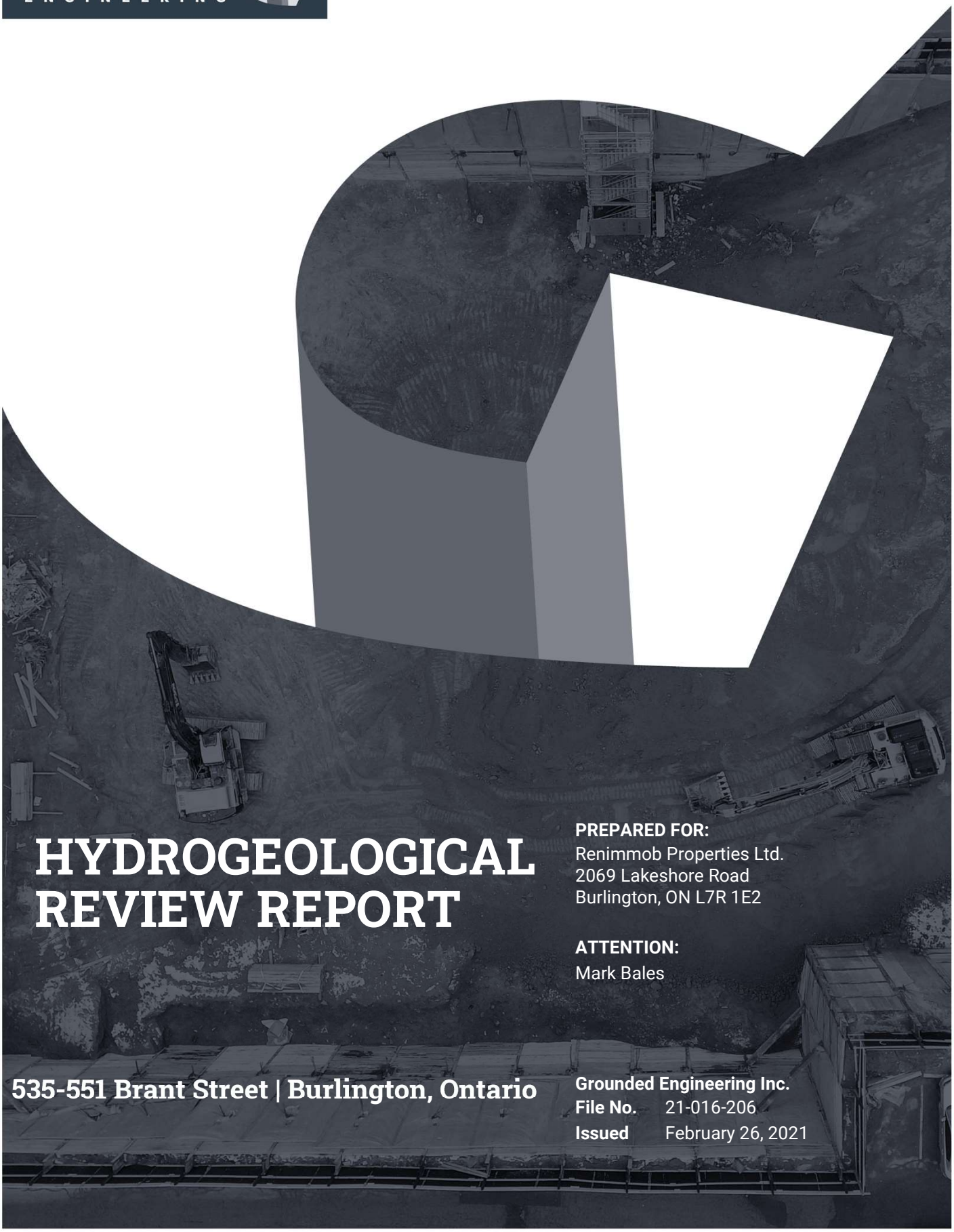
GROUNDED ENGINEERING



HYDROGEOLOGICAL REVIEW REPORT

PREPARED FOR:
Renimmob Properties Ltd.
2069 Lakeshore Road
Burlington, ON L7R 1E2

ATTENTION:
Mark Bales

535-551 Brant Street | Burlington, Ontario

Grounded Engineering Inc.
File No. 21-016-206
Issued February 26, 2021

12 Banigan Drive, Toronto ON M4H 1E9 | (647) 264-7909 | groundedeng.ca | Grounded Engineering

Executive Summary

Grounded Engineering Inc. (Grounded) was retained by Renimmob Properties Ltd. to conduct a Hydrogeological Review for the proposed redevelopment of 535-551 Brant Street in Burlington, Ontario (site). The conclusions of the investigation are summarized as follows:

Development Information

Current Development

Development Phase	Above Grade Levels	Below Grade Levels			
		Level #	Lowest Finished Floor		Approximate Base of Footings (masl)
			Depth (m)	Elevation (masl)	
535 – 539 Brant Street	1	1	Unknown	Unknown	Unknown
541 – 551 Brant Street	2	1	Unknown	Unknown	Unknown

Proposed Development

Development Phase	Above Grade Levels	Below Grade Levels			
		Level #	Lowest Finished Floor		Approximate Base of Footings (masl)
			Depth (m)	Elevation (masl)	
1	26	4	12.2	75.4	74.9

Site Conditions

Site Stratigraphy

Stratum/Formation	Aquifer or Aquitard	Depth Range (mbgs)	Elevation Range (masl)	Hydraulic Conductivity (m/s)
Earth Fill	Aquifer	0.0 – 2.3	87.3 – 85.0	9.29×10^{-09}*
Silt Till (Halton Till)	Aquifer	1.5 – 3.3	85.8 – 84.4	1.3×10^{-08}*
Bedrock (Queenston Shale)	Aquifer	3.1 – 18.5	84.7 – 68.9	1.78×10^{-07}**

*Conductivity was approximated using grain size analysis.
**Bedrock conductivity is highest reported between Grounded & Terraprobe via slug test analysis (Appendix B).

Maximum Groundwater Elevation

Monitoring Well ID	Depth Below Grade (m)	Elevation (masl)
BH104	18.5	87.4
BH105	2.3	87.6
BH106	18.0	87.7
BH107	18.1	87.8
BH108	3.0	87.7

Groundwater Quality				
Sample ID	**Sample Date**	**Sample Expiry Date**	**City of Burlington Storm Sewer Limits**	**Halton Region Sanitary and Combined Sewer Limits**
SW-UF-BH107	February 4, 2021	February 6, 2021	Exceeds	Meets

Groundwater Control

Stored Groundwater (pre-excavation/dewatering)			
Volume of Excavation (m^3)	**Volume of Excavation Below Water Table (m^3)**	**Volume of Storage Groundwater (m^3)**	**Volume of Storage Groundwater (L)**
35,527	25,612	8,675	8,675,100

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	69,000	47.9	89,000	61.8

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Infiltration Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	2,000	1.4	22,000	15.3

Zone of Influence	
Zone of Influence	**Potential Settlement**
13 m	1 mm

Regulatory Requirements	
Environmental Activity and Sector Registry (EASR) Posting	Required
Short Term Permit to Take Water (PTTW)	Not Required
Long Term Permit to Take Water (PTTW)	Not Required
Short Term Discharge Agreement Region of Halton or City of Burlington	Required
Long Term Discharge Agreement Region of Halton or City of Burlington	Required

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APPENDICES

Appendix A – Borehole Logs
Appendix B – Aquifer Response Tests
Appendix C – Grain Size Analysis
Appendix D – HydrogeoSieveXL Data
Appendix E – Laboratory Certificate of Analysis
Appendix F – Finite Element Model

1 Introduction

Renimmob Properties Ltd. has retained Grounded Engineering Inc. ("Grounded") to provide hydrogeological engineering design advice for their proposed development at 535-551 Brant Street, in Burlington, Ontario.

Property Information	
Location of Property	535-551 Brant Street
Ownership of Property	Renimmob Properties Ltd.
Property Dimensions (m)	Approx. 51 m EW x 54 m NS
Property Area (m^2)	2,779

Existing Development	
Number of Building Structures	Two (2)
Number of Above Grade Levels	535 – 539 Brant Street: One (1) 541 – 551 Brant Street: Two (2)
Number of Underground Levels	One (1)
Sub-Grade Depth of Development (m)	Unknown
Sub-Grade Area (m^2)	Unknown
Land Use Classification	Commercial

Proposed Development	
Number of Building Structures	One (1): One high-rise tower on a mixed-use podium
Number of Above Grade Levels	Twenty-six (26)
Number of Underground Levels	Four (4) – P4 Level
Sub-Grade Depth of Development (m)	12.4
Sub-Grade Area (m^2)	2,779
Land Use Classification	Mixed Use – Residential and Commercial

Qualified Person and Hydrogeological Review Information	
Qualified Person	Matthew Bielaski, P.Eng.
Consulting Firm	Grounded Engineering Inc.
Date of Hydrogeological Review	February 26, 2021
Scope of Work	▪ Review of MECP Water Well Records for the area ▪ Review of geological information for the area ▪ Review of topographic information for the area ▪ Review of previous Hydrogeological Report by others ▪ Completion of slug tests in accessible monitoring wells ▪ Groundwater sampling and analysis to the City of Burlington and Halton Region Sewer Use Limits ▪ Assessment of groundwater controls and potential impacts ▪ Report preparation in accordance with Ontario Water Resources Act, Ontario Regulation 387/04

General Hydrogeological Characterization	
Property Topography	The site has an approximate ground surface elevation of 87.4 to 87.8 masl.
Local Physiographic Features	The site is composed of clayey to sandy silt fill underlain by a native silt till (Halton Till) with bedrock directly below (Queenston Shale)
Regional Physiographic Features	The West St Lawrence Lowland consists of a limestone plain (elevation 200–250 masl) that is separated by a broad, shale lowland from a broader dolomite and limestone plateau west of Lake Ontario. This plateau is bounded by the Niagara Escarpment. From the escarpment the plateau slopes gently southwest to lakes Huron and Erie (elevation 173 masl). Glaciation has mantled this region with several layers of glacial till (i.e., an unsorted mixture of clay, sand, etc.), the youngest forming extensive, undulating till plains, often enclosing rolling drumlin fields.
Surface Drainage	Surface water is expected to flow to the municipal roads located on adjacent of the site. Catch basins are located on Brant Street to the south and John Street to the north.

2 Study Area Map

A map has been enclosed which shows the following information:

- All monitoring wells identified on-site
- All monitoring wells identified off-site within the study area

- All boreholes identified on-site
- All buildings identified on Site and within the study area
- The property boundaries of the Site
- Any watercourses and drainage features within the study area.

3 Geology and Physical Hydrogeology

The site stratigraphy, including soil materials, composition and texture are presented in detail on the borehole logs in Appendix A. A summary of stratigraphic units that were encountered at the site are as follows:

Site Stratigraphy				
Stratum/Formation	**Aquifer or Aquitard**	**Depth Range (mbgs)**	**Elevation Range (masl)**	**Hydraulic Conductivity (m/s)**
Earth Fill	Aquifer	0.0 – 2.3	87.3 –85.0	9.29×10^{-09}
Silt Till (Halton Till)	Aquifer	1.5 – 3.3	85.8 – 84.4	1.3×10^{-08}
Bedrock (Queenston Shale)	Aquifer	3.1 – 18.5	84.7 – 68.9	1.78×10^{-07}*

*Indicates conductivity was estimated using grain size analysis
***Indicates conductivity was highest reported value between Grounded and Terraprobe

Bedrock			
Stratum	**Depth Range (mbgs)**	**Elevation Range (masl)**	**Hydraulic Conductivity (m/s)**
Weathered	3.1 – 6.8	84.7 – 80.6	1.78×10^{-07}*
Sound	6.4 – 18.0	81.3 - 69.7	1.78×10^{-07}*

*Bedrock conductivity is highest reported between Grounded & Terraprobe via slug test analysis (Appendix B).

Surface Water		
Surface Water Body	**Distance from site (m)**	**Hydraulically Connected to Property (yes/no)**
Lake Ontario	712	No

4 Monitoring Well Information

Well ID	Well Diameter (mm)	Ground Surface (masl)	Top of Screen (masl)	Bottom of Screen (masl)	Screened Geological Unit
BH104	50	87.4	71.9	68.9	Bedrock
BH105	50	87.6	86.8	85.3	Earth Fill to Silt Till
BH106	50	87.7	66.7	69.7	Bedrock
BH107	50	87.8	66.7	69.7	Bedrock
BH108	50	87.7	83.2	84.7	Earth Fill to Silt Till

5 Groundwater Elevations

Well ID	Groundwater Elevation (masl)					
	19-Feb-08	19-Feb-21	19-Mar-15	19-Mar-22	19-Apr-14	21-Feb-04
BH104	84.0	83.8	84.1	84.2	84.2	-
BH105	Dry	Dry	Dry	Dry	Dry	Dry
BH106	76.3	82.8	83.2	83.2	83.3	82.9
BH107	83.5	-	83.5	83.7	83.6	82.1
BH108	Dry	-	Dry	85.1	85.1	85.0

"-" Well inaccessible at time of visit

For design purposes the stabilized water level at the site is assumed to be 84.2 masl within the Bedrock unit, the groundwater within the overlying overburden material is likely part of a perched water table at approximately Elev. 85.1 masl. Groundwater levels fluctuate with time depending on the amount of precipitation and surface runoff and may be influenced by known or unknown dewatering activities at nearby sites.

6 Aquifer Testing

6.1 Single Well Response Test (Slug Test)

The hydraulic conductivities from the monitoring wells were determined based on slug tests (single-well response tests). These tests involve rapid removal of water or addition of a "slug" which displaces a known volume of water from a single well, and then monitoring the water level in the well until it recovers. The results of the slug tests were analyzed using the Bouwer and Rice method (1976).

The hydraulic properties of the strata applicable to the site are as follows:

Well ID	Well Screen Elevation (masl)	Screened Geological Unit	Hydraulic Conductivity (m/s)
BH106	66.7 - 69.7	Bedrock	2.74×10^{-09}*

*Conductivity was much lower than reported values from the previous Terraprobe report, the highest reported conductivity will be used instead.

6.2 Soil Grain Size Distribution

The hydraulic conductivities of various soil types can also be estimated from grain size analyses. An assessment of the grain sizes was conducted using the excel-based tool, HydrogeoSieve XL (*HydrogeoSieve XL ver.2.2, J.F. Devlin, University of Kansas, 2015*). HydrogeoSieve XL compares the results of the grain size analyses against fifteen (15) different analytical methods.

Given our experience in the area as well as published literature, some of the geometric means provided for the soil were biased low by one or more methods. In these instances, the values determined by these methods were excluded from the mean. The table below illustrates the hydraulic conductivity values estimated from the mean of the analytical methods where the soil met the applicable analysis criteria.

Sample ID	Soil Description	Applicable Analysis Methods	Hydraulic Conductivity (m/s)
BH104-SS4B	Silt Till	Alyamani and Sen, Barr, Sauerbrei	3.7×10^{-09}
BH105-SS1	Earth Fill	Alyamani and Sen, Barr, Sauerbrei	9.2×10^{-09}
BH105-SS4	Silt Till	Alyamani and Sen, Barr, Sauerbrei	8.5×10^{-09}
BH106-SS4	Silt Till	Alyamani and Sen, Barr, Sauerbrei	6.0×10^{-09}
BH108-SS4	Silt Till	Alyamani and Sen, Barr, Sauerbrei	1.3×10^{-08}

The results of the analyses are presented in Appendix D.

6.3 Literature

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

Stratum/Formation	Hydraulic Conductivity (m/s)
Earth Fill	10^{-05} to 10^{-09}
Silt Till (Glacial Tills)	10^{-05} to 10^{-09}
Bedrock (Queenston Shale)	10^{-07} to 10^{-09}

7 Water Quality

One (1) unfiltered groundwater sample was collected and analyzed by a Canadian laboratory accredited and licensed by Standards Council of Canada and or Canadian Association for Laboratory Accreditation.

The sample was collected directly from monitoring well BH107 (SW-UF-BH107) on February 4, 2021. The sample was analyzed for the following parameters:

- The City of Burlington Storm Sewer Discharge By-Law 86-2002
- Regional Municipality of Halton By-Law No. 2-03 Section 4 Table 1 – Limits for Sanitary Sewers and Combined Sewers Discharge

The groundwater sample exceeded the City of Burlington Storm Sewer Discharge Limits and will require treatment prior to discharge into the storm sewer. The groundwater sample met the Limits for Sanitary and Combined Sewer Discharge for all parameters analyzed.

A true copy of the analysis report, Certificate of Analysis and a chain of custody record for the sample are enclosed.

8 Proposed Construction Method

The proposed shoring at the site is unknown at the time of writing this report. However, it is assumed that conventional solider pile and lagging will be utilized except where adjacent structures exist.

9 Private Water Drainage System (PWDS)

If the proposed development is designed as a leak tight structure, then a private water drainage system will not be required. However, the structure must then be designed to resist hydrostatic pressure and uplift forces.

If the proposed development is not a leak tight structure, then a private water drainage system will be required. The total sub floor drain area will be approximately 2,575 m^2 based on the drawings which have been provided.

If the development is designed with a private water drainage system, the drainage system is a critical structural element since it keeps water pressure from acting on the basement walls and floor slab. As such, the sump that ensures the performance of this system must have a duplexed pump arrangement for 100% pumping redundancy and these pumps must be on emergency power. The size of the sump should be adequate to accommodate the estimated groundwater seepage. It is anticipated that the groundwater seepage can be controlled with typical, widely available, commercial/residential sump pumps.

10 Groundwater Extraction and Discharge

Numerical analyses were conducted for both short-term and long-term dewatering scenarios. The modeling was conducted using computer software, which deploys the finite element modelling method. The Finite Element Model (FEM) for groundwater seepage indicates the short-term (construction) and long-term (permanent) dewatering requirements as provided below. The finite element model results are presented in Appendix F.

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

Please note that if excavation is exposed to the elements, storm water will have to be managed. The short-term control of groundwater should consider stormwater management from rainfall events. A dewatering system should be designed to consider the removal of rainfall from excavation. A design storm of 25 mm has been used in the quantity estimates.

As required by Ontario Regulation 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event is approximately 259,000 L.

Stored Groundwater (pre-excavation/dewatering)			
Volume of Excavation (m^3)	**Volume of Excavation Below Water Table (m^3)**	**Volume of Storage Groundwater (m^3)**	**Volume of Storage Groundwater (L)**
35,527	25,612	8,675	8,675,100

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	69,000	47.9	89,000	61.8

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		Infiltration Design Rainfall Event (25mm)		Total Daily Water Takings	
L/day	L/min	L/day	L/min	L/day	L/min
20,000	13.9	2,000	1.4	22,000	15.3

Regulatory Requirements	
Environmental Activity and Sector Registry (EASR) Posting	Required
Short Term Permit to Take Water (PTTW)	Not Required
Long Term Permit to Take Water (PTTW)	Not Required
Short Term Discharge Agreement Region of Halton or City of Burlington	Required
Long Term Discharge Agreement Region of Halton or City of Burlington	Required

Please note:

- The native bedrock must be dewatered a minimum of 1 m below the footing elevation prior to excavation to preserve the in-situ integrity of the bedrock during construction dewatering activities. It is anticipated that the groundwater elevation will rise to the elevation of the subfloor drainage in the event of a drained structure or the waterproofing in the event of a leak tight structure.
- The proposed pump schedule for short-term construction dewatering has not been completed. As such the actual peak short-term discharge rate is not available at the time of writing this report. The pump schedule must be specified by either the dewatering contractor retained or the mechanical consultant.
- The proposed pump schedule for long-term permanent drainage has not been completed. As such the actual peak long-term discharge rate is not available at the time writing of this report. The pump schedule must be specified by the mechanical consultant.
- Leak tight structure (structure that has not included a private water drainage system) has not been considered as part of the proposed development at this time.
- On-site containment (infiltration gallery/dry well etc.) has not been considered as part of the proposed development at this time. If this option is considered additional work will have to be conducted (i.e. infiltration testing).

