HYDROGEOLOGICAL INVESTIGATION

789 and 795 Brant Street, Burlington, Ontario

Client

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Project Number

BIGC-ENV-461A

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1 Introduction

1.1 Project Description

B.I.G. Consulting Inc. (BIG) was retained by Mr. Kyle Camarro on behalf of Camarro Developments Inc. (the Client) to conduct a Preliminary Hydrogeological Investigation to support the proposed development of the site located at 789 and 795 Brant Street, Burlington, Ontario (Site).

The Site is located to the south of Prospect Street and east of Brant Street, in Burlington, Ontario, as shown on Figure 1. The Site is irregular in shape and measures approximately 2,250 m^2 in size. The Site is currently occupied by one (1) irregularly shaped two-storey slab-on-grade commercial building at 795 Brant Street, and one (1) irregularly shaped two-storey commercial building with one (1) level of basement and a parking garage at 789 Brant Street (Site buildings). The Site buildings have a total footprint of approximately 420 m^2 and occupy approximately 19 % of the Site. The areas surrounding the Site buildings are covered with asphalt and landscaping.

It is BIG's understanding that the proposed re-development at the Site will consist of a structure with five (5) levels of underground parking.

This report addresses the hydrogeological aspects of the proposed project. Reports for the Preliminary Geotechnical Investigation, Phase One and Phase Two Environmental Site Assessments will be issued under separate covers. The field investigation for the geotechnical, environmental and hydrogeological investigations was carried out concurrently.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation were to:

a) Establish the local hydrogeological settings of the Site;
b) Provide preliminary assessment of anticipated construction dewatering flow rates for a generic construction scenario;
c) Estimate foundation sub-drain discharge volumes, if applicable;
d) Assess groundwater quality and compare the results to Region of Halton and City of Burlington Combined/Sanitary and Storm Sewer Use By-Law parameters;
e) Qualitatively assess the potential impact to the nearby water body and comment on future regulatory agency involvement; and,
f) Prepare a Preliminary Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the investigation objectives, BIG proposed and initiated the following scope of work:

a) Background desktop review of pertinent geological and hydrogeological resources;
b) Review of the Ministry of Environment, Conservation and Parks (MECP) Water Well Records;
c) Advancement of five (5) boreholes (BH1 to BH5) to a maximum depth of 24.8 m bgs and installation of monitoring wells (MW1 to MW5);
d) Perform single well response tests (SWRT) at selected monitoring wells to assess the hydraulic characteristics of the bedrock at the Site;
e) Complete groundwater level measurements at monitoring wells;
f) Evaluate the information of groundwater level measurements and groundwater quality;

g) Collection of one (1) groundwater sample for laboratory testing and compare it against the Region of Halton and City of Burlington Combined/Sanitary and Storm Sewer Use By-Law parameters;
h) Assess groundwater discharges during construction phases;
i) Assess foundation sub-drain discharge volumes, if applicable; and,
j) Prepare a Preliminary Hydrogeological Investigation Report.

2 Regional Setting

2.1 Regional Physiography

The Ontario Geological Survey indicates the Site lies in the Iroquois Plain physiographic region of Southern Ontario known as the shale plains. Figure 2 shows the physiographic regions of Southern Ontario around the Site.

During the last retreat of the Laurentide Ice Sheet (12,000 years B.P.) lake levels in what was to become Lake Ontario where much higher due to ice blockage in the St. Lawrence waterway. This created the glacial Lake Iroquois which was up to 60 m higher in elevation in the Toronto area than the current Lake Ontario water levels. The Iroquois Shoreline that coincided with this elevated lake, terminated just above St. Clair Avenue West.

2.2 Regional Geology

The surficial geology of the immediate area around the Site is described as coarse-textured glaciolacustrine deposits. The surficial geology for the Site and surrounding areas is shown on Figure 3.

Bedrock of the region corresponds to the Queenston Formation consisting of shale, limestone, dolostone and siltstone. The contact between the bedrock and the overlying overburden is expected to be at approximately 4.5 m bgs.

2.3 Regional Hydrogeology

Groundwater movement through the subsurface is controlled by hydraulic gradients, the physical characteristics of the sediments, and the interconnectedness of lithological formations. Fine grained sediments restrict lateral movement of groundwater and induce vertical infiltration, while coarse grained sediments allow vertical flow with increased transmissivity.

The regional shallow groundwater flow is expected to follow the local topography and discharge to local area creeks and streams. Local deviation from the regional groundwater flow directions may occur in response to changes in topography and/or soil stratigraphy, as well as the presence of surface water features and/or existing subsurface infrastructure.

Based on the Conservation of Halton Planning & Permits Map, the Site is located within a highly vulnerable aquifer as identified in the Region's Source Water Protection Planning under the Clean Water Act, 2006.

3 Site Setting

3.1 Site Topography and Drainage

The Site is irregular in shape and measures approximately 2,250 m^2 in size. The Site is currently occupied by one (1) irregularly shaped two-storey slab-on-grade commercial building at 795 Brant Street, and one (1) irregularly shaped two-storey commercial building with one (1) level of basement and a parking garage at 789 Brant Street (Site buildings). The areas surrounding the Site buildings are covered with asphalt and landscaped areas. The topography of the Site generally slopes to the south/southeast and based on the borehole logs, the ground elevation ranges between 92.55 and 92.12m above sea level (asl). Precipitation that falls on the Site is inferred to predominantly be directed to the catch basins located in the parking lot of the Site and nearby City of Burlington catch basins.

3.2 Local Surface Water Features

The Site does not feature any surface water bodies on the Site. The closest surface water body to the Site is a tributary to Indian Creek, located approximately 260 m northwest of the Site. The Site is situated within the Lower Rambo Creek watershed and is part of Conservation Halton regulated area.

3.3 Ministry of Environment, Conservation and Parks Water Well Review

Well Records from the Ministry of Environment, Conservation and Parks (MECP) Water Well Record Database (WWR) were reviewed to determine the number of water wells and locations present within a 500 m radius of the Site boundaries.

The MECP WWR database indicated 53 well records within 500 m radius of the Site. All identified wells are shown on Figure 4. A summary of the Water Well Records is included in Appendix B, Table B-1. A review of the records indicated that the majority of the wells were classified for observation well, monitoring well and test hole purposes within 500 m radius of the Site.

3.4 Permit to Take Water and Environmental Activity and Sector Registry Search

The MECP also maintains a database of all active and expired Permit to Take Water (PTTW) and Environmental Activity and Sector Registry (EASR) items related to construction dewatering and pumping test. There are no PTTW or EASR registrations within 1 km of the Site.

4 Field Program

4.1 Borehole and Monitoring Well Details

BIG advanced five (5) borehole (BH1 to BH5) to a maximum depth of 24.8 m bgs between June 10 and 19, 2021 and instrumented all boreholes with monitoring wells (MW1 to MW5). The boreholes were advanced by using a truck mounted hollow and solid stem continuous flight auger equipment under the direction and supervision of BIG field personnel. Soil samples were retrieved at regular intervals with a 50 mm outside diameter split barrel sampler drive and accordance with the Standard Penetration Test Procedure (ASTM D1586). The samples were logged in the field and returned to the BIG laboratory for detailed visual examination. The borehole records and monitoring well construction detail are included in Appendix A.

4.2 Site Specific Overburden Geology

Table 4-1: Soil description

Layer	Description
Ground Surface Cover	Borehole, BH/MW1 was advanced through an existing ground surface cover consisting of approximately 120 mm thick topsoil. Topsoil in general, consists of high contents of organics and rootlets. Remaining boreholes BH/MW2 to BH/MW5 were advanced through existing asphalt pavement consisting of approximately 50-80 mm thick asphalt concrete over 120 to 150 mm thick granular bases.
Fill	Below the ground surface cover in all boreholes, existing fill generally consisted of clayey silt with trace to some sand, and trace to some gravels were encountered in all boreholes that extended to depths varying between 1.5 and 2.3 m bgs. Fill also contained occasional Shale fragments, glass pieces, and trace organics.
Upper Clayey Silt Till	Below existing fill in all boreholes, native deposit of upper clayey silt till was encountered that extended to depths varying between 3.1 and 6.1 m bgs. Clayey silt till deposit also contained trace to sand and trace gravel.
Silty Sand Till	Below upper clayey silt till in boreholes BH/MW2 to BH/MW5, a layer on glacial silty sand till was encountered that extended to depths varying between 3.2 to 4.6 m bgs. Silty sand till also contained trace clay, and trace to some gravel.
Lower Clayey Silt Till	Below silty sand till in boreholes BH/MW3 and BH/MW5, another glacial deposit of lower clayey silt till was encountered that extended to the depth of 6.1 m bgs. Clayey silt till deposit also contained trace to some sand and trace gravel.
Bedrock	Below upper clayey silt till at borehole BH/MW1; below sandy silt till at boreholes BH/MW2 and BH/MW4; and below lower clayey silt till at boreholes BH/MW3 and BH/MW5; highly weathered to excellent quality of reddish brown/grey Shale bedrock was encountered in all boreholes.

4.3 Water Level Monitoring

Water levels at all monitoring well locations were recorded after installation. A summary of all available water level observations is included in Table 4-2. Groundwater was observed in all monitoring wells on June 28, 2021 and depths to the groundwater ranged from 1.94 m to 2.60 m bgs. The shallow wells, BH/MW1, BH/MW2 and BH/MW4 were observed with groundwater elevations of 90.15 m to 90.20 m asl. The deep wells, BH/MW3 and BH/MW5 were observed with groundwater elevations of 89.95 m and 90.14 m asl.

An interpreted shallow groundwater contour map for the water level measurements recorded on June 28, 2021 is included as Figure 8. Based on the water level measurements obtained, the inferred direction of shallow groundwater flow across the Site is interpreted to be to the west direction.

Seasonal variability can produce significant changes to the static water level. It has been observed that groundwater can rise and lower in response to changing weather and climate.

Table 4-2: **Monitoring Well Details and Water Levels Elevations**

Well ID	Ground Elevation (m asl)	Well Depth (m bgs)	June 28, 2021	
			Water Level (m bgs)	Elevation (m asl)
MW1	92.24	15.2	2.09	90.15
MW2	92.34	15.2	2.14	90.20
MW3	92.55	21.3	2.60	89.95
MW4	92.12	16.8	1.94	90.18
MW5	92.17	19.8	2.03	90.14

4.4 Hydraulic Conductivity Testing

The hydraulic conductivity test was completed to estimate the saturated hydraulic conductivity (K) of the soil at the well screen depth at selected monitoring well locations.

In advance of performing SWRT, the monitoring well was developed to remove the potential presence of fine sediments. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. The monitoring well water level was permitted to fully recover prior to performing SWRTs.

During the SWRT, a slug of water was instantaneously removed from the well and the response to the water level is recorded. The Hydraulic Conductivity values for each of the tested wells were calculated from the SWRT data using Aqtesolv Software and the Hvorslev solution for unconfined conditions. The semi-log plots for normalized drawdown versus time are included in Appendix C.

The summary of the hydraulic conductivity (K) values estimated from the SWRTs are provided below in Table 4-3:

Table 4-3: Summary of Hydraulic Conductivity (K) Testing Results

Monitoring Well	Well Depth (m bgs)	Hydraulic Conductivity (m/s)
MW1	15.2	6.15×10^{-8}
MW2	15.2	1.80×10^{-5}
MW3	21.3	5.15×10^{-8}
MW4	16.8	1.58×10^{-5}
MW5	19.8	3.87×10^{-5}
Geometric mean K value (m/s)		**2.03×10^{-6}**

The SWRT provides an estimate of K for the geological formation in the immediate media zone surrounding the well screen and may not be representative of bulk formation hydraulic conductivities.

Given the fast recovery, the hydraulic conductivity test results should be considered as approximate and will require further confirmation. The appropriate method to estimate hydraulic conductivity is by conducting a pump test. Prior to finalizing the dewatering quantity, a properly designed pump test should be conducted. For discussion purposes of this report, a geometric mean hydraulic conductivity value is considered for dewatering calculations.

4.5 Groundwater Sampling

To assess the suitability for discharge of pumped groundwater to the Region of Halton Sanitary or City of Burlington Storm Sewer during dewatering activities, a groundwater sample was collected from BH/MW4 on June 28, 2021.

Prior to collection of the samples, approximately three (3) standing well volumes of groundwater were purged from the well. The sample was collected and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required.

The sample was not field filtered. Dedicated nitrile gloves were used during sample handling. The groundwater sample was submitted to an independent laboratory, Bureau Veritas Laboratories, of Mississauga, Ontario, for analysis.

For the assessment purposes, the analytical results were compared to Table 1 – Limits for Storm Sewer Discharge (By-Law No. 86-2002) of the Corporation of City of Burlington; and Table 2 – Limits for Sanitary and Combined Sewer Discharge (By-Law No. 2-03) of the Regional Municipality of Halton.

The laboratory Certificate of Analysis (CofAs) and chain of custody are enclosed in Appendix D.

The laboratory CofAs show that there were no exceedances against the Limits for Sanitary and Combined Sewer Discharge, or the Storm Sewer Discharge By-Law of the Corporation of the City of Burlington.

If the groundwater encountered during excavation activities is discharged to the Region of Halton sanitary and combined sewer, no treatment will be required. Given there is no chemical criteria for City of Burlington storm sewer, consultation with the City of Burlington is required prior to discharge any water to the sewer system.

5 Temporary Construction Dewatering

5.1 Construction Dewatering Requirements

It is BIG's understanding that the proposed re-development at the Site will consist of a structure with five (5) levels of undergrounding parking structure. It is anticipated that slab of five (5) levels of underground parking structure will be at an approximate depth of 15 m bgs. The footing elevation is assumed approximately 17 m bgs.

Groundwater was observed in all monitoring wells on June 28, 2021 and depths to the groundwater ranged from 1.94 m to 2.60 m bgs. The shallow wells, BH/MW1, BH/MW2 and BH/MW4 were observed with groundwater elevations of 90.15 m to 90.20 m asl. The deep wells, BH/MW3 and BH/MW5 were observed with groundwater elevations of 89.95 m and 90.14 m asl. For conservative purposes, the construction dewatering calculation is based on an open cut excavation at the present time. To excavate under dry conditions, the water level is anticipated to be lowered at least to a minimum of approximately 1.0 m below the footing elevation.

Additional dewatering capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. It should be noted that the dewatering estimates provided in this report are based on the conceptual building information available at this time. If design details are changed (including any changes to excavation depth), the dewatering estimates must be revised to include the final layout of the development.

5.2 Construction Dewatering Flow Rate Assumptions

The assumptions used for the calculation of the dewatering rate for the proposed development are presented in Table 5-1.

