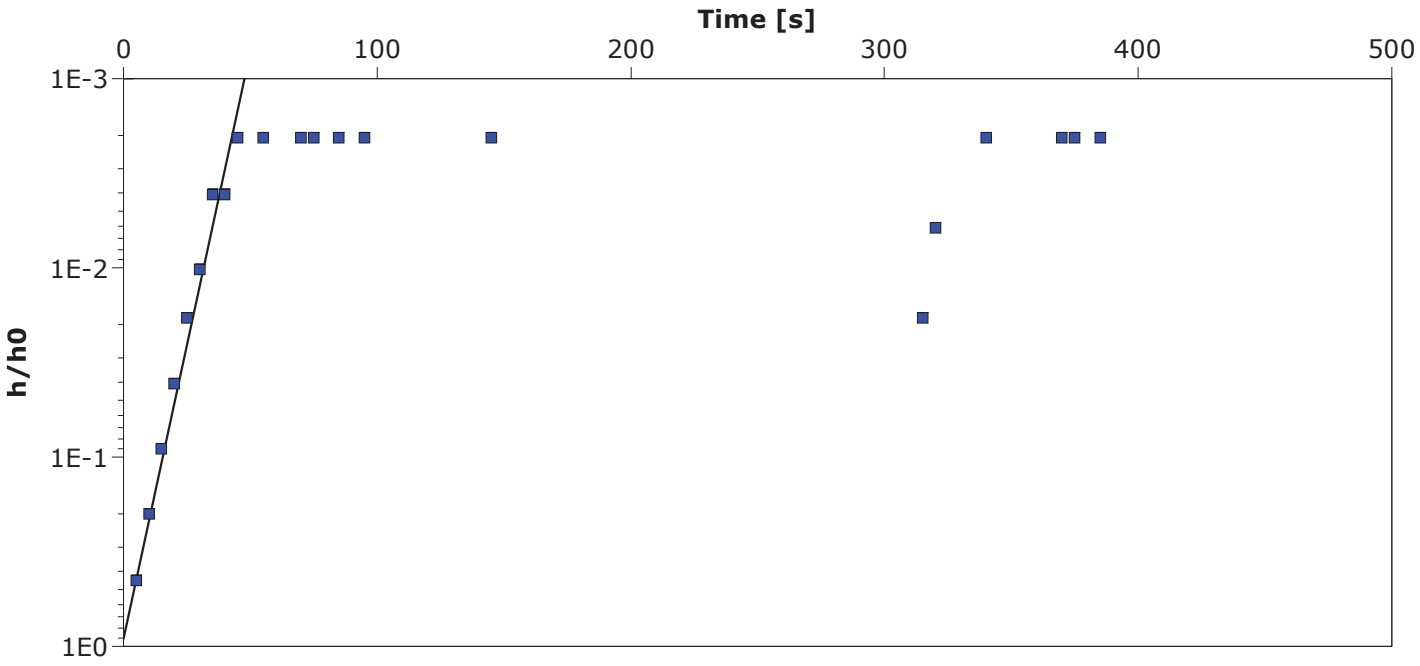
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 1 (Slug Out)	Test Well: BH204
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M. Francis	Slug 1 Out	Analysis Date: 10/17/19
Aquifer Thickness: 2.44 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH204	2.53×10^{-4}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

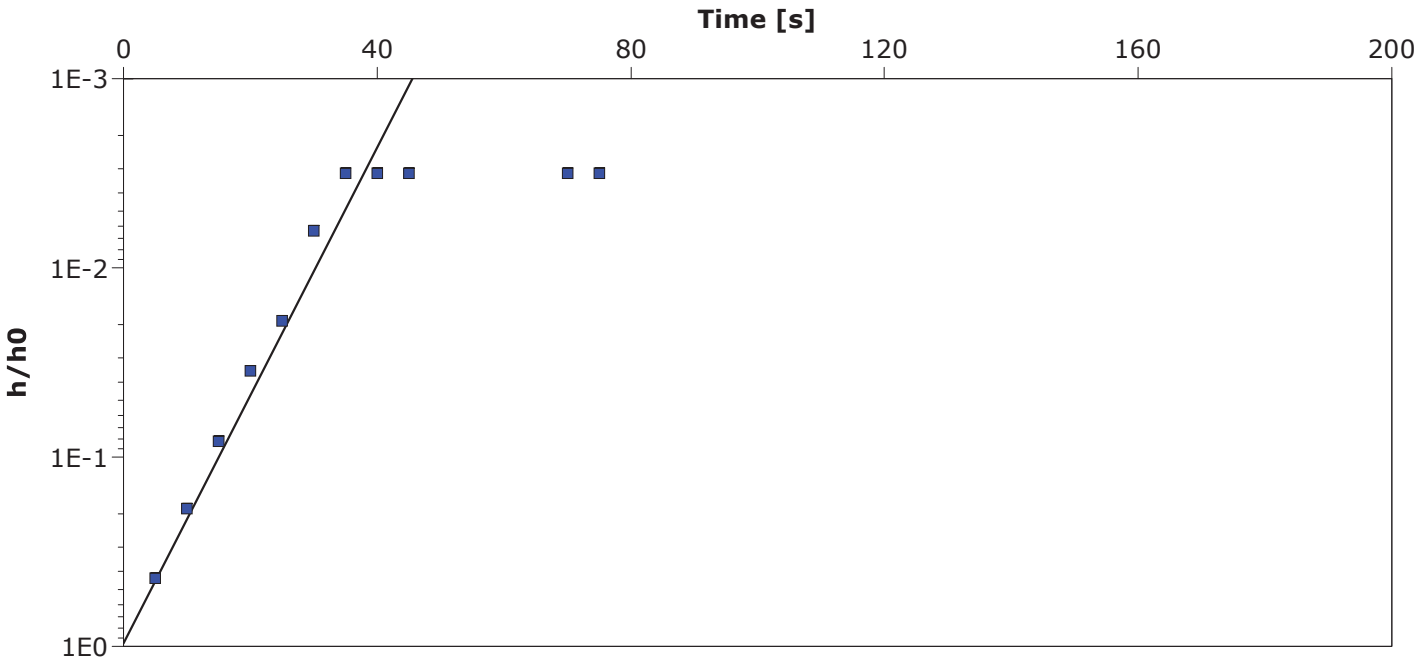
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 2 (Slug Out)	Test Well: BH204
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M. Francis	Slug 2 Out	Analysis Date: 10/17/19
Aquifer Thickness: 2.44 m		

