

HYDROGEOLOGICAL ASSESSMENT

PREPARED FOR:
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Toronto, Ontario

ATTENTION:
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338 Maplevue Dr | Barrie, Ontario

Grounded Engineering Inc.
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1 Introduction

1.1 Background

Loon Avenue Lands OP Inc. retained Grounded Engineering Inc., to complete a Hydrogeological Assessment for the property located at the municipal address of 338 Mapleview Dr E., Barrie, Ontario (the Subject Lands). The Subject Lands are comprised of what will be referred to as the Development Limit and the Conservation Lands. The Development Limit is the portion that is being developed within the Subject Lands outside of the future Environmental Protection Zone. The Conservation Lands are both the Edge Management Zone and the Wetland Buffer within the Development Limit of the Subject Lands. The site location is presented in Figure 1A. The Subject Lands and Development Limit are presented in Figure 1B.

The proposed project ("the Community") includes constructing thirteen (13) new townhome blocks consisting of the following:

- Existing site grades of the Development Limit slope from northwest to southeast. Existing ground elevations range from Elev. 245.5± masl on the west side of the Development Limit to Elev. 242.6± masl on the east side. Grade cuts and raises are proposed.
- Blocks 1 through 13, each consisting of a number of 3-4-storey back-to-back and conventional townhomes with one underground level (basements or lower level walkouts) are proposed. Block details, including the assumed lowest Basement Finished Floor Elevation (BFFE), are summarized below.
- Associated surface parking, private roads and site services are proposed.
- General ground floor FFEs were provided by Counterpoint Engineering Inc. per Block.
- Lowest underground Basement Finished Floor Elevations BFFEs were assumed at 2.75m below the provided ground floor FFEs, as advised by the client.

Block	Unit Type	Number of Units	Number of Storeys	Lowest BFFE (m)
1	Back-to-back Townhomes	Twelve (12)	Three (3)	244.5
2	Back-to-back Townhomes	Sixteen (16)	Three (3)	244.3
3	Back-to-back Townhomes	Sixteen (16)	Three (3)	244.0
4	Back-to-back Townhomes	Eight (8)	Three (3)	243.8
5	Townhomes with walkouts	Eight (8)	Three (3)	243.5
6	Townhomes with walkouts	Eight (8)	Three (3)	243.5
7	Townhome with walkouts	Ten (10)	Three (3)	243.5
8	Townhomes with walkouts	Three (3)	Three (3)	243.5
9	Townhomes with walkouts	Seven (7)	Three (3)	243.5



Block	Unit Type	Number of Units	Number of Storeys	Lowest BFFE (m)
10	Townhomes with walkouts	Two (2)	Three (3)	243.8
11	Townhomes with walkouts	Five (5)	Three (3)	244.0
12	Townhomes with walkouts	Three (3)	Three (3)	244.3
13	Townhomes with walkouts	Seven (3)	Three (3)	244.5

The hydrogeological assessment has been prepared for the purpose of an Official Plan and Zoning Bylaw Amendment application as per the requirement of the Lake Simcoe Region Conservation Authority (LSRCA) and other municipal approval authorities having jurisdiction. The survey plan is provided in Appendix A. The hydrogeological assessment was undertaken to evaluate hydrogeological conditions of the proposed development on the Development Limit and to develop a plan to manage risk of potential impacts associated with activities related to the proposed land use.

1.2 Scope of Work

A summary of the scope of work is provided below:

- Background Information Review: Review of available background geologic and hydrogeological information for the Subject Lands and surrounding areas. This included a review of the Ministry of the Environment, Conservation and Parks (MECP) well records, watershed information by the Lake Simcoe Region Conservation Authority (LSRCA), and results of previous studies and subsurface investigations on neighbouring properties.
- Private Well Survey: A door-to-door well survey was conducted for properties within 500 m of the Subject Lands.
- Groundwater Level Monitoring: Groundwater level monitoring was conducted in order to assess the groundwater flow conditions. The groundwater in the monitoring wells will be monitored for a period of one (1) year to determine seasonally high groundwater levels.
- Hydraulic Conductivity Test: In-situ hydraulic conductivity tests were conducted in select monitoring wells to assess hydraulic conductivity of the strata. The underlying soils were assessed in order to determine potential dewatering requirements.
- Infiltration Tests: In-situ infiltration tests were conducted using a Guelph Permeameter in select areas across the site to assess the infiltration/percolation rates of the strata. The underlying soils were assessed in order to determine the feasibility of any Low Impact Development (LID) measures.
- Water Balance: A water balance and assessment of infiltration rates for existing (pre-development) and post development conditions was completed to determine the feasibility of the proposed development.



2 Site Information

2.1 Site Location and Description

The Subject Lands are L-shaped, with a total area of 11.91 ha. The Development Limit is irregular in shape, with a total area of approximately 2.56 ha. The Development Limit is currently undeveloped. An evaluated wetland, and a regulated woodlot are adjacent to the south of the Development Limit. Lovers Creek is located 174 m to the east of the Subject Lands. It is understood that the Development Limit will be developed with residential townhome buildings with associated internal roads and servicing. The proposed project includes constructing new townhome blocks (Block 1 through 13) consisting of a number of 3-storey back-to-back and conventional townhomes, with basements and walk outs. The general site feature (current and proposed) is presented in Figures 2A and 3.

The townhomes will be serviced with municipal piped water and sewer supply. The surrounding area is currently provided with municipal piped water and sewer supply. The surrounding properties are predominantly residential and commercial. There is, however, agricultural land use in the south portion of the study area, south of Mapleview Dr E.

The Subject Lands information is provided below:

Municipal Address	338 Mapleview Dr E
Area	Subject Lands - 11.91 ha Development Limit – 2.56 ha
Legal Description	Part S1/2 Lot 11, Concession 12, Innisfil as Pt 1, 51 R4733 except Part 1, Expro. Plan SC944619
UTM Coordinates	E: 606838, N: 4911357 (UTM 17T)
Current Land Use	Undeveloped
Property Owner Information	Loon Avenue Lands BT Inc.
Person who has engaged the Qualified Person to conduct the assessment	Colleen Forrest

2.2 Topography & Drainage

The Ministry of Natural Resources and Forestry (MNR) and Ministry of Energy, Northern Development and Mines (MENDM) database were searched to obtain topographic and geological maps of Ontario for review. The maps are provided in Appendix B and the information obtained are summarized below:



Records	Information
Topographic Maps	The approximate elevation of the Development Limit ranges from 245.3 masl on the west side of the Development Limit to 242.6 masl on the east side. The Development Limit is sloping towards the south-southeast.
Hydrology	The nearest water body, Lovers Creek is approximately 174 m to the east of the Subject Lands, locally groundwater and surface water are expected to flow to the east towards Lover's Creek which ultimately drains into Kempenfelt Bay, a western arm of Lake Simcoe.
Run Off	It is expected that the majority of storm water run-off will follow site topography and flow to the east towards the adjacent wetland and Lovers Creek, which ultimately drains into Kempenfelt Bay, a western arm of Lake Simcoe.

2.3 Regional Physiography

From a regional perspective, the Subject Lands are situated within a physiographic feature known as the Till Plains characterized by coarse-textured glaciolacustrine deposits consisting of sand, gravel, minor silt and clay.

The Subject Lands are situated within the Lake Simcoe and Couchiching/Black River Source Protection Area and more specifically within the Lovers Creek Sub watershed which covers an area of approximately 59.9 km². The sub watershed has a total watercourse length (including all branches) of 93.1 km which drain into Kempenfelt Bay, a western arm of Lake Simcoe located approximately 3 km northeast of the Subject Lands, which is approximately 37.8 km² in size.

The watershed maps are presented in Appendix C.

2.4 Regional Geology and Soils

Based on the published information, the regional geology is described as below.

Records	Information
Geological Maps	Overburden: - The overburden consists primarily of undisturbed glacial till deposits. Bedrock: - Limestone, dolostone, shale, arkose; sandstone of the Ottawa Group; Simcoe Group; Shadow Lake Formation Depth to Bedrock: - Approximately 100 mbgs

It should be noted that the subsurface soil and rock conditions described above represent generalized conditions only and should not be considered site specific. The information is presented in Appendix E.



2.5 Regional Hydrogeology

The Lake Simcoe Region Conservation Authority (LSRCA) has summarized the regional hydrogeologic conditions present within the Barrie Creeks Sub-watershed in the Barrie Creeks, Lovers Creek, and Hewitt's Creek Sub-Watershed Plan (LSRCA, 2012). As per LSRCA (2012), there are four (4) regionally extensive overburden confined aquifers within the sub-watershed (A1-A4). The regional stratigraphy also includes an upper confining layer, three (3) lower confining layers (C1-C3).

Based on the information, the below significant hydrostratigraphic units were defined in the vicinity of the Subject Lands.

Upper Confining Layer - UC (Aquitard):

The upper confining layer is comprised of coarse-grained lacustrine deposits which are part of a regionally extensive sand plain extending west from the City of Barrie to the Town of Angus.

Aquifer 1 – A1 (Aquifer):

The A1 Aquifer is composed of fine to medium grained sand with occasional occurrences of gravel. The A1 aquifer is commonly associated with upland areas. Detailed logging of this unit in the northwest part of the City of Barrie indicates that the A1 aquifer consists of a number of coarsening upward sequences of lacustrine sand with only minor occurrences of silt (LSRCA 2012).

Confining Layer 1 – C1 (Aquitard):

The C1 layer has been cored within the City of Barrie and is described as varved clay and silt.

Aquifer 2 – A2 (Aquifer):

The A2 aquifer is found in the elevation range of approximately 175 to 230 masl within lowland areas but the stratigraphic equivalent extends up to approximately 250 masl to the northeast, under the Oro Moraine. The A2 aquifer can generally be described as being composed of sand, with some clast rich portions. The aquifer is interpreted to extend under Kempenfelt Bay and to the north (towards Midhurst). The lower elevation of the aquifer in the vicinity of Kempenfelt Bay corresponds with the deeper channelized aquifer and suggests that it may represent in-filled former river channels in this area. The A2 aquifer ranges in thickness from approximately 10 to 30 m in most areas. It is regionally extensive but does pinch out in some areas. The aquifer is complex in the central core of Barrie, where it consists of inter-layered sand and silt/clay materials. The eastern part of the A2 aquifer is interpreted to be in direct contact with Kempenfelt Bay, based on the base elevation of the bay and the interpreted aquifer extents near its shores (LSRCA 2012).



2.6 Regional Climate

The Subject Lands is located in the climatic region of Southern Ontario known as the Simcoe and Kawartha Lakes region. The following general climate data was obtained from Lake Simcoe Climate Data for the Lovers Creek Sub-Watershed, dated April 2017.

Mean annual precipitation (mm/yr.)	914 mm
Mean annual evapotranspiration	545 mm
Mean annual water surplus	369 mm

The precipitation data was based on Lake Simcoe Climate Data. It is noted that the above are average values, which are representative in a regional context. There will be seasonal and annual variations in these values. However, the average values will govern long-term groundwater recharge and discharge rates. Therefore, average values are appropriate for assessment of hydrogeologic conditions at the site.

2.7 Groundwater Resources

Private well records from the MECP well record database was reviewed for wells located within 500 m radius of the Development Limit. A total of eleven (11) well records were retrieved from the well record database. The MECP well record is presented in Appendix D. A summary of the data obtained is presented in the following table.

Total Number of Wells	11
Wells completed in Overburden	11 (100%)
Bedrock	0 (0%)
Unknown	0 (0%)
Depth Ranges	
50 ft. or less	8 (73%)
51 ft. to 100 ft.	1 (9%)
101 to 200 ft.	0 (0%)
201 to 300 ft.	0 (0%)
301 to 400 ft.	2 (18%)
Unknown Depth	0 (0%)



Water Use	
Monitoring/Test Holes	7 (70%)
Commercial/Industrial	0 (0%)
Water Supply (domestic/public/livestock)	1 (9%)
Municipal (Test Hole)	2 (20%)
Unknown/Not Used/Abandoned	1 (9%)

The wells are generally used as test holes or for groundwater monitoring purposes. There was one (1) record of a well used for domestic water supply. The well records with available construction and installation data indicate that the majority of wells in the Study Area were 50 ft deep or less or greater than 300 ft.

2.8 Private Well Survey

A door-to-door water well survey within 500 m of the Development Limit was completed on March 30, 2021, to characterize the local groundwater condition. Based on the private well survey, it was concluded that no sites within a 500 m radius of the Development Limit were on private well water and previous private wells were not found. The results of this inspection are as follows:

- Fire hydrants were observed along Huronia Road to the west and Loon Avenue to the north.
- Residents within residential subdivisions were using municipally supplied water as evidenced by water curb stops in lawns and driveways.
- The one (1) domestic well identified during the MECP well record search was not located during the inspection. This well is likely not in use or has been decommissioned.
- No domestic water wells were observed at the Subject Lands or within the Study Area.

The Subject Lands are located in a developed area of the Barrie, and all properties are municipally serviced. The location of the wells identified within the MECP Well Record Search are presented in Figure 3. A cross section of the wells identified within the search are presented on Figure 4.

2.9 Subsurface Investigation

A subsurface investigation was conducted by Grounded Engineering within the Development Limit from March 29 – June 2, 2021. The field investigation is as below. Borehole logs is presented in Appendix F. The location of the boreholes is shown on Figures 2A and 2B. Cross sections are shown in Figure 7.



Boreholes	BH101 to BH105
Monitoring Wells	BH101 to BH105
Well Depth (mbgs)	5.5 to 9.1 m bgs

The stratigraphy beneath the investigated areas of the Development Limit generally consists of the following:

Geological Units	Description
Topsoil and upper sands	Boreholes 101, 102, and 105 observed native sands underlying the topsoil. The native sands extended to depths of 0.8 to 1.5 m below grade (Elev. 242.6 to 243.8 ±m). The sands contained a variable amount of silt (ranging from some silt to silty), and trace amounts of gravel, organics and rootlets. The sands generally ranged in colour from dark brown to orangey-brown, and wet.
Native Soils	Underlying the topsoil and surficial sands, the boreholes observed an undisturbed native glacial till deposit. The glacial till had a variable matrix of cohesive clayey silt to cohesionless sandy silt and silty sand, with trace amounts of gravel. This unit was encountered at 0.8 to 1.5 m below grade (Elev. 242.6 to 243.8 ±m) and extended down to targets borehole depths. All boreholes were terminated within the glacial till unit. The upper till was generally brown to grey, and moist to wet. Borehole 102 observed a cohesionless, coarse sand and gravel at a depth of 9.1 m below grade (Elev. 234.0 ±m). Trace rock fragments were observed (cobbles are inferred). The coarse sand and gravel were grey, wet, and dense.
Bedrock	Bedrock was not encountered during the investigation; however, based on available background information the bedrock consists of limestone, dolostone, shale, arkose, sandstone of the Ottawa Group; Simcoe Group; Shadow Lake Formation.

2.10 Groundwater Level Monitoring

A total of five (5) monitoring wells were installed on the Development Limit. To date, groundwater level measurements were taken between April 2021 and January 2022 as part of the hydrogeological assessment. Grounded will continue to take water levels till May 2022 i.e. 1 year to ensure seasonally high groundwater levels have been established for the Development Limit.



Well ID	Ground Elevation (masl)	Well Depth (masl)	Water Level (mbgs/masl)						
			April 1, 2021	June 7, 2021	July 25, 2021	Sept. 10, 2021	Nov. 11, 2021	Dec. 29, 2021	Jan. 28, 2022
BH101	245.3	239.2 - 236.2	1.4/ 243.9	2.0/ 243.3	1.5/ 243.8	1.9/ 243.4	1.5/ 243.8	1.2/ 244.1	1.4/ 243.9
BH102	243.1	237.0 - 234.0	0.2/ 242.9	0.5/ 242.6	0.1/ 243	0.5/ 242.6	0.2/ 242.9	-	-
BH103	243.9	238.4 - 235.3	-	1.4/ 242.5	1.1/ 242.9	1.4/ 242.6	1.1/ 242.9	0.8/ 243.1	1.1/ 242.8
BH104	242.9	236.8 - 233.7	-	1.1/ 241.9	0.4/ 242.5	0.6/ 242.3	0.3/ 242.6	0.1/ 242.8	0.4/ 242.5
BH105	243.4	237.3 - 234.3	-	1.7/ 241.7	0.7/ 242.7	0.9/ 242.5	0.6/ 242.8	0.3/ 243.1	0.6/ 242.8
<i>mbgs: meter below ground surface</i> <i>masl: meter above sea level</i> <i>- : monitoring wells not observed/accessed</i>									

Observations pertaining to the depth of the water level and casing were made in the open boreholes immediately after completion of drilling and are reported on the borehole logs. The measured water level along with other boreholes detailed are presented in Appendix F. Groundwater levels collected to date are summarized in the following table:

Groundwater levels may be influenced by climatic variations, seasonal fluctuations and presence of underground services and structures.

The groundwater table at the Development Limit ranges from approximately elev. 241.7 ± masl to elev. 244.1 ± masl. Groundwater at the Development Limit generally flows east/southeast towards Lovers Creek.

For design purposes, and to account for seasonal fluctuations in the groundwater table, the design water table is the maximum groundwater levels observed to date in order to represent the seasonally high water table within/near each of the development blocks. The following **design water table elevations** should be assumed:



Block	Relevant Monitoring Wells	Design Groundwater Table (masl)
1	BH101	244.1
2	BH101	244.1
3	BH103	243.1
4	BH102	243.0
5	BH102	243.0
6	BH104	242.8
7	BH105	243.1
8	BH105	243.1
9	BH105	243.1
10	BH103	243.1
11	BH103	243.1
12	BH101	244.1
13	BH101	244.1

2.11 Groundwater Quality

Groundwater samples were obtained from one monitoring well on-site and submitted for laboratory analysis on September 29, 2021. All the monitoring wells were screened in the overburden materials. Each sample was analyzed with respect to the City of Barrie Sewer Use bylaw. The result of the groundwater testing is presented in Appendix H and summarized below.

City of Barrie Bylaw	Exceedance
Table 1 – Storm Sewer Discharge Criteria	None
Table 2 - Sanitary Discharge Criteria	None

2.12 Hydraulic Conductivity

In-situ single well response tests (SWRT) were conducted in all five (5) of the monitoring wells (BH101 to BH105) on June 7, 2021 to assess the hydraulic conductivity of the underlying soil. The monitoring wells were installed in the clayey silt and lower sand glacial till. The tests were conducted by drawing down the water levels (rising head test).



Data from the SWRT were analyzed using Bower and Rice. The table below summarized the results of the hydraulic conductivity testing. The analysis graphs of the tests are presented in Appendix I.

Monitoring Well	Hydraulic Conductivity (m/sec)	Well Screen Strata
BH101	1.43×10^{-7} m/sec	Lower Silty Sand Glacial Till
BH102	1.42×10^{-8} m/sec	Upper Silty Sand Glacial Till
BH103	4.71×10^{-7} m/sec	Clayey Silt
BH104	3.23×10^{-8} m/sec	Lower Silty Sand Glacial Till
BH105	8.48×10^{-9} m/sec	Lower Silty Sand Glacial Till

Based on the SWRT analysis, the hydraulic conductivity of the underlying soil ranges from 1.43×10^{-7} m/sec to 8.48×10^{-9} m/sec.

According to Freeze and Cherry (1979), the typical hydraulic conductivity of the strata investigated at the Development Limit are:

- Sands to Sandy Silt: 1×10^{-6} to 1×10^{-7} m/s
- Silty Clay: 1×10^{-7} to 1×10^{-9} m/s
- Glacial Till: 1×10^{-6} to 1×10^{-12} m/s

The hydraulic conductivity field results are relatively consistent with the published values associated with the geological materials which were tested. Based on the in-situ testing, the Development Limit consisted of moderate to low permeability soils and is not considered to be significant in terms of groundwater recharge.

2.13 Surface Water Features

A site inspection was conducted to assess the presence of surface water features on and bounding the Subject Lands. The inspection included the following:

- Inspection of surface and groundwater interactions and associated features
- Inspection of areas of actual and potential groundwater discharge
- Inspection of swales and drainage courses

The site inspection was conducted on March 30, 2021, to assess the presence of any natural environmental features. The topography across the Subject Lands is variable and notable features are summarized as follows:



- The ground slopes from the north to the south-southeast
- Wetlands are present on adjacent lands to the south of the Development Limit
- Lovers Creek is approximately 174 m east of the Subject Lands

During the site visit, the ground surface was covered by significant natural vegetation including grass, trees, and shrubs. Given the sloping topography of the Subject Lands and the Development Limit, the direction of surface runoff is expected to be to the south-southeast.

2.14 Review of Current Regulatory Requirements

Current regulatory requirements associated with water supply and hydrogeology in connection with the proposed development were reviewed. This includes the review of the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan. Relevant information is provided below and presented in Appendix J.

2.14.1 Ministry of Natural Resources and Forestry

The Development Limit is not located within the Niagara Escarpment Plan Area, Oak Ridges Moraine Plan Area, the Greenbelt Protection Act Area, and Natural Heritage Area.

The Development Limit is adjacent to a woodland and Provincially Significant Evaluated Wetland.

2.14.2 Lake Simcoe Region Conservation Authority

According to the Lake Simcoe Region Conservation Authority (LSRCA) website, the Subject Lands/Development Limit is located within an LSRCA regulated area.

2.14.3 Wellhead Protection Areas and Aquifer Vulnerability

Wellhead Protection Area: The Subject Lands/Development Limit is **not** located within a Wellhead Source Protection Area.

Intake Protection Zone: The northeast corner of Subject Lands/Development Limit falls within a Zone 2 Intake Protection Area.

Significant Groundwater Recharge Area: The Subject Lands/Development Limit is **not** located in a Significant Groundwater Recharge Area.

Highly Vulnerable Aquifers: The Subject Lands/Development Limit does not fall within a highly vulnerable aquifer area.

Vulnerable Scoring Area – Groundwater: The Subject Lands/Development Limit is **not** located within a Vulnerable Groundwater Scoring Area.



Vulnerable Scoring Area – Groundwater Under Direct Influence: The Subject Lands/Development Limit is **not** located within a Vulnerable Groundwater Under Direct Influence Scoring Area.

Vulnerable Scoring Area – Surface Water: The Subject Lands/Development Limit **does not** fall within Vulnerable Surface Water Scoring Area.

3 Discussion and Analysis

3.1 Proposed Development Plan

The Development Limit is irregular in shape, with a total area of approximately 2.56 ha. The Development Limit is currently undeveloped. An evaluated wetland, and a regulated woodlot are adjacent to the south of the Development Limit. Lovers Creek is located 174 m to the east of the Subject Lands. It is understood that the Development Limit will be developed with residential townhome buildings with associated internal roads and servicing. The proposed project includes constructing new townhome blocks (Block 1 through 13) consisting of a number of 3-storey back-to-back and conventional townhomes, with basements and walk outs. The general site feature is presented in Figure 2.

The townhomes will be serviced with municipal piped water and sewer supply. The surrounding area is currently provided with municipal piped water and sewer supply. The surrounding properties are predominantly residential and commercial. There is, however, agricultural land use in the south portion of the assessment area south of Mapleview Drive East.

The proposed development plan is presented in Figure 2B.