Table 5-1 Dewatering Estimate Assumptions

Input Parameter	Values	Notes
Lowest Surface Elevation (m asl)	92.12	Based on the borehole logs
Footing Elevation (m asl)	75.12	Assumed 17 m below ground
Dewatered Elevation Target (m asl)	74.12	Approximate 1 m below footing elevation
Groundwater Elevation (m asl)	90.2	Highest groundwater elevation from shallow wells on June 28, 2021
Estimated Excavation Area	50 m x 45 m	Based on area extent equivalent
Hydraulic Conductivity (m/s)	**2.03×10^{-6}**	Geometric mean K

5.3 Dewatering Flow Rate Equation

The Dupuit equation for steady flow from a circular source of an excavation at distance of radius of influence (R_0) through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate, and is expressed as follows:

$$Q_w = \frac{\pi K(H^2 - h^2)}{\ln\left[\frac{R_0}{R_e}\right]}$$

Where:

Q_w = Rate of pumping (m^3/s)

R_0 = Radius of influence (m)

R_e = Equivalent radius of well (m)

K = Hydraulic conductivity (m/s)

H = Head beyond the influence of pumping (static groundwater elevation) (m)

h = Head above base of aquifer at the excavation (m)

It is expected that the initial dewatering rate will be higher in order to remove groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed locally from storage resulting in lower seepage rates into the excavation. Additionally, the use of a continuous caisson shoring system will further reduce groundwater migration into the excavation reducing the ongoing seepage rate.

5.4 Radius of Influence

The Radius of Influence (ROI) for the construction dewatering is based on the empirical Sichardt Equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This equation is empirical and was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

It is noted that in steady state conditions, the radius of influence of pumping will extend until boundary flow conditions are reached and provide sufficient water inputs to the aquifer, such as recharge and surface water bodies. As a result, the distance of influence calculated using Sichardt equation is used to provide a representative flow rate calculation, but it is not precise in determining the actual radius influenced by pumping.

The ROI of pumping (dewatering) for radial flow is calculated based on the Sichardt equation, which is described as follows:

$$R_0 = R_e + 3000\ (\mathrm{H} - \mathrm{h})\sqrt{\mathrm{K}}$$

Where:

K = Hydraulic conductivity (m/s)

H = Static Saturated Head (m)

h = Dynamic Saturated Head (m)

R_0 = Radius of influence (m)

R_e = Equivalent radius of well (m)

Based on the Sichardt equation and the geometric mean K value, the ROI is approximately 69 m from the centre of the excavation for radial flow. The ROI calculation is provided in Appendix E.

The ROI calculation is a conservative methodology and is calculated based on the assumption of active pumping during the construction dewatering. It should be noted that most of the water will be pumped during the first stage of the construction period or when a rain event occurs. Although the ROI was conservatively predicted as 69 m from the centre of the excavation, over a period of time, the drawdown curve will be very close to the bottom of the excavation and thus resulting in negligible ROI. The likelihood for impacts to the nearby structures are negligible. Additionally, the use of a shoring system will further reduce radius of influence.

5.5 Results of Construction Dewatering Flow Rate Estimates

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

Table 5-2 Summary of Construction Dewatering Flow Rate Estimate

Location	Construction Dewatering Flow Rate Without Safety Factor (L/day)	Peak Construction Dewatering Flow Rate Including Safety Factor of 2.5 (L/day)
Excavation area	151,000	378,000

Construction dewatering flow rate estimates are provided in Table E-1, in Appendix E.

The peak construction dewatering flow rate includes a factor of safety of 2.5 to account for accumulation of rainfall, seasonal fluctuations in the groundwater table, flow from beddings of existing sewers, and variation in hydrogeological properties beyond those encountered during the course of this study. This total dewatering flow rate also provides additional capacity for the dewatering contractors. Given that the predicted dewatering volume exceeds the 50,000 L/day limit, an EASR for construction dewatering will be required.

It should be noted that if caisson wall shoring system is considered for the subject Site, reduction in groundwater quantities can be anticipated.

Please note that it is the responsibility of the contractor to ensure dry conditions are maintained within the excavation at all times.

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Additionally, the presence of near-surface fill material could hold significant groundwater.

The maximum flow calculation is intended to provide a conservative estimate to account for unforeseeable conditions that may arise during construction. It should be noted that the dewatering estimate provided in this report are based on the proposed development information available at this time. If changes to the design are implemented (e.g., increase to planned excavation depths, widening of excavations, etc.), the dewatering estimates must be revised to include and reflect future changes.

6 Long Term Discharge Estimate

6.1 Long-Term Dewatering Assumptions

Given that the groundwater level is above foundation depths for the development, a permanent foundation sub-drain is recommended. It is assumed that the below grade structure will feature a perimeter drain and sub-drain system installed at approximately 0.5 m below the basement elevation. Table 6-1 presents the assumptions used to calculate the long-term drainage rate estimates.

Table 6-1 Dewatering Estimate Assumptions

Input Parameter	Values	Notes
Lowest Surface Elevation (m asl)	92.12	Based on the borehole logs
P5 Slab Elevation (m asl)	77.12	Assumed 15 m below ground
Groundwater Elevation (m asl)	90.20	Highest deep groundwater elevation on June 28, 2021
Foundation Elevation (m asl)	76.62	Assumed 0.5 m below the P5 slab elevation
Sub-drain Elevation Target (m asl)	76.62	Assumed 0.5 m below the P5 slab elevation
Drainage Dimensions	50 m x 45 m	Based on area extent equivalent
Hydraulic Conductivity (m/s)	**2.03×10^{-6}**	Geometric mean K

6.2 Radius of Influence

The Radius of Influence (ROI) for the long-term dewatering is based on the empirical Cooper and Jacob Equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This equation is empirical and was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

Based on the Cooper and Jacob equation and the geometric mean K value, the ROI is approximately 115.6 m from the centre of the drainage area for radial flow. The ROI calculation is provided in Table F-1, Appendix F.

Given there are fast and slow hydraulic conductivities generated at the Site, the estimated ROI is affected by the fast recovery bedrock. The ROI is unlikely will extend to approximately 115.6 m from the centre of the drainage area. The ROI will be re-evaluated when a pump test is conducted in the future.

6.3 Long-Term Perimeter Drain Flow Rate Estimate

Based on the assumptions provided in this report (outlined in Section 6.1), the results of the long-term discharge volume estimate are summarized below:

Table 6-2 Summary of Long-Term Discharge Flow Rate

Location	Long-Term Peak Flow Rate (L/day)	Notes
Flow into sub-drain after initial dewatering stages	113,000	Long term sub-drain flow value rounded based on Dupuit's equation including flow from all sides. Safety factor of 1.5 was used.

The results for the estimate are available in Appendix F, Table F-1. The maximum flow rate estimates represent short term events and are not indicative of long-term continuous contributions to the drainage system. Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be

considered for pump specifications. Given that the predicted dewatering volume exceeds the 50,000 L/day limit, a PTTW is required.

It should be noted that the dewatering estimates provided in this report are based on the proposed building information available at this time.

If the groundwater encountered during long-term dewatering is discharged to the Region of Halton sanitary and combined sewer, no treatment will be required. Given there is no chemical criteria for City of Burlington storm sewer, consultation with the City of Burlington is required prior to discharge any water to the sewer system.

In the event that the long-term foundation drainage is not allowed to discharge into the City's sewer system, the proposed building may be designed and supported by "tanked" water-proofed continuous raft foundation without permanent dewatering (i.e., avoiding permanent perimeter and under-floor drainage system).

7 Potential Groundwater Impacts

7.1 Impacts to Nearby Groundwater Users

The Site lies within an urban area of Burlington. Given the area is serviced by municipal system, no private well water user is expected. There are no potential impacts to nearby groundwater users due to construction dewatering or long-term dewatering is expected.

7.2 Impacts to Nearby Structures

As discussed in Section 5, the ROI calculation is a conservative methodology and is calculated based on the assumption of active pumping during the construction dewatering. It should be noted that most of the water will be pumped during the first stage of the construction period or when a rain event occurs. Although the ROI was conservatively predicted as 69 m from the centre of the excavation, over a period of time, the drawdown curve will be very close to the bottom of the excavation and thus resulting in negligible ROI. The likelihood for impacts to the nearby structures are negligible. Additionally, the use of a shoring system will further reduce radius of influence.

As discussed in Section 6, the ROI for long-term dewatering is approximately 115.6 m from the centre of the drainage area for radial flow. Given there are fast and slow hydraulic conductivities generated at the Site, the estimated ROI is affected by the fast recovery bedrock. The ROI is unlikely will extend to approximately 115.6 m from the centre of the drainage area. The ROI will be re-evaluated when a pump test is conducted in the future.

8 Water Taking and Discharge Permits

8.1 EASR

During the active construction dewatering phase, the volume of water expected to be pumped exceeds the daily limit on groundwater taking under the Ontario Water Resources Act (50,000 L/day) if the excavation is to be undertaken all at once. Therefore, it is necessary to register the construction dewatering under the EASR guidelines, as cumulative discharge rate for construction is 378,000 L/day. The limit for water taking under an EASR is 400,000 L/day. If combined storm and groundwater were to exceed this limit, the dewatering rate would need to be capped to 400,000 L/day of pumped water. If it is necessary to exceed 400,000 L/day of water taking, a Permit to Take Water as per O.Reg.387/04 would be required. Given that the predicted long-term dewatering volume exceeds the 50,000 L/day limit, a PTTW is required.

9 Conclusions

Based on the findings of the Hydrogeological Investigation, the following summary of conclusions are provided:

a) It is BIG's understanding that the proposed re-development at the Site will consist of a structure with five (5) levels of undergrounding parking.
b) The Site is located within a physiographic region within the Iroquois Plain known as the shale plains;
c) The surficial geology of the immediate area around the Site is described as coarse-textured glaciolacustrine deposits ;
d) The MECP WWR database indicate that there are 53 well records registered with the database within 500 m of the Site;
e) Groundwater was observed in all monitoring wells on June 28, 2021 and depths to the groundwater ranged from 1.94 m to 2.60 m bgs. The shallow wells, BH/MW1. BH/MW2 and BH/MW4 were observed with groundwater elevations of 90.15 m to 90.20 m asl. The deep wells, BH/MW3 and BH/MW5 were observed with groundwater elevations of 89.95 m and 90.14m asl;
f) Based on the water level measurements obtained, the inferred direction of shallow groundwater flow across the Site is interpreted to be to the west direction;
g) The estimated hydraulic conductivity of the soil ranges from 3.87×10^{-5} m/s to 5.15×10^{-8} m/s with a geometric mean of 2.03×10^{-6} m/s;
h) Based on the assumptions outlined in this report, the estimated peak construction dewatering flow rate including rainfall for the proposed construction activity is 378,000 L/day;
i) Given that the predicted dewatering volume exceeds the 50,000 L/day limit, an EASR for construction dewatering will be required;
j) Based on the assumptions outlined in this report, the cumulative contribution to the foundation drains is 113,000 L/day;
k) The ROI for long-term dewatering is approximately 115.6 m from the centre of the drainage area for radial flow. Given there are fast and slow hydraulic conductivities generated at the Site, the estimated ROI is affected by the fast recovery bedrock. The ROI is unlikely will extend to approximately 115.6 m from the centre of the drainage area. The ROI will be re-evaluated when a pump test is conducted in the future;
l) Given that the predicted dewatering volume exceeds the 50,000 L/day limit, a PTTW is required;
m) The laboratory CofA shows that no exceedance under Limits for Sanitary and Combined Sewer Discharge, or the City of Burlington Storm Sewer Discharge By-Law;
n) If the groundwater encountered during excavation activities is discharged to the Region of Halton sanitary and combined sewer, no treatment will be required. Given there is no chemical criteria for City of Burlington storm sewer, consultation with the City of Burlington is required prior to discharge any water to the sewer system.

It should be noted that the comments and recommendations in this report are based on the assumption that the present design concept described throughout the report will proceed to construction. Any changes to the design concept may result in a modification to the recommendations provided in this report. It is noted that these conclusions and recommendations should be read in conjunction with the entirety of the report.

10 Limitations

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

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

This report was prepared for the exclusive use of Camarro Developments Inc. This report may not be reproduced in whole or in part, without the prior written consent of BIG, or used or relied upon in whole or in part by other parties for any purpose. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. BIG accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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

Yours truly,

B.I.G. Consulting Inc.

Peilin (Eileen) Liu, M.Env.Sc., P.Geo.
Project Manager

Prem Manicks, P.Geo.
Partner

11 References

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FIGURES



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LEGEND

SITE BOUNDARY

SCALE

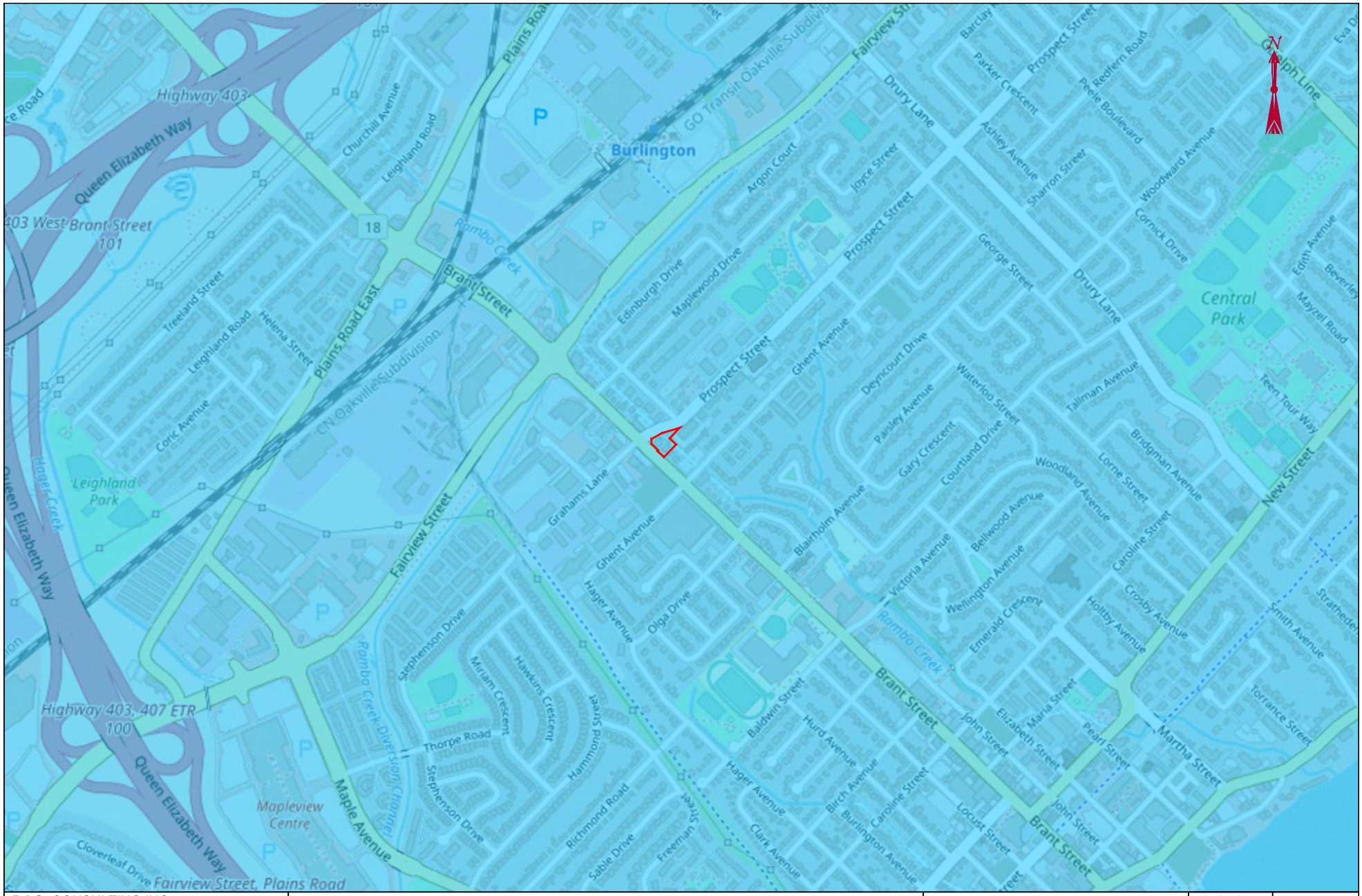
100m 0m 100m 200m 300m 400m 500m

IMAGERY OBTAINED FROM TOPORAMA, NATURAL RESOURCES CANADA,2017

TITLE AND LOCATION

SITE LOCATION PLAN
HYDROGEOLOGICAL INVESTIGATION
789-795 BRANT STREET, BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	1