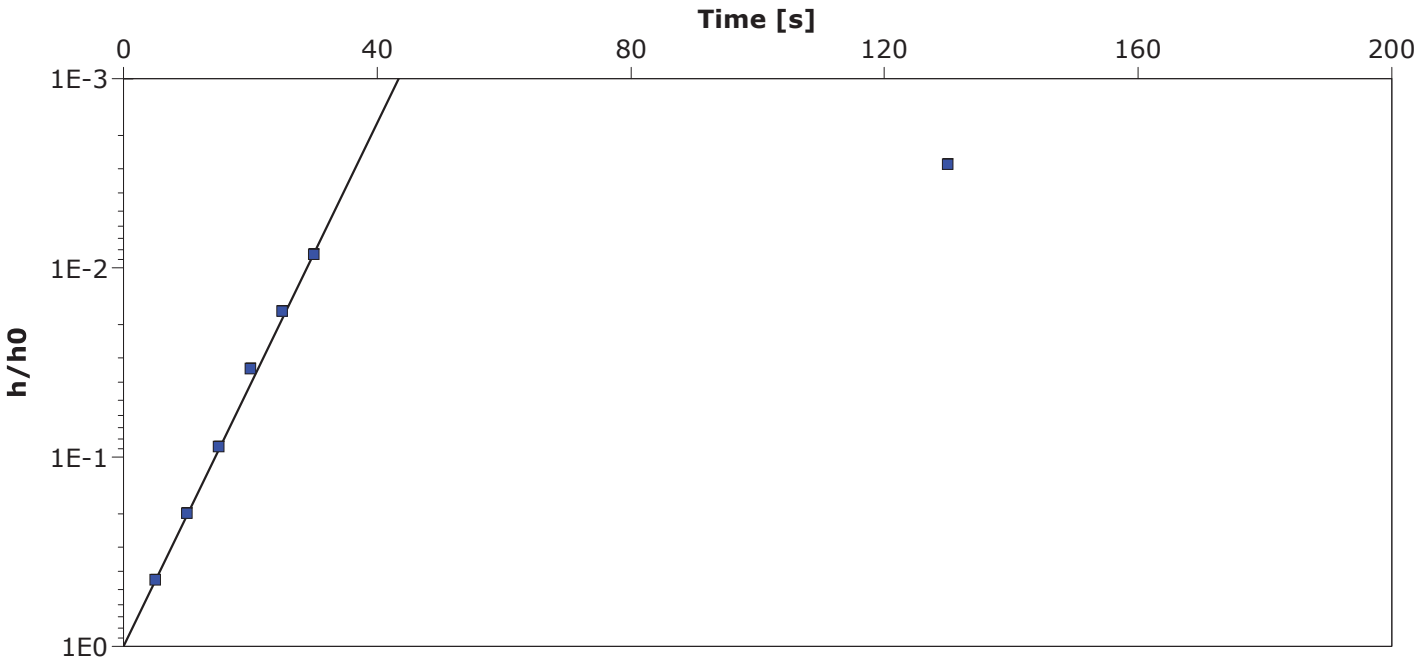


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH204	2.67×10^{-4}	

Cambium Inc. 52 Hunter St. East Peterborough, Ontatio, Canada K9H 1G5	**Slug Test Analysis Report**
	Project: Hydrogeological Assessment
	Number: 9326-002
	Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 3 (Slug Out)	Test Well: BH204
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M. Francis	Slug 3 Out	Analysis Date: 10/17/19
Aquifer Thickness: 2.44 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH204	2.82×10^{-4}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

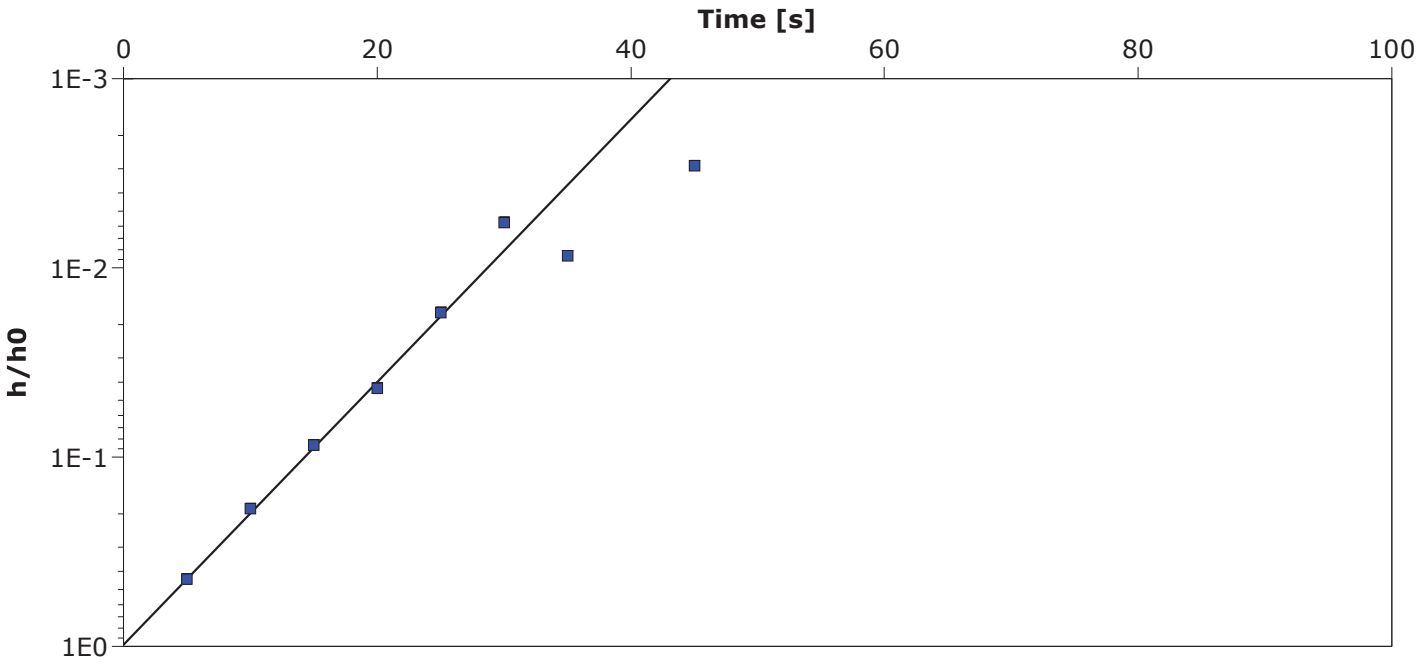
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 4 (Slug Out)	Test Well: BH204
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M. Francis	Slug 4 Out	Analysis Date: 10/17/19
Aquifer Thickness: 2.44 m		