The following summarizes the proposed land coverage areas for the development:

Land Coverage Type	Areas
Building Envelope	0.65 ha
Hard Surface Paving	0.7 ha
Landscape areas for infiltration	1.2 ha
Total Area (Development Lands only)	2.6 ha



3.2 Summary of Hydrogeologic Conditions

Based on the review of the available site information, the hydrogeologic conditions of the Development Limit is summarized as follows:

- The Development Limit is characterized by an undisturbed native glacial till deposit. This deposit is of moderate to low permeability and provide for low recharge capability and groundwater movement.
- Groundwater was observed at approximately 0.1 – 2.0 m depth (Elev. 244.1 to 241.7 masl) within the monitoring wells. The groundwater table has been observed to be very close to ground surface elevation as noted in BH102 on July 25, 2021 and in BH104 on December 29, 2021. The general direction of groundwater flow at the Development Limit is to the east/southeast.
- Based on the highest groundwater levels measured to date, the design groundwater table was established at Elev. 244.1 to 242.8 $\pm$ masl. This translates to about 0.1 to 1.2 $\pm$ m below existing ground surface across the Development Limit.
- Based on the low to moderate permeability of the soils, groundwater transmission is expected to be moderate. A wetland is adjacent to the Development Limit and Lover's Creek is 174 m to the east of the Subject Lands.
- The Subject Lands/Development Limit is not located within a Wellhead Protection Area according to the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan.
- The northeast corner of the Subject Lands/Development Limit falls within a Zone 2 Intake Protection Area. The Subject Lands/Development Limit is not located in a Significant Groundwater Recharge Area. The Subject Lands/Development Limit is not located within a Vulnerable Groundwater Scoring Area and does not fall within a Vulnerable Surface Water Scoring Area.
- MECP well records for wells completed in the vicinity of the Development Limit show that there were eleven (11) wells within 500 m of the Development Limit used for test holes, monitoring, and domestic purposes. The one (1) domestic well identified during the MECP well record search was not located during the private well survey. Well records with available construction method data show that the wells were installed within 15 to 345 ft below grade.

The above hydrogeologic features and functions were considered in assessing the potential impact of the proposed development. This information was used to provide mitigating measures to ensure that hydrogeologic function is not adversely affected during the proposed development.



3.3 Water Balance Analysis

A water balance model was prepared for the Development Limit to assess the distribution of rainfall run-off and infiltration for existing (pre- and post-development) conditions (Appendix L). The model is based on Lake Simcoe Climate Data presented in Section 2.6. The Thornthwaite method was used to evaluate the relative balance between rainfall, evaporation and evapotranspiration in the shallow soil zones. The water balance for pre-and post-development conditions is summarized below:

Pre-Development Water Balance

Pre-Development	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Landscaped Area	25,623	23,419	13,965	3,203	6,252

The post-development water balance accounts for hard surfaced areas created by buildings and pavements and uses the proposed land use statistic information provided by We Merchandise Space Inc, Forrest Group Inc and Counterpoint.

Post-Development Water Balance

Post-Development	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Envelope	6,500	5,941	-	-	5,941
Hard Surface Paving	7,000	6,398	-	-	6,398
Landscaped Area	12,123	11,080	6,607	1,515	2,958

The volume of surface water run-off available from residential roof tops was calculated to be 5,941 m³, as noted in the above table. This volume of water will be available as a resource, to maintain groundwater recharge and function. The volume of roof run-off available is compared to the difference in infiltration volume between pre-development and post-development, as noted below:

Potential Post-Development Infiltration Deficit (m ³)	Volume of Roof Run-off Available (m ³)
1,688	5,941

Approximately 28% of roof run-off would be required to match pre-development infiltration rates.



3.4 Infiltration Rates – Guelph Permeameter Tests

A total of two (2) Guelph Permeameter infiltration tests were completed by Grounded on June 2, 2021. The results of the infiltration tests are presented in Appendix K and summarized below:

Infiltration Location	Approximate Test Depth (mbgs/masl)	Soil Type	Field Saturated K-Value (m/s)	Infiltration Rate* (mm/hr)	Factored Infiltration Rate** (mm/hr)
GP1	0.3 / 245	Silty Sand	NA – Unsuccessful tests due to high groundwater table and saturated conditions within the native silty sand material		
GP2	0.3 / 242.6	Silty Sand			

*Calculated using relationship between infiltration rate and hydraulic conductivity (Figure C11) as defined in the TRCA's Stormwater Management Criteria, Appendix C: Water Balance and Recharge (August 2012)

**Calculated using Table C3: Safety correction factors for calculating design infiltration rates as defined in the TRCA's Stormwater Management Criteria, Appendix C: Water Balance and Recharge (August 2012). Hydraulic conductivity of underlying soil (silty clay till) determined from geomean of SWRTs as per below.

A high groundwater table was observed during the Guelph Permeameter Testing conducted on the Development Limit. The native soils were saturated below grade during the time of testing and on other inspections in dry-weather conditions. The testing in this area was therefore unsuccessful and an infiltration rate for the silty sands could not be determined. Furthermore, the infiltration rate of the underlying silty clay till also could not be tested due to these saturated conditions. The infiltration rate of the underlying strata was calculated using hydraulic conductivities from the in situ single well response tests conducted in the monitoring wells.

Infiltration testing was also attempted in the southern portions of the proposed development and was unsuccessful. If an LID measure is proposed on the Development Limit, the grade will have to be raised to accommodate.

3.5 Groundwater Control Requirements

The proposed project includes constructing new townhouse blocks (Block 1 through 13) consisting of a number of 3-storey back to back and conventional townhomes with basements and walkouts along the perimeter of the development. The footings for the Blocks 1-13 will extend into the groundwater table at the Development Limit. As such, it will be necessary to positively dewater the Development Limit to a minimum of 1.2 m below proposed excavation elevation prior to excavation to preserve the integrity of the native soils during construction. The design considerations for each of the townhome blocks is as follows:



Block	Relevant Borehole	Approx Block Area (m ²)	Borehole Elevations (masl)	Proposed Ground FFE (masl)	Assumed Lowest BFFE (masl)	Assumed Footing Elev. (masl)	Design Groundwater Table Elev. (masl)	Footing Depth Below GWT (m)
1	BH101	720	245.3	247.2	244.5	243.0	244.1	-1.1
2	BH101	1000	245.3	247.0	244.3	242.8	244.1	-1.3
3	BH103	1000	243.9	246.8	244.0	242.5	243.1	n/a*
4	BH102	1000	243.1	246.5	243.8	242.3	243.0	-0.7
5	BH102	800	243.1	246.3	243.5	242.0	243.0	-1.0
6	BH104	800	242.6	246.3	243.5	242.0	242.8	-0.8
7	BH105	675	243.4	246.3	243.5	242.0	243.1	-1.1
8	BH105	300	243.4	246.3	243.5	242.0	243.1	-1.1
9	BH105	525	243.4	246.3	243.5	242.0	243.1	-1.1
10	BH103	225	243.9	246.5	243.8	242.3	243.1	-0.8
11	BH103	525	243.9	246.8	244.0	242.5	243.1	n/a*
12	BH101	300	245.3	247.0	244.3	242.8	244.1	-1.3
13	BH101	525	245.3	247.2	244.5	243.0	244.1	-1.1

*n/a indicates that the footings will not extend below the groundwater table.

Groundwater seepage estimates were conducted for both short-term and long-term dewatering scenarios. The modeling was conducted using an equivalent well radius approximation. The Excel-based calculation for groundwater seepage indicates the short-term (construction) and long-term (permanent) dewatering requirements as provided below.

The groundwater seepage estimates, which have been provided, represent the steady state groundwater seepage. There will be an initial drawdown of the groundwater before a steady state condition is reached. The rate of the initial drawdown, and therefore discharge, is dependent on the dewatering contractor and how the groundwater is being dealt with at the Development Limit. An estimate of the initial volume of stored groundwater which will require removal before steady state is reached has been provided below.

Please note that if excavation is exposed to the elements, storm water will have to be managed. The short-term control of groundwater should consider stormwater management from rainfall events. A dewatering system should be designed to consider the removal of rainfall from excavation. A design storm of 32 mm has been used in the quantity estimates.

As required by Ontario Regulation 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event (94 mm) is approximately 330,000 L.



Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used						
Block	Groundwater Seepage		Design Rainfall Event (32 mm)		Total Daily Water Takings	
	L/day	L/min	L/day	L/min	L/day	L/min
1	9,000	6.3	23,100	16.0	32,100	22.3
2	10,500	7.3	32,000	22.2	42,500	29.5
3	21,000	14.6	32,000	22.2	53,000	36.8
4	21,000	14.6	32,000	22.2	53,000	36.8
5	18,000	12.5	25,600	17.8	43,600	30.3
6	10,500	7.3	25,600	17.8	36,100	25.1
7	13,500	9.4	21,600	15.0	35,100	24.4
8	9,000	6.3	9,600	6.7	18,600	12.9
9	10,500	7.3	16,800	11.7	27,300	19.0
10	10,500	7.3	7,200	5.0	17,700	12.3
11	15,000	10.4	16,800	11.7	31,800	22.1
12	6,000	4.2	9,600	6.7	15,600	10.8
13	9,000	6.3	16,800	11.7	25,800	17.9
Total*	163,500	114	268,700	187	432,200	300
*Totals rounded						

The groundwater control system is required to be designed by a dewatering contractor. The groundwater must be dewatered prior to excavation in order to maintain a stable working base in the excavation. Mitigation measures based on dewatering and infiltration requirements as per the MECP are discussed in Section 3.6.

It is possible for townhome structures at this Development Limit to be made as conventional drained structures provided that the underside of the subfloor drainage layer (nominally 0.3 m below BFE) is at least 0.5 m above the groundwater table in each location (i.e. lowest basement FFE is 0.8 m above the groundwater table in each location). The current site grading plan indicates Blocks 3 and 11 can be constructed with drained foundations, whereas all other proposed structures be made with fully waterproofed basements.



The long-term discharge estimates were calculated as follows.

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used							
Block	Groundwater Seepage		Infiltration Design Rainfall Event (32 mm)*		Total Daily Water Takings		Recommended Basement Structure
	L/day	L/min	L/day	L/min	L/day	L/min	
1	0	0	0	0	0	0	Waterproofed
2	0	0	0	0	0	0	Waterproofed
3	N/A**	N/A**	2700	1.9	2700	1.9	Drained Foundations
4	0	0	0	0	0	0	Waterproofed
5	0	0	0	0	0	0	Waterproofed
6	0	0	0	0	0	0	Waterproofed
7	0	0	0	0	0	0	Waterproofed
8	0	0	0	0	0	0	Waterproofed
9	0	0	0	0	0	0	Waterproofed
10	0	0	0	0	0	0	Waterproofed
11	N/A**	N/A**	1900	1.3	1900	1.3	Drained Foundations
12	0	0	0	0	0	0	Waterproofed
13	0	0	0	0	0	0	Waterproofed
Total*	0	0	4,600	3.2	4,600	3.2	
*Total is rounded							
** N/A indicates underground structures above water table							

The final grading and building configurations have not been advanced to detailed design. To eliminate the requirement for long term discharge due to groundwater seepage, it is recommended that any below grade structures extending into the water table should be waterproofed.

It is noted that permits are required to be submitted for the entire developable area not individual townhouse blocks. The summary below is based on total groundwater takings required, not the groundwater taking required for individual blocks.



Regulatory Requirements	
Environmental Activity and Sector Registry (EASR) Posting	Required
Short Term Permit to Take Water (PTTW)	Not Required
Long Term Permit to Take Water (PTTW)	Not Required

Long-term discharge into the City of Barrie's municipal sewer system is prohibited. Overland discharge of groundwater and surface water is proposed for the Development Limit. If long term overland discharge is not feasible, then the buildings must be waterproofed structures.

3.6 Assessment of Potential Impact

It is understood that the Development Limit will be developed with townhome buildings, with associated internal roads and servicing. The proposed project includes constructing new townhome blocks (Blocks 1 through 13) with basements and walkouts along the perimeter.

The Development Limit will be serviced with municipal piped water, storm, and sanitary sewers. The proposed nature of the development does not pose any significant concern with respect to potential impact to groundwater quality in the area.

3.6.1 Short Term Discharge (Construction Dewatering)

Groundwater takings of approximately 114 L/min to 300 L/min is possible. The flow of water from the dewatering system must be treated to meet Provincial Water Quality Standards prior to overland discharge in order to meet regulation requirements. Sampling of the discharge water from the dewatering system is required during initial discharge and on-going basis as required by the Region during active dewatering activities. Visual monitoring of the dewatering discharge should be conducted daily. Adjustment to the dewatering system should be made if an increase in turbidity sediment is noted. The above recommendations should be included in a dewatering plan prepared in accordance with regulatory requirements prior to construction.

3.6.2 Long Term Discharge (Post Construction)

A permanent dewatering system would be required if the buildings will be drained structures. Groundwater takings of up to approximately 3.2 L/min are possible. The flow of water from the dewatering system must be treated to meet Provincial Water Quality Standards prior to overland discharge in order to meet regulation requirements.

The permanent building drainage system must be properly installed and screened to ensure sediments and fines will not be removed, which is typically a primary cause of dewatering related



settlement. The above recommendations should be included in a dewatering plan prepared in accordance with regulatory requirements prior to construction.

If long term overland discharge is not feasible, then the buildings must be waterproofed structures.

3.6.3 Zone of Influence (ZOI)

The Zone of Influence (ZOI) was calculated based on the estimated groundwater taking rate and the average hydraulic conductivity recorded at the Development Limit. The stratigraphy of the relevant native soil (for dewatering purposes) located at the Development Limit generally consists of a cohesionless upper sand deposit underlain by a tight silty clay till. The ZOI calculated for each of the townhouse blocks is as follows:

Equation : $R_0 = 3000 \cdot dH \cdot K^{0.5}$ Where R_0 = Radius of Influence (Zone of Influence)
 dH = dewatering thickness (m)
 K = hydraulic conductivity (m/s)

The representative hydraulic conductivity of the soils used for the ZOI calculations varied by block. As such, the most conservative hydraulic conductivity from the Development Limit was used for the calculations below:

Block	Hydraulic Conductivity (m/s)	dH (m)	ZOI (m)
1	1.43×10^{-7}	2.3	3
2		2.5	3
3		1.8	2
4		2.0	2
5		2.2	2
6		2.0	2
7		2.3	1
8		2.3	3
9		2.3	3
10		2	2
11		0.3	0
12		2.5	3
13		0	0

The ZOI may reach up to $3 \pm$ m during construction dewatering. Based on these ZOI distances, there are no dewatering induced impacts on the surrounding environment and infrastructure as



this radius of impact remains within the area of development and away from watercourses and wetlands.

If long term overland discharge is not feasible, then the buildings must be waterproofed structures.

3.6.4 Geotechnical Considerations

The Subject Lands are bound by residential properties to the north, vacant land to the west, vacant woodland & wetland to the east, and residential and agricultural properties to the south of Maplevue Dr E.

Changes in the groundwater table have the potential to cause settlement based on the change in effective stress. Within the zone of influence, changes in groundwater level have the potential to cause settlement based on the change in effective stresses that will result from dewatering and draining soil (refer to the geotechnical report). It is recommended that a monitoring and mitigation program during dewatering activities be implemented to confirm that there are not potential implications to existing structures on adjacent properties.

3.6.5 Surface Water, Wetlands, and Natural Significance

A tributary of Lovers Creek and a Provincially Significant Evaluated Wetland are located within close proximity to the Development Limit. Groundwater and surface water is expected to flow towards Lovers Creek which eventually drains into Kempenfelt Bay (western arm of Lake Simcoe) to the northeast.

3.6.6 Local Wells and Zone of Influence

The Development Limit is in an area that is serviced by the City of Barrie. The townhomes will eventually be serviced with municipal piped water and sewer supply. The surrounding area is currently provided with municipal piped water and sewer supply. The MECP well records were searched through the online Water Well Database for records located on the Development Limit and within a 500 m radius.

Eleven (11) wells were identified within the Study Area, whose uses range from test holes and monitoring wells to domestic wells. The domestic well was not located during the Private Well Survey and surrounding inspection and have likely been decommissioned. Fire hydrants were present throughout the Study Area and the results of the Private Well Survey indicate that the Development Limit and surrounding areas are supplied with water from municipal sources. Dewatering activities at the Development Limit are unlikely to impact any of the wells identified in the Study Area.



3.6.7 Contamination Sources

The Subject Lands and immediate surrounding area currently consist mostly of undeveloped, residential and commercial occupants. These activities are not expected to provide an area of potential environmental concern for the Development Limit.

3.7 Mitigation Measures to Maintain Hydrogeologic Functions

3.7.1 Maintenance of Groundwater Recharge

The existing groundwater recharge rates at the Subject Lands are approximately 125 mm/a. This recharge occurs in a broad diffuse manner over the entire Subject Lands. There are watercourses and wetlands adjacent to the boundaries of the Development Limit. Mitigation measures are available to maintain recharge rates. As there is a surplus of water available following development, it is recommended to consider low-impact development (LID) techniques and/or other forms of groundwater control at the Development Limit in order to maintain groundwater recharge and function across the site area.

Based on the results of the Guelph Permeameter testing, LID measures are not likely feasible due to the high groundwater table at the Development Limit. Ground improvement measures or other forms of groundwater control will be required instead.

There is potential for direct surface runoff from the Development Limit to the watercourses and wetlands. Intercepting overland flow water prior to discharging into these areas and thereby preserving groundwater recharge, groundwater flow pathways, and base flow contribution to existing watercourses must be a primary consideration.

The storm water management measures must specifically address the maintenance of groundwater recharge of the proposed development in order to preserve the tributary of Lovers Creek and wetland areas located adjacent to the Development Limit.

3.7.2 Maintenance of Groundwater Transmission Pathways

As previously indicated, the soils present on the Development Limit are of moderate to low permeabilities. No significant groundwater flow or transmission zones were encountered on the Development Limit. However, the overall continuity of the groundwater flow at the Development Limit should be maintained, where practical. Generally, the groundwater transmission pathways can be maintained through the following means:

- Bedding materials beneath underground services may serve as a subdrain to collect and convey groundwater. To prevent drainage of groundwater along bedding materials, clay trench plugs should be provided at all manhole locations in order to cut off the granular bedding.



- The excavation of any underground services or utilities across more permeable layers may interrupt the groundwater flow. It is recommended that trench backfilling be carried out with materials that are similar to the materials that have been excavated. The continuity of any sand or more permeable zones can be maintained by backfilling with the native sandy or more permeable zones as it excavated.

Groundwater flow may occur into the open shallow excavations if more permeable deposits (such as gravelly sand) are encountered. Based on the results of the subsurface investigation, active groundwater control (such as from wells or well points) is not anticipated during construction. Localized groundwater flow into shallow excavations can be controlled by utilizing localized sumps and pumps at the base of the excavations. In addition to this, it is recommended that any excavations should be staged or constructed in such a manner to avoid the collection of overland drainage.

4 Conclusions and Recommendations

- The Development Limit is characterized by an undisturbed native glacial deposit. This deposit is of moderate to low permeability and provide for low recharge capability and groundwater movement.
- Groundwater was observed at approximately 0.1 – 2.0 m depth (Elev. 244.1 to 241.7 masl) within the monitoring wells installed in the Development Limit. The groundwater table has been observed very close to ground surface elevation as noted in BH102 on July 25, 2021 and in BH104 on December 29, 2021. The general direction of groundwater flow at the Development Limit is to the east/southeast.
- Based on the highest groundwater levels measured to date, the design groundwater table was established at Elev. 244.1 to 242.8 $\pm$ masl. This translates to about 0.1 to 1.2 $\pm$ m below existing ground surface across the Development Limit.
- Based on the low to moderate permeability of the soils, groundwater transmission is expected to be moderate.
- A wetland and tributary of Lovers Creek are present close to the Development Limit.
- The Subject Lands/ Development Limit are not located within a Wellhead Protection Area according to the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan.
- The northeast corner of the Subject Lands/ Development Limit fall within a Zone 2 Intake Protection Area. The Subject Lands/ Development Limit are not located in a Significant Groundwater Recharge Area. The Subject Lands/ Development Limit are not located within a Vulnerable Groundwater Scoring Area and do not fall within a Vulnerable Surface Water Scoring Area.



- MECP well records for wells completed in the vicinity of the Development Limit show that there were eleven (11) wells within 500 m of the Development Limit used for test holes, monitoring, and domestic purposes. The one (1) domestic well identified during the MECP well record search were not located during the inspection. Well records with available construction method data show that the wells were installed within 15 to 345 ft below grade.
- Based on the results of the Guelph Permeameter testing, LID measures are not likely feasible due to the high groundwater table at the Development Limit.
- There will be a post-development infiltration deficit of approximately 1,688 m³ for the Development Limit.
- Construction or short-term groundwater control:
 - The footings for the Blocks 1-13 will extend into the groundwater table at the Property. As such, it will be necessary to positively dewater the Property to a minimum of 1.2 m below proposed excavation elevation prior to excavation to preserve the integrity of the native soils during construction
 - Total short-term groundwater takings of approximately 114 to 300 L/min are likely.
 - The flow of water from the dewatering system must be treated to meet Provincial Water Quality Standards prior to overland discharge in order to meet regulation requirements.
 - An EASR and municipal discharge permits will be required prior to any discharge into the municipal sewers.
- Long-term groundwater control:
 - A permanent dewatering system would be required if the buildings will be drained structures. Total long-term groundwater takings of approximately 3.2 L/min are likely.
 - It is recommended that Blocks 1, 2, 4, 5, 6,7, 8, 9,10 12, and 13 be waterproofed since the basement FFE is in the water table.
 - Blocks 3, and 11 can have drained foundations since the basement FFE is sufficiently above the groundwater table.
 - Long-term discharge into the City of Barrie's municipal sewer system is prohibited.
 - Overland discharge of groundwater and surface water is proposed for the Development Limit. If long term overland discharge is not feasible, then the buildings must be waterproofed structures.
 - It is possible for townhome structures at this Development Limit to be made as conventional drained structures provided that the underside of the subfloor drainage layer (nominally 0.3 m below BFE) is at least 0.5 m above the groundwater table in each location (i.e. lowest basement FFE is 0.8 m above the groundwater table in each location).



4.1 Signatures

The Hydrogeological Assessment was conducted by Kim Pickett, C.E.T, LET, QP_{ESA} under the supervision of Suvish Melanta, P. Eng., QP_{ESA} and Matthew Bielaski, P.Eng., QP_{RA-ESA}.

We trust that this report meets your requirements at present.

For and on behalf of our team,



Kim Pickett, C.E.T, LET, QP_{ESA}



Mathew Bielaski, P.Eng., QP_{RA-ESA}
Principal



Suvish Melanta, P. Eng., QP_{ESA}
Associate



5 References

1. Armstrong, D.K. and Dodge, J.E.P. *Paleozoic Geology Map of Southern Ontario*. Ontario Geological Survey, Miscellaneous Release--Data 219.
2. Chapman, L.J. and Putnam, D.F. 2007. *The Physiography of Southern Ontario*. Ontario Geological Survey, Miscellaneous Release--Data 228.
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<https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/Index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-US>
9. Lake Simcoe Region Conservation Authority. *Regulated Areas Map*. Retrieved from: <https://maps.lsrca.on.ca/EH5Viewer/index.html?viewer=LSRCARegulations>
10. Counterpoint Engineering, "Conceptual Grad Plan, 340 Mapleview Dr E, Barrie"; Project No 21076, Figure 6, dated September 2021.
11. We Merchandise Space Inc. and Forrest Group Inc., "Concept Site Plan v3.2, Loon Lands Concept Site Plan"; Project No 3079, dated February 2022.
12. Counterpoint Engineering, "Post-Development Water Balance Plan (Without Mitigation), December 2021



6 Limitations and Restrictions

The assessment should not be considered a comprehensive investigation that eliminates all risks of encountering environmental problems. The information presented in this report is based on information collected during the completion of the Hydrogeological Assessment by Grounded Engineering Inc. It was based on the conditions on the Hydrogeological Assessment at the time of the site inspection supplemented by a review of historical information to assess the environmental conditions regarding the Subject Lands.