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LEGEND

SITE BOUNDARY

IROQUOIS PLAIN

SCALE

100m 0m 100m 200m 300m 400m 500m

NOTES:

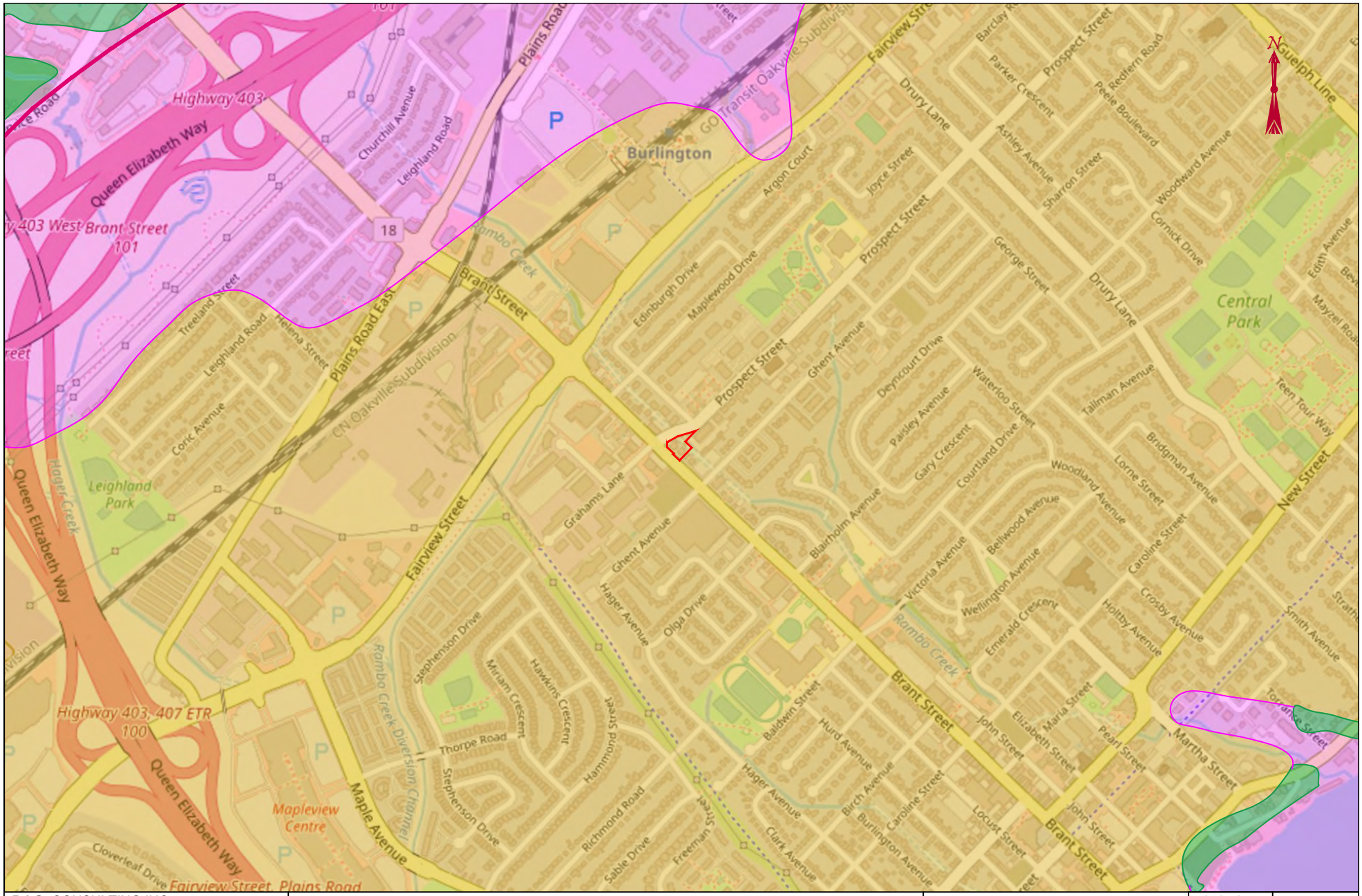
1. PHYSIOGRAPHIC REGIONS PRODUCED BY MINISTRY OF ENERGY, NORTHERN DEVELOPMENT AND MINES, 2021
2. IMAGERY OBTAINED FROM OPENSTREETMAP, 2016

TITLE AND LOCATION

PHYSIOGRAPHIC REGIONS OF SOUTHERN ONTARIO HYDROGEOLOGICAL INVESTIGATION

789-795 BRANT STREET, BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	2



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LEGEND

- SITE BOUNDARY
- TILL
- PALEOZOIC BEDROCK
- 9 COARSE-TEXTURED GLACIOLACUSTRINE DEPOSITS
- SHORE BLUFF OR SCARP

SCALE

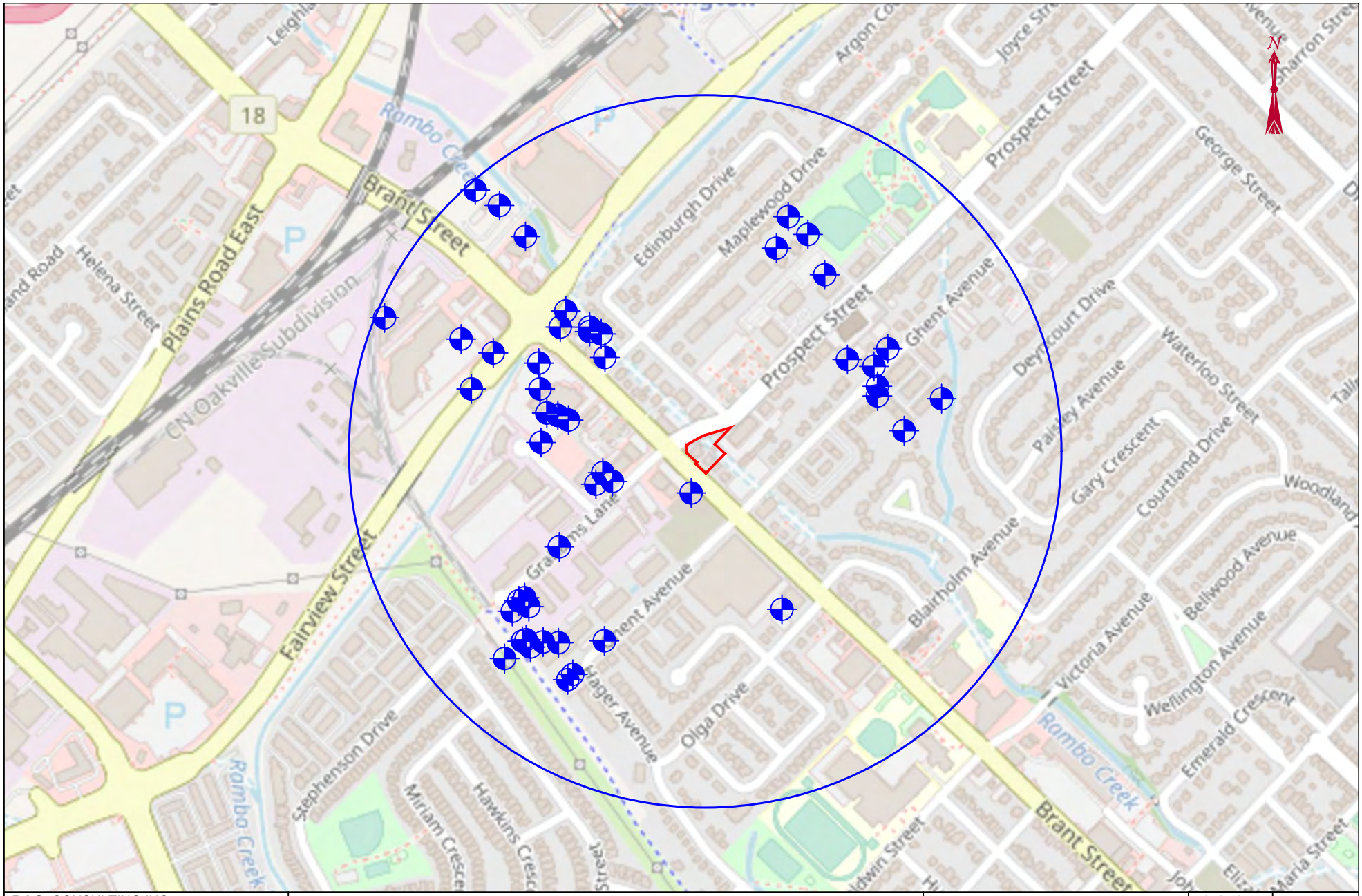
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NOTES:
1. SURFICIAL GEOLOGY PRODUCED BY MINISTRY OF ENERGY, NORTHERN DEVELOPMENT AND MINES, 2021
2. IMAGERY OBTAINED FROM OPENSTREETMAP, 2016

TITLE AND LOCATION

SURFICIAL GEOLOGY OF SOUTHERN ONTARIO
HYDROGEOLOGICAL INVESTIGATION
789-795 BRANT STREET, BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	3



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LEGEND

- SITE BOUNDARY
- WELL RECORD STUDY BOUNDARY
- WELL RECORD LOCATION (2021)

SCALE

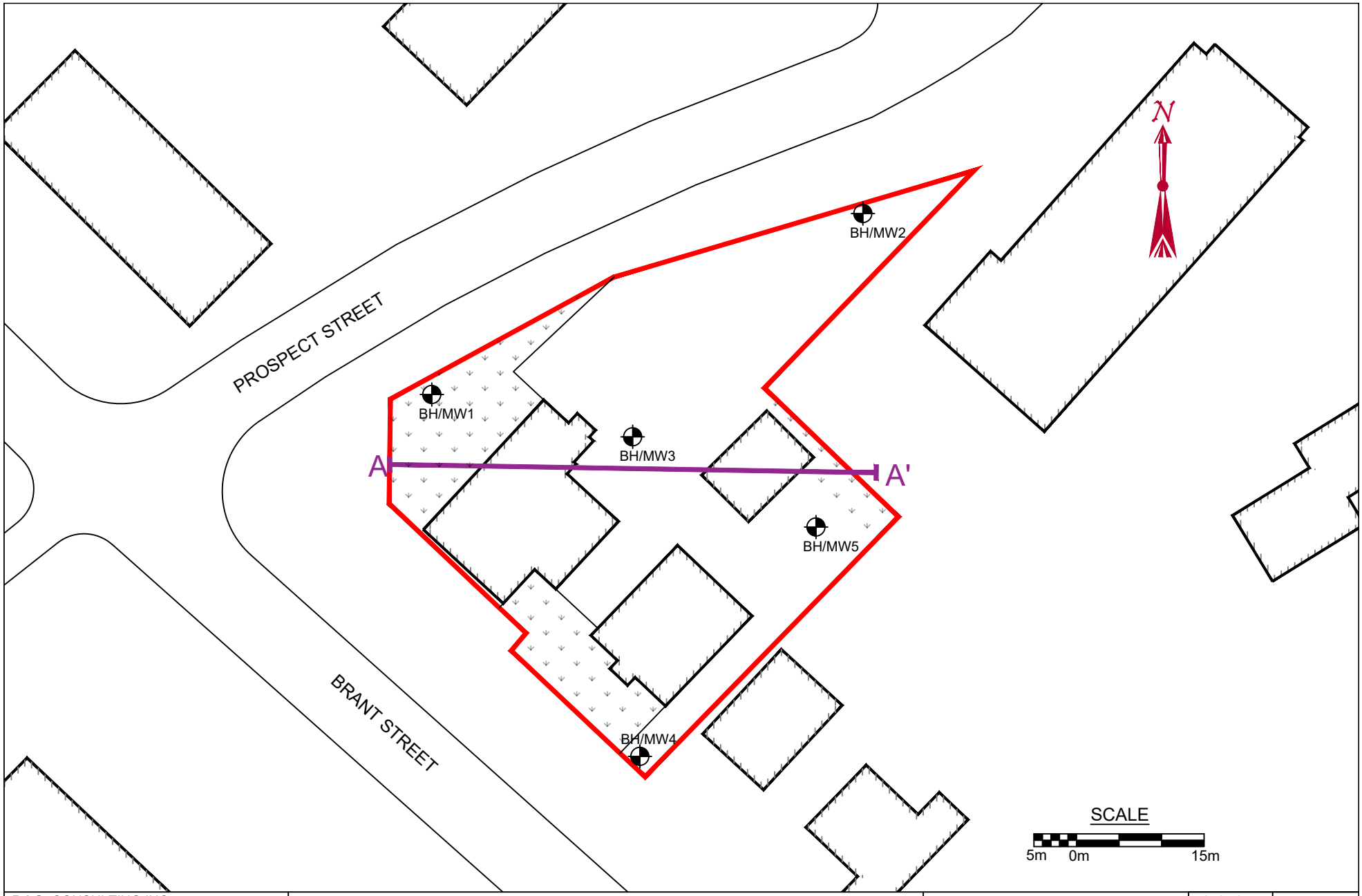
40 20 0 40 80 120 160 200

IMAGERY OBTAINED FROM OPEN STREET MAP, 2016

TITLE AND LOCATION

MECP WATER WELL RECORD LOCATIONS
HYDROGEOLOGICAL INVESTIGATION
789-795 BRANT STREET,
BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	4