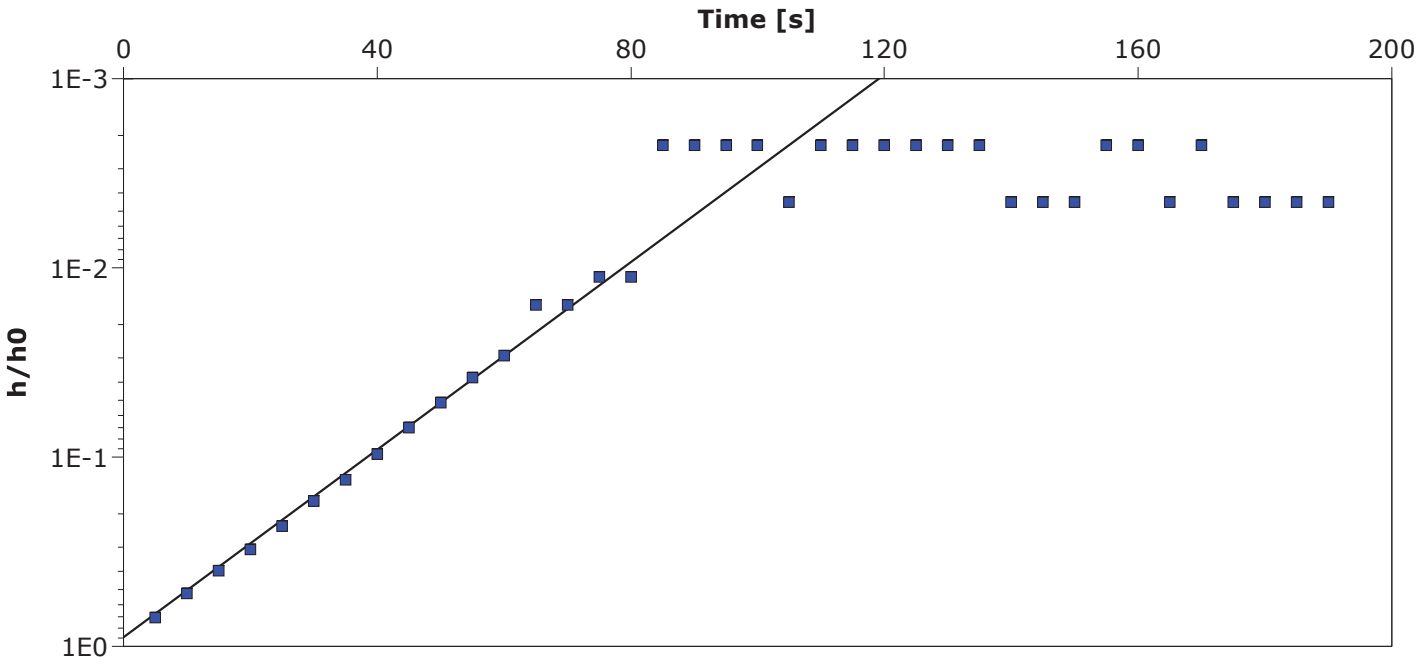


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH204	2.83×10^{-4}	

Cambium Inc. **52 Hunter St. East** **Peterborough, Ontatio, Canada** **K9H 1G5**	**Slug Test Analysis Report**	
	Project: Hydrogeological Assessment	
	Number: 9326-002	
	Client: Chayell Hotels	

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 1 (Slug Out)	Test Well: BH207
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M. Francis	Slug Out 1	Analysis Date: 10/18/19
Aquifer Thickness: 1.55 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH207	1.01×10^{-4}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