There is no warranty expressed or implied by this report regarding the hydrogeologic conditions of the Subject Lands. Professional judgement was exercised in gathering and analysing information collected by our staff, as well as that submitted by others. The conclusions presented are the product of professional care and competence and cannot be construed as an absolute guarantee.

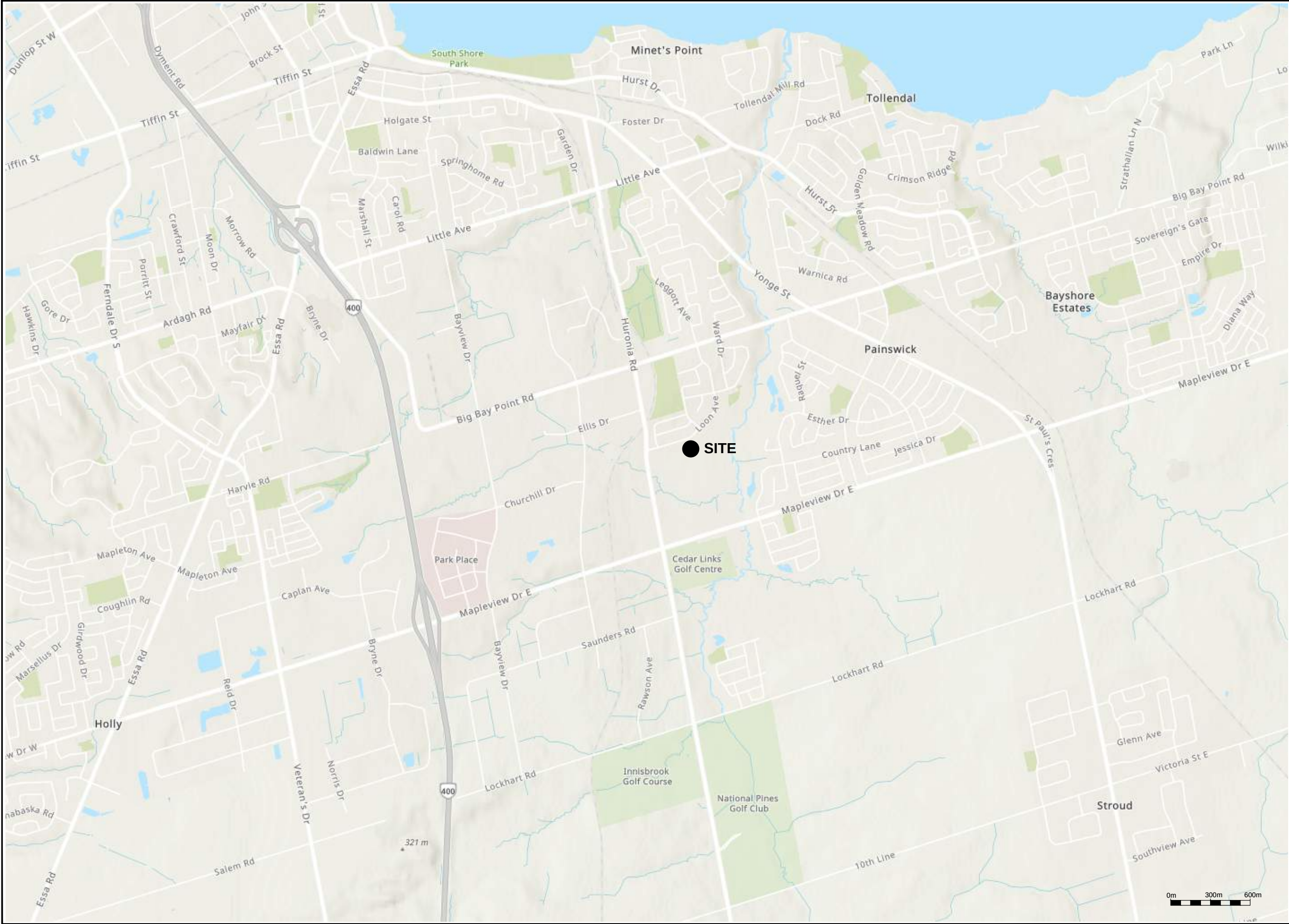
If new information regarding the hydrogeological condition of the Subject Lands is identified during future work, or outstanding responses from regulatory agencies indicate outstanding issues on file with respect to the Subject Lands, Grounded Engineering Inc. should be notified so that we may re-evaluate the findings of this assessment and provide amendments.

6.1 Report Use

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FIGURES





GROUND
ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

● APPROXIMATE SITE LOCATION

Note

Reference

ArcGIS Map 2021

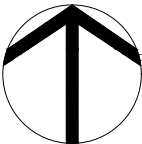
Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

SITE LOCATION PLAN

North



Date

DECEMBER, 2021

Scale

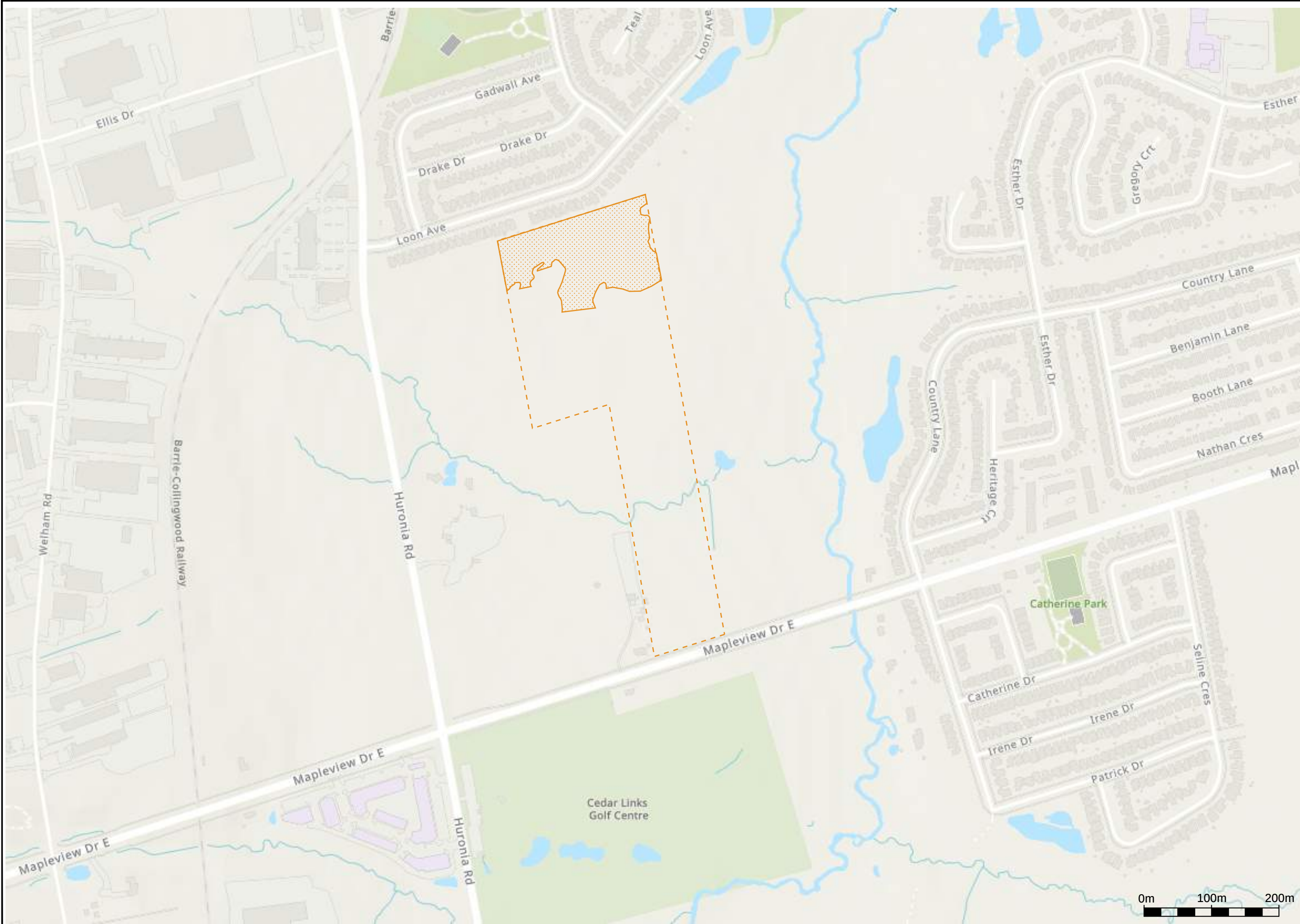
AS INDICATED

Job No

20-295

Figure No

Figure 1A



GROUND
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1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

- SUBJECT LANDS
- PROPOSED DEVELOPMENT LIMIT

Note

Reference

ArcGIS Map 2021

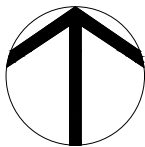
Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

**SUBJECT LANDS AND
DEVELOPMENT LIMIT**

North



Date

FEBRUARY 2022

Scale

AS INDICATED

Job No

20-295

Figure No

FIGURE 1B



GROUND
ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

PROPOSED DEVELOPMENT LIMIT

GROUND BOREHOLE /
MONITORING WELL

CROSS SECTION A-A'

GUELPH PERMEAMETER TESTS
COMPLETED BY GROUND

Note

Reference

Google Earth Satellite Image 2021

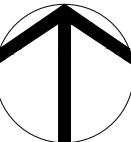
Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

**BOREHOLE LOCATION
PLAN - EXISTING
CONDITION**

North



TRUE

Date

FEBRUARY 2022

Scale

AS INDICATED

Job No

20-295

Figure No

FIGURE 2A

LEGEND

- PROPOSED DEVELOPED AREA
- GROUNDING BOREHOLE / MONITORING WELL
- CROSS SECTION A-A'
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDING

Note

Reference

Concept Grading Plan, 338 Mapleview Dr E,
Project No: 21076, Figure 6, Counterpoint
Engineering Inc, September 2021

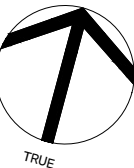
Project

338 MAPLEVIEW DR E
BARRIE, ON

Figure Title

**BOREHOLE LOCATION
PLAN - PROPOSED
CONDITIONS**

North



Date

FEBRUARY 2022

Scale

0m 15m 30m

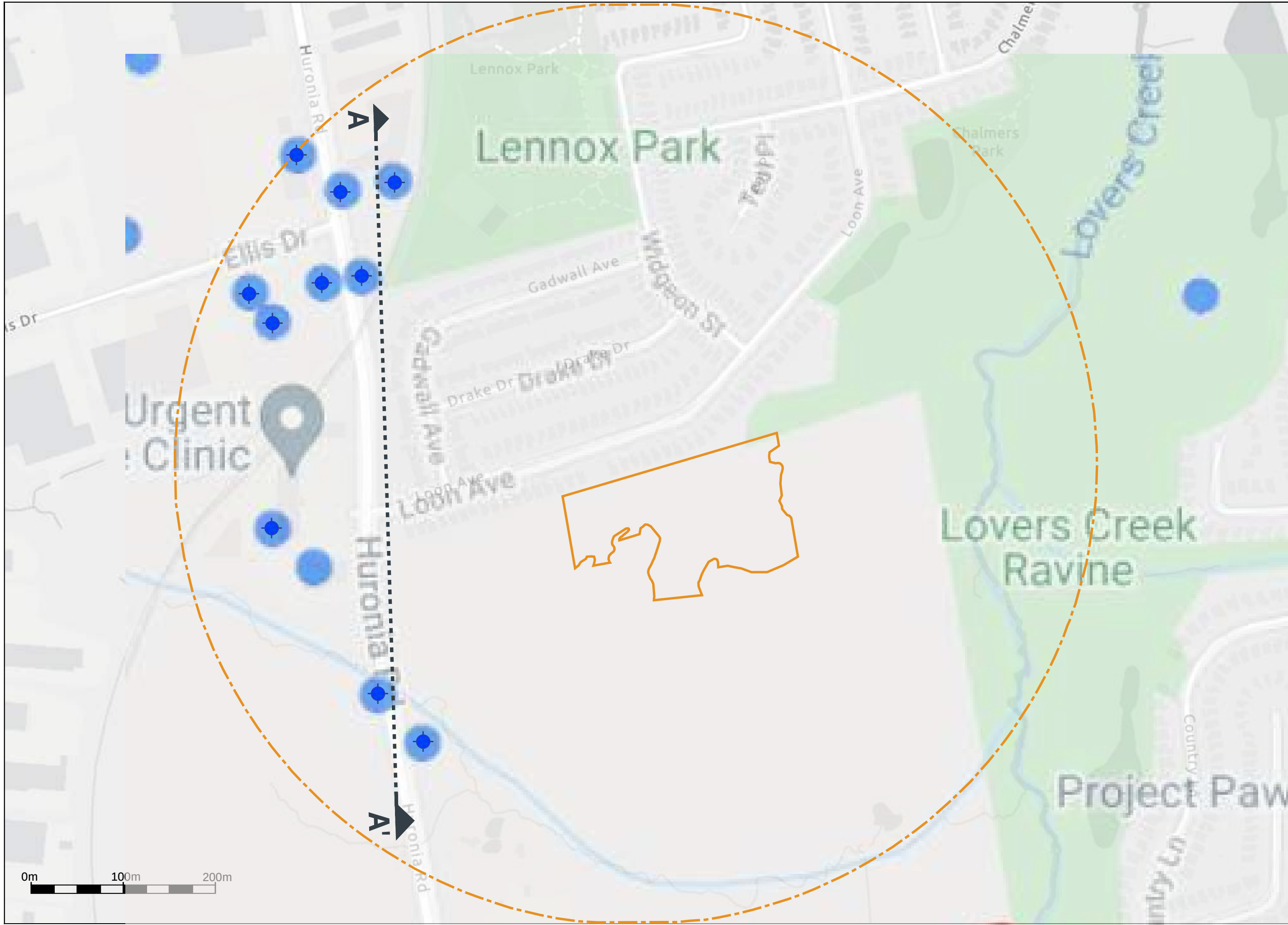
Job No

20-295

Figure No

FIGURE 2B





GROUND
ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

PROPOSED DEVELOPED AREA

500 m RADIUS

MECP WELLS

CROSS SECTION A-A'

Note

Reference

ArcGIS Map 2021

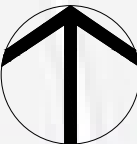
Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

**MECP WELL LOCATION
PLAN**

North



Date

FEBRUARY 2022

Scale

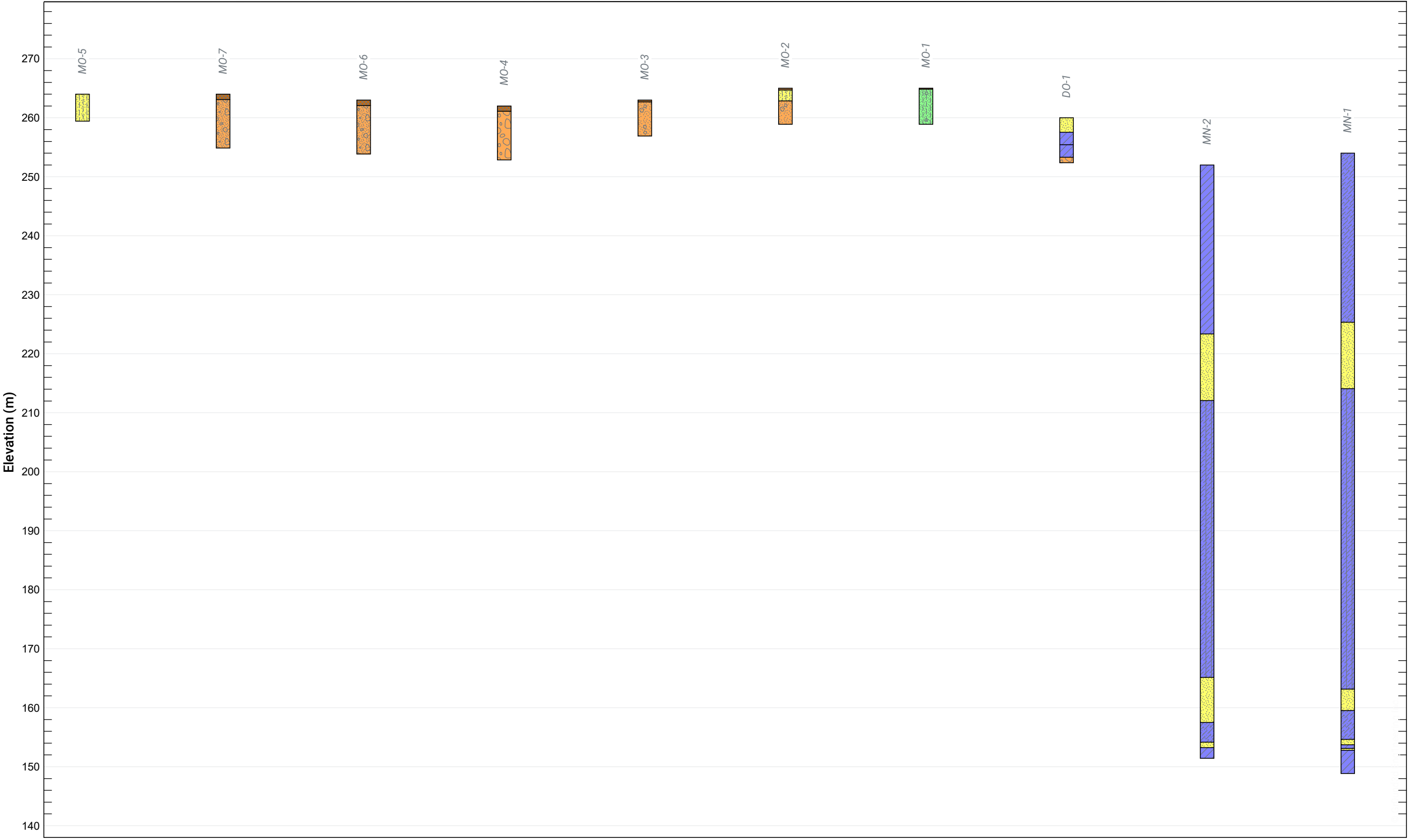
AS INDICATED

Job No

20-295

Figure No

FIGURE 3



Boreholes Equally Spaced



0m 25m 50m



**GROUND
ENGINEERING**

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPMENT LIMIT
- GROUNDWATER BOREHOLE / MONITORING WELL
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDED
- GROUNDWATER ELEVATIONS (masl) - SEPTEMBER 2021
- GROUNDWATER CONTOURS (masl)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

Note

Reference

Google Earth Satellite Image 2021

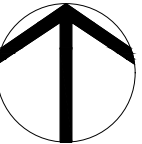
Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

**GROUNDWATER ELEVATIONS
AND GROUNDWATER FLOW
DIRECTION**

North



Date

FEBRUARY 2022

Scale

AS INDICATED

Job No

20-295

Figure No

FIGURE 5



GROUND
ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPMENT LIMIT
- GROUNDING BOREHOLE / MONITORING WELL
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDED
- 119.4 GROUNDWATER ELEVATIONS (masl)
- 119.4 GROUNDWATER CONTOURS (masl)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

Note

Reference

Google Earth Satellite Image 2021

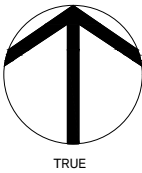
Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

**MAXIMUM GROUNDWATER
ELEVATIONS**

North



Date

FEBRUARY 2022

Scale

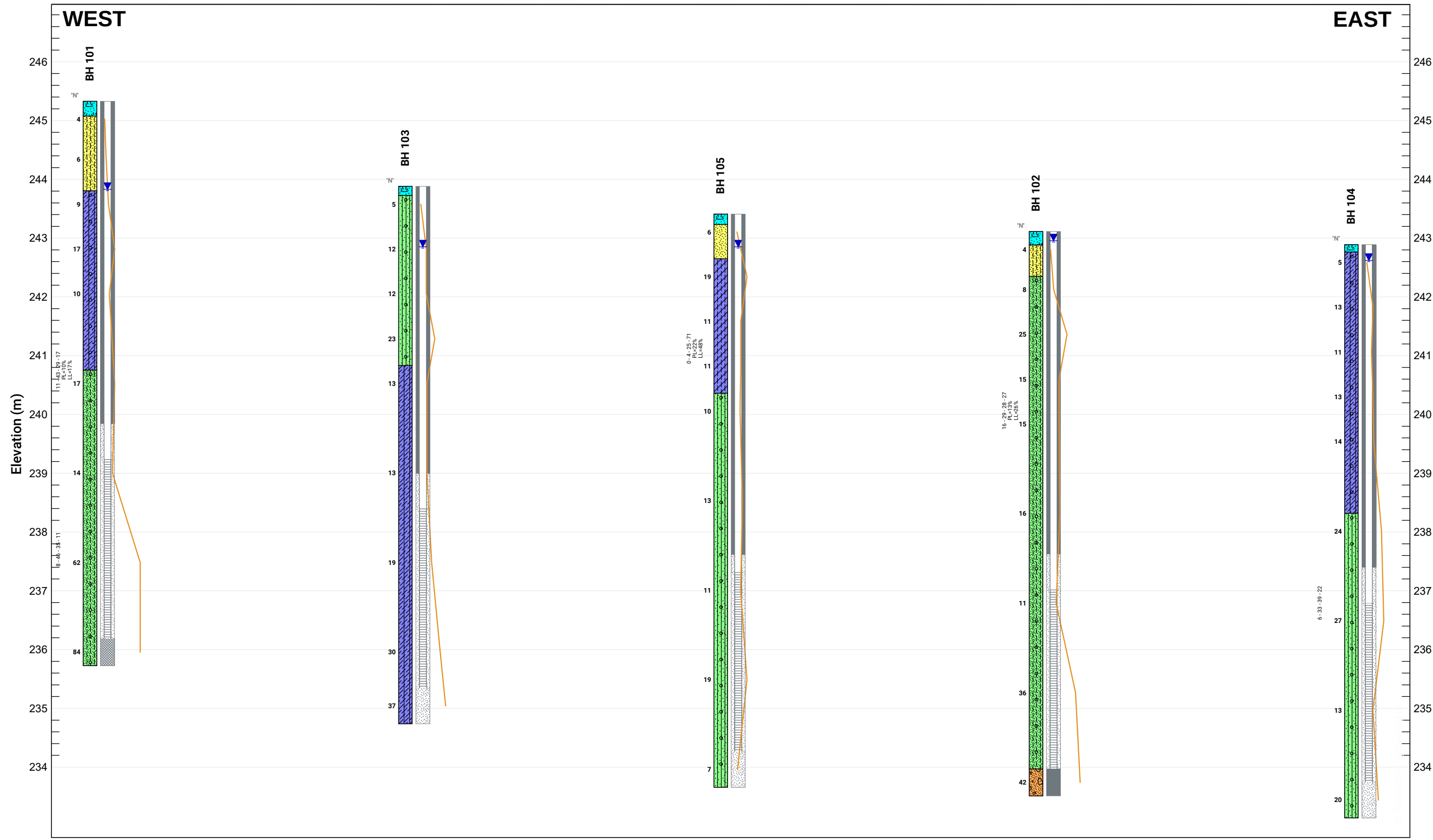
AS INDICATED

Job No

20-295

Figure No

FIGURE 6



LEGEND

- FILL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIONLESS TILLS
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- DISTURBED/REWORKED SOILS
- SPT N-VALUES LINE

Note

Reference

Project

**338 MAPLEVIEW DR E
BARRIE, ON**

Figure Title

**HYDROGEOLOGIC CROSS
SECTION A-A'**

North

Date

FEBRUARY 2022

Scale

N/A

Job No

20-295

Figure No

FIGURE 7

APPENDIX A



SCALE 1 : 750

10 0 30 60
metres

RUDY MAK SURVEYING LTD.