11 Evaluation of Impact

11.1 Zone of Influence (ZOI)

The Zone of Influence (ZOI) with respect to groundwater was calculated based on the estimated groundwater taking rate and the hydraulic conductivity of the unit which water will be taken at the Property.

The ZOI was calculated using the Sichardt equation below.

Equation: $R_0 = 3000*dH*K^{0.5}$

Where:

dH is the dewatering thickness (m)

K is the hydraulic conductivity (m/s)

Calculation:

The ZOI with respect to groundwater seepage at the site is:

$R_0 = 3000*10.5\ m*(1.78 \times 10^{-07})^{0.5}\ m/s$

$R_0 = \pm 13\ m$

11.2 Land Stability

The impacts to land stability of the proposed short term and long-term dewatering at the site on adjacent structures are summarized as follows:

- The proposed dewatering at the subject site locally lowers the groundwater table within the ZOI by a maximum of 13 m. This has the potential increase of effective stress of approximately 86.3 kPa in the native soils.
- Due to the groundwater table being within the bedrock strata, subsequent dewatering of the bedrock will induce minimal amounts of settlement within the zone of influence.
- Based on the change in effective stress and the compressibility of the soil subjected to that change, the proposed dewatering activities will induce a maximum 1 mm of additional settlement in the adjacent soils.
- The maximum induced settlement occurs directly adjacent to the proposed excavation and decreases in a nonlinear fashion with distance away from the excavation.
- For the structures within the public realm adjacent to the site, the dewatering-induced settlement is calculated to be 1 mm or less (depending on the depth of the structure).

On this basis, the impact of the proposed dewatering on the existing adjacent structures is considered by Grounded to be within acceptable limits.

11.3 City's Sewage Works

Negative impacts to City's sewage works may occur in terms of the quantity or quality of the groundwater discharged. This report provided the estimated quantity of the water discharge. However, this report does not speak to the sewer capacities. The sewer capacity analysis is provided under a separate cover by the civil consultant.

The quality of the proposed groundwater discharge is provided in previous Sections. As noted in that section the groundwater sample exceeded the Limits for Storm Sewer Discharge and met the Limits for Sanitary and Combined Sewer Discharge.

As such additional treatment will be required before the water can be discharge to the Storm Sewer and additional treatment will not be required before the water can be discharged to the Sanitary and Combined Sewer, to avoid impacts to the City's sewage works cause by groundwater quality.

11.4 Natural Environment

There are no natural waterbodies within the ZOI that will be caused by the proposed construction dewatering or permanent drainage. Any groundwater which will be taken from the site will be discharged (if required) into the City's sewer systems and not into any natural water body. As such, there will be no impact to the natural environment caused by the water takings at the site.

11.5 Local Drinking Water Wells

The site is located within the municipal boundaries of the City of Burlington. The site and surrounding area are provided with municipal piped water and sewer supply. There is no use of the groundwater for water supply in this area of Burlington. As such, there will be no impact to drinking water wells.

11.6 Contamination Source

The site and immediately surrounding area currently consist mostly of commercial and some residential areas. There are possible land uses which could be a source of potential contamination that should be further investigated. Evaluation of the environmental condition of the site has been completed under a separate cover.

12 Proposed Mitigation Measures and Monitoring Plan

The extent of the negative impact identified in previous sections will be limited to the ZOI caused by the groundwater taking at the site.

As a result of dewatering and draining the bedrock, changes in groundwater level have the potential to cause settlement based on the change in the effective stresses within the ZOI.

If adjacent buildings or municipal infrastructure are within the ZOI and will undergo settlement that may be considered unacceptable as identified the Land Stability Section, consideration should be given to implement a monitoring and mitigation program during dewatering activities.

Both the temporary construction dewatering system and the permanent building drainage system must be properly installed and screened to ensure sediments and fines will not be removed, which is typically a primary cause of dewatering related settlement.

13 Limitations

Natural occurrences, the passage of time, local construction, and other human activity all have the potential to directly or indirectly alter the subsurface conditions at or near the project site. Contractual obligations related to groundwater or stormwater control must be considered with attention and care as they relate this potential site alteration.

The hydrogeological engineering advice provided in this report is based on the factual observations made from the site investigations as reported. It is intended for use by the owner and their retained design team. If there are changes to the features of the development or to the scope, the interpreted subsurface information, geotechnical engineering design parameters, advice, and discussion on construction considerations may not be relevant or complete for the project. Grounded should be retained to review the implications of such changes with respect to the contents of this report.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Grounded accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report, including consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

13.1 Report Use

The authorized users of this report are Renimmob Properties Ltd. and their design team, for whom this report has been prepared. Grounded Engineering Inc. maintains the copyright and ownership of this document. Reproduction of this report in any format or medium requires explicit prior authorization from Grounded Engineering Inc. The City of Burlington may also make use of and rely upon this report, subject to the limitations as stated.

14 Closure

If there are any questions regarding the discussion and advice provided, please do not hesitate to contact our office. We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED ENGINEERING

Jason Ngo, B.Sc

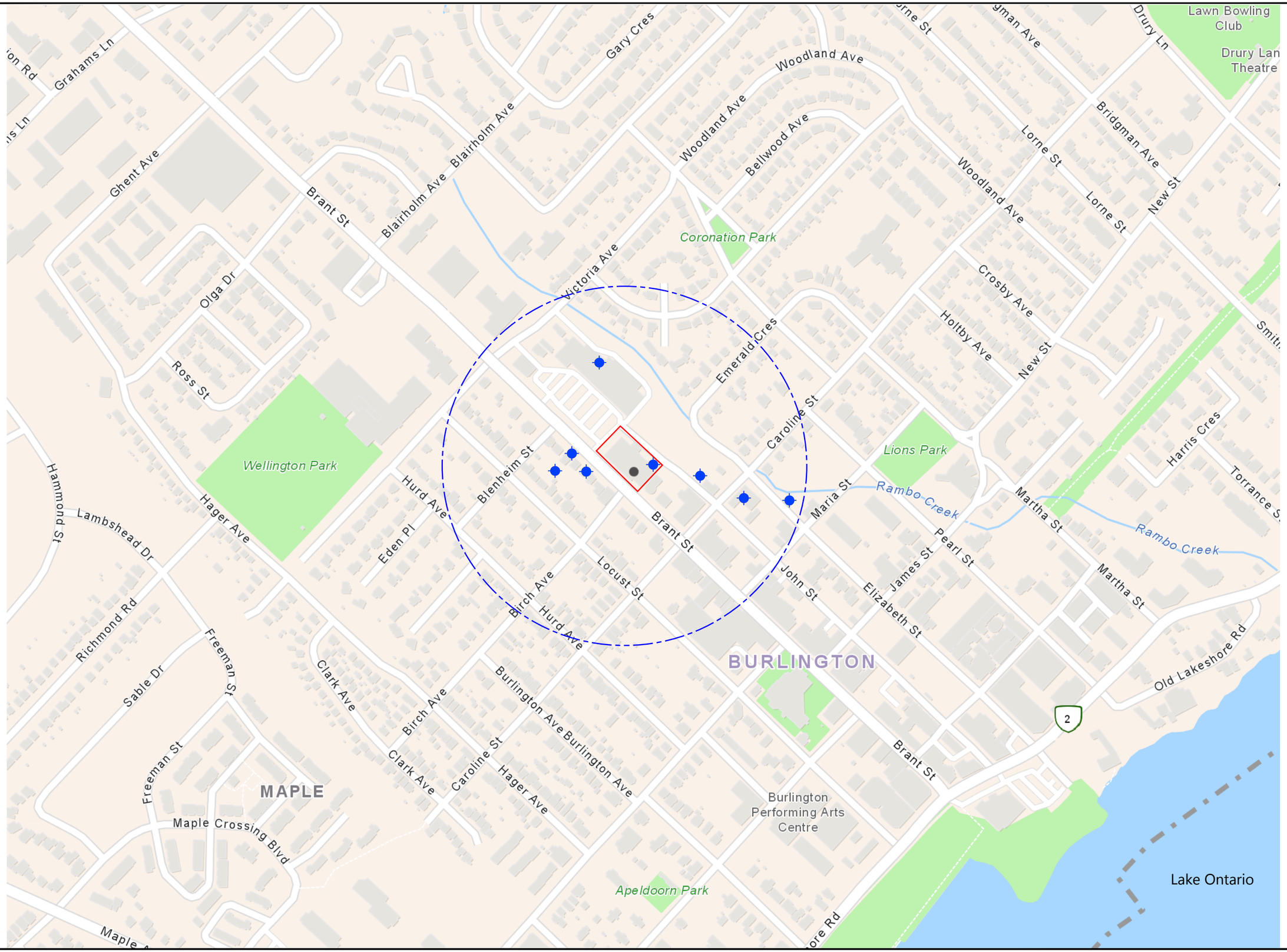
Jeremy Bobro, M$_{ENVM}$
Senior Consultant



Matthew Bielaski, P.Eng., QP$_{ESA-RA}$
Principal

FIGURES





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LEGEND

- PROPERTY BOUNDARY
- STUDY AREA (250m)
- MECP WELL RECORD

Note

Study area is 250m around propterty

Reference

ArcGIS 2021, MECP Well Record Database 2021

Project

535-551 BRANT STREET BURLINGTON, ONTARIO

Figure Title

STUDY AREA MAP

North

TRUE
PROJECT

Date

FEBRUARY 9, 2021

Scale

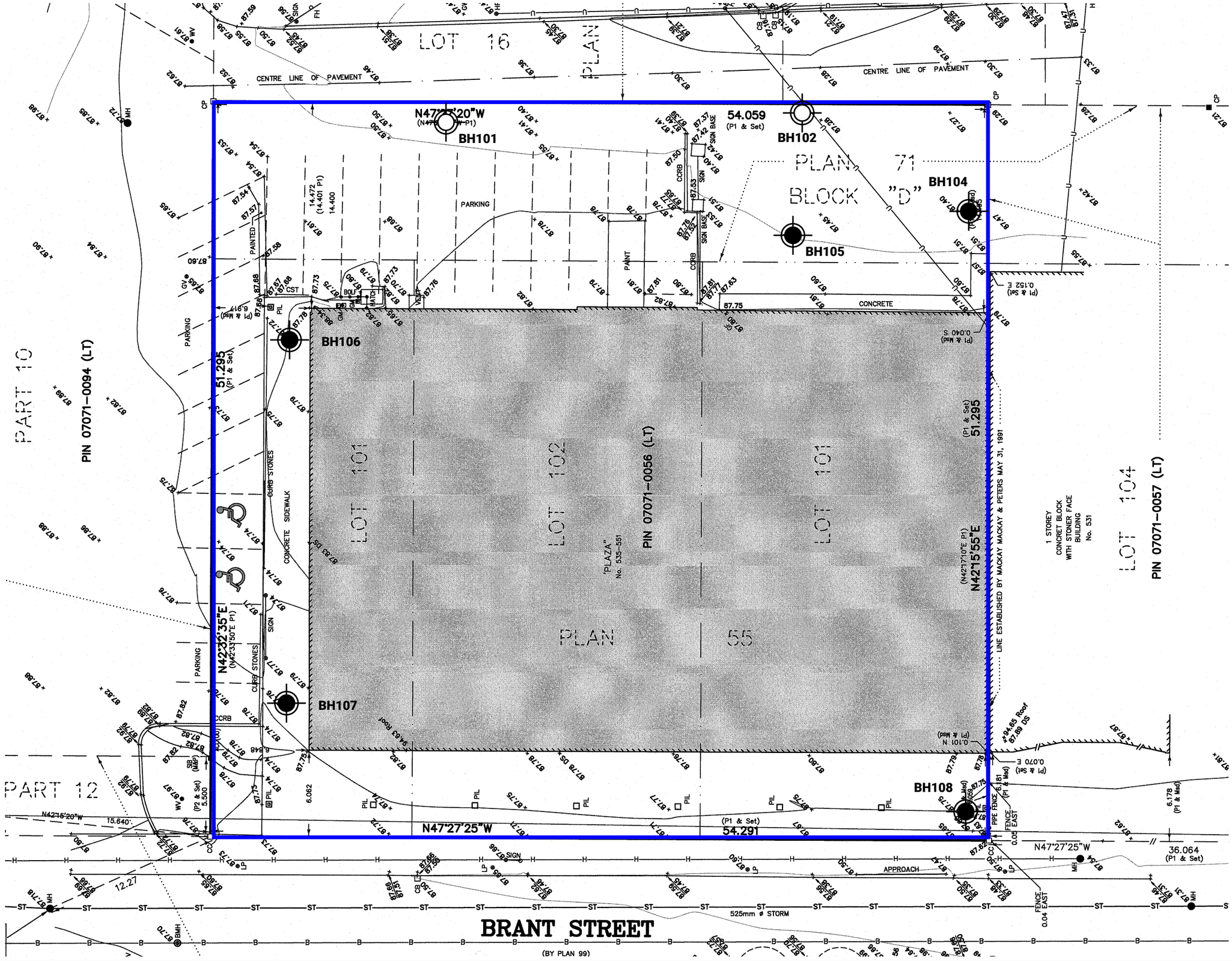
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21-016

Figure No

FIGURE 1



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LEGEND

- PROPERTY BOUNDARY
- MONITORING WELL (TERRAPROBE 2019)
- BOREHOLE (TERRAPROBE 2019)

Note

Reference

Topographic Survey, A.T. McLaren Limited, Dec 2018 (Drawing #35815)

Project

535-551 BRANT STREET BURLINGTON, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (EXISTING CONDITION)

North

TRUE
PROJECT

Date

FEBRUARY 9, 2021

Scale

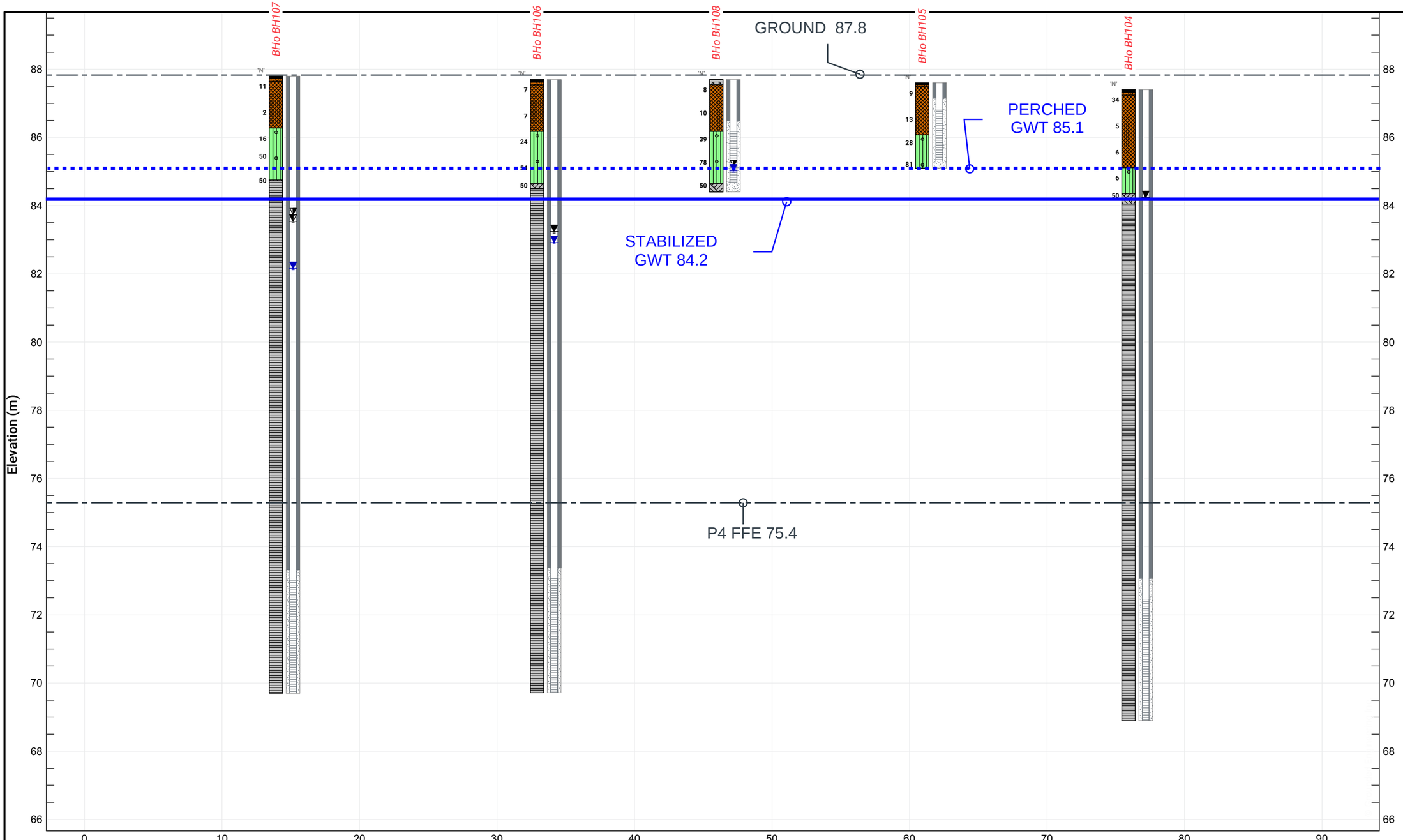
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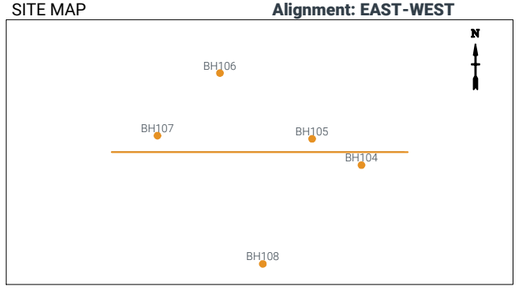
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FIGURE 2



SITE MAP

Alignment: EAST-WEST



LITHOLOGY GRAPHIC LEGEND

- Asphalt
- Aggregate
- Fill
- Silty Till
- Bedrock (inferred)
- Bedrock (cored)
- Concrete

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LEGEND

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

- water level, unstabilized
- water level, stabilized

Project

535-551 BRANT STREET BURLINGTON, ONTARIO

Figure Title

SUBSURFACE CROSS-SECTION

EAST-WEST

Date

FEBRUARY 2021

Scale

AS INDICATED

Job No

21-016

Figure No

FIGURE 3

APPENDIX A



LOG OF BOREHOLE 101

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : November 26, 2018	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597162, N: 4798043 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	87.5	**GROUND SURFACE**											
	87.2	115mm **ASPHALTIC CONCRETE**											
	0.3	150mm **AGGREGATE**											
		FILL, clayey silt, trace sand, trace gravel, trace asphalt, stiff, red with black pockets, moist		1	SS	15	87						SS1 Analysis: M&I
1				2	SS	12							SS2 Analysis: PAH
	86.0						86						
	1.5	**SILT**, some clay, trace sand, trace gravel, hard, reddish brown, moist (HALTON TILL)		3	SS	92 / 275mm							SS3 Analysis: PHC
	85.5												
	2.0	**END OF BOREHOLE**											

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined + Field Vane ● Pocket Penetrometer ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL); 10 20 30

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 102

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : November 26, 2018	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597181, N: 4798028 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
0	87.3	**GROUND SURFACE**										
		120mm **ASPHALTIC CONCRETE**										
	86.9	260mm **AGGREGATE**										
	0.4	**FILL**, clayey silt, some sand, trace to some gravel, trace asphalt, trace rock fragments, firm to stiff, dark brown, moist		1	SS	7	87					SS1 Analysis: PAH
1		...at 0.6 m, red, stiff		2	SS	13						SS2 Analysis: VOC, PHC
	85.8						86					
	1.5	**SILT**, some silt, trace sand, trace gravel, hard, reddish brown, moist		3	SS	59						SS3 Analysis: M&I
	85.3	(HALTON TILL)										
	2.0	**END OF BOREHOLE**										

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL); 10 20 30

Unstabilized Water Level

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Unstabilized water level measured at 0.3 m below ground surface; borehole caved to 0.9 m below ground surface upon completion of drilling.