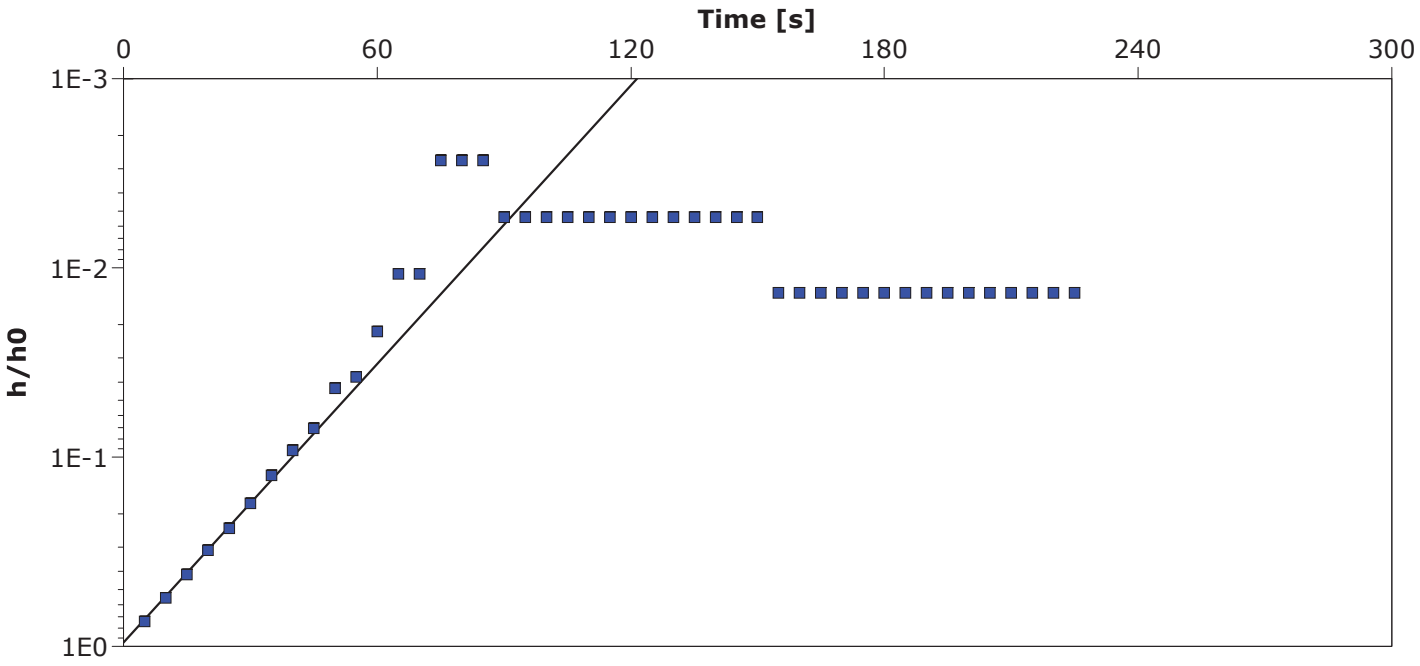
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 2 (Slug Out)	Test Well: BH207
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: M. Francis	Slug Out 2	Analysis Date: 10/18/19
Aquifer Thickness: 1.55 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH207	1.00×10^{-4}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

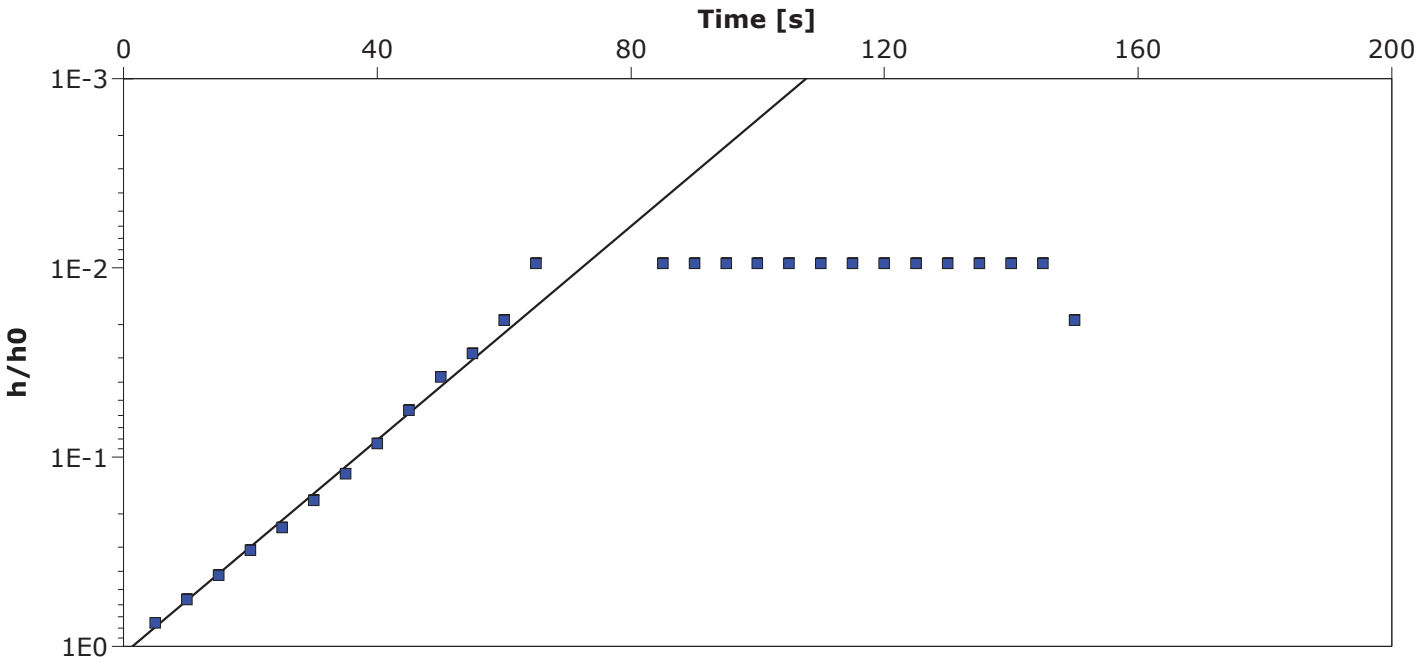
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 3 (Slug Out)	Test Well: BH207
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: C. MacDougall	Slug Out 3	Analysis Date: 10/18/19
Aquifer Thickness: 1.55 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH207	1.15×10^{-4}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontatio, Canada
K9H 1G5

