Hydrogeological Assessment
Ninth Line, Mississauga, Ontario

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March 2020
300044049.1000

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Record of Revisions

Revision	Date	Description
-	March 9, 2020	Initial Submission to Client

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) was retained by The Diocese of Mississauga, Vancouver, and Western Canada to complete a hydrogeological assessment of the property located at Ninth Line in Mississauga, Ontario (hereinafter, referred to as the "Site"). The hydrogeological assessment was completed in accordance with Chapter 22 of the Ministry of Environment Conservation and Parks (MECP) 2008 *"Design Guidelines for Sewage Works"* and the results are intended to support the design of a new wastewater treatment system and application for Environmental Compliance Approval (ECA).

1.1 Property Description

The Site is situated within the western limits of the City of Mississauga, Region of Peel and is an approximately rectangular-shaped parcel of land, being about 3.7 ha in size, situated east of Ninth Line and south of Burnhamthorpe Road West (Figure 1). For the purposes of this report, project north is interpreted as northwest toward Burnhamthorpe Road, with Ninth Line running in a north-south direction.

The south portion of the Site is presently used for vehicle and equipment storage; the remainder of the property is vacant. The Site has a municipal address of 0 Ninth Line and is classified as Commercial/Farmland (Figure 2).

The Site is proposed for development as a church for the St. Mark and St. Demiana Coptic Orthodox Church. The proposed development will be completed in 2 phases: Phase 1 includes an approximately 5,000 m^2 church building and required adequate parking spaces, with the north side of the Site reserved for the onsite wastewater system and stormwater management pond. Phase 2 will include a community center and additional parking spaces once municipal services along Ninth Line are in place to allow the connection to the sanitary system.

1.2 Site Servicing

The proposed development at the Site will receive municipal water supply from the Region of Peel.

Wastewater services are not currently available in the area. As such, the development will include a private subsurface sewage dispersal system. As the daily design flow is greater than 10,000 L/day, an Environmental Compliance Approval (ECA) will be required from the MECP.

1.3 Available Geological Reports

The following report was reviewed to examine geological conditions in the area of the Site.

Foundation Investigation Report for Burnhamthorpe Road Underpass, Ontario Ministry of Transportation, 1977. W.P. 158-75-04, Site 10-280, Hwy. 403, District 4, Hamilton.

- A foundation investigation was completed in 1977 for the Burnhamthorpe Road underpass at Highway 403, which is approximately 250 m north of the Site.
- Six (6) boreholes were advanced to depths ranging from 5 to 19 mbgs. Stratigraphy included the following layers:
  - Topsoil – a thin layer of topsoil – from ground surface to <0.5 mbgs.
  - Glacial till consisting of clayey silt, some sand, some gravel, heterogeneous, very stiff to hard, brown becoming grey at 3 to 5 m bgs – extending from below the topsoil to approximately 10 m bgs.
  - Silt – trace sand, occasional clayey silt layers, very dense to hard – extending from below the till to at least 19 m bgs.
- Grain size analysis was completed to confirm field soil descriptions.
- Groundwater levels of 1 to 4 mbgs were measured in open boreholes following drilling.

1.4 Scope of Work

The hydrogeological assessment included the following tasks:

- Review of published geological and hydrogeological mapping for the area, including physiography, topography, surficial geology, bedrock geology, and natural heritage features.
- Review of published literature for regional geological and hydrogeological information.
- Review of existing reports available for the Site.
- Review of MECP (2020a) water well records within 500 m of the Site (Appendix B).
- Review of borehole logs prepared as part of the geotechnical investigation by CMT Engineering Inc. (Appendix C).
- Review of grain size curves for representative soil samples obtained from the Site (Appendix D).
- Completion of in-situ hydraulic conductivity testing at monitoring wells on the Site to assess the rate of groundwater movement through the subsurface soils.
- Completion of groundwater level monitoring to determine static groundwater levels at the Site.
- Assessment of groundwater flow and completion of effluent dilution calculations to assess concentrations at the proposed infiltration bed and downgradient boundaries.

- Assessment of groundwater flow and completion of effluent dilution calculations to assess concentrations at the proposed infiltration bed and downgradient boundaries.
- Assessment of effluent impacts from the proposed replacement bed to local receptors.

2.0 Regional Setting

2.1 Topography and Drainage

The elevation of the Site is about 178 to 185 m above sea level (masl), sloping from the raised berm on the east side of the Site to the west-southwest across the Site. A topographic survey of the Site is provided as Appendix A. The local topography is undulating to gently sloping to the south (Canada Department of Agriculture, 1974) and accordingly surface drainage and shallow groundwater is interpreted to flow in a southerly direction (Figure 3). Regionally, the land slopes to the south toward Lake Ontario approximately 8 km south of the Site.

The Site is located in the Great Lakes-St. Lawrence Basin, Lake Ontario and Niagara Peninsula Secondary Watershed, Credit – 16 Mile Creek Tertiary Watershed, Joshua's Creek Subwatershed based on watershed mapping provided by the MECP (2020b) and Conservation Halton (2018). Joshua's Creek is a small urban subwatershed draining southeastward through Oakville and discharging to Lake Ontario.

There are no water bodies on the Site. The closest water body is a tributary to the Joshua's Creek approximately 120 m west of the Site. Lake Ontario is located about 8 km to the south.

There are no mapped wetlands on the Site. The nearest mapped wetland is a portion of the North Oakville-Milton East Wetland Complex Provincially Significant Wetland (PSW), which is located approximately 100 m south of the Site surrounding Joshua's Creek (MECP, 2020c).

2.2 Physiography

The Site is located in the South Slope physiographic region (Chapman and Putnam, 1984). This region spans laterally along Lake Ontario between the lower glaciolacustrine sediments and the Oak Ridges Moraine to the north. The South Slope region is characterized by till plains, often drumlinized, overlying limestones of the Verulam and Lindsay Formations, grey shales of the Georgian Bay Formation, and red shales of the Queenston Formation, with fragments of these formations incorporated into the overlying tills in each area. In the area of the Site, fragments of the Queenston Formation are commonly found within the overlying till.

3.0 Geology

3.1 Regional Geology

Surficial geology mapping published by the Ontario Geological Survey (OGS, 2010) indicates that the soil is composed of glaciolacustrine-derived deposits of silty to clayey till (Figure 4).

Bedrock in the area is composed of the Queenston Formation (Figure 5; OGS, 2011). Bedrock of the Queenston Formation is of Upper Ordovician age and typically characterized by red shale with small amounts of green shale, siltstone, sandstone (Armstrong, 2001). The bedrock surface at the Site is typically found at a depth of about 20 m below ground surface (mbgs) or 160 masl (Oak Ridges Moraine Groundwater Program Website, 2020).

3.2 Local Geology

A review of MECP water well records within 500 m of the Site (Appendix B) generally indicated the following stratigraphic layers in the vicinity of the Site, from top to bottom:

- Clay with stones/boulders, grey to brown, from ground surface to 13 to 21 m below ground surface (mbgs).
- Sand was identified in 2 of 7 well records, grey to red to green in colour, from about 15 to 20 mbgs in one well record and from ground surface to 6 mbgs in the other well record.
- Red shale was identified beginning at 2 mbgs in one well record and beginning between 13 and 21 mbgs in the other well records.

It is interpreted that surficial soils in the vicinity of the Site typically consist of clay till, occasionally with sand layers identified close to ground surface. Shale bedrock is typically found around 13 to 21 mbgs but has been found shallower in some areas.

3.3 Site Stratigraphy

CMT advanced 7 boreholes at the Site in February 2020 to depths of 4.6 to 7.6 mbgs (Figure 2). Three of the boreholes (BH1, BH6 and BH7) were completed as monitoring wells. The stratigraphic layers identified in the borehole logs (Appendix C) are depicted on Figure 8 and interpreted as follows, from top to bottom.

- **Topsoil**: silty, organic, dark brown, loose, moist from ground surface to about 0.1 mbgs.
- **Shallow fine-grained soils**: clayey silt, some sand to sandy, trace to some gravel, trace organics and rootlets, brown to grey, soft becoming hard with increasing depth, moist from below the topsoil to about 1.7 to 4.6 mbgs.

- **Perched sand aquifer**: a shallow discontinuous sand layer was encountered in BH1 and BH6 below the clayey silt with a thickness of about 0.2 to 1.0 m. The sand layer was moist to wet, brown to grey with trace silt and gravel. This upper sand aquifer was not identified in the other boreholes on the Site and is interpreted to be perched and laterally discontinuous.
- **Silt till aquitard**: silt, some sand and clay to sandy and clayey, trace gravel, grey, dense to very dense, moist to wet. The silt till was identified in all boreholes from below the clayey silt (and shallow sand in BH1 and BH6) to about 3.9 to 6.1 mbgs.
- **Confined sand aquifer**: sand, some silt, trace clay, trace gravel, grey, dense, wet from below the silt till beginning around 3.9 to 6.1 mbgs to the terminal depth of the boreholes in BH1, BH2 and BH6.

Groundwater levels in open boreholes were recorded between about 2.7 to 4.7 mbgs prior to backfilling. Burnside monitored static water levels in monitoring wells following stabilization of the water table (refer to Section 4.2 for static groundwater levels).

The findings of the borehole for the Site are generally consistent with the published surficial geology mapping and MECP water well records for the area, indicating clayey till material at surface with variable thickness and intermittent sand layers underlain by red shale bedrock beginning around 13 to 21 mbgs.

3.4 Grain Size Analysis

CMT completed grain size analysis on four representative soil samples from various boreholes and depths across the Site. The grain size distribution curves were plotted in accordance with the Unified Soil Classification System and ASTM D422 (Appendix D). A summary is provided in the following table.

Table 1: Grain Size Analysis Results

Test Location	Sample Depth (mbgs)	Sample Description	USCS Soil Type	% Gravel	% Sand	% Silt	% Clay
BH1	0.8-1.4	Clay and silt, some sand, trace gravel	ML	1.6	16.3	40.8	41.3
BH2	1.5-2.1	Clayey sandy silt, trace gravel	ML	2.9	25.5	45.2	26.4
BH4	3.7-4.6	Sandy clayey silt, trace gravel	ML	2.6	26.4	48.7	22.3

Test Location	Sample Depth (mbgs)	Sample Description	USCS Soil Type	% Gravel	% Sand	% Silt	% Clay
BH6	3.1-3.7	Silt, some sand, some clay	ML	0.0	18.7	70.9	10.4

The clay/silt to clayey sandy silt samples obtained from BH1 and BH2 are interpreted to be representative of the soil in the area and at the approximate depth of the proposed leaching bed at the Site.

4.0 Hydrogeology

4.1 Hydraulic Conductivity

Various methods can be used to evaluate soil hydraulic conductivity, i.e., the ability of the soil to transmit groundwater. Assessing soil characteristics and grain size data provides a general estimate of hydraulic conductivity, whereas single well response tests are used to assess site-specific conditions. Both methods were used to estimate the hydraulic conductivity and percolation rate (T-time) of the soils at the Site.

4.1.1 Estimates from Grain Size Analysis

To estimate hydraulic conductivity based on grain size data, an empirical method known as the Hazen estimation is used. This method approximates hydraulic conductivity based on grain size curves for sandy soils. The approximation does not strictly apply to finer grained materials; however, it is still considered useful and provides a general indication of the range of the hydraulic conductivity values. Hydraulic conductivity values were derived empirically using the Hazen method in accordance with the following formula.

$$K = C(D_{10})^2$$

Where:

K is the hydraulic conductivity of the soil (cm/s)
D is the diameter of the 10-percentile grain size of the material (cm)
C is Hazen's empirical coefficient, estimated using the following table (from Fetter, 1994)

Table 2: Hazen's Empirical Coefficient based on Soil Type

Soil Type	C (dimensionless)
Very fine sand, poorly sorted	40 – 80
Fine sand with appreciable fines	40 – 80
Medium sand, well sorted	80 – 120
Coarse sand, poorly sorted	80 – 120
Coarse sand, well sorted, clean	120 – 150

The estimated D_{10} and C values and calculated K values for the Site are summarized in the table below. The estimated T-time values were also estimated based on the percolation time guidelines provided by the Ontario Ministry of Municipal Affairs and Housing (1997).

Table 3: Hydraulic Conductivity Calculations – Grain Size Analysis

Test Location	Sample Depth (mbgs)	Soil Description	D_{10} (mm)	C (dimensionless)	K (m/s)	T-Time (min/cm)
BH1	0.8-1.4	Clay and silt, some sand, trace gravel	<0.001	60	$<10^{-9}$	>50
BH2	1.5-2.1	Clayey sandy silt, trace gravel	<0.001	60	$<10^{-9}$	>50
BH4	3.7-4.6	Sandy clayey silt, trace gravel	<0.001	60	$<10^{-9}$	>50
BH6	3.1-3.7	Silt, some sand, some clay	0.002	60	2×10^{-8}	40-50

The estimated K for the grain size samples analyzed at various locations and depths across the Site ranged from approximately 2×10^{-8} to less than 10^{-9} m/s, which is consistent with literature values of 10^{-8} to 10^{-11} for clay material and 10^{-6} to 10^{-8} m/s for silt to sandy silt material (Fetter, 1994). The clayey to sandy silt soils at BH1 and BH2 in the area of the proposed infiltration bed on the Site had a K of less than 10^{-9} m/s and a corresponding T-time of less than 50 min/cm.

4.1.2 Estimates from In Situ Well Recovery Tests

Burnside completed single well response tests (i.e., slug tests) in each of the three monitoring wells at the Site. Each single well response test was completed by inducing

an instantaneous change in the water level. The recovery of the water level to static was monitored manually with an audible water level measuring tape and automatically using a pressure transducer datalogger set to 1 to 5 second readings. Both falling head and rising head recovery tests were conducted on each well by introducing and removing a solid slug from the wells. The test results are provided in Appendix E and the calculated hydraulic conductivity values and associated estimated infiltration rates are summarized in Table 1.

Table 4: Summary of Hydraulic Conductivity Values - Single Well Response Tests

Monitoring Well	Screen Depth (mbgs)	Soil Type	Hydraulic Conductivity	
			Falling Head Test (m/s)	Rising Head Test (m/s)
BH1	6.1-7.6	Sand, some silt, trace clay, trace gravel, grey	9×10^{-7}	6×10^{-7}
BH5	5.2-6.7	Silt till, some sand, some clay, trace gravel, grey	1×10^{-6}	1×10^{-6}
BH6	6.1-7.6	Sand, some silt, trace clay, trace gravel, grey	9×10^{-6}	7×10^{-6}

The calculated K for the shallow confined aquifer material on the Site was 6×10^{-7} to 9×10^{-6} m/s, which is consistent with literature values of 10^{-7} to 10^{-5} m/s for fine sand and silty sand material (Fetter, 1994). The K values from the slug tests completed in the confined sand aquifer material are higher than those estimated from grain size analyses completed on the overlying silty to clayey confining layers.

4.2 Groundwater Levels

Burnside measured static groundwater levels in monitoring wells across the Site in February 2020. The well construction details and groundwater level monitoring data are provided below in Table 5.

Table 5: Well Construction Details and Groundwater Levels

Location	Well Construction Details						Groundwater Levels			
	Ground Surface	Stickup	Bottom of Well		Top of Screen		**13-Feb-2020**		**3-Mar-2020**	
	(masl)	(m)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)
BH1	180.16	1.03	7.57	172.59	6.05	174.11	1.62	178.54	1.63	178.53
BH5	178.34	0.95	6.79	171.55	5.27	173.07	0.10	178.24	0.07	178.27
BH6	182.18	0.99	7.63	174.55	6.11	176.07	4.22	177.96	4.21	177.97

Groundwater levels measured within monitoring wells BH1, BH5 and BH6 were 0.1 to 4.2 mbgs (178.0 to 178.5 masl) in February 2020. Groundwater levels are influenced by seasonal variability (e.g., recharge from precipitation and surface water sources) and may fluctuate significantly throughout the year. Shallow groundwater levels are typically highest during the spring freshet period and following storm /flood events and lowest during late summer and fall. It is interpreted that the water levels measured in February 2020 are representative of the average groundwater table level across the Site. Groundwater fluctuations up to approximately 1 m or more may occur during the spring freshet and/or following significant precipitation events.

A review of MECP water well records within 500 m of the Site indicated water levels ranging from 1.5 to 5.5 mbgs within wells installed within the red shale bedrock to depths between 19 and 37 mbgs.

Groundwater is interpreted to be shallow at the Site and is expected to typically be around 178.0 to 178.5 masl based on groundwater levels measured in on-site monitoring wells and MECP water well records. Shallow groundwater levels may fluctuate seasonally up to 1 m or more between the high groundwater period in the spring and the low groundwater period in the summer/fall.

4.3 Groundwater Flow

Surface drainage and shallow/unconfined groundwater flow is interpreted to follow surface topography and flow in a west-southwesterly direction across the Site. The monitoring wells on the Site are screened within the shallow confined sand aquifer below the Site at depths between about 5.3 and 7.6 mbgs. Based on static water levels in February and March 2020 groundwater within the shallow confined sand aquifer is interpreted in a southerly direction (Figure 6).

For the purposes of attenuation zone flow from the proposed on-site leaching bed on the north side of the property, a combination of shallow subsurface flow following topography (Appendix A) and confined sand aquifer flow (Figure 6) has been applied to the interpreted attenuation zone. As such, the attenuation zone is interpreted to flow in a southerly direction toward the south property boundary (Figure 7).

4.4 Groundwater Quality

Burnside collected groundwater quality samples from each monitoring well at the Site on February 13, 2020. Prior to sample collection, monitoring wells were developed to remove stagnant water and reduce borehole smearing and sedimentation induced during drilling and installation of the monitoring wells. The groundwater samples were submitted to Bureau Veritas Laboratories in Mississauga for analysis of selected parameters and compared to the Ontario Drinking Water Standards (ODWS). The results are provided in Appendix F and summarized below.

- The ODWS Maximum Acceptable Concentration (MAC) was not exceeded for any tested parameters.
- Elevated nitrate of 9.58 mg/L was identified in the groundwater sample from BH6, which is just below the ODWS MAC of 10.0 mg/L. Nitrate was not detected in groundwater samples from BH1 and BH5. The source of the elevated nitrate in BH6 is unknown.
- Elevated uranium of 0.018 mg/L was identified in the groundwater sample from BH6, which is just below the ODWS MAC of 0.02 mg/L. The concentration of uranium in the sample from BH6 was approximately two orders of magnitude greater than the samples from BH1 and BH5. The source of the elevated uranium in BH6 is unknown.
- Iron and manganese exceeded the ODWS Aesthetic Objectives (AO) of 0.3 mg/L and 0.05 mg/L, respectively, in all groundwater samples obtained from the Site. Iron and manganese are not considered a health-related concern under the ODWS but may impart an adverse taste in drinking water and cause staining on plumbing fixtures.
- Hardness exceeded the ODWS Operational Guideline (OG) of 80-100 mg/L in all groundwater samples obtained from the Site, with results of 380 to 860 mg/L. Hard water is common in southern Ontario groundwater and is not considered a health-related concern.
- Total dissolved solids (TDS) exceeded the OSWS AO of 500 mg/L and alkalinity exceeded the ODWS OG of 30-500 mg/L at BH6. Elevated TDS and alkalinity are not considered a health-related concern under the ODWS.

