Proposed Acorn Valley Development – 83, Christie Drive, Dorchester, Ontario

Cyril J. Demeyere Limited (CJDL)
Preliminary report

Hydrogeology Study Report

December 19, 2025
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ENGLOBE

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1 Introduction

1.1 Objectives of the Study

Englobe Corp. (Englobe) was retained to carry out a hydrogeology study of the proposed residential Acorn Valley Development at 83 Christie Drive in Dorchester, Ontario (herein referred to as the Site or the property) as shown on the Location Plan, Drawing 1 in Appendix A. This work was authorized by Mr. Deren Lyle of Cyril J. Demeyere Ltd.

The scope of work for this hydrogeology study included a review of available topographic, geological and hydrogeological information for the Site and adjacent lands, and a subsurface investigation within the Site. The subsurface investigation was performed to identify the subsoil stratigraphy and hydrogeological properties, groundwater conditions and hydraulic gradients, and the relationship between groundwater and surface water features.

The objectives of this report are:

– To assess the geological and hydrogeological conditions beneath the Site;
– To calculate a pre- and post-development water balance;
– To describe the soil physical properties (including infiltration rates);
– To identify water users and sensitive areas within or near the Site;
– To provide an assessment of proposed Low Impact Development technique(s);
– Provide a preliminary dewatering assessment; and,
– To identify potential impacts of development.

Prior to this hydrogeology study, Englobe undertook a geotechnical investigation at the Site (Englobe project number 160-B-P0019257-0-01-100-GE-R-0001).

1.2 Current and Proposed Land Use

The Site is located in Dorchester, Municipality of Thames Centre, Middlesex County, Ontario (Drawings 1, and 2, Appendix A). The size of the Site is approximately 44 ha. The Site is currently used for agricultural purposes and is intended to be developed into a residential subdivision. The proposed development of the Site will be fully serviced with municipal sanitary sewers and water supply.

The Site is bounded by a variety of land uses including a Provincially Significant Wetland (Tamarack Swamp) to the immediate north, an existing subdivision to the east, woodland and rural residential to the west and agricultural and woodland to the south. Recent environmental studies also identified an additional wetland area is located on the southwestern border of the site.

In addition to the wetlands, surface water features are also present in/near the west-central portion of the Site (the Shaw Drain) and in the southeastern portion of the Site (Rath Harris Drain). The existing subdivision to the east of the Site is serviced with private wells and septic systems.

1.3 Physical Setting of the Site

The Site is situated within the Upper Thames River Watershed (major unit) and more specifically within the Dorchester Corridor. Surface drainage at the Site varies in direction due to the presence of an elevated area in the northeastern portion of the Site and three locally elevated areas in the vicinity of the southern Site boundary. The irregular topography results in drainage, at least locally, to all three surrounding surface water bodies.

The Site is located in a spillway between the Ingersoll Moraine to the south and the Dorchester Moraine to the north (i.e., northern limit of the Mount Elgin Physiographic Region; Chapman and Putnam, 1984). Geological mapping of the area shows surficial deposits in the area of the Site to be glaciolacustrine deposits of sand to sand and gravel. Geological mapping of the area indicates that bedrock beneath the Site is the limestone and dolostone of the Dundee Formation.

Water Well Records (WWRs) for the vicinity of the Site are summarized in Appendix G and indicate that sand, or at least sand with silt, is the predominant shallow soil type and is the local water supply aquifer.

The WWRs indicate that groundwater is used locally as a source of potable water. A municipal well is in the WWR survey and most rural resident seem to use private wells.

There is one Permits to Take Water (PTTWs) on file within 1 km of the Site. The PTTW is for the irrigation of a golf course located northwest of the Site. The Site is located within a Significant Groundwater Recharge Area and is the location of a Highly Vulnerable Aquifer. There are also two registrations on the Environmental Activity and Sector Registry (EASR) for construction dewatering at properties located east of the Site. Both registrations are expired.

Map 3-2 of T-S&RSPC, 2015 indicates that annual precipitation at the Site is approximately 1,028 mm/yr. Map 3-3 of T-S&RSPC, 2015 indicates that evapotranspiration at the Site is approximately 586 mm/yr. Map 3-4 of T-S&RSPC, 2015 indicates that groundwater recharge (i.e., infiltration) at the Site could range from 325 mm/yr in the northern and northeastern portions of the Site and approximately 125 mm/yr elsewhere.

The MNRF's Natural Heritage Areas website recognizes the Tamarack Swamp as a Provincially Significant Wetland and recognizes the woodlands along portions of the northern, western and southern boundaries of the Site. Schedule C, Natural Heritage Areas, of the Official Plan of Middlesex County designates the woodlands as Significant Woodlands. Appendix 1 (Part A), Natural Heritage Features, of the Official Plan of the Municipality of Thames Centre designates the larger woodlands in the vicinity of the Site as Significant Woodlands (> 4 hectares in area) and recognizes the Provincially Significant Wetland north of the Site.

2 Hydrogeological Study Methodology

The study methodology involved a number of tasks, which included :

- Reviewing topographic, geological, and hydrogeological mapping and reports for the area;
- Reviewing relevant on-line databases;
- Developing and then performing in situ permeability tests in the monitoring wells installed during the geotechnical investigation to determine hydraulic conductivity values;
- Analyzing grain size distribution data for selected soil samples to validate hydraulic conductivity magnitudes;
- Measuring groundwater levels in all monitoring wells to establish the flow direction and horizontal gradient;
- Collecting groundwater samples from monitoring wells and surface water samples for laboratory analysis for the parameters listed in the Municipality of Thames Centre's By-law No. 641-14 (sewer use by-law); and,
- Analyzing the data and preparing this report.

2.1 Review of Previous Studies and On-Line Databases

The only previous study consulted by Englobe for the Site consisted of a geotechnical investigation by Englobe (Englobe project number 160-B-0020770-1-GE-R-0001-0A dated May 27, 2019. The borehole/monitoring well logs, survey data and grain size distribution from that investigation have been incorporated, where applicable, into this report. Copies of the borehole logs are included in Appendix B.

Online databases used in the preparation of this report are cited in the References section. The findings of the database searches are summarized in Section 1.3, Physical Setting of the Site.

2.2 Hydraulic Conductivity Testing

Hydraulic conductivity estimates for the soils were determined using three methods. The first method consists of in situ permeability tests using a slug. This method is applicable to saturated soils at the well filter pack elevation.

The second method involved a calculated estimate of hydraulic conductivity based on soil sample particle size analysis using the multiple equations to a given sample as provided in Devlin, 2015. The results consist of a geometric mean of the values calculated using applicable equations. This method is valid for saturated and unsaturated soils.

The last method is an interpretation based on Guelph permeameter testing. This method is meant to evaluate percolation rates in unsaturated soils.

2.2.1 Rising Head Tests

Hydraulic conductivity estimates were determined for the saturated soils at depth using tests in three monitoring wells installed at the Site.

Each monitoring well was developed prior to the permeability tests. Well purging through the use of dedicated inertial lift (“Waterra”) pumps and polyethylene tubing was implemented to remove silt and sand introduced into the well during construction, and to remove fine particles from the coarse sand pack placed around the outside of the well screen during construction.

The slug test procedure entails measuring/timing water level recovery following the removal of a known volume from a monitoring well and the use of the theory of Hvorslev (1951). Hvorslev's method is expressed by the following equation:

$$K = \frac{r^2 \ln (L/R)}{2LT_0}$$

Where :

K	=	Hydraulic conductivity of the tested material (m/sec)
r	=	Inner radius of the well riser pipe (m)
R	=	Outer radius of the borehole (m)
L	=	Length of saturated screen and, if applicable, sand pack (m)
T_o	=	Time lag (sec), where $(H-h)/(H-H_o) = 0.37$
h	=	Water level at each time of measurement (m)
H_o	=	Initial water level (m, start of test)
H	=	Static water level prior to test (m)

The time lag, T_0, is defined as the time required for the water level to recover to 63 % of the static level. This time lag is determined graphically as the time for which (H-h) divided by $(H-H_o)$ is equal to 0.37.

Slug test data was analyzed using AquiferTest 10.0. The graphed results of the slug tests tests completed for the monitoring wells are included in Appendix E and in the summary of the hydraulic conductivity estimates in Table 102, Appendix D.

It should be noted that the analyses assume fully penetrating conditions because the thickness of the aquifer is not presently known. Testing with greater assumed thicknesses resulted in minor decreases in hydraulic conductivity. As the in situ tests permeability tests are to be used in the dewatering rates evaluation and not in percolation assessment, it is considered to be a conservative assessment.

2.2.2 Grain Size Analysis

Hydraulic conductivity values of nine soil samples were derived empirically using the particle size distribution data included in Appendix E and the applicable formulae provided in Devlin, 2015. These results are included in Table 102, Appendix D.

2.2.3 Guelph permeameter analysis

The Guelph Permeameter is a portable instrument using the same operating principle as a laboratory permeameter. A cylinder of known diameter, open at the bottom, is set into the soil interval to be tested and, as water leaks form the base, water is added to the cylinder from a graduated reservoir. Water is allowed to leak from the base of the cylinder until the flow rate stabilizes at which point the flow rate is recorded. The flow rate, cylinder/reservoir sizing and soil type is used to estimate hydraulic conductivity and subsequently the associated infiltration rate. Data were then treated on an excel spreadsheet published by Soilmoisture.

Table 1 presents the location of the test pits. The easting and northing values are referenced to Universal Trans Mercator North American Datum of 1983 (UTM NAD83, zone 17N) coordinates.

Table 1 : Test pits location

Test pit name	Easting (m)	Northing (m)
TP01-20	493972	4758450
TP02-20	494247	4758497
TP03-20	494473	4758350
TP04-20	494143	4758263
TP05-20	494078	4758664
TP06-20	493824	4758659

2.3 Groundwater and Surface Water Chemistry Sampling

Groundwater samples were obtained from three selected on-site monitoring wells on January 31, 2020 using the low flow sampling technique. Samples to be analyzed for metals were not field filtered. The samples were placed in coolers on ice packs and transported to ALS Laboratories in London, Ontario (ALS), under continuous Chain of Custody documentation, for analysis of the parameters listed in the Municipality of Thames Centre's By-law No. 641-14 (sewer use by-law). ALS Laboratories is accredited by the Canadian Association for Laboratory Accreditation.

Analytical results for the groundwater samples are summarized in the appended Table 103 with comparison to the applicable sanitary and storm sewer use criteria. A copy of the laboratory Certificate of Analysis is included in Appendix F.

3 Hydrogeological Investigation Results

3.1 Stratigraphy

Fourteen (14) boreholes have been completed during Englobe geotechnical study. Six of these boreholes have then been converted into monitoring wells. Five (5) additional mini piezometers were also added during the hydrogeological study to sample additional areas next to wetlands. Table 2 presents the location of the boreholes and the mini piezometers. The easting and northing values are referenced to Universal Transverse Mercator North American Datum of 1983 (UTM NAD83, zone 17N) coordinates.

Table 2 : Boreholes, monitoring wells and mini piezometers locations

Borehole, wells or mini piezometer ID	Easting (m)	Northing (m)
BH01-19	493813	4758802
BH02-19	493967	4758691
MW03-19	494189	4758756
MW04-19	493813	4758609
MW05-19	494078	4758532
BH06-19	494319	4758587
BH07-19	493859	4758411
MW08-19	493908	4758277

Table 2 : Boreholes, monitoring wells and mini piezometers locations (suite)

Borehole, wells or mini piezometer ID	Easting (m)	Northing (m)
BH09-19	494038	4758390
MW10-19	494386	4758447
BH11-19	494587	4758396
BH12-19	494551	4758258
BH13-19	494392	4758195
MW14-19	493813	4758802
MP01-20	493871	4758800
MP02-20	494064	4758742
MP03-20	493815	4758475
MP04-20	494596	4758258
MP05-20	493671	4758283

The stratigraphy encountered within the depth of investigation consisted of 0.2 to 0.5 m of topsoil over sand with a variable silt content unit. An exception is noted at BH12-19, southeast of the proposed development area, where the top layer is a 2 m of peat. No other geological unit has been observed beneath this aquifer in the boreholes made by Englobe for this project.

Local Water Well records (WWRs) indicate that the sand aquifer is underlain by clay at depths ranging from 20 to 55 mBGS and that the clay extends to bedrock at depths ranging from 34 to74 m.

3.2 Hydraulic Conductivity and Design Infiltration Rates

Discussion and test results provided herein are focused on the portion of the Site that is to be developed. Grain size analyses, in-situ permeability testing and Guelph permeameter testing have been performed on the site. Hydraulic conductivity estimates determined by all testing methods are summarized in Table 102 in Appendix D, with graphical analyses of rising head tests. Grain size distribution data included in Appendix C.

As indicated in Table 102 in Appendix D, the hydraulic conductivity of the on-Site shallow, unsaturated soil ranged from 1.7 x 10^{-10} m/s to 1.7 x 10^{-4} m/s for the grain size analysis, with a geometric mean of 3.3 x 10^{-6} m/s. Guelph permeameter hydraulic conductivities ranged from 1.9 x 10^{-7} m/s to 2.4 x 10^{-4} m/s for the grain size analysis, with a geometric mean of 4.3 x 10^{-5} m/s. Both methods were used to calculate infiltration rates ranging from 1.3 to 57.3 mm/hr (geometric mean 27.8 mm/hr) based on a safety correction factor of 3.5 (inhomogeneous soil) for soil types encountered over the depth interval of interest, as referenced from the Credit Valley Conservation’s “Low Impact Development Stormwater Management Planning and Design Guide” (CVC, 2010). Englobe considers that Guelph permeameter values are more reliable for the evaluation of the infiltration rates, ranging from 8.4 to 57.3 mm/hr and a geometric mean of 36.1 mm/hr. If these results are used for design purpose, location of the test pit and depth of analysis should be considered. Vertical hydraulic conductivity corrections are not considered at current stage of the project, as field conditions comparable to Guelph permeameter test are considered representative of the conditions that could occur in an open channel.

Horizontal hydraulic conductivity values for the on-Site saturated soil ranged from 1.2×10^{-5} m/s to 1.3×10^{-4} m/s, with a geometric mean of 3.9×10^{-5} m/s.

3.3 Groundwater Elevations, Flow Direction

Table 101, Appendix D, summarizes groundwater and surface water measurements across the Site on multiple surveys. The shallow water table occurs in sand unit. On April 29, 2020, date representative of high groundwater table, groundwater elevations in the proposed development area of the Site ranged from 251.84 mASL in MW03-19 in the northeastern portion of the Site to 259.98 mASL in MW-14-19 in the south portion, indicating a northeasterly groundwater flow direction (Drawing 2 of appendix A). The horizontal hydraulic gradient of the overall Site is approximately 0.02 to the northeast.

In terms of depth, groundwater is at an greater depth in the northeast and southwest corners of the site with depths between 7.76 and 10.43 m BGS during April 2020 high water levels conditions. Water levels are at their shallowest depth in the center part of the site with a depth as low as 2.16 m bgs during the high water levels conditions. These field conditions should be considered for the basements construction purposes.

The well MW-03-19, located in the site highland area and the mini-piezometer MP-02-19 located in the lowland area of the wetland have similar groundwater elevations with difference between 0.03 and 0.21 m ASL during the surveyed period. This could indicate that groundwater from the site is connected to the wetland at the north end of the site.

3.4 Groundwater Chemistry

3.4.1 Groundwater quality

Samples of groundwater were obtained from wells MW-03-19, MW-08-19, MW-10-19, MP-01-19, MP-04-19 and MP-05-19 on January 31, 2020. The results for the tested parameters were compared to the applicable storm and sanitary sewer use criteria provided in the Municipality of Thames Centre's By-law No. 07-18 (sewer use by-law) due to the possible need for construction dewatering during development. In addition, due to the presence of Shaw drain on-Site, the results are also compared to the Provincial Water Quality Objectives (PWQOs), which are applicable to surface water. All samples, except MW-03-19 have an absolute error on ionic balance under 10 %. The MW-03-19 has an error of +11 % on its ionic balance. The results are still discussed in the analysis, but a possible bias must be considered.

There were no exceedances of the criteria for discharge to the sanitary sewer systems. The PWQO limits were exceeded for three parameters. The concentration of zinc in samples collected from MW-03-19, MW-05-19, and MW-08-19 of 0.195, 0.07 and 0.616 mg/L, respectively, exceeded its PWQO of 0.030 mg/L. The concentration of phosphorus in the sample collected from MW-05-19, 0.034 mg/L, exceeded its PWQO of 0.030 mg/L. The concentration of iron in the sample collected from MW-04-19, 0.838 mg/L, exceeded its PWQO of 0.3 mg/L.

Based on the analytical results obtained during groundwater sampling, it is recommended that suspended solids removal is implemented using a combination of silt removing bags and settling ponds prior to discharging to the environment if the discharge of groundwater to surface water outlets is considered. Additional groundwater sampling should be performed in the settling ponds prior to discharging the water to the environment. At a minimum, monitoring of turbidity and suspended solids in surface water should also be conducted in surface water bodies upstream, at, and downstream of the discharge points.

Chemistry representation on a Piper diagram indicate that samples are Ca-HCO_3 water types. This water type is generally associated with recharge water or groundwater with a short residence time.

Results are also compared to the PGMN 487-2 well (Drawing 3 of appendix A). Both wells are in the same fluvioglacial sediments and have a similar water type. Results from the PGMN well indicate higher sodium and chloride contents and lower calcium contents. An anthropic contamination is evaluated as the cause of this difference. The well is located next to a street, the aquifer sampled is shallow and located next to the surface and the sampling surveys occurred at the beginning of winter.

3.4.2 Nitrate

Nitrate was identified as a potential concern in scoping session with Upper Thames River Conservation Authority. High nitrate loads caused by the existing residential development were anticipated on the eastern end of the site. High nitrate contents in groundwater is identified as a contamination risk for the wetland areas. High nitrate contents were observed across the site for MW-03-19, MW-08-19 and MW-10-19. Low contents were observed in MP-01-19 and MP-04-19, located on the border of the site. This indicates that activities on the site could be the cause for high nitrate concentrations in groundwater. The use of fertilizer for agricultural purposes is considered the most plausible source. However, the actual nitrate contamination is not expected to be a persistent concern for future groundwater quality if the source is neutralized.

Also, Englobe notes that the neighbouring residential development is located downgradient of the site. Therefore, nitrate contamination from the neighbouring development is unlikely, as the contamination is anticipated to migrate away from the site area based on the groundwater flow direction.

The residential development project would change the purpose of the site, from agricultural to residential. This change of land use is anticipated to lower the nitrate contamination in groundwater.

3.5 Pre-Development Water Balance

The water balance discussed herein addresses only that portion of the Site proposed for development and where LID measures will be required. The focus of this water balance assessment is (i) to determine the infiltration deficit (reduction in current contribution to baseflow) resulting from the proposed development and (ii) to indicate recommendations for the LID methods and the parameters for the design.

The water balance accounts for all water in- and out-flows in the hydrologic cycle. Precipitation (P) falls as rain and snow. Then it can run off towards wetlands, ponds, lakes, and streams (R), infiltrate to the groundwater table (I), or evaporate from surface water and vegetation (ET). When long-term average values of P, R, I and ET are used then minimal or no net change to groundwater storage (ΔS) is assumed.

The annual water balance can be stated as :

$$P = ET + R + I + \Delta S$$

Where :

P	=	Precipitation (mm/year)
ET	=	Evapotranspiration (mm/year)
R	=	Runoff (mm/year)
I	=	Infiltration (mm/year)
ΔS	=	Change in groundwater storage (taken as zero) (mm/year)

The average annual precipitation for the site is taken as 1011.5 mm/year, corresponding to the climate normal of the London International Airport weather station (Government of Canada, 2019). This rate is used as the input for the water balance calculation.

The Thornthwaite and Mather (1957) method has been used to evaluate the potential evapotranspiration (PET). Climatic data used for the PET calculation were taken from the London weather station (Government of Canada, 2019). The resulting PET is 598 mm/yr. As a result, the combined infiltration and runoff components of the water budget are 413.5 mm/yr.

Localized infiltration rates vary based on factors such as the saturated hydraulic conductivity of surface soils, land slope, rainfall intensity, relative soil moisture at the start of a rainfall event, and type of cover of the ground surface. MOE (1995) summarizes all these elements into infiltration rates factor to evaluate the proportion of the infiltration and the runoff. This factor is separated into three parts: slope, surficial soil and land use.

The slope across the Site is over the range of a Rolling Land definition, but under the hilly definition (Table 2, Chapter 4 of MOE, 1995). As a result, the infiltration factor of 0.20 is used.

Surficial soil at the site is typically sand. Therefore, the infiltration factor used for this type of soil is the one of the sandy loam, lowered to acknowledge the smaller particle size of the sand (0.30) from Table 2, Chapter 4 of MOE 1995.

The land is largely open field. An infiltration factor of 0.1 has been used, based on Table 2, Chapter 4 of MOE, 1995.

The combined infiltration factor is 0.6. With an available water surplus of 413.5 mm/year, this results in an average infiltration rate of 248.0 mm/yr. This is within the range given in Table 3, Chapter 4 of MOE, 1995 for medium to coarse sand. This associated type of soil seems to be slightly coarser, Therefore, the recharge could be overestimated, but this value will be used as a conservative approach. The values of the water balance calculation are presented in Table 3, below.

Table 3 : Pre-Development Water Balance for the Site

Hydrologic Component	Site (mm/year)	%
Total Precipitation	1 011.5	100.0
Evapotranspiration	598.2	59.1
Infiltration	248.0	22.5
Runoff	165.3	18.4

3.6 Post-Development Water Balance (No LID Measures)

Post-development water balance is calculated for the developed part of the site. Future development areas are not considered and would need to be updated when the development plans are known. Feature-based water balance was not considered for the current project. According to the site piezometry, the current proposed development features only a few lots that are located upgradient of the wetlands identified as features of interest. Development of the land north of Christie Drive would however be identified as a concern for the water-balance of the wetlands and a feature-based approach would be recommended.

Cyril J. Demeyere has evaluated the following impervious coverage of the site :

Table 4 : Post-Development Land use

Land use	Total area (m^2)	Impervious surface cover (%)	Impervious surface cover (m^2)
Medium density residential	20 000	75	15 000

High density residential	39 300	85	33 405
Freehold lots	89 900	65	58 435
SWM pond	19 100	100	19 100
Streets and walkway	34 000	100	34 000
Open channel, archaeological site, parks and open space	60 400	0	0
Total	262 700	---	159 940

For conservative purposes, it will be considered that the impervious surfaces will create 100 % runoff on their surface. On other surfaces, PET, runoff and infiltration will keep the same proportions as the predeveloped land.

The development of impervious structures also increases the amount of stormwater runoff across the Site. The pre-development runoff is estimated to be 42 416 m^3/year out of the total precipitation of 259 551 m^3/year. Post-development runoff without the development of LID measures could increase runoff to 179 763,904 m^3/year, or 69.3 % of precipitation. Appendix I and Table 5, below, summarize the post-development water balance for the Site without LID measures being implemented.