LEGEND

—X—X—	DENOTES	FENCING
⊗	DENOTES	MANHOLE
⌋	DENOTES	UTILITY POLE
—OH—	DENOTES	OVERHEAD WIRES
■	DENOTES	CATCH BASIN

T:\BLOCK-CAD\BORDER-RUDYMAK\Rudy Mak 45132 web logo.jpg

©COPYRIGHT 2021, RUDY MAK SURVEYING LTD.

DRAWN BY: JAC	CHECK BY: RAB	FILE No. 14529
---------------	---------------	----------------

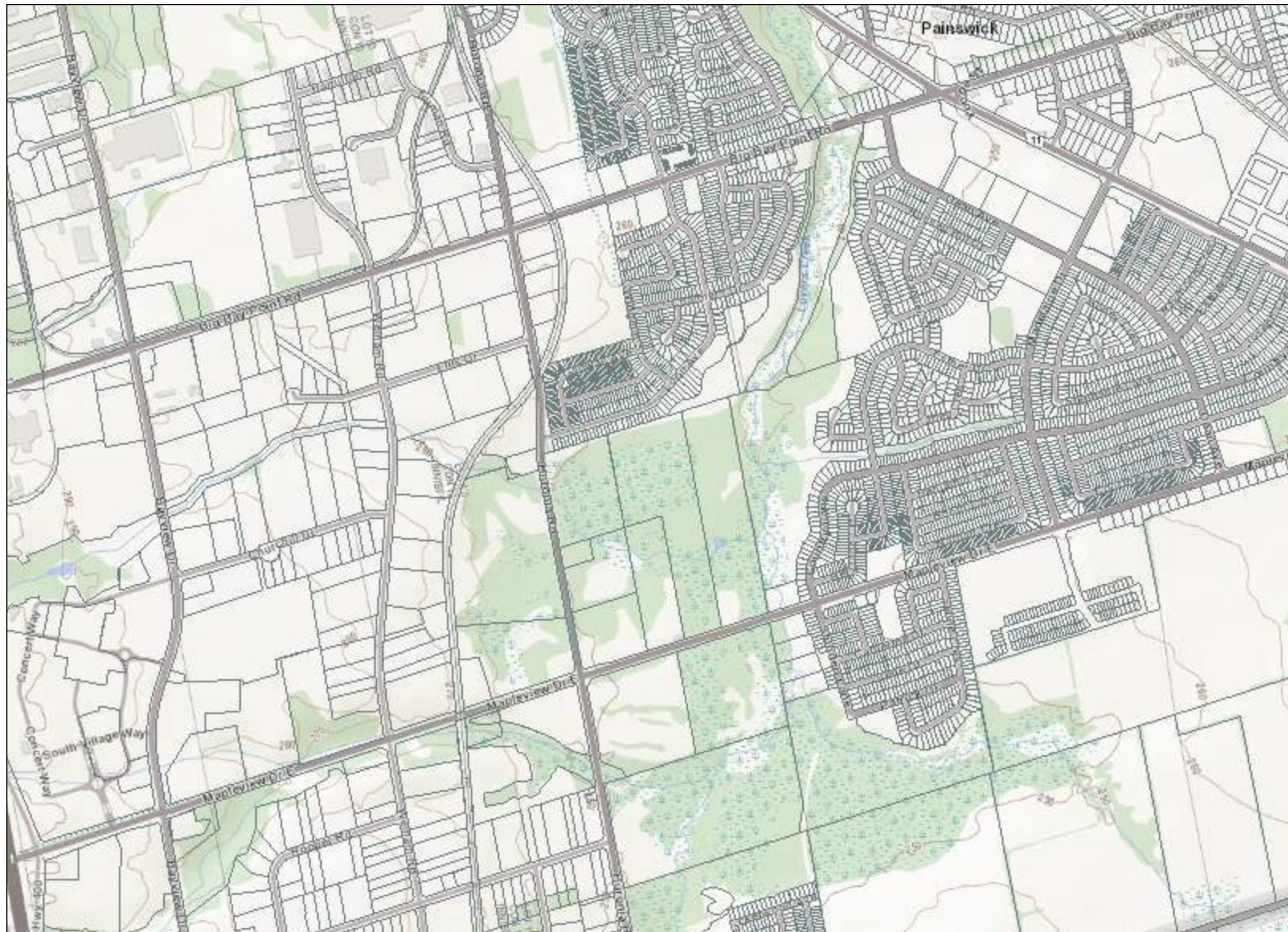
APPENDIX B





Topographic Map

Notes:



Legend

- Building as Symbol
- Building to Scale
- Airport
- Helipoint \ Hospital Helipoint
- Seaplane Base
- Ferry Route
- Trail Head \ Trail
- Railway \ Train Station
- Railway with Bridge
- Railway with Tunnel
- Road (Major → Minor)
- Winter Road
- Road with Bridge
- Road with Tunnel
- Primary, Kings or 400 Series Highway
- Secondary Highway
- Tertiary Highway
- District, County, Regional or Municipal Road
- Toll Highway
- One Way Road
- Road with Permanent Blocked Passage
- Road with Address Ranges
- Hydro Line, Communication Line or Unknown Transmission Line
- Natural Gas Pipeline, Water Pipeline or Unknown Pipeline
- Spot Height
- Index Contour
- Contour
- Wooded Area
- Wetland
- Waterbody
- Waterbody Elevation
- Watercourse
- Falls
- Rapids
- Rapids \ Falls
- Rapids
- Rocks
- Lock Gate
- Dam \ Hydro Wall
- Dam \ Hydro Wall
- Provincial \ State Boundary
- International Boundary
- Upper Tier \ District
- Municipal Boundary
- Lower Tier \ Single Tier
- Municipal Boundary
- Lot Line
- Indian Reserve
- Provincial Park
- National Park
- Conservation Reserve
- Military Lands

0 1.0 km

Projection: Web Mercator



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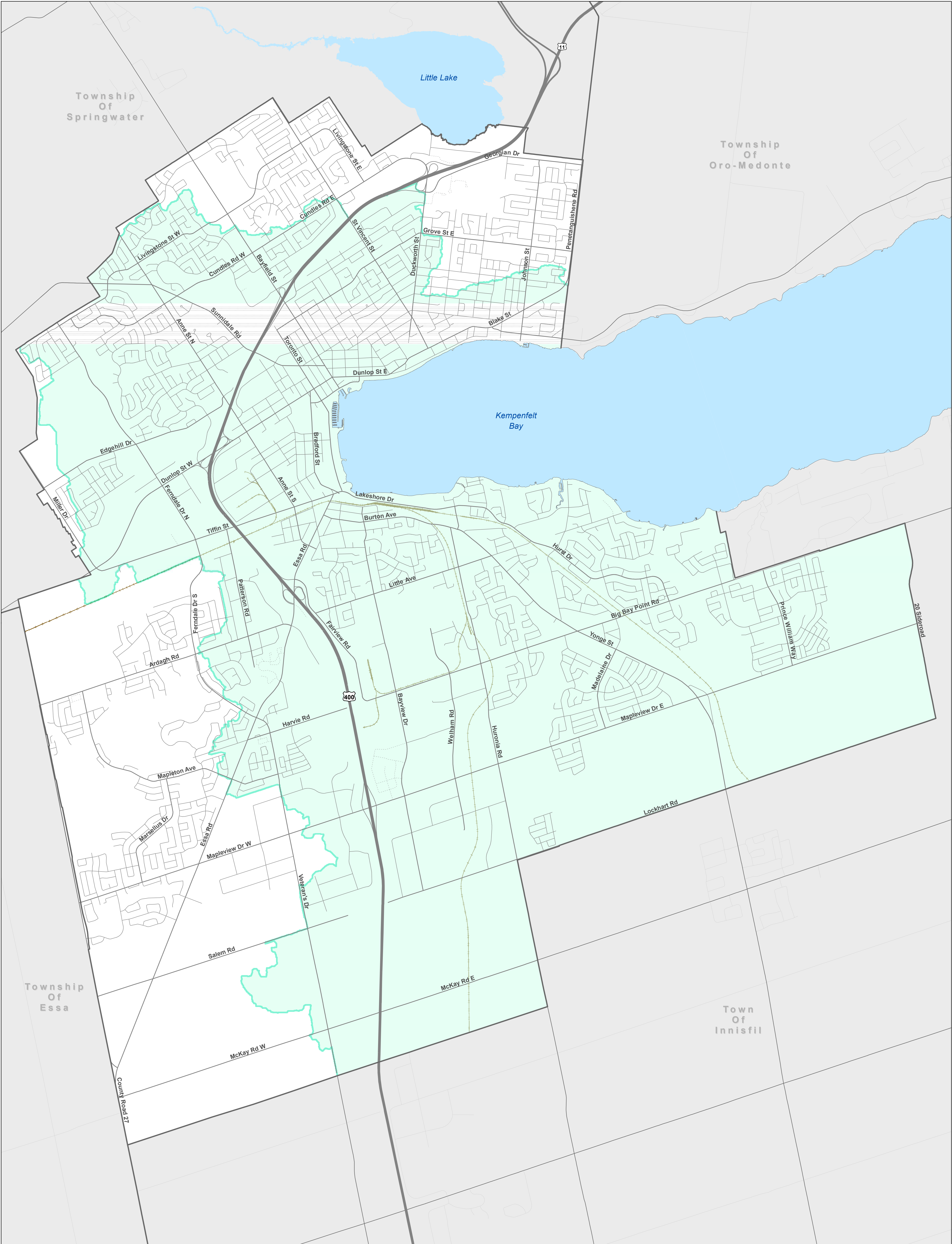
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APPENDIX C





OFFICIAL PLAN
Schedule J
Lake Simcoe Watershed
Office Consolidation
January 2018

 Lake Simcoe Watershed Boundary



1:20,000

0 0.5 1 2 km



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For information please contact Service Barrie at 705-726-4242 or ServiceBarrie@barrie.ca

GIS Branch 4/26/2018

The Barrie Creeks, Lovers Creek and Hewitt's Creek subwatersheds

Figure 2-4

Legend

- Road
- Municipal Boundary
- Watercourse
-  Barrie Creeks
-  Hewitts Creeks
-  Lovers Creeks

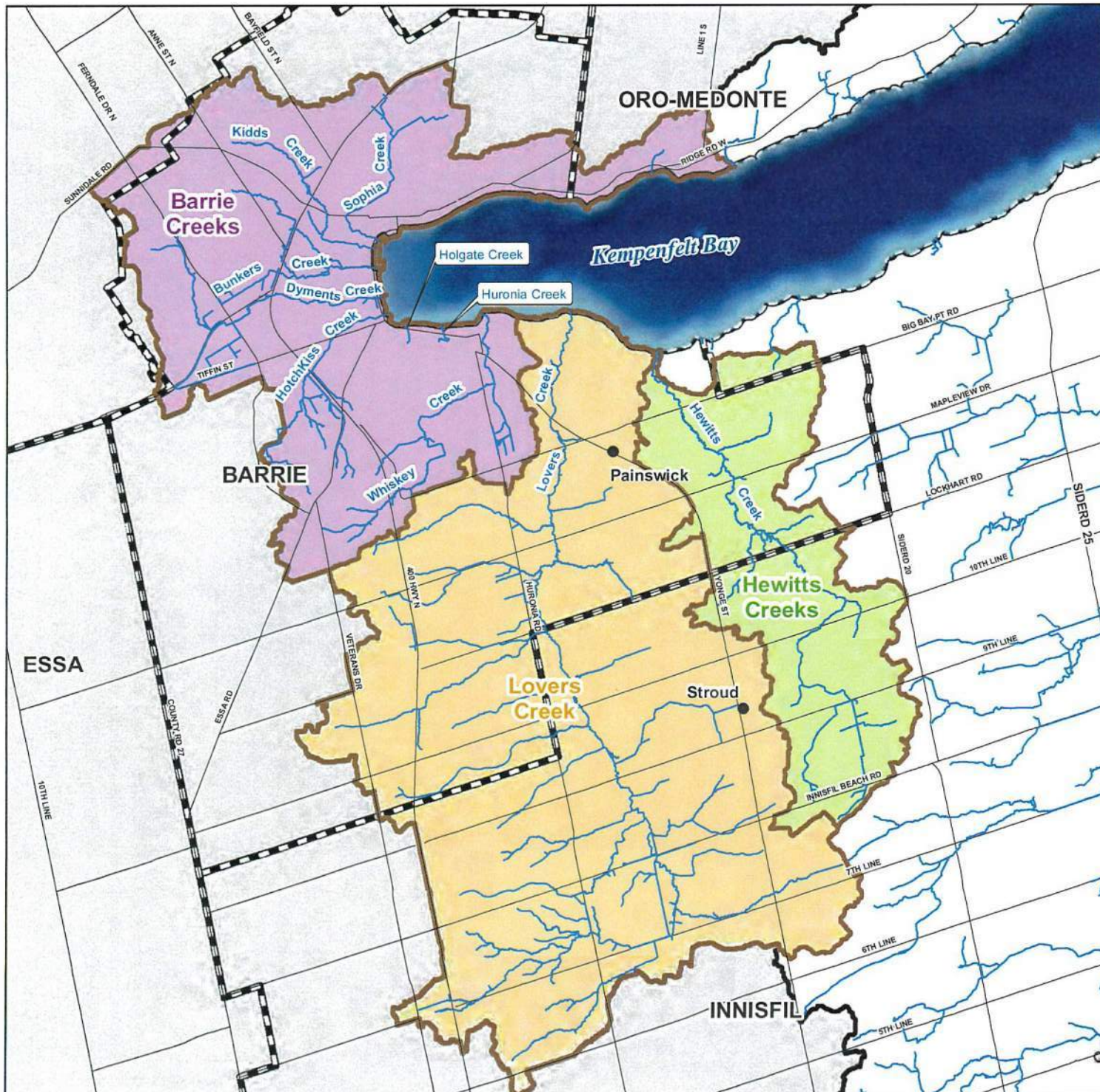


Lake Simcoe Region
conservation authority

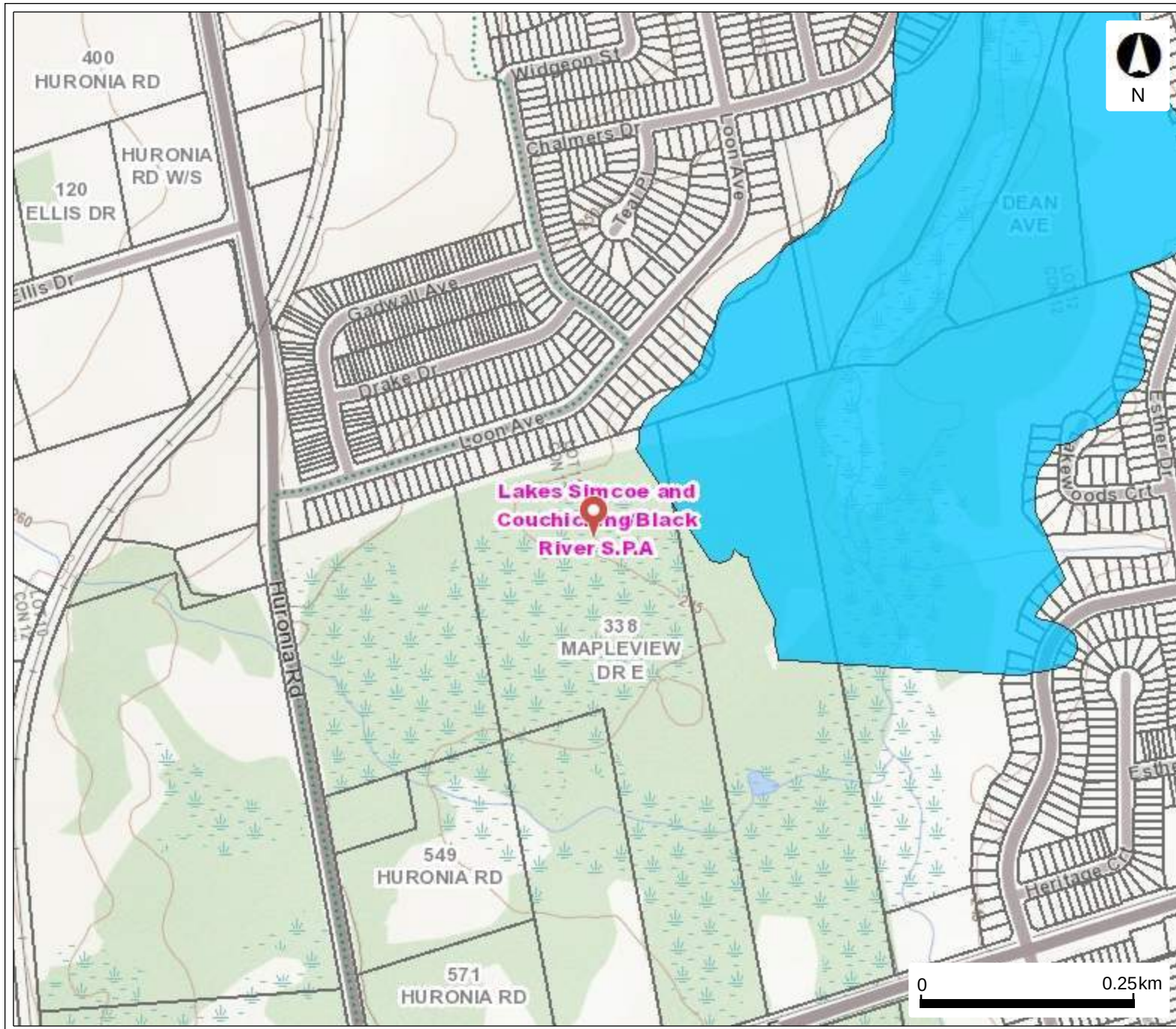
0 0.5 1 2 3 4
Kilometres



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This map has been produced for illustrative purposes only.
LSRCA GIS Services DRAFT created July 2010.
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Source Water Protection



Legend

- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
 - A
 - B
 - C
 - C1
 - D
 - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel with Address

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.

APPENDIX D



Water Well Records

December 6, 2021

11:26:03 AM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BARRIE CITY (INNISFI	17 606420 4911700 W	2016-09 7190	0.75	UT		MO	0010 5	7272826 (Z238664) A156794	BRWN SAND SILT 0015
INNISFIL TOWNSHIP	17 606445 4911259 W	1467						7158673 (Z94549) A082330 A	
INNISFIL TOWNSHIP CON 12	17 606524 4911674 W	2019-12 7360	2		///:	MO	0025 5	7353347 (Z328295) A286160	LOAM 0003 GRVL SNDY 0030
INNISFIL TOWNSHIP CON 12	17 606469 4911661 W	2019-12 7360	2		///:	MO	0025 5	7353346 (Z328304) A286176	LOAM 0003 GRVL SNDY 0030
INNISFIL TOWNSHIP CON 12	17 606491 4911571 W	2019-12 7360	2		///:	MO	0025 5	7353345 (Z328293) A286175	LOAM 0003 GRVL 0030
INNISFIL TOWNSHIP CON 12 010	17 606450 4911562 W	2019-04 7190	1.25		///:	MO	0015 5	7333294 (Z309581) A264206	BLCK LOAM LOOS 0001 BRWN SAND TILL GRVL 0020
INNISFIL TOWNSHIP CON 12 010	17 606372 4911550 W	2019-04 7190	1.25		///:	MO	0015 5	7333293 (Z309580) A264205	BLCK LOAM LOOS 0001 BRWN SAND SILT FILL 0007 BRWN SAND TILL GRVL 0020
INNISFIL TOWNSHIP CON 12 010	17 606396 4911519 W	2019-04 7190	1.25		///:	MO	0015 5	7333292 (Z309579) A264034	BLCK LOAM LOOS 0000 BRWN SAND TILL SLTY 0020
INNISFIL TOWNSHIP CON 12 010	17 606398 4911300 W	1967-08 4608	30	FR 0013	13//2/:	DO		5701453 ()	MSND 0008 BRWN CLAY 0015 GREY CLAY 0022 GRVL 0025
INNISFIL TOWNSHIP CON 12 011	17 606564 4911073 W	1974-07 4816	1	FR 0298	2/71//20:0	MN	0305 5	5711981 ()	CLAY SAND GRVL 0094 SAND CMTD 0131 CLAY SILT 0298 MSND FSND 0310 CLAY SAND LYRD 0326 SAND 0329 CLAY 0331 SAND 0332 CLAY DNSE 0345
INNISFIL TOWNSHIP CON 12 011	17 606514 4911123 W	1974-08 4816	2	UK 0285	10/70/37/20:0	MN		5711980 ()	CLAY GRVL 0094 SAND CMTD 0131 CLAY SILT 0285 FSND 0290 MSND 0301 CSND 0310 CLAY SAND LYRD 0321 SAND CMTD 0324 CLAY GRVL 0330

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
------------------	-----	-----------	------------	-------	-----------	----------	--------	------	-----------

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLV	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

APPENDIX E



×

Lindsay

Unit Name: Lindsay
Group: Simcoe Group
Formation: Lindsay
Lithology: limestone
Description: limestone; nodular to black laminated (Collingwood)

 338 Mapleview Dr E

Image NOAA
Image Landsat / Copernicus



54a

Limestone, dolostone, shale,
arkose, sandstone
Ottawa Group; Simcoe Group;
Shadow Lake Formation

338 Maplevue Dr E

Image Landsat / Copernicus
Image NOAA



Drift Thickness (m)



High : 262

Low : 0

338 Mapleview Dr E

Image NOAA
Image Landsat / Copernicus



9c Coarse-textured
glaciolacustrine deposits
*sand, gravel, minor silt and clay
Foreshore and basinal deposits*

338 Mapleview Dr E



Barrie

6 Till Plains
(Drumlinized)
Till Plains (Drumlinized)

338 Mapleview Dr E

Stroud

Bramley

Vine



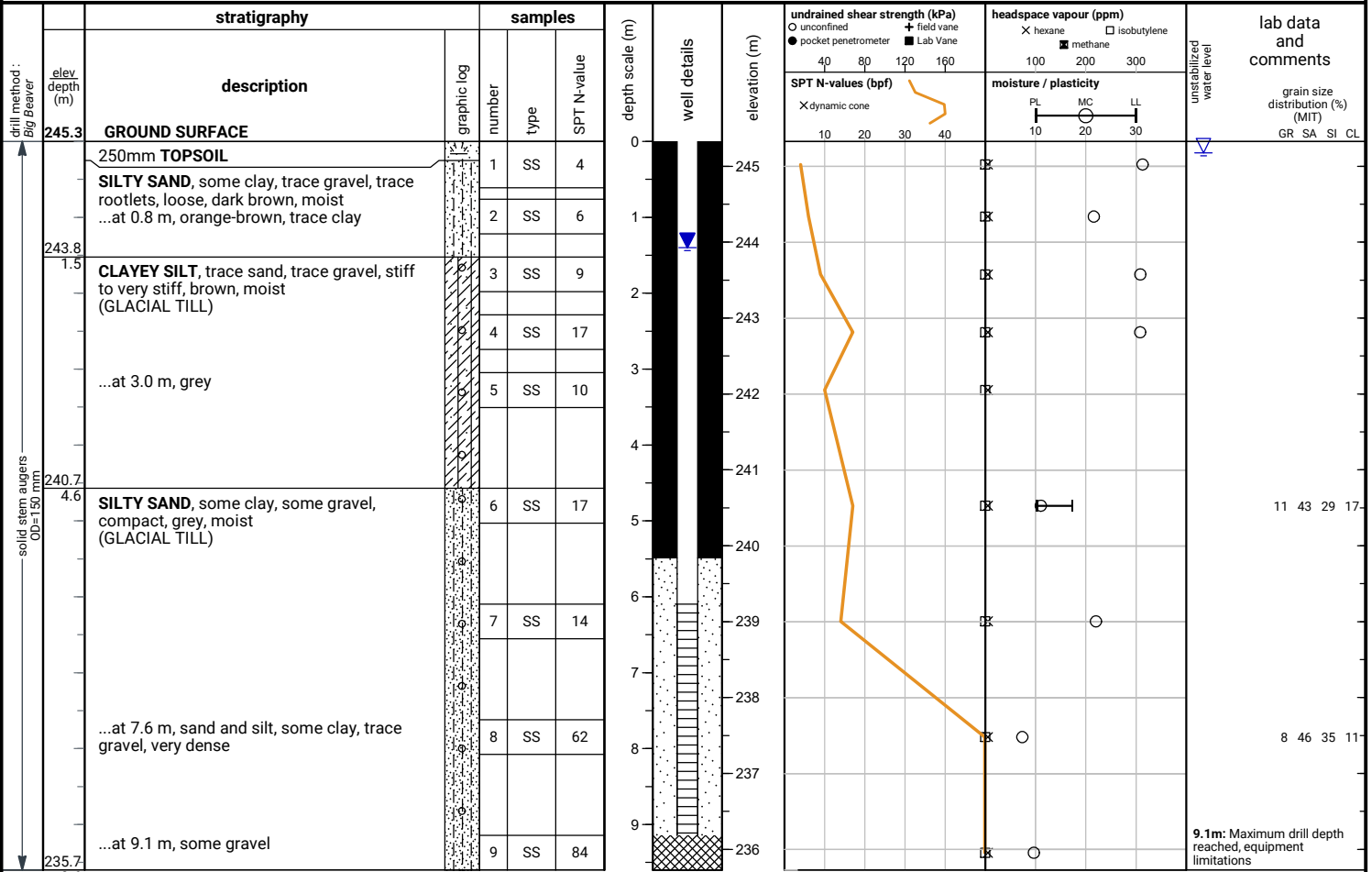
APPENDIX F



File No. : 20-295

Project : Loon Lands, Barrie, ON

Client : Loon Avenue Lands OP Inc.