Overall, the groundwater quality results met the ODWS health-related criteria.

5.0 Proposed Subsurface Dispersal Bed – Reasonable Use Assessment

MECP Guideline B-7 "*Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities*" (Reasonable Use Policy) and Procedure B-7-1 *"Determination of Contaminant Limits and Attenuation Zones"* are used to assess the

suitability of attenuation zones and determine acceptable effluent concentrations in groundwater at downgradient property boundaries.

5.1 Effluent Criteria – Nitrate Attenuation

Sewage effluent flow across the Site is interpreted to flow in an overall southerly direction toward the downgradient property boundary (Figure 7). Effluent flow interpretation is based on a combination of shallow subsurface flow and confined groundwater flow across the Site, as discussed in Section 4.3.

Nitrate-N is considered the indicator contaminant for septic effluent as it relates to groundwater impacts. The nitrate-N attenuation calculations were completed in accordance with MECP Guideline B-7, MECP Procedure B-7-1, and Chapter 22 of the MECP Design Guidelines for Sewage Works. The impact calculations to the downgradient property boundary are provided in Appendix G.

The maximum allowable nitrate-N concentration at the downgradient property boundary (C_{PB}) is 2.5 mg/L. This value does not consider any nitrate-N already present in the shallow groundwater.

The calculations indicate that without treatment, the concentration of nitrate-N at the downgradient property boundary would be approximately 18.5 mg/L. Accordingly, nitrate-N would need to be reduced to less than 5.4 mg/L in the effluent at the dispersal bed to meet the maximum concentration of 2.5 mg/L at the property boundary.

5.2 Effluent Criteria – Phosphorus Attenuation

According to Chapter 22 - Large Subsurface Sewage Disposal Systems of the MECP Design Guidelines for Sewage Works (2008), any large subsurface disposal system (LSSDS) within 300 m of a surface water system must meet site specific impact assessments. A LSSDS is defined as having a capacity greater than 10,000 L/day. The proposed replacement bed will have a balanced design flow of 36,000 L/day during peak usage and an average daily flow of approximately 13,850 L/day, classifying it as a LSSDS.

The closest surface water body is a tributary to the Joshua's Creek approximately 120 m west of the Site and approximately 200 m west and cross-gradient of the proposed leaching bed. Effluent is interpreted to flow in an overall southerly direction (Figure 7). Given the interpreted direction of effluent flow to the south, effluent may intercept Joshua's creek beyond the property boundary at a distance of 400 to 500 m downgradient of the proposed leaching bed. Given the distance from the proposed leaching bed and the fine-grained nature of the surficial soils, the potential for the leaching bed effluent to impact surface water quality is interpreted to be low.

6.0 Wastewater Treatment Objectives

Conventional septic systems do not provide nitrogen removal; therefore, and advanced wastewater treatment system with additional denitrification equipment will be required to provide sufficient nitrogen removal. Typically, this would include a two-stage process to remove nitrogen from the wastewater. The ammonia will be converted into nitrate in the aerobic treatment process, and then subsequently converted from nitrate to nitrogen gas in an anoxic reactor (i.e., lacking in dissolved oxygen) with a carbon source. The effluent from the anoxic reactor will then be polished and sent to the leaching bed for dispersal into the soil.

Based on the attenuation calculations presented herein, the proposed effluent objectives in treated wastewater for the replacement bed options are provided in Table 6.

Table 6: Proposed Effluent Objectives

Parameter	Units	Effluent Objective
Total Biochemical Oxygen Demand – 5 days (cBOD5)	mg/L	<10
Total Suspended Solids	mg/L	<10
Total Inorganic Nitrogen	mg/L	<5.4

7.0 Impact to Local Receptors

7.1 Source Water Protection

The Site is located within the Halton Region Source Protection Area (MECP, 2020b). The Site is not located within a mapped wellhead protection area, highly vulnerable aquifer or significant groundwater recharge area. The nearest surface water intake is approximately 10 km east within Lake Ontario and the nearest wellhead protection area is approximately 18 km west of the Site.

Approximately 400 m^2 at the southwest corner of the Site is within a mapped Intake Protection Zone 3 surrounding Joshua's Creek approximately 120 m west of the Site. Given the interpreted attenuation zone as discussed in Section 5.2, no adverse impact to Joshua's Creek is anticipated.

The proposed development and subsurface sewage dispersal bed are not interpreted to be a source water protection risk.

7.2 Local Domestic Supply Wells

A review of MECP water well records within 500 m of the Site identified a total of 7 well records, including 4 domestic supply wells, 1 public/domestic supply well, 1 commercial supply well and 1 monitoring well. The supply wells were all installed as drilled wells within bedrock with depths of 16 to 37 mbgs and static water levels of 1.5 to 5.5 mbgs. The water supply well records are from 1955 to 2016.

Based on the MECP water well records the nearest supply well is located over 200 m north-northwest of the Site. Impacts on the water quality at surrounding private wells are not anticipated due to the distance from the onsite system and the installation of the drilled wells deep within the overburden, with no shallow dug wells in the area. In addition, municipal water supply is available along Ninth Line and it is interpreted that municipal supply is available to most properties in the vicinity of the Site; however, some supply wells may still be in use.

7.3 Surface Water

The closest surface water feature is Joshua's Creek approximately 120 m west of the Site. Based on the 2008 Design Guideline (Section 22.5.11), attenuation calculations must be done based on the nearest receptor, which is the downgradient property boundary for the Site. Given the interpreted attenuation zone as discussed in Section 5.2, no appreciable effects are anticipated to surface water features.

8.0 Conclusions

Based on the desktop hydrogeological assessment, the following conclusions can be made:

- The Site is undulating to gently sloping toward the south-southwest with an elevation range of approximately 259 to 294 masl.
- The Site is underlain by clayey till material at surface with variable thickness and intermittent sand layers underlain by a confined sand aquifer unit beginning around 4 to 6 mbgs and red shale bedrock beginning around 13 to 21 mbgs.
- A percolation rate (T-time) of >50 min/cm was estimated for the native soils in the area of the proposed subsurface dispersal bed.
- Hydraulic conductivity was estimated at 2 x 10^{-8} to less than 10^{-9} m/s for the native upper clayey to sandy silt material across the Site and within the proposed infiltration bed areas.
- Groundwater is expected to be around 178.0 to 178.5 masl at the Site. Groundwater levels may fluctuate up to 1 m or more based on seasonal conditions.
- Septic effluent flow is expected to follow a combination of surface topography and shallow groundwater flow with overall flow to the south across the Site.

- Municipal water supply is available in the vicinity of the Site, however some private water supply wells may still be in use. Local water supply wells are installed as drilled bedrock wells with depths of 16 to 37 mbgs. No impacts to local water supply wells are expected.
- Based on the proposed effluent treatment technologies, local stratigraphy, groundwater flow direction and hydraulic conductivity, impact to local supply wells and/or surface water is not anticipated.

9.0 Recommendations and Construction Considerations

9.1 Sewage Treatment

Nitrate-N within the sewage effluent needs to be reduced to less than 5.4 mg/L at the disposal bed to meet the maximum concentration of 2.5 mg/L at the property boundary. This will likely require advanced treatment with denitrification technology.

9.2 Dewatering Requirements

The water table may be close to the existing ground surface at the Site, especially during spring conditions. As such, excavations for servicing and building foundations may encounter wet soil conditions. As a result, some drainage/groundwater control may be needed during construction. The preferred groundwater control system will vary depending on factors, such as climate conditions, construction season, depth and size of excavations, and local soil conditions. Sandy soil layers may produce significant volumes of groundwater and require more active dewatering, whereas excavations into the silty clay and till deposits may encounter less groundwater inflow that may be controlled by localized pumping from sumps.

It is expected that either an Environmental Sector Activity Registration (ESAR) or a Permit to Take Water (PTTW) from the MECP will be needed if groundwater control pumping rates are above 50,000 L/day, in accordance with the provincial regulations. The development of a groundwater management plan is recommended to address how groundwater taking and discharge (volume and quality) will be addressed during construction.

9.3 Construction Below Water Table

The construction of buried services below the water table, particularly in lower hydraulic conductivity soils, has the potential to capture and redirect groundwater flow through permeable fill materials typically placed in the base of excavated trenches. Over the long-term, these impacts can lower the local groundwater table. To mitigate this effect, services to be installed below the water table should use appropriate best management techniques to prevent redirection of groundwater flow (e.g., the use of cut-off collars and/or trench plugs in service trenches).

9.4 Private Water Wells

The proposed development will receive municipal water service. However, surrounding rural properties may still use private water supply wells. Thus, it is important that groundwater control during construction does not adversely affect these local groundwater supplies.

9.5 Well Decommissioning

According to the Ontario Water Resource Act, R.R.O. 1990, Regulation 903 as amended (Wells Regulation), all inactive wells on the Site must be located and properly decommissioned by a licensed water well contractor.

At least 3 monitoring wells are present on the Site. The monitoring wells should be maintained as long as possible for use throughout construction. Once construction is complete, all monitoring wells that are no longer required must be decommissioned in accordance with the Reg. 903 and best management practices.

10.0 References

Canada Department of Agriculture. 1974. The System of Soil Classification for Canada. Queen's Printer, Ottawa, 255p.

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Figures

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Client

THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title

HYDROGEOLOGICAL ASSESSMENT REPORT

SITE LOCATION MAP

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	1
Scale		Project No.	
N.T.S.		300044049.10000	

File: \\elmo\shared work areas\044049 - Ninth Line Mississauga\03_ProductionDwg\Hydrogeology Assessment Report\044049 HGA Report Figures.dwg Date Plotted: February 27, 2020 - 12:31 PM

LEGEND

APPROXIMATE SITE BOUNDARY

MONITORING WELL LOCATION
(By CMT, February 2020)

BOREHOLE LOCATION
(By CMT, February 2020)

A A CROSS SECTION ORIENTATION

Air Photo Source:
Background 2017 Air Photo obtained from Google Earth Professional / DigitalGlobe © Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

N

0 40 80 120 160
Metres

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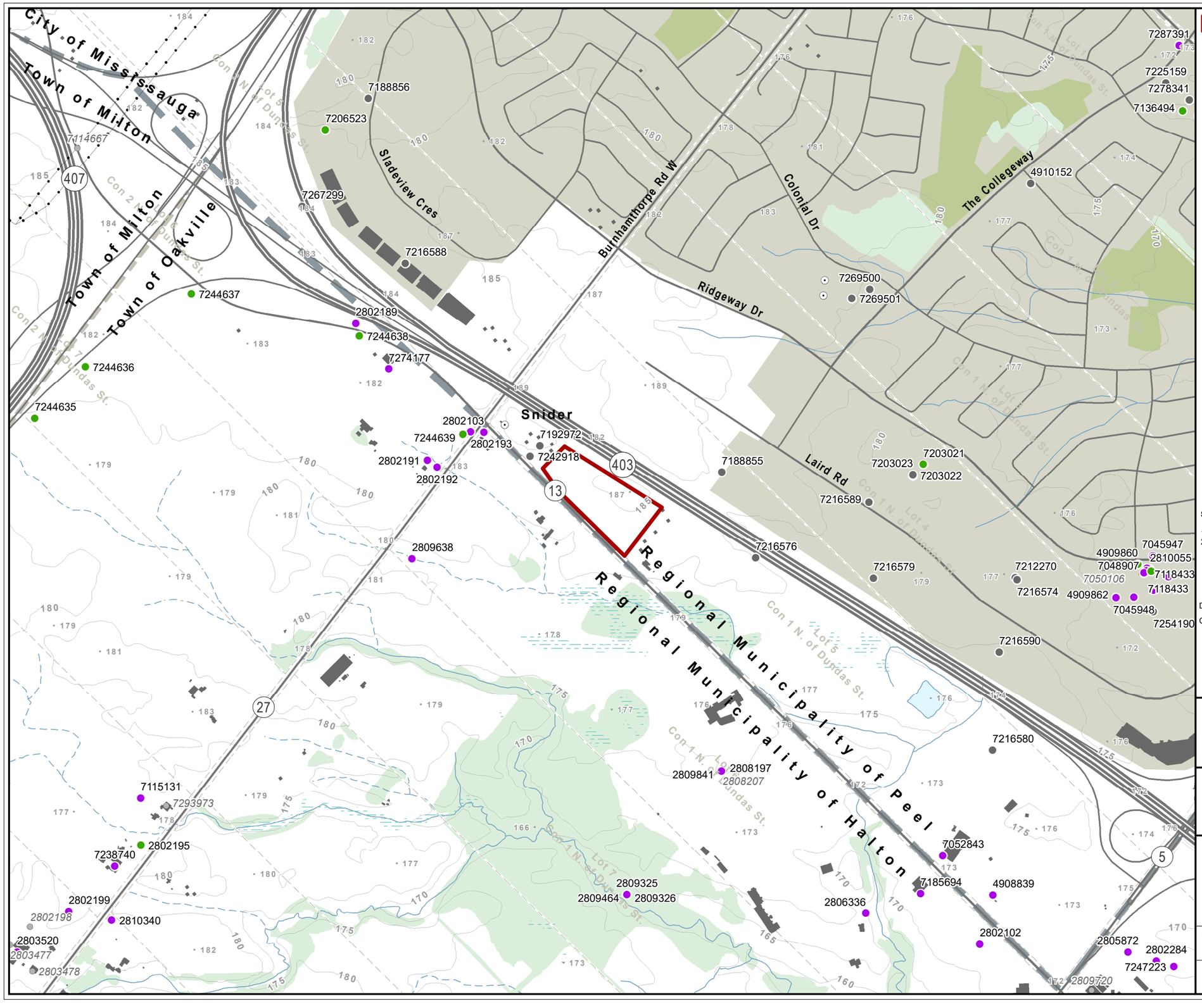
THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title
HYDROGEOLOGICAL ASSESSMENT REPORT
SITE PLAN

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	2
Scale		Project No.	
1:2,000		300044049.10000	

File: \\elmo\shared work areas\044049 - Ninth Line Mississauga\03_Production\Dwg\Hydrogeology Assessment Report\044049 HGA Report Figures.dwg Date Plotted: February 27, 2020 - 12:30 PM



Study Site Property
MECP Bedrock Well Location
MECP Overburden Well Location
MECP Well - Unknown Status/Formation
MECP Abandoned Well Location
Communication or Meteorological Tower; Communication Tower: Cell
Building (Location Defined)
Building
Power Transmission Line
Freeway
Arterial / Collector Road
Local Road
Spot Elevation
Contour
County, Regional Municipality, District Boundary
Municipal Boundary
Geographic Township Boundary
Lot Boundary
Waterbody: Permanent
Wetland
Stream: Permanent
Stream: Intermittent
Wooded Area
Built-Up Area: Impervious
Built-Up Area: Pervious

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Datum: North American 1983 CSRS
Coord. System: NAD 1983 CSRS UTM Zone

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0 200 400 600 800
Metres

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THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title

HYDROGEOLOGICAL ASSESSMENT REPORT

REGIONAL TOPOGRAPHY

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	3
Scale		Project No.	
1:10,000		300044049.1000	

File Path: \\elmolshared work areas\044049 - Ninth Line Mississauga\13_GIS\Hydrogeology Report\044049 HGA Regional Topography.mxd Print Date: 2020/02/27 Time: 12:17 PM

LEGEND

- Study Site Property
- Freeway
- Arterial / Collector Road
- Local Road
- Waterbody
- 3: Paleozoic bedrock
- 5d: Till: Glaciolacustrine-derived silty to clayey till
- 8b: Fine-textured glaciolacustrine deposits: Interbedded flow till, rainout deposits and silt and clay
- 9c: Coarse-textured glaciolacustrine deposits: Foreshore-basinal deposits
- 19: Modern alluvial deposits
- Unit Contact Boundary
- End Moraine
- Moraine (Minor)
- Bedrock Pressure Release Ridge (Pop-up)

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised.

