

# DRAFT - PRELIMINARY HYDROGEOLOGICAL INVESTIGATION

590 Argus Road, Oakville, Ontario

#### Client

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#### **Project Number**

BIGC-ENV-554A

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#### **Date Submitted**

February 1, 2023

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#### 1 Introduction

#### 1.1 Project Description

B.I.G. Consulting Inc. (BIG) was retained by Mr. Clarence Qian on behalf of 590 Argus LP. (the Client), to conduct a Preliminary Hydrogeological Investigation support the proposed development of the site located at 590 Argus Road, Oakville, Ontario (Site). A previous memo titled, "Preliminary Findings of Hydrogeological Investigation, 590 Argus Road, Oakville, Ontario," was prepared by BIG on June 22, 2022.

The Site is located north of Argus Road and to the west of South Service Road East in Oakville, Ontario, as shown on Figure 1. The Site measures approximately 15,500 m² in size and is currently occupied by a commercial building (Site building). The areas surrounding the Site building are covered with asphalt and landscaped areas.

It is BIG's understanding that the proposed development consists of multiple condominium with seven (7) levels of underground parking structures.

The following investigations previously completed for the subject Site and surrounding properties were reviewed by BIG:

- Hydrogeological Investigation, 217 and 227 Cross Avenue and 571 Argus Road, Oakville, Ontario, prepared by BIG, dated March 9, 2021.
- Memo Findings of Preliminary Hydrogeological Investigation, 581-587 Argus Road, Oakville, Ontario, prepared by BIG, dated October 29, 2021.
- Memo Findings of Preliminary Geotechnical Investigation, 590 Argus Road, Oakville, Ontario, prepared by BIG, dated June 15, 2022.
- Phase II Environmental Site Assessment, 590 Argus Road, Oakville, Ontario, prepared by BIG, dated October 4, 2022.

It should be noted that the dewatering estimated 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.

This report addresses the hydrogeological aspects of the proposed project. Reports for the Environmental Geotechnical Investigations will be issued under separate covers. The field investigations for the geotechnical, environmental and hydrogeological investigations were carried out concurrently.

#### 1.2 Project Objectives

The main objectives of the Preliminary Hydrogeological Investigation were to:

- a) Establish the subsurface geological and hydrogeological conditions at the expected foundation elevation;
- b) Estimate any potential construction dewatering flow rates;
- c) Estimate foundation sub-drain discharge volumes, if applicable; and,
- d) 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) Utilization of pre-existing monitoring wells at 581 to 587 Argus Avenue, 217 Cross Avenue and 571 Argus Avenue (BH/MW2, BH/MW5, BH/MW114 and BH/MW115) installed by BIG in 2021;
- d) Advancement of eight (8) boreholes (BH1 to BH8) and installation of five (5) monitoring wells (BH/MW1, BH/MW3, BH/MW4, BH/MW6 and BH/MW8);
- e) Perform single well response tests (SWRT) at selected monitoring wells to assess the hydraulic characteristics of the saturated soils at the Site;
- 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 Regional Municipality of Halton and Town of Oakville Storm and Combined/Sanitary Sewer Use By-Law parameters;
- h) Assess groundwater discharges during construction phases;
- i) Assess foundation sub-drain discharge volumes; and,
- j) The preparation of a Preliminary Hydrogeological Investigation Report.

#### 1.4 Previous Reports

#### 1.4.1 BIG Hydrogeological Investigation

BIG completed a Hydrogeological Investigation at 217 and 227 Cross Avenue and 571 Argus Road, dated March 9, 2021, that consisted of the advancement of fifteen (15) boreholes (BH101 to BH115) to a maximum depth of 23.4 m bgs and installation of monitoring wells (MW101 to MW115) to a maximum depth of 21.60 m bgs.

#### 1.4.2 BIG Memo – Findings of Preliminary Hydrogeological Investigation

BIG completed a Hydrogeological Investigation at 581-587 Argus Road, dated October 29, 2021, that consisted of the advancement of five (5) boreholes (BH1 to BH5) to a maximum depth of 27.6 m bgs and installation of monitoring wells (BH/MW1 to BH/MW5) to a maximum depth of 22.90 m bgs

#### 1.4.3 BIG Memo Findings of Preliminary Geotechnical Investigation

BIG completed a Memo – Findings of Preliminary Geotechnical Investigation at the Site, dated June 15, 2022, that consisted of advancement of eight (8) boreholes (BH1 to BH8) to a maximum depth of 7.7 m bgs and installation of five (5) monitoring wells (BH/MW1, BH/MW3, BH/MW4, BH/MW6 and BH/MW8).

#### 1.4.4 BIG Phase II ESA

BIG completed a Phase II ESA at the Site, dated October 4, 2022, that consisted of advancement of eight (8) boreholes (BH1 to BH8) to a maximum depth of 7.7 m bgs and installation of five (5) monitoring wells (BH/MW1, BH/MW3, BH/MW4, BH/MW6 and BH/MW8).



# 2 Regional Setting

#### 2.1 Regional Physiography

The Ontario Geological Survey Map P. 2204, 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 Paleozoic bedrock. The surficial geology for the Site and surrounding areas is shown on Figure 3.

Bedrock of the region corresponds to the Georgian Bay Formation, Blue Mountain Formation, Billings Formation, Collingwood Member and Eastview Member consisting of shale, limestone, dolostone and siltstone. The contact between the bedrock and the overlying overburden is expected to be at approximately 1 m to 1.5 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.

No local aquifers were identified that could negatively impact the subject Site.



# **3** Site Setting

#### 3.1 Site Topography and Drainage

The Site is rectangular in shape and has an area of approximately 15,500 m<sup>2</sup>. The Site is currently occupied by a commercial building (Site building). The areas surrounding the Site building 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 105.36 m and 104.45 m above sea level (asl). Precipitation that falls on the Site is inferred to be directed to the nearby Town of Oakville 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 Sixteen Mile Creek, located approximately 530 m southwest of the Site. The Site is situated within the Lower Morrison Creek watershed and is not part of a 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 eighty-six (86) 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 as abandoned or for observation well, monitoring well and test hole purposes within 500 m radius of the Site. One (1) supply water well was identified at the Queen Elizabeth Way, located approximate 265 m southwest of the Site. The well was installed in 1948 and the well is located in a developed area, the supply well is likely not present. Given the area is serviced by municipal system, no private well water user is expected.

# 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 seven (7) expired PTTW registrations and two (2) expired EASR registrations within 1 km of the Site and are summarized in Table B-2, Appendix B. The location for each registration is shown on Figure 5.



# 4 Field Program

#### 4.1 Borehole and Monitoring Well Details

BIG advanced eight (8) boreholes (BH1 to BH8) to a maximum depth of 7.7 m bgs between May 25 and 26, 2022 and instrumented five (5) boreholes with monitoring wells (BH/MW1, BH/MW3, BH/MW4, BH/MW6 and BH/MW8). The boreholes were advanced by using a truck mounted 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.

The following monitoring wells were previously installed at 581 to 587 Argus Avenue, 217-227 Cross Avenue and 571 Argus Avenue:

a) Four (4) monitoring wells (BH/MW2, BH/MW5, BH/MW114 and BH/MW115) installed by BIG in 2021

Figure 6 is a detailed Borehole/Monitoring Well Location Map of the Site. The borehole logs are attached in Appendix A.

#### 4.2 Site Specific Overburden Geology

The borehole locations are shown on Figure 6 and detailed subsurface conditions are presented on the borehole logs in Appendix A. The following table is provided in addition to the borehole descriptions to provide a general summary of the soil conditions. The soil descriptions are predominately based on BIG's investigation, however, where applicable soil conditions encountered during previous investigation by others are included. The soil boundaries indicated on the borehole logs and discussed herein are inferred from the visual observations and auger resistance and should not be regarded as exact planes of geological change.

The soil conditions encountered at the borehole locations are summarized below. A stratigraphic cross-section across the property as aligned on Figure 6 is included as Figure 7.

Table 4-1: Soil description

Layer	Description
Ground Cover	Eight (8) boreholes BH1 to BH8 were advanced through the existing asphalt pavement
	consisting approximately 50 to 70 mm thick asphalt over 100 to 120 mm thick granular
	bases.
Fill	Below the ground surface cover, existing fill generally consisting of sand and gravel
	with trace silt was encountered at BH1 to BH5 and BH7 and silty clay/clayey silt with
	trace sand was encountered at all boreholes except for BH5. The fill material extended
	to depths varying between 0.8 and 1.5 m bgs. Existing fill also contained trace organics.
Shale Bedrock	Below existing fill in all borehole locations, a highly weathered reddish brown and/or
	grey shale bedrock was encountered that extended to the maximum termination
	depth at 7.7 m bgs.

#### 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 May 31, 2022 and depths to the groundwater ranged from 2.92 m to 4.55 m bgs. The monitoring wells were observed with groundwater elevations that ranged from 102.44 m to 100.55 m asl.



An interpreted groundwater contour map for the water level measurements recorded on May 31, 2022 is included as Figure 8. Based on the water level measurements obtained, the inferred direction of groundwater flow across the Site is interpreted to be to the southeastern 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

		Ground		October	18, 2021	May 31, 2022		
Well ID	Address	Elevation (m asl)	Well Depth (m bgs)	Water Level (m bgs)	Elevation (m asl)	Water Level (m bgs)	Elevation (m asl)	
BH/MW1	590 Argus Road	104.45	6.1	-	-	3.90	100.55	
BH/MW3	590 Argus Road	104.84	6.1	-	-	3.37	101.47	
BH/MW4	590 Argus Road	105.05	6.1	-	-	3.44	101.61	
BH/MW6	590 Argus Road	105.36	6.1	-	-	2.92	102.44	
BH/MW8	590 Argus Road	105.12	6.1	-	-	4.55	100.57	
BH/MW2	581-587 Argus Road	104.24	15.2	9.05	95.19	-	-	

#### 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 Hyorslev 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	Site	Well Depth	Hydraulic Conductivity
Well	Site	(m bgs)	(m/s)
BH/MW2	581-587 Argus Road	15.2	1.49 x 10 <sup>-8</sup>
BH/MW5	581-587 Argus Road	22.9	6.12 x 10 <sup>-9</sup>
BH/MW114	217-227 Cross Avenue and 571 Argus Road	21.6	1.93 x 10 <sup>-8</sup>
BH/MW115	217-227 Cross Avenue and 571 Argus Road	21.6	1.58 x 10 <sup>-8</sup>
BH/MW1	590 Argus Road	6.1	7.46 x 10 <sup>-6</sup>
BH/MW3	590 Argus Road	6.1	2.71 x 10 <sup>-5</sup>
BH/MW4	590 Argus Road	6.1	5.87 x 10 <sup>-8</sup>
BH/MW6	590 Argus Road	6.1	$1.24 \times 10^{-5}$
BH/MW8	590 Argus Road	6.1	2.28 x 10 <sup>-6</sup>
	Geometric mea	an K value (m/s)	2.76 x 10 <sup>-7</sup>

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.



#### 4.5 Groundwater Sampling

To assess the suitability for discharge of pumped groundwater to the Region of Halton Sanitary or Town of Oakville Storm Sewer during dewatering activities, a groundwater sample was collected from BH/MW1 on June 3, 2022.

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 Sanitary and Combined Sewer Discharge (By-Law No. 2-03) of the Regional Municipality of Halton; and Table 2 - Limits for Storm Sewer Discharge (By-Law No 2009-031) of the Corporation of the Town of Oakville.

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 Table 1 - Limits for Sanitary and Combined Sewer Discharge.

When compared against the more stringent Table 2 – Limits for Storm Sewer Discharge, the sample indicated exceedance for benzene, total manganese (Mn) and total suspended solids (TSS). A summary of the exceedance is provided in Table 4-4.

**Table 4-4: Summary of Analytical Results** 

Parameter	Limits for Sanitary and Combined Sewer Discharge (mg/L) (Table 1)	Limits for Storm Sewer Discharge (mg/L) (Table 2)	Concentration for BH/MW1 (mg/L) (June 3, 2022)				
Benzene	0.01	0.002	0.0024				
Total Manganese (Mn)	5	0.05	0.20				
Total Suspended Solids (TSS)	350	15	110				

Notes:

**Bold** indicates concentration exceeds the Storm Sewer Discharge Limit.

Although the water quality meets the limits of Region of Halton sanitary and combined sewer, the Region typically does not allow groundwater discharge to the Regional sewer system. Alternative discharge method or negotiation with the Town of Oakville will be required.



# 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 multiple condominium towers with seven (7) levels of underground parking structures. It is anticipated that finished floor elevation (FFE) of seven (7) levels of underground parking structure will be at an approximate depth of 22 m bgs. The footing elevation is assumed approximately 2 m below FFE. Groundwater was observed in all monitoring wells on May 31, 2022 and produces a continuous surface across the Site that is situated at an elevation between 102.44 m to 100.55 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.

If the footing or foundation elevation is deeper than the assumptions in this report, additional investigation will be required.

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)	104.45	Based on borehole logs					
P7 FFE (m asl)	82.45	FFE is assumed 22 m bgs					
Footing Elevation (m asl)	80.45	Assumed 2 m below FFE					
Dewatered Elevation Target (m asl)	79.45	Assumed 1 m below footing					
Groundwater Elevation (m asl)	102.44	Highest groundwater elevation (May 31,					
Groundwater Elevation (in asi)	102.44	2022)					
Estimated Excavation Area	160 m x 86 m	Based on area extent equivalent					
Hydraulic Conductivity (m/s)	2.76E-07	Geometric mean K					

#### 5.3 Dewatering Flow Rate Equation

The Dupuit equation for steady flow from a linear source on both sides of a rectangular slot of an excavation through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate, and is expressed as follows:

$$Q_w = \frac{K(x+a)(H^2 - h^2)}{Lo}$$



Where:

Qw = Rate of pumping (m³/s)

x = Length of excavation (m)

a = Width of excavation (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)

Lo = Distance to Line Source (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 linear flow is calculated based on the Sichardt equation, which is described as follows:

$$Lo = 1750 (H - h)\sqrt{K}$$

Where:

K = Hydraulic conductivity (m/s)
 H = Static Saturated Head (m)
 h = Dynamic Saturated Head (m)

Based on the Sichardt equation and the geometric mean K value, the ROI is approximately 21.1 m from the edge of the excavation for linear 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 21.1 m from the edge 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 3 (L/day)
Excavation area	197,800	593,000

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 three (3) 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 400,000 L/day limit, a PTTW 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 FFE elevation. Table 6-1 presents the assumptions used to calculate the long-term drainage rate estimates.

Once the design is available, BIG needs to review and re-evaluate the dewatering estimates. If the foundation elevation is deeper than the assumptions in this report, additional investigation will be required.

**Table 6-1 Dewatering Estimate Assumptions** 

Input Parameter	Values	Notes				
Surface Elevation (m asl)	104.45	Based on borehole logs				
P7 FFE (m asl)	82.45	Assumed 22.0 m bgs				
Groundwater Elevation (m asl)	95.19	Highest deep groundwater elevation from				
Groundwater Elevation (in asi)	95.19	581-587 Argus (October 18, 2021)				
Sub-drain Elevation Target (m asl)	81.95	Assumed 0.5 m below the P7 basement				
Sub-urain Elevation Target (in asi)	01.95	elevation				
Drainage Dimensions	160 m x 86 m	Based on area extent equivalent				
Hydraulic Conductivity (m/s)	1.29E-08	Geometric mean K of deep wells				

#### 6.2 Radius of Influence

The ROI calculation is a conservative methodology and is calculated based on the assumption of active pumping during long-term dewatering. It should be noted that there will be no active pumping during long-term dewatering. The foundation drains will be constructed below the floor slab and/or near the foundation and the groundwater would passively drain into these sub drains and discharged directly to sumps. Due to the nature of overburden material, the groundwater will flow through the natural gradient that exists on the Site and passively flow into the foundation sub-drains and will not be actively pumped. Although, the ROI which was conservatively predicted was at 3.2 m from the edge of the sub-drain, over a period of time, the drawdown curve will be very close to the foundation walls and thus resulting in negligible ROI.

# 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	75,000	Long term sub-drain flow value rounded based on Dupuit's equation including flow from all sides.  Safety factor of 3 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



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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. A treatment is required prior to discharge to the Town of Oakville storm sewer.