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LEGEND

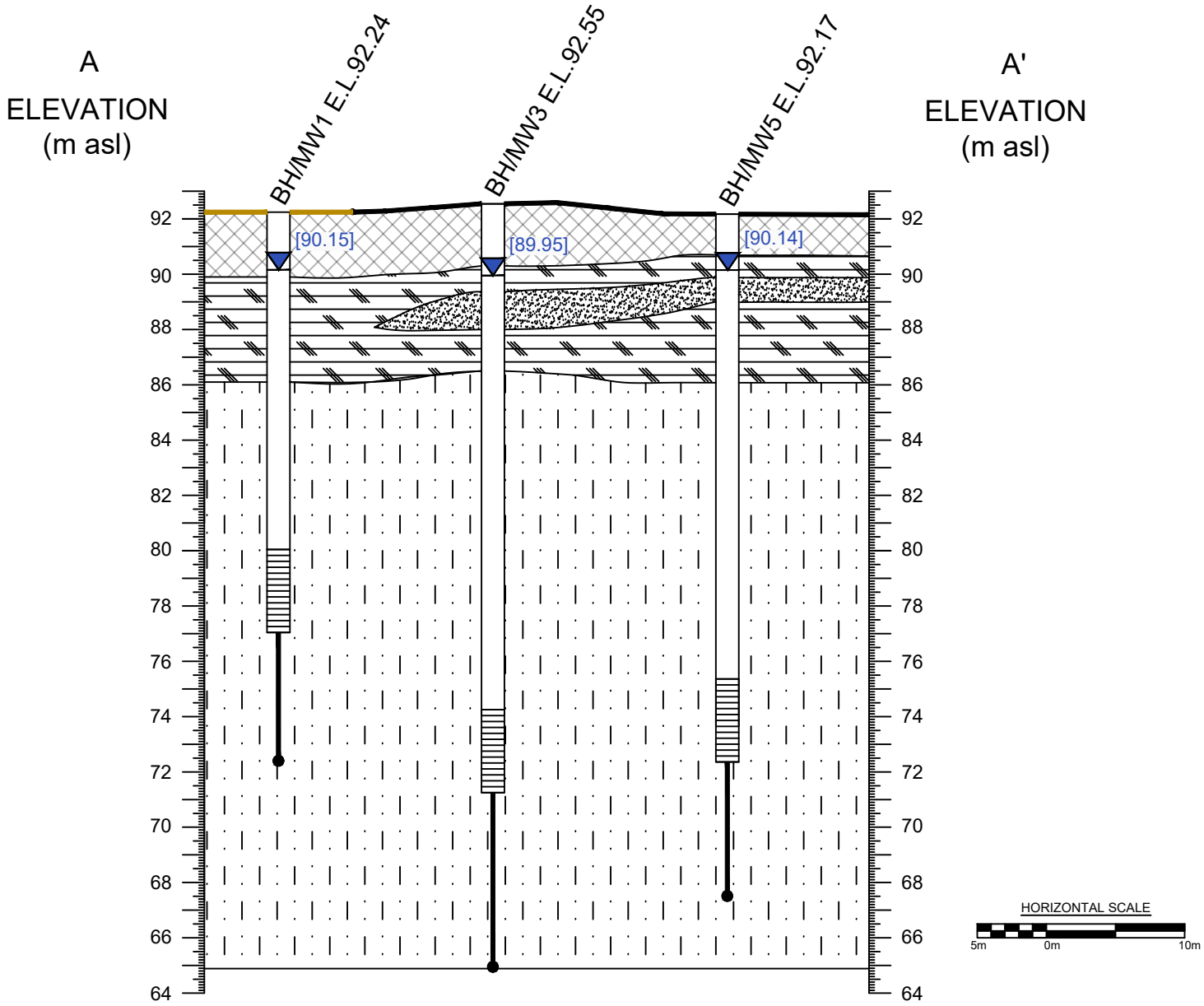
- SITE BOUNDARY
- BUILDING FOOTPRINT
- BOREHOLE/MONITORING WELL
- A A' GEOLOGICAL CROSS SECTION
- LANDSCAPED AREAS

TITLE AND LOCATION

BOREHOLE/MONITORING WELL LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
789-795 BRANT STREET,
BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	5



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LEGEND

- TOPSOIL
- ASPHALT / GRANULAR
- FILL
- CLAYEY SILT / SILTY CLAY
- SILTY SAND / SANDY SILT
- BEDROCK

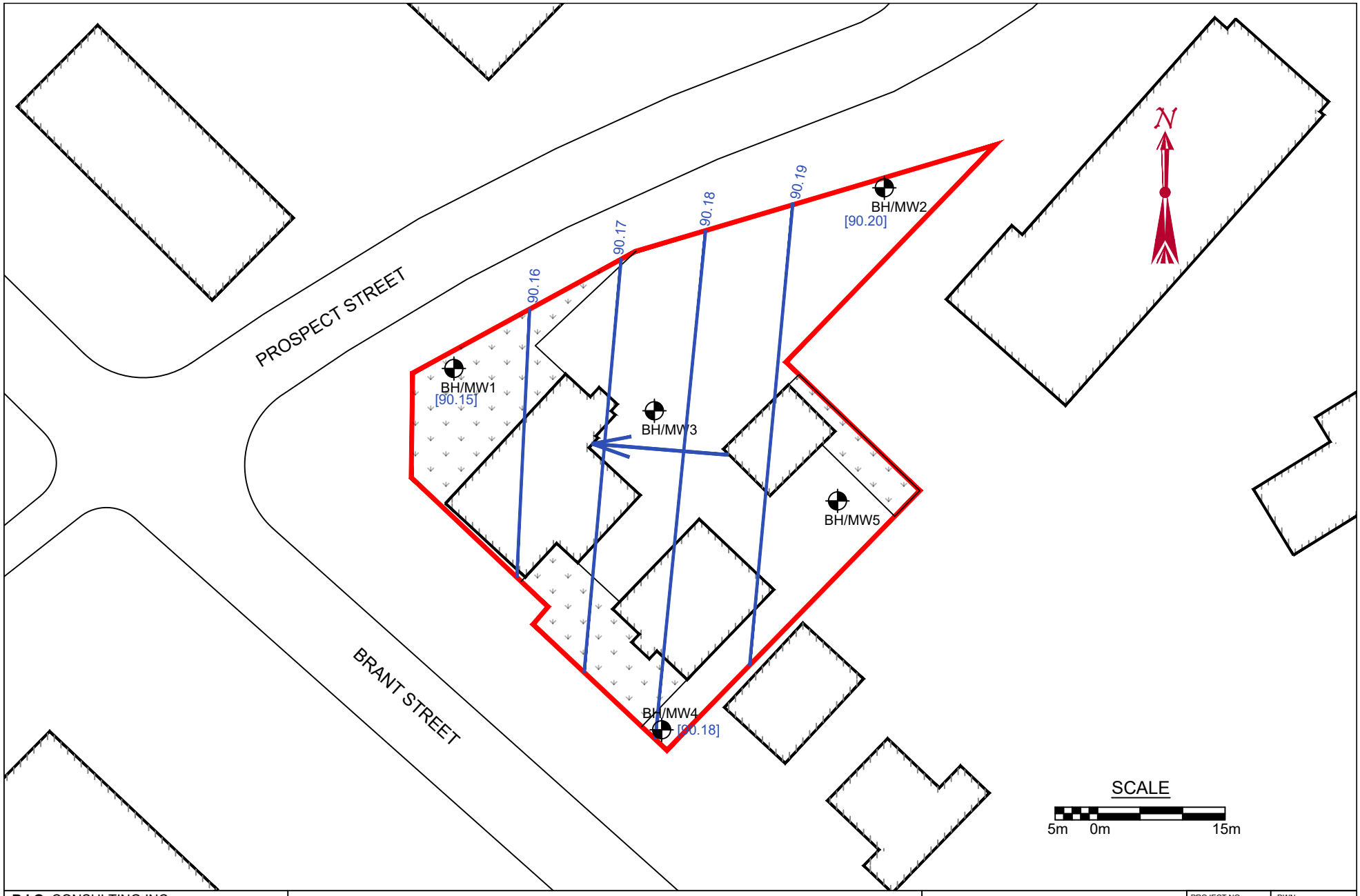
▼ WATER LEVEL

[xx.xx] WATER LEVEL MEASUREMENT (JUNE 28, 2021) (m asl)

TITLE AND LOCATION

GEOLOGICAL CROSS SECTION A-A'
HYDROGEOLOGICAL INVESTIGATION
789-795 BRANT STREET,
BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	6



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LEGEND

- SITE BOUNDARY
- BUILDING FOOTPRINT
- LANDSCAPED AREAS
- LOCATION OF BOREHOLE/MONITORING WELL
- GROUNDWATER CONTOUR
- INTERPRETED DIRECTION OF GROUNDWATER FLOW
- [XX.XX] WATERLEVEL MEASUREMENT (JUNE 28, 2021) (m asl)

TITLE AND LOCATION

SHALLOW GROUNDWATER CONTOUR MAP
HYDROGEOLOGICAL INVESTIGATION
789-795 BRANT STREET,
BURLINGTON, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-461A	L.C.K.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JULY 2021	7

APPENDIX A: BOREHOLE LOGS

RECORD OF BOREHOLE No. BH/MW1

Project Number:	BIGC-ENV-461A	Drilling Location:	See Borehole Location Plan	Logged by:	MV
Project Client:	Camarro Developments Inc.	Drilling Method:	HSA+HQ Rock Coring	Compiled by:	MV
Project Name:	Preliminary Geotechnical and Hydrogeological Investigation	Drilling Machine:	CME75	Reviewed by:	SS
Project Location:	789-785 Brant Street, Burlington, Ontario	Date Started:	14 Jun 21	Date Completed: 15 Jun 21	Revision No.: 0, 20/7/21

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	Geodetic Ground Surface Elevation: 92.2 m							Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80		
	TOPSOIL: 120mm 92.1 0.1	SS	1	67	8		92	○	17		
	FILL: silty clay/ clayey silt, trace sand, trace organics, brown, moist, firm	SS	2	0	6	1	91	○			
	- silty sand, brown, moist to wet, compact 90.0	SS	3	100	11	2 ▼	90	○	11		
	SILTY CLAY/ CLAYEY SILT TILL: trace gravel, 2.3 greyish brown, moist, very stiff to hard	SS	4	75	24			○	16		
	-sandy	SS	5	100	40	3	89	○	16		Gr-6%; Sa-26%; Si-48%; Cl-20%
						4	88				
		SS	6	70	78/25	5	87	78 25	12		
	86.1					6					
	BEDROCK: Shale, highly weathered to excellent 6.1 quality, occasional limestone layers, reddish brown to grey, damp to moist	SS	7	13	100/10		86	100 10			
		AU	8	100		7	85				
		AU	9	100		8	84				
		AU	10	100		9	83				
		AU	11	100		10	82				
	ROCK CORE BEGINS	RC	1	93	91	11	81				
	- Excellent Quality - Fair Quality	RC	2	96	72	12	80	○			
	- Good Quality	RC	3	100	89	13	79	○			
	- Excellent Quality	RC	4	98	98	14	78				
	- Good Quality	RC	5	100	76	15	77	○			
	- Fair Quality 72.4	RC	6	100	68	16	76				
	End of Borehole 19.8					17	75				
						18	74	○			
						19	73	○			

Notes:
1. Borehole open upon completion of drilling.
2. Ground water level not measured upon completion of drilling due introduced drilling water.
3. Groundwater level reading at 2.09 m bgs on June 28, 2021.

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Fax: 416-551-2633

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 28/06/2021 at a depth of: 2.09 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 147

RECORD OF BOREHOLE No. BH/MW2

Project Number:	BIGC-ENV-461A	Drilling Location:	See Borehole Location Plan	Logged by:	MV
Project Client:	Camarro Developments Inc.	Drilling Method:	HSA+HQ Rock Coring	Compiled by:	MV
Project Name:	Preliminary Geotechnical and Hydrogeological Investigation	Drilling Machine:	CME75	Reviewed by:	SS
Project Location:	789-785 Brant Street, Burlington, Ontario	Date Started:	11 Jun 21	Date Completed: 14 Jun 21	Revision No.: 0, 20/7/21

Geodetic Ground Surface Elevation: 92.3 m

Lithology Plot	DESCRIPTION	Elevation (m)	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	ASPHALT PAVEMENT: 50 mm asphalt over 150 mm granular bases	92.1 / 0.2	0	SS	1	46	4
	FILL: silty clay/ clayey silt, trace sand, trace gravel, occasional shale fragments, brown, moist, soft to firm	90.8 / 1.5	1	SS	2	100	6
	-sandy		2	SS	3	100	24
	SILTY CLAY/ CLAYEY SILT TILL: trace sand, trace gravel, greyish brown, moist, very stiff	89.3	3	SS	4	92	28
	SANDY SILT/ SILTY SAND TILL: trace clay, trace gravel, occasional shale fragments, reddish brown, moist, dense	87.8 / 3.1	4	SS	5	59	24
	BEDROCK: Shale, highly weathered to good quality, occasional limestone layers, reddish brown to grey, damp to moist	4.6	5	SS	6	13	50/8
			6	SS	7	13	50/8
			7	AU	8	100	
			8	AU	9	100	
			9	AU	10	100	
			10	AU	11	100	
	ROCK CORE BEGINS		11	RC	1	88	63
	- Fair Quality		12				
	- Poor Quality		13	RC	2	96	45
	- Good Quality		14	RC	3	100	79
	- Good Quality		15	RC	4	100	78
	- Fair Quality		16	RC	5	98	58
	- Fair Quality	71.9	17	RC	6	100	67
	End of Borehole	20.4	18				
			19				
			20				

Notes:
1. Borehole open upon completion of drilling.
2. Ground water level not measured upon completion of drilling due introduced drilling water.
3. Groundwater level reading at 2.14 m bgs on June 28, 2021.