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 17N

N

0 200 400 600 800 1,000 1,200 1,400

Metres

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THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title

HYDROGEOLOGICAL ASSESSMENT REPORT

SURFICIAL GEOLOGY

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	4
Scale		Project No.	
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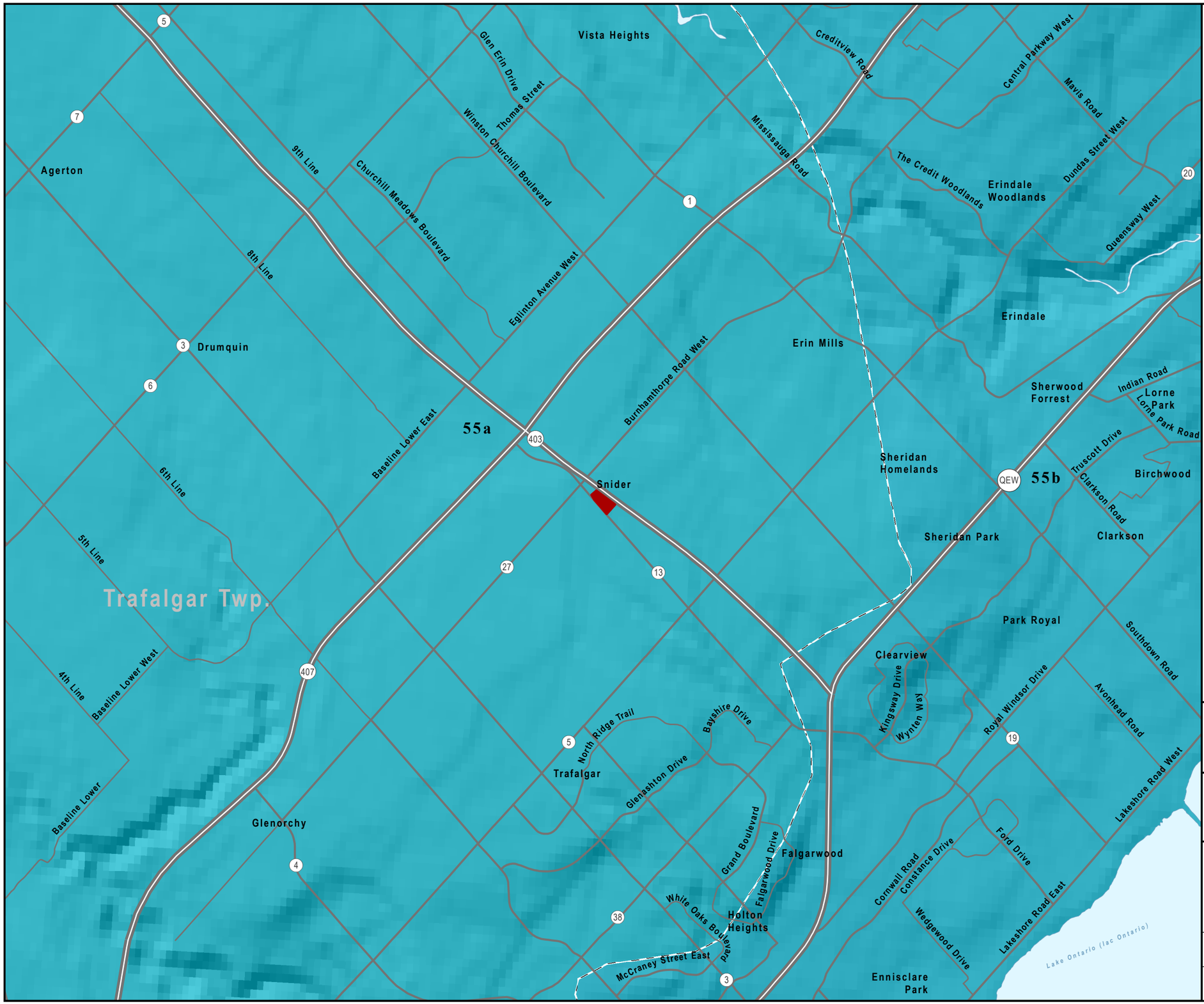
File Path: \\elmo\shared work areas\044049 - Ninth Line Mississauga\13_GIS\Hydrogeology Report\044049 HGA Surficial Geology.mxd Print Date: 2020/02/27 Time: 12:22 PM



LEGEND

- Study Site Property
- Freeway
- Arterial / Collector Road
- Local Road
- Waterbody

UPPER ORDOVICIAN - 55 Shale, limestone, dolostone, siltstone

- 55a Queenston Fm.
- 55b Georgian Bay Fm.; Blue Mountain Fm.; Billings Fm.; Collingwood Mb.; Eastview Mb. MinStr:

Sources:

1. Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1.
2. Ministry of Natural Resources, © Queen's Printer for Ontario
3. Natural Resources Canada © Her Majesty the Queen in Right of Canada

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 18N

N

0 1 2 3 4

Kilometers

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THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title

HYDROGEOLOGICAL ASSESSMENT REPORT

BEDROCK GEOLOGY

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	5
Scale		Project No.	
1:50,000		300044049.1000	

File Path: \\elmo\shared work areas\044049 - Ninth Line Mississauga\13_GIS\Hydrogeology Report\044049 HGA Bedrock Geology.mxd Print Date: 2020/02/27 Time: 12:27 PM

LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL LOCATION (By CMT, February 2020)
- (177.74) GROUNDWATER ELEVATION (masl) (February 13, 2020)
- GROUNDWATER CONTOUR (masl)
- INTERPRETED GROUNDWATER FLOW DIRECTION

Air Photo Source:
Background 2017 Air Photo obtained from Google Earth Professional / DigitalGlobe © Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

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Metres

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THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title
HYDROGEOLOGICAL ASSESSMENT REPORT
GROUNDWATER FLOW DIRECTION

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	6
Scale		Project No.	
1:2,000		300044049.10000	

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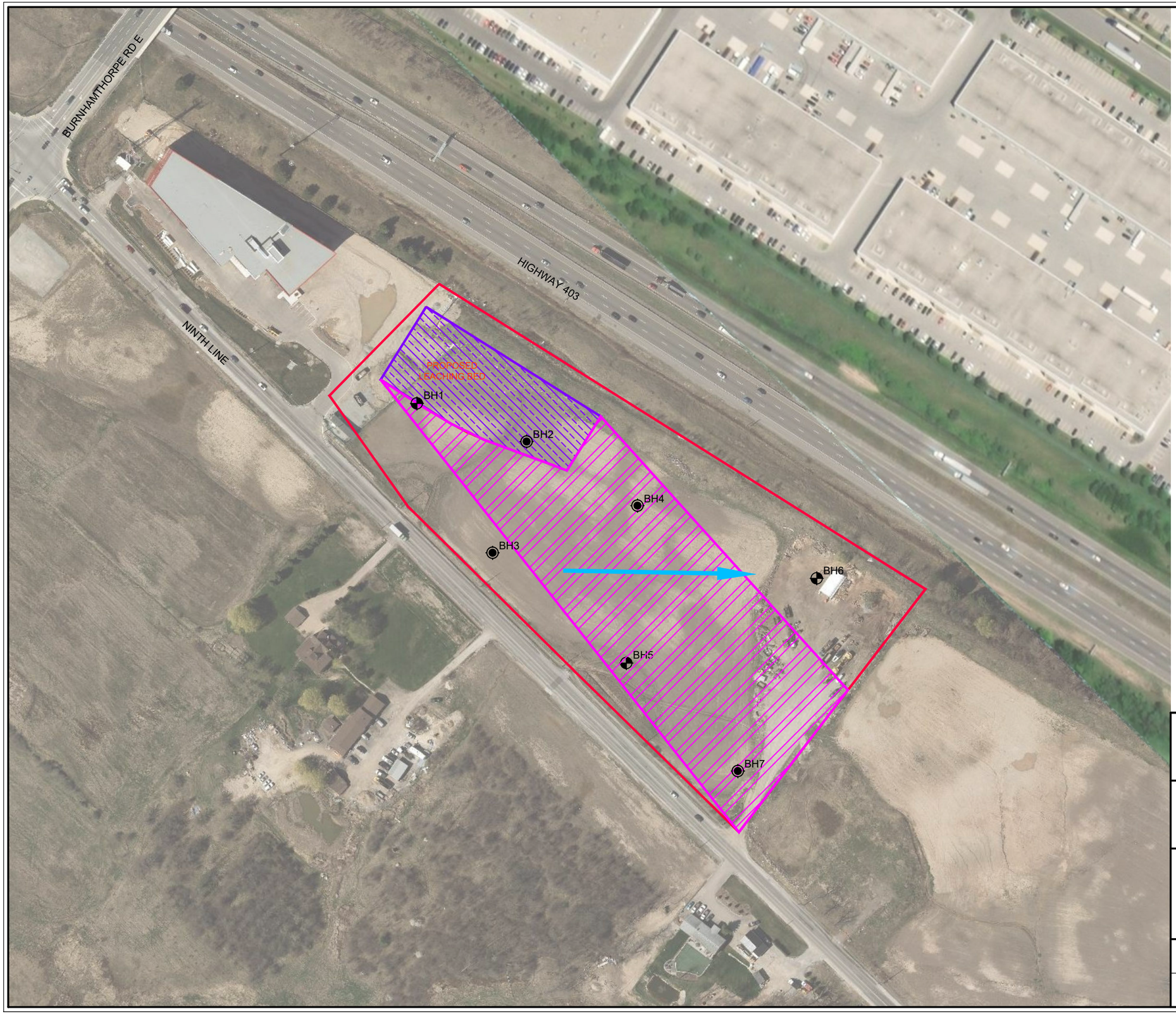

LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL LOCATION (By CMT, February 2020)
- BOREHOLE LOCATION (By CMT, February 2020)
- PROPOSED LEACHING BED LOCATION
- DOWNGRADIENT DILUTION AREA

ATTENUATION AREA SIZES

LEACHING BED SIZE =	4,623m²
DOWGRADIENT DILUTION AREA =	19,090m²
TOTAL ATTENUATION ZONE AREA =	23,713m²

Air Photo Source:
Background 2017 Air Photo obtained from Google Earth Professional / DigitalGlobe © Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

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0 40 80 120 160
Metres

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Client
THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title
HYDROGEOLOGICAL ASSESSMENT REPORT
ATTENUATION ZONE

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	7
Scale		Project No.	
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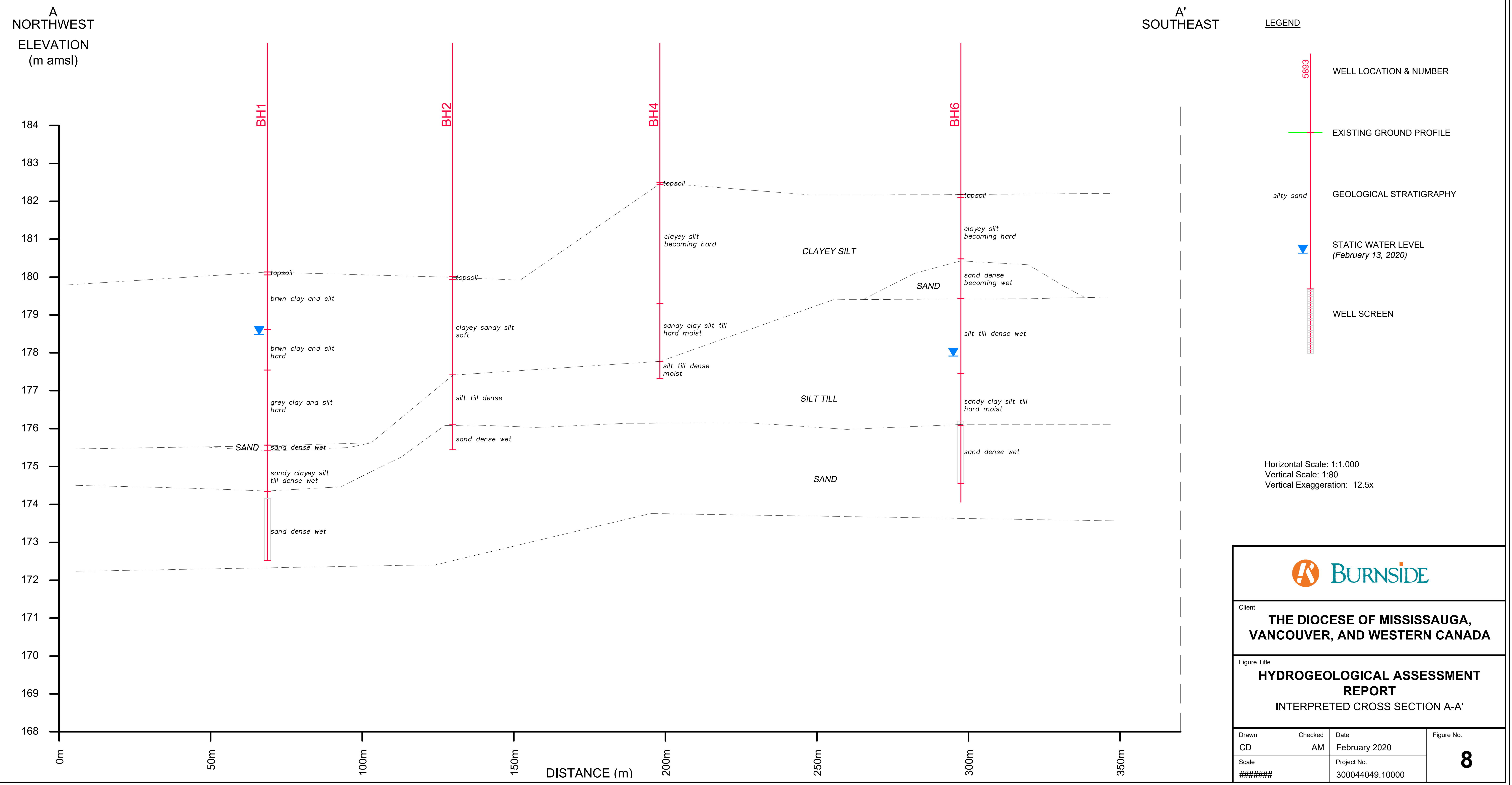

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Client

THE DIOCESE OF MISSISSAUGA, VANCOUVER, AND WESTERN CANADA

Figure Title

HYDROGEOLOGICAL ASSESSMENT REPORT

INTERPRETED CROSS SECTION A-A'

Drawn	Checked	Date	Figure No.
CD	AM	February 2020	8
Scale		Project No.	
########		300044049.10000	

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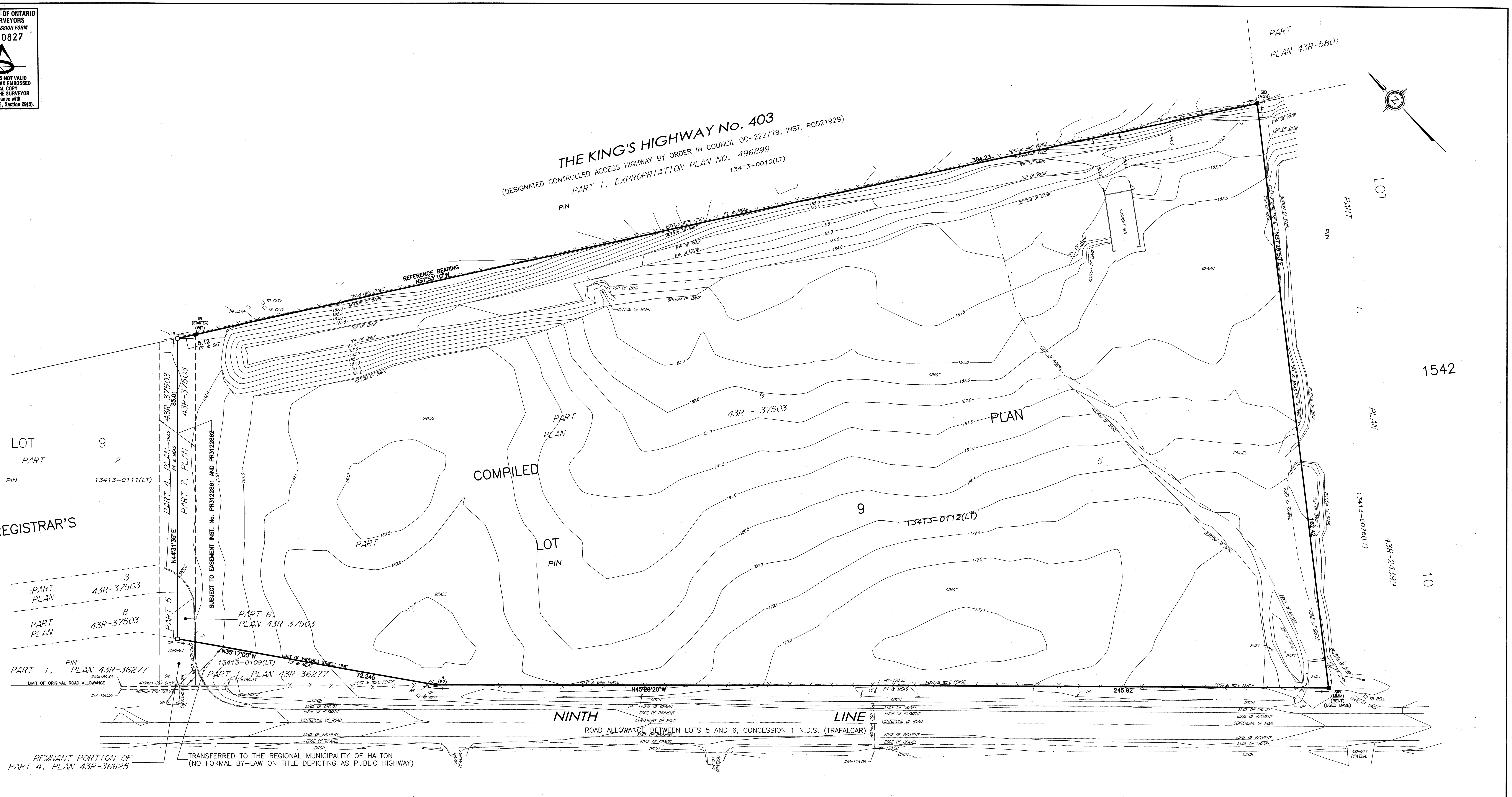
Appendix A

Topographic Survey

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2040827

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29(3).



THE KING'S HIGHWAY No. 403
(DESIGNATED CONTROLLED ACCESS HIGHWAY BY ORDER IN COUNCIL OC-222/79, INST. R0521929)
PART 1, EXPROPRIATION PLAN NO. 496899
13413-0010(LT)
PART 1
PLAN 43R-5801
REFERENCE BEARING N57°53'10"W
304.23
LOT 9
PART 2
PIN 13413-0111(LT)
REGISTRAR'S
COMPILED
PLAN
1542
PART 9 PLAN 43R-37503
PART 5
LOT 9
PIN 13413-0112(LT)
PART 3 PLAN 43R-37503
PART 8 PLAN 43R-37503
PART 6, PLAN 43R-37503
SUBJECT TO EASEMENT INST. No. PR3122861 AND PR3122862
N44°31'35"E
PART 1, PLAN 43R-36277
13413-0109(LT)
N35°17'00"W
72.245
N45°28'20"W
245.92
LOT 10
PART
PIN 13413-0076(LT)
43R-24399
N37°29'50"E
NINTH LINE
ROAD ALLOWANCE BETWEEN LOTS 5 AND 6, CONCESSION 1 N.D.S. (TRAFALGAR)
REMNANT PORTION OF PART 4, PLAN 43R-36625
TRANSFERRED TO THE REGIONAL MUNICIPALITY OF HALTON
(NO FORMAL BY-LAW ON TITLE DEPICTING AS PUBLIC HIGHWAY)
LIMIT OF ORIGINAL ROAD ALLOWANCE
ASPHALT DRIVEWAY

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 7TH DAY OF MAY, 2019.

May 23, 2019
DATE

S. SINNIS
ONTARIO LAND SURVEYOR

LEGEND

■	DENOTES	FOUND MONUMENTS
□	"	SET MONUMENTS
IB	"	IRON BAR
IBø	"	ROUND IRON BAR
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
P1	"	PLAN 43R-37503
P2	"	PLAN 43R-36277
BM	"	BENCHMARK
CM	"	CONCRETE MONUMENT
HCM	"	HORIZONTAL CONTROL MONUMENT
NW	"	NAIL AND WASHER
WIT	"	WITNESS
PIN	"	PROPERTY IDENTIFICATION NUMBER
MEAS	"	MEASURED
PROP	"	PROPORTIONED
OU	"	ORIGIN UNKNOWN
MGS	"	MINISTRY OF GOVERNMENT SERVICES
MMM	"	MARSHALL, MACKLIN & MONAGHAN
STANTEC	"	STANTEC GEOMATICS LTD.