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 Oakville, based on the MECP WWR database, one (1) supply water well was identified at the Queen Elizabeth Way, located approximate 265 m southwest of the Site. The well was installed in 1948 and the well is located in a developed area, the supply well is likely not present. 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, given the groundwater table is above the excavation, construction dewatering is required. 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 21.1 m from the edge 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, 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. If the foundation drains operate on a long-term basis, the radius of influence was conservatively estimated at 3.2 m from the edge of the excavation. However, unlike the construction dewatering activities where active dewatering takes places, the long-term dewatering operates passively where water would flow through fractured bedrock primarily via vertical drains. Therefore, the actual radius of influence will be less than the predicted distance and no impacts to the surrounding feature is expected.



# **8** Water Taking and Discharge Permits

#### 8.1 EASR and PTTW

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. The cumulative discharge rate for construction is 593,000 L/day. The limit for water taking under an EASR is 400,000 L/day. Given the cumulative construction discharge rate exceeds this limit, a PTTW for construction dewatering as per O.Reg.387/04 would be required. Given that the predicted long-term dewatering volume is 75,000 L/day and exceeds the 50,000 L/day limit, a PTTW for long-term discharge is required.



#### 9 Conclusions

Based on the findings of the Preliminary 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 multiple condominium towers with seven (7) levels of underground parking structures;
- 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 Paleozoic bedrock;
- d) The MECP WWR database indicated eighty-six (86) well records within 500 m radius of the Site. One (1) supply water well was identified at the Queen Elizabeth Way, located approximate 265 m southwest of the Site. The well was installed in 1948 and the well is located in a developed area, the supply well is likely not present. Given the area is serviced by municipal system, no private well water user is expected;
- e) Groundwater was observed in all monitoring wells on May 31, 2022 and depths to the groundwater ranged from 2.92 m to 4.55 m bgs. The monitoring wells were observed with groundwater elevations that ranged from 102.44 m to 100.55 m asl;
- f) Based on the water level measurements obtained, the inferred direction of groundwater flow across the Site is interpreted to be to the southeast direction;
- g) The estimated hydraulic conductivity of the soil and bedrock ranges from  $2.71 \times 10^{-5}$  m/s to  $6.12 \times 10^{-9}$  m/s with a geometric mean of  $2.76 \times 10^{-7}$  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 593,000 L/day;
- i) Based on the assumptions outlined in this report, the cumulative contribution to the foundation drains is 75,000 L/day;
- j) Given that the predicted dewatering volume exceeds the 400,000 L/day limit, a PTTW for construction dewatering will be required;
- k) Given that the predicted dewatering volume exceeds the 50,000 L/day limit, a PTTW for long-term dewatering is required;
- The laboratory CofA shows that no exceedance under Table 1 Limits for Sanitary and Combined Sewer Discharge;
- m) When compared against the more stringent Table 2 Limits for Storm Sewer Discharge, the sample indicated exceedances for benzene, total manganese (Mn) and total suspended solids (TSS); and,
- n) Although the water quality meets the limits of Region of Halton sanitary and combined sewer, the Region typically does not allow groundwater discharge to the Regional sewer system. Alternative discharge method or negotiation with the Town of Oakville will be required.

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.

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.

**DRAFT** 

Travis Van Holst, M.Env.Sc., GIT Environmental Scientist

DRAFT

Prem Manicks, P.Geo. Partner **DRAFT** 

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



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Singer, S.N., Cheng, C.K., and Scafe, M.G. (2003). The Hydrogeology of Southern Ontario, 2<sup>nd</sup> Edition. Environmental Monitoring and Reporting Branch, Ontario Ministry of Environment.

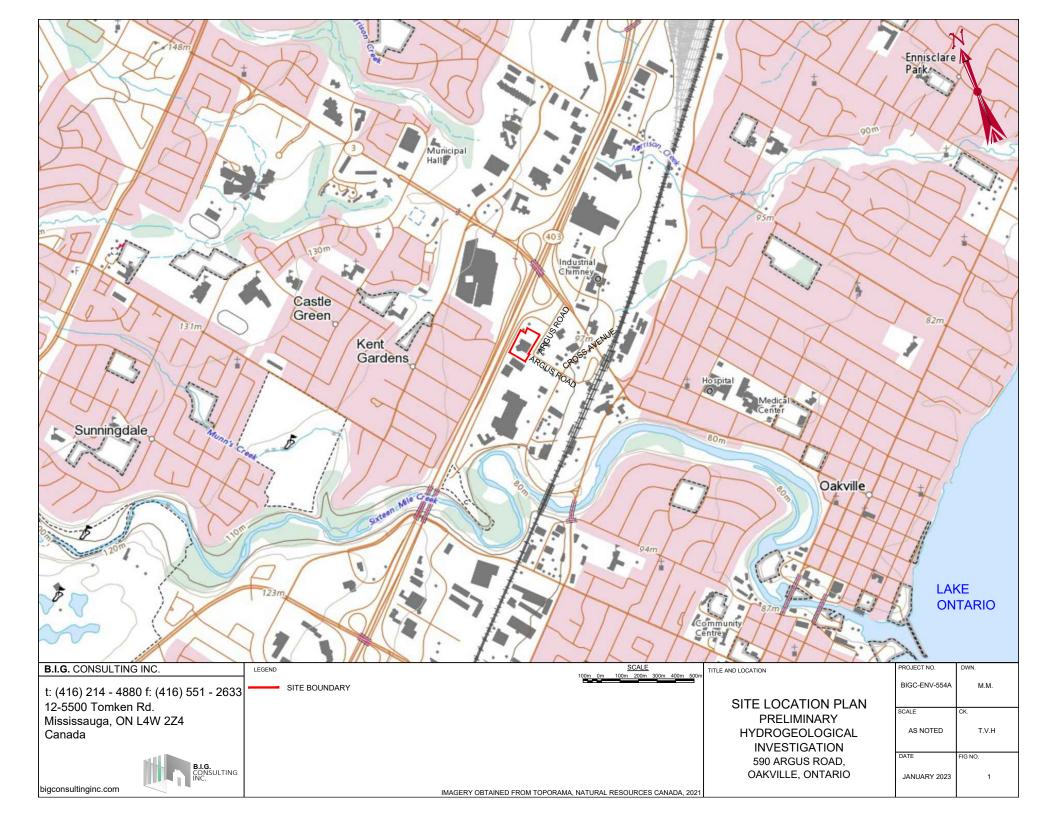
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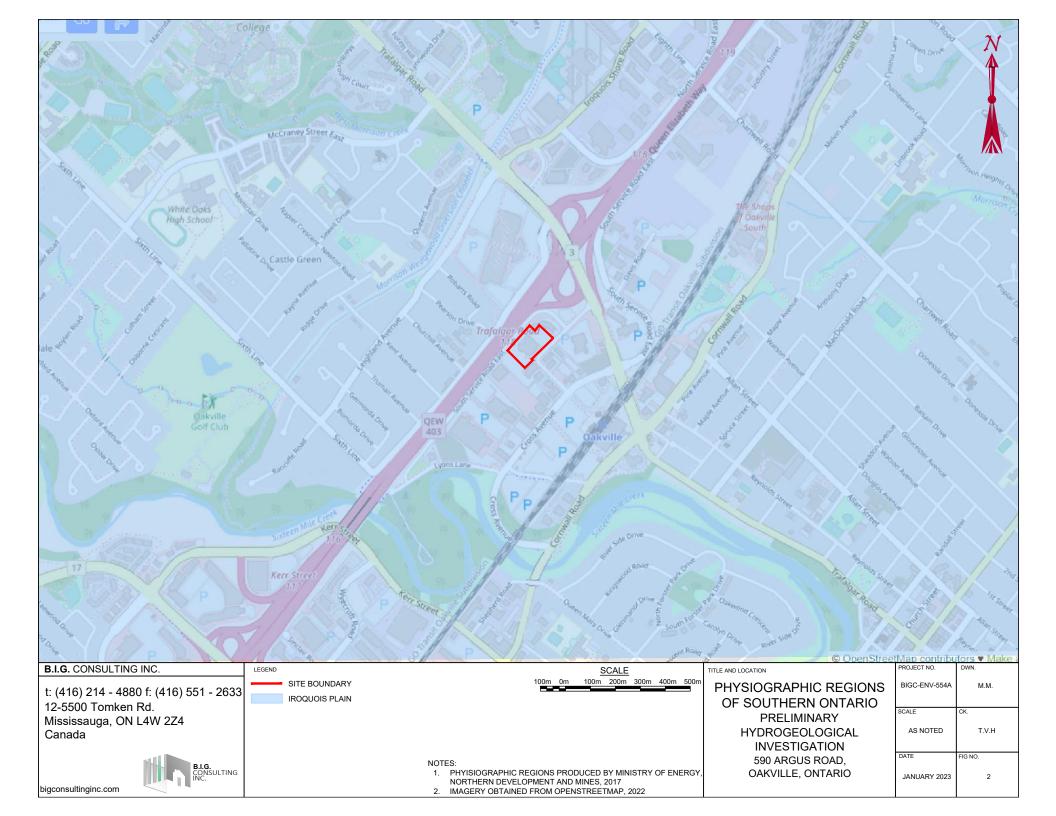
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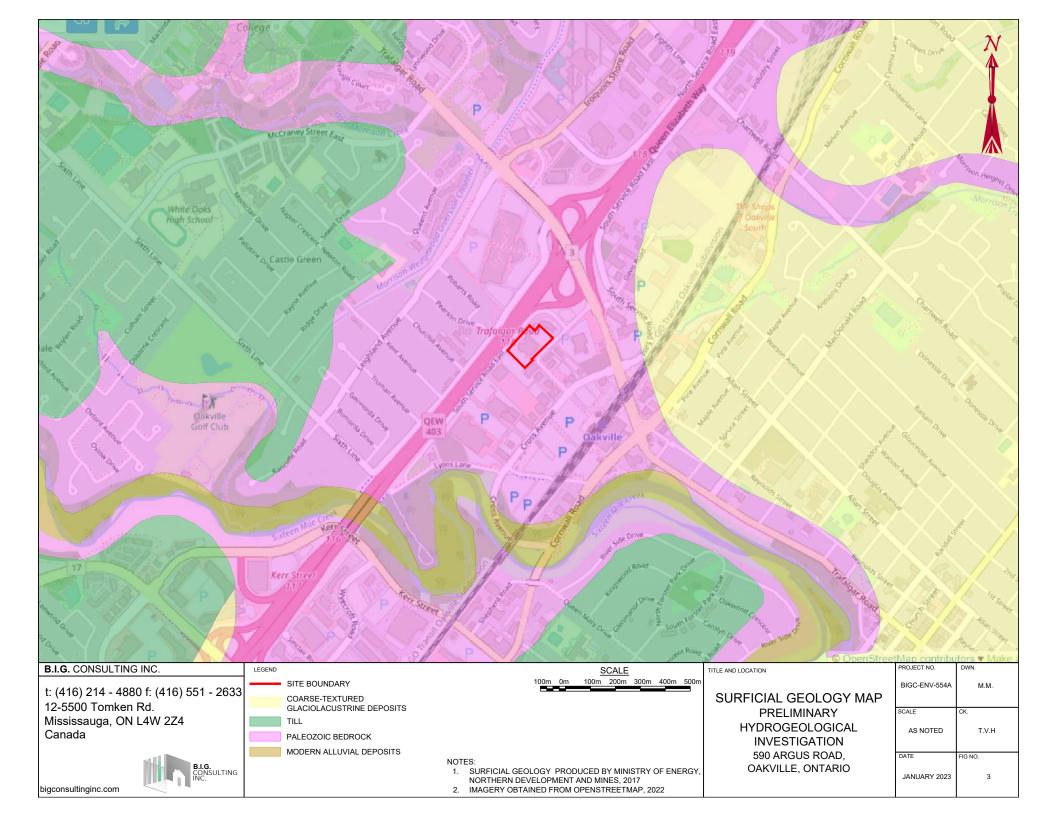