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 103

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : November 26, 2018	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597202, N: 4798017 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
0	87.3	**GROUND SURFACE**										
	87.0	95mm **ASPHALTIC CONCRETE**					87					
	0.3	240mm **AGGREGATE**										
		FILL, clayey silt, some sand, trace to some gravel, trace asphalt, trace rock fragments, stilff to very stiff, red with black pockets, moist		1	SS	26						SS1 Analysis: VOC, PHC
1				2	SS	12						SS2 Analysis: M&I
	85.8						86					
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff, reddish brown, moist (HALTON TILL)		3	SS	17						SS3 Analysis: PAH
	85.3											
	2.0	**END OF BOREHOLE**										

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Unstabilized Water Level

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 104

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 22, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597190, N: 4798010 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	87.4	**GROUND SURFACE**				
	87.2	80mm **ASPHALTIC CONCRETE**				
	0.2	80mm **AGGREGATE**				
		FILL, clayey silt, trace to some gravel, trace sand, trace asphalt, hard, red with grey and black pockets, moist		1	SS	34
1		...at 0.8 m, some sand, trace concrete, dark brown to black, firm		2	SS	5
		...at 1.5 m, brown with red staining		3	SS	6
2	85.1					
	2.3	**SILT**, some clay, trace sand, trace gravel, firm, reddish brown, moist (HALTON TILL)		4A	SS	6
		...at 2.6 m, silty clay, trace shale fragments		4B		
3	84.4					
	3.0			5	SS	50 / 125mm
	84.1	**INFERRED BEDROCK**, shale, red				
	3.3	**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
4		...at 3.5 m, transition to sound bedrock		2	RUN	
5				3	RUN	
6				4	RUN	
7				5	RUN	
8						
9				6	RUN	
10						
11				7	RUN	

Elevation Scale (m): 87, 86, 85, 84, 83, 82, 81, 80, 79, 78, 77, 76

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm): PID: <5 | PID: 5 | PID: 10 | PID: <5 | PID: <5 | PID: <5

Instrument Details: Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

SS1 Analysis: M&I

SS2 Analysis: PAH

SS3 Analysis: VOC, PHC

17 11 47 25

4B Analysis: M&I, PAH, VOC, PHC

(continued next page)

LOG OF BOREHOLE 104

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 22, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 2 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597190, N: 4798010 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
12		*(continued)*				
		QUEENSTON FORMATION (See rock core log for details) *(continued)*		7	RUN	
13				8	RUN	
14						
15				9	RUN	
16						
17				10	RUN	
18				11	RUN	
	68.9 / 18.5	**END OF BOREHOLE**				

Elevation Scale (m): 75, 74, 73, 72, 71, 70, 69

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10, 20, 30, 40

Undrained Shear Strength (kPa): ○ Unconfined, ● Pocket Penetrometer, + Field Vane, ■ Lab Vane; 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL; 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	3.3	84.2
Mar 22, 2019	3.2	84.2

file: 1-18-0718 bh logs.gpj

ROCK CORE LOG 104

Terraprobe

Project No. : 1-18-0718 | Client : Carriage Gate Homes | Originated by : TG

Date started : January 22, 2019 | Project : 535-551 Brant Street | Compiled by : JK

Sheet No. : 1 of 1 | Location : Burlington, ON | Checked by : MD

Position : E: 597190, N: 4798010 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth (m)	GENERAL DESCRIPTION	Run / Elev Depth (m)	Recovery	Elevation (m)	Comments
	Rock coring started at 3.3m below grade	**84.1**			
4	**QUEENSTON FORMATION** **calcareous Shale**, red, medium bedded, weak; joints are horizontal, closed to gapped, clean;	3.3 R1 83.3	TCR = **103%** SCR = **87%** RQD = **45%**	84	**3.3m:** *highly weathered* **3.8m:** *dipping joint, closed, clean, smooth, planar* **4.1m:** *vertilcal joint, closed, clean, smooth, planar*
5	interbedded with **limestone**, grey, thinly bedded, medium strong ...at 3.5m, transition to sound bedrock *Run 1 : 0% limestone 100% shale*	4.1 R2 81.8	TCR = **100%** SCR = **97%** RQD = **83%**	83 82	
6	*Run 2 : 10% limestone 90% shale*	5.6 R3 80.2	TCR = **100%** SCR = **93%** RQD = **68%**	81	**5.6-5.7m:** *50mm rubblized*
7	*Run 3 : 7% limestone 93% shale*	7.2 R4 78.7	TCR = **98%** SCR = **98%** RQD = **95%**	80 79	
8	*Run 4 : 16% limestone 84% shale*	8.7 R5 77.2	TCR = **93%** SCR = **88%** RQD = **60%**	78	**8.8-8.8m:** *rubble* **8.9m:** *dipping joint, clean, smooth, closed, planar* **9.6-9.7m:** *horizontal joint, clay infilled, gapped, smooth, planar*
10	*Run 5 : 29% limestone 71% shale*	10.2 R6 75.7	TCR = **100%** SCR = **97%** RQD = **85%**	77 76	**10.3m:** *dipping joint, closed, smooth, planar, clean*
11	*Run 6 : 17% limestone 83% shale*	11.7 R7 74.3	TCR = **98%** SCR = **98%** RQD = **98%**	75	
13	*Run 7 : 8% limestone 92% shale*	13.1 R8 72.7	TCR = **100%** SCR = **100%** RQD = **100%**	74 73	**13.0m:** *cacium deposits*
14	*Run 8 : 9% limestone 91% shale*	14.7 R9 71.2	TCR = **97%** SCR = **97%** RQD = **97%**	72	
16	*Run 9 : 9% limestone 91% shale*	16.2 R10 69.6	TCR = **95%** SCR = **94%** RQD = **87%**	71	**16.5m:** *vertical joint, clean, closed, smooth, undulating*
17	*Run 10 : 6% limestone 94% shale*			70	
18	*Run 11 : 4% limestone 96% shale*	17.8 R11 68.9 **18.5m**	TCR = **100%** SCR = **96%** RQD = **96%**	69	

Shale Weathering Zones: Z1 Z2 Z3 Z4

UCS (MPa) 5 25 50 100 250 — Estimated Strength: R1 R2 R3 R4 R5 R6

Natural Fractures — Frequency / Spacing

Frequency	Spacing
5	
2	
6	
2	
2	
1	
2	
2	
WZ	
3	
1	
0	
1	
1	
1	
0	
1	
1	
>10	
3	
1	
5	
2	
1	
0	
1	
1	
0	
0	
1	
0	
0	
0	
0	
1	
1	
1	
0	
0	
0	
0	
0	
1	
0	
2	
0	
0	
0	
2	
0	
0	
0	
0	

Laboratory Testing

END OF COREHOLE

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 105

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 25, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597175, N: 4798018 (UTM 17T) Elevation Datum : Geodetic

Rig type : Big Beaver Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
0	87.6	**GROUND SURFACE**											
		50mm **ASPHALTIC CONCRETE**											
		50mm **AGGREGATE**											
		FILL, clayey silt, trace to some sand, trace to some gravel, trace asphalt, trace wood fragments, trace rock fragments, stiff, reddish brown, moist		1	SS	9				PID: <5			14 22 46 18 SS1 Analysis: M&I
1				2	SS	13	87			PID: <5			SS2 Analysis: PAH, VOC, PHC
	86.1												
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff, reddish brown, moist (HALTON TILL)		3	SS	28	86			PID: <5			SS3 Analysis: M&I, PAH, VOC, PHC
2		...at 2.3 m, trace shale fragments, hard, grey with red		4	SS	81 / 200mm				PID: <5			21 18 41 20
	85.0						85						
	2.6	**END OF BOREHOLE**											

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined + Field Vane ● Pocket Penetrometer ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL); 10 20 30

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	dry	n/a
Mar 22, 2019	dry	n/a

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 106

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 23, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597147, N: 4798038 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	87.7	**GROUND SURFACE**				
	87.5	80mm **ASPHALTIC CONCRETE**				
	0.2	80mm **AGGREGATE**		1	SS	7
		FILL, sandy silt, trace gravel, trace asphalt, loose, brown to dark brown, moist		2	SS	7
	86.2					
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff to hard, reddish brown, moist (HALTON TILL)		3	SS	24
				4	SS	54
	84.7					
	3.0	**INFERRED BEDROCK**, shale, red		5	SS	50 / 125mm
	84.5	**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
	3.2	..at 3.2 m, transition to sound bedrock		2	RUN	
				3	RUN	
				4	RUN	
				5	RUN	
				6	RUN	
				7	RUN	

Elevation Scale (m): 87, 86, 85, 84, 83, 82, 81, 80, 79, 78, 77, 76

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm): PID: <5 (SS1); PID: <5 (SS2); PID: <5 (SS3); PID: <5 (SS4); PID: <5 (5)

Instrument Details: Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

SS1 Analysis: PAH

SS2 Analysis: M&I, VOC, PHC

SS3 Analysis: M&I, PAH

0 10 74 16

SS4 Analysis: VOC, PHC

file: 1-18-0718 bh logs.gpj

(continued next page)

LOG OF BOREHOLE 106

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 23, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 2 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597147, N: 4798038 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
12		*(continued)*				
		QUEENSTON FORMATION (See rock core log for details) *(continued)*		7	RUN	
13						
				8	RUN	
14						
				9	RUN	
15						
16						
				10	RUN	
17						
	69.7					
	18.0	**END OF BOREHOLE**				

Elevation Scale (m): 75, 74, 73, 72, 71, 70

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	4.5	83.2
Mar 22, 2019	4.5	83.3

file: 1-18-0718 bh logs.gpj

ROCK CORE LOG 106

Terraprobe

Project No. : 1-18-0718 | Client : Carriage Gate Homes | Originated by : TG

Date started : January 23, 2019 | Project : 535-551 Brant Street | Compiled by : JK

Sheet No. : 1 of 1 | Location : Burlington, ON | Checked by : MD

Position : E: 597147, N: 4798038 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth (m)	Graphic Log	GENERAL DESCRIPTION Rock coring started at 3.2m below grade	Run / Elev Depth (m)	Recovery	Elevation (m)	Shale Weathering Zones (Z1 Z2 Z3 Z4)	UCS (MPa) 5 25 50 100 250 / Estimated Strength (R1 R2 R3 R4 R5 R6)	Natural Fractures: Frequency	Natural Fractures: Spacing	Laboratory Testing	Comments	Elevation (m)
			84.5									
		QUEENSTON FORMATION **calcareous Shale**, red, medium bedded, weak; joints are horizontal, closed to gapped, clean;	3.2 R1 83.4	TCR = **98%** SCR = **88%** RQD = **77%**	84			4 0 1 1			**3.4m:** *dipping joint, clean, smooth, planar, closed*	84
4		interbedded with **limestone**, grey, thinly bedded, medium strong ...at 3.2m, transition to sound bedrock	4.3 R2 81.9	TCR = **95%** SCR = **93%** RQD = **92%**	83			2 2 1 2				83
5		*Run 1 : 16% limestone* *84% shale*	5.8 R3 80.4	TCR = **100%** SCR = **95%** RQD = **92%**	82			0 >10 1 1			**5.8m:** *approx. 75mm core loss* **6.1-6.2m:** *approx. 25mm rubblized* **6.2m:** *orange colour in joint (oxidation)*	82
6		*Run 2 : 16% limestone* *84% shale*										
7		*Run 3 : 21% limestone* *79% shale*	7.3 R4 78.9	TCR = **100%** SCR = **100%** RQD = **100%**	81			0 1 1 1 1				81
8		*Run 4 : 32% limestone* *68% shale*			80			0				80
9			8.8 R5 77.3	TCR = **97%** SCR = **90%** RQD = **62%**	79			5 4 2 3				79
10		*Run 5 : 17% limestone* *83% shale*			78			0 0				78
11			10.4 R6 75.8	TCR = **95%** SCR = **95%** RQD = **95%**	77			0 1 0 0				77
12		*Run 6 : 3% limestone* *97% shale*			76			0 0 0				76
13			11.9 R7 74.3	TCR = **100%** SCR = **98%** RQD = **94%**	75			2 0 0				75
14		*Run 7 : 18% limestone* *82% shale*	13.4 R8 72.8	TCR = **100%** SCR = **100%** RQD = **87%**	74			0 0 4 1			**14.2-14.3m:** *approx. 25mm dipping joint, clean*	74
15		*Run 8 : 8% limestone* *92% shale*			73			3 0				73
16			14.9 R9 71.2	TCR = **100%** SCR = **100%** RQD = **100%**	72			0 0 1				72
17		*Run 9 : 17% limestone* *83% shale*			71			0 0 1				71
		Run 10 : 5% limestone *95% shale*	16.5 R10 69.7	TCR = **98%** SCR = **98%** RQD = **98%**	70			0 0				70
			18.0m									
		END OF COREHOLE										

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 107

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 24, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597128, N: 4798019 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	**87.8**	**GROUND SURFACE**				
	87.6	75mm **ASPHALTIC CONCRETE**				
	0.2	75mm **AGGREGATE**		1	SS	11
		FILL, clayey silt, sandy, trace to some gravel, trace asphalt, trace concrete fragments, trace brick, very loose/very soft to stiff/compact, black to dark brown, moist		2	SS	2
1	86.3					
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff to hard, reddish brown, moist (HALTON TILL)		3	SS	16
2				4	SS	50 / 125mm
	84.8					
3	3.0	**INFERRED BEDROCK**, shale, red		5	SS	50 / 25mm
	84.7	**QUEENSTON FORMATION**		1	RUN	
	3.1	(See rock core log for details) ...at 3.6 m, transition to sound bedrock		2	RUN	
4						
5				3	RUN	
6				4	RUN	
7						
8				5	RUN	
9						
10				6	RUN	
11				7	RUN	

Elevation Scale (m): 87, 86, 85, 84, 83, 82, 81, 80, 79, 78, 77, 76

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details — Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

SS1 Analysis: M&I, PAH

SS2 Analysis: VOC, PHC

SS3 Analysis: M&I, PAH

SS4 Analysis: VOC, PHC

(continued next page)

LOG OF BOREHOLE 107

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 24, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 2 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597128, N: 4798019 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
12		*(continued)*				
		QUEENSTON FORMATION (See rock core log for details) *(continued)*		7	RUN	
13				8	RUN	
14						
15				9	RUN	
16				10	RUN	
17						
18	69.7			11	RUN	
	18.1	**END OF BOREHOLE**				

Elevation Scale (m): 75, 74, 73, 72, 71, 70

Penetration Test Values (Blows / 0.3m): × Dynamic Cone (10, 20, 30, 40)

Undrained Shear Strength (kPa): ○ Unconfined, ● Pocket Penetrometer, + Field Vane, ■ Lab Vane (40, 80, 120, 160)

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) (10, 20, 30)

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	4.3	83.5
Mar 22, 2019	4.1	83.7

file: 1-18-0718 bh logs.gpj

ROCK CORE LOG 107

Terraprobe

Project No. : 1-18-0718 | Client : Carriage Gate Homes | Originated by : TG

Date started : January 24, 2019 | Project : 535-551 Brant Street | Compiled by : JK

Sheet No. : 1 of 1 | Location : Burlington, ON | Checked by : MD

Position : E: 597128, N: 4798019 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Rock coring started at 3.1m below grade

QUEENSTON FORMATION

calcareous Shale, red, medium bedded, weak; joints are horizontal, closed to gapped, clean;

interbedded with **limestone**, grey, thinly bedded, medium strong

...at 3.6m, transition to sound bedrock

Run 1 : 9% limestone, 91% shale

Run 2 : 33% limestone, 67% shale

Run 3 : 10% limestone, 90% shale

Run 4 : 19% limestone, 81% shale

Run 5 : 30% limestone, 70% shale

Run 6 : 28% limestone, 72% shale

Run 7 : 25% limestone, 75% shale

Run 8 : 9% limestone, 91% shale

Run 9 : 19% limestone, 81% shale

Run 10 : 0% limestone, 100% shale

Run 11 : 8% limestone, 92% shale

END OF COREHOLE

Run	Elev Depth (m)	Recovery	Elevation (m)
	84.7		
R1	3.1 – 83.5	TCR = **100%** SCR = **72%** RQD = **43%**	84
R2	4.3 – 82.0	TCR = **97%** SCR = **92%** RQD = **68%**	83
R3	5.8 – 80.5	TCR = **100%** SCR = **98%** RQD = **97%**	82
R4	7.3 – 79.6	TCR = **100%** SCR = **89%** RQD = **78%**	81
R5	8.2 – 78.0	TCR = **100%** SCR = **97%** RQD = **93%**	80
R6	9.8 – 76.5	TCR = **95%** SCR = **95%** RQD = **90%**	79
R7	11.3 – 75.0	TCR = **95%** SCR = **95%** RQD = **92%**	78
R8	12.8 – 73.6	TCR = **100%** SCR = **100%** RQD = **100%**	77
R9	14.2 – 72.0	TCR = **98%** SCR = **98%** RQD = **81%**	76
R10	15.8 – 70.4	TCR = **100%** SCR = **100%** RQD = **100%**	75
R11	17.4 – 69.7	TCR = **100%** SCR = **100%** RQD = **100%**	74
	18.1m		73
			72
			71
			70

Shale Weathering Zones: Z1 Z2 Z3 Z4

UCS (MPa): 5 25 50 100 250

Estimated Strength: R1 R2 R3 R4 R5 R6

Natural Fractures: Frequency / Spacing

Depth (m)	Frequency
4	>10
5	>10
6	2
7	2
8	1
9	4
10	6
11	>10
12	2
13	0
14	12
15	3
16	2
17	1
18	>10
	1
	2
	1
	1
	1
	0
	4
	0
	2
	2
	1
	0
	0
	0
	0
	1
	2
	0
	0
	0
	1
	0
	0
	0
	3
	2
	1
	0
	0
	0
	0
	0
	0
	0
	0
	0