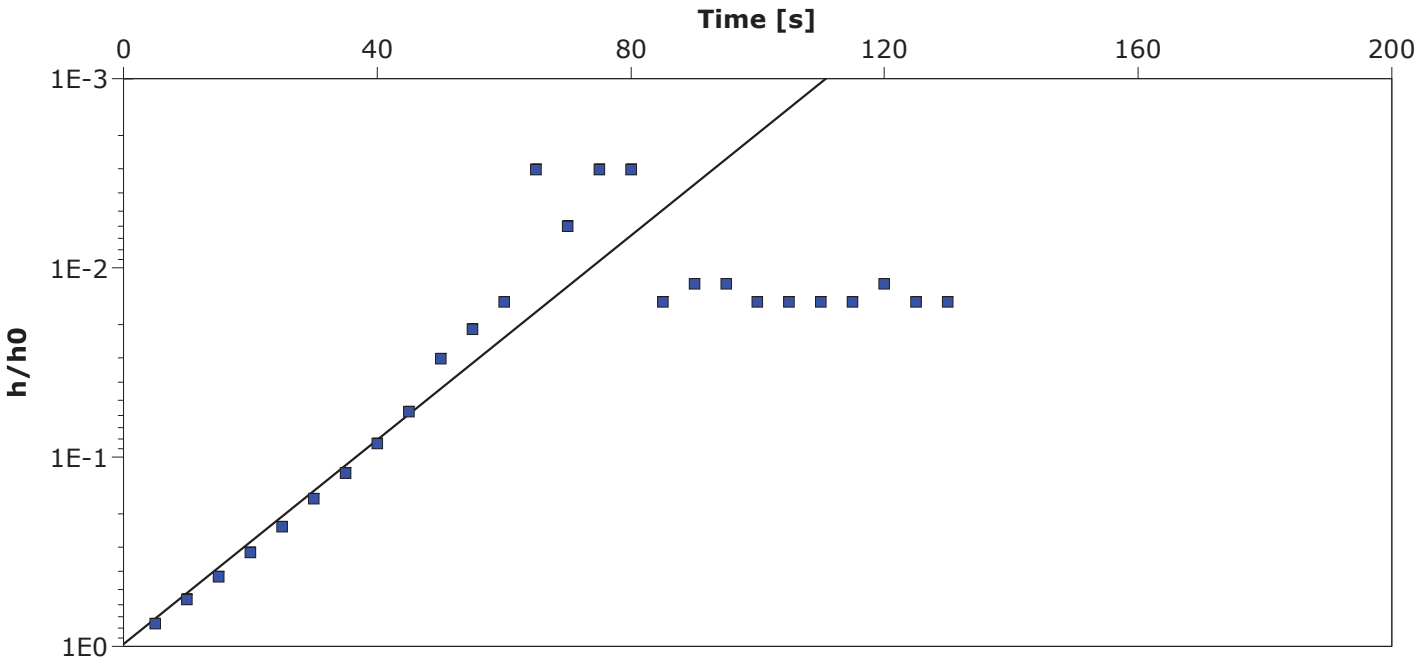
Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 9326-002

Client: Chayell Hotels

Location: 220 Bradford Street, Barrie, ON	Slug Test: Slug Test 4 (Slug Out)	Test Well: BH207
Test Conducted by: Chris M.		Test Date: 10/02/19
Analysis Performed by: C. MacDougall	Slug Out 4	Analysis Date: 10/18/19
Aquifer Thickness: 1.55 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH207	1.10×10^{-4}	

Appendix E
Certificates of Analysis

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	1	Kingston	US	08-Oct-19	A-CN-001 (k)	SM 4500CN
Anions	1	Holly Lane	VK	08-Oct-19	A-IC-01 (o)	SM4110C
Anions	1	Holly Lane	VK	09-Oct-19	A-IC-01 (o)	SM4110C
pH	1	Holly Lane	SYL	07-Oct-19	A-PH-01 (o)	SM 4500H
Sulphide	1	Kingston	TK	07-Oct-19	A-S2	SM4500-S2
A - Wet Chem	1	Kingston	KD	07-Oct-19	A-TPTKN-001 (N)(k)	E3199A.1
A - Wet Chem	1	Kingston	KD	07-Oct-19	A-TPTKN-001 (P)(k)	E3199A.1
Total Suspended Solids	1	Kingston	LSE	07-Oct-19	A-TSS-001 (k)	SM2540D
BOD	1	Kingston	JWF	07-Oct-19	C-BOD-001 (k)	SM 5210B
COD	1	Holly Lane	ST	10-Oct-19	C-COD-01 (o)	SM 5220D
Oil & Grease	1	Kingston	MLY	09-Oct-19	C-O&G-001 (k)	SM 5520
Phenolics (4-aap)	1	Kingston	TK	09-Oct-19	C-PHEN-01 (k)	MOEE 3179
Metals - ICP-OES	2	Holly Lane	AHM	16-Oct-19	D-ICP-01 (o)	SM 3120
Metals-ICP-MS	2	Holly Lane	JGC	16-Oct-19	D-ICPMS Dissolved 7800	EPA 200.8

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

Steve Garrett
Director of Laboratory Services

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

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

	Client I.D.		BH 204	BH 204 - Filtered Metals			Barrie Sanitary	
							Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Sample I.D.		B19-31789-1	B19-31789-2				
	Date Collected		02-Oct-19	02-Oct-19				
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.71				9.5	9.5
BOD(5 day)	mg/L	3	< 3				300	15
COD	mg/L	5	81				600	
Total Kjeldahl Nitrogen	mg/L	0.1	1.3				100	
Total Suspended Solids	mg/L	3	**51000**				350	15
Oil and Grease-Mineral	mg/L	1.0	< 1.0				15	
Oil and Grease-Anim/Veg.	mg/L	1.0	< 1.0				150	
Phosphorus-Total	mg/L	0.01	5.20				10	
Chloride	mg/L	0.5	360				1500	
Fluoride	mg/L	0.1	< 0.1				10	
Sulphate	mg/L	1	33				1500	
Sulphide	mg/L	0.01	< 0.1 [1]				1.0	
Cyanide (Total)	mg/L	0.005	< 0.005				1.2	
Aluminum (total)	mg/L	0.01	18.9	1.91			50	
Bismuth	mg/L	0.02	< 0.02	< 0.02			5.0	
Gold	mg/L	0.0007	< 0.0007	< 0.0007			5.0	
Iron	mg/L	0.005	36.5	3.93			50	
Manganese (Total)	mg/L	0.001	1.97	0.446			5.0	
Phenolics	mg/L	0.002	< 0.002				0.1	
Platinum	mg/L	0.00004	< 0.00004	< 0.00004			5.0	
Rhodium	mg/L	0.00002	< 0.00002	< 0.00002			5.0	
Tin	mg/L	0.05	< 0.05	< 0.05			5.0	
Titanium	mg/L	0.005	0.846	0.129				