Table 5 : **Post Development Water Balance for the Site**

Hydrologic Component	Pre-Development		Post Development (No LID Measures)	
	Site (m^3/year)	%	Site (m^3/year)	%
Total Precipitation	265 721	100.0	265 721	100
Evapotranspiration	157 147	59.1	61 471	23.1
Infiltration	65 150	24.5	25 484	9.6
Runoff	43 424	16.3	178 766	67.3

3.7 Comments on LID measures

Based on post development water balance calculations presented in the previous section, a loss of 39,666 m^3 of infiltration is anticipated annually if no LID measures are implemented. The structure currently planned to mitigate the infiltration loss is an open channel located on the northern side of Christie Drive. This channel could be used as an infiltration trench. In order to promote infiltration, the open channel design should consider including features promoting some retention to slow down runoff and allow time for infiltration. The high infiltration rates from Guelph permeameter testing indicate that this method could be considered for the site conditions given that shallow soils at the site have a good infiltration potential. In effect, the calculated infiltration rates discussed in section 3.2 suggest the open channel has the potential to infiltrate a sufficient volume to compensate for the anticipated loss in infiltration related to the development if water is allowed to pool and infiltrate. Decentralized LID measures such as rear lot swales should also be considered. Decentralized measures could prove more flexible and easier to implement while maintaining the form and function of surrounding surface water features and wetlands. The feasibility and design for infiltration should be designed and confirmed by a qualified professional.

It should also be noted that besides the quantity of infiltration to be augmented by the LID measures, the quality of the runoff water to be infiltrated should be kept as the highest priority. In effect, infiltrating poor quality water, for example water with a high salt content originating from road salt, could potentially prove more detrimental to nearby wetlands and well users than a localized marginal loss of infiltration. Water directed to the LID structures should therefore not originate from areas where significant risks of contamination are anticipated but rather originate from high quality water sources such as rooftops and green spaces.

According to the overall groundwater flow direction, most of the infiltration from the channel would reach Tamarack Swamp. Modifications to the groundwater flow to the wetland area could affect some species that are vulnerable to groundwater level changes or the difference of groundwater discharge in the land slope to the swamp. Good groundwater quality would also need to be maintained, as contaminated water could impact the wetlands. Therefore, in addition to the LID, it is recommended to implement a post development groundwater level monitoring plan.

4 Dewatering assessment

4.1 Sanitary sewer construction

It is Engobe's understanding residential structures will not be built under or near the water table, taking into consideration spring high water level conditions. The calculated hydraulic conductivities indicate that construction under the water table, if considered, would require significant drainage that is not adapted for conventional houses.

Sanitary sewer construction is planned to be the deepest construction under the water table level. In addition, some sections of the sewer will also be located in areas where the greatest hydraulic conductivity was calculated, therefore the construction of the sanitary sewer has the potential of generating the greatest construction dewatering rates for the proposed development. A dewatering study is therefore needed on this part of the construction planning. The Thiem Equation for unconfined flow into a long excavation (Powers et al., 2007) was used to estimate lateral flow into the excavation. Please note that desktop calculations do not consider vertical flow from the bottom of the excavation (upwelling of groundwater). Further, the values calculated are for steady state dewatering rates and transient, initial dewatering rates could be up to 4 times higher than the steady state dewatering in order to remove groundwater from storage within the surrounding soils. The following assumptions were made for the dewatering calculations :

- Construction dewatering is assumed to be completed in segments. A typical 30 m segment has been used for calculation;
- Steady state unconfined flow conditions are occurring;
- The drawdown required for the sewer construction varies on the site. For conservative assumption, required drawdown was evaluated at every location presented on drawing 3 of Appendix A. The sector with the largest drawdown was used for the dewatering assessment, as it is the most restrictive for construction planning and for PPTW application. The largest distance between the water table and the bottom of excavation was evaluated at location 1 at a distance of approximately 8.66 m;

– Water levels from the April 2020 survey are retained for the dewatering assessment. These water levels are considered to represent a high-water table condition. An additional 0.30 m has been added to the water level to represent a higher water table occurrence;
– The maximum dewatering target depths were assumed to be 0.5 m below the projected trunk sewer to ensure a dry excavation base for the pipe placement;
– The K-value used for the dewatering calculation for the sand is the in-situ result from MW-04-19, as it is the closest to the evaluated dewatering location;
– Clay aquitard elevation has not been observed in boreholes. As mentioned in section 1.3, the range for the aquitard is between 20 and 55 m mBGS. However, these values don't correspond to the thickness of the aquifer. Thiem equation suppose an aquifer completely screened and mostly horizontal flow. Therefore, the thickness of the aquifer is considered to be equal to the bottom of the excavation and an additional 2 m for a conservative assessment. This thickness in the calculation is noted as active dewatering thickness.

Dewatering assessment consider that the trenches would have a width of 10 m. This assumption is only for dewatering assumption. Please refer to the geotechnical study for the excavation design recommendations.

Unconfined flow into a long excavation is calculated with the following equation

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

where:

Q	=	Construction dewatering rate (m^3/sec)
K	=	Hydraulic conductivity (m/sec)
H	=	Hydraulic charge of water in aquifer (static head) prior to dewatering
h	=	Hydraulic charge of the water during dewatering
R_0	=	Area of influence of construction dewatering/pumping = 3000*(H-h)*$K^{0.5}$
r_s	=	Equivalent well radius of well = (area of excavation)0.5 / π
x	=	Length of the trench = 100 m
L	=	R_0/2 (m)
π	=	Pi = 3.14159

Drawing 3 of Appendix A presents the location of the sewers on the Site. The undeveloped portions have not been considered in the dewatering evaluation.

Based on the assumptions noted above, the proposed steady-state water taking would be approximately 601 000 L/day for a 30 m x 10 m trench. Dewatering design should be made for larger flow than the flow presented in this report. Transient flow state during the drawdown, variations in soil and groundwater conditions beyond those encountered during the geotechnical and hydrogeological investigations, and any other unforeseen events that may contribute to increased dewatering requirements.

4.2 SWM pond

January 2024 stormwater management report indicate the SWM pond would have permanent pool at elevation 254.5 m ASL and its bottom would be at elevation 253.0 m. The water table would be higher than both elevations. This situation could cause hydrostatic pressure under the pond since no drainage layers are identified in the drawings. This would also suggest that an impervious liner would be required to prevent the pond from acting like a drain if significant seepage occurred. The thickness and properties of the liner should be defined by the design engineer. Hydrogeologist and geotechnical engineers should be provided the opportunity to review the SWM pond design at the detailed engineering design phase of the project to ensure compliance with the recommendations of the hydrogeological and geotechnical reporting.

SWM pond construction would require dewatering for its construction, as it reaches lower than the groundwater level. Dewatering assumptions are similar to those of section 4.1, with the following differences :

- The whole pond is expected cover an area of 260 x 80 m;
- The base of the excavation is expected to reach an elevation of 253.00 m;
- The drawdown required for the pond construction is based on March 2020 water level from MW-10-19. With the addition of 0.30 m for seasonal variations, the water level is 253.53 m;
- The maximum dewatering target depths were assumed to be 0.5 m below the projected trunk sewer to ensure a dry excavation base for the pipe placement;
- The K-value used for the dewatering calculation (1.2×10^{-5} m/s) for the sand is the in-situ result from MW-10-19, as it is the closest monitoring well to the evaluated dewatering location.

Based on the assumptions noted above, the proposed steady-state water taking would be approximately 240 300 L/day for the whole pond. Dewatering design should be made for larger flow than the flow presented in this report. Transient flow state during the drawdown, variations in soil and groundwater conditions beyond those encountered during the geotechnical and hydrogeological investigations, and any other unforeseen events that may contribute to increased dewatering requirements.

4.3 Permit to take water

Based on our calculations, the estimated dewatering rate will be over 400 000L/day. Based on these assumptions, it is recommended that an EASR is completed for the dewatering work completion.

5 Potential Impacts of Land Development

5.1 Water users

Well Records from the Ministry of the Environment and Climate Change (MOECC) Water Well Record (WWR) Database were reviewed to determine the number of private supply wells present within a 500 m radius of the limits of the property. A total of 104 wells were reported by the MOECC; 25 of these wells have been either abandoned or are wells identified as monitoring wells, test holes, not in use.

According to the MOECC WWR database, the remaining 79 wells are unlisted (considered for domestic use), listed for domestic use, listed as commercial use or listed as municipal supply. These considered wells are plotted on the appended Drawing 3 in Appendix A. These wells are identified in Table 6 and are referenced to Universal Trans Mercator North American Datum of 1983 (UTM NAD83, zone 17N) coordinates. However, Englobe notes that some wells are located in the woodland and in the wetland areas, probably due to a lack of precision in the well location coordinates provided in the WWRs, suggesting that the actual well locations remain unknown. Validation should be made with the land owners.

Prior to dewatering, residents that are serviced by private wells within the area of influence of the selected scenario should be contacted in writing to notify them of the upcoming water takings and, on a voluntary basis, fill a survey regarding the location, construction details and current condition of their well with respect to water quantity and quality. The contractor must be prepared to address complaints promptly and provide water totes should any of the households be negatively impacted by the water takings.

It is noted that the wells plotted on Drawing 3 in Appendix A, may not be plotted in their precise location; however, the MOECC WWR coordinate data has been used in the absence of more reliable information. A summary of the Water Well Records is included in Appendix G.

5.2 Sensitive Areas – Wetlands

As mentioned in section 1.2, the Site is bounded by the Tamarack Swamp. According to the groundwater flow direction, a part of the recharge from the Site goes through these wetlands. Therefore, a decrease in recharge could affect the wetland water balance.

Due to the steep difference in topography between the residential development site and the wetlands area, a part of the water input to the wetland could be from the groundwater discharge in the slope in the north of the development. A difference in the overall water balance of the site could then affect the groundwater flow to the wetlands. It is therefore recommended to maintain the pre-development water balance.

This increases the importance of a proper LID method planning. By developing the Site with LID stormwater structures, it is anticipated that infiltration into the shallow groundwater system could be maintained. The LID method should also include considerations for groundwater quality. Implementation of LID structures, including surface bioretention cells, could allow for additional filtration of the typical contaminants (sediment) carried with stormwater. Additional recommendations could also be provided to the population to ensure the awareness for environmental considerations. In effect, some recommendations could be made regarding the use of chemicals such as fertilizers, herbicides, pesticides and salts or with respect to the location of the discharge of swimming pool water, for example.

For the wetland on the southwestern corner of the site, the long-term hydrogeological impact from the site is not expected to be significant. This wetland area is on the upgradient of the site and seems to be recharged from outside the residential development area.

5.3 Soil settlement

Groundwater drawdown can cause soil settlement. Soil settlement could cause stress on existing structures. Its impact should be evaluated by a geotechnical engineer prior to dewatering activities and settlement monitoring should be conducted during construction if warranted.

6 Conclusion

The hydrogeological study conducted by Englobe has provided information about the subsurface stratigraphy across the Site. The subsurface stratigraphy across the Site is mainly sand with variable content of silt overlying clayey silt/silty clay. The shallow water table is present in the sand unit.

Maximum groundwater elevations to date (April 29^{th}, 2020) in the proposed development area of the Site range from 251.84 mASL in MW03-19 in the northeastern portions of the Site to 259.98 mASL in MW-14-19 in the south portion of the Site. Groundwater flow across the Site is to the north towards the wetlands.

There was no exceedance of the sanitary sewer use criteria. However, three parameters exceeded the PWQO criteria. Zinc (0.07 mg/L as opposed to a PWQO of 0.03 mg/L) and phosphorus (0.034 mg/L as opposed to a PWQO of 0.03 mg/L) are exceeded at MW-05-19. Iron (0.838 mg/L as opposed to a PWQO of 0.3 mg/L) is exceeded at MW-04-19.

Water balance calculations indicate that the proposed development, without LID measures, will increase the amount of runoff and decrease the amount of infiltration. The potential infiltration deficit is estimated at 39 666 m^3/yr for the developed portion of the site. Englobe's calculations indicate that additional LID methods should be implemented on the upgradient of the wetland area to maintain the pre-development groundwater flow to the wetland area on the northern end.

It is expected that the construction of the sewers and other structures will require authorization for dewatering. The high hydraulic conductivity and the shallow water table in some area of the site indicate that significant groundwater discharge is to be expected. The land developer should expect the need for an EASR.

Multiple wells have been identified in the area of influence of the dewatering. The developer should plan monitoring and communicating with potentially impacted well owners. Impacts on the wetlands could be significant due to the change in water balance of the site. The implementation of LID methods during the construction planning is highly recommended to reduce the impacts. The LID methods should maintain a quantity and quality of water that is similar to the pre-development state. Potential soil settlement concerns should also need to be addressed.

7 Statement of Limitations

The hydrogeology recommendations provided in this report are applicable only to the project described in the text and are intended for the use of the project designer. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that this investigation involves a limited sampling of the Site gathered at specific test hole locations, and the conclusions in this report are based on this information gathered. The subsurface conditions between and beyond the boreholes may differ from those encountered at the boreholes. Should subsurface conditions be encountered which differ materially from those indicated in the borehole logs, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions.

Additionally, much of the information and conclusions presented in this report have been based on, and taken from, data and reports collected and prepared by other consultants. Englobe is not responsible for any errors or omissions in these third-party reports.

The professional services provided for this project include only the hydrogeological aspects of the subsurface conditions at the Site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client and Consultant in the design of the specific project. No other warranties or guarantees, expressed or implied, are made.

We trust that this report is suitable for your present requirements and we thank Cyril J Demeyere Ltd. Properties Inc. for this opportunity to have provided hydrogeological services. If you have any questions or require further hydrogeological or geotechnical consultation, please do not hesitate to contact our office.

8 References

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Appendix A
Drawings

Drawing 1 : Location Plan
Drawing 2 : Groundwater Contours, January 31th, 2020
Drawing 3 : PGMN Well W107-1 Location water well record and area of influence

LEGEND:

- Boreholes
- Monitoring Wells
- Mini Piezometers
- Test Pits
- Site Limits

This document must be used in a joint way with the recommendations formulated in the report study

Scale

0 20 40 60 80 100 150 200 m

1:4 000

Client

Cyril J. Demeyere Ltd.

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Sherbrooke, QC J1L 1W6
T 819 563-3372
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Project

Hydrogeology
Study Report

284 Christie Drive, Dorchester

Title

Drawing 1 :
Site Location

Discipline: Geosciences		Prepared by: F. Proteau-Bédard, M.Sc.A.	Checked by: F. Proteau-Bédard, M.Sc.A.
Scale: 1:4 000		Drawn by: R. Careau	Approved by: J.-P. Gobeil, P.Geo. Geo., M.Sc.
Date: 08/12/2025		Figure N°: 01	
Page setup: 0001	Paper format: ANSI full bleed B (17.00 x 11.00 pouces)	Register N°:	

Resp.	Project	Phase	Disc.	Type	Drawing N°	Rev.
05	P-0019257.000	0100	GS	D	0101	01

LEGEND:

- Boreholes (Water Level)
- Monitoring Wells (Water Level)
- Site Limits
- Piezometry

This document must be used in a joint way with the recommendations formulated in the report study

Scale

0 20 40 60 80 100 150 200 m

1:4 000

Client

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Project

Hydrogeology
Study Report

284 Christie Drive, Dorchester

Title

Drawing 2 :
Piezometric Map

Discipline: Geosciences	Prepared by: F. Proteau-Bédard, M.Sc.A.	Checked by: F. Proteau-Bédard, M.Sc.A.
Scale: 1:4 000	Drawn by: R. Careau	Approved by: J.-P. Gobeil, P.Geo. Geo., M.Sc.
Date: 30/01/2024	Figure N°: 02	
Page setup: 0002 Paper format: ANSI full bleed B (17.00 x 11.00 pouces)	Register N°:	

Resp.	Project	Phase	Disc.	Type	Drawing N°	Rev.
05	P-0019257.000	0100	GS	D	0102	00

LEGEND:

- Water Wells
- Site Limits
- Area of influence
- Sanitary sewer location

Dewatering sources

1. Sewers
2. SWM pond

This document must be used in a joint way with the recommendations formulated in the report study

Scale

0 25 50 75 100 150 200 250 m

1:5 000

Client

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Project

Hydrogeology
Study Report

284 Christie Drive, Dorchester

Title

Drawing 3 :
Water Wells Records (WWR)

Discipline: Geosciences	Prepared by: F. Proteau-Bédard, M.Sc.A. / Checked by: F. Proteau-Bédard, M.Sc.A.
Scale: 1:5 000	Drawn by: R. Careau / Approved by: J.-P. Gobeil, P.Geo. Geo., M.Sc.
Date: 03/12/2025	Figure N°: 03
Page setup: 0003 / Paper format: ANSI full bleed B (17.00 x 11.00 pouces)	Register N°:

Resp.	Project	Phase	Disc.	Type	Drawing N°	Rev.
05	P-0019257.000	0100	GS	D	0103	01

Appendix B
Borehole Logs

Boreholes BH01-19 to BH-14-19

ENGLOBE

Englobe
CONSULTING SOILS AND MATERIALS ENGINEERS
417 Exeter Road, London, Ontario, N6E 2Z3
Phone: 519-685-6400 Fax: 519-685-0943

LOG OF BOREHOLE NO. 01-19

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

Encl. No. 01 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 16, 2019

SUBSURFACE PROFILE

Ground elevation: 257.74 m

Depth (m)	DESCRIPTION
0 – 0.25	250 mm topsoil.
0.25 – 3.81	SAND: Loose to compact, brown sand, some to trace silt, moist.
3.81 – 4.57	saturated.
4.57 – 6.10	gravelly sand.
6.10 – 6.55	TILL: Stiff, grey silt, some sand, clay and gravel, moist.
6.55	Borehole terminated. Water level at 3.81 m below ground surface upon completion of drilling.

NUMBER	TYPE	"N" Blows/ft	NATURAL WATER %
1	ss	8	2
2	ss	18	2
3	ss	17	4
4	ss	19	4
5	ss	19	20
6	ss	14	13
7	ss	9	9

Penetration Resistance Blows/ft: 20 40 60 80
Undrained Shear Strength kPa: ▲ Field Vane Test ★ Compression Test: 20 40 60 80

PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT %

Englobe

CONSULTING SOILS AND MATERIALS ENGINEERS

417 Exeter Road, London, Ontario, N6E 2Z3 — Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO.

02-19

Encl. No. 02 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 16, 2019

SUBSURFACE PROFILE

Ground surface elevation: 254.78 m

Elev. metres	Depth metres	DESCRIPTION
254.78	0	230 mm topsoil.
		SAND: Loose, brown sand, some silt, very moist to wet.
		compact.
		loose, saturated.
		Borehole terminated. Water level at 3.81 m below ground surface upon completion of drilling.

Sample NUMBER	TYPE	"N" Blows/ft	Natural Water %
1	ss	4	18
2	ss	14	18
3	ss	16	14
4	ss	19	18
5	ss	9	19
6	ss	8	20
7	ss	10	18

● Penetration Resistance Blows/ft (20, 40, 60, 80)
Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20, 40, 60, 80)

Columns: PLASTIC LIMIT %, NATURAL WATER %, LIQUID LIMIT %

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CONSULTING SOILS AND MATERIALS ENGINEERS

417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO. 03-19

Encl. No. 03 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 16, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
262.27	0	300 mm topsoil.							0.88m stickup; Concrete
		SAND: Very loose, brown sand, some silt, moist.	1	ss	4		6		
			2	ss	2		4		
			3	ss	2		3		
			4	ss	3		3		
		compact, trace gravel.	5	ss	10		3		
			6	ss	11		3		Bentonite
			7	ss	17		3		
			8	ss	21		4		
			9	ss	21		5		
		saturated.	10	ss	16		21		
		dense.	11	ss	36		19		Sand Filter; 50 mm diameter screen with filter pack
			12	ss	40				
		Borehole terminated. Water level at 10.52 m below ground surface upon completion of drilling.							

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417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO.

04-19

Encl. No. 04 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 18, 2019

Elev. metres	Depth metres	DESCRIPTION	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
259.14										0.85m stickup
	0	250 mm topsoil.								concrete
		SAND: Very loose to compact, brown sand, some silt, moist.		1	ss	3				
				2	ss	10				
	2	very moist.								Bentonite
		TILL: Stiff to very stiff, clayey silt, seams of sandy silt, saturated.	▼	3	ss	11		17		
				4	ss	17		17		
		SAND: Compact, brown sand trace silt and gravel, saturated.		5	ss	10				
		grey, loose silty sand.		6	ss	9		15		Sand Filter 50 mm diameter screen with filter pack
		compact.		7	ss	27		17		
		some gravel. Borehole terminated. Monitoring Well Installed.								

Elevation scale: 259, 258, 257, 256, 255, 254, 253. Depth scale: 0, 1, 2, 3, 4, 5, 6.

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417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO.

05-19

Encl. No. 05 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 18, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
260.10									0.80m stickup
260	0	230 mm topsoil.							Concrete
		SAND: Loose, brown sand, some silt, moist.							
259	1		1	ss	6		16		
		saturated.	2	ss	9		14		
258	2	SILT: Stiff, brown clayey silt, trace sand, very moist.							Bentonite
		seams of sandy silt.	3	ss	14		17		
257	3	very stiff, grey.	4	ss	19				
256	4		5	ss	16		10		
		SAND: Compact, brown sand, some silt, trace gravel, saturated.	6	ss	11				50 mm diameter screen with filter pack Sand Filter
255	5								
254	6		7	ss	22		16		
253	7								Bentonite
		grey sand.	8	ss	11		15		
	8	Borehole terminated. Monitoring Well installed.							

Groundwater level indicated at approximately 3.6 m depth.

LOG OF BOREHOLE BOREHOLE LOGS.GPJ ATK_DAV.GDT 1/27/20

Englobe
CONSULTING SOILS AND MATERIALS ENGINEERS
417 Exeter Road, London, Ontario, N6E 2Z3 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

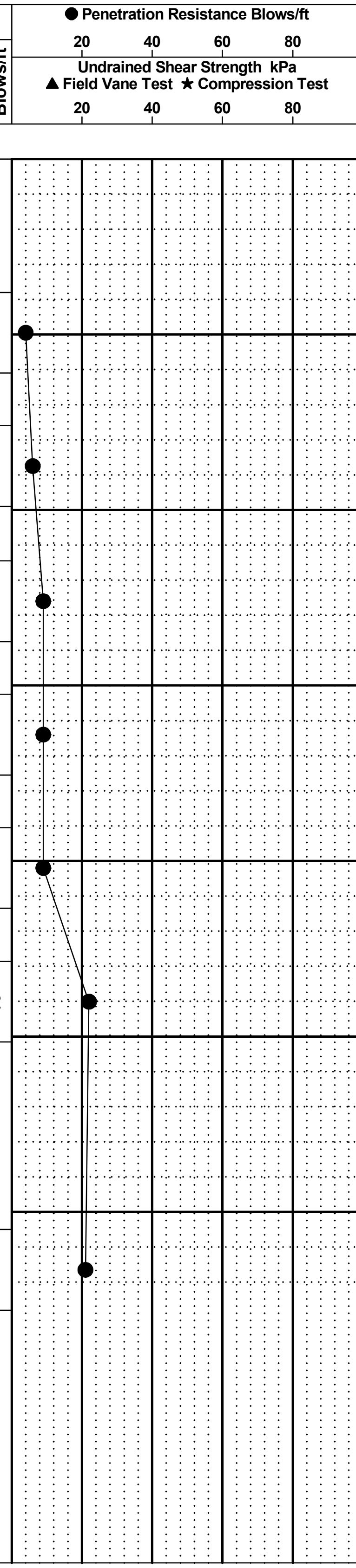
LOG OF BOREHOLE NO.