Laboratory Testing

Comments

- **3.1-3.3m:** *approx. 200mm rubble*
- **3.4-3.5m:** *approx. 25mm rubblized zone*
- **3.5m:** *vertical joint, clean, gapped, smooth, planar*
- **3.5-3.6m:** *approx. 100mm weathered zone, clay with angular blocks*
- **7.3-7.4m:** *approx. 100mm rubblized zone probably caved material*
- **12.5-12.6m:** *approx. 150mm calcium layer*
- **13.4m:** *calcium deposits*
- **15.0m:** *dipping joint, gapped, smooth, planar, clean*
- **15.1-15.1m:** *approx. 40mm dipping joint, smooth, undulating, open, clay infilled*

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 108

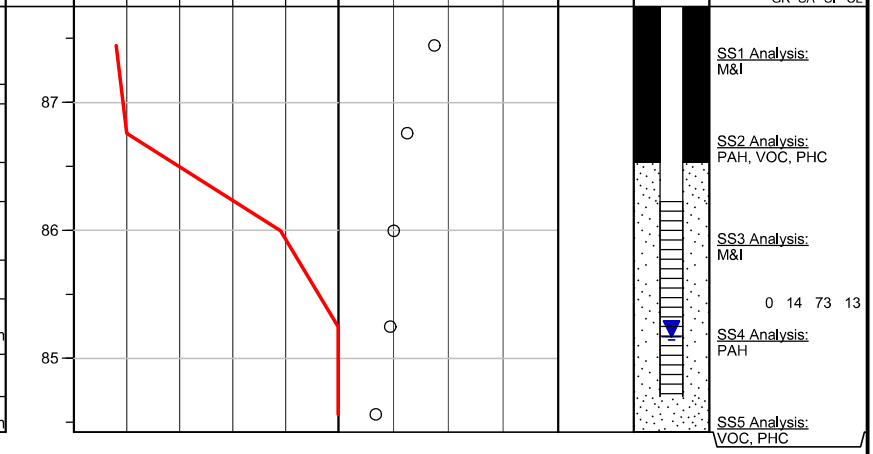
Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 25, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597160, N: 4797980 (UTM 17T) Elevation Datum : Geodetic

Rig type : Big Beaver Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	87.7	**GROUND SURFACE**				
0	87.5	150mm **PC CONCRETE**				
	0.2	**FILL**, sandy silt, trace gravel, trace rock fragments, loose to compact, dark brown, moist		1	SS	8
1				2	SS	10
	86.2					
	1.5	**SILT**, some clay, trace sand, trace gravel, hard, reddish brown, moist (HALTON TILL)		3	SS	39
2				4	SS	78 / 275mm
	84.7					
3	3.0	**INFERRED BEDROCK**, shale, red		5	SS	50 / 125mm
	84.4					
	3.3	**END OF BOREHOLE**				



Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	dry	n/a
Mar 22, 2019	2.6	85.2

file: 1-18-0718 bh logs.gpj

APPENDIX B



GROUNDED ENGINEERING

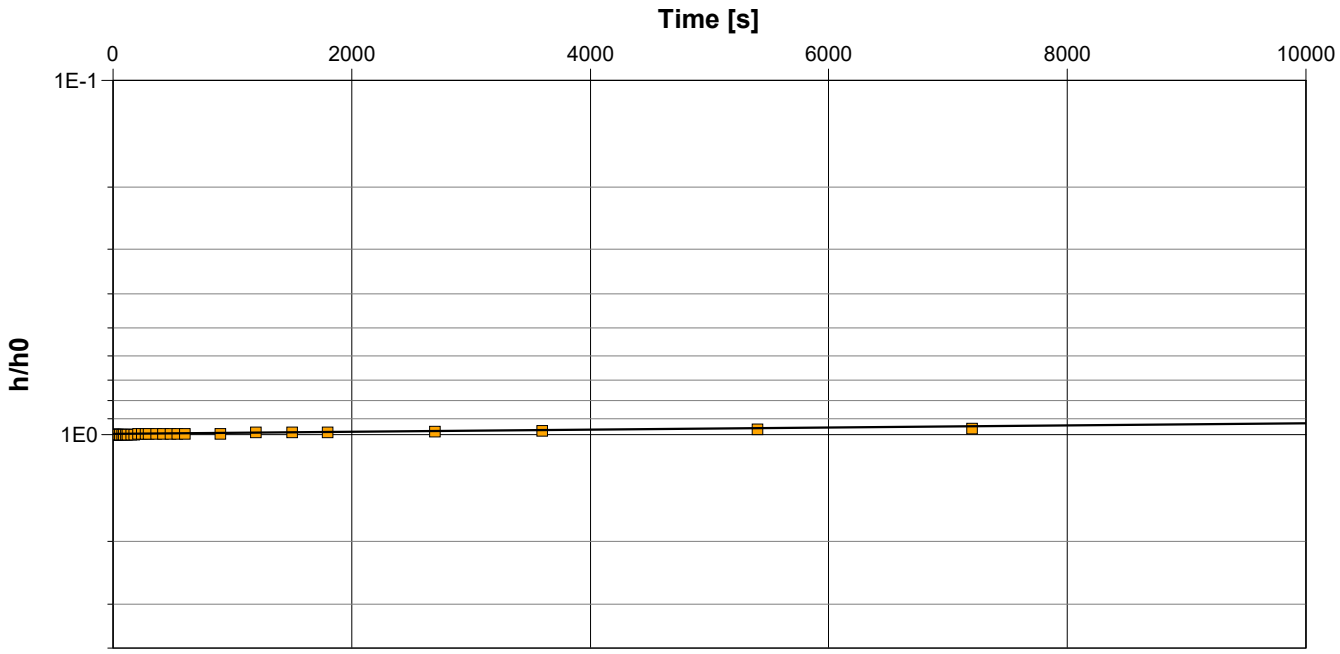
Slug Test Analysis Report

Project: 535-551 Brant Street

Number: 20-016

Client: Carriage Gate

Location: Burlington, Ontario	Slug Test: BH106	Test Well: BH106
Test Conducted by: LJ		Test Date: 2021-02-04
Analysis Performed by: JN	BH106	Analysis Date: 2021-02-09
Aquifer Thickness: 18.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106	2.74×10^{-9}	

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Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

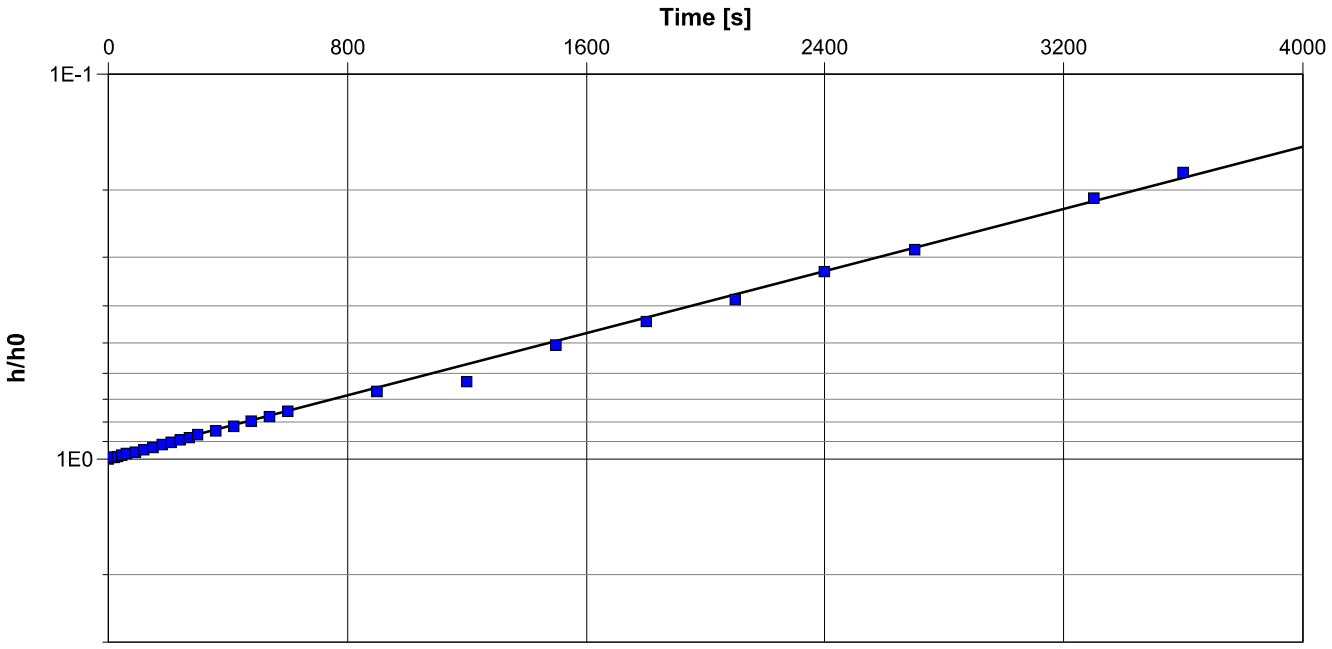
Slug Test Analysis Report

Project: 535 - 551 Brant Street

Number: 1-18-0718-46

Client: Carriage Gate Homes

Location: Burlington	Slug Test: Rising Head Test - BH104	Test Well: BH104
Test Conducted by: TG		Test Date: 2/8/2019
Analysis Performed by: AA	Rising Head Test - BH104	Analysis Date: 4/15/2019
Aquifer Thickness: 18.51 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH104	1.78×10^{-7}	

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

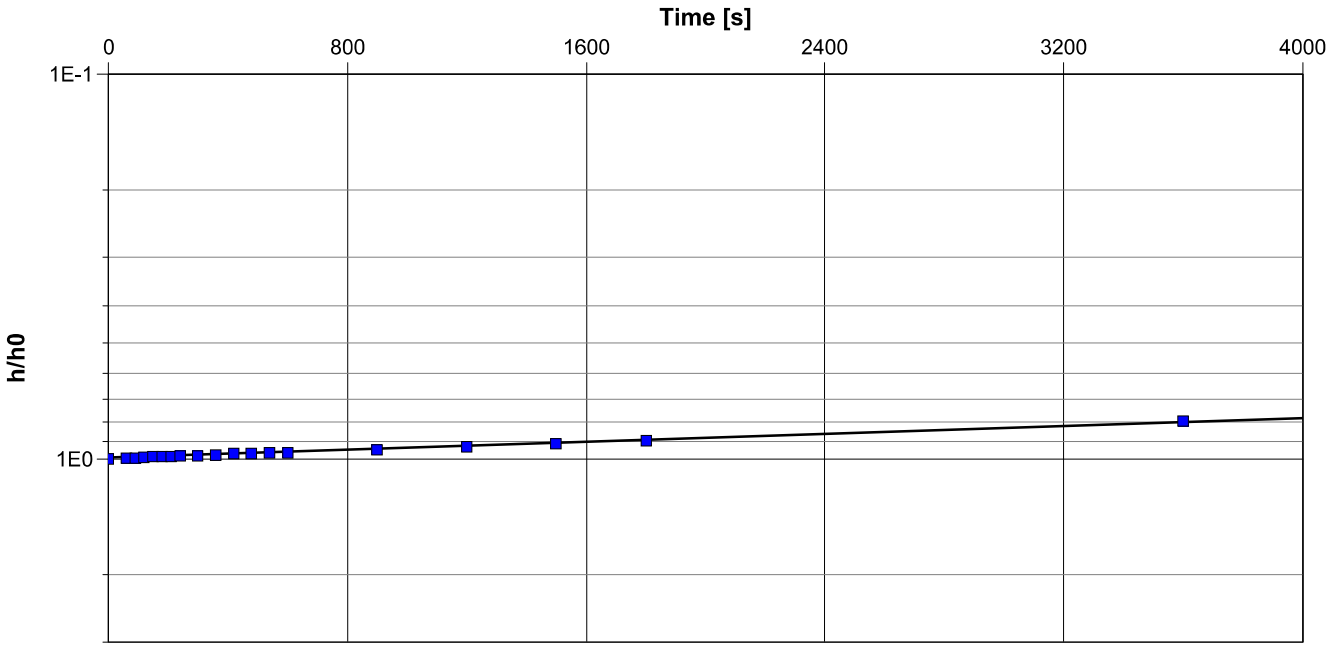
Slug Test Analysis Report

Project: 535 - 551 Brant Street

Number: 1-18-0718-46

Client: Carriage Gate Homes

Location: Burlington	Slug Test: Rising Head Test - BH106	Test Well: BH106
Test Conducted by: TG		Test Date: 2/8/2019
Analysis Performed by: AA	Rising Head Test - BH106	Analysis Date: 4/15/2019
Aquifer Thickness: 18.01 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106	2.28×10^{-8}	

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

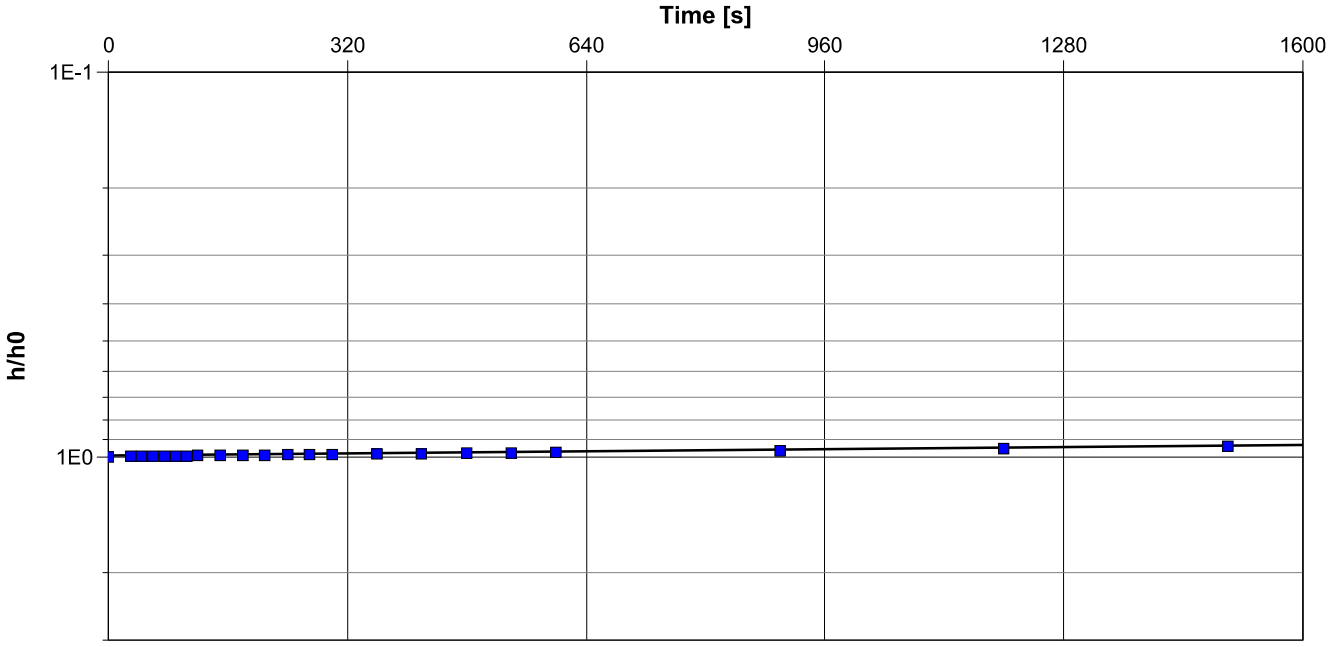
Slug Test Analysis Report

Project: 535 - 551 Brant Street

Number: 1-18-0718-46

Client: Carriage Gate Homes

Location: Burlington	Slug Test: Rising Head Test - BH107	Test Well: BH107
Test Conducted by: TG		Test Date: 2/8/2019
Analysis Performed by: AA	Rising Head Test - BH107	Analysis Date: 4/15/2019
Aquifer Thickness: 18.11 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH107	1.56×10^{-8}	

APPENDIX C



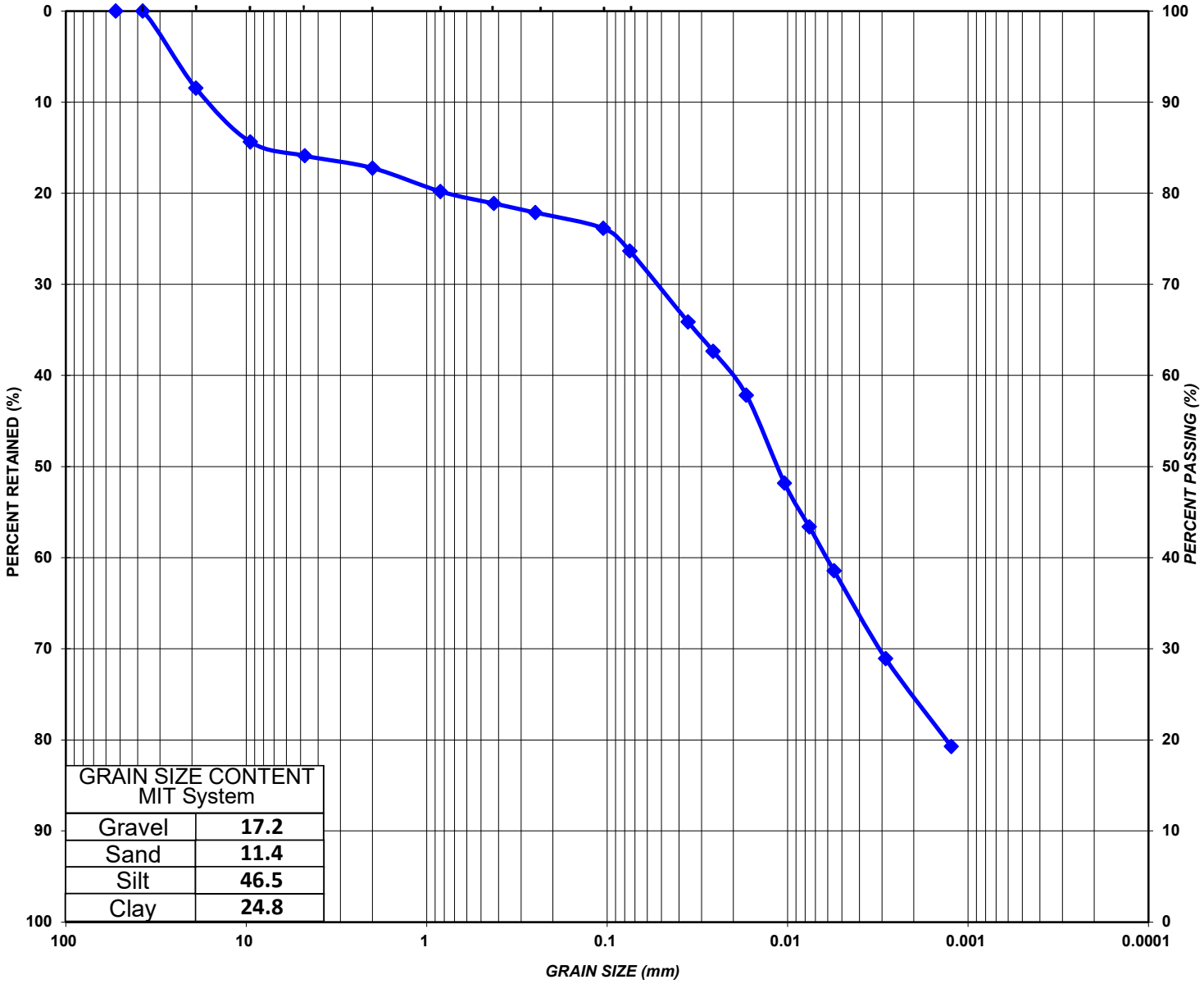
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **104**
SAMPLE NUMBER: **4B**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **CLAYEY SILT, some gravel, some sand**