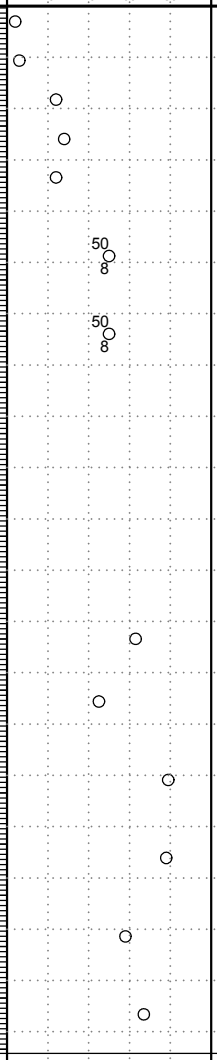
FIELD TESTING

Penetration Testing: ○ SPT ● DCPT

MTO Vane*: △ Intact ▲ Remould

Nilcon Vane*: ◇ Intact ◆ Remould

* Undrained Shear Strength (kPa): 20 40 60 80



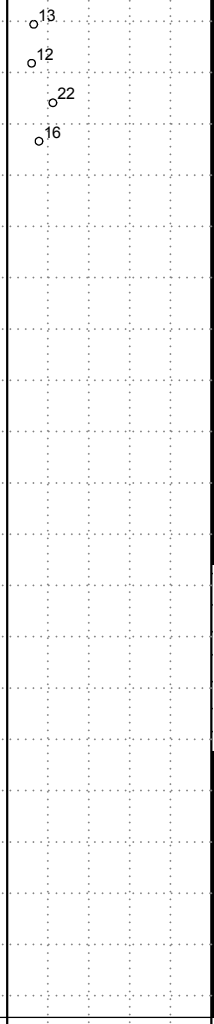
LAB TESTING

★ Rinse pH Values: 2 4 6 8 10 12

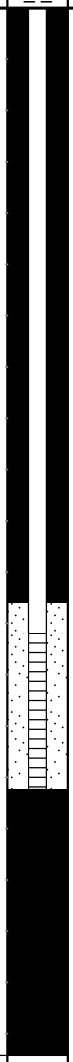
Soil Vapour Reading: △ parts per million (ppm): 100 200 300 400

▲ Lower Explosive Limit (LEL): W_P W W_L

Plastic Liquid: 20 40 60 80



INSTRUMENTATION INSTALLATION



COMMENTS

Sieve Analysis: 17, 25, (58)

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Fax: 416-551-2633

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 28/06/2021 at a depth of: 2.14 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH/MW3

Project Number:	BIGC-ENV-461A	Drilling Location:	See Borehole Location Plan	Logged by:	MV
Project Client:	Camarro Developments Inc.	Drilling Method:	HSA+HQ Rock Coring	Compiled by:	MV
Project Name:	Preliminary Geotechnical and Hydrogeological Investigation	Drilling Machine:	CME75	Reviewed by:	SS
Project Location:	789-785 Brant Street, Burlington, Ontario	Date Started:	10 Jun 21	Date Completed: 11 Jun 21	Revision No.: 0, 20/7/21

Geodetic Ground Surface Elevation: 92.6 m

Depth (m)	Description	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
0.0	**ASPHALT PAVEMENT:** 80 mm asphalt over 120 mm granular bases	92.4	SS	1	59	12
0.7	**FILL:** silty sand, trace clay, trace gravel, occasional glass pieces, dark brown/ black, moist, loose to compact		SS	2	95	8
	- clayey silt, some sand, trace gravel, dark reddish brown, moist, firm	90.3	SS	3	59	6
2.3	**SILTY CLAY/ CLAYEY SILT TILL:** trace sand, trace gravel, occaisonal cobble, brown, moist, very stiff	89.4	SS	4	92	24
3.2	**SILTY SAND/ SANDY SILT TILL:** some gravel, trace clay, occasional shale fragments, reddish brown, moist, very dense	88.0	SS	5	100	64
4.6	**CLAYEY SILT/ SILTY CLAY TILL:** trace to some sand, trace gravel, occasional pebble, brown, moist, hard	86.5	SS	6	41	50/13
6.1	**BEDROCK:** Shale, highly weathered to poor quality, occasional limestone layers, reddish brown to grey, damp to moist		SS	7	13	50/8
			AU	8		
			AU	9		
			AU	10		
			AU	11		
	ROCK CORE BEGINS					
	- Poor Quality		RC	1	100	41
	- Fair Quality		RC	2	99	67
	- Excellent Quality		RC	3	100	100
	- Excellent Quality		RC	4	99	90
	- Poor Quality		RC	5	100	47
	- Excellent Quality		RC	6	100	92
	- Excellent Quality *observed calcite precipitation at 22.42 m		RC	7	99	99
	- Fair Quality *observed calcite precipitation at 23.18 m		RC	8	100	51
24.7	**End of Borehole**	67.9				

Notes:
1. Borehole open upon completion of drilling.
2. Ground water level not measured upon completion of drilling due introduced drilling water.
3. Groundwater level reading at 2.60 m bgs on June 28, 2021.

FIELD TESTING: Penetration Testing (SPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

Sieve Analysis: 1, 16, (83)

Gr-20%; Sa-41%; Si-32%; Cl-7%

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Fax: 416-551-2633

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 28/06/2021 at a depth of: 2.60 m.

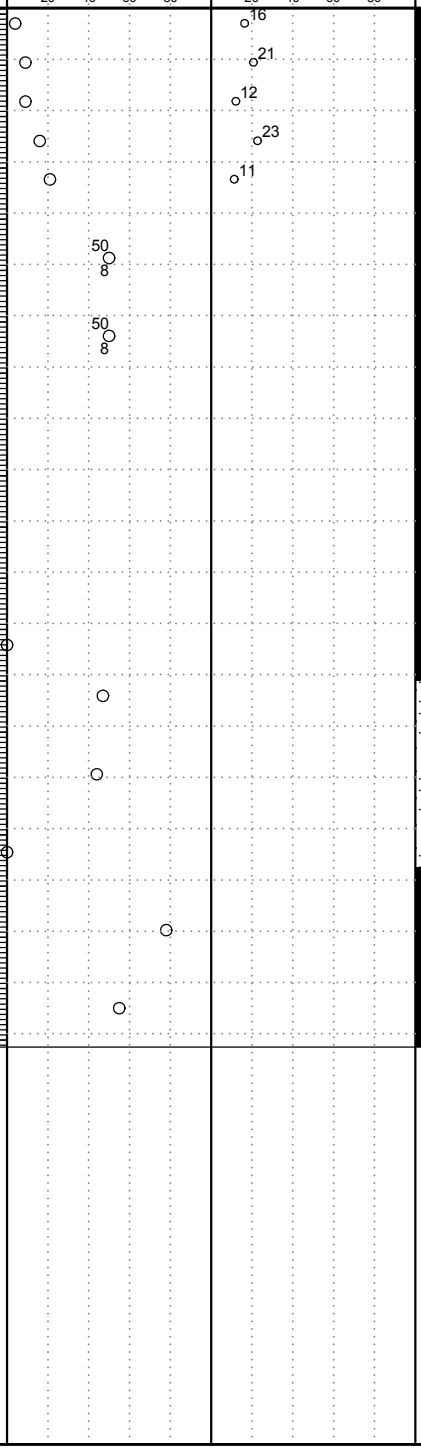
Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH/MW4

Project Number:	BIGC-ENV-461A	Drilling Location:	See Borehole Location Plan	Logged by:	MV
Project Client:	Camarro Developments Inc.	Drilling Method:	HSA+HQ Rock Coring	Compiled by:	MV
Project Name:	Preliminary Geotechnical and Hydrogeological Investigation	Drilling Machine:	CME75	Reviewed by:	SS
Project Location:	789-785 Brant Street, Burlington, Ontario	Date Started:	19 Jun 21	Date Completed: 19 Jun 21	Revision No.: 0, 20/7/21

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	Geodetic Ground Surface Elevation: 92.1 m						
	ASPHALT PAVEMENT: 50 mm asphalt over 150 mm granular bases 91.9 / 0.2	SS	1	92	4	1	91
	FILL: silty clay/ clayey silt, trace sand, trace gravel, trace shale fragments, greyish brown, moist, soft to stiff 90.6 / 1.5	SS	2	84	9		
	SILTY CLAY/ CLAYEY SILT TILL: trace sand, trace gravel, brownish grey, moist, stiff to very stiff 89.1	SS	3	75	9	2	90
		SS	4	75	16		
	SILTY SAND/ SANDY SILT TILL: trace clay, trace gravel, occasional shale fragments, reddish brown, moist to wet, compact 87.7 / 3.1	SS	5	75	21	3	89
	BEDROCK: Shale, highly weathered to poor quality, occasional limestone layers, reddish brown to grey, damp to moist 4.5					4	88
		SS	6	13	50/8	5	87
		SS	7	13	50/8	6	86
		AU	8	100		7	85
		AU	9	100		8	84
		AU	10	100		9	83
		AU	11	100		10	82
	ROCK CORE BEGINS	RC	1	100	0	11	81
	- Very Poor Quality - *clay infill in weathered limestone between 12.2 & 12.7 m - Poor Quality	RC	2	100	47	12	80
	- Poor Quality *clay infill between 14.4 & 14.3 m and 14.9 & 15.4 m	RC	3	86	44	13	79
	- Very Poor Quality	RC	4	92	0	14	78
	- Good Quality	RC	5	99	78	15	77
	- Fair Quality 71.9	RC	6	99	55	16	76
	End of Borehole 20.3					17	75
						18	74
						19	73
						20	72

Notes:
1. Borehole open upon completion of drilling.
2. Ground water level not measured upon completion of drilling due introduced drilling water.
3. Groundwater level reading at 1.94 m bgs on June 28, 2021.



INSTRUMENTATION INSTALLATION

COMMENTS

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 28/06/2021 at a depth of: 1.94 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

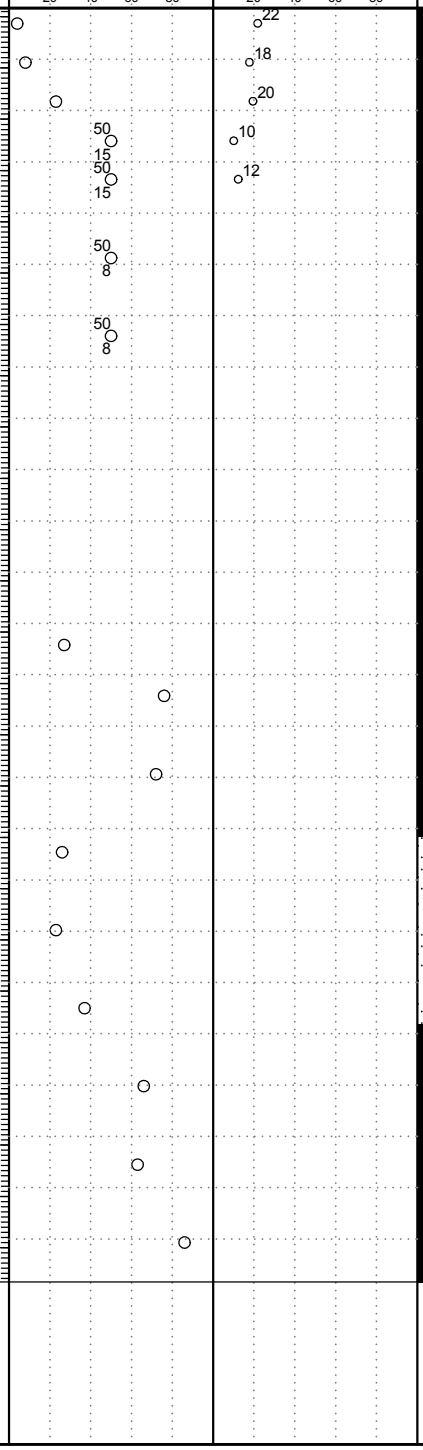
RECORD OF BOREHOLE No. BH/MW5

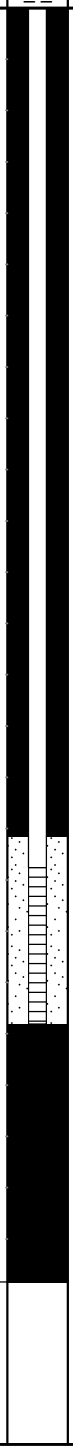
Project Number:	BIGC-ENV-461A	Drilling Location:	See Borehole Location Plan	Logged by:	MV
Project Client:	Camarro Developments Inc.	Drilling Method:	HSA+HQ Rock Coring	Compiled by:	MV
Project Name:	Preliminary Geotechnical and Hydrogeological Investigation	Drilling Machine:	CME75	Reviewed by:	SS
Project Location:	789-785 Brant Street, Burlington, Ontario	Date Started:	15 Jun 21	Date Completed: 17 Jun 21	Revision No.: 0, 20/7/21

Geodetic Ground Surface Elevation: 92.2 m

Description	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
ASPHALT PAVEMENT: 50 mm asphalt over 150 mm granular bases	0.2	SS	1	84	4
FILL: silty clay/ clayey silt, trace sand, brown, moist, firm	1.5	SS	2	100	8
SILTY CLAY/ CLAYEY SILT TILL: trace sand, trace gravel, occasional cobble, brown, moist, very stiff	2.3	SS	3	95	23
SILTY SAND/ SANDY SILT TILL: trace clay, trace gravel, brown, moist, very dense	3.2	SS	4	25	50/15
SILTY CLAY/ CLAYEY SILT TILL: trace sand, trace gravel, reddish brown, moist, hard		SS	5	51	50/15
limestone fragments	6.1	SS	6	25	50/8
BEDROCK: Shale, highly weathered to good quality, occasional limestone layers, reddish brown to grey, damp to moist		SS	7	25	50/8
		AU	8	100	
		AU	9	100	
		AU	10	100	
		AU	11	100	
ROCK CORE BEGINS		RC	1	85	27
- Poor Quality					
Good Quality		RC	2	100	76
- Fair Quality *clay infill between14.37 and 14.42 m		RC	3	100	72
- Poor Quality *clay infill between 15.76 and 15.78 m		RC	4	100	26
- Very Poor Quality *clay infill between 18.08 and 18.38 m		RC	5	100	23
- Poor Quality *clay infill between 18.79 & 18.88 m and 19.09 & 19.19 m		RC	6	95	37
- Fair Quality *clay infill between 20.32 and 20.36 m		RC	7	95	66
- Fair Quality *clay infill between 23.05 and 23.17 m		RC	8	100	63
- Good Quality	67.3	RC	9	99	86
End of Borehole	24.8				

Notes:
1. Borehole open upon completion of drilling.
2. Ground water level not measured upon completion of drilling due introduced drilling water.
3. Groundwater level reading at 2.03 m bgs on June 28, 2021.