END OF BOREHOLE

Unstabilized water level measured at 0.2 m below ground surface upon completion of drilling.

25 mm dia. monitoring well installed.
No. 10 screen

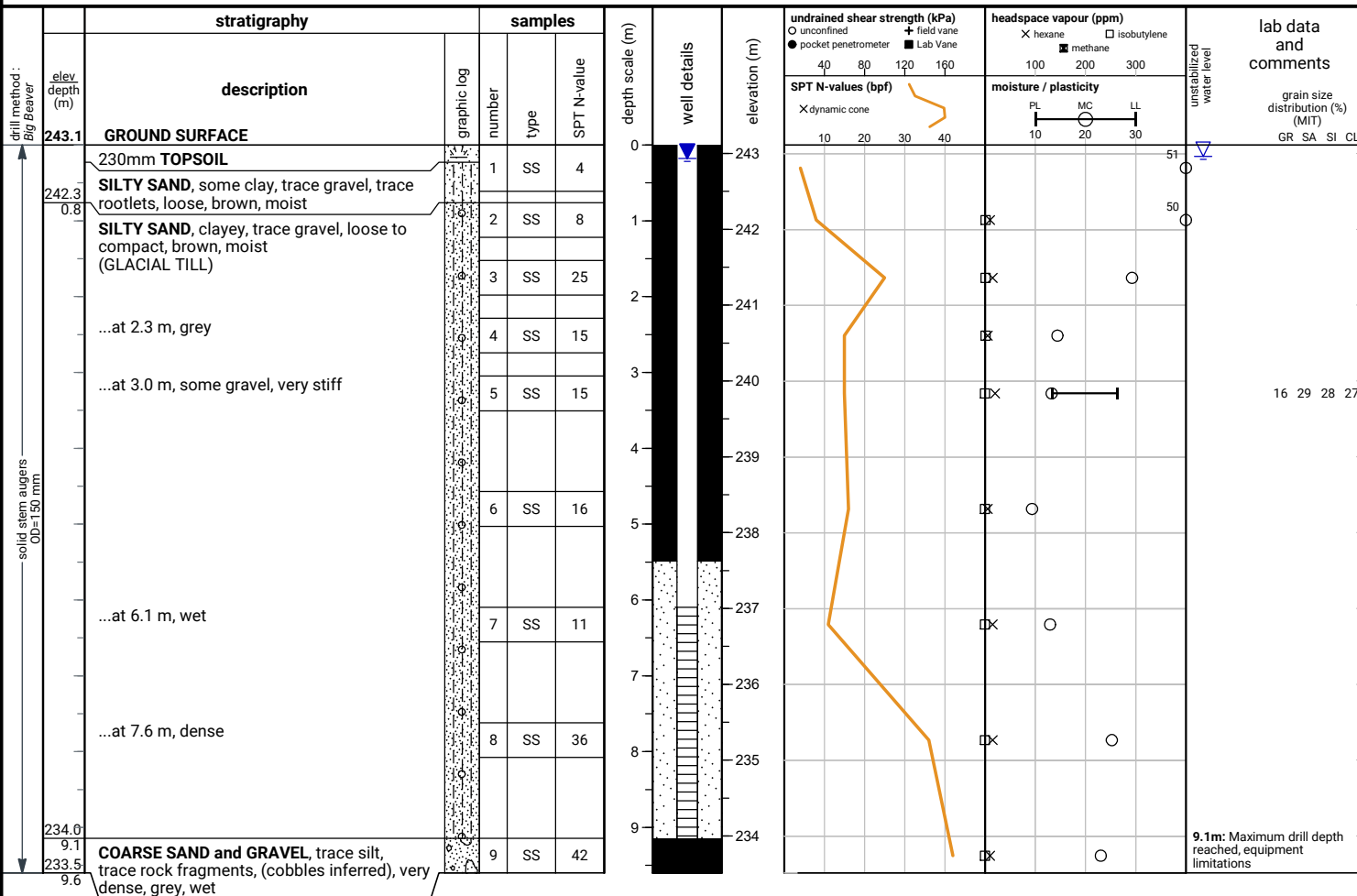
GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Apr 1, 2021	1.4	243.9
Jun 7, 2021	2.0	243.3
Jul 25, 2021	1.5	243.8
Sep 10, 2021	1.9	243.4
Nov 11, 2021	1.5	243.8
Dec 29, 2021	1.2	244.1
Jan 28, 2022	1.4	243.9

File No. : 20-295

Project : Loon Lands, Barrie, ON

Client : Loon Avenue Lands OP Inc.



END OF BOREHOLE

Unstabilized water level measured at 0.2 m below ground surface upon completion of drilling.

25 mm dia. monitoring well installed.
No. 10 screen

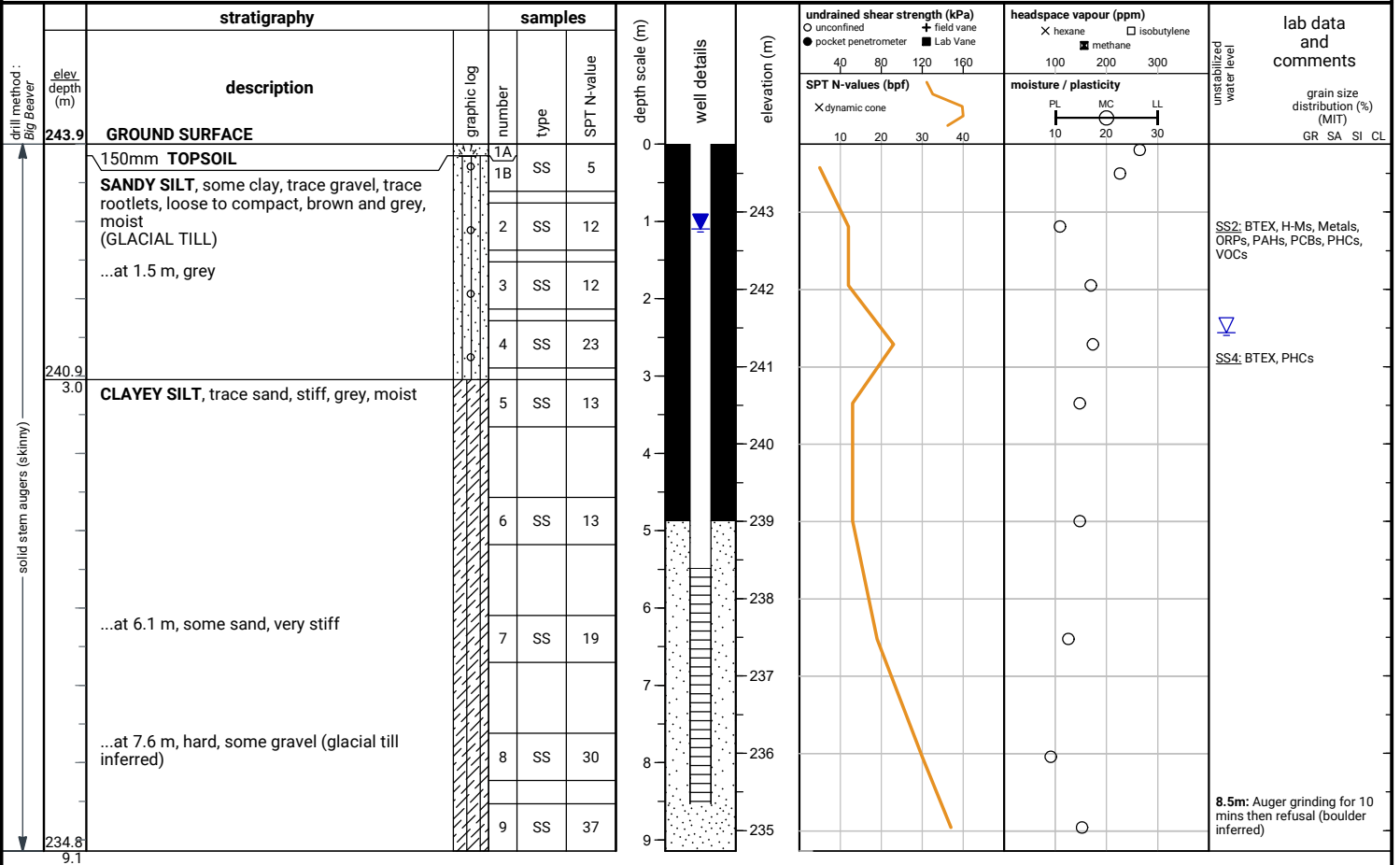
GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Apr 1, 2021	0.2	242.9
Jun 7, 2021	0.5	242.6
Jul 25, 2021	0.1	243.0
Sep 10, 2021	0.5	242.6
Nov 11, 2021	0.2	242.9

File No. : 20-295

Project : Loon Lands, Barrie, ON

Client : Loon Avenue Lands OP Inc.



END OF BOREHOLE

Unstabalized water level measured at 2.4 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

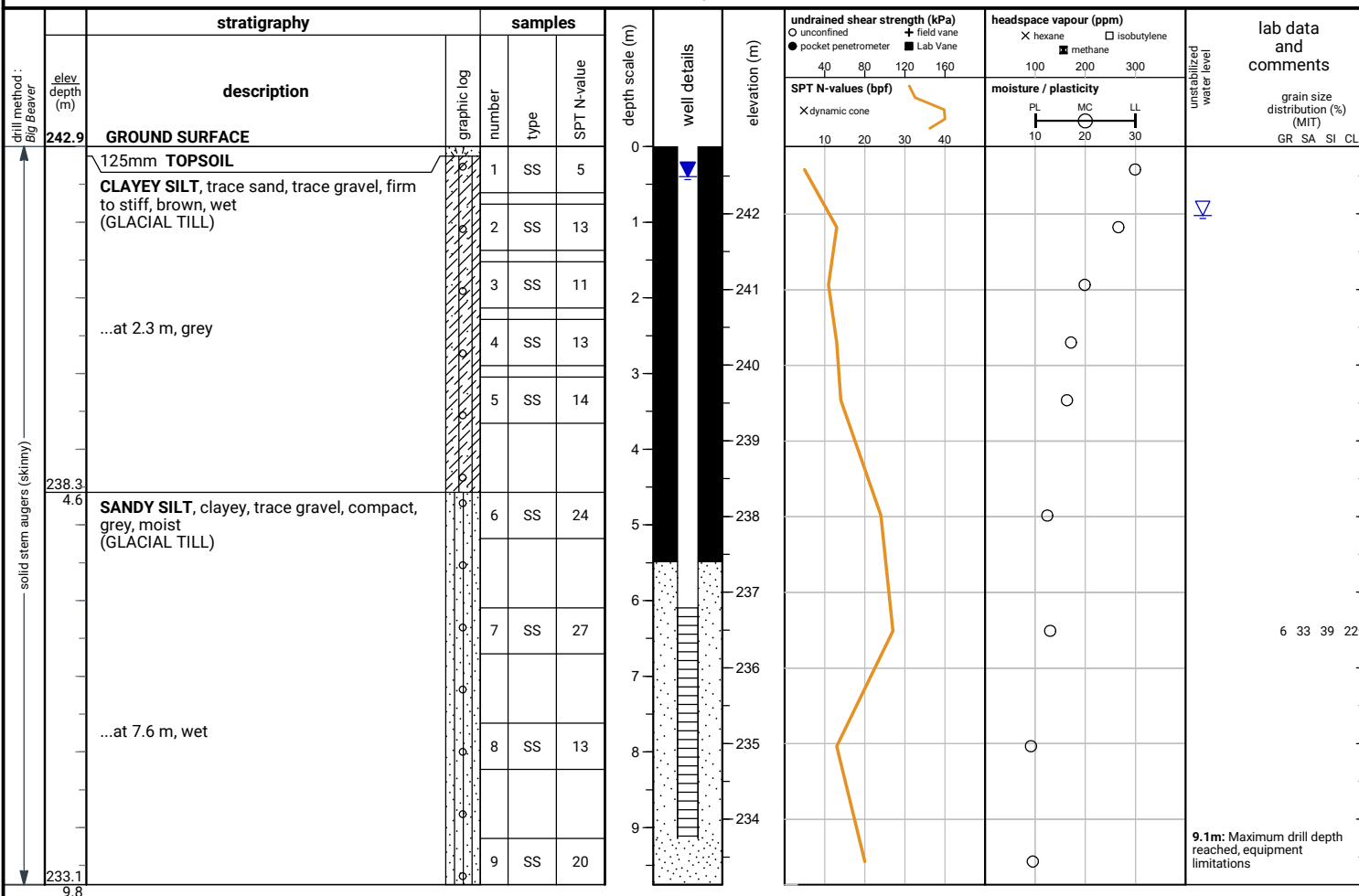
GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Jun 3, 2021	1.3	242.6
Jun 7, 2021	1.4	242.5
Jul 25, 2021	1.1	242.8
Sep 10, 2021	1.4	242.5
Nov 11, 2021	1.1	242.8
Dec 29, 2021	0.8	243.1
Jan 28, 2022	1.1	242.8

File No. : 20-295

Project : Loon Lands, Barrie, ON

Client : Loon Avenue Lands OP Inc.



END OF BOREHOLE

Unstabilized water level measured at 0.9 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

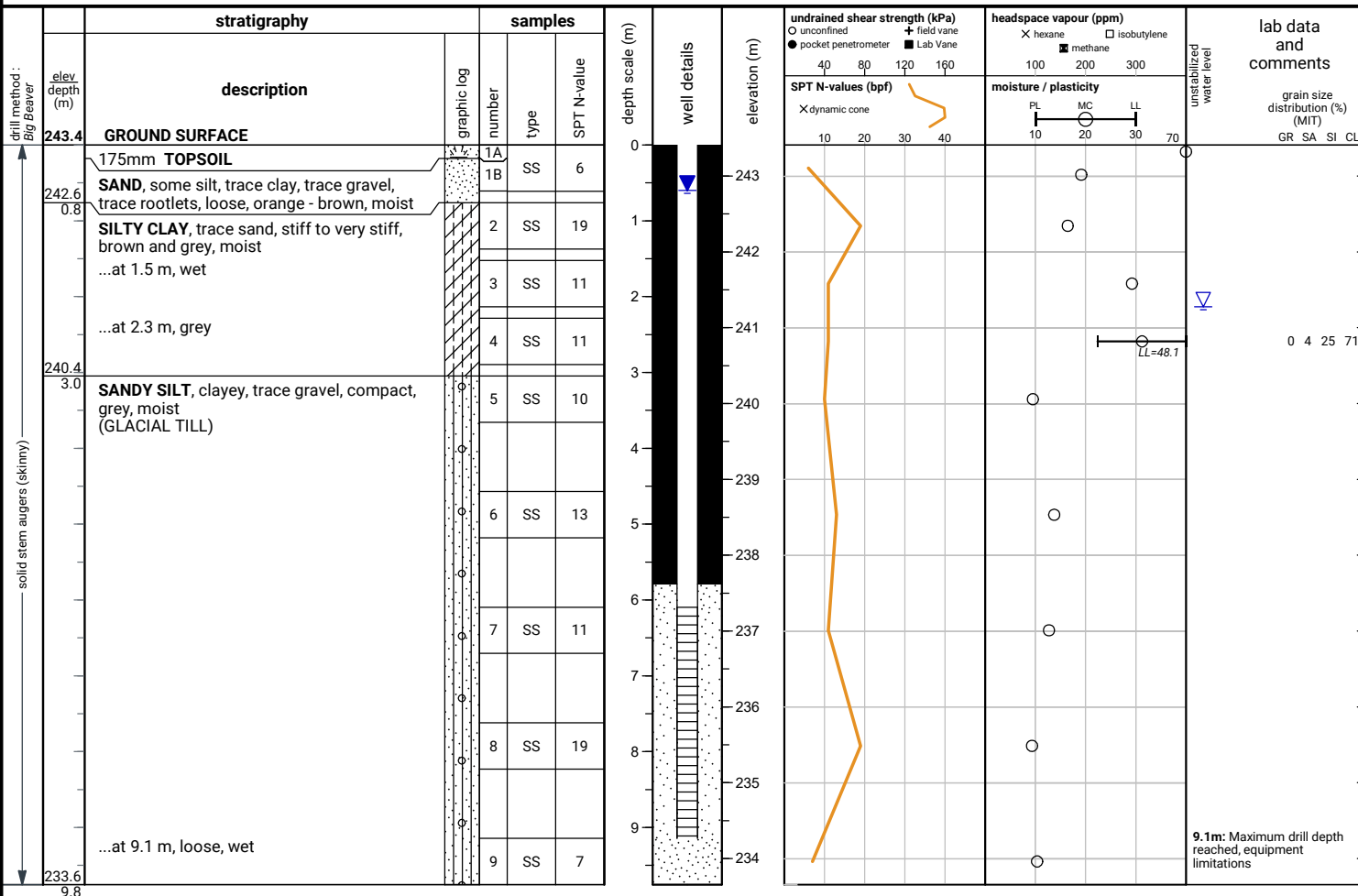
GROUNDWATER LEVELS

<u>date</u>	<u>depth (m)</u>	<u>elevation (m)</u>
Jun 3, 2021	1.3	241.6
Jun 7, 2021	1.1	241.8
Jul 25, 2021	0.4	242.5
Sep 10, 2021	0.6	242.3
Nov 11, 2021	0.3	242.6
Dec 29, 2021	0.1	242.8
Jan 28, 2022	0.4	242.5

File No. : 20-295

Project : Loon Lands, Barrie, ON

Client : Loon Avenue Lands OP Inc.



END OF BOREHOLE

Unstabalized water level measured at 2.1 m below ground surface upon completion of drilling.

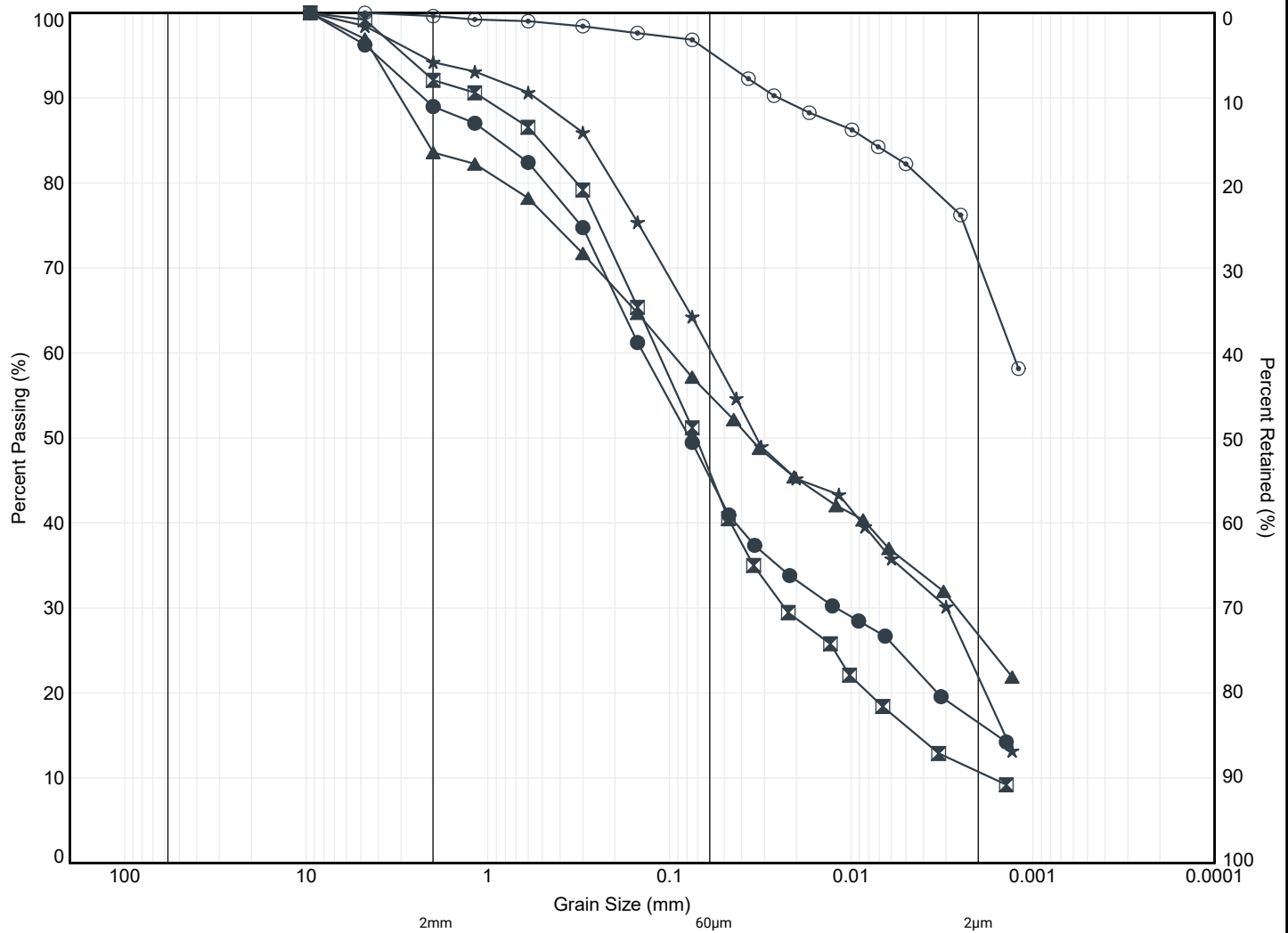
50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Jun 3, 2021	2.9	240.5
Jun 7, 2021	1.7	241.7
Jul 25, 2021	0.7	242.7
Sep 10, 2021	0.9	242.5
Nov 11, 2021	0.6	242.8
Dec 29, 2021	0.3	243.1
Jan 28, 2022	0.6	242.8

APPENDIX G





MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
● 101	SS6	4.8	240.5	11	43	29	17
⊠ 101	SS8	7.8	237.5	8	46	35	11
▲ 102	SS5	3.3	239.8	16	29	28	27
★ 104	SS7	6.4	236.5	6	33	39	22
⊙ 105	SS4	2.6	240.8	0	4	25	71

APPENDIX H





Your Project #: 20-295
Your C.O.C. #: 848089-03-01

Attention: Kimberley Pickett

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2021/11/11
Report #: R6896990
Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C1S3010

Received: 2021/09/30, 09:32

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sewer Use By-Law Semivolatile Organics	1	2021/10/02	2021/10/04	CAM SOP 00301	EPA 8270 m
Biochemical Oxygen Demand (BOD)	1	2021/10/01	2021/10/06	CAM SOP-00427	SM 23 5210B m
1,3-Dichloropropene Sum	1	N/A	2021/10/05		EPA 8260C m
Chromium (VI) in Water	1	N/A	2021/10/04	CAM SOP-00436	EPA 7199 m
Total Cyanide	1	2021/10/01	2021/10/01	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2021/10/02	2021/10/05	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/10/04	2021/10/04	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2021/10/04	2021/10/05	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS	1	N/A	2021/10/13	CAM SOP-00447	EPA 6020B m
Total Nonylphenol in Liquids by HPLC	1	2021/10/04	2021/10/05	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/10/04	2021/10/05	CAM SOP-00313	In-house Method
Animal and Vegetable Oil and Grease	1	N/A	2021/10/07	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/10/07	2021/10/07	CAM SOP-00326	EPA1664B m,SM5520B m
Polychlorinated Biphenyl in Water	1	2021/10/01	2021/10/01	CAM SOP-00309	EPA 8082A m
pH	1	2021/10/02	2021/10/05	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/10/01	CAM SOP-00444	OMOE E3179 m
Total Kjeldahl Nitrogen in Water	1	2021/10/04	2021/10/05	CAM SOP-00938	OMOE E3516 m
Total PAHs (1)	1	N/A	2021/10/04	CAM SOP - 00301	
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	1	2021/10/07	2021/10/07	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/10/02	2021/10/05	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	2	N/A	2021/10/04	CAM SOP-00228	EPA 8260C m

Remarks:

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

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



Your Project #: 20-295
Your C.O.C. #: 848089-03-01

Attention: Kimberley Pickett

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2021/11/11

Report #: R6896990

Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C1S3010

Received: 2021/09/30, 09:32

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Total PAHs include only those PAHs specified in the sewer use by-law.