LEGEND

ACU	"	AIR CONDITIONING UNIT
AN	"	ANCHOR
AP	"	AIR PUMP
ANT	"	ANTENNA
BH	"	BOREHOLE
BIB	"	HOSE BIB
BKR	"	BIKE RACK
BENCH	"	BENCH
BOL	"	BOLLARD
BOUL	"	BOULDER
CB	"	CATCH BASIN
DCB	"	DOUBLE CB
CBMH	"	CB MANHOLE
DCBMH	"	DOUBLE CB MANHOLE
SICB	"	SIDE INLET CB
CHM	"	CHIMNEY
CSV	"	CURB STOP VALVE
CO	"	CLEAN OUT
DRN	"	DRAIN
EPOST	"	ELECTRICAL OUTLET
FP	"	FLAG POLE

LEGEND

FL	"	FLOOD LIGHT
FTF	"	FUEL TANK FILLER CAP
GC	"	GARBAGE CAN
GFL	"	PIPE FLANGE (GAS)
GFP	"	GAS FUEL PUMP
GP	"	POLE GUYWIRE
GSR	"	GAS SERVICE REGULATOR
GV	"	GAS VALVE
HIC	"	HICKENBOTTOM
HDS	"	HEADSTONE
HLS	"	HYDRO LIGHT STANDARD
HM	"	HYDRO METER
HTN	"	HYDRO TRANSFORMER
HW	"	HAND WELL
HYD	"	FIRE HYDRANT
JBX	"	JUNCTION BOX
LS	"	LIGHT STANDARD
MB	"	MAILBOX
MH	"	MAINTENANCE HOLE UNIDENTIFIED
MHB	"	MAINTENANCE HOLE BELL
MHF	"	MAINTENANCE HOLE FIBRE OPTIC

LEGEND

MHH	"	MAINTENANCE HOLE HYDRO
MHSA	"	MAINTENANCE HOLE SANITARY
MHST	"	MAINTENANCE HOLE STORM
MHT	"	MAINTENANCE HOLE TRAFFIC
MW	"	MONITORING WELL
NPB	"	NEWS PAPER BOX
OLS	"	LIGHT STANDARD ORNAMENTAL
OW	"	OBSERVATION WELL
PKM	"	PARKING METER
PLBX	"	PULL BOX
PLQ	"	PLAQUE
PLR	"	PILLAR
PZ	"	PIEZIOMETER
RLC	"	RED LIGHT CAMERA
RWSL	"	RAILWAY SIGNAL LIGHT
RWSS	"	RAILWAY SWITCH STAND
SAT	"	SATELLITE DISH
SCLP	"	SCULPTURE
SCP	"	SUMP/CATCH PIT
SCV	"	SPRINKLER CONTROL VALVE
SH	"	SPRINKLER HEAD

LEGEND

SIA	"	SIAMESE CONNECTION
SN	"	SIGN
SPAN	"	SOLAR PANEL
SPT	"	SEPTIC TANK LID
TBL	"	TABLE
TB BELL	"	TERMINAL BOX - BELL
TB CATV	"	TERMINAL BOX - CABLE
TCB	"	TRAFFIC CONTROL BOX
TPIT	"	TEST PIT
TSL	"	TRAFFIC SIGNAL LIGHT
UMB	"	MARKER BELL UNDERGROUND
UMC	"	MARKER CABLE UNDERGROUND
UMG	"	MARKER GAS UNDERGROUND
UMO	"	MARKER OIL UNDERGROUND
UP	"	UTILITY POLE
VB	"	VALVE BOX
VC	"	VALVE CHAMBER
WV	"	WATER VALVE
	"	TREE STUMP
	"	TREE CONIFEROUS (D.B.H. SHOWN)
	"	TREE DECIDUOUS (D.B.H. SHOWN)

Stantec

Stantec Geomatics Ltd.
300W-675 Cochrane Drive
Markham ON
Tel. (905) 944-7777
www.stantec.com

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

BEARING NOTE
BEARINGS ARE GRID AND ARE REFERRED TO THE NORTHERLY LIMIT OF PART 5, AS SHOWN ON PLAN 43R-37503 BEARING OF N57°53'10"W.

VERTICAL DATUM NOTE
ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928: PRE 1978) AND ARE DERIVED FROM CITY OF MISSISSAUGA BENCHMARK MONUMENT No. 1065, HAVING A PUBLISHED ELEVATION OF 178.912 METRES.

HORIZONTAL DATUM NOTE
PROJECTION: UNIVERSAL TRANSVERSE MERCATOR (UTM, ZONE 17, CM81°00'W)
DATUM: NAD 83 (CSRS)(2010.0)

THIS PLAN MAY BE CONVERTED TO GROUND BY DIVIDING BY A COMBINED SCALE FACTOR OF 0.999710.

TOPOGRAPHIC PLAN OF SURVEY OF **PART OF LOT 9 REGISTRAR'S COMPILED PLAN 1542**

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

Scale 1:500
10 0 10 20 30 METRES

Stantec Geomatics Ltd.
ONTARIO LAND SURVEYORS

REVISED: May 23, 2019 - ADDITIONAL TOPO/ MONUMENTS SET
DRAWN: BDC DATE: FEBRUARY 28, 2019 PROJECT No.: 161670138

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Appendix B

MECP Water Well Records

Water Well Records

Monday, March 02, 2020
9:17:02 AM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
MILTON TOWN (TRAFALG DS N 02 006	17 603518 4819727 W	2016/09 2604	6.5 6.25 4	FR 0067	12//9/1:	PS DO	0068 3	7274177 (Z222743) A178049	GREY CLAY STNS 0066 GREY STNS CLAY 0068 RED SHLE 0071
MISSISSAUGA CITY (TR	17 603892 4819496 W	2015/05 7215						7242918 (C29378) A126287 P	
MISSISSAUGA CITY (TR	17 604489 4819228 W	2013/08 6607						7216576 (C22120) A146804 P	
MISSISSAUGA CITY (TR	17 603918 4819524 W	2012/06 6607						7192972 (C18006) A126287 P	
MISSISSAUGA CITY (TR	17 604399 4819454 W	2012/06 7215						7188855 (C18431) A126349 P	
OAKVILLE TOWN	17 603714 4819554 W	2015/06 7472	2.04			MO	0010 10	7244639 (Z214693) A188222	GREY FSND SILT LOOS 0010 GREY MSND SILT DNSE 0020
OAKVILLE TOWN DS N 01 006	17 603579 4819225 W	2002/09 4868	8 8	FR 0081 FR 0114	13/104/5/1:0	CO		2809638 (207072)	BRWN LOAM 0001 BRWN CLAY STNS HARD 0022 GREY CLAY SHLE HARD 0036 RED SHLE CLAY 0044 RED SHLE LMSN HARD 0121
OAKVILLE TOWN DS N 01 006	17 603770 4819559 W	1967/07 3414	6 6	FR 0078	5/70/2/3:0	DO		2802103 ()	CLAY SILT BLDR 0012 BLDR CLAY 0069 RED SHLE 0078
OAKVILLE TOWN DS N 02 006	17 603735 4819561 W	1964/11 4602	6 6	FR 0031 FR 0054 FR 0068	18/75/1/1:30	DO		2802193 ()	YLLW CLAY 0014 GREY CLAY BLDR 0048 RED MSND CLAY 0054 GREN QSND 0065 RED SHLE 0075
OAKVILLE TOWN DS N 02 006	17 603646 4819467 W	1959/05 4602	6	FR 0051	14/53/2/2:0	DO		2802192 ()	BRWN CLAY 0018 GREY CLAY 0048 RED SHLE 0053
OAKVILLE TOWN DS N 02 006	17 603621 4819485 W	1955/10 2415	6 6	FR 0046	11/60/1/1:0	DO		2802191 ()	BLUE CLAY 0006 RED SHLE 0060

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

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

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

1. Core Material and Descriptive terms

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

2. Core Color

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

3. Well Use

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

4. Water Detail

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

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Appendix C

Borehole Logs

BOREHOLE 1

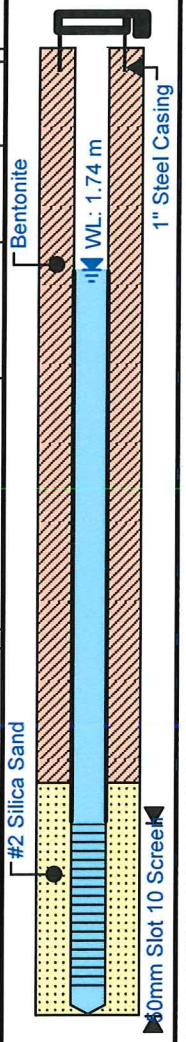
Date Drilled: February 10, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 179.66 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation	Depth	Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 200 300 400 / SPT (N) Blows/0.3 m 20 40 60 80
					Ground Surface (m)	179.66	0.00			
0	SS		1		**TOPSOIL** Loose, dark brown, silty organic topsoil, moist (100mm)	178.90	0.76		15.6	6
1	SS		2		**CLAY AND SILT** Firm, brown, red and grey mottled clay and silt, some sand, trace gravel, moist	178.14	1.52		12.9	26
2	SS		3		Becoming very stiff, brown Becoming hard				14.0	37
3	SS		4		Becoming grey	177.07	2.59		11.1	62
4	SS		5						11.7	41
5	MC5		6						10.4	
6	SS		7		**SAND** Dense, grey sand, some gravel, trace silt, wet	175.09	4.57		20.9	36
7	MC5		8		**SANDY CLAYEY SILT TILL** Dense, grey sandy clayey silt till, trace gravel, wet	173.87	5.79		10.2	
8	MC5		9		**SAND** Dense, grey sand, some silt, trace clay and gravel, wet				13.8	
9									16.9	
					End of Borehole	172.04	7.62			

Groundwater measured at approximately 1.74 m below ground surface (elev. 177.92 m) on Feb. 12, 2020



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BOREHOLE 2

Date Drilled: February 12, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 179.52 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation / Depth	Well Installation	Moisture Content % (Wp [----X----] Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 200 300 400) / SPT (N) Blows/0.3 m (20 40 60 80)
					Ground Surface (m)	179.52			
0					***TOPSOIL*** Loose, dark brown, silty organic topsoil, moist (100mm)	0.00			
1	SS		1					29.9	1
2					***CLAYEY SANDY SILT*** Very soft, dark brown clayey, sandy silt, trace gravel, with trace organics and rootlets, moist	178.76 0.76			
3	SS		2					18.3	11
4									
5					Becoming stiff, brown, with no organics and rootlets	178.00 1.52			
6	SS		3					11.0	36
7					Becoming hard				
8	SS		4					11.3	50(3")
9						176.93 2.59		7.7	
10					***SILT TILL*** Very dense, grey silt till, some sand and clay, moist				
11	SS		5					8.5	50(4")
12									
13	MC	5	6			175.61 3.91		10.6	
14					***SAND*** Very dense, grey sand, some silt, trace clay and gravel, wet			20.2	
15						174.95 4.57			
16					End of Borehole				
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									

Borehole caved at about 3.05 m below ground surface.

Accumulated groundwater encountered at approximately 2.74 m below ground surface in open borehole.

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BOREHOLE 3

Date Drilled: February 12, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 180.13 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation / Depth	Well Installation	Moisture Content % Wp [----X----] Wl	Pocket Penetrometer kPa	SPT (N) Blows/0.3 m
					Ground Surface (m)	180.13				
0	SS		1		**TOPSOIL** Loose, dark brown, silty organic topsoil, moist (90mm)	0.00		26.1	3	
1	SS		2		**CLAYEY SILT** Soft, brown and dark brown mottled clayey silt, some sand, trace gravel, organics and rootlets, moist	179.37 0.76		13.3		30
2	SS		3		Becoming very stiff, brown, no organics and rootlets Becoming hard	178.61 1.52		13.7		35
3	SS		4					10.8		54
	SS		5					12.8		50(6")
4	MC		6		**SILT TILL** Very dense, light brown silt till, some clay and sand, moist	176.52 3.61		14.5		
								12.9		
5	SS		7		**SANDY CLAYEY SILT TILL** Hard, grey sandy clayey silt till, trace gravel, moist	175.46 4.67		10.2		36
					End of Borehole	174.95 5.18				
6										
7										
8										

Borehole caved at about 5.03 m below ground surface.

Accumulated groundwater encountered at approximately 4.72 m below ground surface in open borehole.

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BOREHOLE 4

Date Drilled: February 12, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 182.49 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation / Depth	Well Installation	Moisture Content % Wp [----X----] Wl (10 20 30 40)	Pocket Penetrometer kPa (100 200 300 400) / SPT (N) Blows/0.3 m (20 40 60 80)
					Ground Surface (m)	182.49			
0	SS		1		**TOPSOIL** Loose, dark brown, silty organic topsoil, moist (100mm)	0.00		23.9	3
						181.73			
1	SS		2		**CLAYEY SILT** Soft, brown and dark brown mottled clayey silt, some sand, trace gravel, organics and rootlets, moist	0.76		14.4	30
2	SS		3		Becoming very stiff, brown, no organics and rootlets			13.3	28
						180.20			
	SS		4		Becoming hard	2.29		12.3	45
3						179.29			
	SS		5		**SANDY CLAYEY SILT TILL** Very dense, brown sandy clayey silt till, trace gravel, moist	3.20		11.0	50(4")
						178.68			
4	MC		6		Becoming grey	3.81		12.0	
								10.0	
						177.77			
	SS		7		**SILT TILL** Dense, grey silt till, some sand and clay, moist	4.72		13.3	41
5						177.31			
						5.18			
					End of Borehole				
6									
7									
8									

Borehole caved at about 4.67 m below ground surface.

No accumulated groundwater encountered in open borehole.

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BOREHOLE 5

Date Drilled: February 10, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 177.84 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation	Depth	Well Installation	Moisture Content % Wp [----X----] Wl	Pocket Penetrometer kPa	SPT (N) Blows/0.3 m
					Ground Surface (m)	177.84	0.00	0.15 m Vent			
0	SS		1		**TOPSOIL** Loose, dark brown, silty organic topsoil, moist (120mm)	177.08	0.76	1" Steel Casing	25.3	3	
1	SS		2		**CLAYEY SILT** Firm, brown, red, and grey mottled clayey silt, some sand and gravel, moist			Bentonite	12.3		28
2	SS		3		Becoming very stiff, brown	176.32	1.52		11.0		50(3")
					Becoming hard						
3	SS		4		Becoming grey	175.25	2.59		8.5		57
	SS		5						10.5		59
4	MC	5	6		**SANDY CLAYEY SILT TILL** Very dense, grey sandy clayey silt till, some gravel, wet	174.28	3.56		12.9		
									12.1		
5	SS		7		**SILT TILL** Very dense, grey silt till, some sand and clay, trace gravel, moist	173.27	4.57		7.6		50(5")
	MC	5	8		Becoming wet	172.66	5.18	#3 Silca Sand			
6						171.74	6.10	50mm Slot 10 Screen	24.4		
					End of Borehole						
7											
8											
9											

Groundwater measured at approximately 0.15 m below ground surface (elev. 177.69 m) on Feb. 12, 2020.

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BOREHOLE 6

Date Drilled: February 10, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 181.68 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation	Depth	Well Installation	Moisture Content % Wp [----X----] Wl (10 20 30 40)	Pocket Penetrometer kPa (100 200 300 400)	SPT (N) Blows/0.3 m (20 40 60 80)
					Ground Surface (m)	181.68	0.00				
0	SS		1		**TOPSOIL** Loose, dark brown, silty organic topsoil, moist (80mm)	180.92	0.76		15.7	4	
1	SS		2		**CLAYEY SILT** Firm, brown, red, and grey mottled clayey silt, some sand and gravel, moist				12.5		32
2	SS		3		Becoming hard, brown	179.98	1.70	Bentonite	10.0		50(5")
					SAND Very dense, brown sand, trace silt and gravel, moist	179.39	2.29		19.0		44
3	SS		4		Becoming wet, some silt	178.94	2.74		18.5		54
	SS		5		**SILT TILL** Dense, brown silt till, some sand and clay, wet				19.5		
4	MC5		6					WL: 4.27 m	10.6		
	SS		7		**SANDY CLAYEY SILT TILL** Hard, grey sandy clayey silt till, trace gravel, moist	176.96	4.72		9.4		50(5")
5	MC5		8					#2 Silica Sand	9.4		
6	MC5		9		**SAND** Very dense, grey sand, some silt, trace clay and gravel, wet	175.58	6.10	1" Steel Casing	19.3		
						174.06	7.62	10mm Slot 10 Screen			
7					End of Borehole						
8											
9											

Groundwater measured at approximately 4.27 m below ground surface (elev. 177.41 m) oin Feb. 12, 2020.

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BOREHOLE 7

Date Drilled: February 12, 2020
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 179.02 m
Logged by: SW

Project No.: 20-026
Project: Geotech - Proposed Church
Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation / Depth	Well Installation	Moisture Content % (Wp [----X----] Wl)	Pocket Penetrometer kPa / SPT (N) Blows/0.3 m
					Ground Surface (m)	179.02			
0	SS		1		**TOPSOIL** Loose, dark brown, silty organic topsoil, moist (50mm)	0.00		16.4	7
1	SS		2		**CLAYEY SILT** Soft to firm, brown and dark brown mottled clayey silt, some sand, trace gravel, organics and rootlets, moist	178.26 / 0.76		12.8	26
2	SS		3		Becoming very stiff, brown, no organics and rootlets	177.29 / 1.73		11.6	36
	SS		4		Becoming hard, red			11.1	56
3	SS		5		**SILT TILL** Dense, grey silt till, some sand and clay, moist	175.97 / 3.05		8.4	48
4	MC	5	6					8.8	
	SS		7					9.0	28
5					End of Borehole	173.84 / 5.18			

Borehole open to termination.

No accumulated groundwater encountered in open borehole.