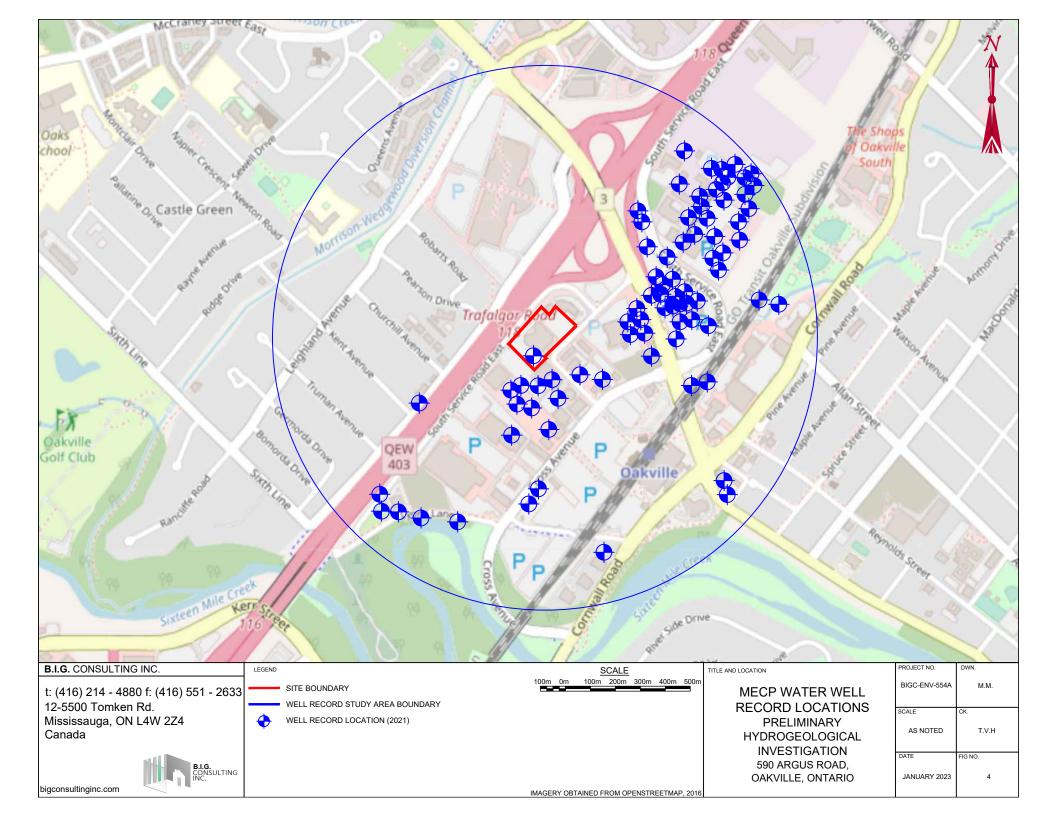
# **FIGURES**

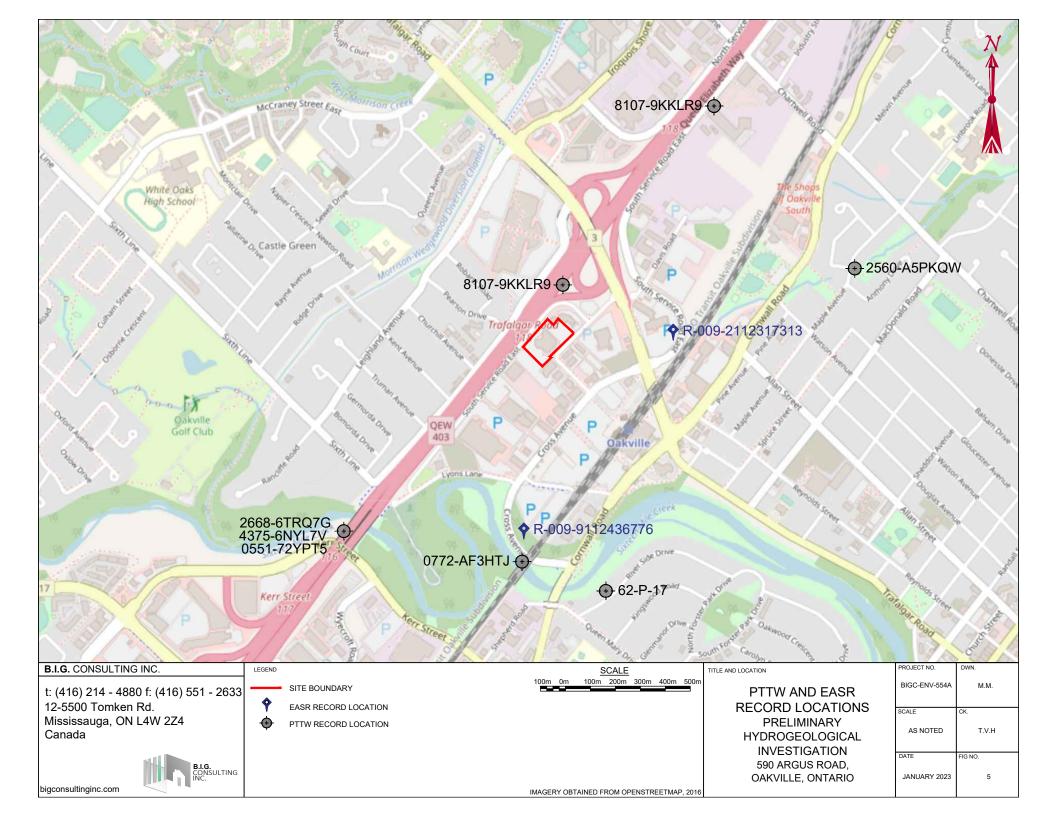


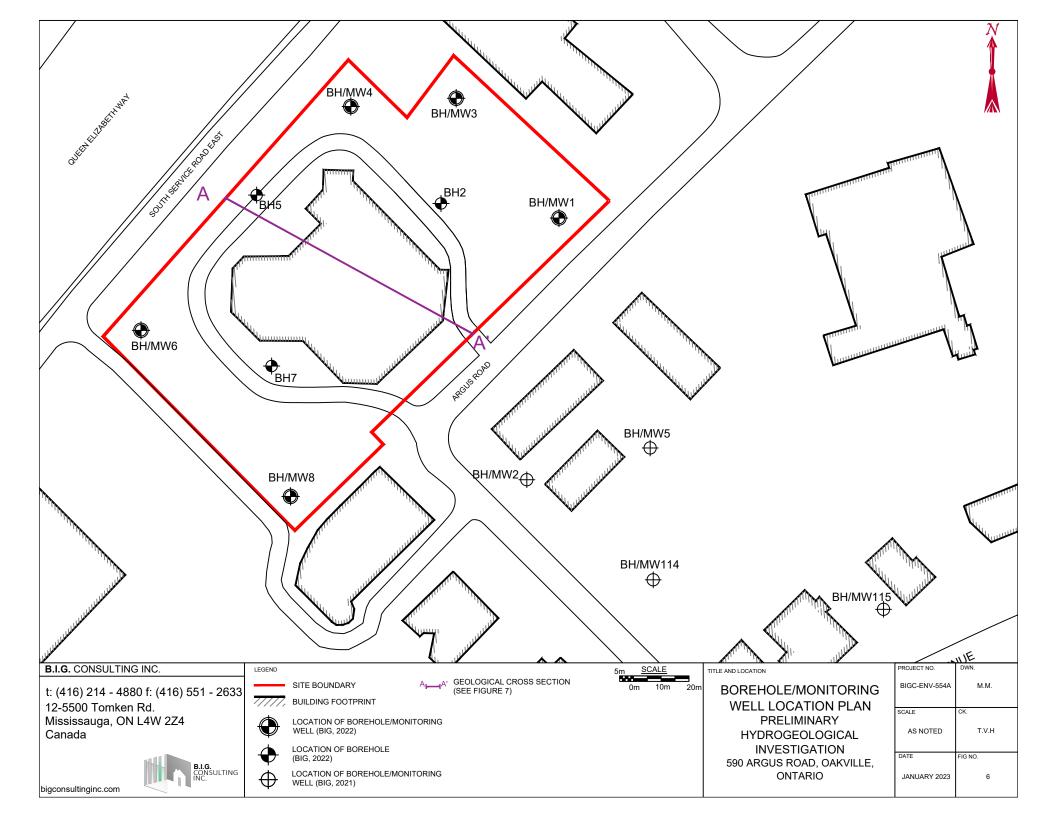


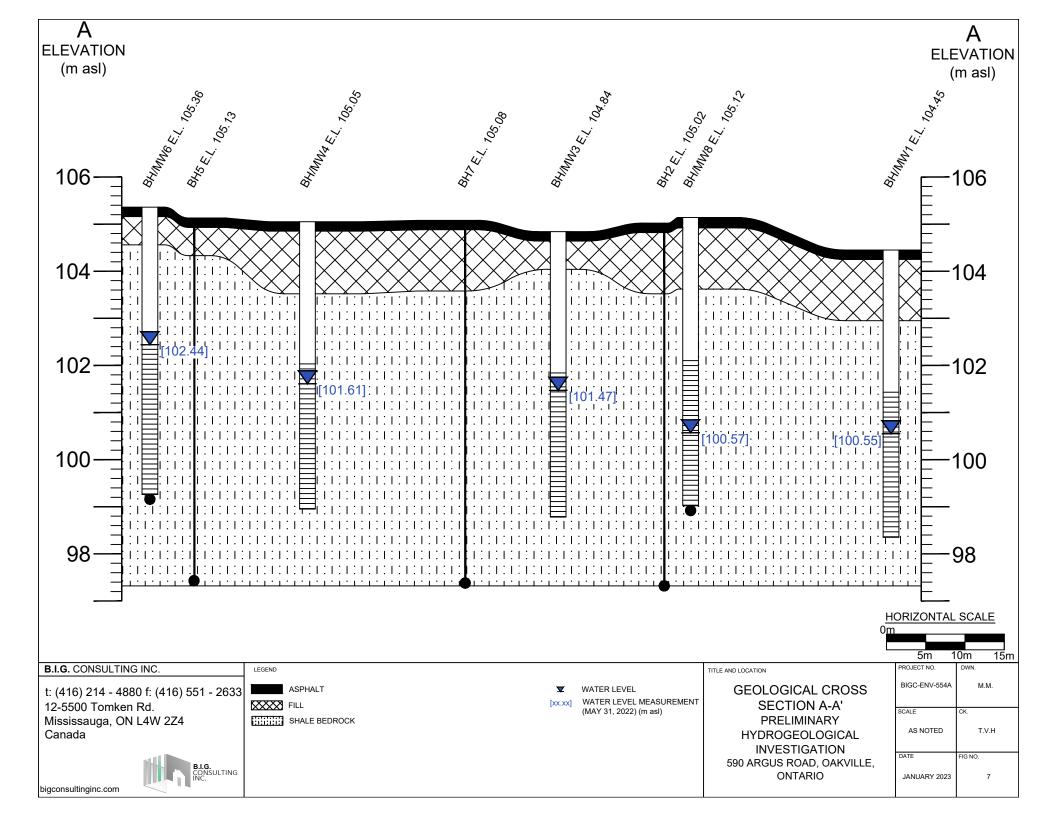


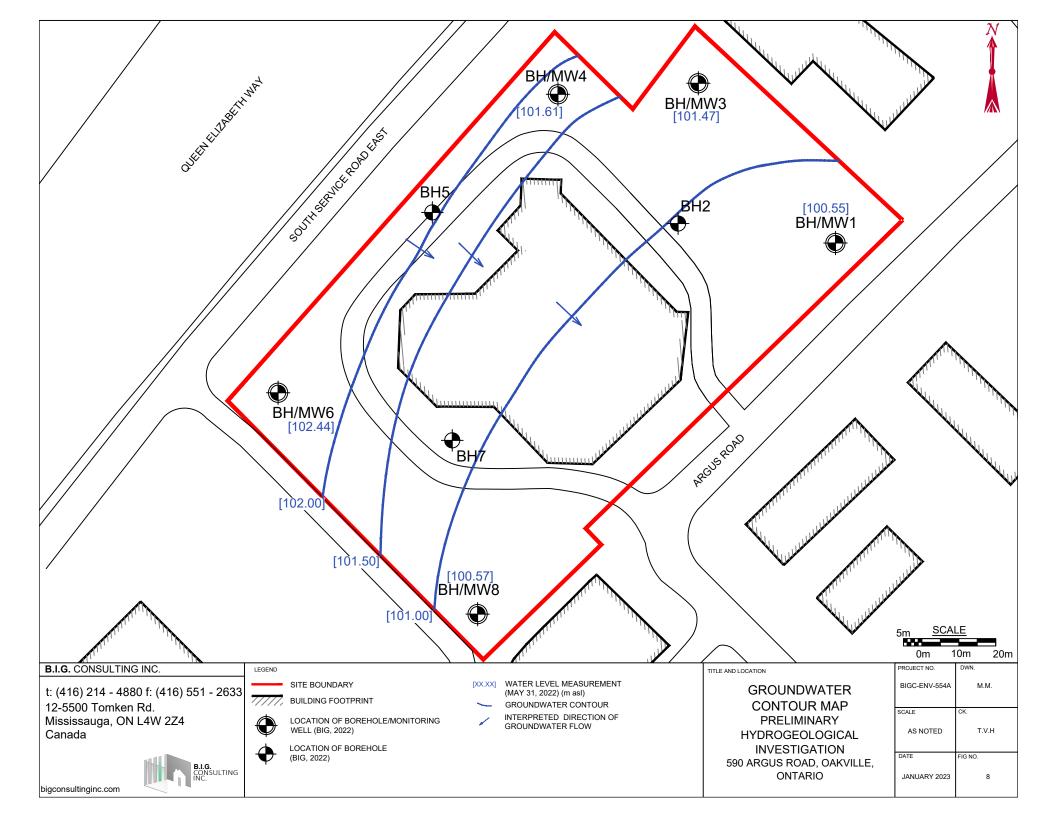












**APPENDIX A: BOREHOLE LOGS** 



roje roje	ct Number: ct Client: ct Name: ct Location:	BIGC-ENV-554A  Distrikt Capital  Phase II ESA  590 Argus Road, Oakville, Onta	ario					. •			iee Borehol 100 mm So Truck Mount 2 May 25	lid Stem	Logged by: Compiled by: Reviewed by: Revision No.:				
	LITH	OLOGY PROFILE	SOIL SAMPLI		1		(E)	FIELD Penetrat O SPT			LAB TESTING  ★ Rinse pH Values 2 4 6 8 10 12  Soil Vapour Reading			AATION	20111511		
3	eodetic Ground	DESCRIPTION  d Surface Elevation: 104.45 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEPTH (m)	ELEVATION (	MTO Va △ Intact ▲ Remo * Undraine 20	ould	Nilcon Vane* Intact Remould Strength (kPa) 60 80	△ parts 100  ▲ Lowe W <sub>P</sub> Plasti 20	per million ( 200 30 Explosive W	Limit (LEL)  W <sub>L</sub> Liquid	INSTRUMENTATION INSTALLATION	COMMEN	IIS
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××××××××××××××××××××××××××××××××××××××	- black stains,	oxidations	SS	2	84	8	- - - 1 -		0			···· <sub>o</sub> 16·					
<u> </u>	BEDROCK: Sidamp to moist	102.93 hale, highly weathered, grey, 1.5 , hard	SS	3	95	63	_ - - - - - 2	103 -			O	o <sup>11</sup>					
			SS	4	125	50/8cm	- - - - -	102 -		50 8cm		o <sup>2</sup>					
			SS	5	260	50/5cm	- - 3 - - - -	101 -		50 5cm		o <sup>3</sup> ·····					
			SS	6	48	50/15cm	_ _ _ 4 =	<u>*</u>		50 15cm		o <sup>4</sup>					
			SS	7	50	53/28cm	ŀ	7 - 100 -		53 28cm		o <sup>14</sup>					
	 wet		SS	8	100	50/8cm	- 5 - - - - -	99 –		50 8cm		o <sup>16</sup>					
=======================================	End of Boreho	98.35 <b>ole</b> 6.1					- - - - 6										
	Borehole op     Ground wate     completion of	en upon completion of drilling. er level reading at 3.89 m bgs upon drilling. er level reading at 3.9 m bgs on May															

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			OLE N	<b>o.</b>	BH2	2			Drilling	g Locati	ion:	See Boreh	ole Lo	cation	Plan			Logged by:	B.I.G. Consuming he
Pro	ject Client:	Distrikt Capital							Drilling	) Metho	od:	100 mm \$	Solid S	tem A	ugering	9		Compiled by:	KK
Pro	ject Name:	Phase II ESA							Drilling	y Machi	ne:	Truck Mounted Drill						Reviewed by:	ss
Proposition in the Community of the Comm	0, 22-6-15																		
	LITH	OLOGY PROFILE		SO	IL SA	MPLI	NG			FIE	ELD 1	ESTING		LAB	TESTI	NG			
Lithology Plot	Geodetic Ground	DESCRIPTION	5.02 m					DЕРТН (m)		P€ O SP¹ MTO \ ∆ Inta ▲ Rer * Undrai	enetrati  /ane* ct mould	onTesting	2 △ p △ p A L	Soil Vap parts per 00 20 ower Ex W <sub>P</sub>	6 8 Dour Reamillion (pp 0 300 plosive Lin W	ading wh) 400 nit (LEL) WL Liquid	INSTRUMENTATION INSTALLATION	COMMEN	TS
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			stains,	SS	2	100	10	- - - - - 1 - - -	104 -	0			····o1	13					
	BEDROCK: Si limestone laye	nale, highly weathered, rs, reddish brown, damp	occasional .5	SS	3	92	26	- - - - - 2	103 —		0								
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12-5 Miss	5500 Tomken Rd sissauga, ON L4\		∑ Groundwa	ater dep	oth on co	ompletio	on of dril	ling:	<u>4.30 m</u> .	:	•	: :			:	•			
T: 4		f	Borehole details a from a qualified Goommisioned and	Seotechn	ical Engi	neer. Als	o, boreh	ole infor	mation sl	nding of a nould be r	III poten ead in c	tial conditions onjunction with	present a	ind requitechnica	ires inter	oretative as	ssistance was		Scale: 1 : 47

Page: 1 of 1

ject Client:	BIGC-ENV-554A  Distrikt Capital						Drilling Method:		d: 10	0 mm Sc	olid Stem	Logged by: Compiled by:	KK KK			
-	Phase II ESA							, Machi		ıck Moun		Reviewed by:				
ject Location:	590 Argus Road, Oakville, Onta	ario					Date S	Started:		May 25	_ Date C	Revision No.:	0, 22-6-1			
LITH	DLOGY PROFILE	SC	OIL SA	MPLI	NG			FIE	LD TES	TING	LAE	TES	TING	T		
		SOIL SAMPLIN							enetrationT		<b>LAB TESTING</b> ★ Rinse pH Values 2 4 6 8 10 12			N O		
	DESCRIPTION	Φ	nber	(9)	'N' Value/RQD%		Ē	O SP		DCPT	Soil Vapour Reading  Δ parts per million (ppm)  100 200 300 400		I I I I I I I I I I I I I I I I I I I	COMMEN	ITS	
	DESCRIPTION	э Тур	un N e	ery (%	' Valu	DEPTH (m)	MTO \ △ Inta ▲ Rer	ct 💠	con Vane* Intact Remould	▲ Lower E	Explosive W	Limit (LEL)	UME			
01.11.0	10. for Election 404.04 ii	Sample Type	Sample Number	Recovery (%)	SPT 'N	EPTI	LEV.			rength (kPa)	Plastic	40 6	Liquid 0 80	ASTA		
ASPHALT PAV 110 mm granul	Surface Elevation: 104.84 m /EMENT: 60 mm asphalt over 104.67	0)	0)	<u> </u>	0)	-	- Ш	2,0	40 0		2,0	40 0				
FILL: sand and brown, moist, lo	gravel, trace silt, trace organics,	SS	1	79	9	-		0		:	o <sup>8</sup>		:			
	ey silt, trace sand, black stains, wn/grey, moist, firm 104.08_					-		]		:			:			
BEDROCK: Sh	nale, highly weathered, grey, 0.8						104 -			:			:			
damp to moist,	hard	SS	2	79	38	<del></del> 1			0		o <sup>10</sup> · · ·		· · · · · ; · · · ·			
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ay 01, 2022.																
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	∖120 mm granu	ular base nd gravel, trace silt, trace organics,	SS	1	84	7	-  -  -  -  -  -	- - -			o <sup>28</sup>			
▓	- silty clay/clay oxidations, bro	yey silt, trace sand, black stains, own/grey, moist, firm	SS	2	100	6	1 1 1 	104 -	0		Q19			
	BEDROCK: Si brown, damp t	103.53 Shale, highly weathered, reddish 1.5 to moist	SS	3	100	81	_ - - - - - 2	103 -		O	o <sup>6</sup>			
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Project Number: Project Client: Project Name:		OF BOREI BIGC-ENV-554A Distrikt Capital Phase II ESA	Distrikt Capital Phase II ESA								See Borehole Location Plan  100 mm Solid Stem Augering  Truck Mounted Drill			_ Logged by: _ Compiled by: Reviewed by:	B.I.G.  CONSULTING  KK  KK  SS
⊃ro	ject Location:	590 Argus Road, Oakville, Ontario								Started:	22 May 26	Date Completed: 22 May 26		Revision No.:	0, 22-6-15
	LITH	OLOGY PROFIL	.E	SC	IL SA	MPLI	NG			FIELD	TESTING	LAB TESTING			
Lithology Plot	Geodetic Groun	DESCRIPTION	05.13 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEРТН (m)	ELEVATION (m)	O SPT  MTO Vane*  Δ Intact  ▲ Remould	DCPT Nilcon Vane*  Intact Remould Bear Strength (kPa) 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)  Wy  Plastic  20 40 60 80	INSTALLATION INSTALLATION	COMMEN	TS
<b>**</b>	100 min grant	d gravel, trace silt, tra	റമി	SS	1	41	14	- - - -	105 -	0		o <sup>5</sup>			
	BEDROCK: S brown, damp t	hale, highly weathered o moist	104.37 d, reddish 0.8	SS	2	92	20	- - - - - 1 - -	104 —	0		06			
				SS	3	100	73	- - - - - 2	103 -		0	o <sup>9</sup>			
				SS	4	100	5/10cm	- - - - -	100	5 0 mm		o <sup>6</sup>			
	grey			SS	5	56	76/20cm	- - - - - -	102 -		76 20cm	o <sup>15</sup>			
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				SS	6	100	50/8cm	-  -  -  - 5  -  - <u> </u>  - <u> </u>	100 - Z	80	i0 O m	o16	:		
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	<ol><li>Ground wat</li></ol>	ole  oen upon completion of er level reading measompletion of drilling.		<u> </u>	8	100	50/8cm			80	O :				
12-5 Miss	<b>3. Consulting In</b> 5500 Tomken Rd sissauga, ON L4 <sup>1</sup> ada		Ÿ Groundwa	ater dep	oth on co	ompletic	on of drill	ling:	<u>5.3 m</u> .	<u>                                     </u>	<u> </u>				
T: 41	16-214-4880 16-551-2633		Borehole details a from a qualified G commissioned and	Seotechn	nical Eng	ineer. Als	o, boreho	ole infor	mation s	nding of all pote hould be read in	ntial conditions pre conjunction with th	esent and requires interpretative a he geotechnical report for which it	ssistance was		Scale: 1 : 47