06-19

Encl. No. 06 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 16, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
260.69	0	250 mm topsoil.						
		SAND: Loose, brown sand, some silt, some rootlets, moist.	1	ss	4		8	
			2	ss	6		7	
			3	ss	9		1	
			4	ss	9		4	
			5	ss	9		4	
		Compact.	6	ss	22		5	
			7	ss	21		6	
		Borehole terminated. Open and dry.						



Englobe

CONSULTING SOILS AND MATERIALS ENGINEERS

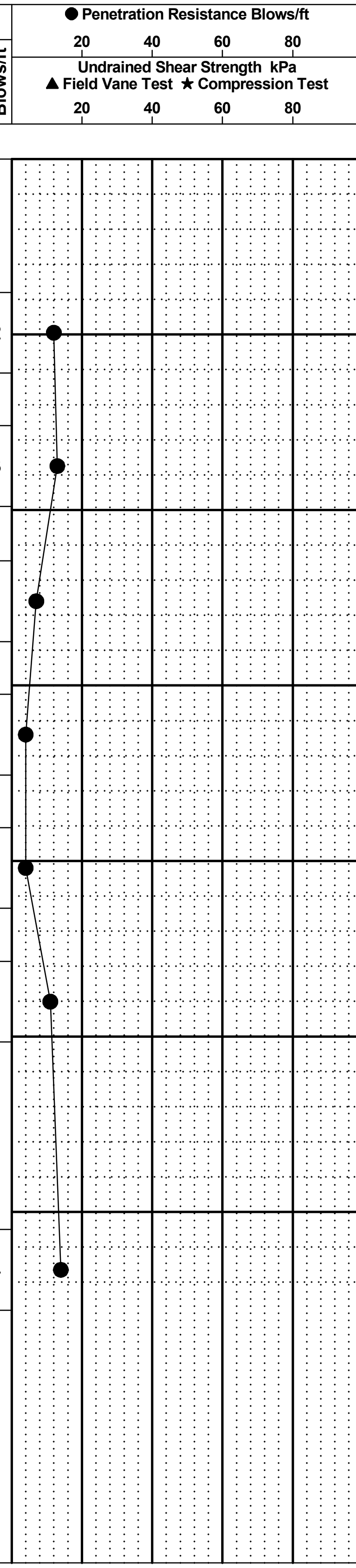
417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
LOG OF BOREHOLE NO. **07-19**
Encl. No. 07 (Sheet 1 of 1)
CLIENT: Cyril J. Demeyere Ltd.
DRILLING DATA: London Soil Test
PROJECT: Proposed Residential Subdivision
METHOD: Hollow Stem Auger
LOCATION: 83 Christie Drive, Dorchester, Ontario
DIAMETER: 200mm
DATUM ELEVATION: Geodetic
DATE: Jul 16, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	Ground Water	Number	Type	"N" Blows/ft	Plastic Limit %	Natural Water %	Liquid Limit %
261.34	0	250 mm topsoil.							
		SAND: Compact, brown sand, some silty sand seams, moist.		1	ss	12		11	
		some to trace silt.		2	ss	13		2	
		loose, very moist.		3	ss	7		1	
				4	ss	4		3	
			▽ (4.3 m)	5	ss	4		17	
		compact, saturtated.		6	ss	11		21	
				7	ss	14		20	
		Borehole terminated. Water level at 4.3 m below ground surface upon completion of drilling.							

Elevation scale: 261, 260, 259, 258, 257, 256, 255. Depth scale: 0, 1, 2, 3, 4, 5, 6.



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CONSULTING SOILS AND MATERIALS ENGINEERS

417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO.

08-19

Encl. No. 08 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Jul 18, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
266.37	0	230 mm topsoil.							0.90m stickup; Concrete
		SAND: Loose to very loose, brown sand, some silt, moist.	1	ss	5				
			2	ss	3				
		Compact, very moist.	3	ss	13		9		
			4	ss	20		1		
			5	ss	24		1		Bentonite
			6	ss	29		1		
		(Ground water ▼ at approx. 8 m)	7	ss	19		17		
		saturated.	8	ss	20		14		50 mm diameter screen with filter pack Sand Filter
			9	ss	23		17		
	11	Borehole terminated. Montoring Well Installed.							

Elevation scale: 266, 265, 264, 263, 262, 261, 260, 259, 258, 257, 256
Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

LOG OF BOREHOLE BOREHOLE LOGS.GPJ ATK_DAV.GDT 1/27/20

Englobe

CONSULTING SOILS AND MATERIALS ENGINEERS

417 Exeter Road, London, Ontario, N6E 2Z3 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

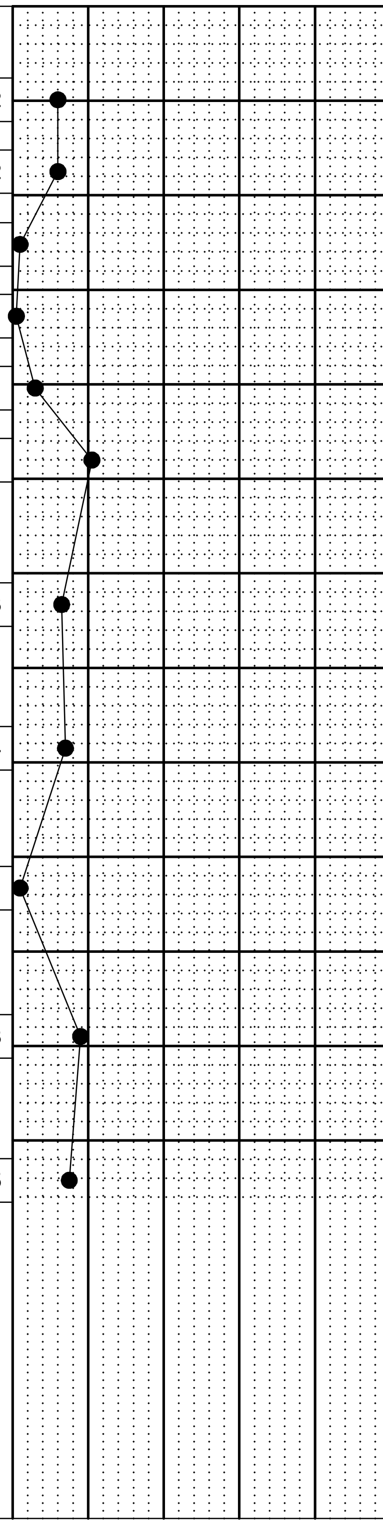
LOG OF BOREHOLE NO. 09-19

Encl. No. 09 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Aug 1, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
261.01	0	500 mm topsoil.							
		SILT: Compact, brown silt, some gravel, trace sand, moist.		1	ss	12			
				2	ss	12		7	
		SAND: Very loose, brown sand, some silt, trace rootlets, moist.		3	ss	2			
				4	ss	1		5	
				5	ss	6			
		compact, saturated.	∇	6	ss	21		17	
				7	ss	13		19	
				8	ss	14		18	
		very loose.		9	ss	2			
		compact.		10	ss	18			
				11	ss	15			
		Borehole terminated. Water level at 4.57 m below ground surface upon completion of drilling.							

● Penetration Resistance Blows/ft: 20 40 60 80
Undrained Shear Strength kPa
▲ Field Vane Test ★ Compression Test: 20 40 60 80



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417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
LOG OF BOREHOLE NO. 10-19
Encl. No. 10 (Sheet 1 of 1)
CLIENT: Cyril J. Demeyere Ltd.
DRILLING DATA: London Soil Test
PROJECT: Proposed Residential Subdivision
METHOD: Hollow Stem Auger
LOCATION: 83 Christie Drive, Dorchester, Ontario
DIAMETER: 200mm
DATUM ELEVATION: Geodetic
DATE: Aug 1, 2019

SUBSURFACE PROFILE

Ground surface elevation: 257.33

Depth (m)	Description	Ground Water	Number	Type	"N" Blows/ft	LEL %	Natural Water %	Gas %	Well Construction
0	500 mm topsoil.								0.9m stickup. Concrete
	SAND: Very loose, brown sand, trace silt and gravel, trace rootlets, moist.		1	ss	2		7		Bentonite
			2	ss	7		19		
	Dense.	▼	3	ss	39		18		
	compact, brown sand and gravel, trace silt, saturated.		4	ss	12		11		
	gravelly sand.		5	ss	18		5		
			6	ss	34		9		50 mm diameter screen with filter pack
	dense		7	ss	42		14		
	SILT: Compact, brown silt and sand, trace gravel, moist.		8	ss	25		15		
	clayey silt.		9	ss	24		9		

Borehole terminated.
Water level at 4.88 m below ground surface upon completion of drilling.
Monitoring Well Installed.

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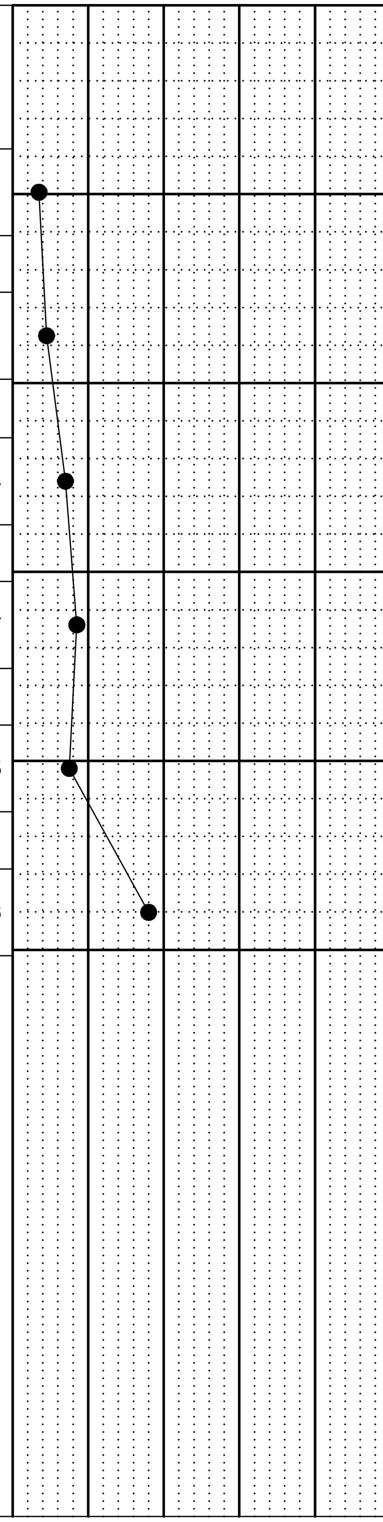
CONSULTING SOILS AND MATERIALS ENGINEERS
417 Exeter Road, London, Ontario, N6E 2Z3
Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0019257-100
LOG OF BOREHOLE NO. 11-19
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

Encl. No. 11 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Aug 1, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	NUMBER	TYPE	"N" Blows/ft	NATURAL WATER %
257.58	0	500 mm topsoil.				
		SAND: Loose, brown sand, some silt, moist.				
	1		1	ss	7	2
			2	ss	9	3
		compact.	3	ss	14	3
			4	ss	17	2
			5	ss	15	
		Dense, saturated.	6	ss	36	16
	5	Borehole terminated. Open and dry.				



PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT %

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CONSULTING SOILS AND MATERIALS ENGINEERS

417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO.

12-19

Encl. No. 12 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Aug 1, 2019

Elev. metres	Depth metres	DESCRIPTION (SUBSURFACE PROFILE)	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	● Penetration Resistance Blows/ft (20, 40, 60, 80); Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20, 40, 60, 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
255.19	0	Peat: Very loose, dark brown/black, silt, some sand and clay, very moist.									
	1				1	ss	2			88	
					2	ss	2			31	
	2	CLAY: Soft to firm, brown silty clay, some sand seams, very moist to wet.		∇							
					3	ss	7				
	3				4	ss	7				
	4				5	ss	5				
		Borehole terminated. Water level at 2.29 m below ground surface upon completion of drilling.									

Elevation scale: 255, 254, 253, 252, 251

LOG OF BOREHOLE BOREHOLE LOGS.GPJ ATK_DAV.GDT 1/27/20

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417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

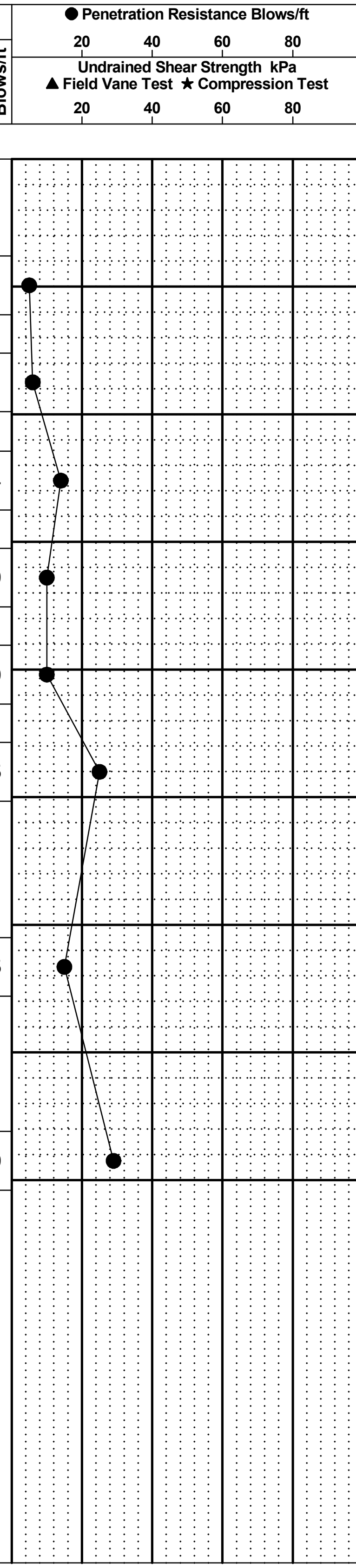
REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

LOG OF BOREHOLE NO. 13-19

Encl. No. 13 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Aug 2, 2019

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	NATURAL WATER %
262.26	0	500 mm topsoil.					
		SAND: Loose, brown sand, some silt, trace gravel, some rootlets on the upper layers, moist.		1	ss	5	12
				2	ss	6	
		compact, layers of clayey silt, very moist.		3	ss	14	3
				4	ss	10	17
		SILT: Firm, brown clayey silt, some sand, wet.		5	ss	10	22
		Compact, brown sandy silt, trace gravel, moist to wet.		6	ss	25	
			∇				
				7	ss	15	
		clayey silt, trace gravel, saturated.		8	ss	29	
		Borehole terminated. Water level at 5.79 m below ground surface upon completion of drilling.					



PLASTIC LIMIT % | LIQUID LIMIT %

Englobe

CONSULTING SOILS AND MATERIALS ENGINEERS

417 Exeter Road, London, Ontario, N6E 2Z3 **Phone: 519-685-6400 Fax: 519-685-0943**

LOG OF BOREHOLE NO.

14-19

REF. NO.: P-0019257-100
CLIENT: Cyril J. Demeyere Ltd.
PROJECT: Proposed Residential Subdivision
LOCATION: 83 Christie Drive, Dorchester, Ontario
DATUM ELEVATION: Geodetic

Encl. No. 14 (Sheet 1 of 1)
DRILLING DATA: London Soil Test
METHOD: Hollow Stem Auger
DIAMETER: 200mm
DATE: Aug 13, 2019

SUBSURFACE PROFILE									LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft					
265.63	0	300 mm topsoil.										0.89m stickup; Concrete
		SAND: Very loose, mottled brown sand, some silt, trace gravel, moist.			1	ss	1					Bentonite
	3	compact.			2	ss	16					
		dense, silty sand.		▼	3	ss	34					
	6	compact, saturated.			4	ss	18			20		Sand Filter 50 mm diameter screen with filter pack
					5	ss	18					
					6	ss	25			22		
		Borehole terminated. Monitoring Well Installed.										

Appendix C
Figures

ENGLOBE

Englobe

PARTICLE SIZE ANALYSIS

Project: **Proposed Residential Subdivision**

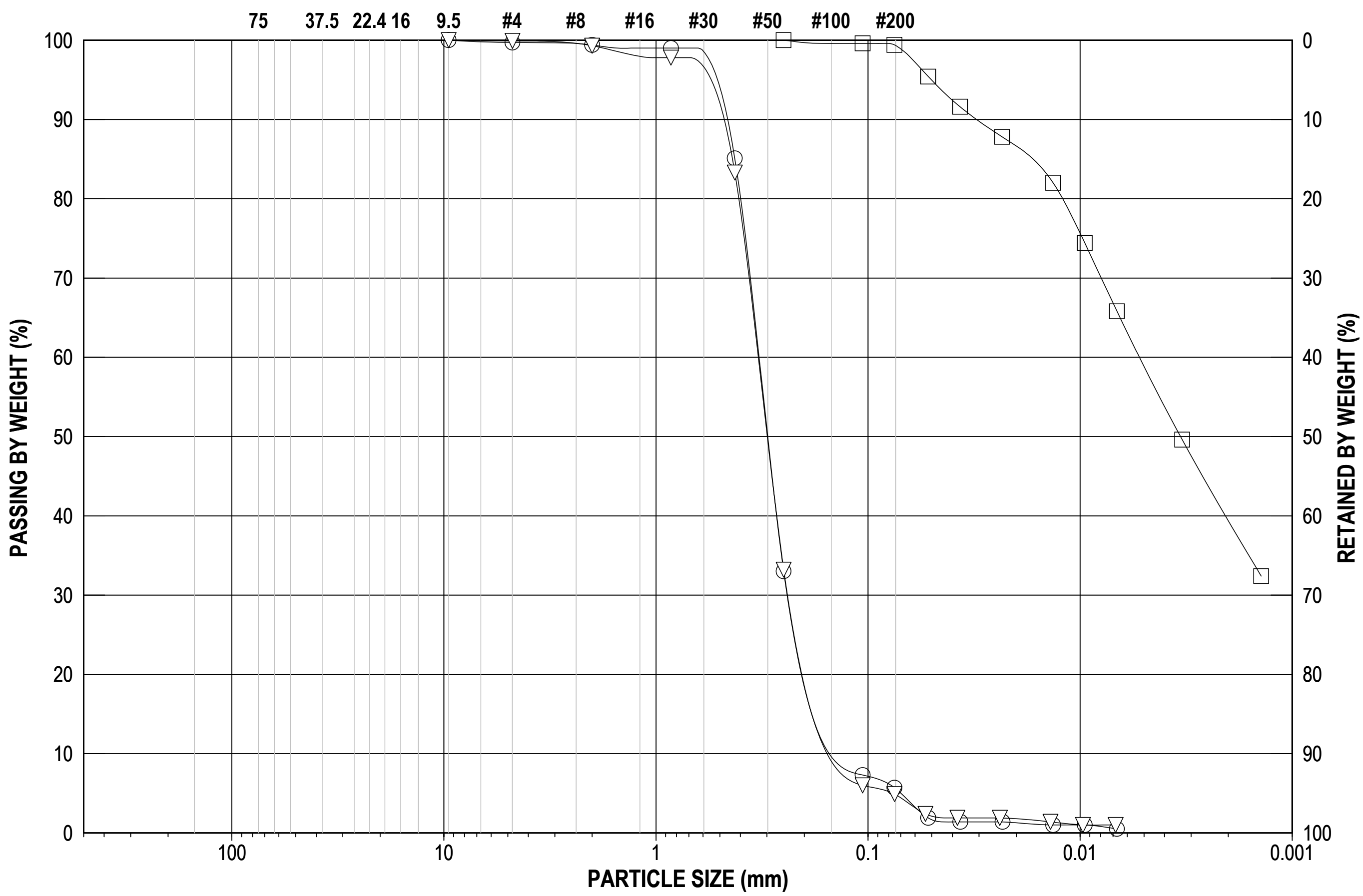
Figure No : **1**

Location: **83 Christie Street, Dorchester, Ontario**

File No : **P-0019257-0-01-100**

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



Symbol	Borehole n°	Sample n°	Depth (m)	Description
—○—	BH-03-19	SA-3	2.29 - 2.74	SAND, trace Silt
—□—	BH-05-19	SA-4	3.05 - 3.51	SILT and CLAY
—▽—	BH-06-19	SA-3	2.29 - 2.74	SAND, trace Silt

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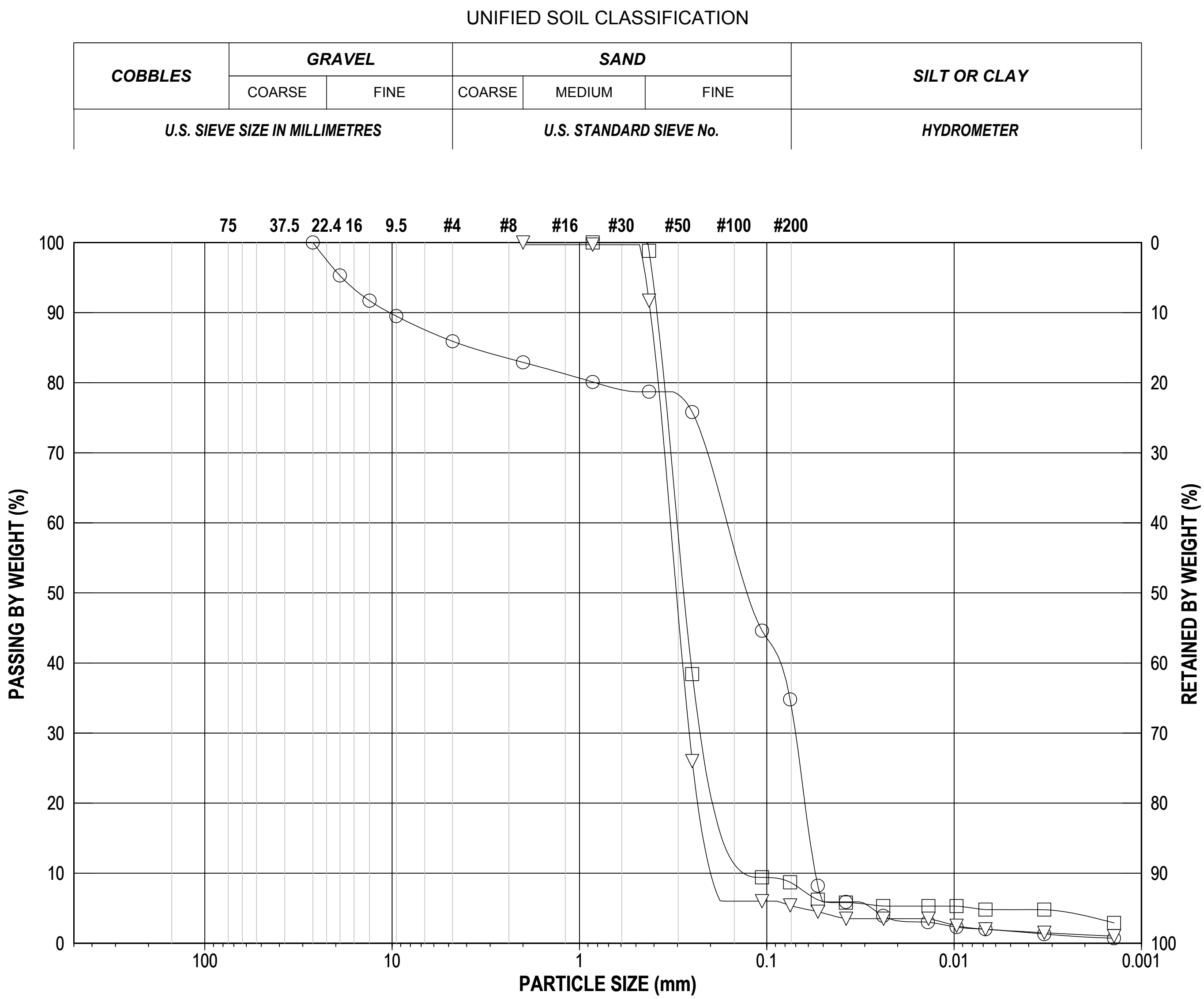
PARTICLE SIZE ANALYSIS