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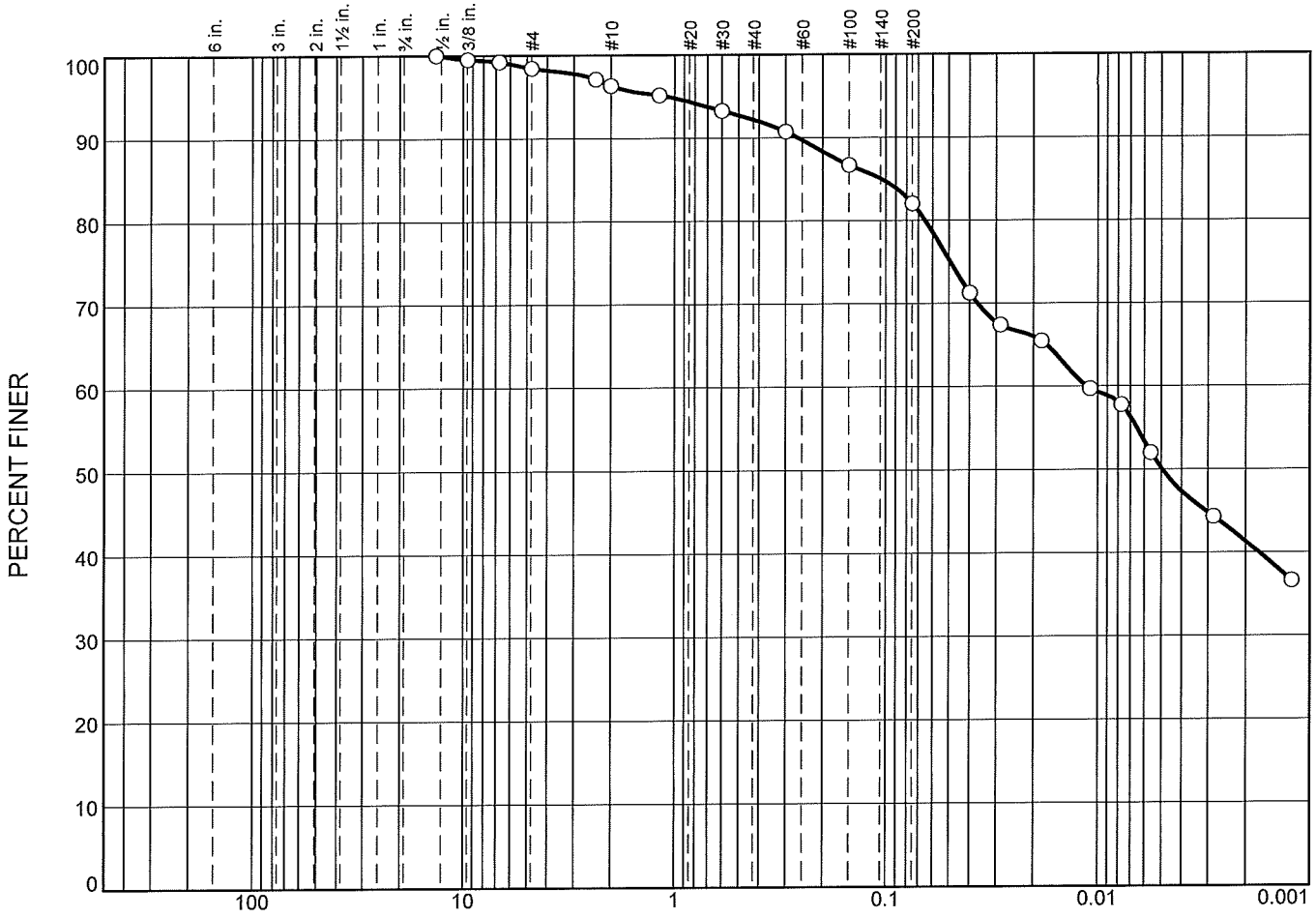
Appendix D

Grain Size Analysis

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.6	2.1	4.1	10.1	40.8	41.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH1	2	0.76-1.37m	clay and silt, some sand, trace gravel	ML
				Estimated Percolation Rate: T >50 min/cm	
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

CMT Engineering Inc.

St. Clements, ON

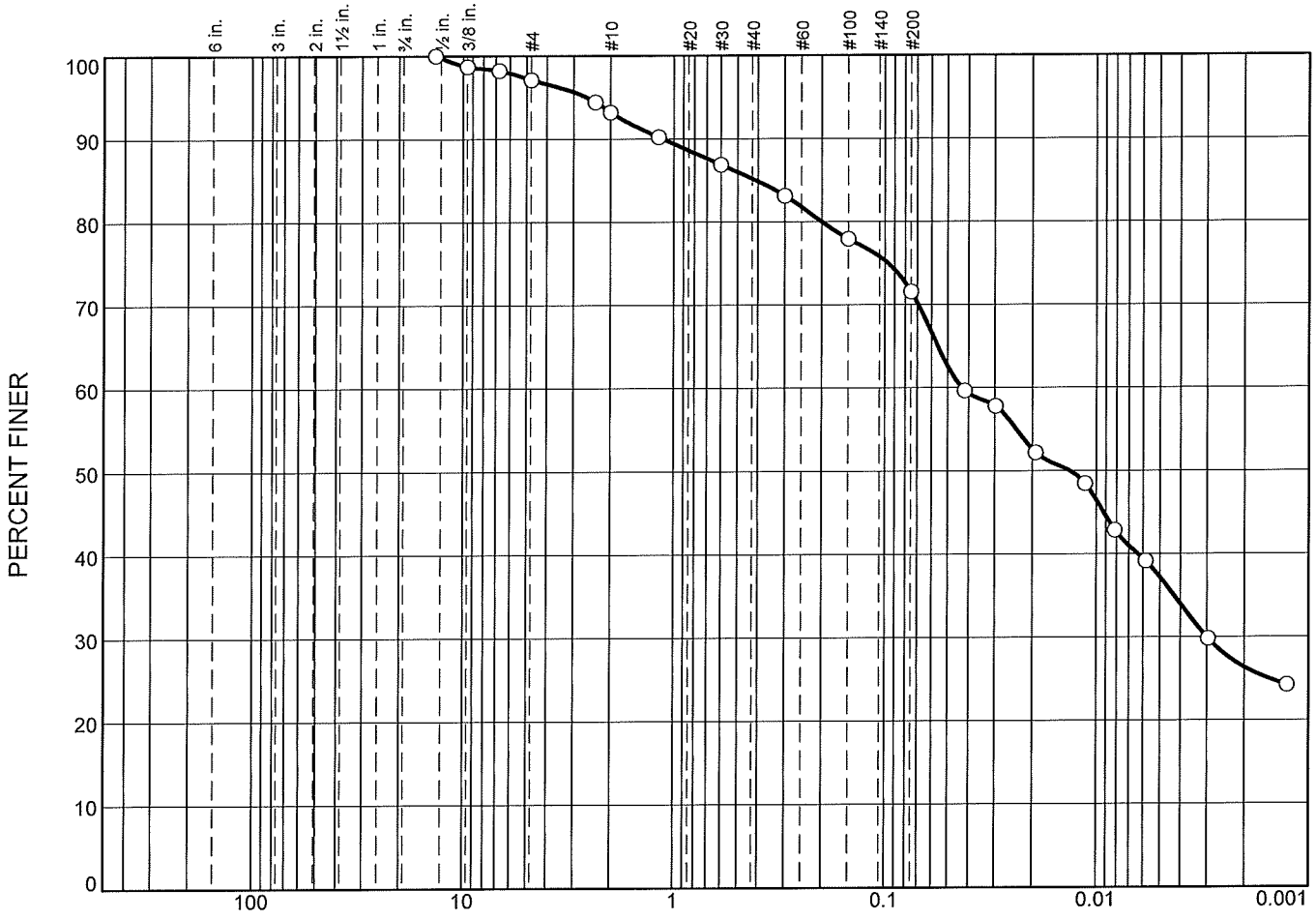
Client: Moheb Michael

Project: Ninth Line
Mississauga, Ontario

Project No.: 20-026

Figure 1

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.9	3.9	8.0	13.6	45.2	26.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH2	3	1.52-2.13m	clayey, sandy silt, trace gravel	ML
				Estimated Percolation Rate: T = 50 min/cm	
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

CMT Engineering Inc.

St. Clements, ON

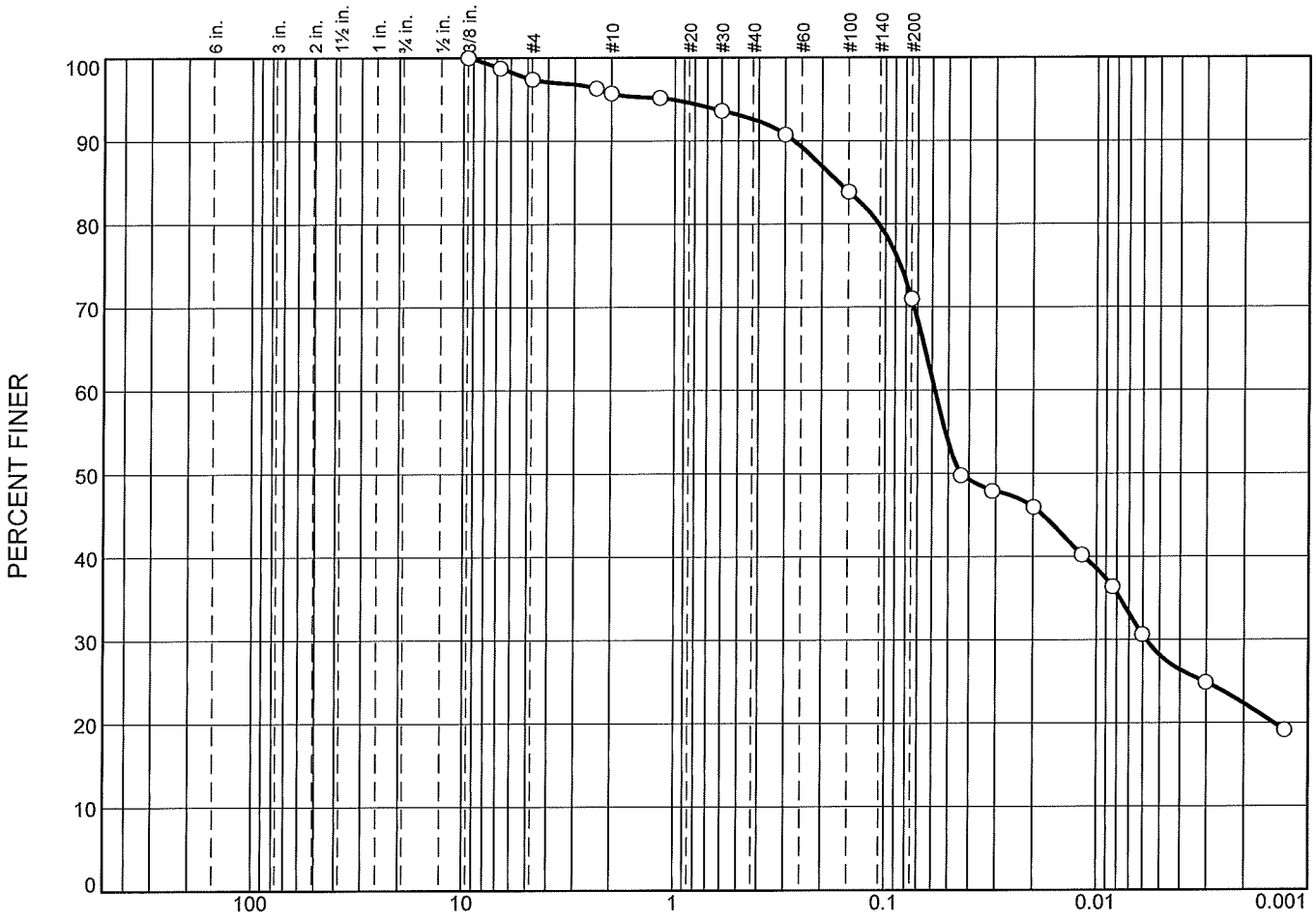
Client: Moheb Michael

Project: Ninth Line
Mississauga, Ontario

Project No.: 20-026

Figure 2

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.6	1.7	3.1	21.6	48.7	22.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH4	6	3.66-4.57m	sandy, clayey silt, trace gravel	ML
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

CMT Engineering Inc.

St. Clements, ON

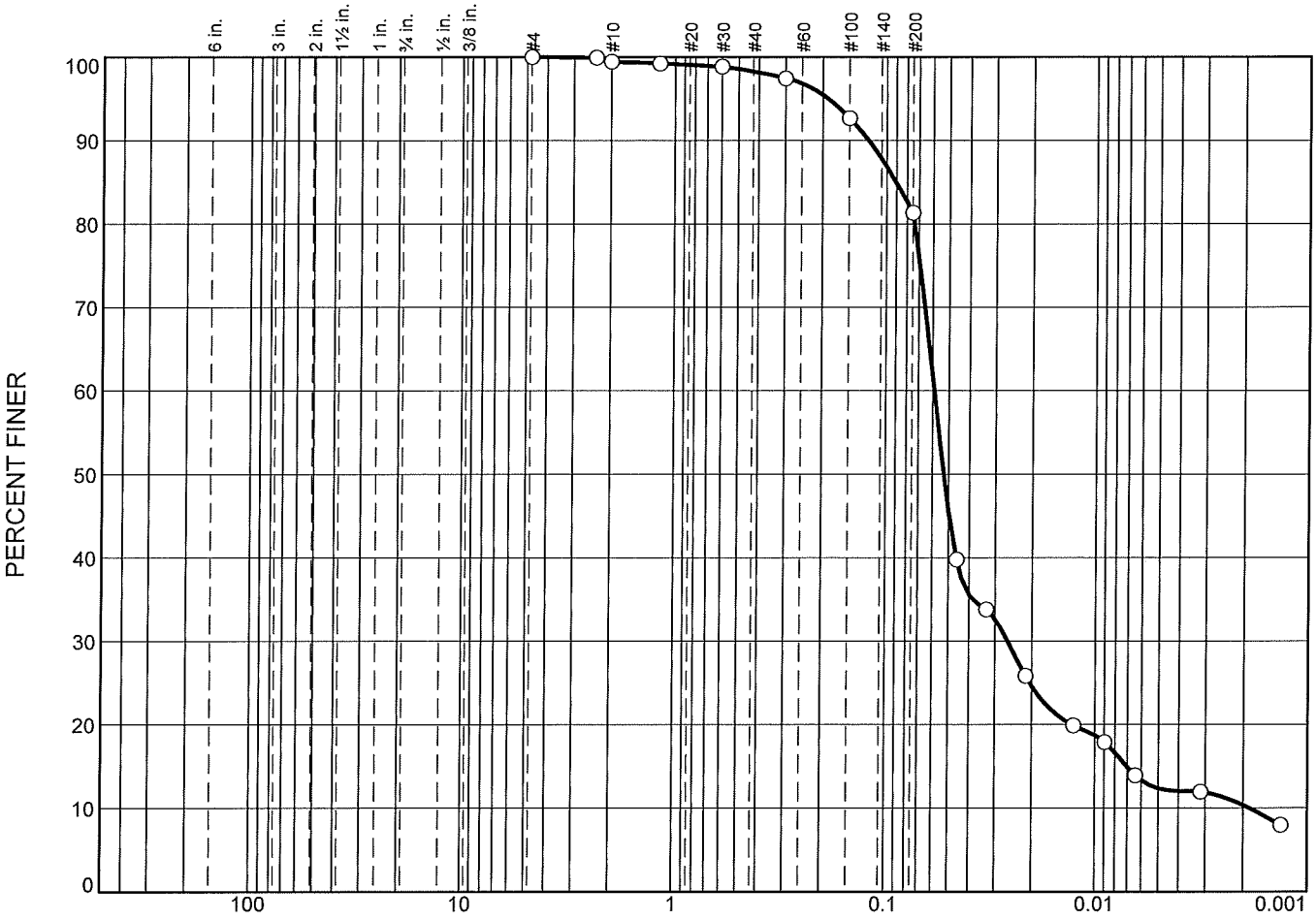
Client: Moheb Michael

Project: Ninth Line
Mississauga, Ontario

Project No.: 20-026

Figure 3

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.6	1.1	17.0	70.9	10.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH6	5	3.05-3.66m	silt, some sand and clay	ML
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

CMT Engineering Inc.

St. Clements, ON

Client: Moheb Michael

Project: Ninth Line
Mississauga, Ontario

Project No.: 20-026

Figure 4

BURNSIDE

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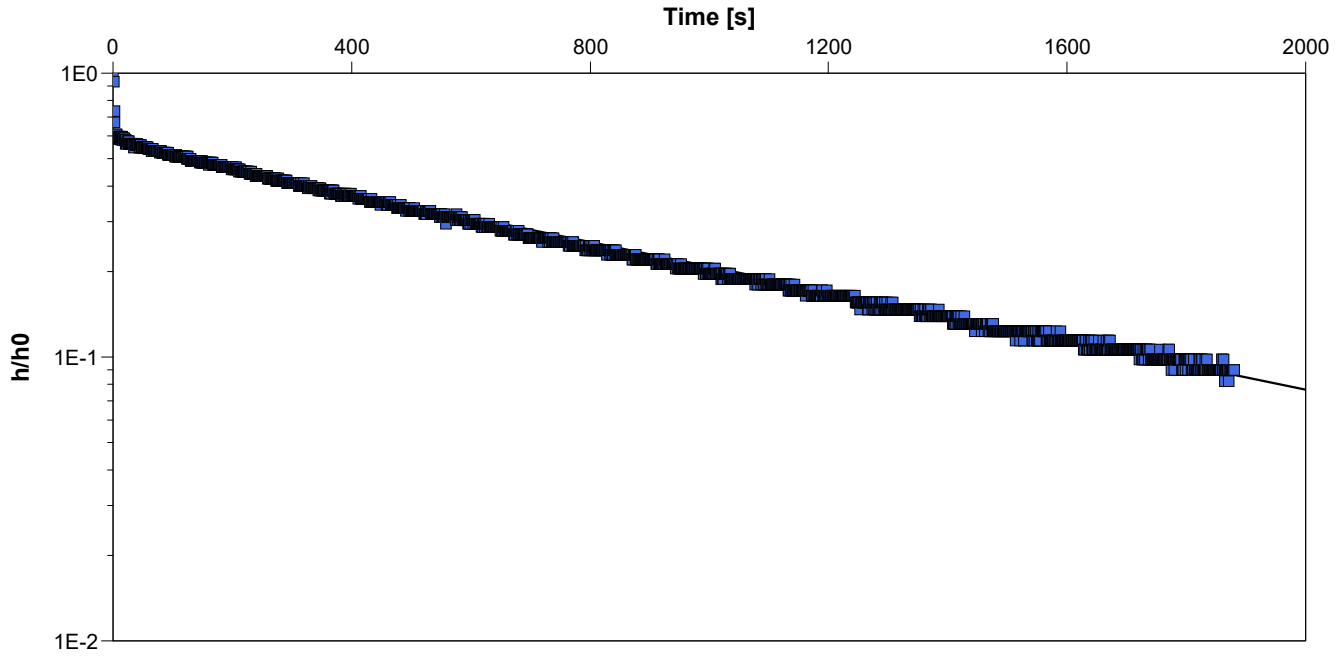
Appendix E