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roject Number: roject Client: roject Name: roject Location:	Distrikt Capital  Phase II ESA  590 Argus Road, Oakville, Ontario							g Location: g Method: g Machine: Started:		ole Location Plan  olid Stem Augering  nted Drill  Date Completed: 22 M	Logged by: Compiled by: Reviewed by: Revision No.:		
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Geodetic Groun	DESCRIPTION d Surface Elevation: 105.36 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEPTH (m)	ELEVATION (m)	O SPT MTO Vane* Δ Intact ▲ Remould * Undrained Sh 20 40	● DCPT  Nilcon Vane*  ◇ Intact ● Remould  ear Strength (kPa)  60 80	Soil Vapour Reading  △ parts per million (ppm) 100 200 300 400  ▲ Lower Explosive Limit (LEL) W <sub>P</sub> W  Plastic Liquid 20 40 60 80	INSTRUMENTATION	COMMEN	TS
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BEDROCK: S brown, damp	104.60 shale, highly weathered, reddish 0.8 to moist	SS	2	92	24	- - - 1 - 1 -	104 -	0		09			
		SS	3	100	100	- - - - - 2				Φ ο <sup>8</sup>			
		SS	4	100	50/8cm	- - - - - <u>\</u>	103 -		0 0	о3	<b>83 83</b>		
		SS	5	95	88/28cm	- 3 <u>-</u> 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3	102 -		88 0 28cm	o <sup>12</sup>			
grey		SS	6	100	50/8cm	4 - - - - - -	101 –		0	o <sup>11</sup>			
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- wet	99.16 ole 6.2	SS	7	100	50/10cm	- - - 6 -		5 10ci	0 O n	o <sup>12</sup>			
m bgs upon c	pen upon completion of drilling. ter level reading measured at 3.15 ompletion of drilling. er level reading at 2.92 mbgs on												

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	ECORD	OF BOREHOL	E N	<b>o.</b>	BH7	7			Drilling	Location:	Soo Borol	hala l agatio	n Dian		Logged by	B.I.G. Consume he
	ject Number.	BIGC-ENV-554A  Distrikt Capital								Method:		hole Locatio Solid Stem A			Logged by: Compiled by:	KK K
	ject Ollent. ject Name:	Phase II ESA								Machine:		unted Drill	Augering		Reviewed by:	
	-	590 Argus Road, Oakvil	le Onta	ario						Started:	22 May 26		ompleted: 22 Ma	av 26	Revision No.:	
			,		W CA	MDLI	NC						TESTING	. <del>,</del>		<u> </u>
Lithology Plot	Goodetic Ground	DESCRIPTION  d Surface Elevation: 105.08 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DЕРТН (m)	ELEVATION (m)	Penetra O SPT  MTO Vane* Δ Intact ▲ Remould	TESTING  tionTesting  DCPT  Nilcon Van  Intact  Remould  Remould  Rear Strength (kP  60 80	Pa)  Rinse pl 2 4  Soil Va 2 parts pe 100 2  Lower E Wp Plastic		INSTRUMENTATION INSTALLATION	COMMEN	тѕ
	ASPHALT PA	VEMENT: 60 mm asphalt over	<sup>9</sup> 104.91_	- "			.,		105 -			:	: : :			
	FILL: sand an brown, moist, l	d gravel, trace silt, trace organ		SS	1	100	12	- - - -	- - - - -	0		o <sup>14</sup>				
			103.56	SS	2	95	15	— 1 - - - -	104 -	0		o13····				
	brown, damp t	hale, highly weathered, reddis o moist	sh 1.5	SS	3	92	69	- - - - - 2	103 -		0	o <sup>7</sup>				
	grey			SS	4	135	50/13cm	- - - -	- - - -	13c	50 : :	o <sup>5</sup>				
				SS	5	100	50/8cm		102 - Z - = - - - -	- 8c	i0	o <sup>24</sup>				
								- - 4 - - - -	101 -		50					
	wet			SS	6	100	50/13cm	- - - 5 - -	100 -	13c	50 O	o <sup>14</sup>				
				<del>-\$\$</del> -	<del>7</del>	100	<del>50/3cm</del>	- - - - - - 6 -	99 —	; ; 3c	50 O	o <sup>15</sup>				
								- - - - - - - -	-							
	End of Boreh	ole	97.38 7.7	ss	- 8	100	50/5cm	-	98 —		50	o <sup>18</sup>				
	Notes: 1. Borehole op 2. Ground wat	one upon completion of drilling er level reading measured at a ompletion of drilling.	<b>j</b> .													
12-5	G. Consulting In 5500 Tomken Rd sissauga, ON L4\ ada	.   = `	Groundwa	ater dep	oth on co	ompletic	on of drill	ing:	<u>3.2 m</u> .	<u> </u>	: :	:	: : :	<u>                                      </u>		_
T: 4	16-214-4880 16-551-2633	from a	le details qualified ( sioned and	Geotechn	ical Engi	ineer. Als	o, boreho	ole infor	mation sh	nding of all pote	ntial conditions conjunction wit	s present and req	uires interpretative as al report for which it	ssistance was		Scale: 1 : 47

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oject Number:  oject Client:  oject Name:  oject Location:	BIGC-ENV-554A  Distrikt Capital  Phase II ESA  590 Argus Road, Oakville, Onto	ario				C	Orilling Orilling	Location:   Method:   Machine:   Started:		le Location Plan blid Stem Augering ted Drill Date Completed:	<b>22 May</b>	26	Logged by: Compiled by: Reviewed by: Revision No.:	
LITH	OLOGY PROFILE	SC	DIL SA	MPLI				Penetra	TESTING ionTesting			N 00		
Condutio Cuniu	DESCRIPTION  d Surface Elevation: 105.12 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	<b>DEPTH</b> (m)	ELEVATION (m)	O SPT  MTO Vane* △ Intact ▲ Remould  * Undrained Sh 20 40	Nilcon Vane*  ◇ Intact  ◆ Remould  ear Strength (kPa)  60 80	Soil Vapour Read △ parts per million (ppm 100 200 300  ▲ Lower Explosive Limit W <sub>P</sub> W Plastic Li 20 40 60	400 (LEL) W <sub>L</sub> —● quid 80	INSTALLATION	COMMEN	TS
ASPHALT PA 110 mm gran FILL:silty clay	VEMENT: 50 mm asphalt over 04 96	SS	1	92	7 -		105 —	0		o <sup>16</sup>				
	103.60	SS	2	84	12 _	- <b>1</b>	104 — - - 104 — -	0		o <sup>11</sup>				
BEDROCK: S brown, damp	Shale, highly weathered, reddish 1.5	SS	3	58	70/28cm	- 2 1	- - - - 103 —		70 28cm	o <sup>17</sup>				
		SS	4	100	50/3cm-	_ <u>∑</u>	-	5 3cr	0	o <sup>7</sup>				
grey		SS	5	100	50/10cm - - - - - - -	J	102 — - - - - - -	5 10cr	) O	o <sup>3</sup>				
		SS	6	100	50/13cm	- 4 <u>=</u>	101 — - - - - - - -	.5 13cr	0	o <sup>4</sup>				
					- - - - - - - - - - - - - - - - - - -	- 5 1	100 — - - - - - -							
End of Borel		SS	7	100	50/8cm	- 6	99 —	:5 8cr	0 0	o <sup>5</sup>				
m bgs upon o	pen upon completion of drilling. ter level reading measured at 5.80 ompletion of drilling. er level reading at 4.55 mbgs on													

Pro Pro Pro	ject Number: ject Client: ject Name:	OF BOREHOLE No BIGC-GEO-490A Oakville Argus Cross LP Preliminary Geotechnical Inves 581-587 Argus Road, Oakville			MW	<u>12</u>		Drilling Drilling	J Locat J Metho J Mach Started:	od: ine:	96	mm Mud	le Location Rotary/ ted Drill	HQ Coi		: 21		Logged by: Compiled by: Reviewed by: Revision No.:	
	LITH	OLOGY PROFILE	SC	IL SA	MPLI	NG			FII	ELD	TES	TING		3 TEST	ING				
Lithology Plot	Geodetic Groun	DESCRIPTION  d Surface Elevation: 104.24 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DЕРТН (m)	ELEVATION (m)	O SP MTO \ △ Inta ▲ Rea	Vane* act mould ined She	Nilco ♦	sting DCPT on Vane* Intact Remould ength (kPa) 80	Soil \	6 8 /apour Right of the control of t	opm) 0 400  Limit (LEL) W L Liquid	INSTRUMENTATION	INO I ALL'A I I ON	COMMEN	TS
<b>***</b>	FILL: silty clay	to clayey silt, trace gravel, dark	SS	1	70	16		104	0	:	:		o <sup>15</sup>						
<b>***</b>		κ, damp, very stiff ish brown, stiff	SS	2	75	12	- 1 - 1	103 —	0				<sub>o</sub> 12						
***		102.72  TILL: trace sand, trace gravel, 1.5 h brown, damp, hard	SS	3	79	34	- - - - - 2	-		0			o <sup>8</sup>						
	BEDDOCK: S	101.65 hale, highly weathered to excellen2.6	SS	4	100	50/23		102		5	00 :								
		onal limetone layers throughout,	<del>- \$\$</del>	5	100	50/5	3	101 -		5	0 0 5								
							4	100 -								٠			
			SS	6	100	50/8	5	99 —		5	008								
			<del></del>	-	100	50/5	6			5	005								
	- first water str	ike		,	100	30/3		98 -			5 :								
	 ROCI	 K CORE BEGINS at 7.32 m	RC	1	83	0	7 - - - - -	97											
	 - Very Poor Q	uality					E 8	96 -											
	- Fair Quality		RC	2	100	70	9 \	Z :				0							
				_			10	95											
	- Fair Quality - Good Quality	,	RC	3	100	72		94 -				0							
	soft zone from	12.06 to 12.2 m	RC	4	97	78	11	93 —				0							
								92 -											
	- Good Quality	,	RC	5	100	77	13 - - - - - - -	91 -				O							
B.I.C	G. Consulting In	nc.   ☑ Groundwa	ator do-	oth on c	ample#	on of dail	<u> </u>	Not mea	i :	; m	:	:	:	: :	:		<u>                                     </u>		
12-5 Miss	500 Tomken Ro issauga, ON L4	ı. = Glodildwa								<u>11</u> . 9.05	<u>m</u> .								
	ada 16-214-4880 16-551-2633	Borehole details : from a qualified G	as prese	nted, do	not cons	titute a th	orough	understa	nding of a	all poter	ntial co	nditions pro	esent and re	quires inte	rpretative a	ssistan was	ce		Scale: 1 : 74

commisioned and the accompanying Notes to Record of Boreholes'.

#### RECORD OF BOREHOLE No. BM/MW5

RC 8

RC 9

RC

RC 11 94 70

RC 12 100 99

RC

78.49

25.3

13 100 88

10 98 90



Project Number: BIGC-GEO-490A Drilling Location: See Borehole Location Plan Logged by: MV LITHOLOGY PROFILE SOIL SAMPLING LAB TESTING **FIELD TESTING** Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
parts per million (ppm)
100 200 300 400 INSTRUMENTATION INSTALLATION PenetrationTesting SPT 'N' Value/RQD% Ξ O SPT DCPT COMMENTS Sample Number Pot DESCRIPTION % Sample Type ELEVATION MTO Vane\* Nilcon Vane 100 200 300 400

Lower Explosive Limit (LEL)

W<sub>P</sub> W W<sub>L</sub>

Plastic Liquid

20 40 60 80 Ξ △ Intact
▲ Remould ♦ Intact♦ Remould ecovery \_ithology \* Undrained Shear Strength (kPa) 20 40 60 80 **BEDROCK:** Shale, highly weathered to excellent quality, occasional limetone layers throughout, grey, moist to damp RC 6 100 93 0 89 - Excellent Quality 15 88 16 100 74 0 - Fair Quality sub vertical fracture from from 15.84 to 15.92 m

> 87 17

> > 86

85 19**V** 

84 20

83

82 22

81

80

79

24

25

21

18

0

0

0

0

0

93

92

94

100

- Excellent Quality

- Excellent Quality

- Excellent Quality

- Fair Quality

- Excellent Quality fracture zone from 23.81 to 23.91 m

- Good Quality

### End of Borehole

Borehole open upon completion of drilling.
 Groundwater level reading not measured upon completion of drilling due to introduced drilling

water.

3. Groundwater level reading at 19.04 m bgs on October 18, 2021.

#### RECORD OF BOREHOLE No. BH/MW114 Project Number: BIGC-ENV-349B Drilling Location: See BH Location Plan Logged by: <u>TVH</u> Project Client: Distrikt Capital Drilling Method: 150 mm Hollow Stem Augering + Rock Compiled by: TVH Coring Truck Mounted Drill Rig Project Name: **Geotechnical Investigation** Drilling Machine: Reviewed by: SS Project Location: 217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON Date Completed: 27 Jan 21 Date Started: 21 Jan 21 Revision No.: 1, 9/2/21 LITHOLOGY PROFILE **SOIL SAMPLING** FIELD TESTING **LAB TESTING** Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 NSTRUMENTATION NSTALLATION PenetrationTesting Value/RQD Ξ SPT DCPT Number **COMMENTS** DESCRIPTION Pot 8 MTO Vane\* Nilcon Vane\* ELEVATION Ξ Lower Explosive Limit (LEL) W<sub>P</sub> W W<sub>L</sub> ♦ Intact Remould △ Intact ▲ Remould ž DEPTH \* Undrained Shear Strength (kPa) Plastic Liquid Geodetic Ground Surface Elevation: 103.31 m TOPSOIL:150 mm 40 60 20 40 60 20 80 **FILL:** clayey silt, trace gravel, mottled, grey, moist, very stiff to firm 100 20 103 Ó 011 SS1 sampled for Metals and Inorganics and PAHs on January 21, 2021 SS2 sampled for Metals and Inorganics and PAHs on January 21, SS 2 100 8 Ö 102 CLAYEY SILT TILL: trace sand, trace gravel, 1.7 011 3 100 37 frgments of Shalr, oxidized fissures, mottled, grey, moist, hard SS O 2 101 011 SS 4 100 57 O BEDROCK: Shale, highly weathered to excellen 2.8 qaulity, occasional Limestone layers, grey, moist 9 100 50/5 100 99 50 5 o<sup>7</sup> - first water strike 98 019 96 **ROCK CORE BEGINS** RC 35 0 - Poor Quality 8 95 28 RC 2 69 0 - Poor Quality B.I.G. Consulting Inc. $\begin{tabular}{ll} $\searrow$ Groundwater depth on completion of drilling:$ NOT MEASURED DUE TO DRILLING WATER m. 12-5500 Tomken Rd. Mississauga, ON L4W 2Z4 Groundwater depth observed on 08/02/2021 at a depth of: Canada T: 416-214-4880 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 commissioned and the accompanying Notes to Record of Boreholes'. F: 416-551-2633 Scale: 1:47

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#### RECORD OF BOREHOLE No. BH/MW114

Continued on Next Page

B.LG. Crockers

Project Number: BIGC-ENV-349B Drilling Location: See BH Location Plan Logged by: TVH LITHOLOGY PROFILE SOIL SAMPLING FIELD TESTING 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)
Wp W W.