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

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

Steve Garrett
Director of Laboratory Services

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

	Client I.D.		BH 204	BH 204 - Filtered Metals			Barrie Sanitary	
							Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Sample I.D.		B19-31789-1	B19-31789-2				
	Date Collected		02-Oct-19	02-Oct-19				
Parameter	**Units**	**R.L.**						
Zirconium	mg/L	0.003	0.004	< 0.003				

1 . Elevated detection limit due to dilution

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

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

Steve Garrett
Director of Laboratory Services

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

Summary of Exceedances

Sanitary/Combined Sewer Guidelines

BH 204	Found Value	Limit
Total Suspended Solids (mg/L)	51000	350

Storm Sewer Guidelines

BH 204	Found Value	Limit
Total Suspended Solids (mg/L)	51000	15

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

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

Steve Garrett
Director of Laboratory Services

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
OC Pesticides	1	Kingston	CS	10-Oct-19	C-PESTCL-01 K	EPA 8080
VOC's	1	Richmond Hill	JE	07-Oct-19	C-VOC-02 (rh)	EPA 8260

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

Steve Garrett
Director of Laboratory Services

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

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

	Client I.D. / Sample I.D. / Date Collected		BH 204 B19-31789-1 02-Oct-19				Barrie Sanitary	
							Barrie-Sanitary/Combined	Barrie-Storm Sewer
Parameter	**Units**	**R.L.**						
Dichloromethane (Methylene Chloride)	mg/L	0.005	< 0.005				0.09	
Aldrin	µg/L	0.01	< 0.01					
Chlordane (alpha)	µg/L	0.05	< 0.05					
Chlordane (Gamma)	µg/L	0.05	< 0.05					
Chlordane Total (alpha+gamma)	µg/L	0.05	< 0.05					
DDD, 2,4-	µg/L	0.05	< 0.05					
DDD, 4,4-	µg/L	0.05	< 0.05					
DDD Total Water	µg/L	0.05	< 0.05					
DDE, 2,4-	µg/L	0.01	< 0.01					
DDE, 4,4-	µg/L	0.01	< 0.01					
DDE Total water	µg/L	0.01	< 0.01					
DDT, 2,4-	µg/L	0.05	< 0.05					
DDT, 4,4-	µg/L	0.05	< 0.05					
DDT Total water	µg/L	0.05	< 0.05					
Dieldrin	µg/L	0.05	< 0.05					
Lindane (Hexachlorocyclohexane, Gamma)	µg/L	0.01	< 0.01					
Endosulfan I	µg/L	0.05	< 0.05					
Endosulfan II	µg/L	0.05	< 0.05					
Endosulfan I/II	µg/L	0.05	< 0.05					
Endrin	µg/L	0.05	< 0.05					

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

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

Steve Garrett
Director of Laboratory Services

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

	Client I.D. / Sample I.D. / Date Collected		BH 204 B19-31789-1 02-Oct-19				Barrie Sanitary	
							Barrie-Sanitary/Combined	Barrie-Storm Sewer
Parameter	**Units**	**R.L.**						
Heptachlor	µg/L	0.01	< 0.01					
Heptachlor Epoxide	µg/L	0.01	< 0.01					
Hexachlorobenzene	µg/L	0.01	**< 0.01**				0.0001	
Hexachlorobutadiene	µg/L	0.01	< 0.01					
Hexachloroethane	µg/L	0.02	< 0.02					
Methoxychlor	µg/L	0.05	< 0.05					

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

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

Steve Garrett
Director of Laboratory Services

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85468 **REPORT No. B19-31789 (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: 03-Oct-19
DATE REPORTED: 16-Oct-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 9326-002
WATERWORKS NO.

Summary of Exceedances

Sanitary/Combined Sewer Guidelines		
BH 204	Found Value	Limit
Hexachlorobenzene (µg/L)	< 0.01	0.0001

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

Steve Garrett
Director of Laboratory Services

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

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

TESTING REQUIREMENTS

- [ ] O.Reg 153 — Table ____ — [ ] Medium/Fine — [ ] Coarse — [ ] MISA Guidelines
- [ ] RPI — [ ] ICC — [ ] Agricultural (O.Reg 153) — [ ] O.Reg 558 Leachate Analysis
- [ ] Yes — [ ] No — Record of Site Condition (O.Reg 153) — Disposal Site: ____
- [ ] Provincial Water Quality Objectives — [ ] Landfill Monitoring
- [x] Sewer Use By-Law: City of Barrie — [ ] Other: ____

REPORT NUMBER (Lab Use): B19-31789

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? [ ] Yes [x] No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Indicate Laboratory Samples are submitted to: [ ] Kingston [ ] Ottawa [ ] Richmond Hill [ ] Windsor [x] Barrie [ ] London

Organization: Cambium Inc.	Address and Invoicing Address (if different): Cambium Inc. 74 Cedar Pointe Drive, Unit 1009 Barrie, Ontario L4N 5R7	
Contact: Cameron MacDougall		
Tel: 705-742-7400 ext. 212		
Fax:	Quote No.: P190925_CM	Project Name: 9326-002 220 Bradford Street
Email: Cameron.macdougall@cambium-inc.com	P.O. No.:	Additional Info:

ANALYSES REQUESTED (Print Test in Boxes)

See attached Quote | Metals (Filtered) | Suspected Highly Contaminated

TURNAROUND SERVICE REQUESTED (see back page)

- [ ] Platinum — 200% Surcharge
- [ ] Gold — 100% Surcharge
- [ ] Silver — 50% Surcharge
- [ ] Bronze — 25% Surcharge
- [x] 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