Project: **Proposed Residential Subdivision**

Figure No : **2**

Location: **83 Christie Street, Dorchester, Ontario**

File No : **P-0019257-0-01-100**



Symbol	Borehole n°	Sample n°	Depth (m)	Description
○	BH-08-19	SA-3	2.29 - 2.74	Silty SAND, some Gravel, trace Clay
□	BH-09-19	SA-2	1.52 - 1.98	SAND, trace Silt and Clay
▽	BH-09-19	SA-5	3.81 - 4.27	SAND, trace Silt and Clay

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PARTICLE SIZE ANALYSIS

Project: **Proposed Residential Subdivision**

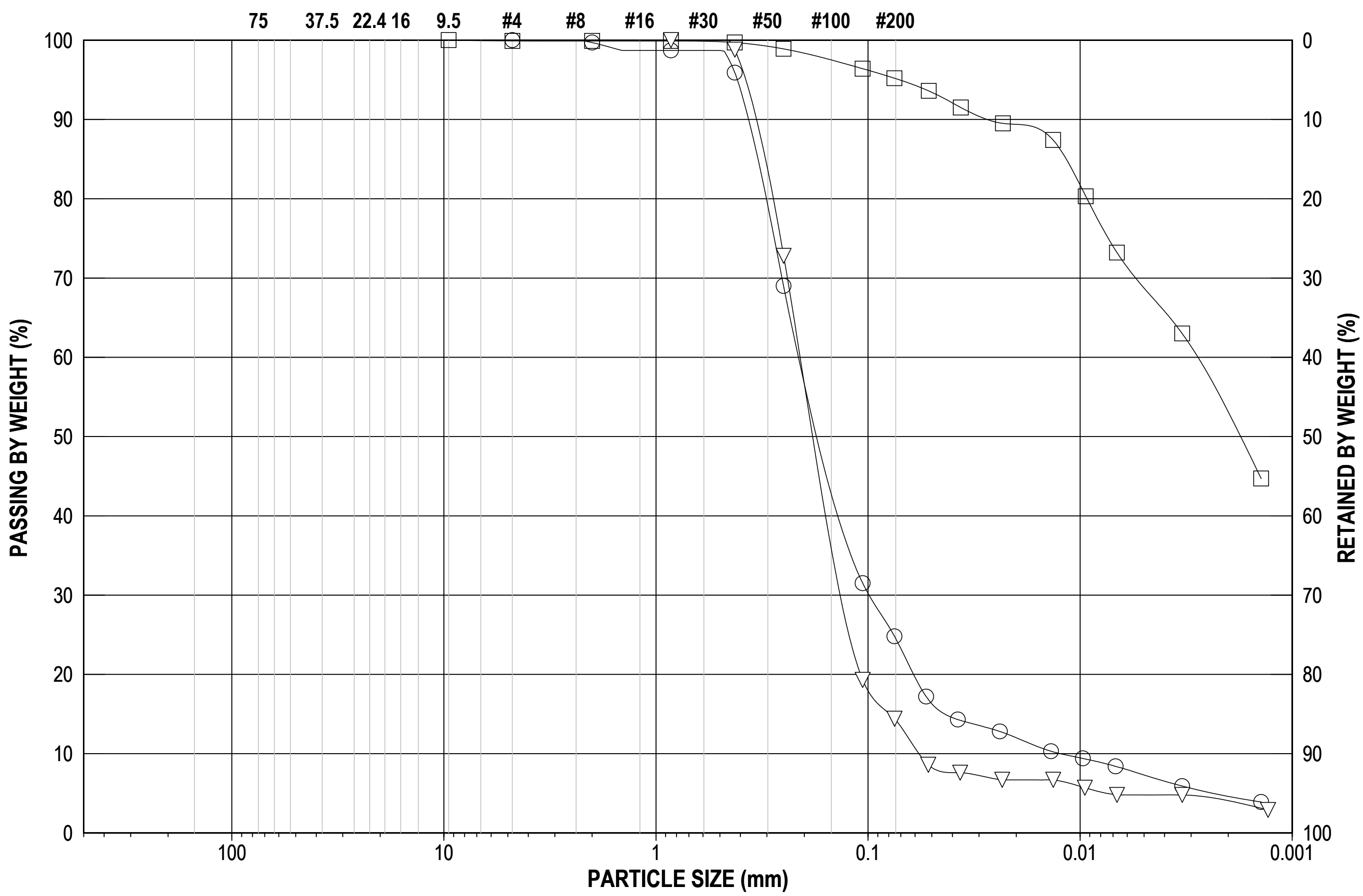
Figure No : **3**

Location: **83 Christie Street, Dorchester, Ontario**

File No : **P-0019257-0-01-100**

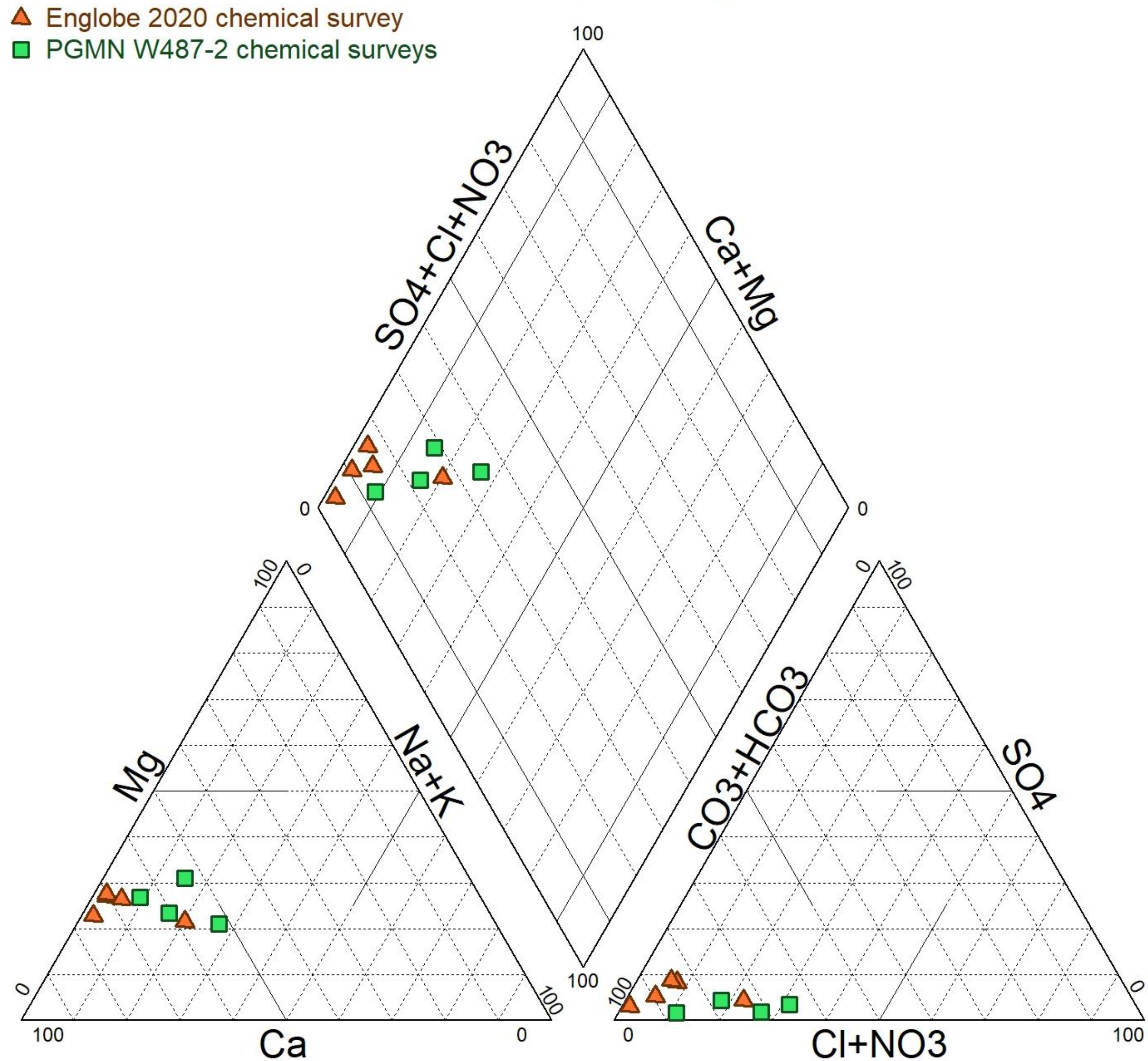
UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



Symbol	Borehole n°	Sample n°	Depth (m)	Description
○	BH-12-19	SA-2	1.52 - 1.98	SAND and SILT, trace Clay
□	BH-12-19	SA-3	2.29 - 2.74	SILT and CLAY, trace Sand
▽	BH-13-19	SA-2	1.52 - 1.98	SAND, some SILT, trace Clay

Figure 4: Piper Diagram



Appendix D
Tables

Table 101 : Groundwater and Surface Water Elevations
Table 102 : Hydraulic Conductivity Estimates and Infiltration Rates
Table 103 : Groundwater Chemistry Results
Table 104 : Water Levels Fluctuation for Infiltration Assessment

ENGLOBE

TABLE 101

WELLS LOCATIONS AND GROUNDWATER ELEVATION

83, CHRISTIE DR, DORCHESTER

Well ID	Northing (m) (UTM NAD83 - Zone 17N)	Easting (m) (UTM NAD83 - Zone 17N)	Ground surface elevation (m ASL)	Date	Water level (m BGS)	Water levels (m ASL)
MW03-19	4758756	494189	262,27	30/08/2019	10,52	251,75
				13/09/2019	10,54	251,73
				09/12/2019	10,61	251,66
				27/01/2020	10,53	251,745
				26/02/2020	10,49	251,78
				30/03/2020	10,44	251,83
				29/04/2020	10,43	251,84
				09/06/2020	10,50	251,77
				07/01/2021	10,60	251,67
				16/09/2022	10,58	251,69
MW04-19	4758609	493813	259,14	08/08/2019	2,51	256,635
				30/08/2019	2,63	256,515
				13/09/2019	2,67	256,47
				09/12/2019	2,36	256,785
				27/01/2020	1,85	257,295
				26/02/2020	2,19	256,955
				30/03/2020	1,96	257,185
				29/04/2020	2,17	256,975
				09/06/2020	2,24	256,905
				07/01/2021	2,19	256,955
				16/09/2022	2,72	256,425
MW05-19	4758532	494078	260,1	08/08/2019	3,49	256,61
				30/08/2019	3,64	256,46
				13/09/2019	3,71	256,39
				09/12/2019	3,78	256,32
				27/01/2020	3,39	256,715
				26/02/2020	3,37	256,73
				30/03/2020	3,28	256,82
				29/04/2020	3,30	256,8
				09/06/2020	3,34	256,76
				07/01/2021	3,68	256,42
				16/09/2022	3,87	256,23
MW08-19	4758277	493908	266,37	08/08/2019	7,92	258,42
				30/08/2019	8,02	258,32
				13/09/2019	8,06	258,28
				09/12/2019	8,11	258,23
				27/01/2020	7,92	258,42
				26/02/2020	7,83	258,51
				30/03/2020	7,77	258,57
				29/04/2020	7,76	258,58
				09/06/2020	7,84	258,5
				07/01/2021	8,10	258,24
				16/09/2022	8,95	257,39
MW10-19	4758447	494386	257,33	08/08/2019	2,23	255,1
				30/08/2019	2,33	255
				13/09/2019	2,33	255
				09/12/2019	2,38	254,95
				27/01/2020	2,17	255,16
				26/02/2020	2,20	255,135
				30/03/2020	2,10	255,23
				29/04/2020	2,16	255,17
				09/06/2020	2,18	255,15
				07/01/2021	2,32	255,01
				16/09/2022	2,43	254,9
MW14-19	4758073	494200	265,63	30/08/2019	5,82	259,81
				13/09/2019	5,90	259,73
				09/12/2019	6,08	259,55
				27/01/2020	5,88	259,75
				26/02/2020	5,77	259,86
				30/03/2020	5,71	259,92
				29/04/2020	5,65	259,98
				09/06/2020	5,17	260,46
				07/01/2021	6,14	259,49
				16/09/2022	6,11	259,52
MP01-20	4758800	493871	252,87	13/09/2019	0,06	252,815
				09/12/2019	0,04	252,835
				27/01/2020	0,01	252,865
				26/02/2020	0,02	252,855
				30/03/2020	0,04	252,835
				29/04/2020	0,04	252,835
				09/06/2020	0,04	252,835
				07/01/2021	0,05	252,825
				16/09/2022	0,11	252,765
MP02-20	4758742	494064	251,88	13/09/2019	0,01	251,87
				09/12/2019	0,01	251,87
				27/01/2020	0,01	251,87
				26/02/2020	0,00	251,88
				30/03/2020	0,01	251,87
				29/04/2020	0,01	251,87
				09/06/2020	0,01	251,87
				07/01/2021	-0,01	251,89
				16/09/2022	0,01	251,87
MP03-20	4758475	493815	257,44	13/09/2019	0,60	256,845
				09/12/2019	0,45	256,99
				27/01/2020	0,02	257,42
				26/02/2020	0,20	257,245
				30/03/2020	0,05	257,39
				29/04/2020	0,16	257,28
				09/06/2020	0,23	257,21
				07/01/2021	0,35	257,09
				16/09/2022	0,57	256,87
MP04-20	4758258	494596	253,82	13/09/2019	0,96	252,86
				09/12/2019	0,52	253,3
				27/01/2020	0,47	253,35
				26/02/2020	0,79	253,03
				30/03/2020	0,55	253,27
				29/04/2020	0,55	253,27
				09/06/2020	0,57	253,25
				07/01/2021	0,36	253,46
				16/09/2022	0,71	253,11
MP05-20	4758283	493671	-	29/04/2020	0,32	-
				09/06/2020	0,15	-
				07/01/2021	0,01	-
				16/09/2022	0,43	-

TABLE 102

HYDRAULIC CONDUCTIVITY ESTIMATES AND INFILTRATION RATES

83, CHRISTIE DR, DORCHESTER

Test ID	Test Used	Depth (mBGS)	K (cm/s)	LN(I)	Infiltration Rate (mm/hour)	Safety factor of 2.5	Safety factor of 3.5
BH3SA3	Grain size	1.60 - 2.00	1,4E-02	5,16	173,64	69,45	49,61
BH5SA4	Grain size	3.00 - 3.50	5,9E-08	1,84	6,32	2,53	1,81
BH6SA3	Grain size	2.25 - 2.75	1,6E-02	5,19	179,95	71,98	51,42
BH8SA3	Grain size	2.25 - 2.75	1,8E-03	4,61	100,28	40,11	28,65
BH9SA2	Grain size	1.50 - 2.00	9,7E-03	5,06	157,40	62,96	44,97
BH9SA5	Grain size	3.80 - 4.25	1,7E-02	5,21	182,90	73,16	52,26
BH12SA2	Grain size	1.50 - 2.00	3,1E-04	4,14	62,63	25,05	17,89
BH12SA3	Grain size	2.30 - 2.80	1,7E-08	1,51	4,53	1,81	1,30
BH13SA2	Grain size	1.50 - 2.00	2,5E-03	4,70	109,49	43,80	31,28
TP01-20	Guelph	1,20	1,1E-03	4,47	87,68	35,07	25,05
TP01-20	Guelph	1,80	3,4E-03	4,77	118,42	47,37	33,83
TP02-20 -test1	Guelph	1,20	5,8E-03	4,92	137,41	54,96	39,26
TP02-20-test2	Guelph	1,20	4,9E-03	4,88	131,25	52,50	37,50
TP02-20-test1	Guelph	1,80	1,2E-02	5,12	167,36	66,94	47,82
TP02-20 -test2	Guelph	1,80	8,2E-03	5,01	150,23	60,09	42,92
TP03-20	Guelph	1,20	1,9E-05	3,38	29,45	11,78	8,41
TP04-20	Guelph	1,20	2,3E-03	4,67	106,45	42,58	30,41
TP04-20	Guelph	1,70	8,6E-04	4,41	82,39	32,96	23,54
TP04-20 -test1	Guelph	2,35	1,7E-02	5,21	182,32	72,93	52,09
TP04-20 -test2	Guelph	2,35	2,4E-02	5,30	200,58	80,23	57,31
TP05-20	Guelph	1,20	3,1E-03	4,75	115,48	46,19	32,99
TP05-20-test1	Guelph	1,75	1,9E-02	5,24	188,95	75,58	53,99
TP05-20-test2	Guelph	1,75	1,8E-02	5,22	185,16	74,07	52,90
TP05-20	Guelph	2,35	1,9E-02	5,24	188,16	75,26	53,76
Geometric Mean, Shallow Soil			1,6E-03	4,58	97,89	39,16	27,97
MW04-19	Hvorslev/Rising head	4.20-5.70	1,3E-02	-	-	-	-
MW05-19	Hvorslev/Rising head	4.10-5.60	3,9E-03	-	-	-	-
MW10-19	Hvorslev/Rising head	4.30-5.80	1,2E-03	-	-	-	-
Geometric Mean, Water Table Soils			-	-	-	-	-

mBGS = metres below ground surface.

y=6E-11($X^{3.7363}$)
LN(K)=LN6-11LN10+3.7363LN(I)
K = cm/s
I = mm/hour
LN(I)=(LN(K)+11LN(10)-LN(6))/3.7363

Use safety factor of 2.5 if soils in the infiltration interval are homogeneous. Use 3.5 otherwise.