FILE NO.: **1-18-0718**
LAB NO.: **1070A**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	**17.2**
Sand	**11.4**
Silt	**46.5**
Clay	**24.8**

MIT SYSTEM	**GRAVEL**		COARSE	MEDIUM	FINE	**SILT**	**CLAY**
			SAND				
UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	**SILT AND CLAY**	
	GRAVEL		**SAND**				

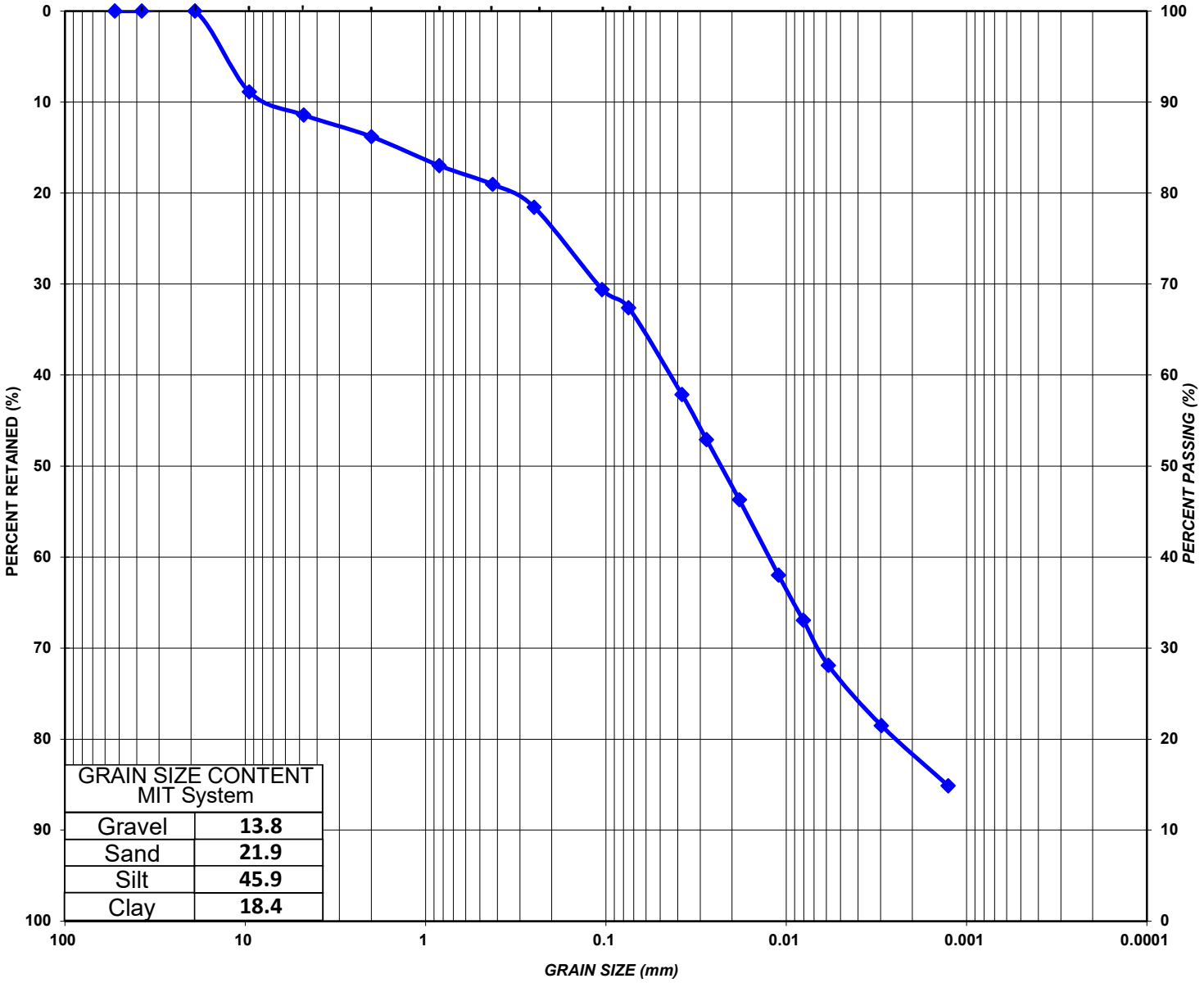
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **105**
SAMPLE NUMBER: **1**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **SANDY SILT, some clay, some gravel**

FILE NO.: **1-18-0718**
LAB NO.: **1070B**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	13.8
Sand	21.9
Silt	45.9
Clay	18.4

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				

UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

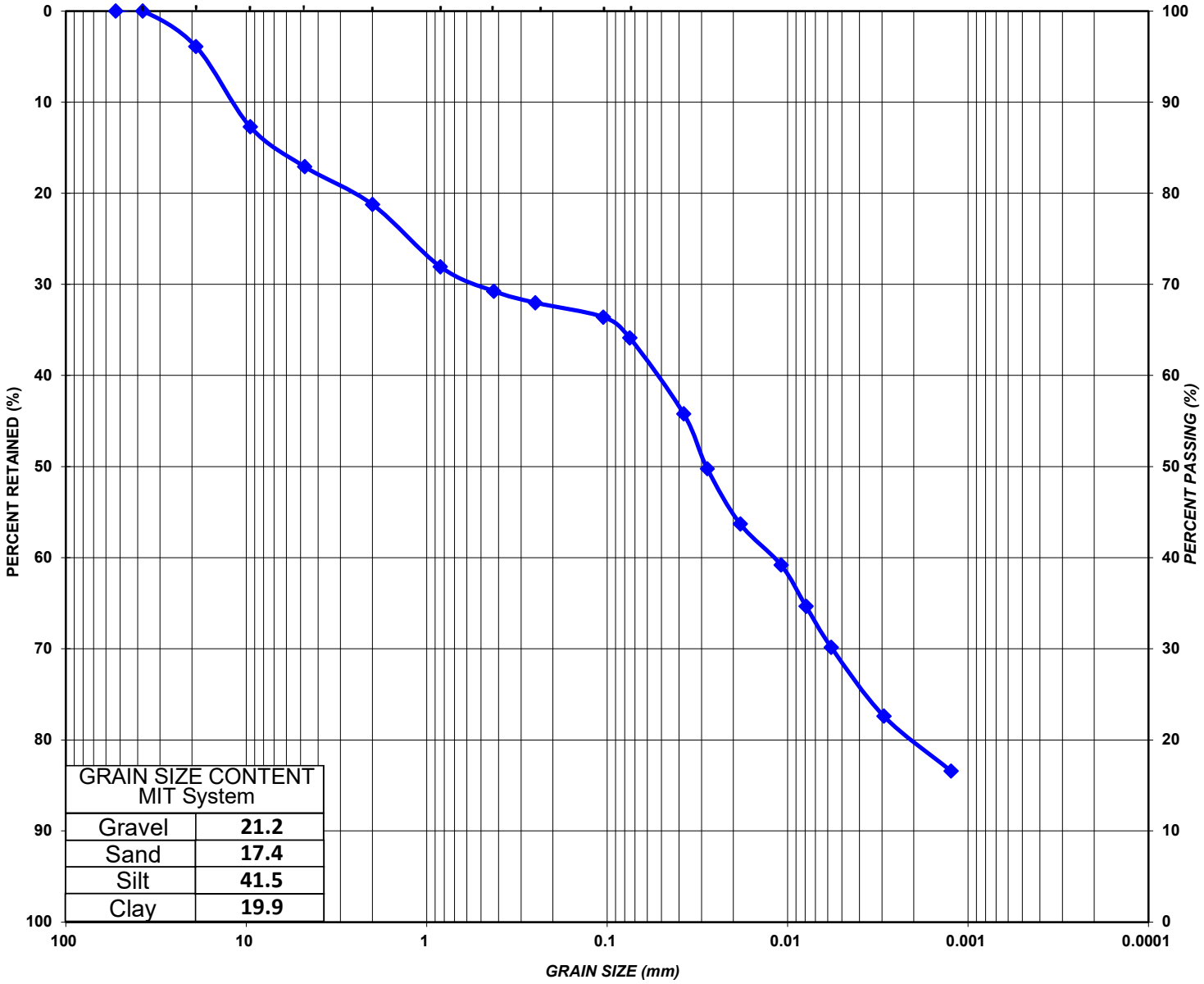
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **105**
SAMPLE NUMBER: **4**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **GRAVELLY SILT, some clay, some sand**

FILE NO.: **1-18-0718**
LAB NO.: **1070C**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	**21.2**
Sand	**17.4**
Silt	**41.5**
Clay	**19.9**

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

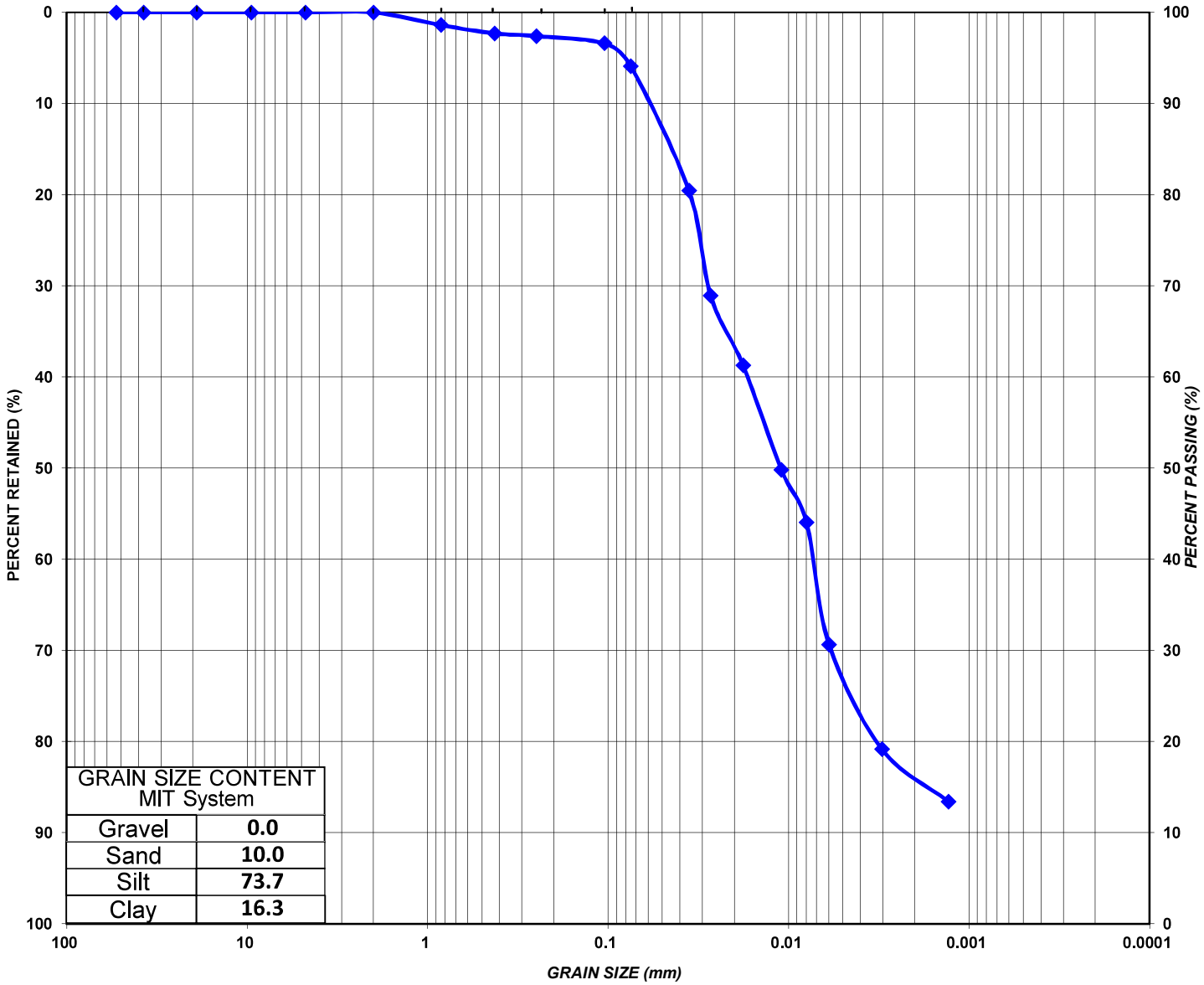
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, On.**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **106**
SAMPLE NUMBER: **4**
SAMPLE DEPTH: **7'**
SAMPLE DESCRIPTION: **SILT, some clay, trace sand**

FILE NO.: **1-18-0718**
LAB NO.: **1057**
SAMPLE DATE: **Jan 27, 2019**
SAMPLED BY: **TG**

GRAIN SIZE DISTRIBUTION



GRAIN SIZE CONTENT MIT System	
Gravel	**0.0**
Sand	**10.0**
Silt	**73.7**
Clay	**16.3**

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				

UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

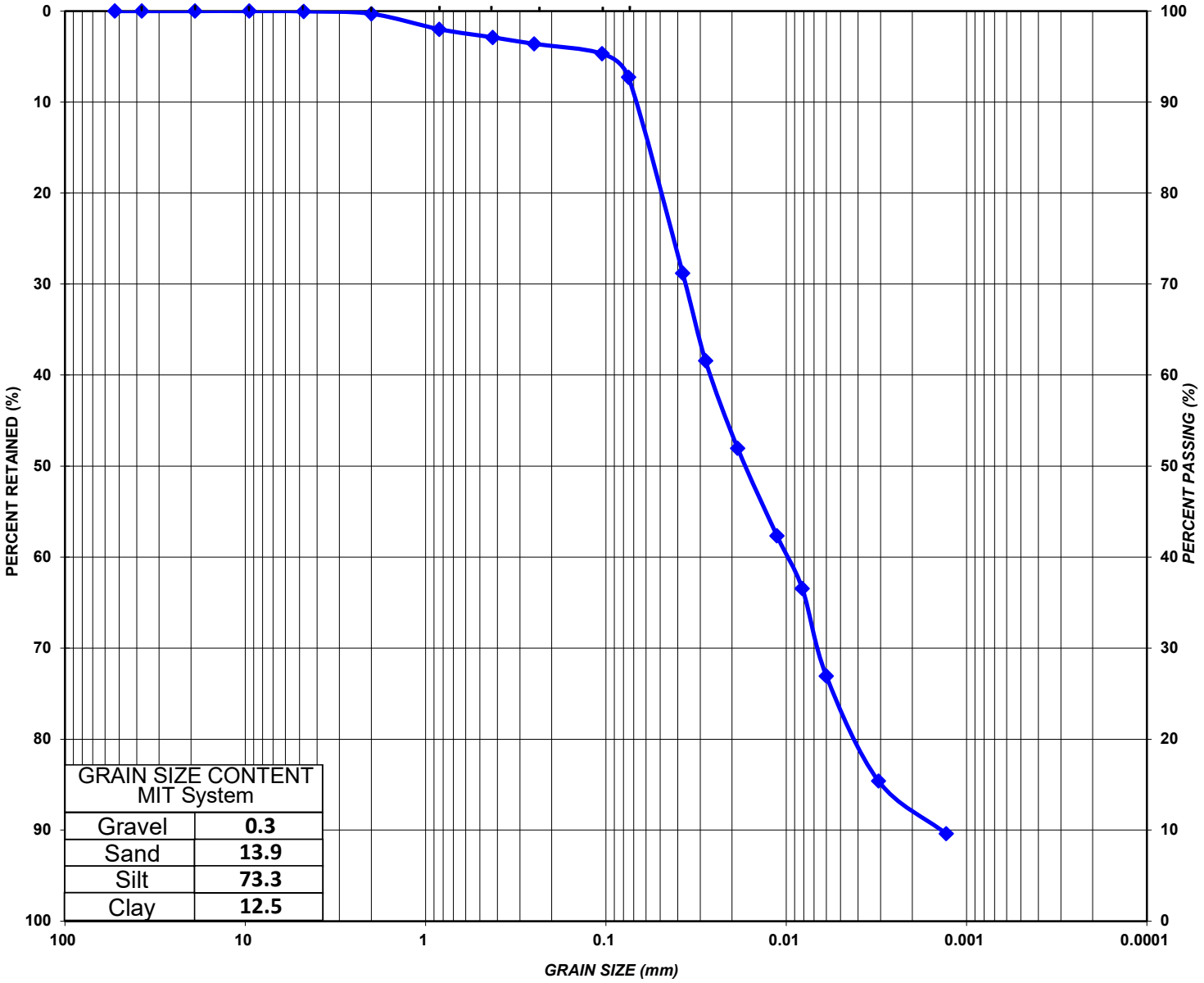
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **108**
SAMPLE NUMBER: **4**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **SILT, some sand, some clay, trace gravel**

FILE NO.: **1-18-0718**
LAB NO.: **1070D**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	0.3
Sand	13.9
Silt	73.3
Clay	12.5

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

APPENDIX D



K from Grain Size Analysis Report

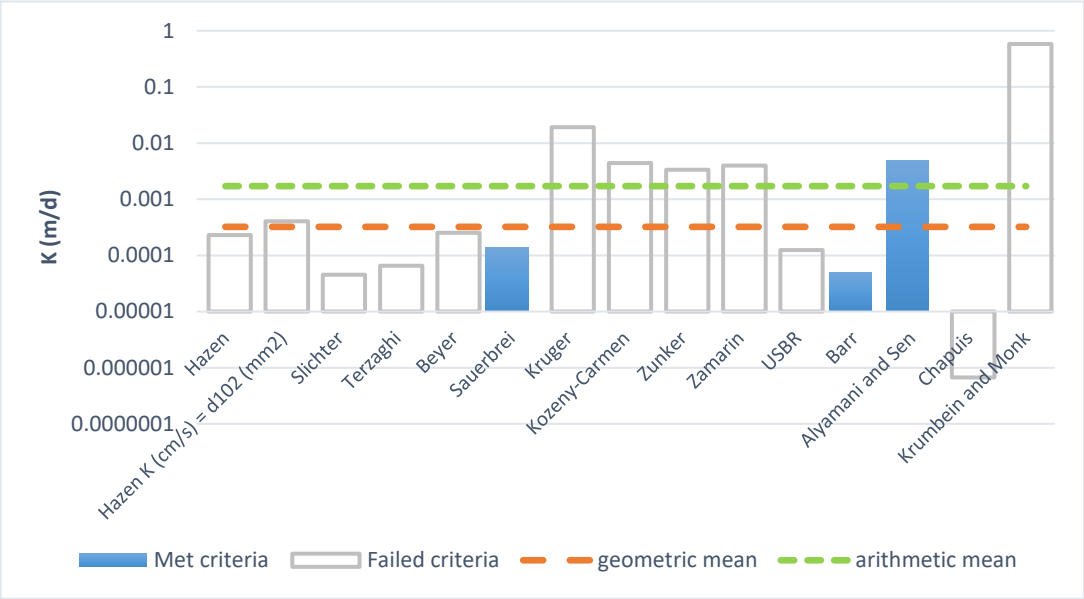
Date: 10-Feb-21

Sample Name: BH104-SS4B

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	2.7E-07	2.7E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	4.7E-07	4.7E-09	0.00	
Slichter	5.3E-08	5.3E-10	0.00	
Terzaghi	7.5E-08	7.5E-10	0.00	
Beyer	2.9E-07	2.9E-09	0.00	
Sauerbrei	1.6E-07	1.6E-09	0.00	
Kruger	2.2E-05	2.2E-07	0.02	
Kozeny-Carmen	5.1E-06	5.1E-08	0.00	
Zunker	3.9E-06	3.9E-08	0.00	
Zamarin	4.6E-06	4.6E-08	0.00	
USBR	1.4E-07	1.4E-09	0.00	
Barr	5.7E-08	5.7E-10	0.00	
Alyamani and Sen	5.7E-06	5.7E-08	0.00	
Chapuis	7.8E-10	7.8E-12	0.00	
Krumbein and Monk	6.7E-04	6.7E-06	0.58	
geometric mean	3.7E-07	3.7E-09	0.00	
arithmetic mean	2.0E-06	2.0E-08	0.00	