Hydraulic Conductivity Analysis

BURNSIDE	**Slug Test Analysis Report**
	Project: Ninth Line Mississauga
	Number: 300044049
	Client:

Location: Mississauga, Ontario	Slug Test: Falling Head	Test Well: MW1
Test Conducted by: Matt Valeriote		Test Date: 2/14/2020
Analysis Performed by: MV	Hvorslev	Analysis Date: 2/24/2020
Aquifer Thickness:		

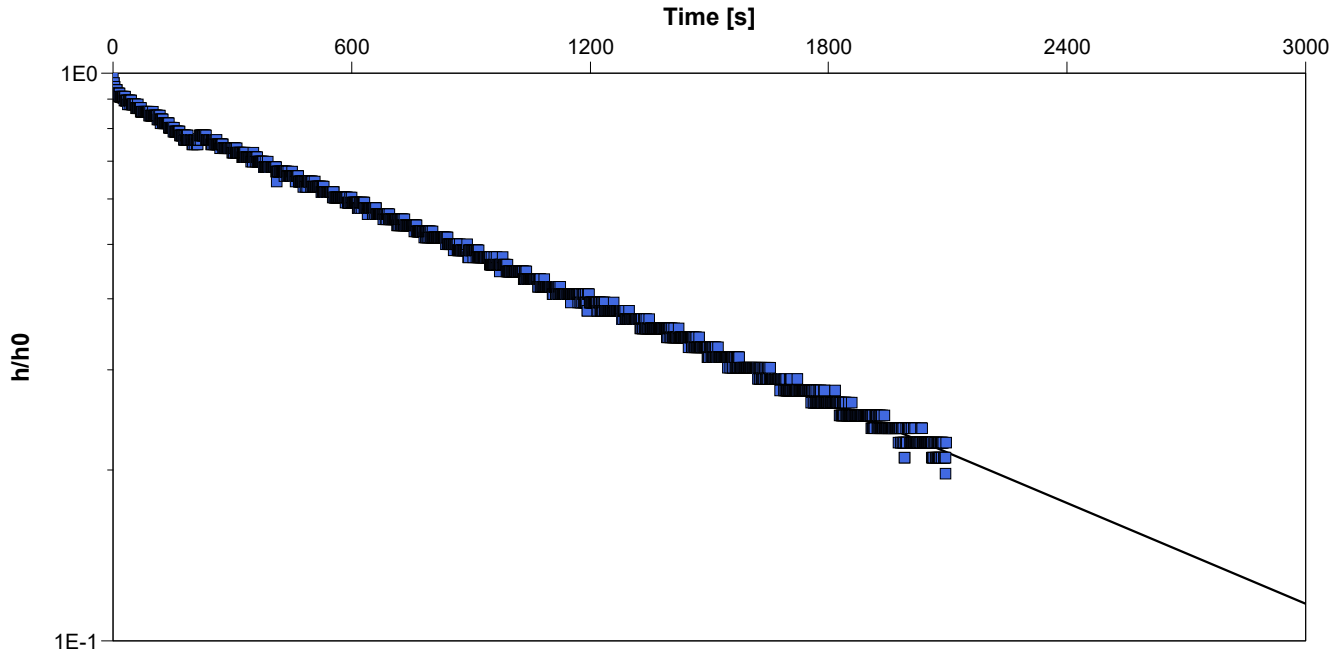


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW1	8.46×10^{-7}	

BURNSIDE	**Slug Test Analysis Report**
	Project: Ninth Line Mississauga
	Number: 300044049
	Client:

Location: Mississauga, Onatrio	Slug Test: Rising Head	Test Well: MW1
Test Conducted by: Matt Valeriote		Test Date: 2/14/2020
Analysis Performed by: MV	Hvorslev	Analysis Date: 2/24/2020
Aquifer Thickness:		

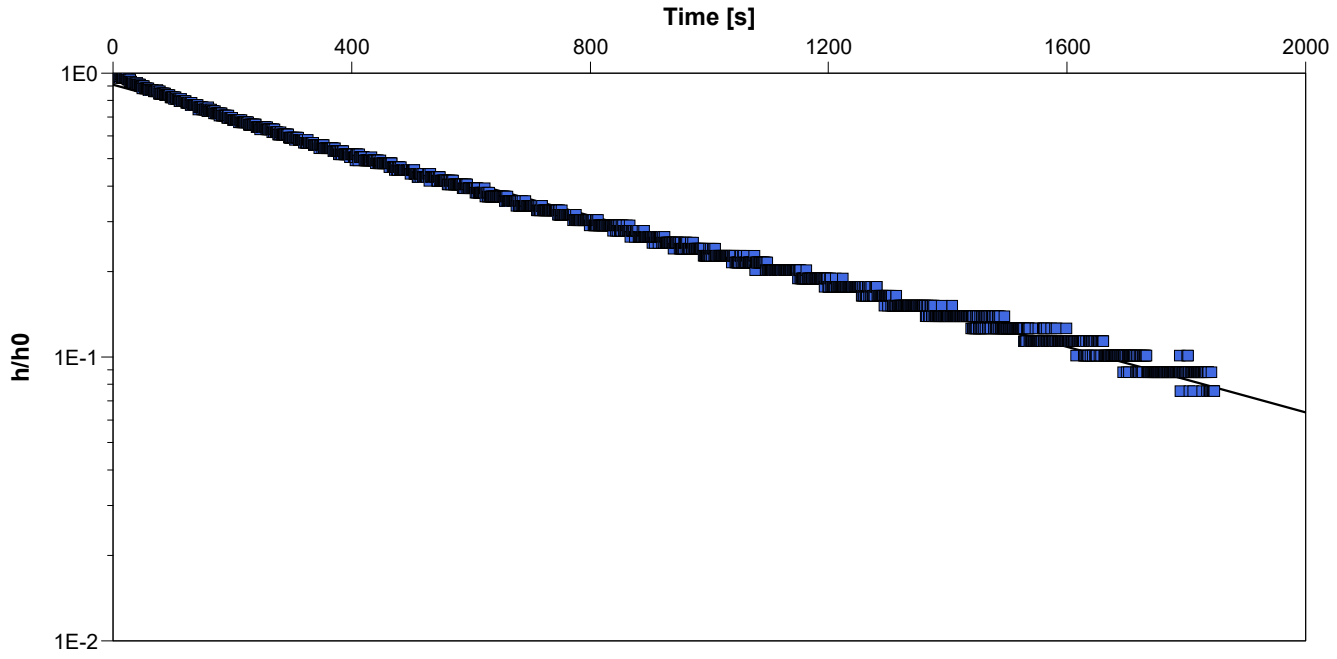


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW1	5.77×10^{-7}	

BURNSIDE	**Slug Test Analysis Report**
	Project: Ninth Line Mississauga
	Number: 300044049
	Client:

Location: Mississauga, Ontario	Slug Test: Falling Head	Test Well: MW2
Test Conducted by: Matt Valeriote		Test Date: 2/14/2020
Analysis Performed by: MV	Hvorslev	Analysis Date: 2/24/2020
Aquifer Thickness:		

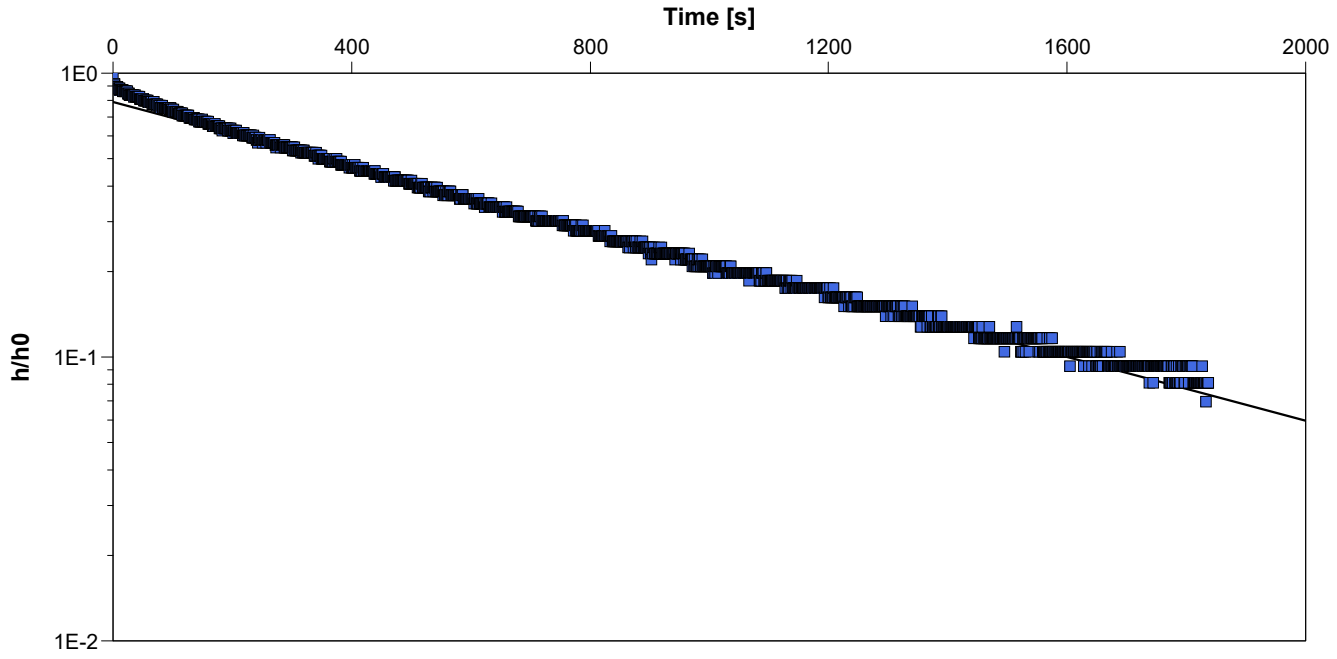


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW2	1.13×10^{-6}	

BURNSIDE	**Slug Test Analysis Report**
	Project: Ninth Line Mississauga
	Number: 300044049
	Client:

Location: Mississauga, Ontario	Slug Test: Rising Head	Test Well: MW2
Test Conducted by: Matt Valeriote		Test Date: 2/14/2020
Analysis Performed by: MV	Hvorslev	Analysis Date: 2/24/2020
Aquifer Thickness:		

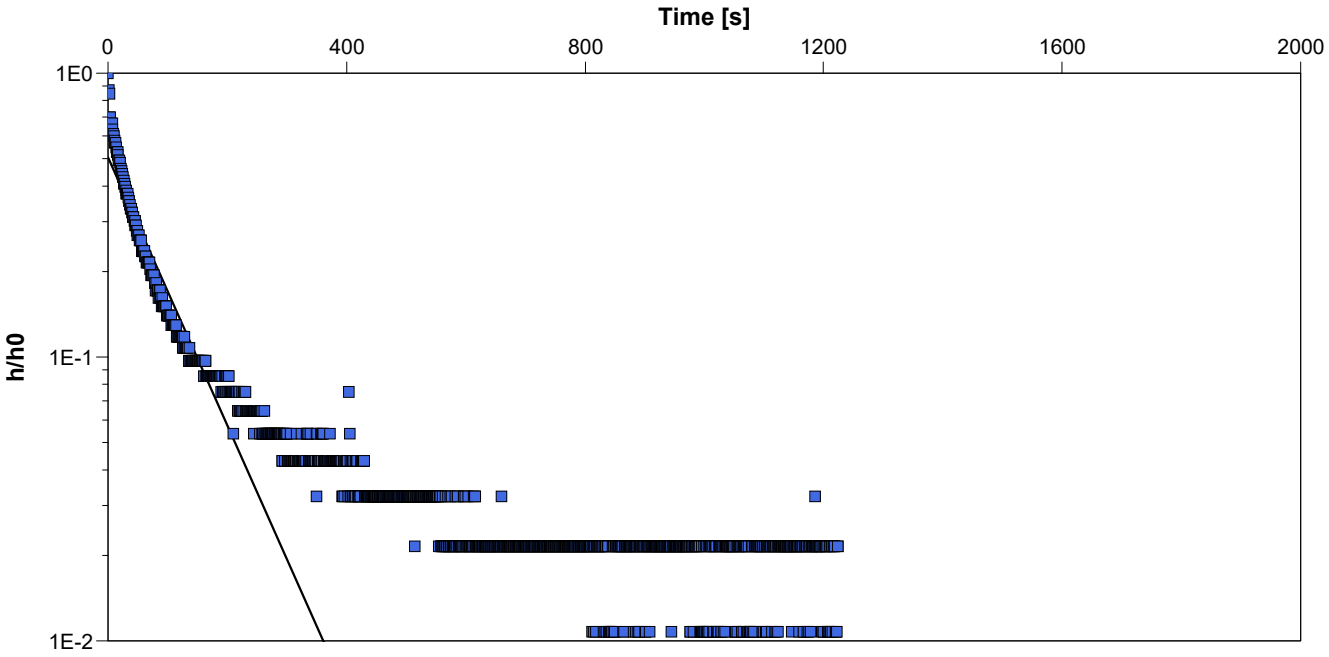


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW2	1.10×10^{-6}	

BURNSIDE	**Slug Test Analysis Report**
	Project: Ninth Line Mississauga
	Number: 300044049
	Client:

Location: Mississauga, Ontario	Slug Test: Falling Head	Test Well: MW3
Test Conducted by: Matt Valeriote		Test Date: 2/14/2020
Analysis Performed by: MV	Hvorslev	Analysis Date: 2/24/2020
Aquifer Thickness:		

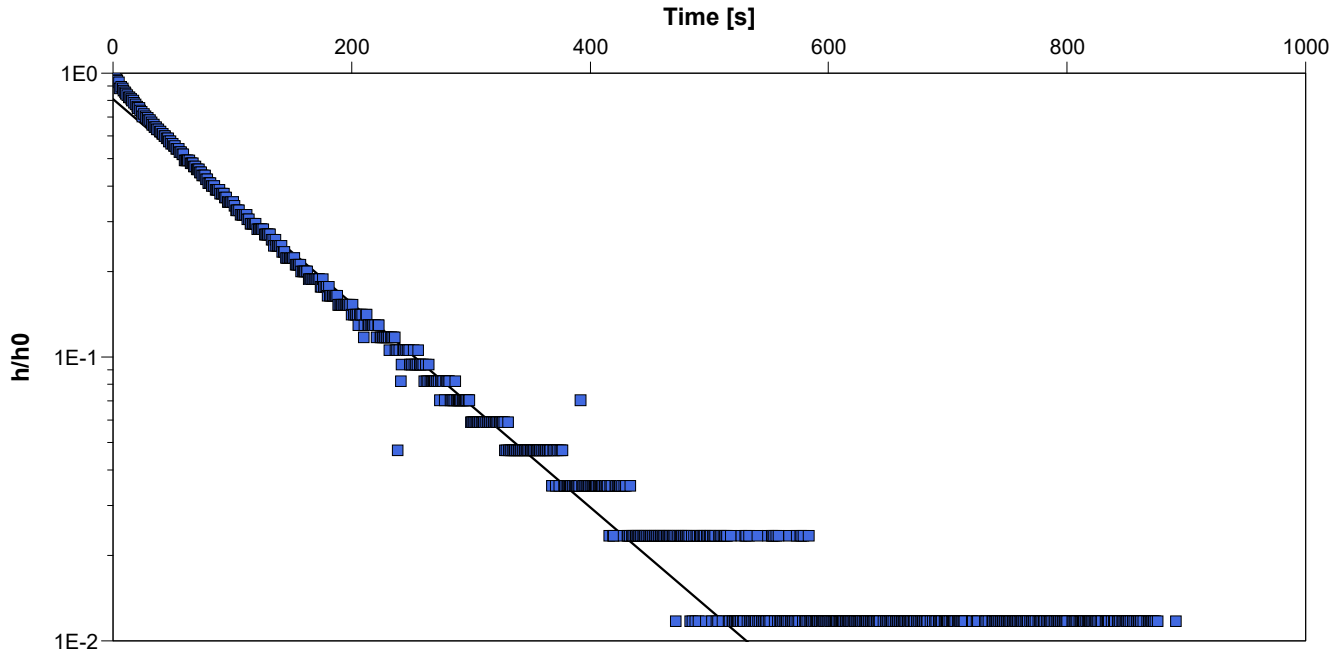


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW3	9.21×10^{-6}	

BURNSIDE	**Slug Test Analysis Report**
	Project: Ninth Line Mississauga
	Number: 300044049
	Client:

Location: Mississauga, Ontario	Slug Test: Rising Head	Test Well: MW3
Test Conducted by: Matt Valeriote		Test Date: 2/14/2020
Analysis Performed by: MV	Hvorslev	Analysis Date: 2/24/2020
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW3	7.02×10^{-6}	