Lab No:	Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	Indicate Test For Each Sample By Using A Check Mark In The Box Provided	✓	Field pH	Field Temp.	# Bottles/ Sample	Field Filtered(Y/N)
	BH 204		GW	19-10-02	15:00	✓*				12	N
	BH 204 "Filtered Metals Bottle"		GW	19-10-02	15:47	✓				1	Y
	*extra Hg bottle submitted. Sent to Ottawa. SC										
	Vials→RH										
	gen chem, nut, mercury,	metals (#1 & #2)	→O								
	gen chem, nut, 1L Amber	(x2), Sulphides, cyanide →~~RH~~									

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	Chris Malliaros	Chris Malliaros
Sign:	C. Malliaros	C. Malliaros
	19-10-02	19-10-03
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:

SHIPPING INFORMATION

- [ ] Client's Courier
- [ ] Caduceon's Courier
- [x] Drop Off
- [ ] Caduceon (Pick-up)

Invoice [ ] — # of Pieces

REPORTING / INVOICING

- [ ] Report by Fax
- [x] Report by Email
- [x] Invoice by Email
- [ ] Invoice by Mail

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Received By (print): S. Teal — Signature: [signature]
Date Received (yy-mm-dd): 19/10/03 — Time Received: 16:15
Laboratory Prepared Bottles: [✓] Yes [ ] No
Sample Temperature °C: 12.7 — Labeled by: BS

Comments: * Two sets of metals - One is total (unfiltered) and a second bottle is filtered. Please analyze both. Filtered metals should be the same metals suite as outlined in quote P190925_CM

Page ____ of ____

G 85468

White: Lab Copy / Yellow: Invoicing Copy / Pink: Client Copy

Appendix F
S. 59 Screening Form

Clean Water Act - S.59 Screening Form

The information on this form will help the City of Barrie determine if a development or building application is subject to any policies under the South Georgian Bay Lake Simcoe Source Protection Plan. After reviewing your completed form, we will issue a Section 59 Notice to Proceed or a letter outlining any additional requirements.

PERMIT APPLICATION NUMBER: _____

ADDRESS TO WHICH PERMIT APPLIES: 220 Bradford Street

BUSINESS / TENANT / PROPERTY OWNER INFORMATION (the Notice must be issued to the business, tenant or property owner; please ensure this section is completed)

Mataj Architects Inc.	Eva Mataj
Name of Business	Name of Business Owner
Telephone	Email (include to have notice emailed)

Mailing Address

APPLICANT INFORMATION (if different from above)

Name of Business	Name of Business Owner
Telephone	Email (include to have notice emailed)

Mailing Address

TYPE OF APPLICATION (CHECK ALL THAT APPLY)

☐	Building Permit	☐	Minor Variance
☐	Consent/Severance	☐	Site Plan Approval
☐	Zone Change	☑	Condominium
☐	Subdivision	☐	Official Plan Amendment

CURRENT AND PROPOSED PROPERTY USE

Is the property used for any commercial activities (including home businesses)?	☐	Yes	☑	No
Is the property zoned for residential use?	☐	Yes	☑	No
Are there any active or inactive private water production wells on the property?	☐	Yes	☑	No
Are there any monitoring wells or boreholes on the property?	☑	Yes	☐	No
Are there any active or inactive geothermal systems on the property?	☐	Yes	☑	No

Clean Water Act - S.59 Screening Form

Provide a brief description of the proposed work:

Construction of a 14 storey condominium building. Parking will be above ground.

Provide a brief description of the type of business, manufacturing processes, or service activities that are proposed to occur at this property:

Residential

CURRENT OR PROPOSED ACTIVITIES ON THE PROPERTY

Please check all activities that are currently occurring or proposed to occur on the property as part of regular site operations.

Fuel Handling and Storage

- ☐ Liquid Fuel Storage (gasoline, diesel, etc.)
  Indicate maximum quantity: _____
- ☐ Fuel Oil Storage, including home heating oil (or waste oil if used as a fuel)
  Indicate maximum quantity: _____

Chemical Handling and Storage

Please check any chemical products that will be used, stored, or sold in ANY quantity.

- ☐ Paints and other coatings (stains, enamels, lacquers, rust paint, sealants, etc.)
- ☐ Solvent-based degreasers or metal parts washing liquids
- ☐ Dry cleaning chemicals
- ☐ Furniture strippers
- ☐ Liquid adhesives (solvent cement, craft adhesive, industrial adhesives, etc.)
- ☐ Organic or chlorinated solvents
- ☐ Vinyl chloride monomer
- ☐ Other (please list) _____

Clean Water Act - S.59 Screening Form

Winter Maintenance

- ☐ Road salt applied to parking areas, driveways, or walkways
- ☐ Road salt stored indoors
- ☐ Road salt stored outdoors
- ☐ Road salt stored in quantities greater than 5 tonnes
- ☐ Snow storage area with a footprint larger than 0.01 hectares (10m x 10m or 33ft x 33ft)

Waste Management

- ☐ Waste Oil Storage (used motor oil, hydraulic oil, machine oil, cutting oil, etc.)
- ☐ Used Coolant/Antifreeze
- ☐ Other Hazardous or Liquid Industrial Wastes

Please list: _____

Nutrients and Pesticides

- ☐ Application of Agricultural Source Material (ASM) to Land (e.g. manure)
- ☐ Application of Non-Agricultural Source Material (NASM) to Land (e.g. biosolids)
- ☐ Storage of ASM or NASM
- ☐ Storage of Commercial Fertilizer

Indicate maximum quantity: _____

- ☐ Storage of Pesticides

Indicate maximum quantity: _____

SIGNATURE OF APPLICANT

Please sign below to certify that the information provided above is accurate and complete to the best of your knowledge. Understand that incomplete or inaccurate information may result in future involvement of the Risk Management Official to ensure compliance with applicable Provincial legislation.

Signature of Applicant	Date

Please submit this form to the Risk Management Official via SourceWater@barrie.ca, in person to the sixth floor of City Hall, or fax a copy to (705) 739-4247. For further information, call the Risk Management Official at (705) 739-4220 ext. 4796.