TABLE 103

GROUNDWATER CHEMICAL RESULTS

83, CHRISTE DR, DORCHESTER

Parameter	Thames center limits for sanitary sewer discharge	Provinvial Water Quality Objective	Detection Limit	Units	MW-03-19	MW-08-19	MW-10-19	MP-01-19	MP-04-19	MW-05-19
Colour, Apparent			2	CU	7.50	20.90	51.50	40.00	96.10	
Conductivity			3	umhos/cm	599.00	666.00	600.00	478.00	652.00	
Hardness (as CaCO3)			0.5	mg/L	366.00	355.00	325.00	283.00	265.00	
pH		6.5 - 8.5	0.1	pH units	7.78	8.16	7.71	8.14	8.26	7.94
Total Suspended Solids	350		2	mg/L						41.40
Total Dissolved Solids			20	mg/L	376.00	386.00	451.00	272.00	359.00	
Turbidity			0.1	NTU	5.68	29.40	211.00	9.47	24.20	
Alkalinity, Total (as CaCO3)	Not decreased by more than 25% from natural		10	mg/L	254.00	315.00	284.00	255.00	251.00	
Ammonia, Total (as N)			0.01	mg/L	0.02	<0.010	0.02	0.02	0.37	
Chloride (Cl)			0.5	mg/L	12.30	9.22	9.71	2.63	53.80	
Fluoride (F)	10		0.02	mg/L	0.07	0.05	0.12	0.05	0.15	0.06
Nitrate (as N)			0.02	mg/L	8.04	7.21	9.42	0.03	0.83	
Nitrite (as N)			0.01	mg/L	0.03	<0.010	0.03	<0.010	<0.010	
Total Kjeldahl Nitrogen	100		0.15	mg/L						
Orthophosphate-Dissolved (as P)			0.003	mg/L	<0.0030	0.0054	<0.0030	0.0088	0.01	
Phosphorus, Total	10	0.03	0.003	mg/L						0.034
Sulfate (SO4)	1500		0.3	mg/L	24	17.7	27.5	7.85	14.70	25.90
Sulphide (as S)	1	1.7	0.018	mg/L						<0.018
Sulphide (as H2S)			0.019	mg/L						<0.019
Cyanide, Total	1	0.005	0.002	mg/L						<0.0020
Antimony (Sb)-Total	5	0.1	0.0001	mg/L						<0.00010
Arsenic (As)-Total	1	0.005	0.0001	mg/L						0.00
Cadmium (Cd)-Total		0.0002	0.000005	mg/L						0.00
Chromium (Cr)-Total		0.008	0.0005	mg/L						0.00
Cobalt (Co)-Total		0.0009	0.0001	mg/L						0.00
Copper (Cu)-Total		0.005	0.001	mg/L						0.00
Lead (Pb)-Total	1	0.025	0.00	mg/L						0.00
Mercury (Hg)-Total	0.01	0.0002	0.00	mg/L						
Molybdenum (Mo)-Total		0.04	0.00	mg/L						0.00
Nickel (Ni)-Total		0.025	0.00	mg/L						0.00
Selenium (Se)-Total	1	0.1	0.00	mg/L						0.00
Silver (Ag)-Total	5	0.0001	0.00	mg/L						<0.000050
Tin (Sn)-Total	5		0.00	mg/L						0.00
Zinc (Zn)-Total		0.03	0.00	mg/L						0.07
Aluminum (Al)-Dissolved		0.075	0.005	mg/L	<0.0050	7.5E-03	<0.0050	<0.0050	<0.0050	
Antimony (Sb)-Dissolved		0.02	0.0001	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Arsenic (As)-Dissolved		0.1	0.0001	mg/L	0.00023	2.9E-04	0.0004	0.00023	0.00	
Barium (Ba)-Dissolved			0.0001	mg/L	0.023	1.9E-02	0.0427	0.0169	0.02	
Beryllium (Be)-Dissolved		1.1	0.0001	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth (Bi)-Dissolved			0.00005	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron (B)-Dissolved		0.2	0.01	mg/L	0.013	1.6E-02	0.013	<0.010	0.02	
Cadmium (Cd)-Dissolved	0.7		0.000005	mg/L	0.0000098	1.3E-05	0.0000137	<0.0000050		
Calcium (Ca)-Dissolved			0.05	mg/L	106	1.0E+02	93.4	86.9	77.40	
Chromium (Cr)-Dissolved	3		0.0005	mg/L	0.00051	<0.00050	0.00073	<0.00050	<0.00050	
Cobalt (Co)-Dissolved	5		0.00	mg/L	<0.00010	<0.00010	<0.00010	0.00	0.00	
Copper (Cu)-Dissolved	3		0.00	mg/L	1.98E-03	4.7E-03	0.00	0.00	0.00	
Iron (Fe)-Dissolved		0.3	0.01	mg/L	<0.010	<0.010	<0.010	0.21	0.84	
Lead (Pb)-Dissolved		0.025	0.00	mg/L	<0.000050	3.1E-04	0.00	<0.000050	0.00	
Magnesium (Mg)-Dissolved			0.01	mg/L	24.7	2.4E+01	22.20	16.10	17.30	
Manganese (Mn)-Dissolved			0.00	mg/L	0.00272	4.1E-03	0.01	0.17	0.93	
Molybdenum (Mo)-Dissolved	5		0.00	mg/L	0.000415	9.0E-04	0.00	0.00	0.00	
Nickel (Ni)-Dissolved	2	0.025	0.00	mg/L	0.00142	<0.00050	0.00	0.00	0.00	
Phosphorus (P)-Dissolved			0.05	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	
Potassium (K)-Dissolved			0.05	mg/L	0.785	8.7E-01	1.56	0.271	2.03	
Selenium (Se)-Dissolved			0.00005	mg/L	0.00111	3.0E-03	0.000142	0.000247	0.00	
Silicon (Si)-Dissolved			0.05	mg/L	6.41	6.3E+00	5.6	4.82		
Silver (Ag)-Dissolved			0.00005	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Sodium (Na)-Dissolved			0.05	mg/L	4.24	3.3E+00	8.37	2.84	29.70	
Strontium (Sr)-Dissolved			0.001	mg/L	0.185	1.5E-01	0.199	0.155	0.25	
Thallium (Tl)-Dissolved			0.00001	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Tin (Sn)-Dissolved			0.0001	mg/L	0.00062	3.1E-04	0.00037	0.00036	0.00	
Titanium (Ti)-Dissolved			0.0003	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	
Tungsten (W)-Dissolved			0.00	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Uranium (U)-Dissolved		0.005	0.00	mg/L	5.99E-04	1.0E-03	0.00	0.00	0.00	
Vanadium (V)-Dissolved		0.006	0.00	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Zinc (Zn)-Dissolved	3		0.00	mg/L	1.95E-01	6.2E-01	0.03	0.02	0.01	
Zirconium (Zr)-Dissolved			0.00	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	
BOD	300		2.00	mg/L						<2.0
Oil and Grease, Total			5.00	mg/L						<5.0
Animal/Veg Oil & Grease			5.00	mg/L						
Mineral Oil and Grease			2.5	mg/L						<2.5
Phenols (4AAP)	1	0.001	0.001	mg/L						0.00
Benzene		0.1	0.5	ug/L						<0.50
Chloroform	40		1	ug/L						<1.0
1,2-Dichlorobenzene	50	2.5	0.5	ug/L						<0.50
1,4-Dichlorobenzene	80	4	0.5	ug/L						<0.50
Dichloromethane			2	ug/L						<2.0
Ethylbenzene	160	8	0.5	ug/L						<0.50
1,1,2,2-Tetrachloroethane	40	70	0.5	ug/L						<0.50
Tetrachloroethylene	50	50	0.5	ug/L						<0.50
Toluene	200	0.8	0.50	ug/L						<0.50
Trichloroethylene	50	20	0.50	ug/L						<0.50
Xylenes (Total)			0.50	ug/L						<0.50
4-Bromofluorobenzene				%						
1,4-Difluorobenzene				%						99.70
Total THMs			2.00	ug/L						<2.0

Appendix E
Hydraulic Conductivity Testing

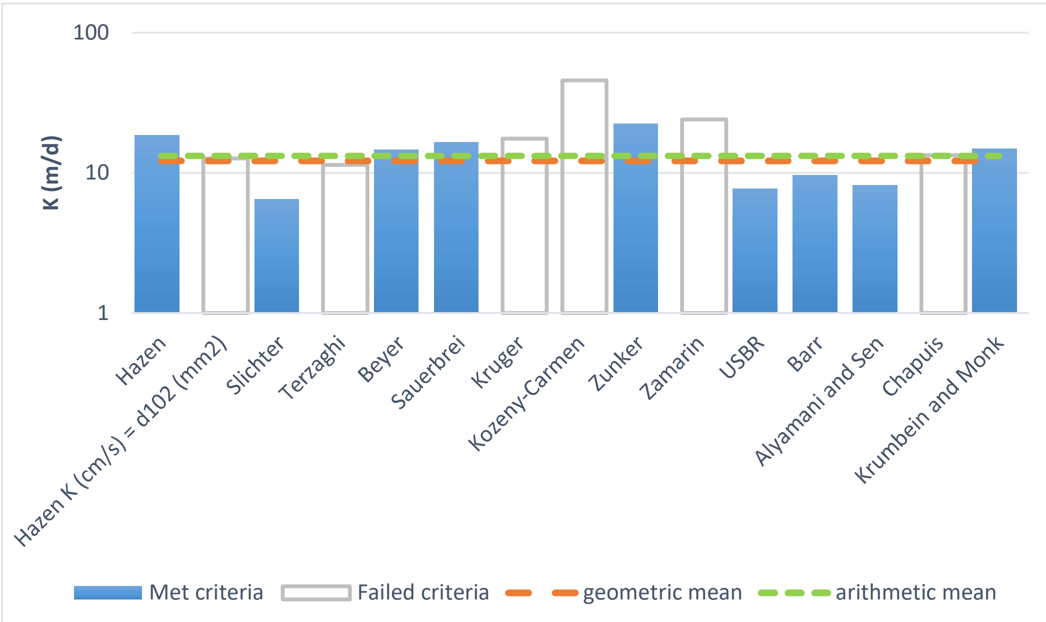
ENGLOBE

K from Grain Size Analysis Report   Date: ____________

Sample Name: BH03-19-Sample3

Mass Sample (g): 100   T (oC) 20

BH03-SA3: Moderately well sorted sand low in fines



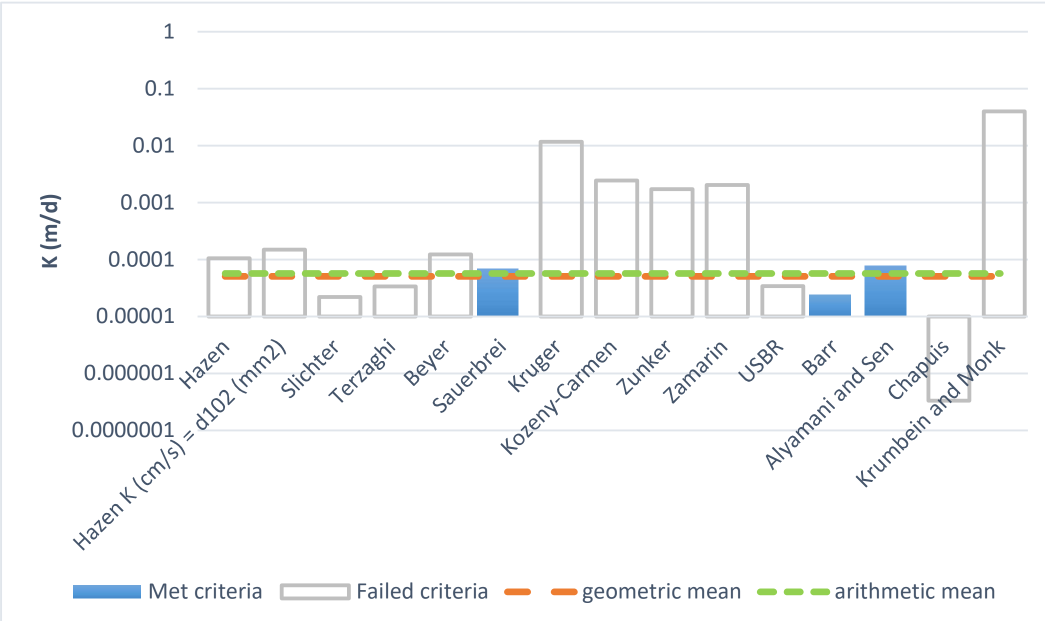
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	2.1E-02	2.1E-04	18.55	
Hazen K (cm/s) = d_{10} (mm)	1.5E-02	1.5E-04	12.66	
Slichter	7.5E-03	7.5E-05	6.49	
Terzaghi	1.3E-02	1.3E-04	11.38	
Beyer	1.7E-02	1.7E-04	14.71	
Sauerbrei	1.9E-02	1.9E-04	16.50	
Kruger	2.0E-02	2.0E-04	17.54	
Kozeny-Carmen	5.3E-02	5.3E-04	45.68	
Zunker	2.6E-02	2.6E-04	22.38	
Zamarin	2.8E-02	2.8E-04	23.98	
USBR	8.9E-03	8.9E-05	7.68	
Barr	1.1E-02	1.1E-04	9.58	
Alyamani and Sen	9.4E-03	9.4E-05	8.15	
Chapuis	1.5E-02	1.5E-04	13.29	
Krumbein and Monk	1.7E-02	1.7E-04	14.90	
geometric mean	1.4E-02	1.4E-04	12.17	
arithmetic mean	1.5E-02	1.5E-04	13.22	

K from Grain Size Analysis Report Date: ______________

Sample Name: BH-04-19-Sample4

Mass Sample (g): 100 T (oC) 20

BH05-SA8: Poorly sorted clay with fines



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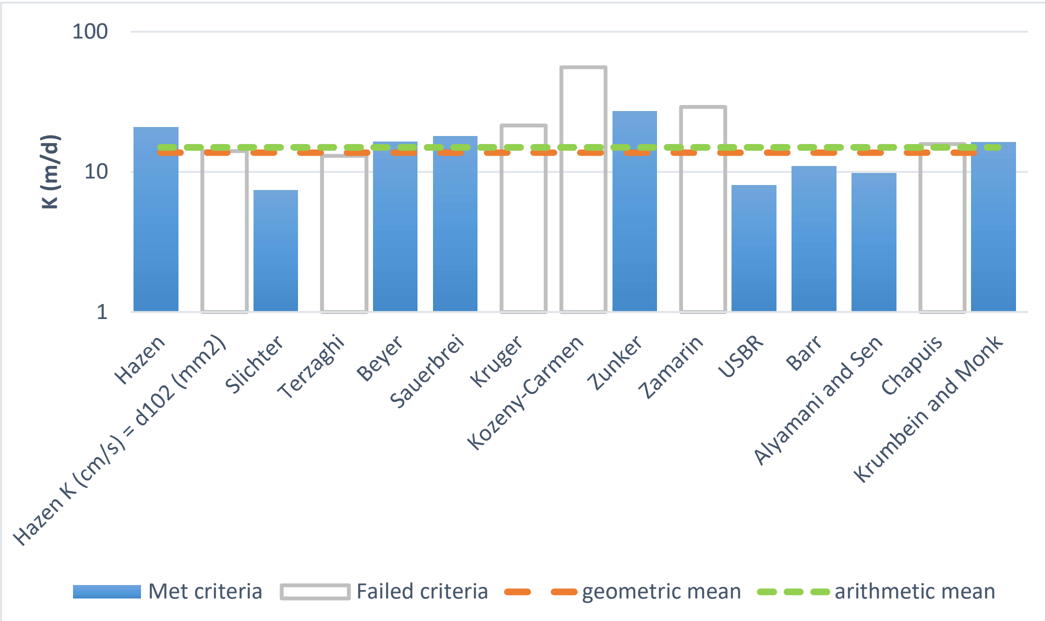
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.2E-07	1.2E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	1.7E-07	1.7E-09	0.00	
Slichter	2.5E-08	2.5E-10	0.00	
Terzaghi	3.9E-08	3.9E-10	0.00	
Beyer	1.4E-07	1.4E-09	0.00	
Sauerbrei	8.0E-08	8.0E-10	0.00	
Kruger	1.4E-05	1.4E-07	0.01	
Kozeny-Carmen	2.8E-06	2.8E-08	0.00	
Zunker	2.0E-06	2.0E-08	0.00	
Zamarin	2.4E-06	2.4E-08	0.00	
USBR	3.9E-08	3.9E-10	0.00	
Barr	2.8E-08	2.8E-10	0.00	
Alyamani and Sen	9.0E-08	9.0E-10	0.00	
Chapuis	3.9E-10	3.9E-12	0.00	
Krumbein and Monk	4.6E-05	4.6E-07	0.04	
geometric mean	5.9E-08	5.9E-10	0.00	
arithmetic mean	6.6E-08	6.6E-10	0.00	

K from Grain Size Analysis Report | Date: ____________

Sample Name: BH-06-19-Sample3

Mass Sample (g): 100 | T (oC) 20

BH06-SA3: Moderately well sorted sand low in fines



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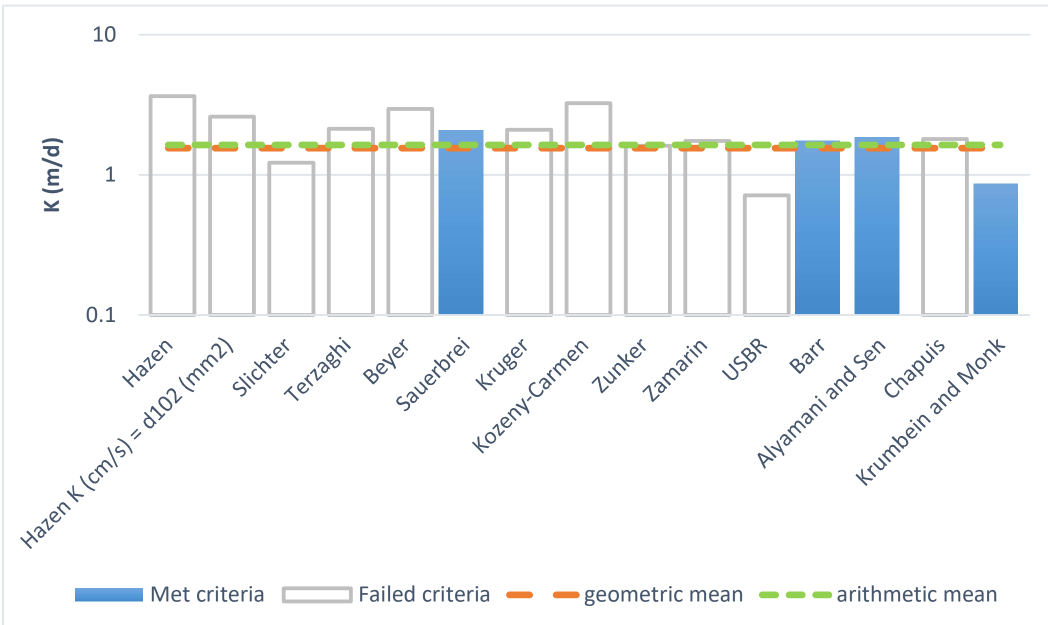
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	2.4E-02	2.4E-04	20.82	
Hazen K (cm/s) = d_{10} (mm)	1.6E-02	1.6E-04	14.01	
Slichter	8.5E-03	8.5E-05	7.38	
Terzaghi	1.5E-02	1.5E-04	12.95	
Beyer	1.9E-02	1.9E-04	16.42	
Sauerbrei	2.1E-02	2.1E-04	17.98	
Kruger	2.5E-02	2.5E-04	21.35	
Kozeny-Carmen	6.4E-02	6.4E-04	55.60	
Zunker	3.1E-02	3.1E-04	27.17	
Zamarin	3.4E-02	3.4E-04	29.07	
USBR	9.3E-03	9.3E-05	8.01	
Barr	1.3E-02	1.3E-04	10.99	
Alyamani and Sen	1.1E-02	1.1E-04	9.74	
Chapuis	1.8E-02	1.8E-04	15.77	
Krumbein and Monk	1.9E-02	1.9E-04	16.29	
geometric mean	1.6E-02	1.6E-04	13.72	
arithmetic mean	1.7E-02	1.7E-04	14.98	

K from Grain Size Analysis Report Date: ______________

Sample Name: BH-08-19-Sample3

Mass Sample (g): 100 T (oC) 20

BH08-SA3: Moderately well sorted gravelly sand low in fines



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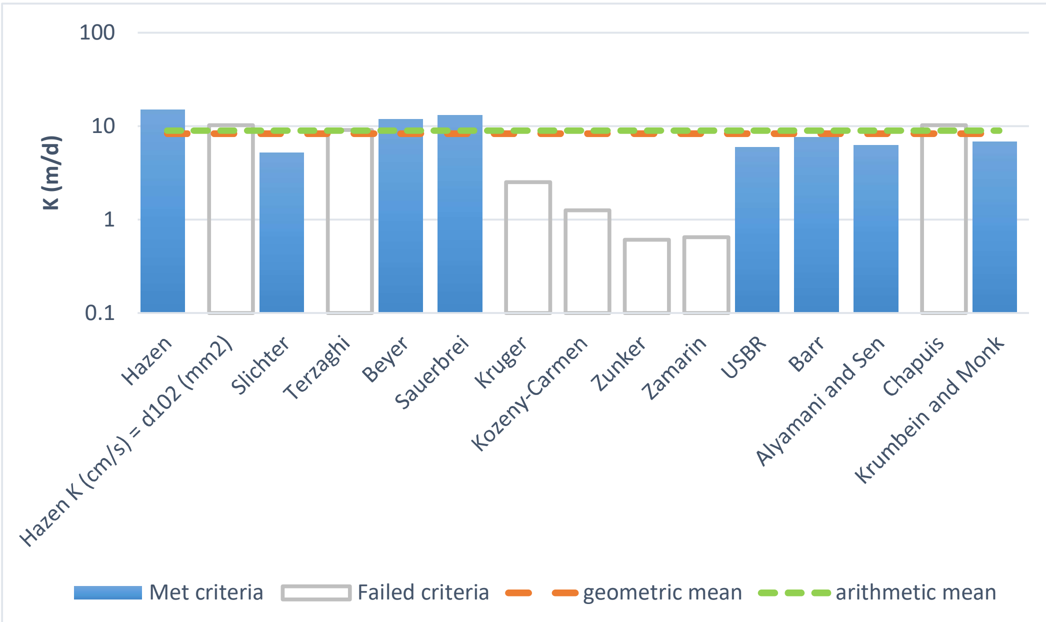
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.2E-03	4.2E-05	3.64	
Hazen K (cm/s) = d_{10} (mm)	3.0E-03	3.0E-05	2.60	
Slichter	1.4E-03	1.4E-05	1.22	
Terzaghi	2.5E-03	2.5E-05	2.13	
Beyer	3.4E-03	3.4E-05	2.94	
Sauerbrei	2.4E-03	2.4E-05	2.09	
Kruger	2.4E-03	2.4E-05	2.09	
Kozeny-Carmen	3.7E-03	3.7E-05	3.24	
Zunker	1.9E-03	1.9E-05	1.61	
Zamarin	2.0E-03	2.0E-05	1.74	
USBR	8.3E-04	8.3E-06	0.71	
Barr	2.0E-03	2.0E-05	1.75	
Alyamani and Sen	2.2E-03	2.2E-05	1.86	
Chapuis	2.1E-03	2.1E-05	1.80	
Krumbein and Monk	1.0E-03	1.0E-05	0.86	
geometric mean	1.8E-03	1.8E-05	1.55	
arithmetic mean	1.9E-03	1.9E-05	1.64	

K from Grain Size Analysis Report | Date: ____________

Sample Name: BH-09-19-Sample2

Mass Sample (g): 100 | T (oC) 20

BH09-SA2: Moderately well sorted sand low in fines



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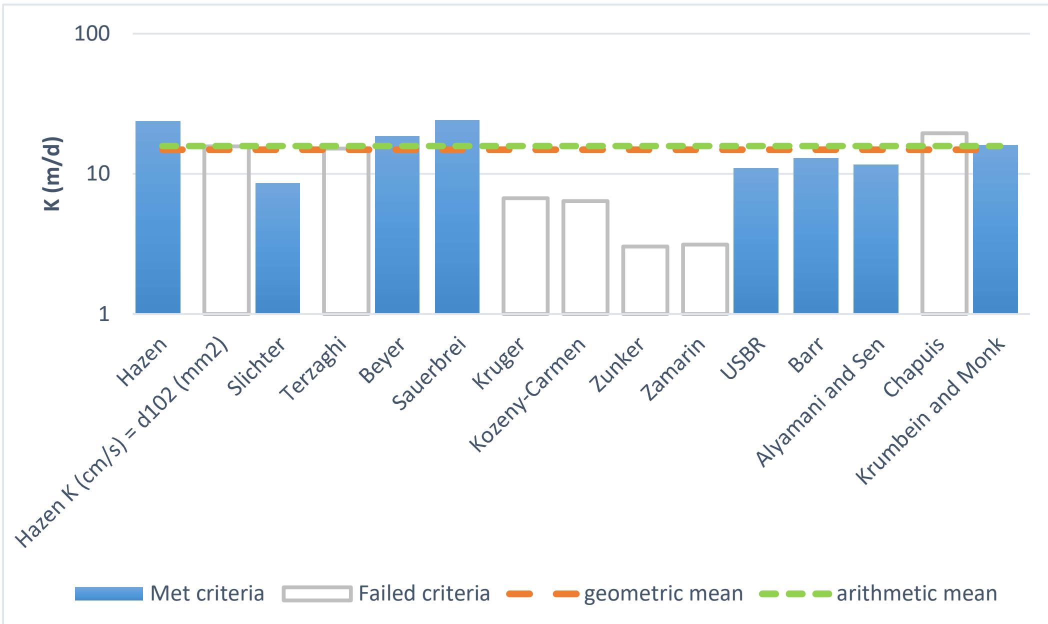
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.7E-02	1.7E-04	14.92	
Hazen K (cm/s) = d_{10} (mm)	1.2E-02	1.2E-04	10.24	
Slichter	6.0E-03	6.0E-05	5.19	
Terzaghi	1.1E-02	1.1E-04	9.09	
Beyer	1.4E-02	1.4E-04	11.86	
Sauerbrei	1.5E-02	1.5E-04	13.04	
Kruger	2.9E-03	2.9E-05	2.52	
Kozeny-Carmen	1.5E-03	1.5E-05	1.26	
Zunker	7.0E-04	7.0E-06	0.61	
Zamarin	7.4E-04	7.4E-06	0.64	
USBR	6.9E-03	6.9E-05	5.97	
Barr	8.8E-03	8.8E-05	7.62	
Alyamani and Sen	7.3E-03	7.3E-05	6.29	
Chapuis	1.2E-02	1.2E-04	10.19	
Krumbein and Monk	7.9E-03	7.9E-05	6.84	
geometric mean	9.7E-03	9.7E-05	8.34	
arithmetic mean	1.0E-02	1.0E-04	8.96	