B.I.G. Consulting Inc.
12-5500 Tomken Road
Mississauga, Ontario L4W 2Z4, Canada
Tel: 416-214-4880
Fax: 416-551-2633

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 28/06/2021 at a depth of: 2.03 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 147

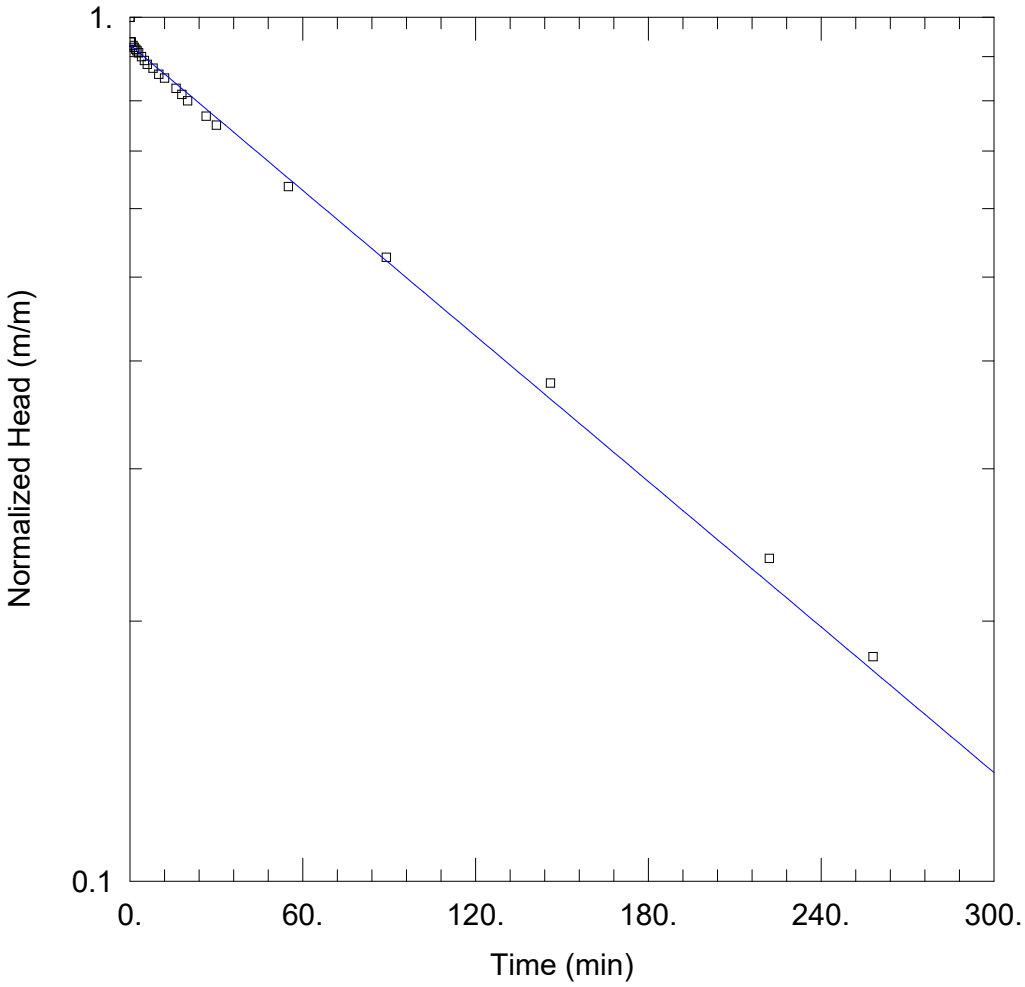
APPENDIX B: MECP WWR AND PTTW AND SUMMARY TABLES

Table B-1: MECP WWR Summary Table

Count	Well ID	Date Completed	Depth (m)	Reported Water Level (m)	Status of Well
1.	2810058	07/05/2004	7.6	N/A	Observation Well
2.	2810171	02/09/2005	4.5	3.5	Observation Well
3.	2810214	03/21/2005	4.5	2	Observation Well
4.	2810308	05/16/2005	4.6	2.5	Observation Well
5.	6715010	07/06/2004	4.5	3.2	Observation Well
6.	7042731	04/03/2007	4.0	N/A	Observation Well
7.	7128794	01/09/2008	N/A	N/A	Abandoned
8.	7128794	01/09/2009	N/A	N/A	Abandoned
9.	7129794	01/09/2009	N/A	N/A	Abandoned
10.	7161863	03/10/2011	N/A	N/A	N/A
11.	7179514	01/19/2012	5.1	N/A	Test Hole
12.	7179515	01/19/2012	5.1	N/A	Monitoring and Test Hole
13.	7179516	01/19/2010	5.1	N/A	Monitoring and Test Hole
14.	7179605	01/19/2012	5.5	N/A	Monitoring and Test Hole
15.	7187211	N/A	6.1	N/A	Observation Well
16.	7187212	N/A	6.1	N/A	Observation Well
17.	7220604	04/21/2014	5.2	N/A	Monitoring Well
18.	7220605	04/21/2014	N/A	N/A	Monitoring Well
19.	7243101	04/29/2015	7.6	N/A	Monitoring Well
20.	7244979	06/03/2015	N/A	2.1	Abandoned
21.	7244980	06/03/2015	5.5	N/A	Observation Well
22.	7244981	06/03/2015	5.5	N/A	Observation Well
23.	7244982	06/03/2015	N/A	N/A	Abandoned
24.	7251865	09/11/2015	6.1	N/A	N/A
25.	7252011	09/04/2015	6.1	N/A	Observation Well
26.	7265586	03/10/2016	N/A	N/A	N/A
27.	7283351	11/04/2016	6.0	N/A	Monitoring and Test Hole
28.	7284939	03/07/2017	4.6	N/A	Monitoring and Test Hole
29.	7284940	03/07/2017	4.6	N/A	Monitoring and Test Hole
30.	7290057	05/26/2017	6.1	N/A	Observation Well
31.	7290058	05/26/2017	6.1	N/A	Observation Well
32.	7291911	06/12/2017	N/A	N/A	N/A
33.	7292314	06/21/2017	6.1	N/A	Observation Well
34.	7292315	06/21/2017	9.1	N/A	Observation Well
35.	7292316	06/21/2017	5.5	N/A	Observation Well
36.	7292317	06/21/2017	5.5	N/A	Observation Well
37.	7314898	07/04/2018	4.6	N/A	Observation Well
38.	7320914	08/22/2018	20.0	N/A	Test Hole
39.	7320915	08/22/2018	20.0	N/A	Test Hole
40.	7320916	08/22/2018	20.0	N/A	Test Hole
41.	7323581	10/05/2018	N/A	N/A	Test Hole
42.	7330854	02/14/2019	4.0	N/A	Observation Well

Count	Well ID	Date Completed	Depth (m)	Reported Water Level (m)	Status of Well
43.	7330855	02/14/2019	4.8	N/A	Observation Well
44.	7330856	02/15/2019	4.8	N/A	Monitoring and Test Hole
45.	7330857	02/15/2019	4.8	N/A	Observation Well
46.	7330858	02/15/2019	4.8	N/A	Monitoring and Test Hole
47.	7330859	02/14/2019	6.1	N/A	Observation Well
48.	7331850	08/23/2018	6.1	N/A	Observation Well
49.	7343297	08/13/2019	7.3	N/A	Monitoring and Test Hole
50.	7343298	08/13/2019	5.2	N/A	Monitoring and Test Hole
51.	7343299	08/13/2019	4.9	N/A	Monitoring and Test Hole
52.	7354371	01/31/2020	N/A	N/A	Abandoned
53.	7354375	01/31/2020	N/A	N/A	Abandoned

APPENDIX C: SWRT RESULTS



WELL TEST ANALYSIS

Data Set: C:\...\MW1.aqt
Date: 07/16/21 Time: 17:20:48

PROJECT INFORMATION

Company: B.I.G. Consulting Inc.
Client: Camarro Developments Inc.
Project: BIGC-ENV-461A
Location: 789-795 Brant Street
Test Well: MW1
Test Date: June 28, 2021

AQUIFER DATA

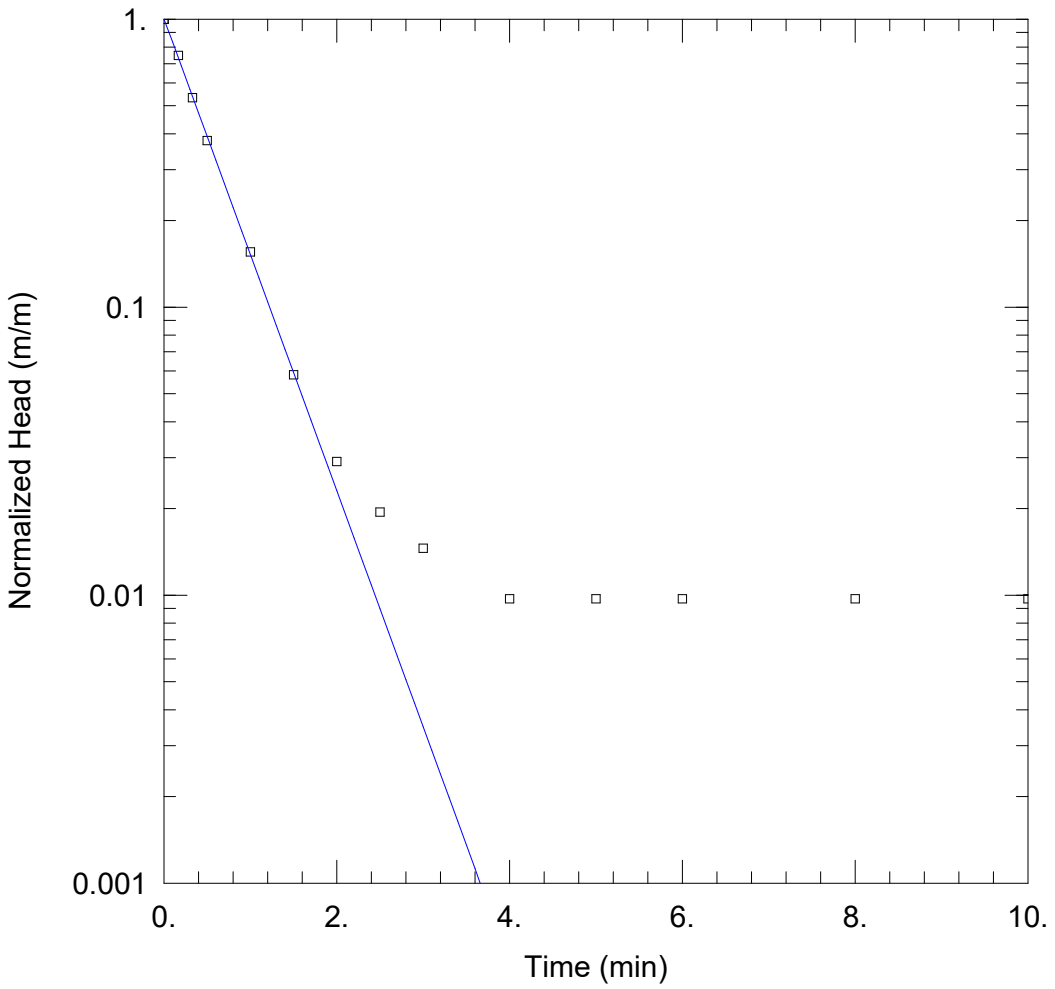
Saturated Thickness: 12.91 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW1)

Initial Displacement: 1.1 m
Total Well Penetration Depth: 12.91 m
Casing Radius: 0.025 m
Static Water Column Height: 12.91 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 6.151E-8 m/sec
y0 = 1.022 m



WELL TEST ANALYSIS

Data Set: C:\...\MW2.aqt
Date: 07/16/21 Time: 17:24:45

PROJECT INFORMATION

Company: B.I.G. Consulting Inc.
Client: Camarro Developments Inc.
Project: BIGC-ENV-461A
Location: 789-795 Brant Street
Test Well: MW2
Test Date: June 28, 2021

AQUIFER DATA

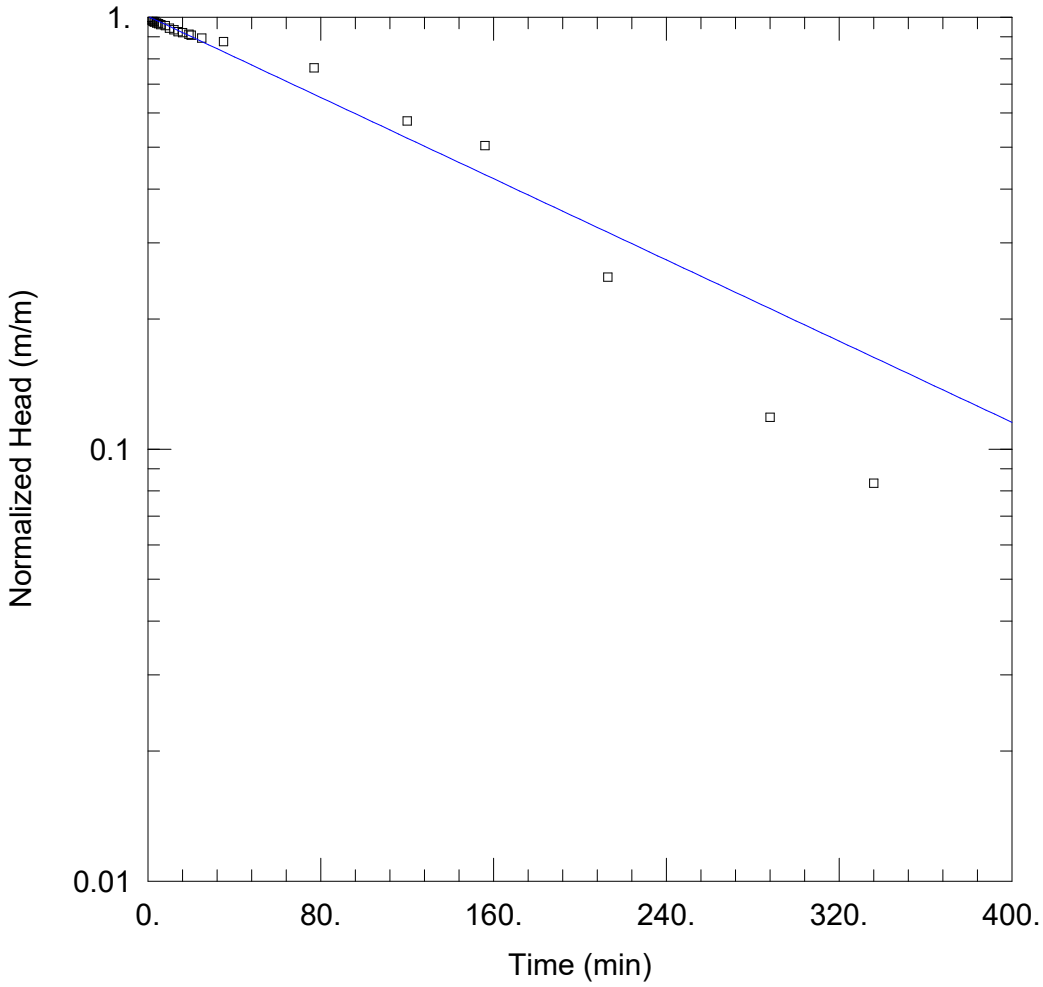
Saturated Thickness: 13.39 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW2)