Plastic Liquid
20 40 60 80 INSTRUMENTATION INSTALLATION SPT 'N' Value/RQD% PenetrationTesting Ξ O SPT DCPT COMMENTS Sample Number DESCRIPTION ithology Plot (ecovery (%) ELEVATION MTO Vane\* Nilcon Vane\* Ξ △ Intact ◇ Intact
▲ Remould ◆ Remould \* Undrained Shear Strength (kPa) 20 40 60 80 **BEDROCK:** Shale, highly weathered to excellent qaulity, occasional Limestone layers, grey, moist to damp 10 93 RC 3 98 62 Ö - Fair Quality 92 100 87 0 RC 4 - Good Quality 12 91 13 RC 100 76 0 - Good Quality 89 RC 6 100 83 0 - Good Quality 15 88 16 87 RC 100 98 - Excellent Quality 17 86 0 RC 8 97 89 18 - Good Quality

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 commissioned and the accompanying Notes to Record of Boreholes'.

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#### RECORD OF BOREHOLE No. BH/MW114



Project Number: BIGC-ENV-349B Drilling Location: See BH Location Plan Logged by: TVH LITHOLOGY PROFILE SOIL SAMPLING LAB TESTING **FIELD 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)
Wp W W.

Plastic Liquid
20 40 60 80 INSTRUMENTATION INSTALLATION SPT 'N' Value/RQD% PenetrationTesting Ξ O SPT DCPT COMMENTS Sample Number DESCRIPTION % ithology Plot Sample Type ELEVATION MTO Vane\* Nilcon Vane\* Ξ △ Intact
 △ Remould
 ◆ Remould ecovery \* Undrained Shear Strength (kPa) 20 40 60 80 **BEDROCK:** Shale, highly weathered to excellent qaulity, occasional Limestone layers, grey, moist to damp RC 100 94 0 - Excellent Quality 20 83 21 RC 10 100 90 0 - Excellent Quality 82 22 81 RC 100 97 11 - Excellent Quality 23 79.99 23.3 Borehole terminated at 23.32 Borehole open upon completion of drilling. Groundwater level not measured upon completion of drilling due to introduced drilling 3. Groundwater level reading at 18.88 m bgs on February 8, 2021.

#### RECORD OF BOREHOLE No. BH/MW115 Project Number: BIGC-ENV-349B Drilling Location: See BH Location Plan Logged by: <u>TVH</u> Drilling Method: Project Client: Distrikt Capital 150 mm Hollow Stem Augering + Rock Compiled by: TVH Coring Truck Mounted Drill Rig Project Name: **Geotechnical Investigation** Drilling Machine: Reviewed by: SS Project Location: 217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON Date Completed: 26 Jan 21 Date Started: 22 Jan 21 Revision No.: 1, 9/2/21 LITHOLOGY PROFILE FIELD TESTING **LAB TESTING SOIL SAMPLING** Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 NSTRUMENTATION NSTALLATION PenetrationTesting Value/RQD Ξ SPT DCPT Number **COMMENTS** DESCRIPTION 8 Pot MTO Vane\* ELEVATION Nilcon Vane Ξ Lower Explosive Limit (LEL) W<sub>P</sub> W W<sub>L</sub> ♦ Intact Remould △ Intact ▲ Remould ž DEPTH Plastic \* Undrained Shear Strength (kPa) Liquid Geodetic Ground Surface Elevation: 101.72 m ASPHALT:100 mm asphalt concrete over 300 40 60 20 40 60 20 mm granular bases 16 0 015 FILL: dayey silt, trace gravel, rootlets, organic 0.4 staining, dark brown, moist, very stiff SS1 sampled for Metals and Inorganics and PAHs on January 22, 2021 101 CLAYEY SILT TILL: trace sand, trace gravel, 0.8 o<sup>13</sup> oxidized fissures, mottled, grey, moist, stiff to hard SS2 sampled for Metals and Inorganics and PAHs on January 22, 2 100 12 O 100 o<sup>12</sup> 32 0 SS 3 84 2 o<sup>10</sup> 50 13 50/13 100 BEDROCK: Shale, highly weathered to excellen 2.4 qaulity, occasional Limestone layers, grey, moist 99 6 100 50/5 98 - first water strike 95 **ROCK CORE BEGINS** RC 83 30 0 - Poor Quality 8 93 RC 2 98 74 0 - Fair Quality B.I.G. Consulting Inc. $\stackrel{\textstyle abla}{=}$ Groundwater depth on completion of drilling: NOT MEASURED DUE TO DRILLING WATER m. 12-5500 Tomken Rd. Mississauga, ON L4W 2Z4 Groundwater depth observed on 08/02/2021 at a depth of: Canada T: 416-214-4880 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 commissioned and the accompanying Notes to Record of Boreholes'. F: 416-551-2633 Scale: 1:47

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#### RECORD OF BOREHOLE No. BH/MW115



Project Number: BIGC-ENV-349B Drilling Location: See BH Location Plan Logged by: TVH LITHOLOGY PROFILE SOIL SAMPLING FIELD TESTING 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)
Wp W W.

Plastic Liquid
20 40 60 80 INSTRUMENTATION INSTALLATION SPT 'N' Value/RQD% PenetrationTesting Ξ O SPT DCPT COMMENTS Sample Number DESCRIPTION ithology Plot Recovery (%) ELEVATION MTO Vane\* Nilcon Vane\* Ξ △ Intact ◇ Intact
▲ Remould ◆ Remould \* Undrained Shear Strength (kPa) 20 40 60 80 **BEDROCK:** Shale, highly weathered to excellent qaulity, occasional Limestone layers, grey, moist to damp 92 10 RC 3 99 61 Ö - Fair Quality 91 90 RC 4 99 77 O. - Good Quality 12 89 13 RC 100 98 - Excellent Quality 87 RC 6 98 87 0 15 - Good Quality 86 16 RC 100 95 - Excellent Quality 85 17 RC 100 92 0 8 - Excellent Quality 83 19

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 commissioned and the accompanying Notes to Record of Boreholes'.

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### RECORD OF BOREHOLE No. BH/MW115



Project Number: BIGC-ENV-349B Drilling Location: See BH Location Plan Logged by: TVH

1	LITHOLOGY PROFILE	SOIL SAMPLING				FIELD TESTING								
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DЕРТН (m)	ELEVATION (m)	Penetra O SPT MTO Vane* △ Intact ▲ Remould	■ DCP1  Nilcon V  Intact Remo	) Γ ane* ould	Rinse pH Va 2 4 6 Soil Vapou parts per mill 100 200 Lower Explos W W W W	lues  § 10 12  ur Reading lion (ppm)  300 400  sive Limit (LEL)  WL	INSTRUMENTATION INSTALLATION	COMMENTS
Lith	BEDROCK: Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp - Excellent Quality	San	o San	100	91	- - - - - - - - 20	82 -	* Undrained Sh 20 40	ear Strength 60 8	(kPa) 0	Plastic 20 40	Liquid 60 80	SNI	Groundwater sampled for Metals and Inorganics on February 3, 2021
	- Good Quality	RC	10	96	89	- - - - - - - - - 21	81 -			0				
	- Excellent Quality	RC	11	100	92	- - - - - - - - - - - - - - - - - - -	80 -			0				
	Rorehole terminated at 23.32  Notes:  1. Borehole open upon completion of drilling. 2. Groundwater level not measured upon completion of drilling due to introduced drilling water. 3. Groundwater level reading at 17.91 m bgs on February 8, 2021.					_ 23								

APPENDIX B: MECP WWR, PTTW AND EASR SUMMARY TABLES



Table B-1: MECP WWR Summary Table

			Doroth	Reported	
Count	Well ID	Date Completed	Depth (m)	Water Level (m)	Status of Well
1.	2802422	07/21/1948	12.2	4.9	Water supply
2.	2810039	04/06/2004	5.1	N/A	Observation well
3.	2810241	05/13/2005	N/A	4	Abandoned
4.	2810392	09/20/2005	4.5	3.9	Observation well
5.	2810455	12/13/2005	5.8	5.5	Observation well
6.	2810456	12/16/2005	N/A	2	Abandoned
7.	2810649	08/28/2006	7.6	N/A	Observation well
8.	7041205	01/12/2007	2.4	N/A	Observation well
9.	7100453	09/26/2007	4.7	N/A	Observation well
10.	7100453	09/26/2007	N/A	N/A	Observation well
11.	7101141	09/27/2007	N/A	N/A	Test Hole
12.	7101141	09/27/2007	N/A	N/A	Test Hole
13.	7104345	03/17/2008	5.2	N/A	Observation well
14.	7134031	09/16/2009	6.1	N/A	Observation well
15.	7152039	09/03/2010	4	N/A	Test Hole
16.	7152039	09/03/2010	N/A	N/A	Test Hole
17.	7152039	09/03/2010	N/A	N/A	Test Hole
18.	7152039	09/03/2010	N/A	N/A	Test Hole
19.	7152039	09/03/2010	N/A	N/A	Test Hole
20.	7152039	09/07/2010	N/A	N/A	Test Hole
21.	7152039	09/07/2010	N/A	N/A	Test Hole
22.	7152039	09/07/2010	N/A	N/A	Test Hole
23.	7152039	09/07/2010	N/A	N/A	Test Hole
24.	7152039	09/07/2010	N/A	N/A	Test Hole
25.	7152039	09/07/2010	N/A	N/A	Test Hole
26.	7152039	09/08/2010	N/A	N/A	Test Hole
27.	7152039	09/08/2010	N/A	N/A	Test Hole
28.	7152039	09/08/2010	N/A	N/A	Test Hole
29.	7152039	09/09/2010	N/A	N/A	Test Hole
30.	7152039	09/09/2010	N/A	N/A	Test Hole
31.	7161332	03/29/2011	3.4	N/A	N/A
32.	7161333	03/29/2011	3.4	N/A	N/A
33.	7161334	03/29/2011	3.4	N/A	N/A
34.	7173256	11/17/2011	5.5	N/A	Test Hole
35.	7173257	11/17/2011	4.6	N/A	Test Hole
36.	7173258	11/17/2011	4.3	N/A	Test Hole
37.	7173259	11/17/2011	4.3	N/A	Test Hole
38.	7173260	11/17/2011	4.3	N/A	Test Hole
39.	7187270	05/04/2012	N/A	1.5	Abandoned
40.	7187271	05/07/2012	N/A	1.5	Abandoned
41.	7187272	05/07/2012	N/A	1.4	Abandoned
42.	7187273	05/07/2012	N/A	1.5	Abandoned



44.       7187275       05/07/2012       N/A       1.5       Abar         45.       7187276       05/02/2012       N/A       1.5       Abar	ndoned ndoned ndoned ndoned
45. 7187276 05/02/2012 N/A 1.5 Abar	ndoned ndoned
	ndoned
	ndoned
47. 7187278 05/07/2012 N/A 1.5 Abar	ndoned
48. 7187787 08/28/2012 3.4 N/A Observ	ation well
49. 7188619 04/13/2012 N/A N/A N	N/A
50. 7192191 05/18/2012 N/A N/A N	N/A
51. 7205225 06/21/2013 4.9 N/A Tes	t Hole
52. 7205226 06/21/2013 4.9 N/A Tes	t Hole
53. 7205227 06/20/2013 4.6 N/A Tes	t Hole
54. 7205228 06/20/2013 4.6 N/A Tes	t Hole
55. 7205229 06/20/2013 4.6 N/A Tes	t Hole
	t Hole
	t Hole
	and Test Hole
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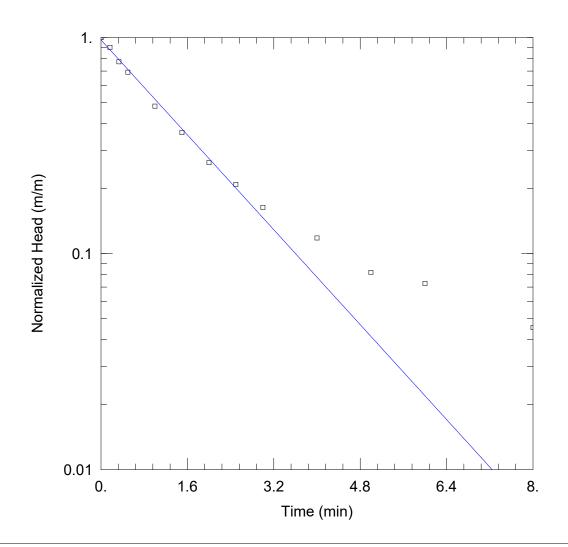
**Table B-2: MECP EASR Summary Table** 

Permit Number	Purpose	Address	Municipality	Water Source	Max L/Day	Active
2560-A5PKQW	Dewatering construction	477 Maple Avenue	Oakville	Groundwater	390,000	No
62-P-17	Lake	491 River Side Drive	Oakville	Surface water	1,083,940	No
0772-AF3HTJ	Dewatering	Canadian National Railway and Cross Avenue	Oakville	Groundwater	20,000 to 400,000	No
2668-6TRQ7G	Dewatering construction	Northeast of Queen Elizabeth Way (Hwy 403) and Kerr Street	Oakville	Groundwater	1,962,744	No
4375-6NYL7V	Dewatering construction	Northeast of Queen Elizabeth Way (Hwy 403) and Kerr Street	Oakville	Groundwater	1,962,744	No
0551-72YPT5	Dewatering construction	Northeast of Queen Elizabeth Way (Hwy 403) and Kerr Street	Oakville	Groundwater	1,962,744	No
8107-9KKLR9	Dewatering construction	Queen Elizabeth Way (Hwy 403), north of South Service Road East, southwest of Chartwell Road	Oakville	Surface water	449,280,000 to 1,168,128,000	No
R-009-2112317313	Construction dewatering	547 Trafalgar Road	Oakville	Groundwater	50,000 to 400,000	No
R-009-9112436776	Construction dewatering	Trans-Northern Pipelines Inc.	Oakville	Groundwater	50,000 to 400,000	No



## **APPENDIX C: SWRT RESULTS**





Data Set: C:\...\BH.MW1 - 554A SWRT.aqt

Date: 06/09/22 Time: 17:53:57

#### PROJECT INFORMATION

Company: B.I.G. Consulting Client: Distrikt Capital Project: BIGC-ENV-554A Location: 590 Argus Road Test Well: BH/MW1 Test Date: May 31, 2022

#### **AQUIFER DATA**

Saturated Thickness: 2.34 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW1)

Initial Displacement: 1.1 m

Total Well Penetration Depth: 2.34 m

Casing Radius: 0.025 m

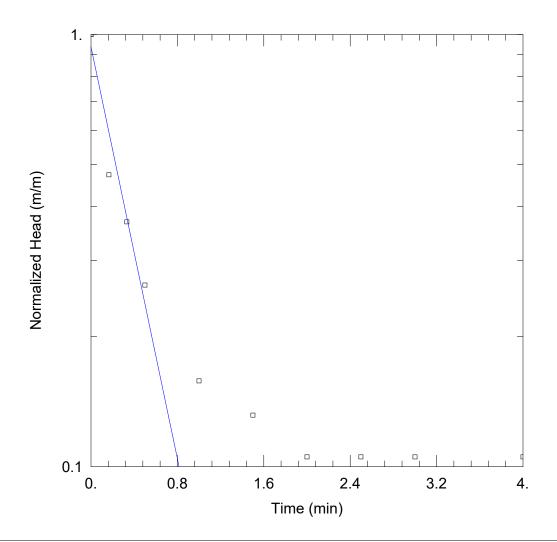
Static Water Column Height: 2.34 m

Screen Length: 2.34 m Well Radius: 0.025 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 7.457E-6 m/secy0 = 1.072 m