(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Marijane Cruz, Senior Project Manager

Email: Marijane.Cruz@bureauveritas.com

Phone# (905)817-5756

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

Total Cover Pages : 2

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

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.



BARRIE SAN. SEWER EXCL. RH (2021-002)

Bureau Veritas ID			QUM030		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	Criteria	BH105	RDL	QC Batch
Calculated Parameters					
Total Animal/Vegetable Oil and Grease	mg/L	150	0.80	0.50	7610151
Inorganics					
Fluoride (F-)	mg/L	10	0.19	0.10	7614570
Total Kjeldahl Nitrogen (TKN)	mg/L	100	0.23	0.10	7616650
Phenols-4AAP	mg/L	0.1	0.0018	0.0010	7612017
Total Cyanide (CN)	mg/L	1.2	<0.0050	0.0050	7613230
Petroleum Hydrocarbons					
Total Oil & Grease	mg/L	-	0.80	0.50	7623538
Total Oil & Grease Mineral/Synthetic	mg/L	15	<0.50	0.50	7623539
Metals					
Mercury (Hg)	mg/L	0.01	<0.00010	0.00010	7616090
Volatile Organics					
Acetone (2-Propanone)	mg/L	-	<0.010	0.010	7612867
Benzene	mg/L	0.01	<0.00020	0.00020	7612867
Bromodichloromethane	mg/L	-	<0.00050	0.00050	7612867
Bromoform	mg/L	-	<0.0010	0.0010	7612867
Bromomethane	mg/L	-	<0.00050	0.00050	7612867
Carbon Tetrachloride	mg/L	-	<0.00019	0.00019	7612867
Chlorobenzene	mg/L	-	<0.00020	0.00020	7612867
Chloroform	mg/L	-	<0.00020	0.00020	7612867
Dibromochloromethane	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichlorobenzene	mg/L	0.05	<0.00040	0.00040	7612867
1,3-Dichlorobenzene	mg/L	-	<0.00040	0.00040	7612867
1,4-Dichlorobenzene	mg/L	0.08	<0.00040	0.00040	7612867
Dichlorodifluoromethane (FREON 12)	mg/L	-	<0.0010	0.0010	7612867
1,1-Dichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,2-Dichloroethane	mg/L	-	<0.00049	0.00049	7612867
1,1-Dichloroethylene	mg/L	-	<0.00020	0.00020	7612867
cis-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
trans-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichloropropane	mg/L	-	<0.00020	0.00020	7612867
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2021-002					



BARRIE SAN. SEWER EXCL. RH (2021-002)

Bureau Veritas ID			QUM030		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	Criteria	BH105	RDL	QC Batch
cis-1,3-Dichloropropene	mg/L	-	<0.00030	0.00030	7612867
trans-1,3-Dichloropropene	mg/L	-	<0.00040	0.00040	7612867
Ethylbenzene	mg/L	0.06	<0.00020	0.00020	7612867
Ethylene Dibromide	mg/L	-	<0.00019	0.00019	7612867
Hexane	mg/L	-	<0.0010	0.0010	7612867
Methylene Chloride(Dichloromethane)	mg/L	0.09	<0.0020	0.0020	7612867
Methyl Ethyl Ketone (2-Butanone)	mg/L	-	<0.010	0.010	7612867
Methyl Isobutyl Ketone	mg/L	-	<0.0050	0.0050	7612867
Methyl t-butyl ether (MTBE)	mg/L	-	<0.00050	0.00050	7612867
Styrene	mg/L	-	<0.00040	0.00040	7612867
1,1,1,2-Tetrachloroethane	mg/L	-	<0.00050	0.00050	7612867
1,1,2,2-Tetrachloroethane	mg/L	0.06	<0.00040	0.00040	7612867
Tetrachloroethylene	mg/L	0.06	<0.00020	0.00020	7612867
Toluene	mg/L	0.02	<0.00020	0.00020	7612867
1,1,1-Trichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,1,2-Trichloroethane	mg/L	-	<0.00040	0.00040	7612867
Trichloroethylene	mg/L	0.05	<0.00020	0.00020	7612867
Trichlorofluoromethane (FREON 11)	mg/L	-	<0.00050	0.00050	7612867
Vinyl Chloride	mg/L	-	<0.00020	0.00020	7612867
p+m-Xylene	mg/L	-	<0.00020	0.00020	7612867
o-Xylene	mg/L	-	<0.00020	0.00020	7612867
Total Xylenes	mg/L	0.3	<0.00020	0.00020	7612867
Surrogate Recovery (%)					
4-Bromofluorobenzene	%	-	89		7612867
D4-1,2-Dichloroethane	%	-	119		7612867
D8-Toluene	%	-	93		7612867
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2021-002					



BARRIE STORM SEWER BYLAW (2021-002)

Bureau Veritas ID				QUM030		
Sampling Date				2021/09/29 12:00		
COC Number				848089-03-01		
	UNITS	Criteria	Criteria-2	BH105	RDL	QC Batch
Inorganics						
Total BOD	mg/L	15	300	<2	2	7611930
pH	pH	6.0:9.5	6.0:9.5	7.94		7614574
Total Suspended Solids	mg/L	15	350	12	10	7613006
Metals						
Total Aluminum (Al)	mg/L	-	50	<0.1	0.1	7616398
Total Antimony (Sb)	mg/L	-	5	<0.02	0.02	7616398
Total Arsenic (As)	mg/L	-	1	<0.01	0.01	7616398
Total Chromium (Cr)	mg/L	0.08	2	<0.01	0.01	7616398
Total Cobalt (Co)	mg/L	-	5	<0.002	0.002	7616398
Total Copper (Cu)	mg/L	0.01	2	<0.01	0.01	7616398
Total Lead (Pb)	mg/L	0.05	0.7	<0.01	0.01	7616398
Total Manganese (Mn)	mg/L	-	5	0.040	0.001	7616398
Total Molybdenum (Mo)	mg/L	-	5	<0.005	0.005	7616398
Total Nickel (Ni)	mg/L	0.05	2	<0.005	0.005	7616398
Total Phosphorus (P)	mg/L	-	10	<0.05	0.05	7616398
Total Selenium (Se)	mg/L	-	1	<0.02	0.02	7616398
Total Silver (Ag)	mg/L	-	0.4	<0.01	0.01	7616398
Total Tin (Sn)	mg/L	-	5	<0.02	0.02	7616398
Total Titanium (Ti)	mg/L	-	-	<0.005	0.005	7616398
Total Zinc (Zn)	mg/L	0.04	2	<0.005	0.005	7616398
Total Cadmium (Cd)	mg/L	0.001	0.7	<0.000090	0.000090	7630714
No Fill	No Exceedance					
Grey	Exceeds 1 criteria policy/level					
Black	Exceeds both criteria/levels					
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Criteria: The City of Barrie Discharges to Storm Sewers By Law 2021-002						
Criteria-2: The City of Barrie Discharges to Sanitary Sewers By Law 2021-002						



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

NONYL PHENOL AND NONYL PHENOL ETHOXYLATE (WATER)

Bureau Veritas ID		QUM030		
Sampling Date		2021/09/29 12:00		
COC Number		848089-03-01		
	UNITS	BH105	RDL	QC Batch
Miscellaneous Parameters				
Nonylphenol Ethoxylate (Total)	mg/L	<0.005	0.005	7615731
Nonylphenol (Total)	mg/L	0.002	0.001	7615730
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		QUM030		
Sampling Date		2021/09/29 12:00		
COC Number		848089-03-01		
	UNITS	BH105	RDL	QC Batch
Metals				
Chromium (VI)	mg/L	0.00085	0.00050	7613594
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		QUM030			QUM030		
Sampling Date		2021/09/29 12:00			2021/09/29 12:00		
COC Number		848089-03-01			848089-03-01		
	UNITS	BH105	RDL	QC Batch	BH105 Lab-Dup	RDL	QC Batch
Semivolatile Organics							
Di-N-butyl phthalate	mg/L	<0.002	0.002	7614554	<0.002	0.002	7614554
Bis(2-ethylhexyl)phthalate	mg/L	<0.002	0.002	7614554	<0.002	0.002	7614554
3,3'-Dichlorobenzidine	mg/L	<0.0008	0.0008	7614554	<0.0008	0.0008	7614554
Pentachlorophenol	mg/L	<0.001	0.001	7614554	<0.001	0.001	7614554
Phenanthrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Anthracene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Fluoranthene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(a)anthracene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Chrysene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(b,j)fluoranthene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(k)fluoranthene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(a)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Indeno(1,2,3-cd)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Dibenzo(a,h)anthracene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(g,h,i)perylene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Dibenzo(a,i)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(e)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Perylene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Dibenzo(a,j) acridine	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
7H-Dibenzo(c,g) Carbazole	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
1,6-Dinitropyrene	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
1,3-Dinitropyrene	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
1,8-Dinitropyrene	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
Calculated Parameters							
Total PAHs (18 PAHs)	mg/L	<0.001	0.001	7610316			
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	79		7614554	90		7614554
2-Fluorobiphenyl	%	66		7614554	74		7614554
D14-Terphenyl (FS)	%	91		7614554	89		7614554
D5-Nitrobenzene	%	92		7614554	100		7614554
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		QUM030			QUM030		
Sampling Date		2021/09/29 12:00			2021/09/29 12:00		
COC Number		848089-03-01			848089-03-01		
	UNITS	BH105	RDL	QC Batch	BH105 Lab-Dup	RDL	QC Batch
D8-Acenaphthylene	%	79		7614554	89		7614554
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



VOLATILE ORGANICS BY GC/MS (WATER)

Bureau Veritas ID			QUM031		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	Criteria	TRIP BLANK	RDL	QC Batch
Calculated Parameters					
1,3-Dichloropropene (cis+trans)	mg/L	-	<0.00050	0.00050	7611026
Volatile Organics					
Acetone (2-Propanone)	mg/L	-	<0.010	0.010	7612867
Benzene	mg/L	0.01	<0.00020	0.00020	7612867
Bromodichloromethane	mg/L	-	<0.00050	0.00050	7612867
Bromoform	mg/L	-	<0.0010	0.0010	7612867
Bromomethane	mg/L	-	<0.00050	0.00050	7612867
Carbon Tetrachloride	mg/L	-	<0.00019	0.00019	7612867
Chlorobenzene	mg/L	-	<0.00020	0.00020	7612867
Chloroform	mg/L	-	<0.00020	0.00020	7612867
Dibromochloromethane	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichlorobenzene	mg/L	0.05	<0.00040	0.00040	7612867
1,3-Dichlorobenzene	mg/L	-	<0.00040	0.00040	7612867
1,4-Dichlorobenzene	mg/L	0.08	<0.00040	0.00040	7612867
Dichlorodifluoromethane (FREON 12)	mg/L	-	<0.0010	0.0010	7612867
1,1-Dichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,2-Dichloroethane	mg/L	-	<0.00049	0.00049	7612867
1,1-Dichloroethylene	mg/L	-	<0.00020	0.00020	7612867
cis-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
trans-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichloropropane	mg/L	-	<0.00020	0.00020	7612867
cis-1,3-Dichloropropene	mg/L	-	<0.00030	0.00030	7612867
trans-1,3-Dichloropropene	mg/L	-	<0.00040	0.00040	7612867
Ethylbenzene	mg/L	0.06	<0.00020	0.00020	7612867
Ethylene Dibromide	mg/L	-	<0.00019	0.00019	7612867
Hexane	mg/L	-	<0.0010	0.0010	7612867
Methylene Chloride(Dichloromethane)	mg/L	0.09	<0.0020	0.0020	7612867
Methyl Ethyl Ketone (2-Butanone)	mg/L	-	<0.010	0.010	7612867
Methyl Isobutyl Ketone	mg/L	-	<0.0050	0.0050	7612867
Methyl t-butyl ether (MTBE)	mg/L	-	<0.00050	0.00050	7612867
Styrene	mg/L	-	<0.00040	0.00040	7612867
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2021-002					



VOLATILE ORGANICS BY GC/MS (WATER)

Bureau Veritas ID			QUM031		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	Criteria	TRIP BLANK	RDL	QC Batch
1,1,1,2-Tetrachloroethane	mg/L	-	<0.00050	0.00050	7612867
1,1,2,2-Tetrachloroethane	mg/L	0.06	<0.00040	0.00040	7612867
Tetrachloroethylene	mg/L	0.06	<0.00020	0.00020	7612867
Toluene	mg/L	0.02	<0.00020	0.00020	7612867
1,1,1-Trichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,1,2-Trichloroethane	mg/L	-	<0.00040	0.00040	7612867
Trichloroethylene	mg/L	0.05	<0.00020	0.00020	7612867
Trichlorofluoromethane (FREON 11)	mg/L	-	<0.00050	0.00050	7612867
Vinyl Chloride	mg/L	-	<0.00020	0.00020	7612867
p+m-Xylene	mg/L	-	<0.00020	0.00020	7612867
o-Xylene	mg/L	-	<0.00020	0.00020	7612867
Total Xylenes	mg/L	0.3	<0.00020	0.00020	7612867
Surrogate Recovery (%)					
4-Bromofluorobenzene	%	-	90		7612867
D4-1,2-Dichloroethane	%	-	117		7612867
D8-Toluene	%	-	94		7612867
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2021-002					



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Bureau Veritas ID		QUM030		
Sampling Date		2021/09/29 12:00		
COC Number		848089-03-01		
	UNITS	BH105	RDL	QC Batch
PCBs				
Total PCB	mg/L	<0.00005	0.00005	7611999
Surrogate Recovery (%)				
Decachlorobiphenyl	%	85		7611999
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

TEST SUMMARY

Bureau Veritas ID: QUM030
Sample ID: BH105
Matrix: Water

Collected: 2021/09/29
Shipped:
Received: 2021/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	7614554	2021/10/02	2021/10/04	Adriana Zurita
Biochemical Oxygen Demand (BOD)	DO	7611930	2021/10/01	2021/10/06	Nusrat Naz
Chromium (VI) in Water	IC	7613594	N/A	2021/10/04	Lang Le
Total Cyanide	SKAL/CN	7613230	2021/10/01	2021/10/01	Aditiben Patel
Fluoride	ISE	7614570	2021/10/02	2021/10/05	Surinder Rai
Mercury in Water by CVAA	CV/AA	7616090	2021/10/04	2021/10/04	Gagandeep Rai
Total Metals Analysis by Axial ICP	ICPX	7616398	2021/10/04	2021/10/05	Jolly John
Total Metals Analysis by ICPMS	ICP/MS	7630714	N/A	2021/10/13	Arefa Dabhad
Total Nonylphenol in Liquids by HPLC	LC/FLU	7615730	2021/10/04	2021/10/05	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7615731	2021/10/04	2021/10/05	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7610151	N/A	2021/10/07	Automated Statchk
Total Oil and Grease	BAL	7623538	2021/10/07	2021/10/07	Mitul Patel
Polychlorinated Biphenyl in Water	GC/ECD	7611999	2021/10/01	2021/10/01	Dawn Howard
pH	AT	7614574	2021/10/02	2021/10/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7612017	N/A	2021/10/01	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	7616650	2021/10/04	2021/10/05	Massarat Jan
Total PAHs	CALC	7610316	N/A	2021/10/04	Automated Statchk
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7623539	2021/10/07	2021/10/07	Mitul Patel
Total Suspended Solids	BAL	7613006	2021/10/02	2021/10/05	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7612867	N/A	2021/10/04	Chandni Khawas

Bureau Veritas ID: QUM030 Dup
Sample ID: BH105
Matrix: Water

Collected: 2021/09/29
Shipped:
Received: 2021/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	7614554	2021/10/02	2021/10/04	Adriana Zurita

Bureau Veritas ID: QUM031
Sample ID: TRIP BLANK
Matrix: Water

Collected: 2021/09/29
Shipped:
Received: 2021/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	7611026	N/A	2021/10/05	Automated Statchk
Volatile Organic Compounds in Water	GC/MS	7612867	N/A	2021/10/04	Chandni Khawas



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

GENERAL COMMENTS

Revised Report (2021/11/11) : City of Barrie Sanitary criteria added per client request.

Revised Report (2021/10/14) : Cadmium repeated.

Revised Report (2021/10/08) : City of Barrie Storm sewer criteria added per client request.

Results relate only to the items tested.



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

QUALITY ASSURANCE REPORT

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7611999	Decachlorobiphenyl	2021/10/01	107	60 - 130	94	60 - 130	100	%				
7612867	4-Bromofluorobenzene	2021/10/04	101	70 - 130	101	70 - 130	95	%				
7612867	D4-1,2-Dichloroethane	2021/10/04	111	70 - 130	106	70 - 130	112	%				
7612867	D8-Toluene	2021/10/04	103	70 - 130	105	70 - 130	95	%				
7614554	2,4,6-Tribromophenol	2021/10/04	82	10 - 130	81	10 - 130	71	%				
7614554	2-Fluorobiphenyl	2021/10/04	63	30 - 130	64	30 - 130	64	%				
7614554	D14-Terphenyl (FS)	2021/10/04	76	30 - 130	80	30 - 130	84	%				
7614554	D5-Nitrobenzene	2021/10/04	75	30 - 130	79	30 - 130	80	%				
7614554	D8-Acenaphthylene	2021/10/04	77	30 - 130	81	30 - 130	80	%				
7611930	Total BOD	2021/10/06					<2	mg/L	1.3	30	96	80 - 120
7611999	Total PCB	2021/10/01	107	60 - 130	107	60 - 130	<0.00005	mg/L	NC	40		
7612017	Phenols-4AAP	2021/10/01	97	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
7612867	1,1,1,2-Tetrachloroethane	2021/10/04	101	70 - 130	103	70 - 130	<0.00050	mg/L	NC	30		
7612867	1,1,1-Trichloroethane	2021/10/04	101	70 - 130	102	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,1,2,2-Tetrachloroethane	2021/10/04	99	70 - 130	99	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,1,2-Trichloroethane	2021/10/04	103	70 - 130	103	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,1-Dichloroethane	2021/10/04	95	70 - 130	96	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,1-Dichloroethylene	2021/10/04	92	70 - 130	96	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,2-Dichlorobenzene	2021/10/04	94	70 - 130	97	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,2-Dichloroethane	2021/10/04	99	70 - 130	97	70 - 130	<0.00049	mg/L	NC	30		
7612867	1,2-Dichloropropane	2021/10/04	96	70 - 130	97	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,3-Dichlorobenzene	2021/10/04	91	70 - 130	95	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,4-Dichlorobenzene	2021/10/04	104	70 - 130	110	70 - 130	<0.00040	mg/L	NC	30		
7612867	Acetone (2-Propanone)	2021/10/04	105	60 - 140	101	60 - 140	<0.010	mg/L	NC	30		
7612867	Benzene	2021/10/04	88	70 - 130	90	70 - 130	<0.00020	mg/L	NC	30		
7612867	Bromodichloromethane	2021/10/04	103	70 - 130	103	70 - 130	<0.00050	mg/L	NC	30		
7612867	Bromoform	2021/10/04	103	70 - 130	103	70 - 130	<0.0010	mg/L	NC	30		
7612867	Bromomethane	2021/10/04	100	60 - 140	99	60 - 140	<0.00050	mg/L	NC	30		
7612867	Carbon Tetrachloride	2021/10/04	99	70 - 130	101	70 - 130	<0.00019	mg/L	NC	30		
7612867	Chlorobenzene	2021/10/04	93	70 - 130	96	70 - 130	<0.00020	mg/L	NC	30		
7612867	Chloroform	2021/10/04	98	70 - 130	99	70 - 130	<0.00020	mg/L	NC	30		

BUREAU
VERITAS

Bureau Veritas Job #: C153010

Report Date: 2021/11/11

QUALITY ASSURANCE REPORT(CONT'D)

Grounded Engineering Inc.