K from Grain Size Analysis Report

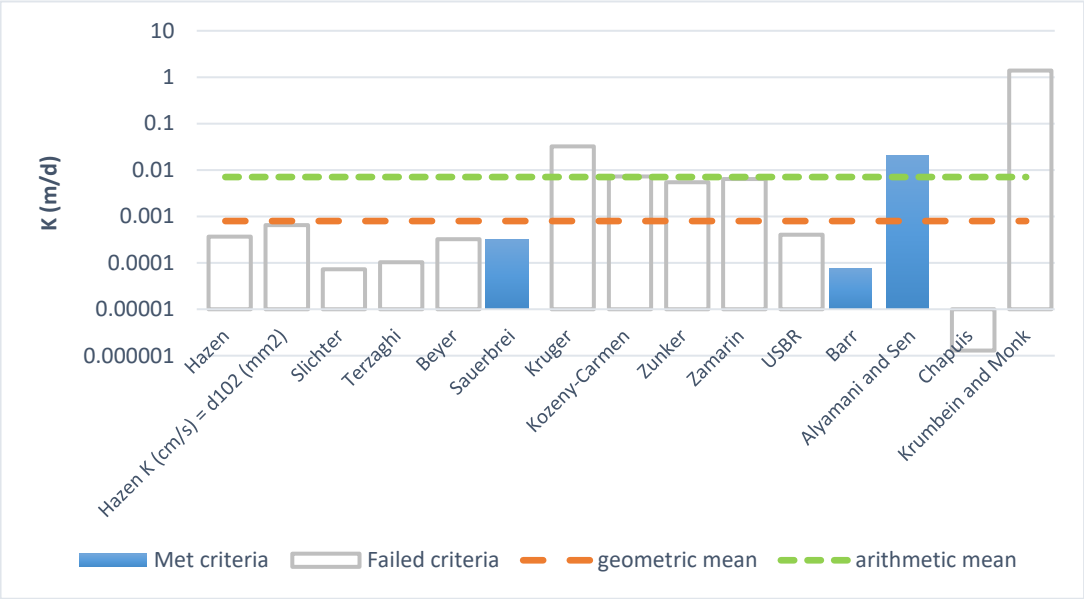
Date: 10-Feb-21

Sample Name: BH105-SS1

Mass Sample (g): 100

T (oC) 20

Poorly sorted silt low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.3E-07	4.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	7.5E-07	7.5E-09	0.00	
Slichter	8.4E-08	8.4E-10	0.00	
Terzaghi	1.2E-07	1.2E-09	0.00	
Beyer	3.7E-07	3.7E-09	0.00	
Sauerbrei	3.6E-07	3.6E-09	0.00	
Kruger	3.7E-05	3.7E-07	0.03	
Kozeny-Carmen	8.4E-06	8.4E-08	0.01	
Zunker	6.4E-06	6.4E-08	0.01	
Zamarin	7.5E-06	7.5E-08	0.01	
USBR	4.7E-07	4.7E-09	0.00	
Barr	9.0E-08	9.0E-10	0.00	
Alyamani and Sen	2.4E-05	2.4E-07	0.02	
Chapuis	1.5E-09	1.5E-11	0.00	
Krumbein and Monk	1.6E-03	1.6E-05	1.40	
geometric mean	9.2E-07	9.2E-09	0.00	
arithmetic mean	8.2E-06	8.2E-08	0.01	

K from Grain Size Analysis Report

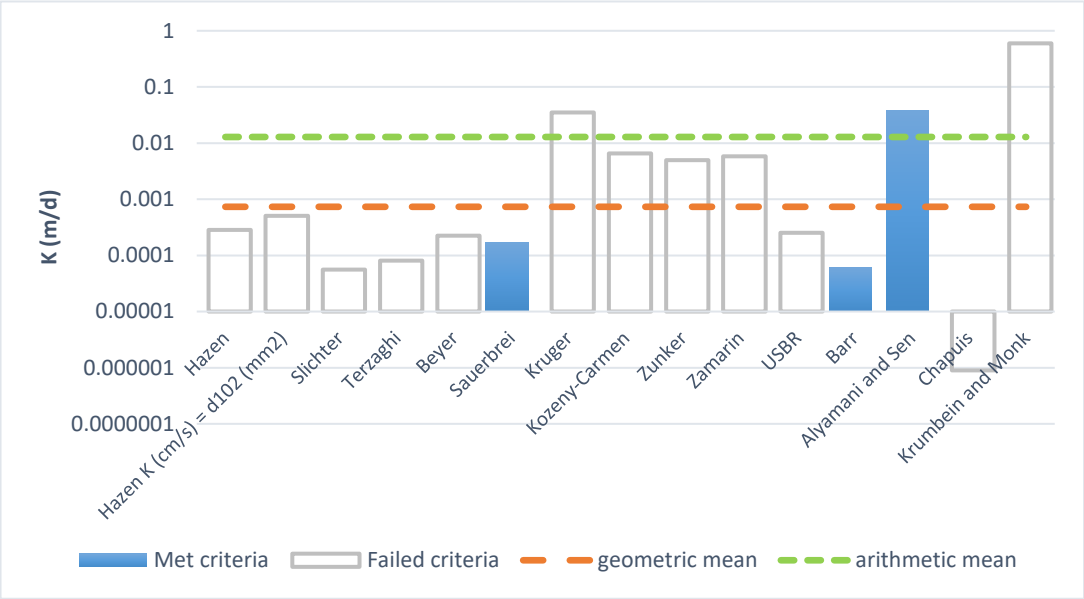
Date: 10-Feb-21

Sample Name: BH105-SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted silt low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	3.3E-07	3.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	5.8E-07	5.8E-09	0.00	
Slichter	6.5E-08	6.5E-10	0.00	
Terzaghi	9.3E-08	9.3E-10	0.00	
Beyer	2.6E-07	2.6E-09	0.00	
Sauerbrei	2.0E-07	2.0E-09	0.00	
Kruger	4.1E-05	4.1E-07	0.04	
Kozeny-Carmen	7.6E-06	7.6E-08	0.01	
Zunker	5.7E-06	5.7E-08	0.00	
Zamarin	6.7E-06	6.7E-08	0.01	
USBR	2.9E-07	2.9E-09	0.00	
Barr	7.0E-08	7.0E-10	0.00	
Alyamani and Sen	4.4E-05	4.4E-07	0.04	
Chapuis	1.0E-09	1.0E-11	0.00	
Krumbein and Monk	6.9E-04	6.9E-06	0.60	
geometric mean	8.5E-07	8.5E-09	0.00	
arithmetic mean	1.5E-05	1.5E-07	0.01	

K from Grain Size Analysis Report

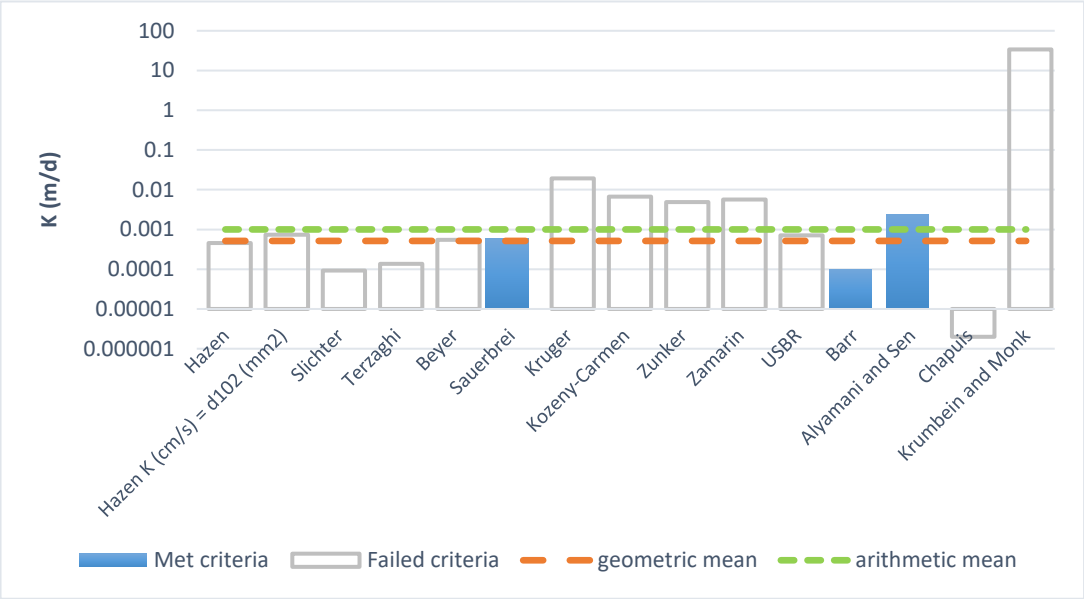
Date: 10-Feb-21

Sample Name: BH106-SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	5.3E-07	5.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	8.6E-07	8.6E-09	0.00	
Slichter	1.1E-07	1.1E-09	0.00	
Terzaghi	1.6E-07	1.6E-09	0.00	
Beyer	6.4E-07	6.4E-09	0.00	
Sauerbrei	6.8E-07	6.8E-09	0.00	
Kruger	2.2E-05	2.2E-07	0.02	
Kozeny-Carmen	7.7E-06	7.7E-08	0.01	
Zunker	5.6E-06	5.6E-08	0.00	
Zamarin	6.6E-06	6.6E-08	0.01	
USBR	8.2E-07	8.2E-09	0.00	
Barr	1.2E-07	1.2E-09	0.00	
Alyamani and Sen	2.7E-06	2.7E-08	0.00	
Chapuis	2.3E-09	2.3E-11	0.00	
Krumbein and Monk	4.0E-02	4.0E-04	34.21	
geometric mean	6.0E-07	6.0E-09	0.00	
arithmetic mean	1.2E-06	1.2E-08	0.00	

K from Grain Size Analysis Report

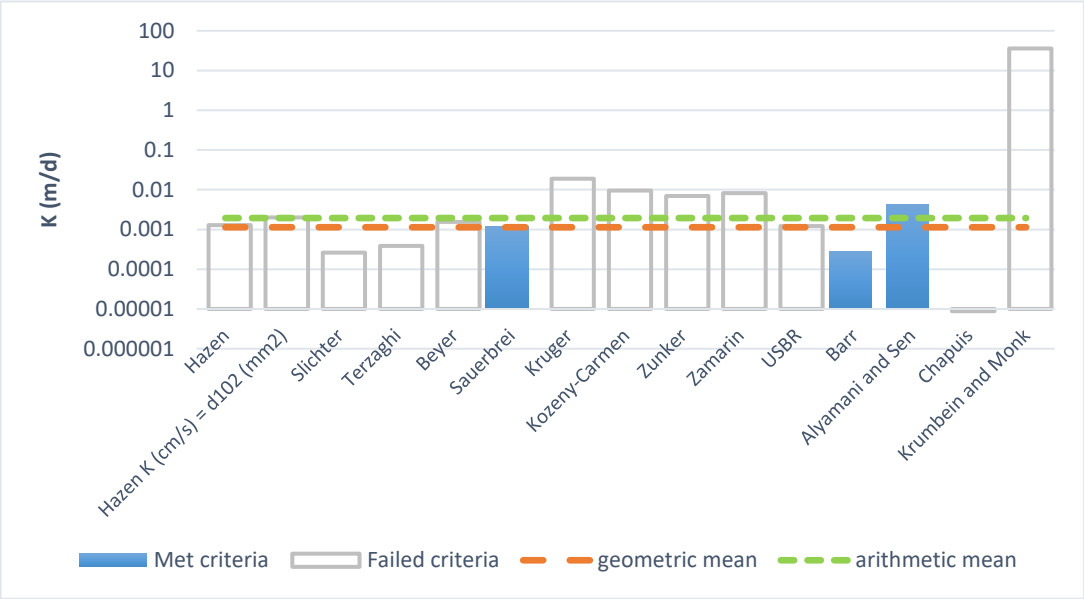
Date: 10-Feb-21

Sample Name: BH108-SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted silt low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.5E-06	1.5E-08	0.00	
Hazen K (cm/s) = d_{10} (mm)	2.3E-06	2.3E-08	0.00	
Slichter	3.0E-07	3.0E-09	0.00	
Terzaghi	4.5E-07	4.5E-09	0.00	
Beyer	1.8E-06	1.8E-08	0.00	
Sauerbrei	1.4E-06	1.4E-08	0.00	
Kruger	2.2E-05	2.2E-07	0.02	
Kozeny-Carmen	1.1E-05	1.1E-07	0.01	
Zunker	8.1E-06	8.1E-08	0.01	
Zamarin	9.6E-06	9.6E-08	0.01	
USBR	1.4E-06	1.4E-08	0.00	
Barr	3.3E-07	3.3E-09	0.00	
Alyamani and Sen	5.0E-06	5.0E-08	0.00	
Chapuis	1.0E-08	1.0E-10	0.00	
Krumbein and Monk	4.2E-02	4.2E-04	36.07	
geometric mean	1.3E-06	1.3E-08	0.00	
arithmetic mean	2.2E-06	2.2E-08	0.00	

Adopting the equation form presented in Vukovic and Soro (1992),

$$K = \frac{\rho g}{\mu} N \varphi(n) d_e^2$$

the following values and equations aresubstituted into the appropriate terms to evalute the models listed in the table below. The values of d_e to be entered should be in cm units. The values of *K* calculated have the units cm/s, except for the Alyamani and Sen model (see footnote).

Source	*N*	*φ(n)*	d_e	Applicable Conditions
Hazen simplified (Freeze and Cherry, 1979)	$10\frac{\mu}{\rho g}$	1	d_{10}	uniformly graded sand, $n = 0.375$ $T = 10$ °C
Hazen (1892)[a]	6×10^{-4}	$[1 + 10(n - 0.26)]$	d_{10}	0.01 cm < d_{10} < 0.3 cm $U < 5$
Slichter (1898)[a]	1×10^{-2}	$n^{3.287}$	d_{10}	0.01 cm < d_{10} < 0.5 cm
Terzaghi (1925)[a]	10.7×10^{-3} smooth grains 6.1×10^{-3} coarse grains	$\left(\frac{n - 0.13}{\sqrt[3]{1-n}}\right)^2$	d_{10}	sandy soil, coarse sand
Beyer (1964)[a]	$5.2 \times 10^{-4} \log\frac{500}{U}$	1	d_{10}	0.006 cm < d_{10} <0.06 cm $1 < U < 20$
Sauerbrei (1932)[a] (Vuković and Soro, 1992)	$(3.75 \times 10^{-5}) \times \tau$ $\tau \cong 1.093 \times 10^{-4} T^2 + 2.102 \times 10^{-2} T + 0.5889$	$\frac{n^3}{(1-n)^2}$	d_{17}	sand and sandy clay $d_{17} < 0.05$ cm
Krüger (1919)[a]	4.35×10^{-4}	$\frac{n}{(1-n)^2}$	$\frac{1}{\sum_{i=1}^{n} \frac{\Delta w_i}{d_i}}$	medium sand $U > 5$ $T = 0$ °C
Kozeny-Carmen (1953)[a]	8.3×10^{-3}	$\frac{n^3}{(1-n)^2}$	d_{10} or $\frac{1}{\frac{3}{2}\frac{\Delta w_1}{d_1} + \sum_{i=2}^{n} \Delta g_i \frac{d_i^g + d_i^d}{2 d_i^g d_i^d}}$ $d_1 = \frac{1}{\frac{1}{2}\left(\frac{1}{d_i^g} + \frac{1}{d_i^d}\right)}$	Coarse sand
Zunker (1930)[a]	0.7 × 10⁻³ for nonuniform, clayey, angular grains 1.2 × 10⁻³ for nonuniform 1.4 × 10⁻³ for uniform, coarse grains 2.4 × 10⁻³ for uniform sand, well rounded grains	$\frac{n}{(1-n)}$	$\frac{1}{\sum_{i=1}^{n} \Delta g_i \frac{d_i^g - d_i^d}{d_i^g d_i^d ln\left(\frac{d_i^g}{d_i^d}\right)}}$	no fractions finer than $d = 0.0025$ mm
Zamarin (1928)[a]	8.65×10^{-3}	$\frac{n^3}{(1-n)^2} C_n$ $C_n = (1.275 - 1.5n)^2$	$\frac{1}{\frac{\ln\left(\frac{d_i^g}{d_i^d}\right)}{\sum_{i=1}^{n} \Delta g_i \frac{d_i^g - d_i^d}{d_i^g}}}$	Large grained sands with no fractions having $d < 0.00025$ mm
USBR (United States Bureau of Reclamation) (Bialas, 1966)[a]	$(4.8 \times 10^{-4})(10^{0.3})$	1.0	$d_{20}^{1.15}$	Medium grained sands with $U < 5$; derived for $T = 15$ °C
Barr (2001)	$\frac{1}{(36)5C_s^2}$ $C_s^2 = 1$ for spherical grains $C_s^2 = 1.35$ for angular grains	$\frac{n^3}{(1-n)^2}$	d_{10}	unspecified
Alyamani and Sen (1993)	1300	1.0	$[I_o + 0.025(d_{50} - d_{10})]$	unspecified
Chapuis (2004)	$\frac{\mu}{\rho g}$	$10^{1.291\xi - 0.6435}$ $\xi = \frac{n}{1-n}$	$d_{10}^{\left(\frac{10^{(0.5504 - 0.2937\xi)}}{2}\right)}$	$0.3 < n < 0.7$ $0.10 < d_{10} < 2.0$ mm $2 < U < 12$ $d_{10}/d_5 < 1.4$
Krumbein and Monk (1942)	7.501×10^{-6}	$e^{(-1.31 \times \sigma_\phi)}$ $\sigma_\phi = \frac{d_{84\phi} - d_{16\phi}}{4} - \frac{d_{95\phi} - d_{5\phi}}{6.6}$	$2^{\left(\frac{d_{16\phi} + d_{50\phi} + d_{84\phi}}{3}\right)}$	natural sands with lognormal grain size distribution

* indicates formulas were taken from Vuković and Soro, (1992)
N = constant dependent on characteristics of the porous medium
φ(n) = function of porosity
T = water temp. (°C)
g = 980 cm s^{-2}
$\rho = 3.1 \times 10^{-8} T^3 - 7.0 \times 10^{-6} T^2 + 4.19 \times 10^{-5} T + 0.99985$
$\mu = -7.0 \times 10^{-8} T^3 + 1.002 \times 10^{-5} T^2 - 5.7 \times 10^{-4} T + 0.0178$
$\tau = 1.093 \times 10^{-4} T^2 + 2.102 \times 10^{-2} T + 0.5889$
n = porosity as fraction of aquifer volume
d_i^g = the maximum grain diameter in fraction *i*
d_i^d = the minimum grain diameter in fraction *i*
d_{10} = grain size (cm) corresponding to 10% by weight passing through the sieves
d_{20} = grain size (cm) corresponding to 20% by weight passing through the sieves
d_{50} = grain size (cm) corresponding to 50% by weight passing through the sieves
d_{60} = grain size (cm) corresponding to 60% by weight passing through the sieves
$U = d_{60}/d_{10}$
Δg_i = the fraction of mass that passes between sieves *i* and *i+1* where *i* is the smaller sieve
Δw_i = fraction of total weight of sample with fraction identifier '*i*'
d_i = mean grain diameter of the fraction *i*
$d_{i\phi}$ = mean grain diameter of the fraction *i* in phi units ($\phi = \log_2 (d_e/d_o)$, d_e in mm, $d_o = 1$ mm)
I_o = x-intercept (grain size) of a percent grain retention curve plotted on arithmetic axes and focussing on data below 50% retained

References

(1) Aguilar, J.R. 2013. Analysis of grain size distribution and hydraulic conductivity for a variety of sediment types with application to wadi sediments. M.B2:B19S. thesis submitted to King Abdullah University of Science and Technology, Thuwal, Kingdom of Saudi Arabia, 134 pp.