Data Set: C:\...\BH.MW3 - 554A SWRT.aqt

Date: 06/09/22 Time: 17:57:18

#### PROJECT INFORMATION

Company: B.I.G. Consulting
Client: Distrikt Capital
Project: BIGC-ENV-554A
Location: 590 Argus Road
Test Well: BH/MW3
Test Date: May 31, 2022

#### **AQUIFER DATA**

Saturated Thickness: 2.88 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW3)

Initial Displacement: 0.19 m

Total Well Penetration Depth: 2.88 m

Casing Radius: 0.0254 m

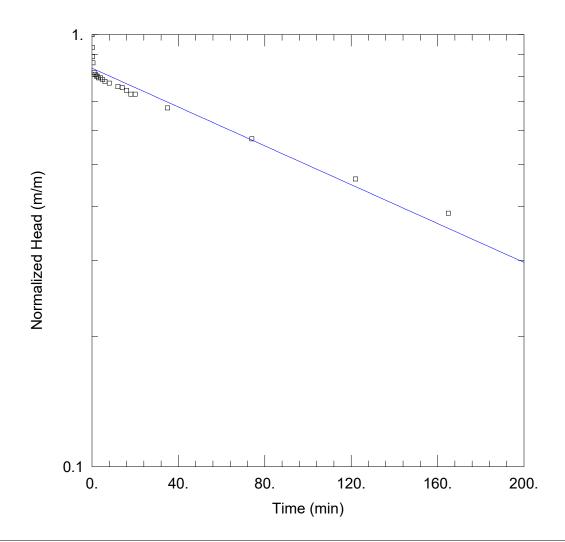
Static Water Column Height: 2.88 m

Screen Length: 2.88 m Well Radius: 0.025 m

#### **SOLUTION**

Aguifer Model: Unconfined Solution Method: Hvorslev

K = 2.714E-5 m/sec y0 = 0.178 m



Data Set: C:\...\BH.MW4 - 554A SWRT.aqt

Date: 06/09/22 Time: 17:56:55

#### PROJECT INFORMATION

Company: B.I.G. Consulting Client: Distrikt Capital Project: BIGC-ENV-554A Location: 590 Argus Road Test Well: BH/MW4 Test Date: May 31, 2022

#### **AQUIFER DATA**

Saturated Thickness: 2.51 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW4)

Initial Displacement: 1.36 m

Total Well Penetration Depth: 2.51 m

Casing Radius: 0.0254 m

Static Water Column Height: 2.51 m

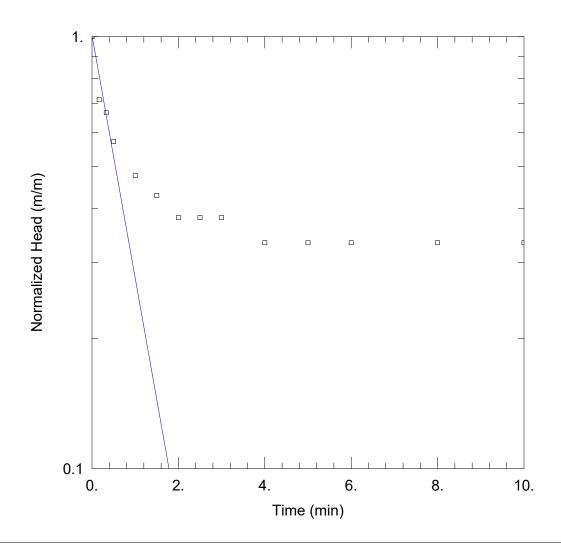
Screen Length: 2.51 m Well Radius: 0.0254 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 5.874E-8 m/sec

y0 = 1.137 m



Data Set: C:\...\BH.MW6 - 554A SWRT.aqt

Date: 06/09/22 Time: 17:59:59

#### PROJECT INFORMATION

Company: B.I.G. Consulting Client: Distrikt Capital Project: BIGC-ENV-554A Location: 590 Argus Road Test Well: BH/MW6 Test Date: May 31, 2022

#### **AQUIFER DATA**

Saturated Thickness: 2.98 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW6)

Initial Displacement: 0.21 m

Static Water Column Height: 2.98 m

Total Well Penetration Depth: 2.98 m

Screen Length: 2.98 m Well Radius: 0.0254 m

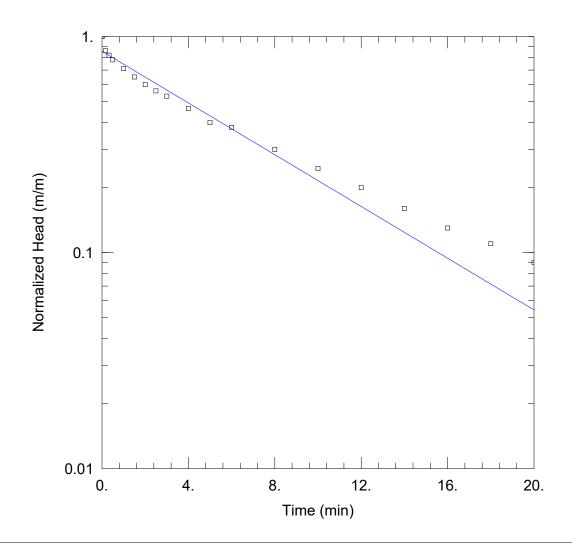
Casing Radius: 0.0254 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.239E-5 m/sec

y0 = 0.2117 m



Data Set: C:\...\BH.MW8 - 554A SWRT.aqt

Date: 06/09/22 Time: 18:04:10

#### PROJECT INFORMATION

Company: B.I.G. Consulting Client: Distrikt Capital Project: BIGC-ENV-554A Location: 590 Argus Road Test Well: BH/MW8 Test Date: May 31, 2022

#### **AQUIFER DATA**

Saturated Thickness: 1.72 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW8)

Initial Displacement: 1. m

Total Well Penetration Depth: 1.72 m

Casing Radius: 0.0254 m

Static Water Column Height: 1.72 m

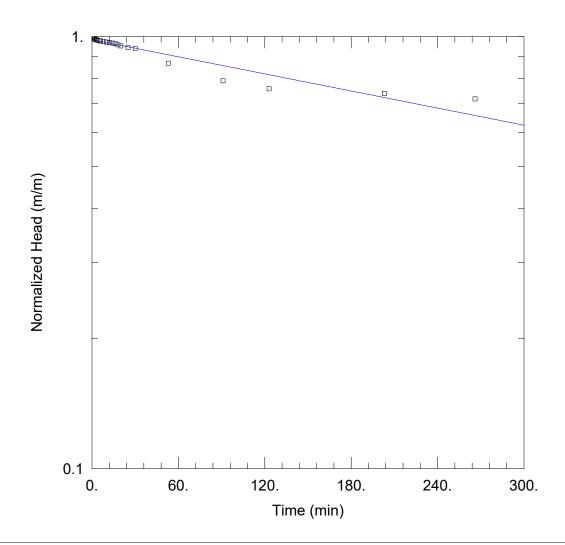
Screen Length: 1.72 m Well Radius: 0.0254 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 2.283E-6 m/sec

y0 = 0.8552 m



Data Set: C:\...\MW2.aqt

Date: 10/26/21 Time: 22:58:16

#### PROJECT INFORMATION

Company: B.I.G. Consulting Inc. Client: Oakville Argus Cross LP Project: BIGC-GEO-490A

Location: 581-587 Argus Road, ON

Test Well: BH/MW2

Test Date: October 13, 2021

#### **AQUIFER DATA**

Saturated Thickness: 5.74 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW2)

Initial Displacement: 4.28 m

Total Well Penetration Depth: 5.74 m

Casing Radius: 0.0254 m

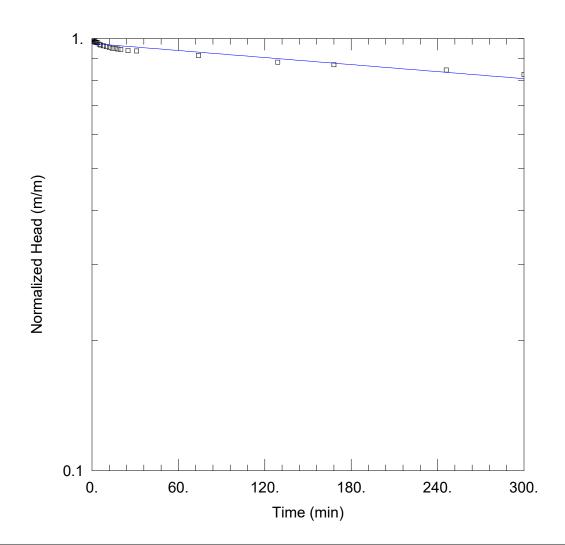
Static Water Column Height: 5.74 m

Screen Length: 3. m Well Radius: 0.0254 m

#### **SOLUTION**

Aguifer Model: Unconfined Solution Method: Hvorslev

K = 1.488E-8 m/sec y0 = 4.21 m



Data Set: C:\...\MW5.aqt

Date: 10/26/21 Time: 23:23:18

#### PROJECT INFORMATION

Company: B.I.G. Consulting Inc. Client: Oakville Argus Cross LP Project: BIGC-GEO-490A

Location: 581-587 Argus Road, ON

Test Well: BH/MW3

Test Date: October 13, 2021

#### **AQUIFER DATA**

Saturated Thickness: 3.84 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW5)

Initial Displacement: 2.495 m

Total Well Penetration Depth: 4.84 m

Casing Radius: 0.0254 m

Static Water Column Height: 3.84 m

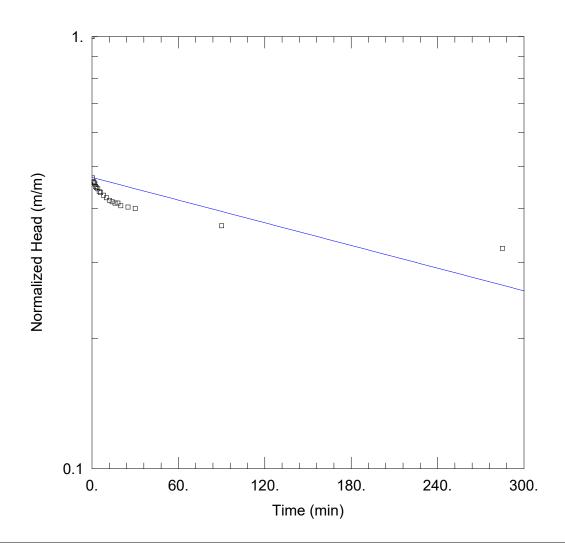
Screen Length: 3. m Well Radius: 0.0254 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

y0 = 2.43 m

K = 6.119E-9 m/sec



Data Set: C:\...\MW114.aqt

Date: 03/03/21 Time: 10:04:37

#### PROJECT INFORMATION

Company: B.I.G. Consulting Inc.

Client: Distrikt Capital Project: BIGC-ENV-349B

Location: Cross and Argus, Oakville, ON

Test Well: BH/MW114 Test Date: February 3, 2021

#### **AQUIFER DATA**

Saturated Thickness: 2.89 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW114)

Initial Displacement: 1.7 m Static Water Column Height: 2.89 m

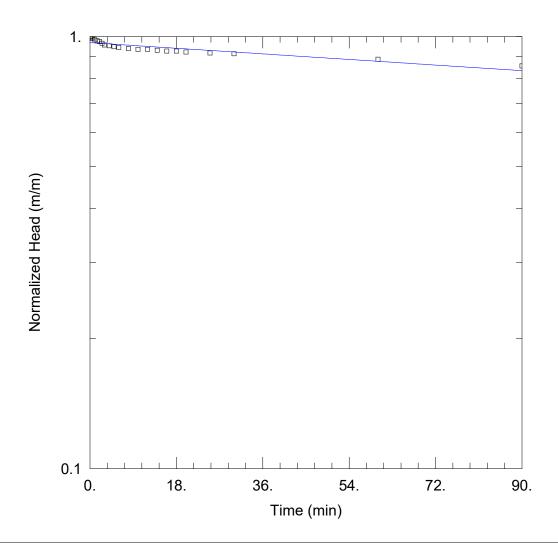
Total Well Penetration Depth: 2.89 m Screen Length: 2.89 m

Casing Radius: 0.025 m Well Radius: 0.025 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.925E-8 m/secy0 = 0.8025 m



Data Set: C:\...\MW115(2).aqt

Date: 03/03/21 Time: 10:04:08

#### PROJECT INFORMATION

Company: B.I.G. Consulting Inc.

Client: Distrikt Capital
Project: BIGC-ENV-349B

Location: Cross and Argus, Oakville, ON

Test Well: BH/MW115
Test Date: February 8, 2021

#### **AQUIFER DATA**

Saturated Thickness: 3.93 m Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA (BH/MW115)

Initial Displacement: 1.14 m Static Water Column Height: 3.93 m

Total Well Penetration Depth: 3.93 m Screen Length: 3. m Casing Radius: 0.025 m Well Radius: 0.025 m

#### **SOLUTION**

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.576E-8 m/sec y0 = 1.103 m

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





Your Project #: BIGC-ENV-554A Your C.O.C. #: 881898-01-01

**Attention: Eileen Liu** 

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

Report Date: 2022/06/12

Report #: R7164264 Version: 1 - Final

#### **CERTIFICATE OF ANALYSIS**

BUREAU VERITAS JOB #: C2F2517 Received: 2022/06/03, 19:47

Sample Matrix: Water # Samples Received: 1

		Date	Date		
Analyses	Quantity	Extracted	Analyzed	Laboratory Method	Analytical Method
Sewer Use By-Law Semivolatile Organics	1	2022/06/07	2022/06/08	CAM SOP 00301	EPA 8270 m
Biochemical Oxygen Demand (BOD)	1	2022/06/06	2022/06/11	CAM SOP-00427	SM 23 5210B m
Carbonaceous BOD	1	2022/06/06	2022/06/11	CAM SOP-00427	SM 23 5210B m
Chromium (VI) in Water	1	N/A	2022/06/07	CAM SOP-00436	EPA 7199 m
Total Cyanide	1	2022/06/04	2022/06/04	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2022/06/04	2022/06/07	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2022/06/07	2022/06/07	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2022/06/09	2022/06/09	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS	1	N/A	2022/06/09	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2022/06/03	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2022/06/05	2022/06/07	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2022/06/05	2022/06/07	CAM SOP-00313	In-house Method
Animal and Vegetable Oil and Grease	1	N/A	2022/06/10	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2022/06/09	2022/06/09	CAM SOP-00326	EPA1664B m,SM5520B m
OC Pesticides (Selected) & PCB (1)	1	2022/06/06	2022/06/07	CAM SOP-00307	EPA 8081A/8082B m
OC Pesticides Summed Parameters	1	N/A	2022/06/04	CAM SOP-00307	EPA 8081A/8082B m
рН	1	2022/06/04	2022/06/07	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2022/06/07	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2022/06/09	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2022/06/07	2022/06/09	CAM SOP-00938	OMOE E3516 m
Total PAHs (2)	1	N/A	2022/06/08	CAM SOP - 00301	
Mineral/Synthetic O & G (TPH Heavy Oil) (3)	1	2022/06/09	2022/06/09	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2022/06/08	2022/06/09	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2022/06/07	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



Your Project #: BIGC-ENV-554A Your C.O.C. #: 881898-01-01

**Attention: Eileen Liu** 

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

Report Date: 2022/06/12

Report #: R7164264 Version: 1 - Final

#### **CERTIFICATE OF ANALYSIS**

#### **BUREAU VERITAS JOB #: C2F2517**

Received: 2022/06/03, 19:47

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.

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) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane
- (2) Total PAHs include only those PAHs specified in the sewer use by-by-law.
- (3) 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

This report has been generated and distributed using a secure automated process.