Client Project #: 20-295

Sampler Initials: VT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7612867	cis-1,2-Dichloroethylene	2021/10/04	100	70 - 130	101	70 - 130	<0.00050	mg/L	NC	30		
7612867	cis-1,3-Dichloropropene	2021/10/04	91	70 - 130	90	70 - 130	<0.00030	mg/L	NC	30		
7612867	Dibromochloromethane	2021/10/04	100	70 - 130	101	70 - 130	<0.00050	mg/L	NC	30		
7612867	Dichlorodifluoromethane (FREON 12)	2021/10/04	82	60 - 140	87	60 - 140	<0.0010	mg/L	NC	30		
7612867	Ethylbenzene	2021/10/04	79	70 - 130	85	70 - 130	<0.00020	mg/L	NC	30		
7612867	Ethylene Dibromide	2021/10/04	96	70 - 130	97	70 - 130	<0.00019	mg/L	NC	30		
7612867	Hexane	2021/10/04	90	70 - 130	95	70 - 130	<0.0010	mg/L	NC	30		
7612867	Methyl Ethyl Ketone (2-Butanone)	2021/10/04	102	60 - 140	100	60 - 140	<0.010	mg/L	NC	30		
7612867	Methyl Isobutyl Ketone	2021/10/04	95	70 - 130	96	70 - 130	<0.0050	mg/L	NC	30		
7612867	Methyl t-butyl ether (MTBE)	2021/10/04	84	70 - 130	87	70 - 130	<0.00050	mg/L	NC	30		
7612867	Methylene Chloride(Dichloromethane)	2021/10/04	102	70 - 130	98	70 - 130	<0.0020	mg/L	NC	30		
7612867	o-Xylene	2021/10/04	81	70 - 130	90	70 - 130	<0.00020	mg/L	NC	30		
7612867	p+m-Xylene	2021/10/04	83	70 - 130	89	70 - 130	<0.00020	mg/L	NC	30		
7612867	Styrene	2021/10/04	93	70 - 130	102	70 - 130	<0.00040	mg/L	NC	30		
7612867	Tetrachloroethylene	2021/10/04	92	70 - 130	95	70 - 130	<0.00020	mg/L	NC	30		
7612867	Toluene	2021/10/04	88	70 - 130	92	70 - 130	<0.00020	mg/L	NC	30		
7612867	Total Xylenes	2021/10/04					<0.00020	mg/L	NC	30		
7612867	trans-1,2-Dichloroethylene	2021/10/04	95	70 - 130	97	70 - 130	<0.00050	mg/L	NC	30		
7612867	trans-1,3-Dichloropropene	2021/10/04	103	70 - 130	102	70 - 130	<0.00040	mg/L	NC	30		
7612867	Trichloroethylene	2021/10/04	99	70 - 130	102	70 - 130	<0.00020	mg/L	NC	30		
7612867	Trichlorofluoromethane (FREON 11)	2021/10/04	99	70 - 130	101	70 - 130	<0.00050	mg/L	NC	30		
7612867	Vinyl Chloride	2021/10/04	92	70 - 130	95	70 - 130	<0.00020	mg/L	NC	30		
7613006	Total Suspended Solids	2021/10/05					<10	mg/L	NC	25	98	85 - 115
7613230	Total Cyanide (CN)	2021/10/01	109	80 - 120	106	80 - 120	<0.0050	mg/L	0.22	20		
7613594	Chromium (VI)	2021/10/04	101	80 - 120	102	80 - 120	<0.00050	mg/L	NC	20		
7614554	1,3-Dinitropyrene	2021/10/04	71	30 - 130	124	30 - 130	<0.0004	mg/L	NC	40		
7614554	1,6-Dinitropyrene	2021/10/04	78	30 - 130	116	30 - 130	<0.0004	mg/L	NC	40		
7614554	1,8-Dinitropyrene	2021/10/04	67	30 - 130	102	30 - 130	<0.0004	mg/L	NC	40		
7614554	3,3'-Dichlorobenzidine	2021/10/04	50	30 - 130	85	30 - 130	<0.0008	mg/L	NC	40		
7614554	7H-Dibenzo(c,g) Carbazole	2021/10/04	89	30 - 130	94	30 - 130	<0.0004	mg/L	NC	40		
7614554	Anthracene	2021/10/04	79	30 - 130	84	30 - 130	<0.0002	mg/L	NC	40		

BUREAU
VERITAS

Bureau Veritas Job #: C1S3010

Report Date: 2021/11/11

QUALITY ASSURANCE REPORT(CONT'D)

Grounded Engineering Inc.

Client Project #: 20-295

Sampler Initials: VT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7614554	Benzo(a)anthracene	2021/10/04	83	30 - 130	84	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(a)pyrene	2021/10/04	69	30 - 130	74	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(b,j)fluoranthene	2021/10/04	81	30 - 130	89	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(e)pyrene	2021/10/04	86	30 - 130	92	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(g,h,i)perylene	2021/10/04	96	30 - 130	104	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(k)fluoranthene	2021/10/04	90	30 - 130	92	30 - 130	<0.0002	mg/L	NC	40		
7614554	Bis(2-ethylhexyl)phthalate	2021/10/04	90	30 - 130	92	30 - 130	<0.002	mg/L	NC	40		
7614554	Chrysene	2021/10/04	89	30 - 130	91	30 - 130	<0.0002	mg/L	NC	40		
7614554	Dibenzo(a,h)anthracene	2021/10/04	98	30 - 130	103	30 - 130	<0.0002	mg/L	NC	40		
7614554	Dibenzo(a,i)pyrene	2021/10/04	71	30 - 130	87	30 - 130	<0.0002	mg/L	NC	40		
7614554	Dibenzo(a,j) acridine	2021/10/04	95	30 - 130	98	30 - 130	<0.0004	mg/L	NC	40		
7614554	Di-N-butyl phthalate	2021/10/04	94	30 - 130	97	30 - 130	<0.002	mg/L	NC	40		
7614554	Fluoranthene	2021/10/04	86	30 - 130	89	30 - 130	<0.0002	mg/L	NC	40		
7614554	Indeno(1,2,3-cd)pyrene	2021/10/04	99	30 - 130	108	30 - 130	<0.0002	mg/L	NC	40		
7614554	Pentachlorophenol	2021/10/04	96	30 - 130	52	30 - 130	<0.001	mg/L	NC	40		
7614554	Perylene	2021/10/04	85	30 - 130	89	30 - 130	<0.0002	mg/L	NC	40		
7614554	Phenanthrene	2021/10/04	82	30 - 130	86	30 - 130	<0.0002	mg/L	NC	40		
7614554	Pyrene	2021/10/04	86	30 - 130	88	30 - 130	<0.0002	mg/L	NC	40		
7614570	Fluoride (F-)	2021/10/05	102	80 - 120	99	80 - 120	<0.10	mg/L	11	20		
7614574	pH	2021/10/05			102	98 - 103			0.44	N/A		
7615730	Nonylphenol (Total)	2021/10/05	126	50 - 130	101	50 - 130	<0.001	mg/L	NC	40		
7615731	Nonylphenol Ethoxylate (Total)	2021/10/05	104	50 - 130	107	50 - 130	<0.005	mg/L				
7616090	Mercury (Hg)	2021/10/04	95	75 - 125	98	80 - 120	<0.00010	mg/L	NC	20		
7616398	Total Aluminum (Al)	2021/10/05	NC	80 - 120	103	80 - 120	<0.1	mg/L				
7616398	Total Antimony (Sb)	2021/10/05	109	80 - 120	108	80 - 120	<0.02	mg/L				
7616398	Total Arsenic (As)	2021/10/05	108	80 - 120	105	80 - 120	<0.01	mg/L				
7616398	Total Chromium (Cr)	2021/10/05	103	80 - 120	104	80 - 120	<0.01	mg/L				
7616398	Total Cobalt (Co)	2021/10/05	100	80 - 120	103	80 - 120	<0.002	mg/L				
7616398	Total Copper (Cu)	2021/10/05	105	80 - 120	105	80 - 120	<0.01	mg/L				
7616398	Total Lead (Pb)	2021/10/05	100	80 - 120	104	80 - 120	<0.01	mg/L				
7616398	Total Manganese (Mn)	2021/10/05	102	80 - 120	104	80 - 120	<0.001	mg/L				

BUREAU
VERITAS

Bureau Veritas Job #: C1S3010

Report Date: 2021/11/11

QUALITY ASSURANCE REPORT(CONT'D)

Grounded Engineering Inc.

Client Project #: 20-295

Sampler Initials: VT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7616398	Total Molybdenum (Mo)	2021/10/05	106	80 - 120	106	80 - 120	<0.005	mg/L				
7616398	Total Nickel (Ni)	2021/10/05	100	80 - 120	105	80 - 120	<0.005	mg/L				
7616398	Total Phosphorus (P)	2021/10/05	NC	80 - 120	111	80 - 120	<0.05	mg/L	2.2	20		
7616398	Total Selenium (Se)	2021/10/05	107	80 - 120	105	80 - 120	<0.02	mg/L				
7616398	Total Silver (Ag)	2021/10/05	99	80 - 120	101	80 - 120	<0.01	mg/L				
7616398	Total Tin (Sn)	2021/10/05	102	80 - 120	107	80 - 120	<0.02	mg/L				
7616398	Total Titanium (Ti)	2021/10/05	103	80 - 120	103	80 - 120	<0.005	mg/L				
7616398	Total Zinc (Zn)	2021/10/05	106	80 - 120	108	80 - 120	<0.005	mg/L				
7616650	Total Kjeldahl Nitrogen (TKN)	2021/10/05	110	80 - 120	99	80 - 120	<0.10	mg/L	4.5	20	99	80 - 120
7623538	Total Oil & Grease	2021/10/07			98	85 - 115	<0.50	mg/L	1.0	25		
7623539	Total Oil & Grease Mineral/Synthetic	2021/10/07			95	85 - 115	<0.50	mg/L	1.1	25		
7630714	Total Cadmium (Cd)	2021/10/13	101	80 - 120	101	80 - 120	<0.000090	mg/L	NC	20		

N/A = Not Applicable

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

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

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

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

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

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

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

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times \text{RDL}$).



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

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

VTL Company Name: #36876 Grounded Engineering Inc. Attention: Kimberley Pickett Address: 1 Banigan Drive Toronto ON M4H 1G3 Tel: (647) 265-0915 Fax: Email: kpickett@groundedeng.ca						REPORT TO: Company Name: Kimberley Pickett Attention: Kimberley Pickett Address: Tel: (647) 265-0915 Fax: Email: kpickett@groundedeng.ca						PROJECT INFORMATION: Quotation #: C04975 P.O. #: Project: 20-295 Project Name: Site #: Sampled By: VT/MC						Laboratory Use Only: BV Labs Job #: Bottle Order #: 848089 COC #: C#848089-03-01 Project Manager: Manjane Cruz											
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY												Turnaround Time (TAT) Required: Please provide advance notice for rush projects																	
Regulation 153 (2011) ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table _____						Other Regulations ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality _____ ☐ PWQO ☐ Reg 406 Table _____ ☐ Other _____						Special Instructions 						ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Field Filtered (please circle): Metals / Hg / Cr-VI ☐ Reg 153-Metals & Inorganics-Pkg (Soil) ☐ Reg 468-PHC+STX&LEL (Soil) ☐ Reg 153-VOCs by NIS (Soil) ☐ Reg 558-TCLP-Inorganics Package ☐ Reg 558-TCLP-VOCs by ITS ☐ Reg 558-TCLP-BBP TCLP PCB ☒ Toronto Sanitary & Comm. Sewer (100-2016) PWQO						Regular (Standard) TAT: <i>(will be applied if Rush TAT is not specified):</i> Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dissins/Furans are > 5 days - contact your Project Manager for details. Job Specific Rush TAT (if applies to entire submission) Date Required: _____ Time Required: _____ Rush Confirmation Number: _____ (call lab for #)					
Sample Barcode Label		Sample (Location) Identification		Date Sampled	Time Sampled	Matrix										# of Bottles	Comments												
1		BH105	09/29/12	12:00	6W								X			18													
2		Trip Blank	↓	↓	↓											2													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													

* RELINQUISHED BY: (Signature/Print) <i>Vivi Tran</i>		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print) 		Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
		21/09/12	9:30			20/09/12	0917L		Time Sensitive	Temperature (°C) on Recl	Custody Seal Present	Yes	No
										9/21L	Intact		

* UNLESS OTHERWISE AGREED IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.
 * IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.
 ** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

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

White: BV Labs
Yellow: Client



Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

Exceedance Summary Table – Barrie Storm Sewer
Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						
The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

Exceedance Summary Table – Barrie Sanitary Sewer
Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						
The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

APPENDIX I





Slug Test Analysis Report

Project: 338 Maplevue Dr E

Number: 20-295

Client:

Location: Barrie, ON

Slug Test: BH101

Test Well: BH101

Test Conducted by: VT

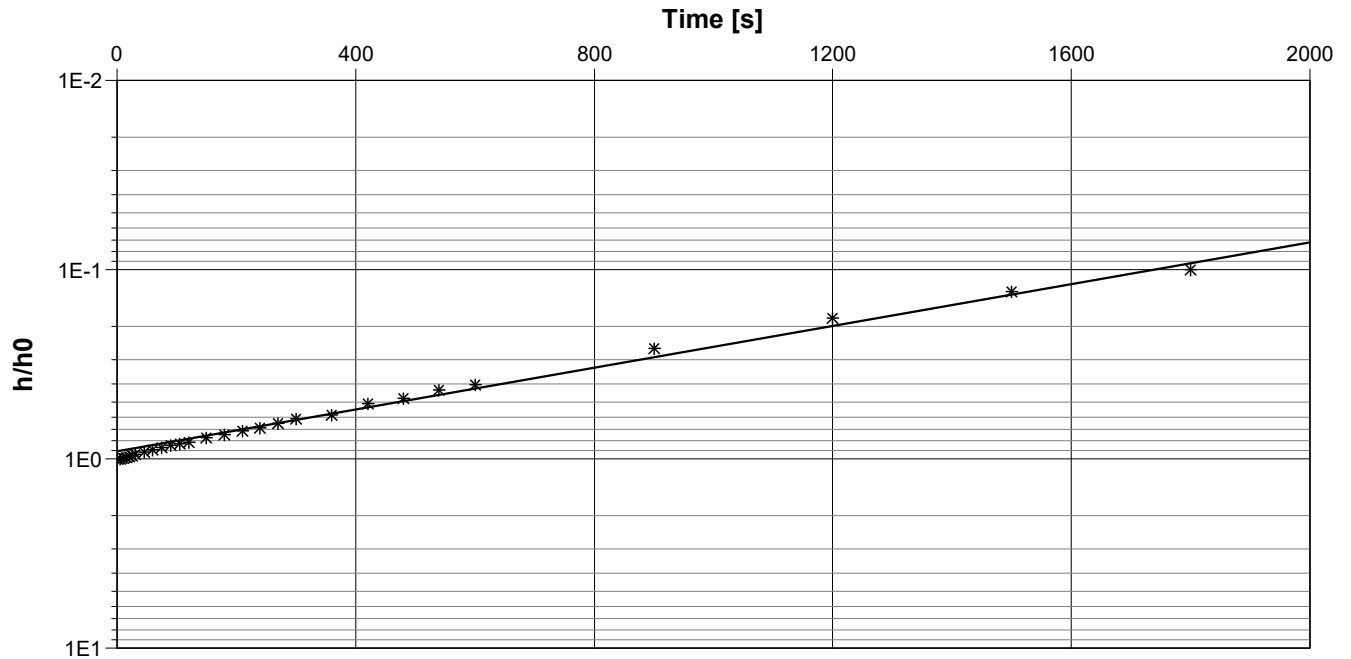
Test Date: 2021-06-07

Analysis Performed by: EN

BH101

Analysis Date: 2021-08-18

Aquifer Thickness: 5.00 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

BH101

1.43×10^{-7}



Slug Test Analysis Report

Project: 338 Maplevue Dr E

Number: 20-295

Client:

Location: Barrie, ON

Slug Test: BH102

Test Well: BH102

Test Conducted by: VT

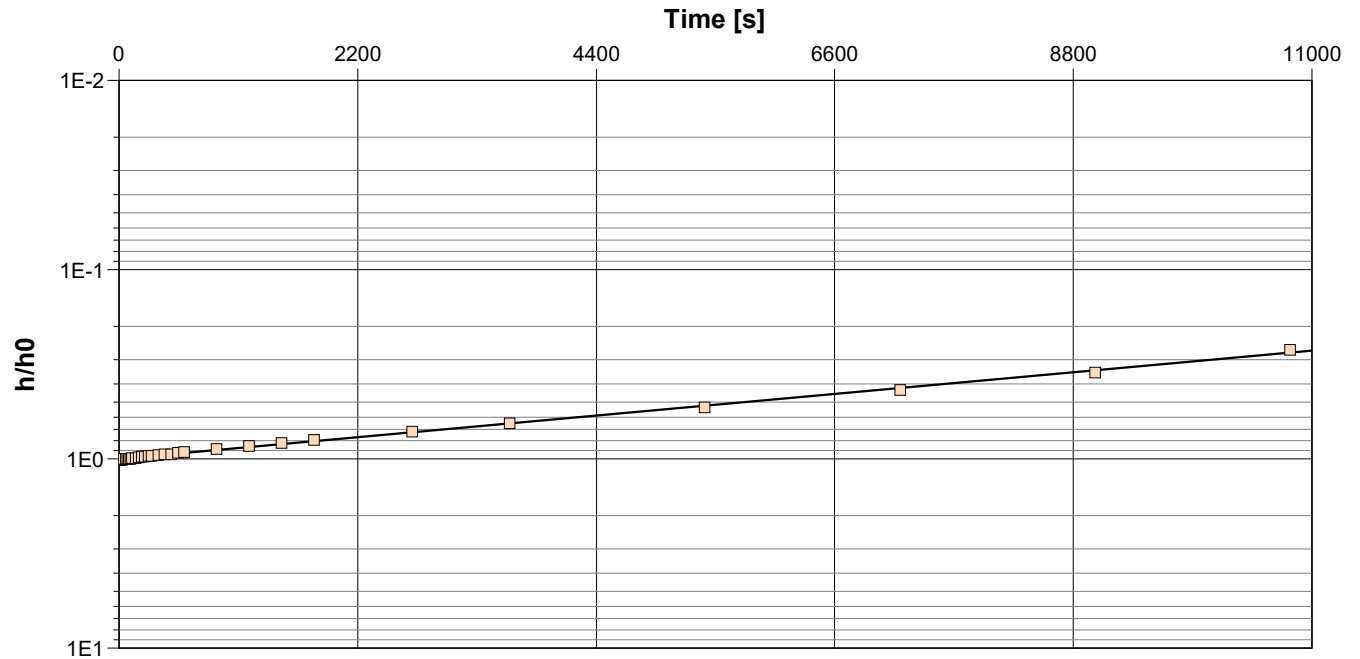
Test Date: 2021-06-07

Analysis Performed by: EN

BH102

Analysis Date: 2021-08-18

Aquifer Thickness: 9.60 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

BH102

1.42×10^{-8}



Slug Test Analysis Report

Project: 338 Maplevue Dr E

Number: 20-295

Client:

Location: Barrie, ON

Slug Test: BH103

Test Well: BH103

Test Conducted by: VT

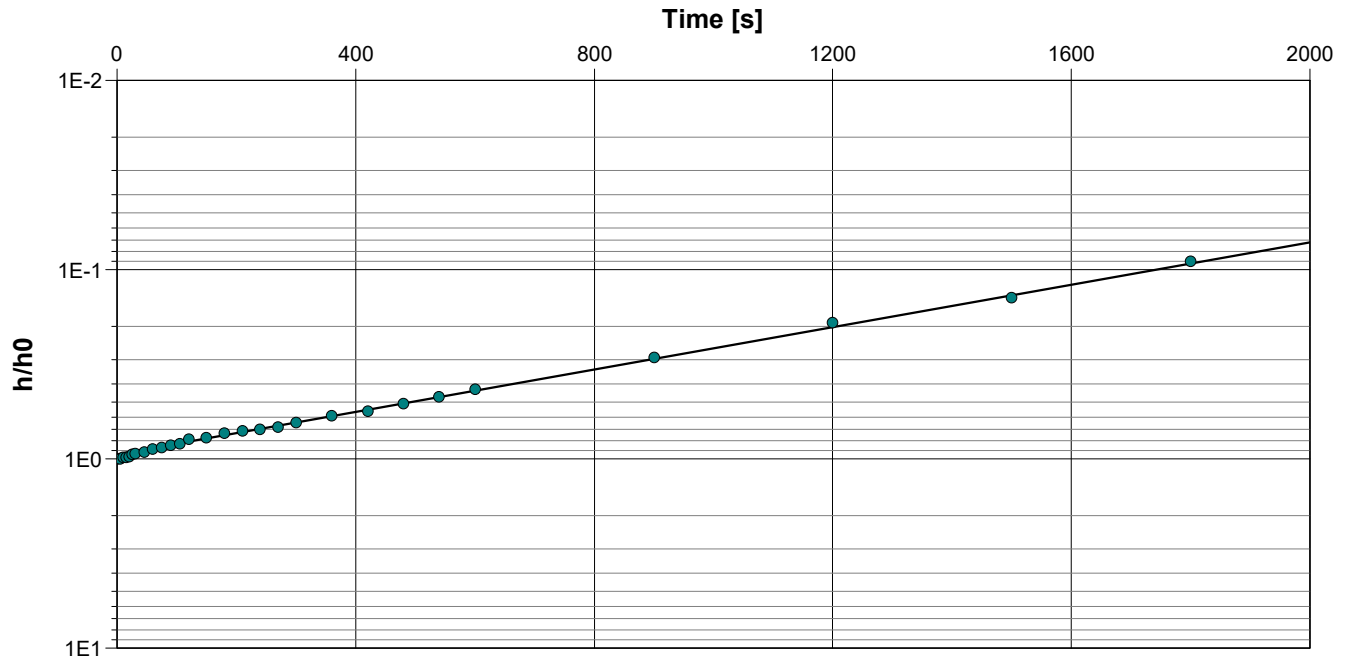
Test Date: 2021-06-07

Analysis Performed by: EN

BH103

Analysis Date: 2021-08-18

Aquifer Thickness: 9.10 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

BH103

4.71×10^{-7}



Slug Test Analysis Report

Project: 338 Maplevue Dr E

Number: 20-295

Client:

Location: Barrie, ON

Slug Test: BH104

Test Well: BH104

Test Conducted by: VT

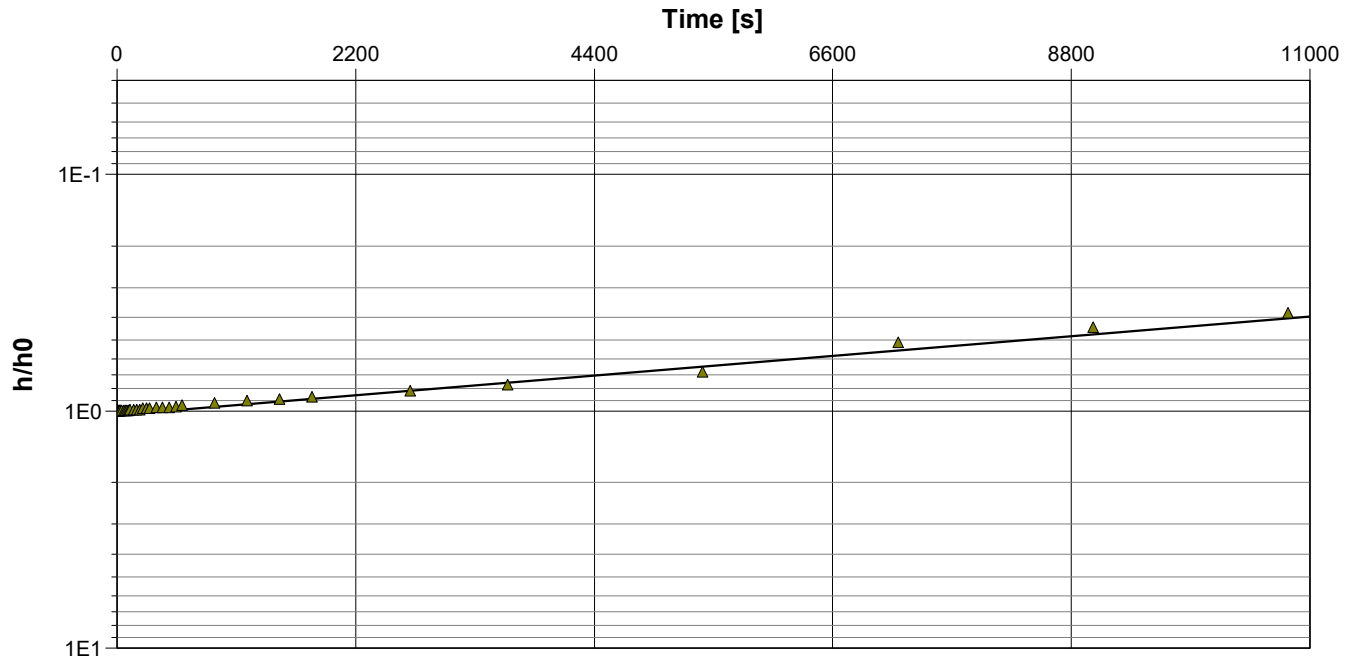
Test Date: 2021-06-07

Analysis Performed by: EN

BH104

Analysis Date: 2021-08-18

Aquifer Thickness: 5.20 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

BH104

3.23×10^{-8}



Slug Test Analysis Report

Project: 338 Maplevue Dr E

Number: 20-295

Client:

Location: Barrie, ON

Slug Test: BH105

Test Well: BH105

Test Conducted by: VT

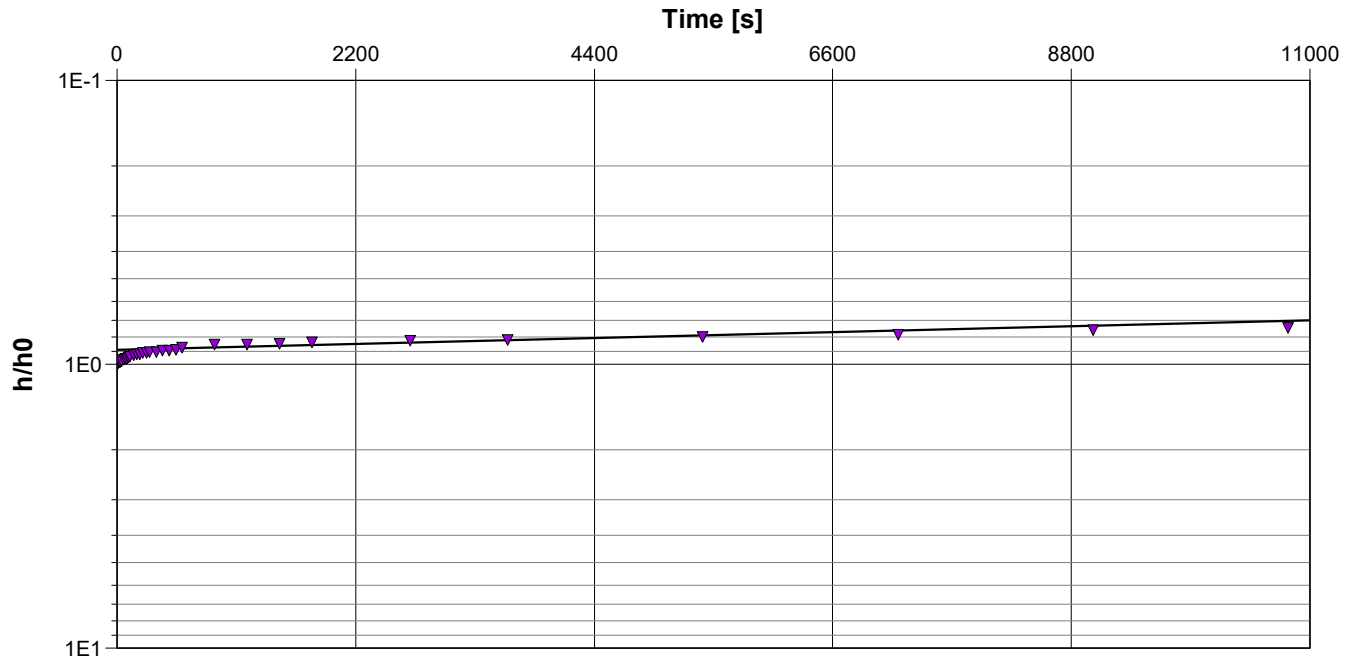
Test Date: 2021-06-07

Analysis Performed by: EN

BH105

Analysis Date: 2021-08-18

Aquifer Thickness: 6.80 m



Calculation using Bouwer & Rice

Observation Well

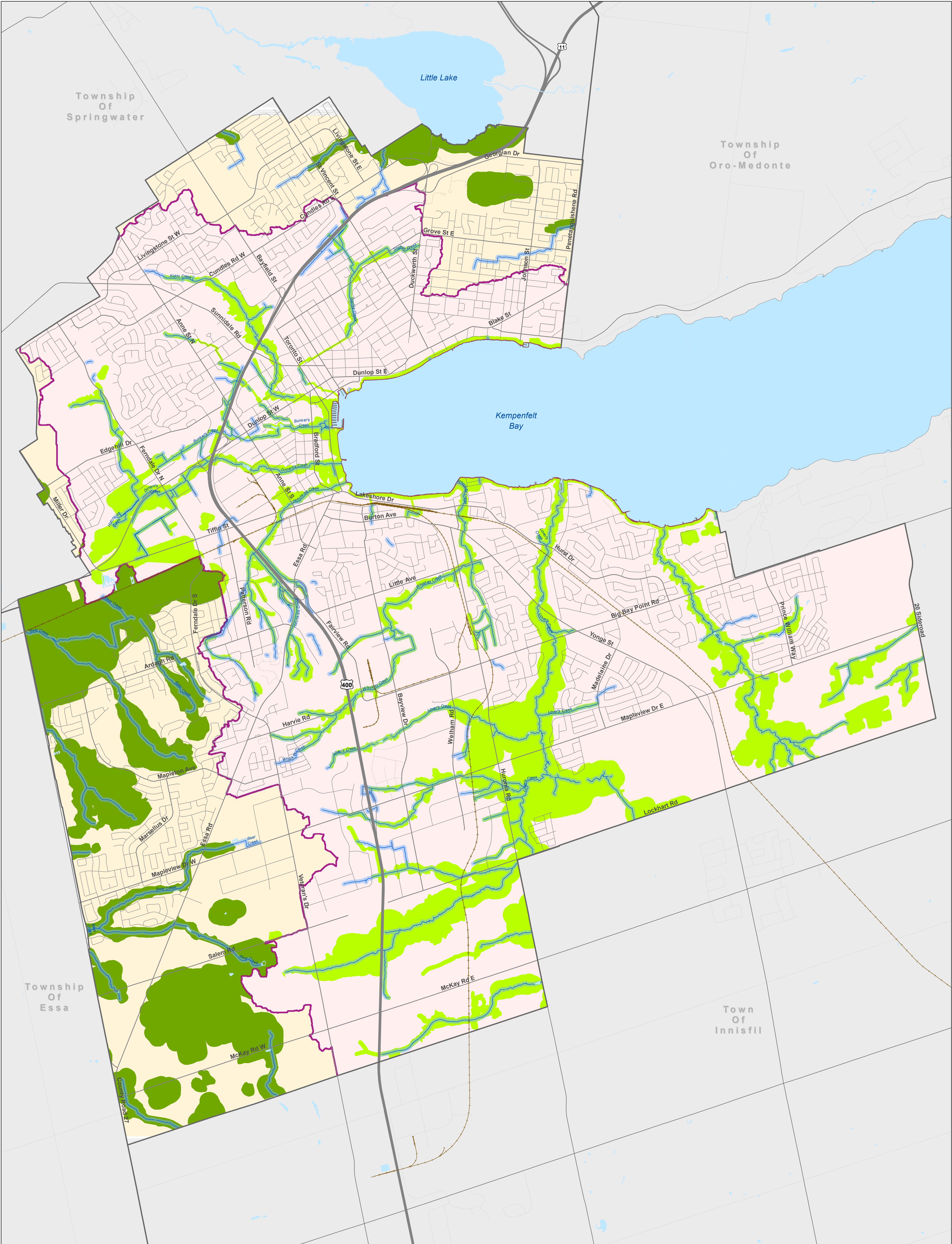
Hydraulic Conductivity
[m/s]

BH105

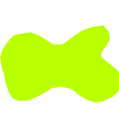
8.48×10^{-9}

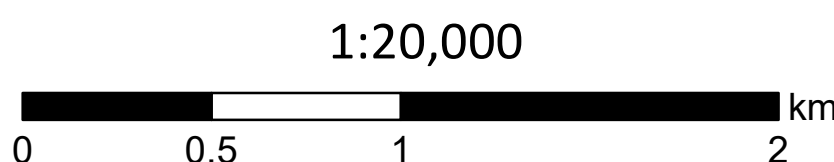
APPENDIX J





OFFICIAL PLAN
Schedule F
Conservation Authority
Regulation Limits
Office Consolidation
January 2018

- | | | |
|--|---|---|
|  Watercourse |  Lake Simcoe Region Conservation Authority Regulation Limits |  Lake Simcoe Regional Conservation Authority |
|  30 Metre Watercourse Setback |  Nottawasaga Valley Conservation Authority Regulation Limits |  Nottawasaga Valley Conservation Authority |
|  Waterbody | | |



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For information please contact Service Barrie at 705-726-4242 or ServiceBarrie@barrie.ca



Lake Simcoe Region
conservation authority

338 Mapleview Dr- LSRCA Regulated Area



Features

- LSRCA Watershed Boundary
- Lake Simcoe
- Watercourse
- Regulated Area Boundary
- Regulated Area
- Road Labels
- Roads
 - Hwy 400 Series
 - Highway, Arterials
 - Local Road
- Railway

Printed On:
12/7/2021

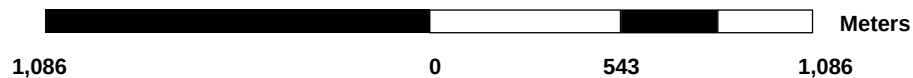


WGS_1984_Web_Mercator_
Auxiliary_Sphere

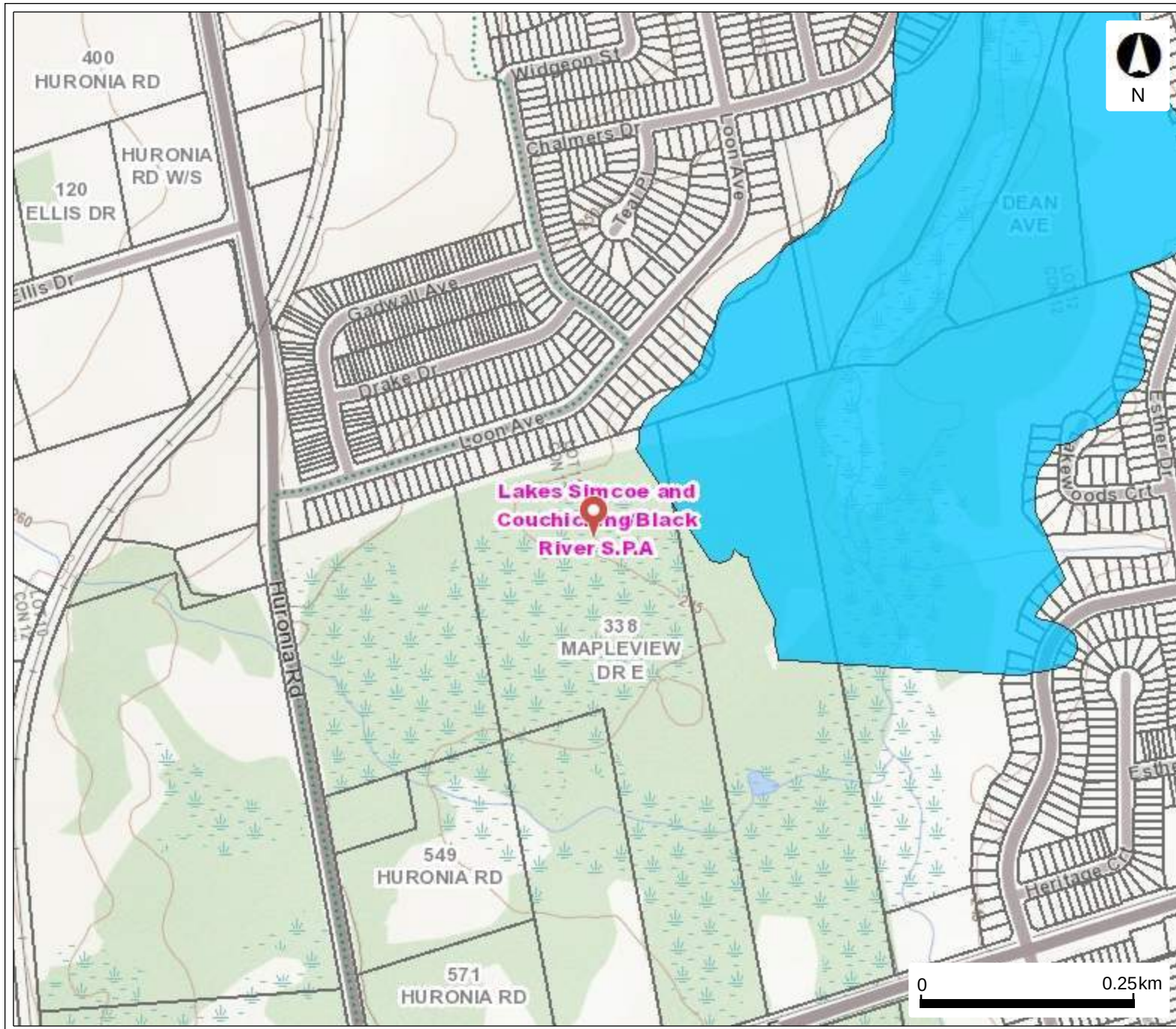
Mapped By:

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Scale 1: 21,385



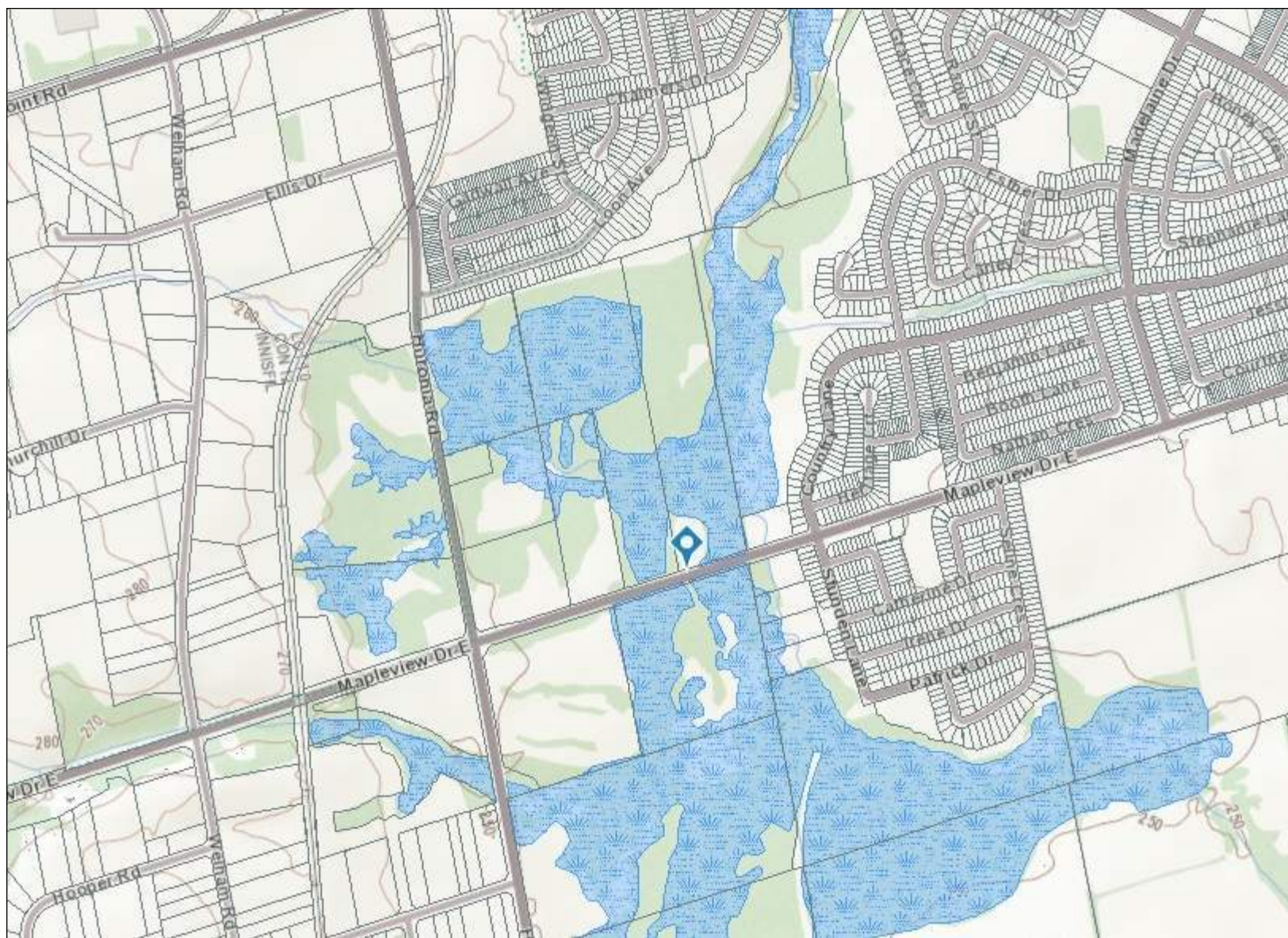
Source Water Protection



Legend

- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
 - A
 - B
 - C
 - C1
 - D
 - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel with Address

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Legend

- Assessment Parcel
- Woodland
- Conservation Reserve
- Provincial Park
- Natural Heritage System
- Ecoregion
- Wetland**
 - Provincially Significant Wetland Evaluated
 - Non - Provincially Significant Wetland Evaluated
 - Unevaluated Wetland
- Area of Natural Heritage & Scientific Interest (ANSI)**
 - Provincially Significant Life Science ANSI
 - Provincially Significant Earth Science ANSI
- Greenbelt Plan**
 - Boundary
 - Greenbelt External Connections
- Land Use Designations**
 - Protected Countryside
 - Greenbelt Towns and Villages
 - Greenbelt Hamlets
 - Urban River Valley
 - Greenbelt Specialty Crop Area
- Niagara Escarpment Plan (NEP)**
 - Boundary
 - Parks and Open Space System
- Land Use Designations**
 - Escarpment Natural Area
 - Escarpment Protection Area
 - Escarpment Rural Area
 - Mineral Resource Extraction Area
 - Escarpment Recreation Area
 - Urban Area
 - Minor Urban Centre
- Oak Ridges Moraine Conservation Plan (ORM)**
 - Boundary
- Land Use Designations**
 - Natural Core Area
 - Natural Linkage Area
 - Countryside Area
 - Rural Settlement
 - Palgrave Estates Residential Community
 - Settlement Area

0.7 0 0.33 0.7 Kilometers



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APPENDIX K



None Available



APPENDIX L



Water Balance

1. Climate Information

(for LSRCA use the rate provided on their website)

Precipitation	914 mm/a	0.91 m/a
Evapotranspiration	545 mm/a	0.55 m/a
Water Surplus	369 mm/a	0.37 m/a

2. Infiltration Rates

Table 2 Approach - Infiltration Factors

Hilly land, average slope of 28 to 47 m per km	0.1
Open Sandy Loam	0.4
Woodland	0.2
TOTAL:	0.7

Infiltration (Infil. Fac - Water Surplus)	258.3 mm/a	0.2583 m/a
Run-off (Water Surplus - B19)	111 mm/a	0.1107 m/a

Table 3 Approach - Typical Recharge Rates

silty sand to sandy silt	150 - 200 mm/a
silt	125 - 150 mm/a
clayey silt	100 - 125 mm/a

The site development area is underlain by silty sand to silty clay till.

Based on the above, the recharge rate is	125 mm/a	0.125 m/a
with runoff of	244 mm/a	0.244 m/a

Property Statistics

3. Pre- Development Site Coverage

Area Covered by Existing Building	0 m ²	0.00 ha
Area Covered by Existing Hard Surface Paving	0 m ²	0.00 ha
Area Covered by Existing Landscaped area	25,623 m ²	2.56 ha
TOTAL	25,623 m ²	2.56 ha

4. Post-Development Coverage

Area Covered by Building with Additions	6,500 m ²	0.65 ha
Area Covered by Hard Surface Paving	7,000 m ²	0.70 ha
Area Covered by Landscaped Area	12,123 m ²	1.21 ha
TOTAL:	25,623 m ²	2.56 ha

Water Balance

5. Annual Water Balance Before Building Additions

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building (entire site)	0	0	-	-	-	-
Hard Surface Paving	0	0	-	-	-	-
Landscape Area (entire site)	25,623	23,419	13,965		3,203	6,252
TOTAL	25,623	23,419	13,965	0	3,203	6,252

6. Annual Water Balance After Building Additions

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building (entire site)	6,500	5,941	-	-	-	5,941
Hard Surface Paving	7,000	6,398	-	-	-	6,398
Landscape Area (entire site)	12,123	11,080	6,607	-	1,515	2,958
TOTAL	25,623	23,419	6,607	0	1,515	15,297

7. Comparison of Pre-Development (before building additions) and Post-Development (after building additions)

	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Pre-Development	23,419	13,965	-	3,203	6,252
Post-Development	23,419	6,607	-	1,515	15,297

1,688

8. Requirement for Infiltration of Roof Runoff

Volume of roof (building additions) run-off captured (90%)	5,941 m ³
Volume of post-development infiltration without roof run-off	1,515 m ³
Volume of roof run-off required to match pre-development infiltration rates	1,688 m ³
Percentage of roof run-off (building additions roof) required to match pre-development infiltration	28%

APPENDIX M



TABLE 1
GROUNDWATER LEVEL MONITORING SUMMARY
338 Mapleview Dr E
Barrie, ON
20-295

Well ID	Ground Surface Elevation (masl)	Screen Interval	Screen Interval	Soil Strata	Grounded Engineering														Minimum Elev. (Lowest)		Maximum Elev. (Highest)		Seasonal Fluctuation
					April 1, 2021		June 7, 2021		July 25, 2021		September 10, 2021		November 11, 2021		December 29, 2021		January 28, 2022		(mbgs)	(masl)	(mbgs)	(masl)	
		(mbgs)	(masl)		(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)					
BH101	245.3	6.1 - 9.1	239.2 - 236.2	Lower Silty Sand Glacial Till	1.4	243.9	2.0	243.3	1.5	243.8	1.9	243.4	1.5	243.8	1.2	244.1	1.4	243.9	2.0	243.3	1.2	244.1	0.4
BH102	243.1	6.1 - 9.1	237.0 - 234.0	Upper Silty Sand Glacial Till	0.2	242.9	0.5	242.6	0.1	243.0	0.5	242.6	0.2	242.9	-	-	-	-	0.5	242.6	0.1	243.0	0.2
BH103	243.9	5.5 - 8.5	238.4 - 235.3	Clayey Silt	-	-	1.4	242.5	1.1	242.9	1.4	242.6	1.1	242.9	0.8	243.1	1.1	242.8	1.4	242.5	0.8	243.1	0.3
BH104	242.9	6.1 - 9.1	236.8 - 233.7	Lower Silty Sand Glacial Till	-	-	1.1	241.9	0.4	242.5	0.6	242.3	0.3	242.6	0.1	242.8	0.4	242.5	1.1	241.9	0.1	242.8	0.5
BH105	243.4	6.1 - 9.1	237.3 - 234.3	Lower Silty Sand Glacial Till	-	-	1.7	241.7	0.7	242.7	0.9	242.5	0.6	242.8	0.3	243.1	0.6	242.8	1.7	241.7	0.3	243.1	0.7

mbgs = metres below existing ground surface
masl = metres above sea level
* = unstabilized groundwater level