BURNSIDE

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Appendix F

Groundwater Quality Results

Table E-1
Groundwater Analytical Results

			Location	**MW1**	**MW2**	**MW3**
			Matrix	Groundwater	Groundwater	Groundwater
			Sampling Date	Feb 13, 2020	Feb 13, 2020	Feb 13, 2020
			Sampling Time	10:15 AM	11:20 AM	12:05 PM
Parameter	***ODWS***	***RDL***	***Units***	***Result***	***Result***	***Result***
Anion Sum	-	N/A	me/L	8.09	7.72	16.8
Bicarb. Alkalinity (calc. as CaCO3)	$30\text{-}500_{OG}$	1.0	mg/L	330	330	**530**
Calculated TDS	500_{AO}	1.0	mg/L	440	430	**950**
Carb. Alkalinity (calc. as CaCO3)	-	1.0	mg/L	2.7	2.4	<1.0
Cation Sum	-	N/A	me/L	8.44	8.58	18
Hardness (CaCO3)	$80\text{-}100_{OG}$	1	mg/L	**380**	**380**	**860**
Ion Balance (% Difference)	-	N/A	%	2.12	5.27	3.41
Langelier Index (@ 20C)	-	N/A	N/A	0.965	0.926	0.778
Langelier Index (@ 4C)	-	N/A	N/A	0.716	0.678	0.532
Saturation pH (@ 20C)	-	N/A	N/A	6.98	6.96	6.43
Saturation pH (@ 4C)	-	N/A	N/A	7.23	7.21	6.68
Total Ammonia-N	-	0.050	mg/L	0.69	1.8	0.081
Conductivity	-	1.0	umho/cm	700	690	1500
Dissolved Organic Carbon	5_{AO}	0.50	mg/L	1.5	1.6	2.5
Orthophosphate (P)	-	0.010	mg/L	<0.010	0.074	<0.010
pH	$6.5\text{-}8.5_{OG}$	N/A	pH	7.95	7.89	7.21
Dissolved Sulphate (SO4)	500_{AO}	1.0	mg/L	46	44	160
Alkalinity (Total as CaCO3)	-	1.0	mg/L	330	330	530
Dissolved Chloride (Cl-)	250_{AO}	1.0	mg/L	19	5	78
Nitrite (N)	1_{MAC}	0.010	mg/L	<0.010	<0.010	0.038
Nitrate (N)	10_{MAC}	0.10	mg/L	<0.10	<0.10	9.58
Nitrate + Nitrite (N)	10_{MAC}	0.10	mg/L	<0.10	<0.10	9.62
Dissolved Aluminum (Al)	0.1_{OG}	0.0050	mg/L	<0.0050	<0.0050	<0.0050
Dissolved Antimony (Sb)	0.006_{IMAC}	0.00050	mg/L	<0.00050	<0.00050	<0.00050
Dissolved Arsenic (As)	0.025_{IMAC}	0.0010	mg/L	<0.0010	<0.0010	0.0021
Dissolved Barium (Ba)	1_{MAC}	0.0020	mg/L	0.30	0.37	0.120
Dissolved Beryllium (Be)	-	0.00050	mg/L	<0.00050	<0.00050	<0.00050
Dissolved Boron (B)	5_{IMAC}	0.0010	mg/L	0.040	0.081	0.024
Dissolved Cadmium (Cd)	0.005_{MAC}	0.00010	mg/L	<0.00010	<0.00010	<0.00010
Dissolved Calcium (Ca)	-	0.20	mg/L	90	93	250
Dissolved Chromium (Cr)	0.05_{MAC}	0.0050	mg/L	<0.0050	<0.0050	<0.0050
Dissolved Cobalt (Co)	-	0.00050	mg/L	<0.00050	<0.00050	0.0015
Dissolved Copper (Cu)	1_{AO}	0.0010	mg/L	<0.0010	<0.0010	<0.0010
Dissolved Iron (Fe)	0.3_{AO}	0.10	mg/L	**0.760**	**0.460**	**0.540**
Dissolved Lead (Pb)	0.01_{MAC}	0.00050	mg/L	<0.00050	<0.00050	<0.00050
Dissolved Magnesium (Mg)	-	0.050	mg/L	37	36	59
Dissolved Manganese (Mn)	0.05_{AO}	0.0020	mg/L	**0.093**	**0.10**	**0.49**
Dissolved Molybdenum (Mo)	-	0.00050	mg/L	0.0035	0.0011	0.00089
Dissolved Nickel (Ni)	-	0.0010	mg/L	0.0015	<0.0010	0.0047
Dissolved Phosphorus (P)	-	0.10	mg/L	<0.10	0.22	<0.10
Dissolved Potassium (K)	-	0.20	mg/L	4.8	2.6	2.3
Dissolved Selenium (Se)	0.01_{MAC}	0.0020	mg/L	<0.0020	<0.0020	<0.0020
Dissolved Silicon (Si)	-	0.050	mg/L	13	13	9.40
Dissolved Silver (Ag)	-	0.00010	mg/L	<0.00010	<0.00010	<0.00010
Dissolved Sodium (Na)	$20_{OG};200_{MOH}$	0.10	mg/L	15	18	18
Dissolved Strontium (Sr)	-	0.0010	mg/L	0.50	1.20	0.51
Dissolved Thallium (Tl)	-	0.000050	mg/L	<0.000050	<0.00050	<0.00050
Dissolved Titanium (Ti)	-	0.0050	mg/L	<0.0050	<0.0050	<0.0050
Dissolved Uranium (U)	0.02_{MAC}	0.00010	mg/L	0.00018	0.00016	0.018
Dissolved Vanadium (V)	-	0.00050	mg/L	<0.00050	<0.00050	0.00051
Dissolved Zinc (Zn)	5_{AO}	0.0050	mg/L	<0.0050	<0.0050	<0.0050

LEGEND	
Bold & Red	Exceedes criteria
Bold	Reportable detection limit exceeds criteria
"N/A"	Not applicable
"RDL"	Reportable Detection limit
ODWS	Ontario Drinking Water Standards, Objectives and Guidelines (revised June 2006)
MAC	ODWS Maximum Acceptable Concentration
IMAC	ODWS Interim Maximum Acceptable Concentration
AO	ODWS Aesthetic Objective
OG	ODWS Operational Guideline
MOH	Medical Officer of Health reporting limit

Your Project #: 300044049.1000
Your C.O.C. #: 758990-01-01

Attention: Angela Mason

R J Burnside & Associates Ltd
15 Townline Rd
Orangeville, ON
CANADA L9W 3R4

Report Date: 2020/02/19
Report #: R6080355
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C040454
Received: 2020/02/13, 13:32

Sample Matrix: Ground Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	3	N/A	2020/02/18	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	3	N/A	2020/02/14	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	3	N/A	2020/02/18	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	3	N/A	2020/02/18	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	3	N/A	2020/02/14	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	3	N/A	2020/02/14	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	3	N/A	2020/02/14	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	3	N/A	2020/02/19		
Anion and Cation Sum	3	N/A	2020/02/14		
Total Ammonia-N	3	N/A	2020/02/19	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	3	N/A	2020/02/14	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	3	2020/02/14	2020/02/14	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	3	N/A	2020/02/18	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	3	N/A	2020/02/19		
Sat. pH and Langelier Index (@ 4C)	3	N/A	2020/02/19		
Sulphate by Automated Colourimetry	3	N/A	2020/02/18	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	3	N/A	2020/02/19		

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs 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 BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing.

Your Project #: 300044049.1000
Your C.O.C. #: 758990-01-01

Attention: Angela Mason

R J Burnside & Associates Ltd
15 Townline Rd
Orangeville, ON
CANADA L9W 3R4

Report Date: 2020/02/19
Report #: R6080355
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C040454
Received: 2020/02/13, 13:32

BV Labs 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 BV Labs, 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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bvlabs.com
Phone# (905)817-5765

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

RCAP - COMPREHENSIVE (GROUND WATER)

BV Labs ID		LZZ189			LZZ189			LZZ190		
Sampling Date		2020/02/13 10:15			2020/02/13 10:15			2020/02/13 11:20		
COC Number		758990-01-01			758990-01-01			758990-01-01		
	UNITS	**MW1**	**RDL**	**QC Batch**	**MW1 Lab-Dup**	**RDL**	**QC Batch**	**MW2**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	me/L	8.09	N/A	6588427				7.72	N/A	6588427
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	330	1.0	6588425				330	1.0	6588425
Calculated TDS	mg/L	440	1.0	6588430				430	1.0	6588430
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.7	1.0	6588425				2.4	1.0	6588425
Cation Sum	me/L	8.44	N/A	6588427				8.58	N/A	6588427
Hardness (CaCO3)	mg/L	380	1.0	6588376				380	1.0	6588376
Ion Balance (% Difference)	%	2.12	N/A	6588426				5.27	N/A	6588426
Langelier Index (@ 20C)	N/A	0.965		6588428				0.926		6588428
Langelier Index (@ 4C)	N/A	0.716		6588429				0.678		6588429
Saturation pH (@ 20C)	N/A	6.98		6588428				6.96		6588428
Saturation pH (@ 4C)	N/A	7.23		6588429				7.21		6588429
Inorganics										
Total Ammonia-N	mg/L	0.69	0.050	6593189				1.8	0.050	6593189
Conductivity	umho/cm	700	1.0	6590012				690	1.0	6590012
Dissolved Organic Carbon	mg/L	1.5	0.50	6588644				1.6	0.50	6588644
Orthophosphate (P)	mg/L	ND	0.010	6591588				0.074	0.010	6591588
pH	pH	7.95		6589849				7.89		6589849
Dissolved Sulphate (SO4)	mg/L	46	1.0	6591589				44	1.0	6591589
Alkalinity (Total as CaCO3)	mg/L	330	1.0	6590002				330	1.0	6590002
Dissolved Chloride (Cl-)	mg/L	19	1.0	6589856	20	1.0	6589856	5.0	1.0	6589857
Nitrite (N)	mg/L	ND	0.010	6589853				ND	0.010	6589853
Nitrate (N)	mg/L	ND	0.10	6589853				ND	0.10	6589853
Nitrate + Nitrite (N)	mg/L	ND	0.10	6589853				ND	0.10	6589853
Metals										
Dissolved Aluminum (Al)	ug/L	ND	5.0	6589837				ND	5.0	6589837
Dissolved Antimony (Sb)	ug/L	ND	0.50	6589837				ND	0.50	6589837
Dissolved Arsenic (As)	ug/L	ND	1.0	6589837				ND	1.0	6589837
Dissolved Barium (Ba)	ug/L	300	2.0	6589837				370	2.0	6589837
Dissolved Beryllium (Be)	ug/L	ND	0.50	6589837				ND	0.50	6589837
Dissolved Boron (B)	ug/L	40	10	6589837				81	10	6589837
Dissolved Cadmium (Cd)	ug/L	ND	0.10	6589837				ND	0.10	6589837
Dissolved Calcium (Ca)	ug/L	90000	200	6589837				93000	200	6589837
Dissolved Chromium (Cr)	ug/L	ND	5.0	6589837				ND	5.0	6589837

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
ND = Not detected

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

RCAP - COMPREHENSIVE (GROUND WATER)

BV Labs ID		LZZ189			LZZ189			LZZ190		
Sampling Date		2020/02/13 10:15			2020/02/13 10:15			2020/02/13 11:20		
COC Number		758990-01-01			758990-01-01			758990-01-01		
	UNITS	**MW1**	**RDL**	**QC Batch**	**MW1 Lab-Dup**	**RDL**	**QC Batch**	**MW2**	**RDL**	**QC Batch**
Dissolved Cobalt (Co)	ug/L	ND	0.50	6589837				ND	0.50	6589837
Dissolved Copper (Cu)	ug/L	ND	1.0	6589837				ND	1.0	6589837
Dissolved Iron (Fe)	ug/L	760	100	6589837				460	100	6589837
Dissolved Lead (Pb)	ug/L	ND	0.50	6589837				ND	0.50	6589837
Dissolved Magnesium (Mg)	ug/L	37000	50	6589837				36000	50	6589837
Dissolved Manganese (Mn)	ug/L	93	2.0	6589837				100	2.0	6589837
Dissolved Molybdenum (Mo)	ug/L	3.5	0.50	6589837				1.1	0.50	6589837
Dissolved Nickel (Ni)	ug/L	1.5	1.0	6589837				ND	1.0	6589837
Dissolved Phosphorus (P)	ug/L	ND	100	6589837				220	100	6589837
Dissolved Potassium (K)	ug/L	4800	200	6589837				2600	200	6589837
Dissolved Selenium (Se)	ug/L	ND	2.0	6589837				ND	2.0	6589837
Dissolved Silicon (Si)	ug/L	13000	50	6589837				13000	50	6589837
Dissolved Silver (Ag)	ug/L	ND	0.10	6589837				ND	0.10	6589837
Dissolved Sodium (Na)	ug/L	15000	100	6589837				18000	100	6589837
Dissolved Strontium (Sr)	ug/L	500	1.0	6589837				1200	1.0	6589837
Dissolved Thallium (Tl)	ug/L	ND	0.050	6589837				ND	0.050	6589837
Dissolved Titanium (Ti)	ug/L	ND	5.0	6589837				ND	5.0	6589837
Dissolved Uranium (U)	ug/L	0.18	0.10	6589837				0.16	0.10	6589837
Dissolved Vanadium (V)	ug/L	ND	0.50	6589837				ND	0.50	6589837
Dissolved Zinc (Zn)	ug/L	ND	5.0	6589837				ND	5.0	6589837

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not detected

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RCAP - COMPREHENSIVE (GROUND WATER)

BV Labs ID		LZZ191		
Sampling Date		2020/02/13 12:05		
COC Number		758990-01-01		
	UNITS	**MW3**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	16.8	N/A	6588427
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	530	1.0	6588425
Calculated TDS	mg/L	950	1.0	6588430
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND	1.0	6588425
Cation Sum	me/L	18.0	N/A	6588427
Hardness (CaCO3)	mg/L	860	1.0	6588376
Ion Balance (% Difference)	%	3.41	N/A	6588426
Langelier Index (@ 20C)	N/A	0.778		6588428
Langelier Index (@ 4C)	N/A	0.532		6588429
Saturation pH (@ 20C)	N/A	6.43		6588428
Saturation pH (@ 4C)	N/A	6.68		6588429
Inorganics				
Total Ammonia-N	mg/L	0.081	0.050	6593189
Conductivity	umho/cm	1500	1.0	6590012
Dissolved Organic Carbon	mg/L	2.5	0.50	6588644
Orthophosphate (P)	mg/L	ND	0.010	6591588
pH	pH	7.21		6589849
Dissolved Sulphate (SO4)	mg/L	160	1.0	6591589
Alkalinity (Total as CaCO3)	mg/L	530	1.0	6590002
Dissolved Chloride (Cl-)	mg/L	78	1.0	6589857
Nitrite (N)	mg/L	0.038	0.010	6589853
Nitrate (N)	mg/L	9.58	0.10	6589853
Nitrate + Nitrite (N)	mg/L	9.62	0.10	6589853
Metals				
Dissolved Aluminum (Al)	ug/L	ND	5.0	6589837
Dissolved Antimony (Sb)	ug/L	ND	0.50	6589837
Dissolved Arsenic (As)	ug/L	2.1	1.0	6589837
Dissolved Barium (Ba)	ug/L	120	2.0	6589837
Dissolved Beryllium (Be)	ug/L	ND	0.50	6589837
Dissolved Boron (B)	ug/L	24	10	6589837
Dissolved Cadmium (Cd)	ug/L	ND	0.10	6589837
Dissolved Calcium (Ca)	ug/L	250000	200	6589837
Dissolved Chromium (Cr)	ug/L	ND	5.0	6589837
Dissolved Cobalt (Co)	ug/L	1.5	0.50	6589837

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
ND = Not detected

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RCAP - COMPREHENSIVE (GROUND WATER)

BV Labs ID		LZZ191		
Sampling Date		2020/02/13 12:05		
COC Number		758990-01-01		
	UNITS	**MW3**	**RDL**	**QC Batch**
Dissolved Copper (Cu)	ug/L	ND	1.0	6589837
Dissolved Iron (Fe)	ug/L	540	100	6589837
Dissolved Lead (Pb)	ug/L	ND	0.50	6589837
Dissolved Magnesium (Mg)	ug/L	59000	50	6589837
Dissolved Manganese (Mn)	ug/L	490	2.0	6589837
Dissolved Molybdenum (Mo)	ug/L	0.89	0.50	6589837
Dissolved Nickel (Ni)	ug/L	4.7	1.0	6589837
Dissolved Phosphorus (P)	ug/L	ND	100	6589837
Dissolved Potassium (K)	ug/L	2300	200	6589837
Dissolved Selenium (Se)	ug/L	ND	2.0	6589837
Dissolved Silicon (Si)	ug/L	9400	50	6589837
Dissolved Silver (Ag)	ug/L	ND	0.10	6589837
Dissolved Sodium (Na)	ug/L	18000	100	6589837
Dissolved Strontium (Sr)	ug/L	510	1.0	6589837
Dissolved Thallium (Tl)	ug/L	ND	0.050	6589837
Dissolved Titanium (Ti)	ug/L	ND	5.0	6589837
Dissolved Uranium (U)	ug/L	18	0.10	6589837
Dissolved Vanadium (V)	ug/L	0.51	0.50	6589837
Dissolved Zinc (Zn)	ug/L	ND	5.0	6589837

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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TEST SUMMARY

BV Labs ID: LZZ189
Sample ID: MW1
Matrix: Ground Water

Collected: 2020/02/13
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6590002	N/A	2020/02/18	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6588425	N/A	2020/02/14	Automated Statchk
Chloride by Automated Colourimetry	KONE	6589856	N/A	2020/02/18	Deonarine Ramnarine
Conductivity	AT	6590012	N/A	2020/02/18	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6588644	N/A	2020/02/14	Mandeep Kaur
Hardness (calculated as CaCO3)		6588376	N/A	2020/02/14	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6589837	N/A	2020/02/14	Prempal Bhatti
Ion Balance (% Difference)	CALC	6588426	N/A	2020/02/19	Automated Statchk
Anion and Cation Sum	CALC	6588427	N/A	2020/02/14	Automated Statchk
Total Ammonia-N	LACH/NH4	6593189	N/A	2020/02/19	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6589853	N/A	2020/02/14	Chandra Nandlal
pH	AT	6589849	2020/02/14	2020/02/14	Kazzandra Adeva
Orthophosphate	KONE	6591588	N/A	2020/02/18	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6588428	N/A	2020/02/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6588429	N/A	2020/02/19	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6591589	N/A	2020/02/18	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6588430	N/A	2020/02/19	Automated Statchk

BV Labs ID: LZZ189 Dup
Sample ID: MW1
Matrix: Ground Water

Collected: 2020/02/13
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	6589856	N/A	2020/02/18	Deonarine Ramnarine

BV Labs ID: LZZ190
Sample ID: MW2
Matrix: Ground Water

Collected: 2020/02/13
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6590002	N/A	2020/02/18	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6588425	N/A	2020/02/14	Automated Statchk
Chloride by Automated Colourimetry	KONE	6589857	N/A	2020/02/18	Deonarine Ramnarine
Conductivity	AT	6590012	N/A	2020/02/18	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6588644	N/A	2020/02/14	Mandeep Kaur
Hardness (calculated as CaCO3)		6588376	N/A	2020/02/14	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6589837	N/A	2020/02/14	Prempal Bhatti
Ion Balance (% Difference)	CALC	6588426	N/A	2020/02/19	Automated Statchk
Anion and Cation Sum	CALC	6588427	N/A	2020/02/14	Automated Statchk
Total Ammonia-N	LACH/NH4	6593189	N/A	2020/02/19	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6589853	N/A	2020/02/14	Chandra Nandlal
pH	AT	6589849	2020/02/14	2020/02/14	Kazzandra Adeva
Orthophosphate	KONE	6591588	N/A	2020/02/18	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6588428	N/A	2020/02/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6588429	N/A	2020/02/19	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6591589	N/A	2020/02/18	Alina Dobreanu

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TEST SUMMARY

BV Labs ID: LZZ190
Sample ID: MW2
Matrix: Ground Water

Collected: 2020/02/13
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids (TDS calc)	CALC	6588430	N/A	2020/02/19	Automated Statchk