Bureau Veritas 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 Page 2 of 16



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **HALTON SANITARY & COMBINED BYLAW (2-03)**

Bureau Veritas ID					SUN780		
Sampling Date					2022/06/03 05:00		
COC Number					881898-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH/MW1	RDL	QC Batch
Calculated Parameters							
Total Animal/Vegetable Oil and Grease	mg/L	150	-	-	ND	0.50	8033291
Inorganics		!					
Total Carbonaceous BOD	mg/L	300	-	-	ND	2	8036062
Fluoride (F-)	mg/L	10	-	-	0.41	0.10	8034172
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	-	2.2	0.10	8038660
рН	рН	6.0:10.0	6.5:8.5	6.5:8.5	7.85		8034173
PhenoIs-4AAP	mg/L	1	-	0.008	ND	0.0010	8037445
Total Suspended Solids	mg/L	350	-	15	110	10	8035930
Dissolved Sulphate (SO4)	mg/L	1500	-	-	250	1.0	8035929
Total Cyanide (CN)	mg/L	2	-	0.02	ND	0.0050	8034252
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L	-	-	-	ND	0.50	8043541
Total Oil & Grease Mineral/Synthetic	mg/L	-	-	-	ND	0.50	8043548
Metals							
Total Aluminum (AI)	mg/L	50	-	-	0.6	0.1	8042315
Total Antimony (Sb)	mg/L	5	-	-	ND	0.02	8042315
Total Arsenic (As)	mg/L	1	-	0.02	ND	0.01	8042315
Total Beryllium (Be)	mg/L	5	-	-	ND	0.0005	8042315
Total Cadmium (Cd)	mg/L	1	-	0.008	ND	0.002	8042315
Total Chromium (Cr)	mg/L	3	-	0.08	ND	0.01	8042315
Total Cobalt (Co)	mg/L	5	-	-	ND	0.002	8042315
Total Copper (Cu)	mg/L	3	-	0.04	ND	0.01	8042315
Total Iron (Fe)	mg/L	50	-	-	3.2	0.02	8042315
Total Lead (Pb)	mg/L	3	-	0.12	ND	0.01	8042315
Total Manganese (Mn)	mg/L	5	-	0.05	0.20	0.001	8042315
Mercury (Hg)	mg/L	0.05	-	0.0004	ND	0.00010	8037167
Total Molybdenum (Mo)	mg/L	5	-	-	ND	0.005	8042315
Total Nickel (Ni)	mg/L	3	-	0.08	ND	0.005	8042315
Total Phosphorus (P)	mg/L	10	-	0.4	ND	0.05	8042315

No Fill Grey

Black

No Exceedance

Exceeds 1 criteria policy/level Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria, Criteria B: Halton Sanitary and Storm sewer by-law

Criteria-2: The Town of Oakville Storm Sewer Discharge By Law 2009-031



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **HALTON SANITARY & COMBINED BYLAW (2-03)**

Bureau Veritas ID					SUN780		
Sampling Date					2022/06/03 05:00		
COC Number					881898-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH/MW1	RDL	QC Batch
Total Selenium (Se)	mg/L	5	-	0.02	ND	0.02	8042315
Total Silver (Ag)	mg/L	5	-	0.12	ND	0.01	8042315
Total Tin (Sn)	mg/L	5	-	-	ND	0.02	8042315
Total Titanium (Ti)	mg/L	5	-	-	ND	0.005	8042315
Total Zinc (Zn)	mg/L	3	-	0.04	ND	0.005	8042315
Volatile Organics							
Benzene	ug/L	10	-	2	2.4	0.40	8034119
Chloroform	ug/L	40	-	2	ND	0.40	8034119
1,2-Dichlorobenzene	ug/L	-	-	5.6	ND	0.80	8034119
1,4-Dichlorobenzene	ug/L	80	-	6.8	ND	0.80	8034119
cis-1,2-Dichloroethylene	ug/L	-	-	5.6	ND	1.0	8034119
trans-1,3-Dichloropropene	ug/L	-	-	5.6	ND	0.80	8034119
Ethylbenzene	ug/L	160	-	2	ND	0.40	8034119
Methylene Chloride(Dichloromethane)	ug/L	2000	-	5.2	ND	4.0	8034119
1,1,2,2-Tetrachloroethane	ug/L	-	-	17	ND	0.80	8034119
Tetrachloroethylene	ug/L	1000	-	4.4	ND	0.40	8034119
Toluene	ug/L	16	-	2	ND	0.40	8034119
Trichloroethylene	ug/L	400	-	7.6	ND	0.40	8034119
Total Xylenes	ug/L	-	-	4.4	ND	0.40	8034119
Surrogate Recovery (%)							
4-Bromofluorobenzene	%	-	-	-	98		8034119
D4-1,2-Dichloroethane	%	-	-	-	104		8034119
D8-Toluene	%	-	-	-	96		8034119

No Fill
Grey
Black

No Exceedance

Exceeds 1 criteria policy/level

Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria, Criteria B: Halton Sanitary and Storm sewer by-law

Criteria-2: The Town of Oakville Storm Sewer Discharge By Law 2009-031



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **OAKVILLE STORM SEWER BYLAW (2009-031)**

Bureau Veritas ID					SUN780		
Sampling Date					2022/06/03 05:00		
COC Number					881898-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH/MW1	RDL	QC Batch
Inorganics							
Total BOD	mg/L	-	-	15	ND	2	8036060
Miscellaneous Parameters	-	4	Į.	Į.		·	
Nonylphenol Ethoxylate (Total)	mg/L	-	-	0.01	ND	0.005	8034479
Nonylphenol (Total)	mg/L	-	-	0.001	ND	0.001	8034478
Metals		!				!	
Chromium (VI)	ug/L	-	-	40	ND	0.50	8034995
Total Arsenic (As)	ug/L	1000	-	20	1.2	1.0	8042314
Total Cadmium (Cd)	ug/L	1000	-	8	ND	0.090	8042314
Total Chromium (Cr)	ug/L	3000	-	80	ND	5.0	8042314
Total Copper (Cu)	ug/L	3000	-	40	4.4	0.90	8042314
Total Lead (Pb)	ug/L	3000	-	120	ND	0.50	8042314
Total Manganese (Mn)	ug/L	5000	-	50	200	2.0	8042314
Total Nickel (Ni)	ug/L	3000	-	80	1.8	1.0	8042314
Total Phosphorus (P)	ug/L	10000	-	400	ND	100	8042314
Total Selenium (Se)	ug/L	5000	-	20	ND	2.0	8042314
Total Silver (Ag)	ug/L	5000	-	120	ND	0.090	8042314
Total Zinc (Zn)	ug/L	3000	-	40	6.6	5.0	8042314
Semivolatile Organics			-	-			
Naphthalene	ug/L	140	-	-	ND	0.3	8036992
Di-N-butyl phthalate	ug/L	-	-	15	ND	2	8036992
Bis(2-ethylhexyl)phthalate	ug/L	-	-	8.8	ND	2	8036992
3,3'-Dichlorobenzidine	ug/L	-	-	0.8	ND	0.8	8036992
Pentachlorophenol	ug/L	-	-	2	ND	1	8036992
Phenanthrene	ug/L	-	-	-	ND	0.2	8036992
Anthracene	ug/L	-	-	-	ND	0.2	8036992
Fluoranthene	ug/L	-	-	-	ND	0.2	8036992
Pyrene	ug/L	-	-	-	ND	0.2	8036992
Benzo(a)anthracene	ug/L	-	-	-	ND	0.2	8036992
Chrysene	ug/L	-	-	-	ND	0.2	8036992

No Fill Grey

Black

No Exceedance

Exceeds 1 criteria policy/level Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria, Criteria B: Halton Sanitary and Storm sewer by-law

Criteria-2: The Town of Oakville Storm Sewer Discharge By Law 2009-031



Report Date: 2022/06/12

B.I.G Consulting Inc.

Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **OAKVILLE STORM SEWER BYLAW (2009-031)**

Bureau Veritas ID		<u> </u>			SUN780		
Sampling Date					2022/06/03 05:00		
COC Number					881898-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH/MW1	RDL	QC Batch
Benzo(b/j)fluoranthene	ug/L	-	-	-	ND	0.2	8036992
Benzo(k)fluoranthene	ug/L	-	-	-	ND	0.2	8036992
Benzo(a)pyrene	ug/L	-	-	-	ND	0.2	8036992
Indeno(1,2,3-cd)pyrene	ug/L	-	-	-	ND	0.2	8036992
Dibenzo(a,h)anthracene	ug/L	-	-	-	ND	0.2	8036992
Benzo(g,h,i)perylene	ug/L	-	-	-	ND	0.2	8036992
Dibenzo(a,i)pyrene	ug/L	-	-	-	ND	0.2	8036992
Benzo(e)pyrene	ug/L	-	-	-	ND	0.2	8036992
Perylene	ug/L	-	-	-	ND	0.2	8036992
Dibenzo(a,j) acridine	ug/L	-	-	-	ND	0.4	8036992
7H-Dibenzo(c,g) Carbazole	ug/L	-	-	-	ND	0.4	8036992
1,6-Dinitropyrene	ug/L	-	-	-	ND	0.4	8036992
1,3-Dinitropyrene	ug/L	-	-	-	ND	0.4	8036992
1,8-Dinitropyrene	ug/L	-	-	-	ND	0.4	8036992
Calculated Parameters							
Total PAHs (18 PAHs)	ug/L	-	-	2	ND	1	8032665
Pesticides & Herbicides							
Aldrin	ug/L	-	-	-	ND	0.005	8034785
Dieldrin	ug/L	-	-	-	ND	0.005	8034785
a-Chlordane	ug/L	-	-	-	ND	0.005	8034785
g-Chlordane	ug/L	-	-	-	ND	0.005	8034785
o,p-DDT	ug/L	-	-	0.04	ND	0.005	8034785
p,p-DDT	ug/L	-	-	0.04	ND	0.005	8034785
Lindane	ug/L	-	-	40	ND	0.003	8034785
Hexachlorobenzene	ug/L	-	-	0.04	ND	0.005	8034785
Mirex	ug/L	-	-	40	ND	0.005	8034785
Microbiological							
Escherichia coli	CFU/100mL	-	200	200	<10	10	8033562
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	-	-	-	100		8036992
No Fill No Excee	dance						

No Fill Grey Black

No Exceedance

Exceeds 1 criteria policy/level Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria, Criteria B: Halton Sanitary and Storm sewer by-law

Criteria-2: The Town of Oakville Storm Sewer Discharge By Law 2009-031



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **OAKVILLE STORM SEWER BYLAW (2009-031)**

Bureau Veritas ID					SUN780		
Sampling Date					2022/06/03 05:00		
COC Number					881898-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH/MW1	RDL	QC Batch
2-Fluorobiphenyl	%	-	-	-	70		8036992
D14-Terphenyl (FS)	%	-	-	-	63		8036992
D5-Nitrobenzene	%	-	-	-	79		8036992
D8-Acenaphthylene	%	-	-	-	72		8036992
2,4,5,6-Tetrachloro-m-xylene	%	-	-	-	87		8034785
Decachlorobiphenyl	%	-	_	_	93		8034785

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, Criteria B: Halton Sanitary and Storm sewer by-law

Criteria-2: The Town of Oakville Storm Sewer Discharge By Law 2009-031



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **ORGANOCHLORINATED PESTICIDES BY GC-ECD (WATER)**

Bureau Veritas ID			SUN780		
Sampling Date			2022/06/03 05:00		
COC Number			881898-01-01		
	UNITS	Criteria	BH/MW1	RDL	QC Batch
Calculated Parameters					
Aldrin + Dieldrin	ug/L	0.08	ND	0.005	8032139
Chlordane (Total)	ug/L	40	ND	0.005	8032139
DDT+ Metabolites	ug/L	-	ND	0.005	8032139
Heptachlor + Heptachlor epoxide	ug/L	-	ND	0.005	8032139
o,p-DDD + p,p-DDD	ug/L	-	ND	0.005	8032139
o,p-DDE + p,p-DDE	ug/L	-	ND	0.005	8032139
o,p-DDT + p,p-DDT	ug/L	-	ND	0.005	8032139
Total Endosulfan	ug/L	-	ND	0.005	8032139
Total PCB	ug/L	0.4	ND	0.05	8032139

No Fill

No Exceedance

Grey Black Exceeds 1 criteria policy/level

Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria: The Town of Oakville Storm Sewer Discharge By Law 2009-031



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **GENERAL COMMENTS**

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

Package 1	18.0°C
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Sample SUN780 [BH/MW1]: VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.



#### **QUALITY ASSURANCE REPORT**

B.I.G Consulting Inc.

Client Project #: BIGC-ENV-554A

			Matrix	Spike	SPIKED	BLANK	Method E	Blank	RP	D O	QC Sta	ndard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8034119	4-Bromofluorobenzene	2022/06/07	103	70 - 130	100	70 - 130	98	%				
8034119	D4-1,2-Dichloroethane	2022/06/07	104	70 - 130	99	70 - 130	98	%				
8034119	D8-Toluene	2022/06/07	96	70 - 130	100	70 - 130	98	%				
8034785	2,4,5,6-Tetrachloro-m-xylene	2022/06/07	88	50 - 130	83	50 - 130	62	%				
8034785	Decachlorobiphenyl	2022/06/07	85	50 - 130	119	50 - 130	75	%				
8036992	2,4,6-Tribromophenol	2022/06/07	97	10 - 130	106	10 - 130	95	%				
8036992	2-Fluorobiphenyl	2022/06/07	73	30 - 130	73	30 - 130	64	%				
8036992	D14-Terphenyl (FS)	2022/06/07	59	30 - 130	76	30 - 130	75	%				
8036992	D5-Nitrobenzene	2022/06/07	71	30 - 130	76	30 - 130	69	%				
8036992	D8-Acenaphthylene	2022/06/07	70	30 - 130	73	30 - 130	67	%				
8034119	1,1,2,2-Tetrachloroethane	2022/06/07	103	70 - 130	94	70 - 130	ND, RDL=0.40	ug/L	NC	30		
8034119	1,2-Dichlorobenzene	2022/06/07	96	70 - 130	92	70 - 130	ND, RDL=0.40	ug/L	NC	30		
8034119	1,4-Dichlorobenzene	2022/06/07	105	70 - 130	102	70 - 130	ND, RDL=0.40	ug/L	NC	30		
8034119	Benzene	2022/06/07	94	70 - 130	89	70 - 130	ND, RDL=0.20	ug/L	NC	30		
8034119	Chloroform	2022/06/07	97	70 - 130	94	70 - 130	ND, RDL=0.20	ug/L	NC	30		
8034119	cis-1,2-Dichloroethylene	2022/06/07	98	70 - 130	95	70 - 130	ND, RDL=0.50	ug/L	NC	30		
8034119	Ethylbenzene	2022/06/07	89	70 - 130	87	70 - 130	ND, RDL=0.20	ug/L	NC	30		
8034119	Methylene Chloride(Dichloromethane)	2022/06/07	106	70 - 130	101	70 - 130	ND, RDL=2.0	ug/L	NC	30		
8034119	Tetrachloroethylene	2022/06/07	87	70 - 130	86	70 - 130	ND, RDL=0.20	ug/L	NC	30		
8034119	Toluene	2022/06/07	89	70 - 130	90	70 - 130	ND, RDL=0.20	ug/L	7.1	30		
8034119	Total Xylenes	2022/06/07					ND, RDL=0.20	ug/L	11	30		
8034119	trans-1,3-Dichloropropene	2022/06/07	95	70 - 130	89	70 - 130	ND, RDL=0.40	ug/L	NC	30		
8034119	Trichloroethylene	2022/06/07	100	70 - 130	97	70 - 130	ND, RDL=0.20	ug/L	NC	30		
8034172	Fluoride (F-)	2022/06/07	100	80 - 120	109	80 - 120	ND, RDL=0.10	mg/L	0.96	20		
8034173	рН	2022/06/07			101	98 - 103			2.3	N/A		
8034252	Total Cyanide (CN)	2022/06/04	87	80 - 120	99	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
8034478	Nonylphenol (Total)	2022/06/06	104	50 - 130	103	50 - 130	ND, RDL=0.001	mg/L	NC	40		
8034479	Nonylphenol Ethoxylate (Total)	2022/06/06	91	50 - 130	86	50 - 130	ND, RDL=0.005	mg/L	NC	40		



#### QUALITY ASSURANCE REPORT(CONT'D)

B.I.G Consulting Inc.