K from Grain Size Analysis Report | Date: ______________

Sample Name: BH-09-19-Sample5

Mass Sample (g): 100 | T (oC) 20

BH09-SA5: Moderately well sorted sand low in fines



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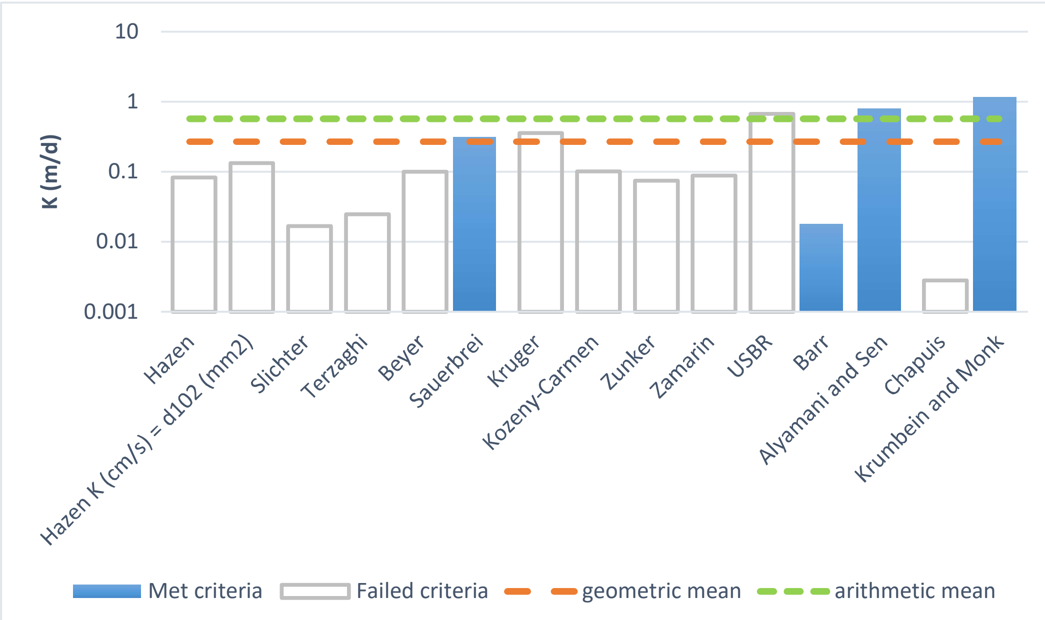
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	2.8E-02	2.8E-04	23.76	
Hazen K (cm/s) = d_{10} (mm)	1.8E-02	1.8E-04	15.68	
Slichter	1.0E-02	1.0E-04	8.60	
Terzaghi	1.7E-02	1.7E-04	15.10	
Beyer	2.2E-02	2.2E-04	18.60	
Sauerbrei	2.8E-02	2.8E-04	24.04	
Kruger	7.7E-03	7.7E-05	6.69	
Kozeny-Carmen	7.4E-03	7.4E-05	6.40	
Zunker	3.5E-03	3.5E-05	3.02	
Zamarin	3.6E-03	3.6E-05	3.13	
USBR	1.3E-02	1.3E-04	10.96	
Barr	1.5E-02	1.5E-04	12.97	
Alyamani and Sen	1.3E-02	1.3E-04	11.59	
Chapuis	2.3E-02	2.3E-04	19.47	
Krumbein and Monk	1.9E-02	1.9E-04	16.00	
geometric mean	1.7E-02	1.7E-04	14.88	
arithmetic mean	1.8E-02	1.8E-04	15.81	

K from Grain Size Analysis Report Date: ____________

Sample Name: BH-12-19-Sample2

Mass Sample (g): 100 T (oC) 20

BH12-SA2: Poorly sorted sand low in fines



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Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	9.5E-05	9.5E-07	0.08	
Hazen K (cm/s) = d_{10} (mm)	1.5E-04	1.5E-06	0.13	
Slichter	1.9E-05	1.9E-07	0.02	
Terzaghi	2.8E-05	2.8E-07	0.02	
Beyer	1.1E-04	1.1E-06	0.10	
Sauerbrei	3.6E-04	3.6E-06	0.32	
Kruger	4.1E-04	4.1E-06	0.36	
Kozeny-Carmen	1.2E-04	1.2E-06	0.10	
Zunker	8.5E-05	8.5E-07	0.07	
Zamarin	1.0E-04	1.0E-06	0.09	
USBR	7.7E-04	7.7E-06	0.67	
Barr	2.1E-05	2.1E-07	0.02	
Alyamani and Sen	9.2E-04	9.2E-06	0.79	
Chapuis	3.2E-06	3.2E-08	0.00	
Krumbein and Monk	1.3E-03	1.3E-05	1.16	
geometric mean	3.1E-04	3.1E-06	0.27	
arithmetic mean	6.6E-04	6.6E-06	0.57	

K from Grain Size Analysis Report

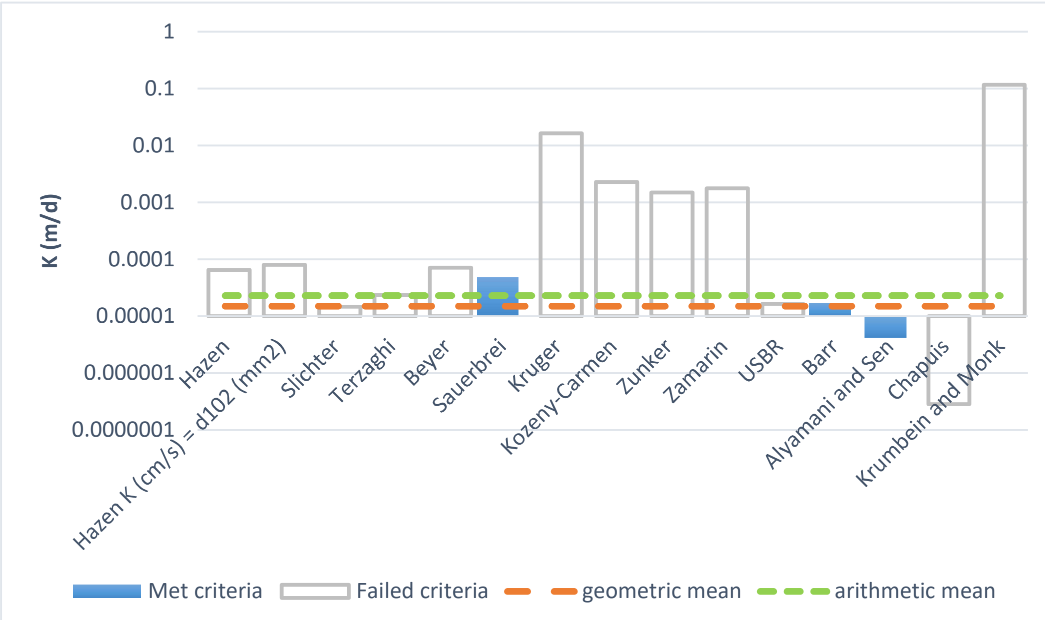
Date: ______________

Sample Name: BH-12-19-Sample3

Mass Sample (g): 100

T (oC) 20

BH12-SA3: Poorly sorted clay with fines



a

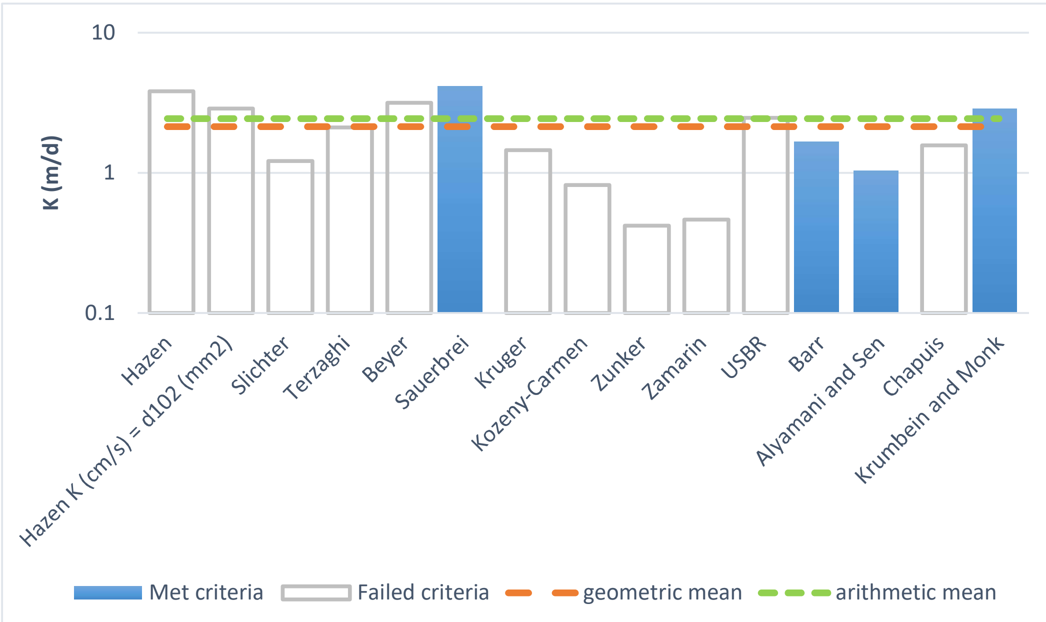
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	7.6E-08	7.6E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	9.3E-08	9.3E-10	0.00	
Slichter	1.7E-08	1.7E-10	0.00	
Terzaghi	2.7E-08	2.7E-10	0.00	
Beyer	8.2E-08	8.2E-10	0.00	
Sauerbrei	5.6E-08	5.6E-10	0.00	
Kruger	1.9E-05	1.9E-07	0.02	
Kozeny-Carmen	2.7E-06	2.7E-08	0.00	
Zunker	1.7E-06	1.7E-08	0.00	
Zamarin	2.0E-06	2.0E-08	0.00	
USBR	1.9E-08	1.9E-10	0.00	
Barr	2.0E-08	2.0E-10	0.00	
Alyamani and Sen	4.9E-09	4.9E-11	0.00	
Chapuis	3.3E-10	3.3E-12	0.00	
Krumbein and Monk	1.3E-04	1.3E-06	0.12	
geometric mean	1.7E-08	1.7E-10	0.00	
arithmetic mean	2.7E-08	2.7E-10	0.00	

K from Grain Size Analysis Report Date:

Sample Name: BH-13-19-Sample2

Mass Sample (g): 100 T (oC) 20

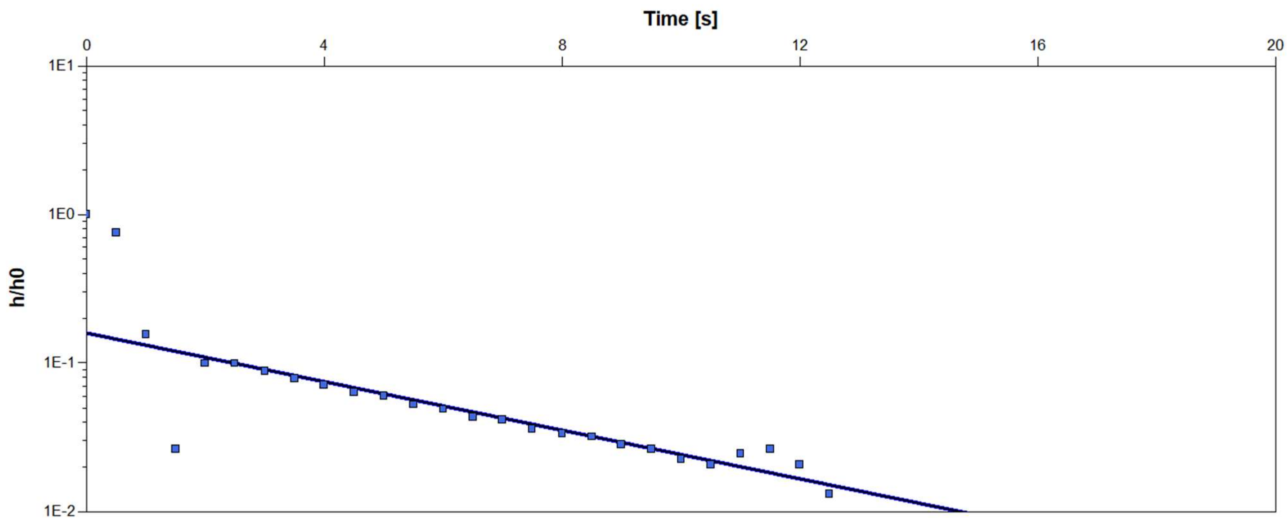
BH13-SA2: Moderately well sorted sand low in fines



a

Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.4E-03	4.4E-05	3.81	
Hazen K (cm/s) = d_{10} (mm)	3.3E-03	3.3E-05	2.88	
Slichter	1.4E-03	1.4E-05	1.21	
Terzaghi	2.4E-03	2.4E-05	2.10	
Beyer	3.7E-03	3.7E-05	3.16	
Sauerbrei	4.8E-03	4.8E-05	4.16	
Kruger	1.7E-03	1.7E-05	1.45	
Kozeny-Carmen	9.5E-04	9.5E-06	0.82	
Zunker	4.9E-04	4.9E-06	0.42	
Zamarin	5.4E-04	5.4E-06	0.46	
USBR	2.9E-03	2.9E-05	2.46	
Barr	1.9E-03	1.9E-05	1.68	
Alyamani and Sen	1.2E-03	1.2E-05	1.04	
Chapuis	1.8E-03	1.8E-05	1.57	
Krumbein and Monk	3.3E-03	3.3E-05	2.88	
geometric mean	2.5E-03	2.5E-05	2.14	
arithmetic mean	2.8E-03	2.8E-05	2.44	

	Permeability test **Falling head 1** **MW04-19**	**MW04-19**

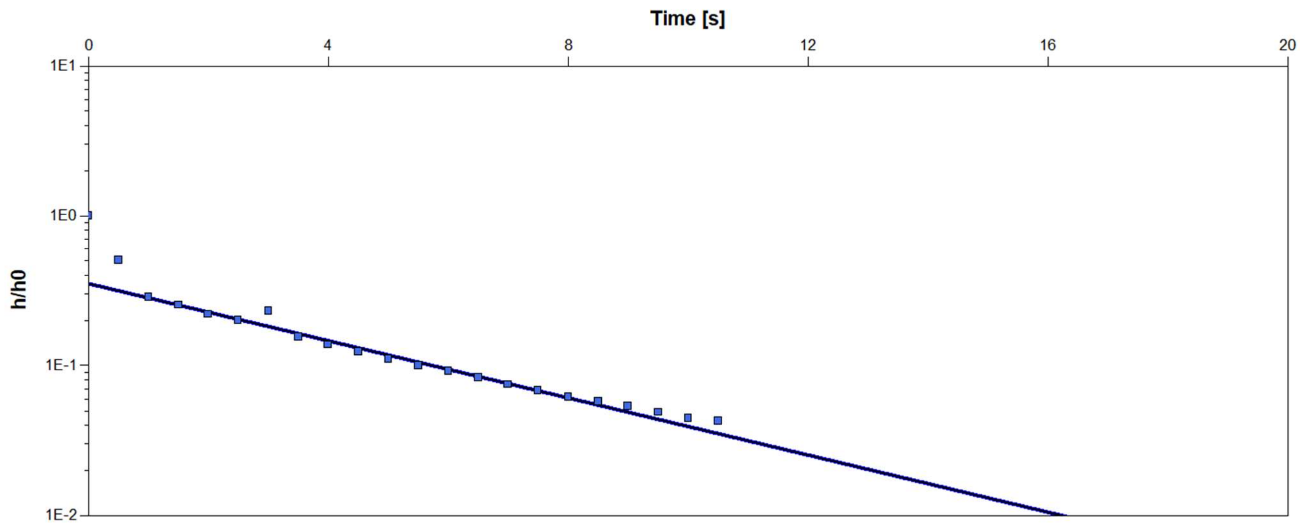


Paramètre	Valeur retenue
Static level (m BTOP)	2,80
Water level at t= 0s (m BTOP)	1,20
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,60

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Préparé by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 1,1 x10^{-4} m/s

Permeability test
Rising head 1
MW04-19

MW04-19

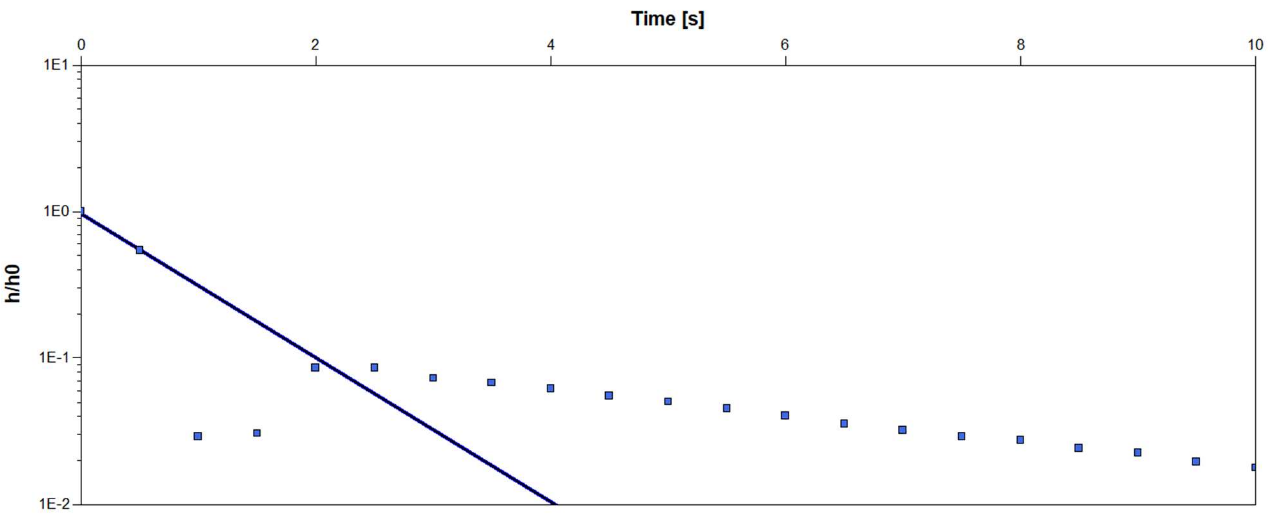


Paramètre	Valeur retenue
Static level (m BTOP)	2,80
Water level at t= 0s (m BTOP)	4,21
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,60

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Prépared by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 1,2 x10^{-4} m/s

Permeability test
Falling head 2
MW04-19

MW04-19

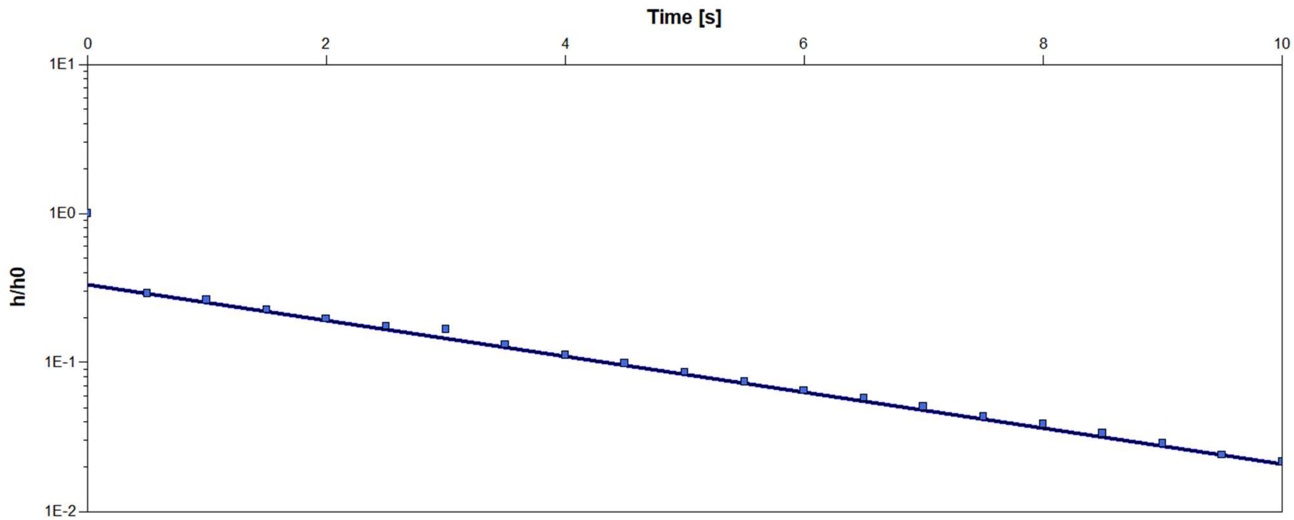


Paramètre	Valeur retenue
Static level (m BTOP)	2,80
Water level at t= 0s (m BTOP)	0,94
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,60

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Prépared by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 6,4 x10^{-4} m/s

Permeability test
Rising head 2
MW04-19

MW04-19

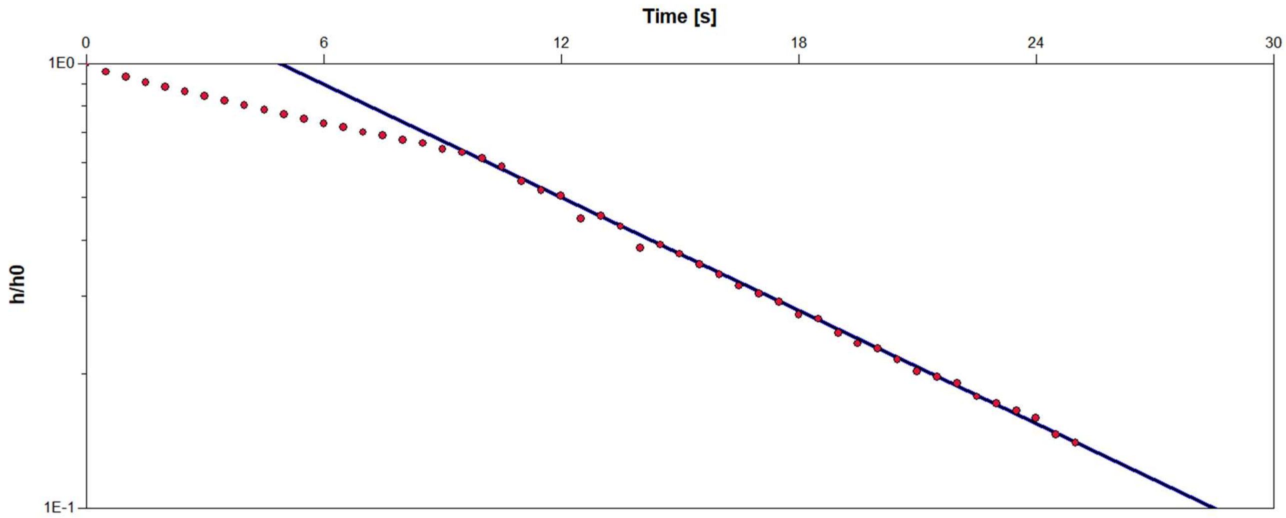


Paramètre	Valeur retenue
Static level (m BTOP)	2,80
Water level at t= 0s (m BTOP)	4,05
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,60