Initial Displacement: 1.03 m
Total Well Penetration Depth: 13.39 m
Casing Radius: 0.025 m
Static Water Column Height: 13.39 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.796E-5 m/sec
y0 = 1.035 m



WELL TEST ANALYSIS

Data Set: C:\...\MW3.aqt
Date: 07/16/21 Time: 17:20:11

PROJECT INFORMATION

Company: B.I.G. Consulting Inc.
Client: Camarro Developments Inc.
Project: BIGC-ENV-461A
Location: 789-795 Brant Street
Test Well: MW3
Test Date: June 28, 2021

AQUIFER DATA

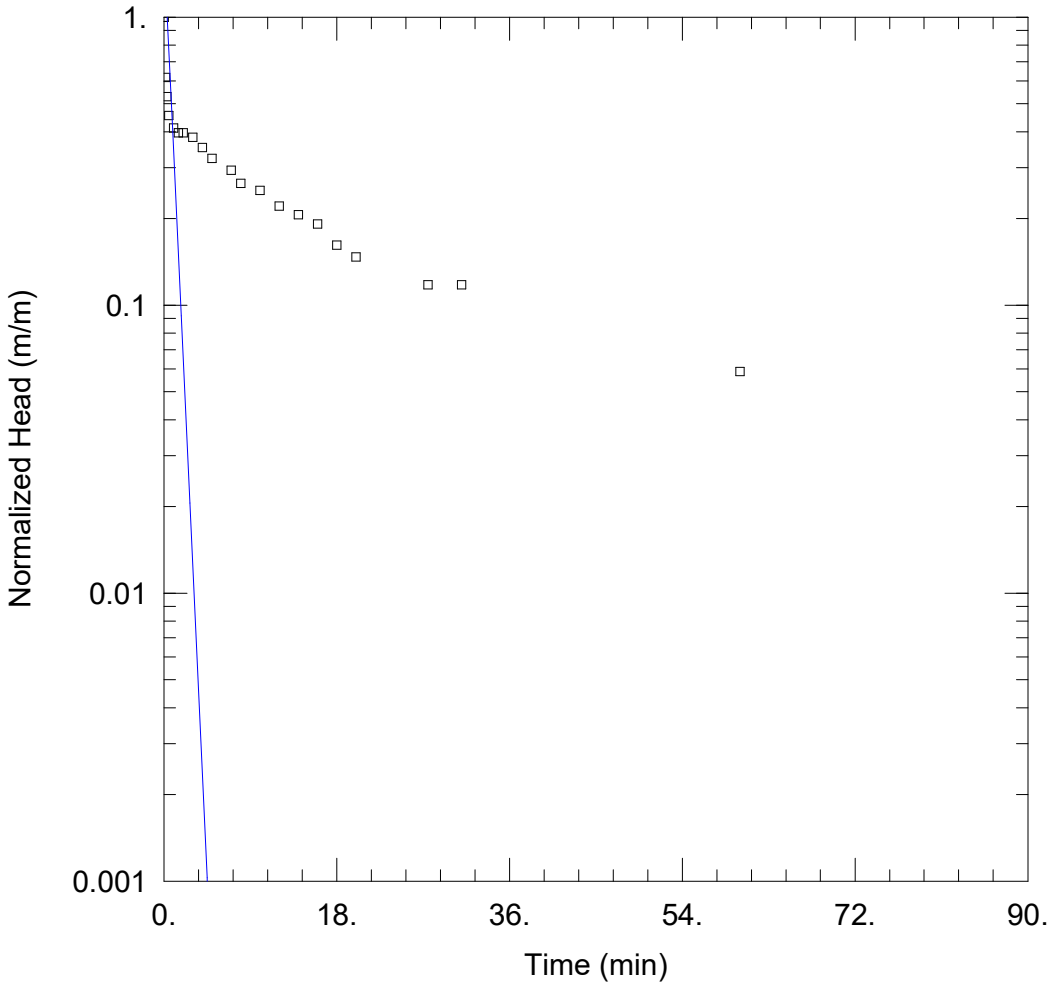
Saturated Thickness: 19.94 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW3)

Initial Displacement: 1.14 m
Total Well Penetration Depth: 19.94 m
Casing Radius: 0.025 m
Static Water Column Height: 19.94 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 5.148E-8 m/sec
y0 = 1.145 m



WELL TEST ANALYSIS

Data Set: C:\...\MW4.aqt
Date: 07/16/21 Time: 17:19:50

PROJECT INFORMATION

Company: B.I.G. Consulting Inc.
Client: Camarro Developments Inc.
Project: BIGC-ENV-461A
Location: 789-795 Brant Street
Test Well: MW4
Test Date: June 28, 2021

AQUIFER DATA

Saturated Thickness: 15.34 m Anisotropy Ratio (Kz/Kr): 1.

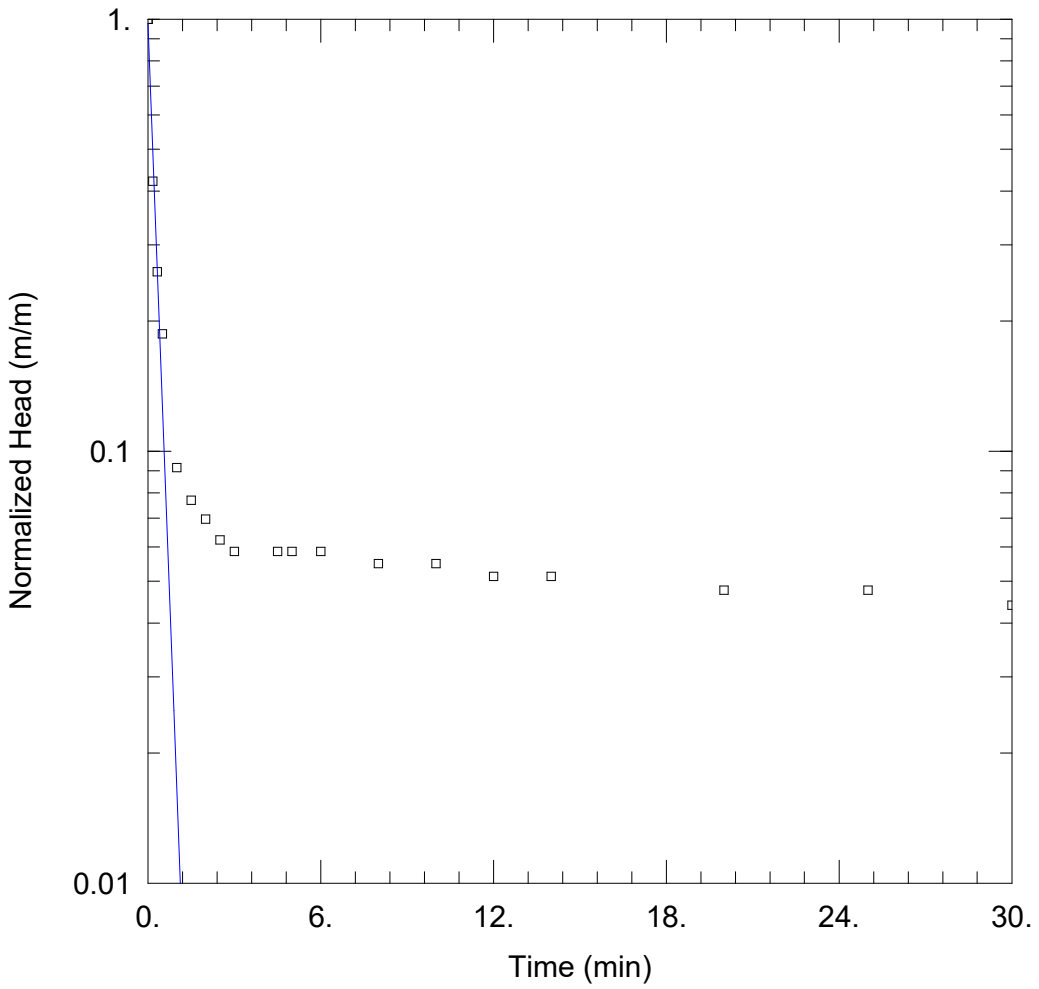
WELL DATA (MW4)

Initial Displacement: 0.34 m
Total Well Penetration Depth: 15.34 m
Casing Radius: 0.025 m
Static Water Column Height: 15.02 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.583E-5 m/sec y0 = 0.6239 m



WELL TEST ANALYSIS

Data Set: C:\...\MW5.aqt
Date: 07/16/21 Time: 17:19:18

PROJECT INFORMATION

Company: B.I.G. Consulting Inc.
Client: Camarro Developments Inc.
Project: BIGC-ENV-461A
Location: 789-795 Brant Street
Test Well: MW5
Test Date: June 28, 2021

AQUIFER DATA

Saturated Thickness: 17.07 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW5)

Initial Displacement: 1.365 m
Total Well Penetration Depth: 17.07 m
Casing Radius: 0.025 m
Static Water Column Height: 17.07 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 3.869E-5 m/sec y0 = 1.33 m

APPENDIX D: WATER QUALITY LABORATORY CERTIFICATE OF ANALYSIS AND CHAIN OF CUSTODY

Your Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Your C.O.C. #: 833962-01-01

Attention: Eileen Liu

B.I.G Consulting Inc.
12-5500 Tomken Road
Mississauga, ON
CANADA L4W 2Z4

Report Date: 2021/07/06
Report #: R6706680
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1H8682
Received: 2021/06/28, 19:50

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonaceous BOD	1	2021/06/30	2021/07/05	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2021/06/30	2021/06/30	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2021/06/29	2021/06/30	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/06/30	2021/06/30	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2021/07/02	2021/07/05	CAM SOP-00408	EPA 6010D m
E.coli, (CFU/100mL)	1	N/A	2021/06/28	CAM SOP-00552	MOE LSB E3371
Animal and Vegetable Oil and Grease	1	N/A	2021/07/06	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/07/05	2021/07/06	CAM SOP-00326	EPA1664B m,SM5520B m
PAH Compounds in Water by GC/MS (SIM)	1	2021/07/02	2021/07/03	CAM SOP-00318	EPA 8270D m
pH	1	2021/06/29	2021/06/30	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/06/30	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2021/07/02	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2021/06/29	2021/06/29	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2021/07/05	2021/07/06	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/07/02	2021/07/05	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2021/07/01	CAM SOP-00228	EPA 8260C m

Remarks:

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

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

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Your Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Your C.O.C. #: 833962-01-01

Attention: Eileen Liu

B.I.G Consulting Inc.
12-5500 Tomken Road
Mississauga, ON
CANADA L4W 2Z4

Report Date: 2021/07/06
Report #: R6706680
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1H8682
Received: 2021/06/28, 19:50

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

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Deepthi Shaji, Project Manager
Email: Deepthi.Shaji@bureauveritas.com
Phone# (905)817-5700 Ext:7065843
==========
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.

BV Labs Job #: C1H8682
Report Date: 2021/07/06

B.I.G Consulting Inc.
Client Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Sampler Initials: SL

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				PYO804			PYO804		
Sampling Date				2021/06/28 16:00			2021/06/28 16:00		
COC Number				833962-01-01			833962-01-01		
	UNITS	Criteria	Criteria-2	MW4	RDL	QC Batch	MW4 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Total Animal/Vegetable Oil and Grease	mg/L	-	150	0.80	0.50	7432655			
Inorganics									
Total Carbonaceous BOD	mg/L	-	300	ND	2	7437858			
Fluoride (F-)	mg/L	-	10	0.63	0.10	7435748			
Total Kjeldahl Nitrogen (TKN)	mg/L	-	100	9.0	0.50	7435698			
pH	pH	6.5:8.5	6.0:10.0	7.70		7435760			
Phenols-4AAP	mg/L	-	1	ND	0.0010	7437624			
Total Suspended Solids	mg/L	-	350	30	10	7442028			
Dissolved Sulphate (SO4)	mg/L	-	1500	1100	5.0	7436117	1000	5.0	7436117
Total Cyanide (CN)	mg/L	-	2	ND	0.0050	7438854			
Petroleum Hydrocarbons									
Total Oil & Grease	mg/L	-	-	1.4	0.50	7445257			
Total Oil & Grease Mineral/Synthetic	mg/L	-	-	0.60	0.50	7445259			
Metals									
Total Aluminum (Al)	mg/L	-	50	0.2	0.1	7441395			
Total Antimony (Sb)	mg/L	-	5	ND	0.02	7441395			
Total Arsenic (As)	mg/L	-	1	ND	0.01	7441395			
Total Beryllium (Be)	mg/L	-	5	ND	0.0005	7441395			
Total Cadmium (Cd)	mg/L	-	1	ND	0.002	7441395			
Total Chromium (Cr)	mg/L	-	3	ND	0.01	7441395			
Total Cobalt (Co)	mg/L	-	5	ND	0.002	7441395			
Total Copper (Cu)	mg/L	-	3	0.03	0.01	7441395			
Total Iron (Fe)	mg/L	-	50	1.2	0.02	7441395			
Total Lead (Pb)	mg/L	-	3	ND	0.01	7441395			
Total Manganese (Mn)	mg/L	-	5	0.38	0.001	7441395			
Mercury (Hg)	mg/L	-	0.05	ND	0.00010	7437958			
Total Molybdenum (Mo)	mg/L	-	5	0.010	0.005	7441395			

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

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Burlington Storm Sewer Discharge By-Law 86-2002
Criteria-2: Halton Sanitary & Combined Sewer Bylaw (2-03)
ND = Not detected

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.