(2) Alyamani, M.S., Sen Z. 1993. Determination of hydraulic conductivity from complete grain-size distribution curves. Ground Water, v. 31, no. 4, 551-555.

(3) Barr, D.W. 2001. Coefficient of permeability determined by measurable parameters. Ground Water, v. 39, no. 3, 356-361.

(4) Barth, G.R., Hill, M.C., Illangasekare, T.H., Rajaram, H. 2001. Predictive modeling of flow and transport in a two-dimensional intermediate-scale, heterogeneous porous medium. Water Resources Research, v. 37, no. 10, 2503–2512.

(5) Beyer, W. 1964. "Zur Bestimmung der Wasserdurchlässigkeit von Kiesen und Sanden aus der Kornverteilungskurve." Wasserwirtschaft-Wassertechnik 14(6): 165-168.

(6) Białas, Z. (1966). O usrednianiu wspolczynnikow filtracji z zastosowaniem elektronicznej cyfrowej maszyny matematycznej (Averaging filter coefficients using digital electronic mathematical machines). Przedsiebiorstwo Geologiczne we Wroclawiu: 47-50.

(7) Chapuis, R.P. 2004. Predicting the saturated hydraulic conductivity of sand and gravel using effective diameter and void ratio. Canadian Geotechnical Journal, v. 41, 787–795.

(8) Devlin, J.F. (2015). HydrogeoSieveXL. Excel-based Visual Basic tool freely available at http://www.people.ku.edu/~jfdevlin/Publications.html. Cited 18 February, 2015.

(9) Dullien, F.A., 1991. Fluid Transport and Pore Structure. Academic Press, San Diego, CA.

(10) Freeze, R.A., Cherry, J.A. 1979. Groundwater. Prentice Hall, Englewood Cliffs, New Jersey.

(11) Fuchs, S. (2010) Deterministische kf-Wert-Schätzung nach petrographischer Bohrgutansprache (Deterministic kf value estimation from petrographic borehole records). Grundwasser – Zeitschrift der Fachsektion Hydrogeologie 15: 177–189.

(12) Hazen, A. 1892. Some physical properties of sands and gravels, with special reference to their use in filtration. Massachusetts State Board of Health, vol. 24th annual report, pp. 539-556.

(13) Kasenow, M., 2002, Determination of Hydraulic Conductivity from Grain Size Analysis: Water Resources Publications, LLC, Highlands Ranch, Colorado, 97p.

(14) Kozeny, J. (1953). Das Wasser im Boden. Grundwasserbewegung (The water in the ground. Groundwater flow). Hydraulik, Springer, p 380-445.

(15) Krüger, E., 1919. Die Grundwasserbewegung (Groundwater flow). Int. Mitt. Bodenk. 8, 105–122.

(16) Krumbein, W.C., Monk, G.D. 1942. Permeability as a function of the size parameters of unconsolidated sand. American Institute of Mining and Metallurgical Engineers, Transactions v. 151, 153-163.

(17) Moreau, J.P. Program to demonstrate the Akima spline fitting of Function SIN(X) in double precision. http://jean-pierre.moreau.pagesperso-orange.fr/Fortran/akima_f90.txt . Cited 30 January, 2015.

(18) Odong, J. 2013. Evaluation of empirical formulae for determination of hydraulic conductivity based on grain-size analysis. International Journal of Agriculture and Environment, v. 1, 1-8.

(19) Rosas, J., Lopez, O., Missimer, T.M., Coulibaly, K.M., Dehwah, A.H.A., Sesler, K., Lujan, L.R., Mantilla, D. 2014. Determination of hydraulic conductivity from grain-size distribution for different depositional environments. Groundwater, v. 52, no. 3, 399-413.

(20) Slichter, C.S., 1898, Theoretical investigations of the motion of ground waters: United States Geological Survey, 19 th Annual Report, p 295-384.

(21) Terzaghi, K., 1925, Principles of soil mechanics: Engineering News-Record, v. 95, p 832.

(22) Urumovic, K., Urumovic, K. Sr. 2106. The referential grain size and effective porosity in the Kozeny–Carman model. Hydrological Earth System Science, v. 20, 1669-1680.

(23) Vukovic, M., Soro, A. 1992. Determinatiion of hydraulic conductivity of porous media from grain-size composition. Miladinov, D., translator, Water Resources Publications, Littleton, Colorado, USA, 83 pp.

(24) Zamarin, J.A. 1928. Calculation of ground-water flow (in Russian). Trudey I.V.H. Taskeni.

(25) Zunker, F. (1930). Das Verhalten des Wassers zum Boden (The behavior of groundwater). Zeitschrift für Pflanzenernährung, Düngung und Bodenkunde. A25(1): 7.

APPENDIX E



Your Project #: 21-016
Site Location: 535-551 BRANT STREET
Your C.O.C. #: 812312-02-01

Attention: Jason Ngo

Grounded Engineering Inc.
12 Banigan Drive
Toronto, ON
CANADA M4H 1E9

Report Date: 2021/02/18
Report #: R6522954
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C131452
Received: 2021/02/04, 17:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonaceous BOD	1	2021/02/05	2021/02/10	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2021/02/05	2021/02/05	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2021/02/05	2021/02/08	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/02/08	2021/02/08	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2021/02/08	2021/02/08	CAM SOP-00408	EPA 6010D m
E.coli, (CFU/100mL)	1	N/A	2021/02/04	CAM SOP-00552	MOE LSB E3371
Animal and Vegetable Oil and Grease	1	N/A	2021/02/10	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/02/10	2021/02/10	CAM SOP-00326	EPA1664B m,SM5520B m
OC Pesticides (Selected) & PCB (1)	1	2021/02/12	2021/02/14	CAM SOP-00307	EPA 8081A/8082B m
OC Pesticides Summed Parameters	1	N/A	2021/02/05	CAM SOP-00307	EPA 8081A/8082B m
PAH Compounds in Water by GC/MS (SIM)	1	2021/02/09	2021/02/10	CAM SOP-00318	EPA 8270D m
pH	1	2021/02/05	2021/02/08	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/02/05	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2021/02/08	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2021/02/05	2021/02/09	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	1	2021/02/10	2021/02/10	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/02/08	2021/02/08	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2021/02/06	CAM SOP-00228	EPA 8260C m

Remarks:

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

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

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

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

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

Your Project #: 21-016
Site Location: 535-551 BRANT STREET
Your C.O.C. #: 812312-02-01

Attention: Jason Ngo

Grounded Engineering Inc.
12 Banigan Drive
Toronto, ON
CANADA M4H 1E9

Report Date: 2021/02/18
Report #: R6522954
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C131452
Received: 2021/02/04, 17:25

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Marijane Cruz, Senior Project Manager
Email: Marijane.Cruz@bureauveritas.com
Phone# (905)817-5756
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

BURLINGTON STORM SEWER (WATER)

BV Labs ID		OTT576		
Sampling Date		2021/02/04 15:00		
COC Number		812312-02-01		
	UNITS	SW-UF-BH107	RDL	QC Batch
Microbiological				
Escherichia coli	CFU/100mL	<10	10	7186157

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

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

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				OTT576		
Sampling Date				2021/02/04 15:00		
COC Number				812312-02-01		
	UNITS	Criteria	Criteria-2	SW-UF-BH107	RDL	QC Batch
Calculated Parameters						
Total Animal/Vegetable Oil and Grease	mg/L	150	-	0.90	0.50	7184589
Inorganics						
Total Carbonaceous BOD	mg/L	300	-	8	2	7186348
Fluoride (F-)	mg/L	10	-	0.26	0.10	7187178
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	17	0.50	7187910
pH	pH	6.0:10.0	6.5:8.5	7.11		7187190
Phenols-4AAP	mg/L	1	0.008	<0.0010	0.0010	7186836
Total Suspended Solids	mg/L	350	15	**98**	10	7189743
Dissolved Sulphate (SO4)	mg/L	1500	-	980	5.0	7187230
Total Cyanide (CN)	mg/L	2	0.02	<0.0050	0.0050	7187280
Petroleum Hydrocarbons						
Total Oil & Grease	mg/L	-	-	0.90	0.50	7193509
Total Oil & Grease Mineral/Synthetic	mg/L	-	-	<0.50	0.50	7193515
Metals						
Total Aluminum (Al)	mg/L	50	-	<1	1	7189582
Total Antimony (Sb)	mg/L	5	-	<0.2	0.2	7189582
Total Arsenic (As)	mg/L	1	0.02	**<0.1 (1)**	0.1	7189582
Total Beryllium (Be)	mg/L	5	-	<0.005	0.005	7189582
Total Cadmium (Cd)	mg/L	1	0.008	**<0.02 (1)**	0.02	7189582
Total Chromium (Cr)	mg/L	3	0.08	**<0.1 (1)**	0.1	7189582
Total Cobalt (Co)	mg/L	5	-	<0.02	0.02	7189582
Total Copper (Cu)	mg/L	3	0.04	**<0.1 (1)**	0.1	7189582
Total Iron (Fe)	mg/L	50	-	6.3	0.2	7189582
Total Lead (Pb)	mg/L	3	0.12	<0.1	0.1	7189582
Total Manganese (Mn)	mg/L	5	0.05	**1.8**	0.01	7189582
Mercury (Hg)	mg/L	0.05	0.0004	<0.00010	0.00010	7189828
Total Molybdenum (Mo)	mg/L	5	-	<0.05	0.05	7189582
Total Nickel (Ni)	mg/L	3	0.08	<0.05	0.05	7189582

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

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
Criteria-2: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge
(1) RDL exceeds criteria

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

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				OTT576		
Sampling Date				2021/02/04 15:00		
COC Number				812312-02-01		
	UNITS	Criteria	Criteria-2	SW-UF-BH107	RDL	QC Batch
Total Phosphorus (P)	mg/L	10	0.4	**<0.5 (1)**	0.5	7189582
Total Selenium (Se)	mg/L	5	0.02	**<0.2 (1)**	0.2	7189582
Total Silver (Ag)	mg/L	5	0.12	<0.1	0.1	7189582
Total Tin (Sn)	mg/L	5	-	<0.2	0.2	7189582
Total Titanium (Ti)	mg/L	5	-	<0.05	0.05	7189582
Total Zinc (Zn)	mg/L	3	0.04	**<0.05 (1)**	0.05	7189582
Polyaromatic Hydrocarbons						
Naphthalene	ug/L	140	-	<0.050	0.050	7193106
Volatile Organics						
Benzene	ug/L	10	2	<0.40	0.40	7184452
Chloroform	ug/L	40	2	0.83	0.40	7184452
1,2-Dichlorobenzene	ug/L	-	5.6	<0.80	0.80	7184452
1,4-Dichlorobenzene	ug/L	80	6.8	<0.80	0.80	7184452
cis-1,2-Dichloroethylene	ug/L	-	5.6	<1.0	1.0	7184452
trans-1,3-Dichloropropene	ug/L	-	5.6	<0.80	0.80	7184452
Ethylbenzene	ug/L	160	2	<0.40	0.40	7184452
Methylene Chloride(Dichloromethane)	ug/L	2000	5.2	<4.0	4.0	7184452
1,1,2,2-Tetrachloroethane	ug/L	-	17	<0.80	0.80	7184452
Tetrachloroethylene	ug/L	1000	4.4	<0.40	0.40	7184452
Toluene	ug/L	16	2	<0.40	0.40	7184452
Trichloroethylene	ug/L	400	7.6	<0.40	0.40	7184452
Surrogate Recovery (%)						
D10-Anthracene	%	-	-	107		7193106
D14-Terphenyl (FS)	%	-	-	91		7193106
D8-Acenaphthylene	%	-	-	94		7193106
4-Bromofluorobenzene	%	-	-	95		7184452
D4-1,2-Dichloroethane	%	-	-	112		7184452
D8-Toluene	%	-	-	95		7184452

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

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
Criteria-2: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge
(1) RDL exceeds criteria

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

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

ORGANOCHLORINATED PESTICIDES BY GC-ECD (WATER)

BV Labs ID			OTT576		
Sampling Date			2021/02/04 15:00		
COC Number			812312-02-01		
	UNITS	Criteria	SW-UF-BH107	RDL	QC Batch
Calculated Parameters					
Aldrin + Dieldrin	ug/L	-	<0.005	0.005	7184287
Chlordane (Total)	ug/L	-	<0.005	0.005	7184287
DDT+ Metabolites	ug/L	-	<0.005	0.005	7184287
Heptachlor + Heptachlor epoxide	ug/L	-	<0.005	0.005	7184287
o,p-DDD + p,p-DDD	ug/L	-	<0.005	0.005	7184287
o,p-DDE + p,p-DDE	ug/L	-	<0.005	0.005	7184287
o,p-DDT + p,p-DDT	ug/L	-	<0.005	0.005	7184287
Total Endosulfan	ug/L	-	<0.005	0.005	7184287
Total PCB	ug/L	0.4	<0.05	0.05	7184287
Pesticides & Herbicides					
Aldrin	ug/L	-	<0.005	0.005	7199906
Dieldrin	ug/L	-	<0.005	0.005	7199906
a-Chlordane	ug/L	-	<0.005	0.005	7199906
g-Chlordane	ug/L	-	<0.005	0.005	7199906
o,p-DDD	ug/L	-	<0.005	0.005	7199906
p,p-DDD	ug/L	-	<0.005	0.005	7199906
o,p-DDE	ug/L	-	<0.005	0.005	7199906
p,p-DDE	ug/L	-	<0.005	0.005	7199906
o,p-DDT	ug/L	-	<0.005	0.005	7199906
p,p-DDT	ug/L	-	<0.005	0.005	7199906
Lindane	ug/L	-	<0.003	0.003	7199906
Endosulfan I (alpha)	ug/L	-	<0.005	0.005	7199906
Endosulfan II (beta)	ug/L	-	<0.005	0.005	7199906
Endrin	ug/L	-	<0.005	0.005	7199906
Heptachlor	ug/L	-	<0.005	0.005	7199906
Heptachlor epoxide	ug/L	-	<0.005	0.005	7199906
Hexachlorobenzene	ug/L	-	<0.005	0.005	7199906
Methoxychlor	ug/L	-	<0.01	0.01	7199906
Aroclor 1016	ug/L	-	<0.05	0.05	7199906

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

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

ORGANOCHLORINATED PESTICIDES BY GC-ECD (WATER)

BV Labs ID			OTT576		
Sampling Date			2021/02/04 15:00		
COC Number			812312-02-01		
	UNITS	Criteria	SW-UF-BH107	RDL	QC Batch
Aroclor 1221	ug/L	-	<0.05	0.05	7199906
Aroclor 1232	ug/L	-	<0.05	0.05	7199906
Aroclor 1242	ug/L	-	<0.05	0.05	7199906
Aroclor 1248	ug/L	-	<0.05	0.05	7199906
Aroclor 1254	ug/L	-	<0.05	0.05	7199906
Aroclor 1260	ug/L	-	<0.05	0.05	7199906
alpha-BHC	ug/L	-	<0.005	0.005	7199906
beta-BHC	ug/L	-	<0.005	0.005	7199906
delta-BHC	ug/L	-	<0.005	0.005	7199906
Endosulfan sulfate	ug/L	-	<0.005	0.005	7199906
Endrin aldehyde	ug/L	-	<0.005	0.005	7199906
Endrin ketone	ug/L	-	<0.005	0.005	7199906
Mirex	ug/L	-	<0.005	0.005	7199906
Octachlorostyrene	ug/L	-	<0.005	0.005	7199906
Oxychlordane	ug/L	-	<0.005	0.005	7199906
Toxaphene	ug/L	-	<0.2	0.2	7199906
Surrogate Recovery (%)					
2,4,5,6-Tetrachloro-m-xylene	%	-	64		7199906
Decachlorobiphenyl	%	-	90		7199906

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

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

TEST SUMMARY

BV Labs ID: OTT576
Sample ID: SW-UF-BH107
Matrix: Water

Collected: 2021/02/04
Shipped:
Received: 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	7186348	2021/02/05	2021/02/10	Nusrat Naz
Total Cyanide	SKAL/CN	7187280	2021/02/05	2021/02/05	Aditiben Patel
Fluoride	ISE	7187178	2021/02/05	2021/02/08	Surinder Rai
Mercury in Water by CVAA	CV/AA	7189828	2021/02/08	2021/02/08	Prempal Bhatti
Total Metals Analysis by Axial ICP	ICPX	7189582	2021/02/08	2021/02/08	Archana Patel
E.coli, (CFU/100mL)	PL	7186157	N/A	2021/02/04	Sirimathie Aluthwala
Animal and Vegetable Oil and Grease	BAL	7184589	N/A	2021/02/10	Automated Statchk
Total Oil and Grease	BAL	7193509	2021/02/10	2021/02/10	Jay Tailor
OC Pesticides (Selected) & PCB	GC/ECD	7199906	2021/02/12	2021/02/14	Li Peng
OC Pesticides Summed Parameters	CALC	7184287	N/A	2021/02/05	Automated Statchk
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7193106	2021/02/09	2021/02/10	Mitesh Raj
pH	AT	7187190	2021/02/05	2021/02/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7186836	N/A	2021/02/05	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	7187230	N/A	2021/02/08	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	7187910	2021/02/05	2021/02/09	Louise Harding
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7193515	2021/02/10	2021/02/10	Jay Tailor
Total Suspended Solids	BAL	7189743	2021/02/08	2021/02/08	Massarat Jan
Volatile Organic Compounds in Water	GC/MS	7184452	N/A	2021/02/06	Juan Pangilinan

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

GENERAL COMMENTS

Revised Report (2021/02/18) : SW-UF City of Burlington Storm Sewer Discharge limits included in the certificate of analysis per client request.