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Préparé by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 1,6 x10^{-4} m/s

Permeability test
Falling head 1
MW05-19

MW05-19

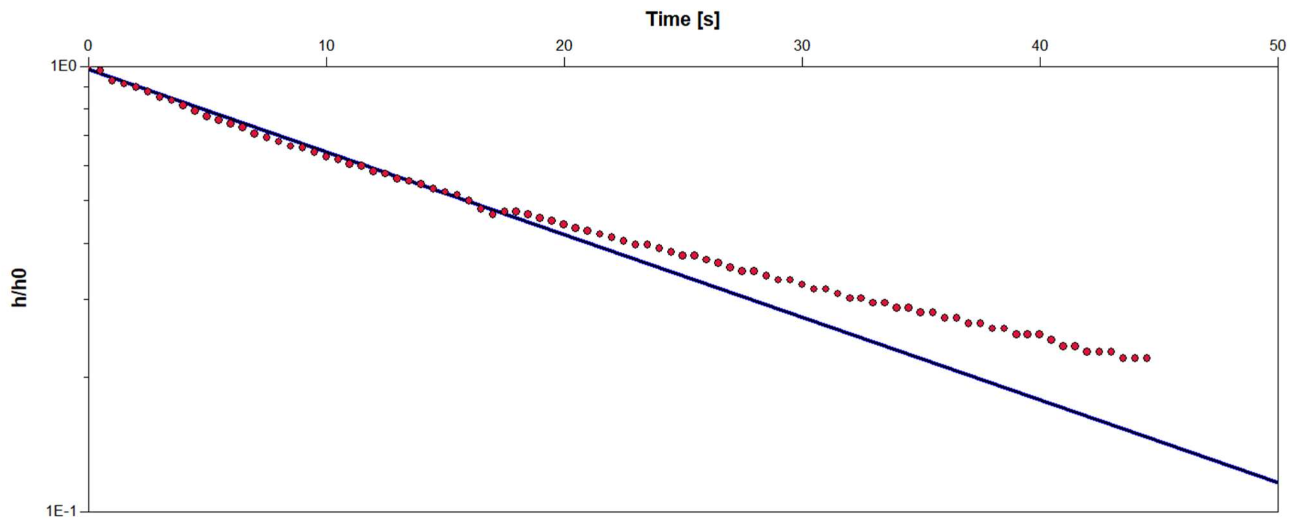


Paramètre	Valeur retenue
Static level (m BTOP)	4,26
Water level at t= 0s (m BTOP)	3,78
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,30

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Préparé by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 6,0 x10^{-5} m/s

Permeability test
Rising head 1
MW05-19

MW05-19

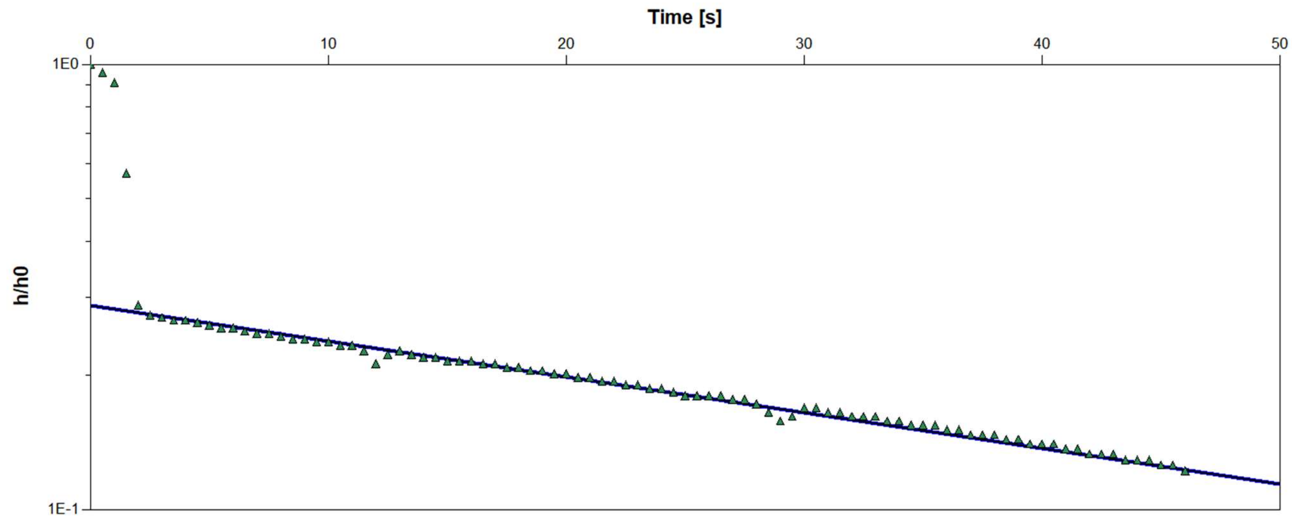


Paramètre	Valeur retenue
Static level (m BTOP)	4,26
Water level at t= 0s (m BTOP)	4,67
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,30

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Prépared by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 2,6 x10^{-5} m/s

Permeability test
Rising head 1
MW10-19

MW10-19



Paramètre	Valeur retenue
Static level (m BTOP)	3,08
Water level at t= 0s (m BTOP)	3,91
Radius of the screen (m)	0,025
Radius of the borehole (m)	0,10
Lenght of the filter pack(m)	2,20

Client: CJDL	Scale: No Scale
Project: 284, Christie Drive	**Ref**. #: P-0019257.0300
	Préparé by: Francis Proteau-Bédard. **Reviewed by**: Jean-Philippe Gobeil. P.geo
Analysis method: Hvorslev	**Date**: 2020-01-21
	K: 1,2 x10^{-5} m/s

Appendix F
Laboratory Certificate of Analysis

EnGlobe Corp. (London)
ATTN: ROB HELWIG
417 EXETER RD
LONDON ON N6E 2Z3

Date Received: 31-JAN-20
Report Date: 11-FEB-20 06:37 (MT)
Version: FINAL

Client Phone: 519-685-6400

Certificate of Analysis

Lab Work Order #: L2412214
Project P.O. #: NOT SUBMITTED
Job Reference: P-19257-300
C of C Numbers: 17-684348
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-1 MW-03-19							
Sampled By: CLIENT on 31-JAN-20 @ 12:00							
Matrix: WATER							
Physical Tests							
Colour, Apparent	7.5		2.0	CU		02-FEB-20	R4986514
Conductivity	599		3.0	umhos/cm		04-FEB-20	R4989650
Hardness (as CaCO3)	366		0.50	mg/L		04-FEB-20	
pH	7.78		0.10	pH units		04-FEB-20	R4989650
Total Dissolved Solids	376	DLDS	20	mg/L		07-FEB-20	R4992754
Turbidity	5.68		0.10	NTU		01-FEB-20	R4989740
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	254		10	mg/L		04-FEB-20	R4989650
Ammonia, Total (as N)	0.016		0.010	mg/L		03-FEB-20	R4987506
Chloride (Cl)	12.3		0.50	mg/L		04-FEB-20	R4989990
Fluoride (F)	0.067		0.020	mg/L		04-FEB-20	R4989990
Nitrate (as N)	8.04		0.020	mg/L		04-FEB-20	R4989990
Nitrite (as N)	0.031		0.010	mg/L		04-FEB-20	R4989990
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		07-FEB-20	R4991531
Sulfate (SO4)	24.0		0.30	mg/L		04-FEB-20	R4989990
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					04-FEB-20	R4987080
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Arsenic (As)-Dissolved	0.00023		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Barium (Ba)-Dissolved	0.0230		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Boron (B)-Dissolved	0.013		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Cadmium (Cd)-Dissolved	0.0000098		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Calcium (Ca)-Dissolved	106		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Chromium (Cr)-Dissolved	0.00051		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Cobalt (Co)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Copper (Cu)-Dissolved	0.00198		0.00020	mg/L	04-FEB-20	04-FEB-20	R4989086
Iron (Fe)-Dissolved	<0.010		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Magnesium (Mg)-Dissolved	24.7		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Manganese (Mn)-Dissolved	0.00272		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Molybdenum (Mo)-Dissolved	0.000415		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Nickel (Ni)-Dissolved	0.00142		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Potassium (K)-Dissolved	0.785		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Selenium (Se)-Dissolved	0.00111		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silicon (Si)-Dissolved	6.41		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Sodium (Na)-Dissolved	4.24		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-1 MW-03-19 Sampled By: CLIENT on 31-JAN-20 @ 12:00 Matrix: WATER							
Dissolved Metals							
Strontium (Sr)-Dissolved	0.185		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Tin (Sn)-Dissolved	0.00062		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Uranium (U)-Dissolved	0.000599		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Zinc (Zn)-Dissolved	0.195		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
L2412214-2 MW-08-19 Sampled By: CLIENT on 31-JAN-20 @ 12:30 Matrix: WATER							
Physical Tests							
Colour, Apparent	20.9		2.0	CU		02-FEB-20	R4986514
Conductivity	666		3.0	umhos/cm		04-FEB-20	R4989650
Hardness (as CaCO3)	355		0.50	mg/L		04-FEB-20	
pH	8.16		0.10	pH units		04-FEB-20	R4989650
Total Dissolved Solids	386	DLDS	20	mg/L		07-FEB-20	R4992754
Turbidity	29.4		0.10	NTU		01-FEB-20	R4989740
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	315		10	mg/L		04-FEB-20	R4989650
Ammonia, Total (as N)	<0.010		0.010	mg/L		03-FEB-20	R4987506
Chloride (Cl)	9.22		0.50	mg/L		04-FEB-20	R4989990
Fluoride (F)	0.051		0.020	mg/L		04-FEB-20	R4989990
Nitrate (as N)	7.21		0.020	mg/L		04-FEB-20	R4989990
Nitrite (as N)	<0.010		0.010	mg/L		04-FEB-20	R4989990
Orthophosphate-Dissolved (as P)	0.0054		0.0030	mg/L		07-FEB-20	R4991531
Sulfate (SO4)	17.7		0.30	mg/L		04-FEB-20	R4989990
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					04-FEB-20	R4987080
Aluminum (Al)-Dissolved	0.0075		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Arsenic (As)-Dissolved	0.00029		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Barium (Ba)-Dissolved	0.0193		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Boron (B)-Dissolved	0.016		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Cadmium (Cd)-Dissolved	0.0000129		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Calcium (Ca)-Dissolved	102		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Cobalt (Co)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Copper (Cu)-Dissolved	0.00474		0.00020	mg/L	04-FEB-20	04-FEB-20	R4989086

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-2 MW-08-19 Sampled By: CLIENT on 31-JAN-20 @ 12:30 Matrix: WATER							
Dissolved Metals							
Iron (Fe)-Dissolved	<0.010		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Lead (Pb)-Dissolved	0.000314		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Magnesium (Mg)-Dissolved	24.3		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Manganese (Mn)-Dissolved	0.00408		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Molybdenum (Mo)-Dissolved	0.000899		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Nickel (Ni)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Potassium (K)-Dissolved	0.866		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Selenium (Se)-Dissolved	0.00301		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silicon (Si)-Dissolved	6.34		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Sodium (Na)-Dissolved	3.29		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Strontium (Sr)-Dissolved	0.146		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Tin (Sn)-Dissolved	0.00031		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Uranium (U)-Dissolved	0.00100		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Zinc (Zn)-Dissolved	0.616		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
L2412214-3 MW-10-19 Sampled By: CLIENT on 31-JAN-20 @ 14:30 Matrix: WATER							
Physical Tests							
Colour, Apparent	51.5		2.0	CU		02-FEB-20	R4986514
Conductivity	600		3.0	umhos/cm		04-FEB-20	R4989650
Hardness (as CaCO3)	325		0.50	mg/L		04-FEB-20	
pH	7.71		0.10	pH units		04-FEB-20	R4989650
Total Dissolved Solids	451	DLDS	20	mg/L		07-FEB-20	R4992754
Turbidity	211		0.10	NTU		01-FEB-20	R4989740
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	284		10	mg/L		04-FEB-20	R4989650
Ammonia, Total (as N)	0.018		0.010	mg/L		03-FEB-20	R4987506
Chloride (Cl)	9.71		0.50	mg/L		04-FEB-20	R4989990
Fluoride (F)	0.116		0.020	mg/L		04-FEB-20	R4989990
Nitrate (as N)	9.42		0.020	mg/L		04-FEB-20	R4989990
Nitrite (as N)	0.025		0.010	mg/L		04-FEB-20	R4989990
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		07-FEB-20	R4991531
Sulfate (SO4)	27.5		0.30	mg/L		04-FEB-20	R4989990
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					04-FEB-20	R4987080

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-3 MW-10-19 Sampled By: CLIENT on 31-JAN-20 @ 14:30 Matrix: WATER							
Dissolved Metals							
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Arsenic (As)-Dissolved	0.00040		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Barium (Ba)-Dissolved	0.0427		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Boron (B)-Dissolved	0.013		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Cadmium (Cd)-Dissolved	0.0000137		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Calcium (Ca)-Dissolved	93.4		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Chromium (Cr)-Dissolved	0.00073		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Cobalt (Co)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Copper (Cu)-Dissolved	0.00283		0.00020	mg/L	04-FEB-20	04-FEB-20	R4989086
Iron (Fe)-Dissolved	<0.010		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Lead (Pb)-Dissolved	0.000060		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Magnesium (Mg)-Dissolved	22.2		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Manganese (Mn)-Dissolved	0.0109		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Molybdenum (Mo)-Dissolved	0.00233		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Nickel (Ni)-Dissolved	0.00103		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Potassium (K)-Dissolved	1.56		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Selenium (Se)-Dissolved	0.000142		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silicon (Si)-Dissolved	5.60		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Sodium (Na)-Dissolved	8.37		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Strontium (Sr)-Dissolved	0.199		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Tin (Sn)-Dissolved	0.00037		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Uranium (U)-Dissolved	0.00110		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Zinc (Zn)-Dissolved	0.0320		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
L2412214-4 MP-01-19 Sampled By: CLIENT on 31-JAN-20 @ 15:00 Matrix: WATER							
Physical Tests							
Colour, Apparent	40.0		2.0	CU		02-FEB-20	R4986514
Conductivity	478		3.0	umhos/cm		04-FEB-20	R4989650
Hardness (as CaCO3)	283		0.50	mg/L		05-FEB-20	
pH	8.14		0.10	pH units		04-FEB-20	R4989650
Total Dissolved Solids	272	DLDS	20	mg/L		07-FEB-20	R4992754

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-4 MP-01-19 Sampled By: CLIENT on 31-JAN-20 @ 15:00 Matrix: WATER							
Physical Tests							
Turbidity	9.47		0.10	NTU		01-FEB-20	R4989740
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	255		10	mg/L		04-FEB-20	R4989650
Ammonia, Total (as N)	0.024		0.010	mg/L		03-FEB-20	R4987506
Chloride (Cl)	2.63		0.50	mg/L		04-FEB-20	R4989990
Fluoride (F)	0.045		0.020	mg/L		04-FEB-20	R4989990
Nitrate (as N)	0.032		0.020	mg/L		04-FEB-20	R4989990
Nitrite (as N)	<0.010		0.010	mg/L		04-FEB-20	R4989990
Orthophosphate-Dissolved (as P)	0.0088		0.0030	mg/L		07-FEB-20	R4991531
Sulfate (SO4)	7.85		0.30	mg/L		04-FEB-20	R4989990
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					04-FEB-20	R4987080
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Arsenic (As)-Dissolved	0.00023		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Barium (Ba)-Dissolved	0.0169		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Boron (B)-Dissolved	<0.010		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Cadmium (Cd)-Dissolved	<0.0000050		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Calcium (Ca)-Dissolved	86.9		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Cobalt (Co)-Dissolved	0.00011		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Copper (Cu)-Dissolved	0.00050		0.00020	mg/L	04-FEB-20	04-FEB-20	R4989086
Iron (Fe)-Dissolved	0.210		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Magnesium (Mg)-Dissolved	16.1		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Manganese (Mn)-Dissolved	0.168		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Molybdenum (Mo)-Dissolved	0.000269		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Nickel (Ni)-Dissolved	0.00156		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Potassium (K)-Dissolved	0.271		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Selenium (Se)-Dissolved	0.000247		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silicon (Si)-Dissolved	4.82		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Sodium (Na)-Dissolved	2.84		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Strontium (Sr)-Dissolved	0.155		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Tin (Sn)-Dissolved	0.00036		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-4 MP-01-19 Sampled By: CLIENT on 31-JAN-20 @ 15:00 Matrix: WATER							
Dissolved Metals							
Uranium (U)-Dissolved	0.000126		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Zinc (Zn)-Dissolved	0.0162		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
L2412214-5 MP-04-19 Sampled By: CLIENT on 31-JAN-20 @ 15:30 Matrix: WATER							
Physical Tests							
Colour, Apparent	96.1		2.0	CU		02-FEB-20	R4986514
Conductivity	652		3.0	umhos/cm		04-FEB-20	R4989650
Hardness (as CaCO3)	265		0.50	mg/L		04-FEB-20	
pH	8.26		0.10	pH units		04-FEB-20	R4989650
Total Dissolved Solids	359	DLDS	20	mg/L		07-FEB-20	R4992754
Turbidity	24.2		0.10	NTU		01-FEB-20	R4989740
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	251		10	mg/L		04-FEB-20	R4989650
Ammonia, Total (as N)	0.368		0.010	mg/L		03-FEB-20	R4987506
Chloride (Cl)	53.8		0.50	mg/L		04-FEB-20	R4989990
Fluoride (F)	0.147		0.020	mg/L		04-FEB-20	R4989990
Nitrate (as N)	0.829		0.020	mg/L		04-FEB-20	R4989990
Nitrite (as N)	<0.010		0.010	mg/L		04-FEB-20	R4989990
Orthophosphate-Dissolved (as P)	0.0069		0.0030	mg/L		07-FEB-20	R4991531
Sulfate (SO4)	14.7		0.30	mg/L		04-FEB-20	R4989990
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					04-FEB-20	R4987080
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Arsenic (As)-Dissolved	0.00082		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Barium (Ba)-Dissolved	0.0214		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Boron (B)-Dissolved	0.018		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Cadmium (Cd)-Dissolved	0.0000073		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Calcium (Ca)-Dissolved	77.4		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Cobalt (Co)-Dissolved	0.00036		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Copper (Cu)-Dissolved	0.00409		0.00020	mg/L	04-FEB-20	04-FEB-20	R4989086
Iron (Fe)-Dissolved	0.838		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Lead (Pb)-Dissolved	0.000242		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Magnesium (Mg)-Dissolved	17.3		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Manganese (Mn)-Dissolved	0.931		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Molybdenum (Mo)-Dissolved	0.00104		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-5 MP-04-19 Sampled By: CLIENT on 31-JAN-20 @ 15:30 Matrix: WATER							
Dissolved Metals							
Nickel (Ni)-Dissolved	0.00053		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Potassium (K)-Dissolved	2.03		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Selenium (Se)-Dissolved	0.000127		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silicon (Si)-Dissolved	4.49		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Sodium (Na)-Dissolved	29.7		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Strontium (Sr)-Dissolved	0.252		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Tin (Sn)-Dissolved	0.00026		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Uranium (U)-Dissolved	0.000515		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Zinc (Zn)-Dissolved	0.0081		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086
L2412214-6 MW-05-19 Sampled By: CLIENT on 31-JAN-20 @ 13:30 Matrix: WATER							
Physical Tests							
pH	7.94		0.10	pH units		04-FEB-20	R4989650
Total Suspended Solids	41.4		2.0	mg/L	06-FEB-20	07-FEB-20	R4991530
Anions and Nutrients							
Fluoride (F)	0.059		0.020	mg/L		04-FEB-20	R4989990
Total Kjeldahl Nitrogen	0.18		0.15	mg/L	04-FEB-20	04-FEB-20	R4988370
Phosphorus, Total	0.0335		0.0030	mg/L	04-FEB-20	05-FEB-20	R4990111
Sulfate (SO4)	25.9		0.30	mg/L		04-FEB-20	R4989990
Sulphide (as S)	<0.018		0.018	mg/L		05-FEB-20	R4990438
Sulphide (as H2S)	<0.019		0.019	mg/L		05-FEB-20	
Cyanides							
Cyanide, Total	<0.0020		0.0020	mg/L		03-FEB-20	R4986792
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4987537
Arsenic (As)-Total	0.00053		0.00010	mg/L	04-FEB-20	04-FEB-20	R4987537
Cadmium (Cd)-Total	0.0000185		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4987537
Chromium (Cr)-Total	0.00317		0.00050	mg/L	04-FEB-20	04-FEB-20	R4987537
Cobalt (Co)-Total	0.00068		0.00010	mg/L	04-FEB-20	04-FEB-20	R4987537
Copper (Cu)-Total	0.0033		0.0010	mg/L	04-FEB-20	04-FEB-20	R4987537
Lead (Pb)-Total	0.00139		0.000050	mg/L	04-FEB-20	04-FEB-20	R4987537
Mercury (Hg)-Total	<0.0000050		0.0000050	mg/L		05-FEB-20	R4989993
Molybdenum (Mo)-Total	0.000404		0.000050	mg/L	04-FEB-20	04-FEB-20	R4987537
Nickel (Ni)-Total	0.00134		0.00050	mg/L	04-FEB-20	04-FEB-20	R4987537