BV Labs ID: LZZ191
Sample ID: MW3
Matrix: Ground Water

Collected: 2020/02/13
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6590002	N/A	2020/02/18	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6588425	N/A	2020/02/14	Automated Statchk
Chloride by Automated Colourimetry	KONE	6589857	N/A	2020/02/18	Deonarine Ramnarine
Conductivity	AT	6590012	N/A	2020/02/18	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6588644	N/A	2020/02/14	Mandeep Kaur
Hardness (calculated as CaCO3)		6588376	N/A	2020/02/14	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6589837	N/A	2020/02/14	Prempal Bhatti
Ion Balance (% Difference)	CALC	6588426	N/A	2020/02/19	Automated Statchk
Anion and Cation Sum	CALC	6588427	N/A	2020/02/14	Automated Statchk
Total Ammonia-N	LACH/NH4	6593189	N/A	2020/02/19	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6589853	N/A	2020/02/14	Chandra Nandlal
pH	AT	6589849	2020/02/14	2020/02/14	Kazzandra Adeva
Orthophosphate	KONE	6591588	N/A	2020/02/18	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6588428	N/A	2020/02/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6588429	N/A	2020/02/19	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6591589	N/A	2020/02/18	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6588430	N/A	2020/02/19	Automated Statchk

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GENERAL COMMENTS

All General bottles contained trace sediment.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6588644	KRM	Matrix Spike	Dissolved Organic Carbon	2020/02/14		99	%	80 - 120
6588644	KRM	Spiked Blank	Dissolved Organic Carbon	2020/02/14		99	%	80 - 120
6588644	KRM	Method Blank	Dissolved Organic Carbon	2020/02/14	ND, RDL=0.50		mg/L	
6588644	KRM	RPD	Dissolved Organic Carbon	2020/02/14	2.1		%	20
6589837	PBA	Matrix Spike	Dissolved Aluminum (Al)	2020/02/14		110	%	80 - 120
			Dissolved Antimony (Sb)	2020/02/14		106	%	80 - 120
			Dissolved Arsenic (As)	2020/02/14		103	%	80 - 120
			Dissolved Barium (Ba)	2020/02/14		NC	%	80 - 120
			Dissolved Beryllium (Be)	2020/02/14		104	%	80 - 120
			Dissolved Boron (B)	2020/02/14		102	%	80 - 120
			Dissolved Cadmium (Cd)	2020/02/14		103	%	80 - 120
			Dissolved Calcium (Ca)	2020/02/14		NC	%	80 - 120
			Dissolved Chromium (Cr)	2020/02/14		101	%	80 - 120
			Dissolved Cobalt (Co)	2020/02/14		104	%	80 - 120
			Dissolved Copper (Cu)	2020/02/14		102	%	80 - 120
			Dissolved Iron (Fe)	2020/02/14		103	%	80 - 120
			Dissolved Lead (Pb)	2020/02/14		100	%	80 - 120
			Dissolved Magnesium (Mg)	2020/02/14		NC	%	80 - 120
			Dissolved Manganese (Mn)	2020/02/14		99	%	80 - 120
			Dissolved Molybdenum (Mo)	2020/02/14		103	%	80 - 120
			Dissolved Nickel (Ni)	2020/02/14		100	%	80 - 120
			Dissolved Phosphorus (P)	2020/02/14		113	%	80 - 120
			Dissolved Potassium (K)	2020/02/14		105	%	80 - 120
			Dissolved Selenium (Se)	2020/02/14		102	%	80 - 120
			Dissolved Silicon (Si)	2020/02/14		108	%	80 - 120
			Dissolved Silver (Ag)	2020/02/14		95	%	80 - 120
			Dissolved Sodium (Na)	2020/02/14		NC	%	80 - 120
			Dissolved Strontium (Sr)	2020/02/14		NC	%	80 - 120
			Dissolved Thallium (Tl)	2020/02/14		100	%	80 - 120
			Dissolved Titanium (Ti)	2020/02/14		107	%	80 - 120
			Dissolved Uranium (U)	2020/02/14		104	%	80 - 120
			Dissolved Vanadium (V)	2020/02/14		104	%	80 - 120
			Dissolved Zinc (Zn)	2020/02/14		102	%	80 - 120
6589837	PBA	Spiked Blank	Dissolved Aluminum (Al)	2020/02/14		105	%	80 - 120
			Dissolved Antimony (Sb)	2020/02/14		101	%	80 - 120
			Dissolved Arsenic (As)	2020/02/14		98	%	80 - 120
			Dissolved Barium (Ba)	2020/02/14		99	%	80 - 120
			Dissolved Beryllium (Be)	2020/02/14		100	%	80 - 120
			Dissolved Boron (B)	2020/02/14		95	%	80 - 120
			Dissolved Cadmium (Cd)	2020/02/14		98	%	80 - 120
			Dissolved Calcium (Ca)	2020/02/14		103	%	80 - 120
			Dissolved Chromium (Cr)	2020/02/14		95	%	80 - 120
			Dissolved Cobalt (Co)	2020/02/14		101	%	80 - 120
			Dissolved Copper (Cu)	2020/02/14		99	%	80 - 120
			Dissolved Iron (Fe)	2020/02/14		99	%	80 - 120
			Dissolved Lead (Pb)	2020/02/14		100	%	80 - 120
			Dissolved Magnesium (Mg)	2020/02/14		98	%	80 - 120
			Dissolved Manganese (Mn)	2020/02/14		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2020/02/14		97	%	80 - 120
			Dissolved Nickel (Ni)	2020/02/14		97	%	80 - 120
			Dissolved Phosphorus (P)	2020/02/14		116	%	80 - 120
			Dissolved Potassium (K)	2020/02/14		102	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Selenium (Se)	2020/02/14		100	%	80 - 120
			Dissolved Silicon (Si)	2020/02/14		103	%	80 - 120
			Dissolved Silver (Ag)	2020/02/14		97	%	80 - 120
			Dissolved Sodium (Na)	2020/02/14		103	%	80 - 120
			Dissolved Strontium (Sr)	2020/02/14		95	%	80 - 120
			Dissolved Thallium (Tl)	2020/02/14		102	%	80 - 120
			Dissolved Titanium (Ti)	2020/02/14		100	%	80 - 120
			Dissolved Uranium (U)	2020/02/14		103	%	80 - 120
			Dissolved Vanadium (V)	2020/02/14		97	%	80 - 120
			Dissolved Zinc (Zn)	2020/02/14		97	%	80 - 120
6589837	PBA	Method Blank	Dissolved Aluminum (Al)	2020/02/14	ND, RDL=5.0		ug/L	
			Dissolved Antimony (Sb)	2020/02/14	ND, RDL=0.50		ug/L	
			Dissolved Arsenic (As)	2020/02/14	ND, RDL=1.0		ug/L	
			Dissolved Barium (Ba)	2020/02/14	ND, RDL=2.0		ug/L	
			Dissolved Beryllium (Be)	2020/02/14	ND, RDL=0.50		ug/L	
			Dissolved Boron (B)	2020/02/14	ND, RDL=10		ug/L	
			Dissolved Cadmium (Cd)	2020/02/14	ND, RDL=0.10		ug/L	
			Dissolved Calcium (Ca)	2020/02/14	ND, RDL=200		ug/L	
			Dissolved Chromium (Cr)	2020/02/14	ND, RDL=5.0		ug/L	
			Dissolved Cobalt (Co)	2020/02/14	ND, RDL=0.50		ug/L	
			Dissolved Copper (Cu)	2020/02/14	ND, RDL=1.0		ug/L	
			Dissolved Iron (Fe)	2020/02/14	ND, RDL=100		ug/L	
			Dissolved Lead (Pb)	2020/02/14	ND, RDL=0.50		ug/L	
			Dissolved Magnesium (Mg)	2020/02/14	ND, RDL=50		ug/L	
			Dissolved Manganese (Mn)	2020/02/14	ND, RDL=2.0		ug/L	
			Dissolved Molybdenum (Mo)	2020/02/14	ND, RDL=0.50		ug/L	
			Dissolved Nickel (Ni)	2020/02/14	ND, RDL=1.0		ug/L	
			Dissolved Phosphorus (P)	2020/02/14	ND, RDL=100		ug/L	
			Dissolved Potassium (K)	2020/02/14	ND, RDL=200		ug/L	
			Dissolved Selenium (Se)	2020/02/14	ND, RDL=2.0		ug/L	
			Dissolved Silicon (Si)	2020/02/14	ND, RDL=50		ug/L	
			Dissolved Silver (Ag)	2020/02/14	ND, RDL=0.10		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2020/02/14	ND, RDL=100		ug/L	
			Dissolved Strontium (Sr)	2020/02/14	ND, RDL=1.0		ug/L	
			Dissolved Thallium (Tl)	2020/02/14	ND, RDL=0.050		ug/L	
			Dissolved Titanium (Ti)	2020/02/14	ND, RDL=5.0		ug/L	
			Dissolved Uranium (U)	2020/02/14	ND, RDL=0.10		ug/L	
			Dissolved Vanadium (V)	2020/02/14	ND, RDL=0.50		ug/L	
			Dissolved Zinc (Zn)	2020/02/14	ND, RDL=5.0		ug/L	
6589837	PBA	RPD	Dissolved Antimony (Sb)	2020/02/14	NC		%	20
			Dissolved Arsenic (As)	2020/02/14	NC		%	20
			Dissolved Barium (Ba)	2020/02/14	2.8		%	20
			Dissolved Beryllium (Be)	2020/02/14	NC		%	20
			Dissolved Boron (B)	2020/02/14	0.22		%	20
			Dissolved Cadmium (Cd)	2020/02/14	NC		%	20
			Dissolved Chromium (Cr)	2020/02/14	NC		%	20
			Dissolved Cobalt (Co)	2020/02/14	2.4		%	20
			Dissolved Copper (Cu)	2020/02/14	NC		%	20
			Dissolved Lead (Pb)	2020/02/14	NC		%	20
			Dissolved Molybdenum (Mo)	2020/02/14	3.0		%	20
			Dissolved Nickel (Ni)	2020/02/14	1.8		%	20
			Dissolved Selenium (Se)	2020/02/14	NC		%	20
			Dissolved Silver (Ag)	2020/02/14	NC		%	20
			Dissolved Sodium (Na)	2020/02/14	1.6		%	20
			Dissolved Thallium (Tl)	2020/02/14	NC		%	20
			Dissolved Uranium (U)	2020/02/14	0.42		%	20
			Dissolved Vanadium (V)	2020/02/14	0.40		%	20
			Dissolved Zinc (Zn)	2020/02/14	4.0		%	20
6589849	KAD	Spiked Blank	pH	2020/02/14		101	%	98 - 103
6589849	KAD	RPD	pH	2020/02/14	0.67		%	N/A
6589853	C_N	Matrix Spike	Nitrite (N)	2020/02/14		111	%	80 - 120
			Nitrate (N)	2020/02/14		113	%	80 - 120
6589853	C_N	Spiked Blank	Nitrite (N)	2020/02/14		108	%	80 - 120
			Nitrate (N)	2020/02/14		108	%	80 - 120
6589853	C_N	Method Blank	Nitrite (N)	2020/02/14	ND, RDL=0.010		mg/L	
			Nitrate (N)	2020/02/14	ND, RDL=0.10		mg/L	
6589853	C_N	RPD	Nitrite (N)	2020/02/14	2.5		%	20
			Nitrate (N)	2020/02/14	0.22		%	20
6589856	DRM	Matrix Spike [LZZ189-01]	Dissolved Chloride (Cl-)	2020/02/18		99	%	80 - 120
6589856	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2020/02/18		103	%	80 - 120
6589856	DRM	Method Blank	Dissolved Chloride (Cl-)	2020/02/18	ND, RDL=1.0		mg/L	
6589856	DRM	RPD [LZZ189-01]	Dissolved Chloride (Cl-)	2020/02/18	1.8		%	20
6589857	DRM	Matrix Spike	Dissolved Chloride (Cl-)	2020/02/18		NC	%	80 - 120
6589857	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2020/02/18		103	%	80 - 120
6589857	DRM	Method Blank	Dissolved Chloride (Cl-)	2020/02/18	ND, RDL=1.0		mg/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6589857	DRM	RPD	Dissolved Chloride (Cl-)	2020/02/18	0.066		%	20
6590002	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2020/02/18		98	%	85 - 115
6590002	SAU	Method Blank	Alkalinity (Total as CaCO3)	2020/02/18	ND, RDL=1.0		mg/L	
6590002	SAU	RPD	Alkalinity (Total as CaCO3)	2020/02/18	0.79		%	20
6590012	SAU	Spiked Blank	Conductivity	2020/02/18		101	%	85 - 115
6590012	SAU	Method Blank	Conductivity	2020/02/18	ND, RDL=1.0		umho/cm	
6590012	SAU	RPD	Conductivity	2020/02/18	0.26		%	25
6591588	ADB	Matrix Spike	Orthophosphate (P)	2020/02/18		112	%	75 - 125
6591588	ADB	Spiked Blank	Orthophosphate (P)	2020/02/18		101	%	80 - 120
6591588	ADB	Method Blank	Orthophosphate (P)	2020/02/18	ND, RDL=0.010		mg/L	
6591588	ADB	RPD	Orthophosphate (P)	2020/02/18	1.8		%	25
6591589	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2020/02/18		NC	%	75 - 125
6591589	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2020/02/18		103	%	80 - 120
6591589	ADB	Method Blank	Dissolved Sulphate (SO4)	2020/02/18	ND, RDL=1.0		mg/L	
6591589	ADB	RPD	Dissolved Sulphate (SO4)	2020/02/18	0.62		%	20
6593189	MT4	Matrix Spike	Total Ammonia-N	2020/02/19		96	%	75 - 125
6593189	MT4	Spiked Blank	Total Ammonia-N	2020/02/19		99	%	80 - 120
6593189	MT4	Method Blank	Total Ammonia-N	2020/02/19	ND, RDL=0.050		mg/L	
6593189	MT4	RPD	Total Ammonia-N	2020/02/19	1.6		%	20

N/A = Not Applicable

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

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

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.

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

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

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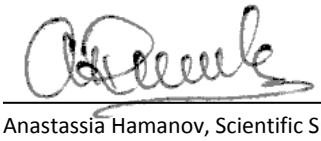
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

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

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Page of

13-Feb-20 13:32
Ashton Gibson
C040454
YHA ENV-695

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#3160 R J Burnside & Associates Ltd	Company Name:		Quotation #:	B16792
Attention:	Accounts Payable	Attention:		P.O. #:	
Address:	15 Townline Rd	Address:		Project:	300044049.1000
	Orangeville ON L9W 3R4			Project Name:	
Tel:	(519) 941-5331 Ext: 286 Fax: (519) 941-7721	Tel:	Fax:	Site #:	
Email:	ap@rjburnside.com, angela.mason@rjburnside.com	Email:	angela.mason@rjburnside.com	Sampled By:	Micaela Hafferty

Bottle Order #: 758990
COC #: C#758990-01-01
Project Manager: Ashton Gibson

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

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

Other Regulations
- [ ] CCME [ ] Sanitary Sewer Bylaw
- [ ] Reg 558 [ ] Storm Sewer Bylaw
- [ ] MISA Municipality _____
- [ ] PWQO
- [ ] Other _____

Special Instructions

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

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

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

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	RCAp - Comprehensive								# of Bottles	Comments
1		MW1	Feb. 13, 2020	10:40	GW	X	X								5	Field Filtered
2		MW2		11:20	GW	X	X								5	Metals
3		MW3		12:05	GW	X	X								5	
4																
5																
6																
7																
8																
9																
10																

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Aaron Brochu Aaron Brochu	20/02/13	1:30	DIPIKA SINGH	20/02/13	13:32	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	6 / 7 / 7	Present		
		Intact		

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

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

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

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix G

Attenuation Calculations

Contaminant Limit Calculations - Nitrate-N Groundwater Impact

Based on MECP Guideline B-7 (Reasonable Use) and Procedure B-7-1 (Determination of Contaminant Limits and Attenuation Zones)

$Cm = Cb + x(Cr-Cb)$

Where:

Cm =	2.5	maximum concentration of contaminant acceptable in groundwater at downgradient boundary (mg/L)	
Cb =	0.0	background concentration of contaminant in groundwater (mg/L)	
Cr =	10.0	maximum concentration of contaminant that should be present in groundwater (mg/L)	*Based on ODWS for nitrate*
x =	0.25	dimensionless constant (0.25 for health related parameters; 0.5 for non-health related parameters)	*ODWS considers nitrate a health-related standard*

$Cw = Cm - Cp - Co$

Where:

Cp =	0.0	present background concentration of contaminant in groundwater (mg/L)	
Co =	0.0	potential contaminant increase from other sources (mg/L)	
Cw =	**2.5**	**maximum concentration of contaminant originating from disposal site that can be permitted to reach downgradient boundary (mg/L)**	

Target Effluent Criteria Calculations - Nitrate-N

Based on MECP Design Guidelines for Sewage Works, Chapter 22

Attenuation Zone Area

$V_A = A_D \times k$

Where:

V_A =	5,928	annual dilution volume (m^3)	
A_D =	23,713	total attenuation zone area (m^2)	*From Figure 6*
k =	0.25	assumes 250 mm annual dilution precipitation rate (m)	

Annual Effluent Discharge

$V_T = V_A + V_S$ *and* $V_S = Q \times t$

Where:

V_T =	10,984	total volume of water discharged annually (m^3)	
V_S =	5,055	annual sewage effluent volume (m^3)	
Q =	13,850	daily average design flow (L/day)	*Average daily flow Church at capacity Saturday + Sunday*
t =	365	annual operation days for effluent discharge (days)	

Contaminant Concentration in Untreated Effluent

$C_{PB} = (C_S \times V_S)/V_T$

Where:

C_{PB} =	18.4	contaminant concentration at downgradient boundary from untreated effluent (mg/L)	
C_S =	40.0	contaminant concentration in untreated effluent (mg/L)	*Typical nitrate concentration in domestic wastewater (based on MECP Design Guidelines, 2008)*

Target Concentration in Treated Effluent

$C_S = (C_{PB} \times V_T)/V_S$

Where:

C_{PB} =	2.5	maximum permitted contaminant concentration from effluent at downgradient boundary (mg/L)	*Based on Cw*
C_S =	**5.4**	**target limit for contaminant concentration in effluent (mg/L)**	

References:

MECP, 1994. Guideline B-7 (formerly 15-08) - Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities.

MECP, 1994. Procedure B-7-1 (formerly referenced by 15-08) - Determination of Contaminant Limits and Attenuation Zones.

MECP, 2008. Design Guidelines for Sewage Works, Chapter 22: Larbe Subsurface Sewage Disposal Systems.