Sample OTT576 [SW-UF-BH107] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Metals: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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

BV Labs Job #: C131452
Report Date: 2021/02/18

QUALITY ASSURANCE REPORT

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7184452	4-Bromofluorobenzene	2021/02/06	101	70 - 130	102	70 - 130	99	%				
7184452	D4-1,2-Dichloroethane	2021/02/06	102	70 - 130	104	70 - 130	105	%				
7184452	D8-Toluene	2021/02/06	101	70 - 130	100	70 - 130	95	%				
7193106	D10-Anthracene	2021/02/10	107	50 - 130	114	50 - 130	112	%				
7193106	D14-Terphenyl (FS)	2021/02/10	101	50 - 130	108	50 - 130	104	%				
7193106	D8-Acenaphthylene	2021/02/10	100	50 - 130	104	50 - 130	93	%				
7199906	2,4,5,6-Tetrachloro-m-xylene	2021/02/13	80	50 - 130	64	50 - 130	59	%				
7199906	Decachlorobiphenyl	2021/02/13	111	50 - 130	110	50 - 130	103	%				
7184452	1,1,2,2-Tetrachloroethane	2021/02/06	97	70 - 130	100	70 - 130	<0.40	ug/L	NC	30		
7184452	1,2-Dichlorobenzene	2021/02/06	96	70 - 130	97	70 - 130	<0.40	ug/L	NC	30		
7184452	1,4-Dichlorobenzene	2021/02/06	112	70 - 130	112	70 - 130	<0.40	ug/L	NC	30		
7184452	Benzene	2021/02/06	93	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
7184452	Chloroform	2021/02/06	100	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
7184452	cis-1,2-Dichloroethylene	2021/02/06	102	70 - 130	105	70 - 130	<0.50	ug/L	NC	30		
7184452	Ethylbenzene	2021/02/06	92	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
7184452	Methylene Chloride(Dichloromethane)	2021/02/06	100	70 - 130	103	70 - 130	<2.0	ug/L	NC	30		
7184452	Tetrachloroethylene	2021/02/06	92	70 - 130	91	70 - 130	<0.20	ug/L	NC	30		
7184452	Toluene	2021/02/06	93	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		
7184452	trans-1,3-Dichloropropene	2021/02/06	107	70 - 130	106	70 - 130	<0.40	ug/L	NC	30		
7184452	Trichloroethylene	2021/02/06	103	70 - 130	105	70 - 130	<0.20	ug/L	NC	30		
7186348	Total Carbonaceous BOD	2021/02/10					<2	mg/L	25	30	92	85 - 115
7186836	Phenols-4AAP	2021/02/05	104	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
7187178	Fluoride (F-)	2021/02/08	108	80 - 120	103	80 - 120	<0.10	mg/L	1.4	20		
7187190	pH	2021/02/08			102	98 - 103			1.9	N/A		
7187230	Dissolved Sulphate (SO4)	2021/02/08	NC	75 - 125	100	80 - 120	<1.0	mg/L	3.0	20		
7187280	Total Cyanide (CN)	2021/02/05	96	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20		
7187910	Total Kjeldahl Nitrogen (TKN)	2021/02/09	98	80 - 120	108	80 - 120	<0.10	mg/L	18	20	107	80 - 120
7189582	Total Aluminum (Al)	2021/02/08	108	80 - 120	106	80 - 120	<0.1	mg/L				
7189582	Total Antimony (Sb)	2021/02/08	106	80 - 120	105	80 - 120	<0.02	mg/L				
7189582	Total Arsenic (As)	2021/02/08	106	80 - 120	105	80 - 120	<0.01	mg/L				
7189582	Total Beryllium (Be)	2021/02/08	107	80 - 120	104	80 - 120	<0.0005	mg/L				

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7189582	Total Cadmium (Cd)	2021/02/08	107	80 - 120	106	80 - 120	<0.002	mg/L				
7189582	Total Chromium (Cr)	2021/02/08	110	80 - 120	107	80 - 120	<0.01	mg/L				
7189582	Total Cobalt (Co)	2021/02/08	102	80 - 120	102	80 - 120	<0.002	mg/L				
7189582	Total Copper (Cu)	2021/02/08	108	80 - 120	106	80 - 120	<0.01	mg/L				
7189582	Total Iron (Fe)	2021/02/08	106	80 - 120	107	80 - 120	<0.02	mg/L				
7189582	Total Lead (Pb)	2021/02/08	102	80 - 120	102	80 - 120	<0.01	mg/L				
7189582	Total Manganese (Mn)	2021/02/08	106	80 - 120	104	80 - 120	<0.001	mg/L				
7189582	Total Molybdenum (Mo)	2021/02/08	103	80 - 120	102	80 - 120	<0.005	mg/L				
7189582	Total Nickel (Ni)	2021/02/08	101	80 - 120	102	80 - 120	<0.005	mg/L				
7189582	Total Phosphorus (P)	2021/02/08	102	80 - 120	103	80 - 120	<0.05	mg/L				
7189582	Total Selenium (Se)	2021/02/08	108	80 - 120	106	80 - 120	<0.02	mg/L				
7189582	Total Silver (Ag)	2021/02/08	106	80 - 120	104	80 - 120	<0.01	mg/L				
7189582	Total Tin (Sn)	2021/02/08	103	80 - 120	103	80 - 120	<0.02	mg/L				
7189582	Total Titanium (Ti)	2021/02/08	103	80 - 120	101	80 - 120	<0.005	mg/L				
7189582	Total Zinc (Zn)	2021/02/08	103	80 - 120	103	80 - 120	<0.005	mg/L				
7189743	Total Suspended Solids	2021/02/08					<10	mg/L	0.31	25	95	85 - 115
7189828	Mercury (Hg)	2021/02/08	92	75 - 125	95	80 - 120	<0.00010	mg/L	NC	20		
7193106	Naphthalene	2021/02/10	91	50 - 130	85	50 - 130	<0.050	ug/L	NC	30		
7193509	Total Oil & Grease	2021/02/10			97	85 - 115	<0.50	mg/L	0.77	25		
7193515	Total Oil & Grease Mineral/Synthetic	2021/02/10			97	85 - 115	<0.50	mg/L	2.6	25		
7199906	a-Chlordane	2021/02/13	84	50 - 130	90	50 - 130	<0.005	ug/L	NC	30		
7199906	Aldrin	2021/02/13	68	50 - 130	66	50 - 130	<0.005	ug/L	NC	30		
7199906	alpha-BHC	2021/02/13	76	30 - 130	86	30 - 130	<0.005	ug/L	13	40		
7199906	Aroclor 1016	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1221	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1232	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1242	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1248	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1254	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1260	2021/02/13					<0.05	ug/L				
7199906	beta-BHC	2021/02/13	75	30 - 130	84	30 - 130	<0.005	ug/L	12	40		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7199906	delta-BHC	2021/02/13	84	30 - 130	89	30 - 130	<0.005	ug/L	11	40		
7199906	Dieldrin	2021/02/13	100	50 - 130	110	50 - 130	<0.005	ug/L	NC	30		
7199906	Endosulfan I (alpha)	2021/02/13	79	50 - 130	86	50 - 130	<0.005	ug/L	2.4	30		
7199906	Endosulfan II (beta)	2021/02/13	78	50 - 130	88	50 - 130	<0.005	ug/L	20	30		
7199906	Endosulfan sulfate	2021/02/13	107	30 - 130	114	30 - 130	<0.005	ug/L	10	40		
7199906	Endrin aldehyde	2021/02/13	89	30 - 130	96	30 - 130	<0.005	ug/L	13	40		
7199906	Endrin ketone	2021/02/13	96	30 - 130	101	30 - 130	<0.005	ug/L	12	40		
7199906	Endrin	2021/02/13	90	50 - 130	100	50 - 130	<0.005	ug/L	13	30		
7199906	g-Chlordane	2021/02/13	82	50 - 130	89	50 - 130	<0.005	ug/L	NC	30		
7199906	Heptachlor epoxide	2021/02/13	86	50 - 130	94	50 - 130	<0.005	ug/L	13	30		
7199906	Heptachlor	2021/02/13	69	50 - 130	67	50 - 130	<0.005	ug/L	11	30		
7199906	Hexachlorobenzene	2021/02/13	77	50 - 130	80	50 - 130	<0.005	ug/L	NC	30		
7199906	Lindane	2021/02/13	81	50 - 130	91	50 - 130	<0.003	ug/L	NC	30		
7199906	Methoxychlor	2021/02/13	93	50 - 130	98	50 - 130	<0.01	ug/L	11	30		
7199906	Mirex	2021/02/13	94	30 - 130	95	30 - 130	<0.005	ug/L	NC	40		
7199906	o,p-DDD	2021/02/13	102	50 - 130	112	50 - 130	<0.005	ug/L	NC	30		
7199906	o,p-DDE	2021/02/13	89	50 - 130	95	50 - 130	<0.005	ug/L	NC	30		
7199906	o,p-DDT	2021/02/13	86	50 - 130	92	50 - 130	<0.005	ug/L	NC	30		
7199906	Octachlorostyrene	2021/02/13	85	30 - 130	86	30 - 130	<0.005	ug/L	9.8	40		
7199906	Oxychlordane	2021/02/13	78	30 - 130	84	30 - 130	<0.005	ug/L	12	30		
7199906	p,p-DDD	2021/02/13	103	50 - 130	114	50 - 130	<0.005	ug/L	NC	30		
7199906	p,p-DDE	2021/02/13	98	50 - 130	100	50 - 130	<0.005	ug/L	NC	30		
7199906	p,p-DDT	2021/02/13	86	50 - 130	89	50 - 130	<0.005	ug/L	NC	30		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7199906	Toxaphene	2021/02/13					<0.2	ug/L				

N/A = Not Applicable

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

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

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

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

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

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

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

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

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

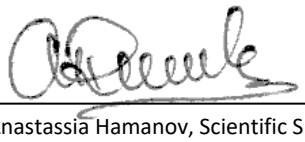
Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

BV Labs Job #: C131452
Report Date: 2021/02/18

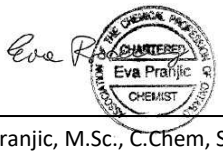
Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

VALIDATION SIGNATURE PAGE

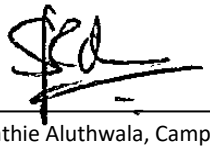
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist



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



Sirimathie Aluthwala, Campobello Micro

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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CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#36876 Grounded Engineering Inc.	Company Name:		Quotation #:	C04975	BV Labs Job #:	Bottle Order #: 812312
Attention:	Accounts Payable	Attention:	Jason Ngo	P.O. #:			
Address:	12 Banigan Drive Toronto ON M4H 1E9	Address:		Project:	21-016	COC #: C#812312-02-01	Project Manager: Marijane Cruz
Tel:	(647) 264-7909 Fax:	Tel:	Fax:	Project Name:	535-551 Brant St		
Email:	stavares@groundedeng.ca	Email:	jngo@groundedeng.ca	Site #:			
				Sampled By:	LJ/GM		

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)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☑ Sanitary Sewer Bylaw ☐ Reg 558 ☑ Storm Sewer Bylaw ☐ MISA Municipality Burlington Storm / Halton Sanitary ☐ PWQO ☐ Reg 406 Table ☐ Other	

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

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

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

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Halton Sanitary & Combined Sewer (2-03)	O Reg 153 PHCs, BTEX/F1-F4	E.coli (CFU/100mL)	OC Pesticides (Selected) & PCB	# of Bottles	Comments
1	812312	SW-UF-BH107	21/02/04	3PM	GW	N	✓		✓	✓	17	
2												
3												
4												
5												
6												
7												
8												
9												
10												

04-Feb-21 17:25
Marijane Cruz
C131452

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Leland Johnston	21/02/04	4PM	[illegible]	04/02/04	17:25	
Leland Johnston	21/02/04	4PM				

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Recei 12/10/10	Custody Seal Present	Yes	No
		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.

* no ice

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

Exceedance Summary Table – Halton Sanitary Sewer

Result Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedance Summary Table – SW-UF Burlington Storm

Result Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
SW-UF-BH107	OTT576-06	Total Manganese (Mn)	0.05	1.8	0.01	mg/L
SW-UF-BH107	OTT576-04	Total Suspended Solids	15	98	10	mg/L

Detection Limit Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
SW-UF-BH107	OTT576-06	Total Arsenic (As)	0.02	<0.1	0.1	mg/L
SW-UF-BH107	OTT576-06	Total Cadmium (Cd)	0.008	<0.02	0.02	mg/L
SW-UF-BH107	OTT576-06	Total Chromium (Cr)	0.08	<0.1	0.1	mg/L
SW-UF-BH107	OTT576-06	Total Copper (Cu)	0.04	<0.1	0.1	mg/L
SW-UF-BH107	OTT576-06	Total Phosphorus (P)	0.4	<0.5	0.5	mg/L
SW-UF-BH107	OTT576-06	Total Selenium (Se)	0.02	<0.2	0.2	mg/L
SW-UF-BH107	OTT576-06	Total Zinc (Zn)	0.04	<0.05	0.05	mg/L

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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APPENDIX F

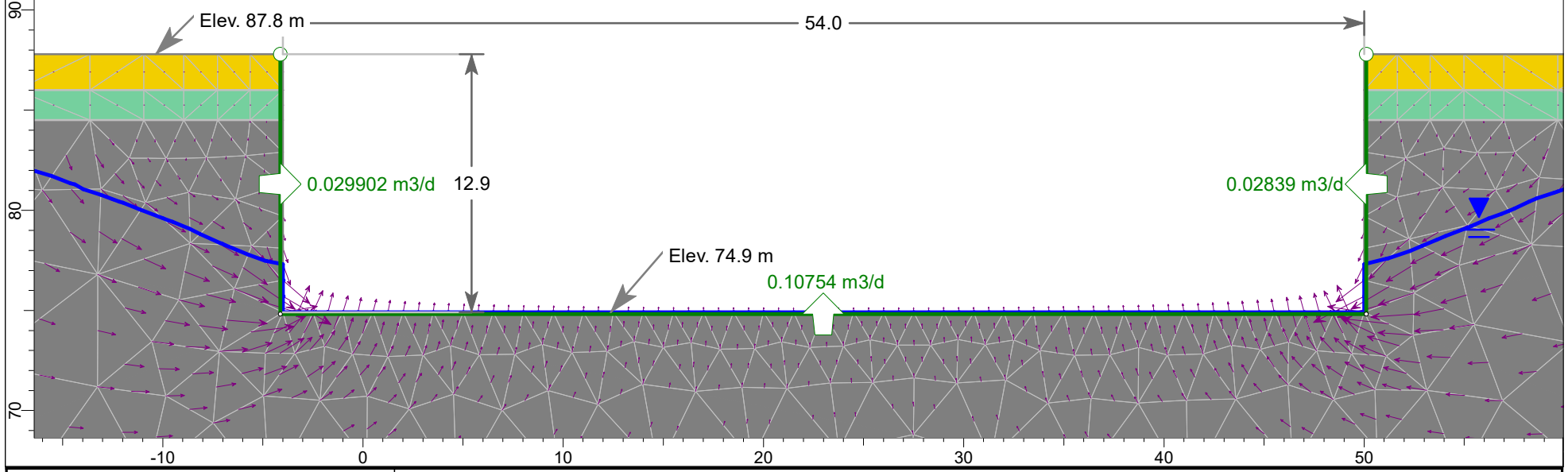


Excavation Dims (Equiv. Rectangle): 54 m by 51 m
Perimeter: 210 m
Equiv Area: 2,754 m2

Lowest FFE: 75.4 m
Dewatering Target: 74.9 m
Shoring: Lagging Wall
Scenario: Short Term Steady State

Total Groundwater Seepage (SF = 1.5): 20,000 ± L/day

Material Name	Color	KS (m/s)
Fill		9.29e-09
Native Till		1.3e-08
Queenston Shale		1.78e-07



GROUNDED ENGINEERING

Project	21-016 | Brant St, Burlington		
Analysis Description	Steady State FEM	Model	Group 1 | ST Dewatering
Drawn By	MD	Scale 1:300	Date 2021-02-18
Source		File Name	Brant St FEM (1).slmd

SLIDEINTERPRET 9.012

535-551 Brant Street
Burlington, Ontario
File No. 21-016

Dewatering Calculation Summary

SHORT TERM

Excavation Dimensions (m)	
N-S	54
E-W	51
Area (m2)	2754
Perimeter (m)	210

Rainfall Data		
Year	2	100
Hour	3	12
Depth (mm)	25	94
Depth (m)	0.025	0.094

Section		Flow [m3/day]	Length [m]	Volume [L/day]
Base		0.064528	51	3,291
Sides		0.037845	210	7,947
		0	0	-
Total				11,238
Factor of Safety	1.5			16,858

Storm Events	
2 Year [L/day]	100 Year [L/day]
68,850	259,000

Summary	L/day	L/min
Groundwater	20,000	13.9
Rainfall	69,000	47.9
Total	89,000	61.8

LONG TERM

Excavation Dimensions (m)	
N-S	54
E-W	51
Area (m2)	2754
Perimeter (m)	210

Rainfall Data		
Year	2	100
Hour	3	12
Depth (mm)	25	94
Depth (m)	0.025	0.094

Section		Flow [m3/day]	Length [m]	Volume [L/day]
Base		0.066954	51	3,415
Sides		0.035324	210	7,418
0		0	0	-
Total				10,833
Factor of Safety	1.5			16,249

Infiltration [L/day]
1575

Summary	L/day	L/min
Groundwater	20,000	13.9
Infiltration	2,000	1.4
Total	22,000	15.3

535-551 Brant Street
Burlington, Ontario
File No. 21-016

GROUNDED ENGINEERING

Groundwater Level Monitoring Summary

Well ID	Ground Surface Elevation (masl)	Screen Interval	Terraprobe				Grounded Engineering		Minimum Elev. (Lowest)		Maximum Elev. (Highest)		Seasonal Fluctuation
			15-Mar-19		22-Mar-19		4-Feb-21						
		(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(±m)
BH104	87.4	65.8 to 68.9	3.3	84.1	3.2	84.2	N/A	-	3.3	84.1	3.2	84.2	0.0
BH105	87.6	83.5 to 85.0	Dry	-	Dry	-	Dry	-	0.0	0.0	0.0	0.0	0.0
BH106	87.7	66.6 to 69.7	4.5	83.2	4.5	83.2	4.8	82.9	4.8	82.9	4.5	83.2	0.2
BH107	87.8	66.6 to 69.7	4.3	83.5	4.1	83.7	5.7	82.1	5.7	82.1	4.1	83.7	0.8
BH108	87.7	82.9 to 84.4	Dry	-	2.6	85.1	2.7	85.0	2.7	85.0	2.6	85.1	0.1

mbgs = metres below existing ground surface
masl = metres above sea level
* = unstabilized groundwater level
N/A = damaged/inaccessible