BV Labs Job #: C1H8682
Report Date: 2021/07/06

B.I.G Consulting Inc.
Client Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Sampler Initials: SL

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				PYO804			PYO804		
Sampling Date				2021/06/28 16:00			2021/06/28 16:00		
COC Number				833962-01-01			833962-01-01		
	UNITS	Criteria	Criteria-2	MW4	RDL	QC Batch	MW4 Lab-Dup	RDL	QC Batch
Total Nickel (Ni)	mg/L	-	3	ND	0.005	7441395			
Total Phosphorus (P)	mg/L	-	10	ND	0.05	7441395			
Total Selenium (Se)	mg/L	-	5	ND	0.02	7441395			
Total Silver (Ag)	mg/L	-	5	ND	0.01	7441395			
Total Tin (Sn)	mg/L	-	5	ND	0.02	7441395			
Total Titanium (Ti)	mg/L	-	5	ND	0.005	7441395			
Total Zinc (Zn)	mg/L	-	3	0.005	0.005	7441395			
Polyaromatic Hydrocarbons									
Naphthalene	ug/L	-	140	0.059	0.050	7442712			
Volatile Organics									
Benzene	ug/L	-	10	ND	0.40	7435856			
Chloroform	ug/L	-	40	1.4	0.40	7435856			
1,4-Dichlorobenzene	ug/L	-	80	ND	0.80	7435856			
Ethylbenzene	ug/L	-	160	ND	0.40	7435856			
Methylene Chloride(Dichloromethane)	ug/L	-	2000	ND	4.0	7435856			
Tetrachloroethylene	ug/L	-	1000	ND	0.40	7435856			
Toluene	ug/L	-	16	ND	0.40	7435856			
Trichloroethylene	ug/L	-	400	ND	0.40	7435856			
Surrogate Recovery (%)									
D10-Anthracene	%	-	-	105		7442712			
D14-Terphenyl (FS)	%	-	-	109		7442712			
D8-Acenaphthylene	%	-	-	99		7442712			
4-Bromofluorobenzene	%	-	-	87		7435856			
D4-1,2-Dichloroethane	%	-	-	111		7435856			
D8-Toluene	%	-	-	88		7435856			

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

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Burlington Storm Sewer Discharge By-Law 86-2002
Criteria-2: Halton Sanitary & Combined Sewer Bylaw (2-03)
ND = Not detected

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

BV Labs Job #: C1H8682
Report Date: 2021/07/06

B.I.G Consulting Inc.
Client Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Sampler Initials: SL

MICROBIOLOGY (WATER)

BV Labs ID			PYO804		
Sampling Date			2021/06/28 16:00		
COC Number			833962-01-01		
	UNITS	Criteria	MW4	RDL	QC Batch
Microbiological					
Escherichia coli	CFU/100mL	200	<10	10	7434598

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 Burlington Storm Sewer Discharge By-Law 86-2002

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BV Labs Job #: C1H8682
Report Date: 2021/07/06

B.I.G Consulting Inc.
Client Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Sampler Initials: SL

GENERAL COMMENTS

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

Package 1	22.7°C

Sample PYO804 [MW4] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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

BV Labs Job #: C1H8682
Report Date: 2021/07/06

QUALITY ASSURANCE REPORT

B.I.G Consulting Inc.
Client Project #: BIGC-ENV-461A
Site Location: 789-795 Brant Street, Burlington
Sampler Initials: SL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7435856	4-Bromofluorobenzene	2021/06/30	104	70 - 130	104	70 - 130	95	%				
7435856	D4-1,2-Dichloroethane	2021/06/30	103	70 - 130	95	70 - 130	108	%				
7435856	D8-Toluene	2021/06/30	108	70 - 130	108	70 - 130	89	%				
7442712	D10-Anthracene	2021/07/05	53	50 - 130	95	50 - 130	97	%				
7442712	D14-Terphenyl (FS)	2021/07/05	67	50 - 130	103	50 - 130	83	%				
7442712	D8-Acenaphthylene	2021/07/05	94	50 - 130	89	50 - 130	94	%				
7435698	Total Kjeldahl Nitrogen (TKN)	2021/06/29	102	80 - 120	96	80 - 120	ND, RDL=0.10	mg/L	1.8	20	94	80 - 120
7435748	Fluoride (F-)	2021/06/30	118	80 - 120	106	80 - 120	ND, RDL=0.10	mg/L	5.1	20		
7435760	pH	2021/06/30			102	98 - 103			0.21	N/A		
7435856	1,4-Dichlorobenzene	2021/06/30	114	70 - 130	110	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7435856	Benzene	2021/06/30	93	70 - 130	91	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7435856	Chloroform	2021/06/30	98	70 - 130	93	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7435856	Ethylbenzene	2021/06/30	89	70 - 130	92	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7435856	Methylene Chloride(Dichloromethane)	2021/06/30	98	70 - 130	92	70 - 130	ND, RDL=2.0	ug/L	NC	30		
7435856	Tetrachloroethylene	2021/06/30	93	70 - 130	91	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7435856	Toluene	2021/06/30	99	70 - 130	98	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7435856	Trichloroethylene	2021/06/30	101	70 - 130	100	70 - 130	ND, RDL=0.20	ug/L	0.037	30		
7436117	Dissolved Sulphate (SO4)	2021/07/02	NC	75 - 125	100	80 - 120	ND, RDL=1.0	mg/L	4.1	20		
7437624	Phenols-4AAP	2021/06/30	96	80 - 120	96	80 - 120	ND, RDL=0.0010	mg/L	0	20		
7437858	Total Carbonaceous BOD	2021/07/05					ND,RDL=2	mg/L	13	30	95	85 - 115
7437958	Mercury (Hg)	2021/06/30	92	75 - 125	96	80 - 120	ND, RDL=0.00010	mg/L	NC	20		
7438854	Total Cyanide (CN)	2021/07/02	101	80 - 120	97	80 - 120	ND, RDL=0.0050	mg/L	1.3	20		
7441395	Total Aluminum (Al)	2021/07/05	95	80 - 120	102	80 - 120	ND, RDL=0.1	mg/L	NC	20		
7441395	Total Antimony (Sb)	2021/07/05	105	80 - 120	105	80 - 120	ND, RDL=0.02	mg/L	NC	20		
7441395	Total Arsenic (As)	2021/07/05	100	80 - 120	100	80 - 120	ND, RDL=0.01	mg/L	NC	20		
7441395	Total Beryllium (Be)	2021/07/05	98	80 - 120	99	80 - 120	ND, RDL=0.0005	mg/L	NC	20		
7441395	Total Cadmium (Cd)	2021/07/05	101	80 - 120	102	80 - 120	ND, RDL=0.002	mg/L	NC	20		

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

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7441395	Total Chromium (Cr)	2021/07/05	99	80 - 120	99	80 - 120	ND, RDL=0.01	mg/L	NC	20		
7441395	Total Cobalt (Co)	2021/07/05	100	80 - 120	100	80 - 120	ND, RDL=0.002	mg/L	NC	20		
7441395	Total Copper (Cu)	2021/07/05	NC	80 - 120	100	80 - 120	ND, RDL=0.01	mg/L	3.3	20		
7441395	Total Iron (Fe)	2021/07/05	97	80 - 120	101	80 - 120	ND, RDL=0.02	mg/L	NC	20		
7441395	Total Lead (Pb)	2021/07/05	100	80 - 120	100	80 - 120	ND, RDL=0.01	mg/L	NC	20		
7441395	Total Manganese (Mn)	2021/07/05	97	80 - 120	99	80 - 120	ND, RDL=0.001	mg/L	NC	20		
7441395	Total Molybdenum (Mo)	2021/07/05	104	80 - 120	104	80 - 120	ND, RDL=0.005	mg/L	NC	20		
7441395	Total Nickel (Ni)	2021/07/05	100	80 - 120	100	80 - 120	ND, RDL=0.005	mg/L	NC	20		
7441395	Total Phosphorus (P)	2021/07/05	108	80 - 120	110	80 - 120	ND, RDL=0.05	mg/L	NC	20		
7441395	Total Selenium (Se)	2021/07/05	103	80 - 120	102	80 - 120	ND, RDL=0.02	mg/L	NC	20		
7441395	Total Silver (Ag)	2021/07/05	98	80 - 120	98	80 - 120	ND, RDL=0.01	mg/L	NC	20		
7441395	Total Tin (Sn)	2021/07/05	102	80 - 120	103	80 - 120	ND, RDL=0.02	mg/L	NC	20		
7441395	Total Titanium (Ti)	2021/07/05	100	80 - 120	101	80 - 120	ND, RDL=0.005	mg/L	NC	20		
7441395	Total Zinc (Zn)	2021/07/05	103	80 - 120	103	80 - 120	ND, RDL=0.005	mg/L	NC	20		
7442028	Total Suspended Solids	2021/07/05					ND, RDL=10	mg/L	8.5	25	99	85 - 115
7442712	Naphthalene	2021/07/03	56	50 - 130	67	50 - 130	ND, RDL=0.050	ug/L	NC	30		
7445257	Total Oil & Grease	2021/07/06			98	85 - 115	ND, RDL=0.50	mg/L	1.5	25		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7445259	Total Oil & Grease Mineral/Synthetic	2021/07/06			98	85 - 115	ND, RDL=0.50	mg/L	5.2	25		

N/A = Not Applicable

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

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

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

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

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

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

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

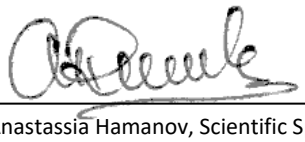
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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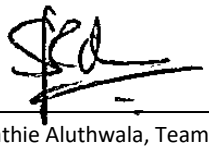
Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

VALIDATION SIGNATURE PAGE

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



Anastassia Hamanov, Scientific Specialist



Sirimathie Aluthwala, Team Lead

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

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

Exceedance Summary Table – Burlington Storm Sewer

Result Exceedances

Sample ID	BV Labs 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 – Halton Sanitary Sewer

Result Exceedances

Sample ID	BV Labs 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.

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MICRO

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Page of

28-Jun-21 19:50

Deepthi Shaji

C1H8682

Bottle Order #: 833962

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:			
Company Name:	#31796 B.I.G Consulting Inc.	Company Name:		Quotation #:	B64476		
Attention:	Accounts Payable	Attention:	Eileen Liu	P.O. #:			
Address:	12-5500 Tomken Road Mississauga ON L4W 2Z4	Address:		Project:	BIGC-ENV-461A	NP4	ENV-980
Tel:	(416) 214-4880 Fax:	Tel:	Fax:	Project Name:		COC #:	Project Manager:
Email:	ldougherty@brownfieldigi.com;admin@brownfieldigi.co	Email:	eliu@brownfieldigi.com	Site #:		C#833962-01-01	Deepthi Shaji
				Sampled By:			

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

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

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

Special Instructions

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

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

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Burlington storm sewer	Halton Sanitary & Combined Sewer (2-03)								# of Bottles	Comments
1		MW4	21/06/28	16:00	GW	N	✓	✓								15	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Shirley Li	21/06/28	19:50		2021/06/28	15:50	

Laboratory Use Only
Time Sensitive | Temperature (°C) on Recei: 20/23/19 | Custody Seal: Present ☑ Intact ☑ | Yes ☑ | No

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

* 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. On Ice

** 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 Canada (2019) Inc.

APPENDIX E: CONSTRUCTION DEWATERING ESTIMATE RATE CALCULATIONS

Construction Dewatering Rate Estimate

789 and 795 Brant Street, Burlington, Ontario
Five (5) levels of underground parking, unconfined aquifer, groundwater seepage to square excavation (radial source)

Table E-1: Construction Dewatering Rate Estimates

Description	Symbol	Values	Unit	Explanation
Input				
Lowest Ground Elevation		92.12	m asl	Based on borehole logs
Highest Groundwater Level		90.20	m asl	Highest groundwater elevation on June 28, 2021
Footing Elevation		75.12	m asl	Assumed 17 m below ground
Aquifer Bottom		74.12	m asl	Assumed 1 m below footing elevation
Hydraulic Conductivity		2.03E-06	m/s	Geometric mean K
Length of Excavation	x	50.0	m	Based on aerial extent of the Site
Width of Excavation	a	45.0	m	Based on aerial extent of the Site
Output				
Top of Aquifer		90.20	m asl	Water table for unconfined aquifer
Target Water Level		74.12	m asl	Assumed 1.0 m below footing elevation
Water Level above aquifer bottom before dewatering	H	16.1	m	
Target water level above aquifer bottom	h	0.0	m	
Equivalent radius	R_e	26.8	m	Equal perimeter
Radius of Influence	L (R_0)	68.80	m	Sichardt's Formula (C=3000 for radial source)
Construction dewatering flow rate - Steady State	Q	151.2	m^3/day	Construction Dewatering flow – Dupuit Equation
Maximum construction dewatering flow rate (safety factor of 2.5)	2.5Q	378.0	m^3/day	During the initial period and after rains
Construction Dewatering Flow Rate - Steady State	Q	**151,000**	L/day	
Maximum Construction Flow Rate (safety factor of 2.5)	2.5Q	**378,000**	L/day	

APPENDIX F: LONG TERM DRAINAGE FLOW RATE ESTIMATE CALCULATIONS

Foundation Drain Flow Rate Estimate

789 and 795 Brant Street, Burlington, Ontario
Five (5) levels of underground parking, unconfined aquifer, groundwater seepage to square excavation (radial source)

Table F-1: Foundation Drain Flow Rate Estimate of Southern Portion

Description	Symbol	Values	Unit	Explanation
Input				
Lowest Ground Elevation		92.12	m asl	Based on borehole logs
Highest Groundwater Level		90.20	m asl	Highest deep groundwater elevation on June 28, 2021
P5 Slab Elevation		77.12	m asl	Assumed 15 m below ground
Aquifer Bottom		76.12	m asl	Assumed 1 m below basement elevation
Hydraulic Conductivity		2.03E-06	m/s	Geometric mean K
Length of Excavation	x	50.0	m	Based on aerial extent of the Site
Width of Excavation	a	45.0	m	Based on aerial extent of the Site
Output				
Top of Aquifer		90.2	m asl	Water table for unconfined aquifer
Target Water Level		76.62	m asl	Assumed 0.5 m below basement floor level
Water Level above aquifer bottom before dewatering	H	14.1	m	
Target water level above aquifer bottom	h	0.5	m	
Equivalent radius	R_e	26.8	m	Equal perimeter
Radius of Influence	L (R_0)	115.60	m	Weber's Equation (from centre of drainage area)
Foundation Drain Flow Rate - Steady State	Q	74.7	m^3/day	Long-term flow rate – Dupuit Equation
Maximum Foundation Drain Flow Rate (safety factor of 1.5)	1.5Q	112.08	m^3/day	During the initial period and after rains
Estimated Long-term Foundation Drain Flow Rate	Q	**75,000**	L/day	
Estimated Maximum Foundation Drain Flow Rate	1.5Q	**112,000**	L/day	