Appendix G
Dewatering Estimates

Construction Excavation Dewatering

Scenario	Depth (mbgs)	Equivalent Radius (m)	Static Level (m)	Dewatered level (m)	Aquifer Thickness (m)	Drawdown (m)	Conductivity (K) (m/s)	Length to Zero Drawdown (R_0) (m)	(H^2-h^2) (m)	Est. Inflow (L/min)	Est. Inflow (m^3/day)
High Hydraulic Conductivity	1.5	35	1	2	3	1	2.83E-04	201	3.00	91.62	132
Low Hydraulic Conductivity	1.5	35	1	2	3	1	7.72E-05	121	3.00	35.06	50

ln(Ro/rw) (high)	1.75
ln(Ro/rw) (low)	1.24
Hydraulic Conductivity (m/s) (high)	2.83E-04
Hydraulic Conductivity (m/s) (low)	7.72E-05

Length to Zero Drawdown	3000*((DRAWDOWN)/0.3048)*(HYDRAULIC CONDUCTIVITY^0.5)
(H^2-h^2)	((AQUIFER THICKNESS-STATIC LEVEL)^2)-((AQUIFER THICKNESS-DEWATERED LEVEL)^2)
Estimated Inflow	((K(H^2-h^2))/(5.31E-6(ln(R_0/Equivalent Radius)))

Appendix H
Water Balance Information

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_N	PROVINCE	LATITUDE	LONGITUDI	ELEVATION	CLIMATE_I	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 Maxir	-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 (mı	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 Da	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 Da	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 Da	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 °(	0	0	0	0	0.1	2.5	8.3	4.2	0.4	0	0	0	15.5	C
Above 18 °(	0	0	0	0.8	8	45.5	95.8	71.4	19.6	1	0	0	242	C
Above 15 °(	0	0	0	3.4	25.6	103.1	180.5	149.2	56.1	5.1	0	0	523	C
Above 10 °(	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 °(	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 °(	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 °(	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

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	Vegetated Areas	Impervious surfaces
Area (m²)	1,358	2,197
Pervious Area (m²)	1,358	0
Impervious Area (m²)	0	2,197
Infiltration Factors		
Topography	0.10	0.00
Soil	0.40	0.00
Land Cover	0.20	0.00
Infiltration Factor	0.70	0.00
Run-Off Coefficient	0.30	1.00
Inputs		
Precipitation (mm/year)	933	933
Outputs (per Unit Area)		
Evapotranspiration (mm/year)	557	0
Evaporation (mm/year)(assumed to be 10% of Precipitation if evapotranspiration does not occur)	-	93
Precipitation Surplus (mm/year)	376	840
Infiltration (mm/year)	263	0
Rooftop Infiltration (mm/year)	0	0
Total Infiltration (mm/year)	263	0
Runoff Pervious Area (mm/year)	113	0
Runoff Impervious Areas (mm/year)	0	840
Total Outputs (mm/year)	933	933
Difference (Inputs-Outputs)	0	0
Inputs (Volumes)		
Precipitation (m³/year)	1,267	2,050
Total Inputs (m³/year)	1,267	2,050
Outputs (Volumes)		
Evapotranspiration (m³/year)	756	0
Evaporation (m³/year)	-	205
Precipitation Surplus (m³/year)	511	1845
Infiltration (m³/year)	357	0
Rooftop Infiltration (m³/year)	0	0
Total Infiltration (m³/year)	**357**	**0**
Runoff Pervious Area (m³/year)	153	0
Runoff Impervious Areas (m³/year)	0	1845
Runoff To Storm Sewer (m³/year)	*0*	*0*
Total Runoff (m³/year)	**153**	**1845**
Total Outputs (m³/year)	1267	2050
Difference (Inputs-Outputs)	0	0

Total Infiltration (QI)	**357**
Total Runoff (QR)	**1998**
Sum of QI and QR	**2355**

Post-Development Water Balance

Catchment Designation	Landscape Areas	Roof Areas	Balconies	Paved Surfaces
Area (m²)	1,027	1,642	271	430
Pervious Area (m²)	1,027	0	0	0
Impervious Area (m²)	0	1,642	271	430
Infiltration Factors				
Topography	0.10	0.00	0.00	0.00
Soil	0.40	0.00	0.00	0.00
Land Cover	0.20	0.00	0.00	0.00
Infiltration Factor	0.70	0.00	0.00	0.00
Run-Off Coefficient	0.30	1.00	1.00	1.00
Inputs				
Precipitation (mm/year)	933	933	933	933
Outputs (per Unit Area)				
Evapotranspiration (mm/year)	557	0	0	0
Evaporation (mm/year)(assumed to be 10% of Precipitation if evapotranspiration does not occur)	0	93	93	93
Precipitation Surplus (mm/year)	376	840	840	840
Infiltration (mm/year)	263	0	0	0
Rooftop Infiltration (mm/year)	0	0	0	0
Total Infiltration (mm/year)	263	0	0	0
Runoff Pervious Area (mm/year)	113	0	0	0
Runoff Impervious Areas (mm/year)	0	840	840	840
Total Outputs (mm/year)	933	933	933	933
Difference (Inputs-Outputs)	0	0	0	0
Inputs (Volumes)				
Precipitation (m³/year)	958	1,532	253	401
Total Inputs (m³/year)	958	1,532	253	401
Outputs (Volumes)				
Evapotranspiration (m³/year)	572	0	0	0
Evaporation (m³/year)	0	153	25	40
Precipitation Surplus (m³/year)	386	1,379	228	361
Infiltration (m³/year)	270	0	0	0
Rooftop Infiltration (m³/year)	0	0	0	0
Total Infiltration (m³/year)	**270**	**0**	**0**	**0**
Runoff Pervious Area (m³/year)	116	0	0	0
Runoff Impervious Areas (m³/year)	0	1,379	228	361
Runoff To Storm Sewer (m³/year)	0	0	0	0
Total Runoff (m³/year)	**116**	**1,379**	**228**	**361**
Total Outputs (m³/year)	958	1,532	253	401
Differece (Inputs-Outputs)	0	0	0	0

Total Infiltration (QI)	**270**
Total Runoff (QR)	**1856**
Sum of QI and QR	**2126**