Client Project #: BIGC-ENV-554A

			Matrix	Spike	SPIKED	BLANK	Method B	lank	RP	D	QC Sta	ndard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8034785	a-Chlordane	2022/06/07	95	50 - 130	97	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034785	Aldrin 2022/06/07		99	50 - 130	93	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034785	Dieldrin	2022/06/07	88	50 - 130	117	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034785	g-Chlordane	2022/06/07	97	50 - 130	93	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034785	Hexachlorobenzene	2022/06/07	86	50 - 130	92	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034785	Lindane	2022/06/07	88	50 - 130	92	50 - 130	ND, RDL=0.003	ug/L	NC	30		
8034785	Mirex	2022/06/07	73	30 - 130	104	30 - 130	ND, RDL=0.005	ug/L	NC	40		
8034785	o,p-DDT	2022/06/07	57	50 - 130	108	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034785	p,p-DDT	2022/06/07	117	50 - 130	117	50 - 130	ND, RDL=0.005	ug/L	NC	30		
8034995	Chromium (VI)	2022/06/07	100	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	NC	20		
8035929	Dissolved Sulphate (SO4)	2022/06/09	127 (1)	75 - 125	103	80 - 120	ND, RDL=1.0	mg/L	NC	20		
8035930	Total Suspended Solids	2022/06/09					ND, RDL=10	mg/L	3.5	25	100	85 - 115
8036060	Total BOD	2022/06/11					ND,RDL=2	mg/L	0.77	30	97	80 - 120
8036062	Total Carbonaceous BOD	2022/06/11					ND,RDL=2	mg/L	NC	30	94	85 - 115
8036992	1,3-Dinitropyrene	2022/06/07	66	30 - 130	99	30 - 130	ND, RDL=0.4	ug/L				
8036992	1,6-Dinitropyrene	2022/06/07	67	30 - 130	96	30 - 130	ND, RDL=0.4	ug/L				
8036992	1,8-Dinitropyrene	2022/06/07	65	30 - 130	96	30 - 130	ND, RDL=0.4	ug/L				
8036992	3,3'-Dichlorobenzidine	2022/06/07	23 (1)	30 - 130	80	30 - 130	ND, RDL=0.8	ug/L	NC	40		
8036992	7H-Dibenzo(c,g) Carbazole	2022/06/07	88	30 - 130	89	30 - 130	ND, RDL=0.4	ug/L	NC	40		
8036992	Anthracene	2022/06/07	80	30 - 130	89	30 - 130	ND, RDL=0.2	ug/L	NC	40		
8036992	Benzo(a)anthracene	2022/06/07	79	30 - 130	92	30 - 130	0.2, RDL=0.2 (2)	ug/L	NC	40		
8036992	Benzo(a)pyrene	2022/06/07	81	30 - 130	101	30 - 130	0.3, RDL=0.2	ug/L	NC	40		



#### QUALITY ASSURANCE REPORT(CONT'D)

B.I.G Consulting Inc.

Client Project #: BIGC-ENV-554A

			Matrix	Spike	SPIKED	BLANK	Method B	Blank	RP	D	QC Sta	ndard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8036992	Benzo(b/j)fluoranthene	2022/06/07	87	30 - 130	103	30 - 130	0.7, RDL=0.2	ug/L	NC	40		
8036992	Benzo(e)pyrene	2022/06/07	86	30 - 130	105	30 - 130	0.4, RDL=0.2	ug/L	NC	40		
8036992	Benzo(g,h,i)perylene	2022/06/07	105	30 - 130	113	30 - 130	0.5, RDL=0.2	ug/L	NC	40		
8036992	Benzo(k)fluoranthene	2022/06/07	93	30 - 130	100	30 - 130	0.4, RDL=0.2	ug/L	NC	40		
8036992	Bis(2-ethylhexyl)phthalate	2022/06/07	74	30 - 130	83	30 - 130	ND,RDL=2	ug/L	NC	40		
8036992	Chrysene	2022/06/07	99	30 - 130	108	30 - 130	ND, RDL=0.2	ug/L	NC	40		
8036992	Dibenzo(a,h)anthracene	2022/06/07	104	30 - 130	113	30 - 130	0.4, RDL=0.2	ug/L	NC	40		
8036992	Dibenzo(a,i)pyrene	2022/06/07	78	30 - 130	86	30 - 130	0.2, RDL=0.2	ug/L	NC	40		
8036992	Dibenzo(a,j) acridine	2022/06/07	95	30 - 130	93	30 - 130	ND, RDL=0.4	ug/L	NC	40		
8036992	Di-N-butyl phthalate	2022/06/07	76	30 - 130	89	30 - 130	ND,RDL=2	ug/L	NC	40		
8036992	Fluoranthene	2022/06/07	81	30 - 130	98	30 - 130	ND, RDL=0.2	ug/L	NC	40		
8036992	Indeno(1,2,3-cd)pyrene	2022/06/07	112	30 - 130	115	30 - 130	0.4, RDL=0.2	ug/L	NC	40		
8036992	Naphthalene	2022/06/07	66	30 - 130	66	30 - 130	ND, RDL=0.3	ug/L				
8036992	Pentachlorophenol	2022/06/07	65	30 - 130	66	30 - 130	ND,RDL=1	ug/L	NC	40		
8036992	Perylene	2022/06/07	92	30 - 130	82	30 - 130	0.4, RDL=0.2	ug/L	NC	40		
8036992	Phenanthrene	2022/06/07	83	30 - 130	91	30 - 130	ND, RDL=0.2	ug/L	NC	40		
8036992	Pyrene	2022/06/07	80	30 - 130	98	30 - 130	ND, RDL=0.2	ug/L	NC	40		
8037167	Mercury (Hg)	2022/06/07	89	75 - 125	91	80 - 120	ND, RDL=0.00010	mg/L	NC	20		
8037445	Phenols-4AAP	2022/06/07	97	80 - 120	99	80 - 120	ND, RDL=0.0010	mg/L	NC	20		
8038660	Total Kjeldahl Nitrogen (TKN)	2022/06/09	NC	80 - 120	105	80 - 120	ND, RDL=0.10	mg/L	0.071	20	105	80 - 120
8042314	Total Arsenic (As)	2022/06/09	99	80 - 120	96	80 - 120	ND, RDL=1.0	ug/L	4.4	20		
8042314	Total Cadmium (Cd)	2022/06/09	101	80 - 120	98	80 - 120	ND, RDL=0.090	ug/L	NC	20		
8042314	Total Chromium (Cr)	2022/06/09	98	80 - 120	95	80 - 120	ND, RDL=5.0	ug/L	NC	20		
8042314	Total Copper (Cu)	2022/06/09	102	80 - 120	96	80 - 120	ND, RDL=0.90	ug/L	NC	20		
8042314	Total Lead (Pb)	2022/06/09	92	80 - 120	91	80 - 120	ND, RDL=0.50	ug/L	NC	20		
8042314	Total Manganese (Mn)	2022/06/09	99	80 - 120	98	80 - 120	ND, RDL=2.0	ug/L	5.4	20		
8042314	Total Nickel (Ni)	2022/06/09	98	80 - 120	96	80 - 120	ND, RDL=1.0	ug/L	6.1	20		
8042314	Total Phosphorus (P)	2022/06/09	101	80 - 120	106	80 - 120	ND, RDL=100	ug/L	NC	20		



#### QUALITY ASSURANCE REPORT(CONT'D)

B.I.G Consulting Inc.

Client Project #: BIGC-ENV-554A

			Matrix	Spike	SPIKED	BLANK	Method B	lank	RP	D	QC Sta	andard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8042314	Total Selenium (Se)	2022/06/09	104	80 - 120	102	80 - 120	ND, RDL=2.0	ug/L	NC	20		
8042314	Total Silver (Ag)	2022/06/09	99	80 - 120	97	80 - 120	ND, RDL=0.090	ug/L	NC	20		
8042314	Total Zinc (Zn)	2022/06/09	101	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
8042315	Total Aluminum (Al)	2022/06/09	100	80 - 120	101	80 - 120	ND, RDL=0.1	mg/L				
8042315	Total Antimony (Sb)	2022/06/09	110	80 - 120	107	80 - 120	ND, RDL=0.02	mg/L				
8042315	Total Arsenic (As)	2022/06/09	108	80 - 120	104	80 - 120	ND, RDL=0.01	mg/L	NC	20		
8042315	Total Beryllium (Be)	2022/06/09	104	80 - 120	104	80 - 120	ND, RDL=0.0005	mg/L				
8042315	Total Cadmium (Cd)	2022/06/09	106	80 - 120	103	80 - 120	ND, RDL=0.002	mg/L	NC	20		
8042315	Total Chromium (Cr)	2022/06/09	108	80 - 120	105	80 - 120	ND, RDL=0.01	mg/L	NC	20		
8042315	Total Cobalt (Co)	2022/06/09	104	80 - 120	102	80 - 120	ND, RDL=0.002	mg/L				
8042315	Total Copper (Cu)	2022/06/09	102	80 - 120	102	80 - 120	ND, RDL=0.01	mg/L	16	20		
8042315	Total Iron (Fe)	2022/06/09	105	80 - 120	106	80 - 120	ND, RDL=0.02	mg/L				
8042315	Total Lead (Pb)	2022/06/09	103	80 - 120	102	80 - 120	ND, RDL=0.01	mg/L	NC	20		
8042315	Total Manganese (Mn)	2022/06/09	101	80 - 120	102	80 - 120	ND, RDL=0.001	mg/L	0	20		
8042315	Total Molybdenum (Mo)	2022/06/09	106	80 - 120	104	80 - 120	ND, RDL=0.005	mg/L				
8042315	Total Nickel (Ni)	2022/06/09	104	80 - 120	103	80 - 120	ND, RDL=0.005	mg/L	NC	20		
8042315	Total Phosphorus (P)	2022/06/09	99	80 - 120	99	80 - 120	ND, RDL=0.05	mg/L	1.7	20		
8042315	Total Selenium (Se)	2022/06/09	106	80 - 120	103	80 - 120	ND, RDL=0.02	mg/L	NC	20		
8042315	Total Silver (Ag)	2022/06/09	99	80 - 120	99	80 - 120	ND, RDL=0.01	mg/L	NC	20		
8042315	Total Tin (Sn)	2022/06/09	105	80 - 120	103	80 - 120	ND, RDL=0.02	mg/L				
8042315	Total Titanium (Ti)	2022/06/09	102	80 - 120	103	80 - 120	ND, RDL=0.005	mg/L				
8042315	Total Zinc (Zn)	2022/06/09	103	80 - 120	103	80 - 120	ND, RDL=0.005	mg/L	5.6	20		
8043541	Total Oil & Grease	2022/06/09			99	85 - 115	ND, RDL=0.50	mg/L	0.51	25		



Bureau Veritas Job #: C2F2517 Report Date: 2022/06/12

#### QUALITY ASSURANCE REPORT(CONT'D)

B.I.G Consulting Inc.

Client Project #: BIGC-ENV-554A

Sampler Initials: MM

			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
8043548	Total Oil & Grease Mineral/Synthetic	2022/06/09			97	85 - 115	ND, RDL=0.50	mg/L	0.52	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).

- (1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
- (2) The flagged analytes were detected in the method blank above the detection limit. Sample results have not been blank corrected. The results may be biased high. For results that were not detected (ND), this potential bias has no impact.



Client Project #: BIGC-ENV-554A

Sampler Initials: MM

#### **VALIDATION SIGNATURE PAGE**

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

Clistia Camine
Cristina Carriere, Senior Scientific Specialist
Songe
Sonja Elavinamannil, Master of Biochemistry, Team Lead

Bureau Veritas 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.

Client Project #: BIGC-ENV-554A

Sampler Initials: MM

## Exceedance Summary Table – Halton Storm and Sanitary Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						
The exceedance summa	ary table is for information purp	oses only and shoul	d not be considered a comp	orehensive listing or	statement of	conformance to
applicable regulatory gu	uidelines.					

## Exceedance Summary Table – Oakville Storm Sewer Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
BH/MW1	SUN780-06	Benzene	2	2.4	0.40	ug/L
BH/MW1	SUN780-12	Total Manganese (Mn)	0.05	0.20	0.001	mg/L
BH/MW1	SUN780-12	Total Manganese (Mn)	50	200	2.0	ug/L
BH/MW1	SUN780-08	Total Suspended Solids	15	110	10	mg/L

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.

	INVO	ICE TO:				REPO	RT TO:					PROJE	CT INFORMATION:			Laboratory Use (	Only:	
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	Idougherty@brown	Fax: fieldigi.com;admir	n@brownfieldigi.c	Tel: O Email:		brownfieldigi.co				Sa	mpled By:	- 1	IM/KMI			C#881898-01-01	Deepthi Shaji	
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_			Reg 406 Table				Field Filtered (please circle): Metals / Hg / Cr VI	8 X	m Se							Rush TAT (if applies to entire subm	ission)	
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Bureau Veritas Canada (2019) Inc.

# APPENDIX E: CONSTRUCTION DEWATERING ESTIMATE RATE CALCULATIONS



### **Construction Dewatering Rate Estimate**

590 Argus Road, Oakville, Ontario

Seven (7) levels of underground parking, unconfined aquifer, groundwater seepage to rectangular excavation (line source)

**Table E-1: Construction Dewatering Rate Estimates** 

Description	Symbol	Values	Unit	Explanation		
Input						
Lowest Ground Elevation		104.45	m asl	Based on borehole logs		
Highest Groundwater Elevation		102.44	m asl	Highest groundwater elevation (May 31, 2022)		
P7 Footing Elevation		80.45	m asl	FFE is assumed 22 m bgs, footing is assumed 2 m below FFE		
Aquifer Bottom		75.45	m asl	Assumed 5 m below footing		
Hydraulic Conductivity	K	2.76E-07	m/s	Geometric mean K		
Length of Excavation	х	160.0	m	Based on area extent equivalent		
Width of Excavation	а	86.0	m	Based on area extent equivalent		
Output						
Top of Aquifer		102.44	m asl	water table for unconfined aquifer		
Target Water Level		79.45	m asl	assumed 1 m below footing		
Water Level above aquifer bottom before dewatering	Н	27.0	m			
target water level above aquifer bottom	h	4.0	m			
Radius of Influence	L (R <sub>0</sub> )	21.14	m	Sichardt's Formula C=1750		
Construction Dewatering Flow Rate - Steady State	Q	197.79	m³/day	Construction Dewatering Flow - Dupuit Equation		
Maximum Construction Flow Rate (safety factor of 3)	3Q	593.4	m³/day	During the initial period and after rains		
Construction Dewatering Flow Rate - Steady State	Q	197,800	L/day			
Maximum Construction Flow Rate (safety factor of 3)	3Q	593,000	L/day			



# APPENDIX F: LONG TERM DRAINAGE FLOW RATE ESTIMATE CALCULATIONS



#### **Foundation Drain Flow Rate Estimate**

590 Argus Road, Oakville, Ontario

Seven (7) levels of underground parking, Unconfined Aquifer, Groundwater seepage to rectangular excavation (line source)

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

Description	Symbol	Values	Unit	Explanation				
Input								
Lowest Ground Elevation		104.45	m asl	Based on borehole logs				
Highest Groundwater Elevation		95.19	m asl	Highest deep groundwater elevation from 587 Argus (October 18, 2021)				
Basement slab level (top)		82.45	m asl	Assumed 22 m below ground				
Aquifer Bottom		77.45	m asl	Assumed 5 m below basement level				
Hydraulic Conductivity	K	1.29E-08	m/s	Geometric mean K of deep wells				
Length of Excavation	х	160.0	m	Based on area extent equivalent				
Width of Excavation	а	86.0	m	Based on area extent equivalent				
Output								
Top of Aquifer		95.2	m asl	Water table for unconfined aquifer				
Target Water Level		81.95	m asl	Assumed 0.5 m below basement floor level				
Water Level above aquifer bottom before dewatering	Н	17.7	m					
Target water level above aquifer bottom	h	4.5	m					
Radius of Influence	L (R <sub>0</sub> )	3.22	m	Weber Equation - R <sub>0</sub> after 35 days				
Long-Term Flow Rate - Steady State	Q	25.07	m³/day	Long-term flow rate - Dupuit Equation				
Maximum Foundation Drain Flow Rate (safety factor of 3)	3Q	75.20	m³/day	During the initial period and after rains				
Estimated Long-term Foundation Drain Flow Rate	Q	25,000	L/day					
Estimated Maximum Foundation Drain Flow Rate	3Q	75,000	L/day					