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-6 MW-05-19 Sampled By: CLIENT on 31-JAN-20 @ 13:30 Matrix: WATER							
Total Metals							
Selenium (Se)-Total	0.000423		0.000050	mg/L	04-FEB-20	04-FEB-20	R4987537
Silver (Ag)-Total	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4987537
Tin (Sn)-Total	0.00017		0.00010	mg/L	04-FEB-20	04-FEB-20	R4987537
Zinc (Zn)-Total	0.0747		0.0030	mg/L	04-FEB-20	04-FEB-20	R4987537
Aggregate Organics							
BOD	<2.0		2.0	mg/L	03-FEB-20	08-FEB-20	R4992139
Oil and Grease, Total	<5.0		5.0	mg/L	05-FEB-20	05-FEB-20	R4990750
Animal/Veg Oil & Grease	<5.0		5.0	mg/L		06-FEB-20	
Mineral Oil and Grease	<2.5		2.5	mg/L	05-FEB-20	05-FEB-20	R4990750
Phenols (4AAP)	0.0019		0.0010	mg/L		04-FEB-20	R4989709
Volatile Organic Compounds							
Benzene	<0.50		0.50	ug/L		04-FEB-20	R4987130
Chloroform	<1.0		1.0	ug/L		04-FEB-20	R4987130
1,2-Dichlorobenzene	<0.50		0.50	ug/L		04-FEB-20	R4987130
1,4-Dichlorobenzene	<0.50		0.50	ug/L		04-FEB-20	R4987130
Dichloromethane	<2.0		2.0	ug/L		04-FEB-20	R4987130
Ethylbenzene	<0.50		0.50	ug/L		04-FEB-20	R4987130
1,1,2,2-Tetrachloroethane	<0.50		0.50	ug/L		04-FEB-20	R4987130
Tetrachloroethylene	<0.50		0.50	ug/L		04-FEB-20	R4987130
Toluene	<0.50		0.50	ug/L		04-FEB-20	R4987130
Trichloroethylene	<0.50		0.50	ug/L		04-FEB-20	R4987130
Xylenes (Total)	<0.50		0.50	ug/L		04-FEB-20	
Surrogate: 4-Bromofluorobenzene	97.1		70-130	%		04-FEB-20	R4987130
Surrogate: 1,4-Difluorobenzene	99.7		70-130	%		04-FEB-20	R4987130
Trihalomethanes							
Total THMs	<2.0		2.0	ug/L		04-FEB-20	
L2412214-7 DUPLICATE Sampled By: CLIENT on 31-JAN-20 @ 14:30 Matrix: WATER							
Physical Tests							
Colour, Apparent	38.3		2.0	CU		02-FEB-20	R4986514
Conductivity	592		3.0	umhos/cm		04-FEB-20	R4989650
Hardness (as CaCO3)	332		0.50	mg/L		04-FEB-20	
pH	7.72		0.10	pH units		04-FEB-20	R4989650
Total Dissolved Solids	434	DLDS	20	mg/L		07-FEB-20	R4992754
Turbidity	124		0.10	NTU		01-FEB-20	R4989740
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	268		10	mg/L		04-FEB-20	R4989650
Ammonia, Total (as N)	0.017		0.010	mg/L		04-FEB-20	R4990204
Chloride (Cl)	9.82		0.50	mg/L		04-FEB-20	R4989990
Fluoride (F)	0.112		0.020	mg/L		04-FEB-20	R4989990
Nitrate (as N)	9.38		0.020	mg/L		04-FEB-20	R4989990

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2412214-7 DUPLICATE Sampled By: CLIENT on 31-JAN-20 @ 14:30 Matrix: WATER							
Anions and Nutrients							
Nitrite (as N)	0.021		0.010	mg/L		04-FEB-20	R4989990
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		07-FEB-20	R4991531
Sulfate (SO4)	27.8		0.30	mg/L		04-FEB-20	R4989990
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					04-FEB-20	R4987080
Aluminum (Al)-Dissolved	0.123		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Antimony (Sb)-Dissolved	0.00011		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Arsenic (As)-Dissolved	0.00044		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Barium (Ba)-Dissolved	0.0446		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Boron (B)-Dissolved	0.015		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Cadmium (Cd)-Dissolved	0.0000080		0.0000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Calcium (Ca)-Dissolved	95.5		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Chromium (Cr)-Dissolved	0.00064		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Cobalt (Co)-Dissolved	0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Copper (Cu)-Dissolved	0.00670		0.00020	mg/L	04-FEB-20	04-FEB-20	R4989086
Iron (Fe)-Dissolved	0.060		0.010	mg/L	04-FEB-20	04-FEB-20	R4989086
Lead (Pb)-Dissolved	0.000276		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Magnesium (Mg)-Dissolved	22.8		0.0050	mg/L	04-FEB-20	04-FEB-20	R4989086
Manganese (Mn)-Dissolved	0.0144		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Molybdenum (Mo)-Dissolved	0.00255		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Nickel (Ni)-Dissolved	0.00112		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Potassium (K)-Dissolved	1.60		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Selenium (Se)-Dissolved	0.000121		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silicon (Si)-Dissolved	6.12		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	04-FEB-20	04-FEB-20	R4989086
Sodium (Na)-Dissolved	8.49		0.050	mg/L	04-FEB-20	04-FEB-20	R4989086
Strontium (Sr)-Dissolved	0.206		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Tin (Sn)-Dissolved	0.00020		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Titanium (Ti)-Dissolved	<0.0030	DLUI	0.0030	mg/L	04-FEB-20	04-FEB-20	R4989086
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	04-FEB-20	04-FEB-20	R4989086
Uranium (U)-Dissolved	0.00118		0.000010	mg/L	04-FEB-20	04-FEB-20	R4989086
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	04-FEB-20	04-FEB-20	R4989086
Zinc (Zn)-Dissolved	0.0372		0.0010	mg/L	04-FEB-20	04-FEB-20	R4989086
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	04-FEB-20	04-FEB-20	R4989086

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Boron (B)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Copper (Cu)-Total	MS-B	L2412214-6
Matrix Spike	Zinc (Zn)-Total	MS-B	L2412214-6
Matrix Spike	Ammonia, Total (as N)	MS-B	L2412214-7
Matrix Spike	Nitrate (as N)	MS-B	L2412214-1, -2, -3, -4, -5, -7
Matrix Spike	Phosphorus, Total	MS-B	L2412214-6
Matrix Spike	Phenols (4AAP)	MS-B	L2412214-6
Matrix Spike	Phenols (4AAP)	MS-B	L2412214-6

Sample Parameter Qualifier key listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-WT	Water	BOD	APHA 5210 B

This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
CN-TOT-WT	Water	Cyanide, Total	ISO 14403-2

Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference

ALS Test Code	Matrix	Test Description	Method Reference**
COLOUR-APPARENT-WT	Water	Colour	APHA 2120

Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ALS Test Code	Matrix	Test Description	Method Reference**
F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-T-CVAA-WT	Water	Total Mercury in Water by CVAAS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

OGG-SPEC-CALC-WT	Water	Speciated Oil and Grease A/V Calc	CALCULATION

Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

OGG-SPEC-WT	Water	Speciated Oil and Grease-Gravimetric	APHA 5520 B

The procedure involves an extraction of the entire water sample with hexane. Sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.

PH-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

PHENOLS-4AAP-WT	Water	Phenol (4AAP)	EPA 9066

An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.

PO4-DO-COL-WT	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

S2-T>H2S-CALC-WT Water Total Sulphide Calculated as H2S Calculation

This calculation converts Total Sulphide as (S2-) and reports it as Total Sulphide as (H2S). Total Sulphide as (S2-) is determined using procedures adapted from APHA 4500-S2 "Sulphide".

SO4-IC-N-WT Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT Water Total Dissolved Solids APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

SOLIDS-TSS-WT Water Suspended solids APHA 2540 D-Gravimetric

A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.

SULPHIDE-WT Water Sulphide (as S) APHA 4500S2D

This analysis is carried out using procedures adapted from APHA Method 4500-S2-D "Methylene Blue Method". Sulphide is determined colourmetrically.

THM-SUM-PPB-CALC-WT Water Total Trihalomethanes (THMs) CALCULATION

Total Trihalomethanes (THMs) represents the sum of bromodichloromethane, bromoform, chlorodibromomethane and chloroform. For the purpose of calculation, results less than the detection limit (DL) are treated as zero.

TKN-WT Water Total Kjeldahl Nitrogen APHA 4500-Norg D

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.

TURBIDITY-WT Water Turbidity APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

VOC-ROU-HS-WT Water Volatile Organic Compounds SW846 8260

Aqueous samples are analyzed by headspace-GC/MS.

XYLENES-SUM-CALC-WT Water Sum of Xylene Isomer Concentrations CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

17-684348

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	**Water**							
Batch R4989650								
WG3269181-2 LCS								
Alkalinity, Total (as CaCO3)			102.7		%		85-115	04-FEB-20
WG3269181-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	04-FEB-20
BOD-WT	**Water**							
Batch R4992139								
WG3268661-3 LCS								
BOD			100.5		%		85-115	08-FEB-20
WG3268661-1 MB								
BOD			<2.0		mg/L		2	08-FEB-20
CL-IC-N-WT	**Water**							
Batch R4989990								
WG3269520-2 LCS								
Chloride (Cl)			101.4		%		90-110	04-FEB-20
WG3269520-1 MB								
Chloride (Cl)			<0.50		mg/L		0.5	04-FEB-20
CN-TOT-WT	**Water**							
Batch R4986792								
WG3268460-2 LCS								
Cyanide, Total			91.6		%		80-120	03-FEB-20
WG3268460-1 MB								
Cyanide, Total			<0.0020		mg/L		0.002	03-FEB-20
COLOUR-APPARENT-WT	**Water**							
Batch R4986514								
WG3268063-3 DUP		**L2412214-1**						
Colour, Apparent		7.5	7.3		CU	3.9	20	02-FEB-20
WG3268063-2 LCS								
Colour, Apparent			103.8		%		85-115	02-FEB-20
WG3268063-1 MB								
Colour, Apparent			<2.0		CU		2	02-FEB-20
EC-WT	**Water**							
Batch R4989650								
WG3269181-2 LCS								
Conductivity			106.0		%		90-110	04-FEB-20
WG3269181-1 MB								
Conductivity			<3.0		umhos/cm		3	04-FEB-20
F-IC-N-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F-IC-N-WT	**Water**							
Batch R4989990								
WG3269520-2 LCS								
Fluoride (F)			101.6		%		90-110	04-FEB-20
WG3269520-1 MB								
Fluoride (F)			<0.020		mg/L		0.02	04-FEB-20
HG-T-CVAA-WT	**Water**							
Batch R4989993								
WG3269801-2 LCS								
Mercury (Hg)-Total			105.0		%		80-120	05-FEB-20
WG3269801-1 MB								
Mercury (Hg)-Total			<0.0000050		mg/L		0.000005	05-FEB-20
MET-D-CCMS-WT	**Water**							
Batch R4989086								
WG3268919-2 LCS								
Aluminum (Al)-Dissolved			102.4		%		80-120	04-FEB-20
Antimony (Sb)-Dissolved			100.0		%		80-120	04-FEB-20
Arsenic (As)-Dissolved			97.8		%		80-120	04-FEB-20
Barium (Ba)-Dissolved			101.8		%		80-120	04-FEB-20
Beryllium (Be)-Dissolved			99.0		%		80-120	04-FEB-20
Bismuth (Bi)-Dissolved			100.6		%		80-120	04-FEB-20
Boron (B)-Dissolved			98.4		%		80-120	04-FEB-20
Cadmium (Cd)-Dissolved			97.8		%		80-120	04-FEB-20
Calcium (Ca)-Dissolved			100.9		%		80-120	04-FEB-20
Chromium (Cr)-Dissolved			101.0		%		80-120	04-FEB-20
Cobalt (Co)-Dissolved			100.3		%		80-120	04-FEB-20
Copper (Cu)-Dissolved			97.3		%		80-120	04-FEB-20
Iron (Fe)-Dissolved			97.9		%		80-120	04-FEB-20
Lead (Pb)-Dissolved			102.5		%		80-120	04-FEB-20
Magnesium (Mg)-Dissolved			110.3		%		80-120	04-FEB-20
Manganese (Mn)-Dissolved			100.1		%		80-120	04-FEB-20
Molybdenum (Mo)-Dissolved			101.5		%		80-120	04-FEB-20
Nickel (Ni)-Dissolved			99.2		%		80-120	04-FEB-20
Phosphorus (P)-Dissolved			103.7		%		80-120	04-FEB-20
Potassium (K)-Dissolved			98.2		%		80-120	04-FEB-20
Selenium (Se)-Dissolved			96.5		%		80-120	04-FEB-20
Silicon (Si)-Dissolved			101.4		%		60-140	04-FEB-20
Silver (Ag)-Dissolved			101.0		%		80-120	04-FEB-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4989086								
WG3268919-2 LCS								
Sodium (Na)-Dissolved			101.6		%		80-120	04-FEB-20
Strontium (Sr)-Dissolved			104.3		%		80-120	04-FEB-20
Thallium (Tl)-Dissolved			100.3		%		80-120	04-FEB-20
Tin (Sn)-Dissolved			97.6		%		80-120	04-FEB-20
Titanium (Ti)-Dissolved			96.5		%		80-120	04-FEB-20
Tungsten (W)-Dissolved			101.3		%		80-120	04-FEB-20
Uranium (U)-Dissolved			106.8		%		80-120	04-FEB-20
Vanadium (V)-Dissolved			101.3		%		80-120	04-FEB-20
Zinc (Zn)-Dissolved			96.8		%		80-120	04-FEB-20
Zirconium (Zr)-Dissolved			99.6		%		80-120	04-FEB-20
WG3268919-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	04-FEB-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	04-FEB-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	04-FEB-20
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	04-FEB-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	04-FEB-20
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	04-FEB-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	04-FEB-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	04-FEB-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	04-FEB-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	04-FEB-20
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	04-FEB-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	04-FEB-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	04-FEB-20
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	04-FEB-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	04-FEB-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	04-FEB-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	04-FEB-20
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	04-FEB-20

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4989086								
WG3268919-1 MB								
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	04-FEB-20
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	04-FEB-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	04-FEB-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	04-FEB-20
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	04-FEB-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	04-FEB-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	04-FEB-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	04-FEB-20
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	04-FEB-20
MET-T-CCMS-WT	**Water**							
Batch R4987537								
WG3268906-2 LCS								
Antimony (Sb)-Total			92.9		%		80-120	04-FEB-20
Arsenic (As)-Total			92.4		%		80-120	04-FEB-20
Cadmium (Cd)-Total			93.1		%		80-120	04-FEB-20
Chromium (Cr)-Total			95.1		%		80-120	04-FEB-20
Cobalt (Co)-Total			95.8		%		80-120	04-FEB-20
Copper (Cu)-Total			95.0		%		80-120	04-FEB-20
Lead (Pb)-Total			93.8		%		80-120	04-FEB-20
Molybdenum (Mo)-Total			95.3		%		80-120	04-FEB-20
Nickel (Ni)-Total			94.6		%		80-120	04-FEB-20
Selenium (Se)-Total			93.3		%		80-120	04-FEB-20
Silver (Ag)-Total			96.2		%		80-120	04-FEB-20
Tin (Sn)-Total			94.2		%		80-120	04-FEB-20
Zinc (Zn)-Total			92.2		%		80-120	04-FEB-20
WG3268906-1 MB								
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	04-FEB-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	04-FEB-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	04-FEB-20
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	04-FEB-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	04-FEB-20
Copper (Cu)-Total			<0.0010		mg/L		0.001	04-FEB-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	04-FEB-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R4987537								
WG3268906-1 MB								
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	04-FEB-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	04-FEB-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	04-FEB-20
Silver (Ag)-Total			<0.000050		mg/L		0.00005	04-FEB-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	04-FEB-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	04-FEB-20
NH3-F-WT	**Water**							
Batch R4987506								
WG3268275-2 LCS								
Ammonia, Total (as N)			99.9		%		85-115	03-FEB-20
WG3268275-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	03-FEB-20
Batch R4990204								
WG3268942-2 LCS								
Ammonia, Total (as N)			92.9		%		85-115	04-FEB-20
WG3268942-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	04-FEB-20
NO2-IC-WT	**Water**							
Batch R4989990								
WG3269520-2 LCS								
Nitrite (as N)			101.1		%		90-110	04-FEB-20
WG3269520-1 MB								
Nitrite (as N)			<0.010		mg/L		0.01	04-FEB-20
NO3-IC-WT	**Water**							
Batch R4989990								
WG3269520-2 LCS								
Nitrate (as N)			101.1		%		90-110	04-FEB-20
WG3269520-1 MB								
Nitrate (as N)			<0.020		mg/L		0.02	04-FEB-20
OGG-SPEC-WT	**Water**							
Batch R4990750								
WG3269804-2 LCS								
Oil and Grease, Total			90.3		%		70-130	05-FEB-20
Mineral Oil and Grease			83.8		%		70-130	05-FEB-20
WG3269804-1 MB								
Oil and Grease, Total			<5.0		mg/L		5	05-FEB-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
OGG-SPEC-WT	**Water**							
Batch R4990750								
WG3269804-1 MB								
Mineral Oil and Grease			<2.5		mg/L		2.5	05-FEB-20
P-T-COL-WT	**Water**							
Batch R4990111								
WG3268452-2 LCS								
Phosphorus, Total			98.5		%		80-120	05-FEB-20
WG3268452-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	05-FEB-20
PH-WT	**Water**							
Batch R4989650								
WG3269181-2 LCS								
pH			6.96		pH units		6.9-7.1	04-FEB-20
PHENOLS-4AAP-WT	**Water**							
Batch R4989709								
WG3268491-2 LCS								
Phenols (4AAP)			103.7		%		85-115	04-FEB-20
WG3268491-1 MB								
Phenols (4AAP)			<0.0010		mg/L		0.001	04-FEB-20
PO4-DO-COL-WT	**Water**							
Batch R4991531								
WG3271575-2 LCS								
Orthophosphate-Dissolved (as P)			107.0		%		80-120	07-FEB-20
WG3271575-1 MB								
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	07-FEB-20
SO4-IC-N-WT	**Water**							
Batch R4989990								
WG3269520-2 LCS								
Sulfate (SO4)			101.6		%		90-110	04-FEB-20
WG3269520-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	04-FEB-20
SOLIDS-TDS-WT	**Water**							
Batch R4992754								
WG3271670-2 LCS								
Total Dissolved Solids			97.3		%		85-115	07-FEB-20
WG3271670-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-WT	**Water**							
Batch R4992754								
WG3271670-1 MB								
Total Dissolved Solids			<10		mg/L		10	07-FEB-20
SOLIDS-TSS-WT	**Water**							
Batch R4991530								
WG3270932-2 LCS								
Total Suspended Solids			96.9		%		85-115	07-FEB-20
WG3270932-1 MB								
Total Suspended Solids			<2.0		mg/L		2	07-FEB-20
SULPHIDE-WT	**Water**							
Batch R4990438								
WG3270258-2 LCS								
Sulphide (as S)			100.0		%		75-125	05-FEB-20
WG3270258-1 MB								
Sulphide (as S)			<0.018		mg/L		0.018	05-FEB-20
TKN-WT	**Water**							
Batch R4988370								
WG3268444-2 LCS								
Total Kjeldahl Nitrogen			107.2		%		75-125	04-FEB-20
WG3268444-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	04-FEB-20
TURBIDITY-WT	**Water**							
Batch R4989740								
WG3267944-2 LCS								
Turbidity			99.0		%		85-115	01-FEB-20
WG3267944-1 MB								
Turbidity			<0.10		NTU		0.1	01-FEB-20
VOC-ROU-HS-WT	**Water**							
Batch R4987130								
WG3268332-1 LCS								
1,1,2,2-Tetrachloroethane			109.4		%		70-130	04-FEB-20
1,2-Dichlorobenzene			103.5		%		70-130	04-FEB-20
1,4-Dichlorobenzene			98.1		%		70-130	04-FEB-20
Benzene			109.0		%		70-130	04-FEB-20
Chloroform			107.7		%		70-130	04-FEB-20
Dichloromethane			111.3		%		70-130	04-FEB-20
Ethylbenzene			98.3		%		70-130	04-FEB-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R4987130								
WG3268332-1 LCS								
Tetrachloroethylene			96.6		%		70-130	04-FEB-20
Toluene			100.8		%		70-130	04-FEB-20
Trichloroethylene			99.0		%		70-130	04-FEB-20
WG3268332-2 MB								
1,1,2,2-Tetrachloroethane			<0.50		ug/L		0.5	04-FEB-20
1,2-Dichlorobenzene			<0.50		ug/L		0.5	04-FEB-20
1,4-Dichlorobenzene			<0.50		ug/L		0.5	04-FEB-20
Benzene			<0.50		ug/L		0.5	04-FEB-20
Chloroform			<1.0		ug/L		1	04-FEB-20
Dichloromethane			<2.0		ug/L		2	04-FEB-20
Ethylbenzene			<0.50		ug/L		0.5	04-FEB-20
Tetrachloroethylene			<0.50		ug/L		0.5	04-FEB-20
Toluene			<0.50		ug/L		0.5	04-FEB-20
Trichloroethylene			<0.50		ug/L		0.5	04-FEB-20
Surrogate: 1,4-Difluorobenzene			99.0		%		70-130	04-FEB-20
Surrogate: 4-Bromofluorobenzene			96.7		%		70-130	04-FEB-20

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2412214-COFC

COC Number: 17 - 684348

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	ENGLOBE
Contact:	ROB HELWIG
Phone:	
Company address below will appear on the final report	
Street:	417 EXETER RD
City/Province:	
Postal Code:	

Report Format / Distribution

Select Report Format: [X] PDF [ ] EXCEL [ ] EDD (DIGITAL)

Quality Control (QC) Report with Report [ ] YES [ ] NO

[ ] Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: [X] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax: ROB HELWIG.

Email 2: EDWARD.VANRUYMBROECK

Email 3: @ENGLOBECORP.COM

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [X] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] [ ]; 3 day [P3-25%] [ ]; 2 day [P2-50%] [ ]

EMERGENCY: 1 Business day [E-100%] [ ]; Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] [ ]

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To

Same as Report To [ ] YES [ ] NO

Copy of Invoice with Report [ ] YES [ ] NO

Company:

Contact:

Invoice Distribution

Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax

Email 2

Project Information

ALS Account # / Quote #:

Job #: P-19257-300

PO / AFE:

LSD: 31B

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): L2412214 MA

ALS Contact: GB

Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	GENERAL CHEM. PKG 1	THAMES CENTRE SEWER BY-LAW	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
1	MW-03-19	31/01/20	12:00		X				
2	MW-08-19	↓	12:30		X				
3	MW-10-19	↓	14:30		X				
4	MP-01-19	↓	15:00		X				
5	MP-04-19	↓	15:30		X				
6	MW-05-19	↓	13:30			X			
7	DUPLICATE	↓	14:30		X				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human consumption/ use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 9.6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: 31/01/20	Time:	Received by:	Date:	Time:	Received by: [signature]	Date: 31/01/20	Time: 16:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SIF 8U 31-JAN-20 1810 5.3

Appendix G
MECP Well Records and Well Survey Results (Summary)

ENGLOBE

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
NORTH DORCHESTER TOW TR N 04 008	17 493974 4759213 W	1962/08 2801	5					4102900 ()	CLAY MSND 0003 MSND GRVL BLDR 0008 CLAY BLDR 0026 MSND GRVL 0028 WHIT CLAY BLDR 0031 ROCK 0036
NORTH DORCHESTER TOW TR S A 020	17 493874 4759063 W	1962/07 2801	10					4102938 ()	LOAM MSND 0006 GRVL CLAY 0012 CLAY GRVL 0019 CLAY MSND 0027 GRVL 0031
NORTH DORCHESTER TOW TR S A 018	17 494159 4759188 W	1953/03 2801	4 4 4	FR	39/40/19/7:0	NU	0055 7	4102950 ()	LOAM 0001 MSND GRVL CLAY 0045 MSND GRVL 0057 BLDR MSND GRVL 0062 MSND GRVL BLDR 0072 ROCK 0074
NORTH DORCHESTER TOW TR S A 019	17 494574 4758703 W	1965/06 1708	4 4	FR 0067	44/64/7/8:0	DO	0059 3	4102952 ()	PRDR 0067 MSND 0069 BLDR 0070
NORTH DORCHESTER TOW TR S A 020	17 493574 4758503 W	1956/06 1708	6 6	FR 0063	15/45/2/4:0	DO		4102953 ()	YLLW MSND 0025 STNS HPAN 0052 MSND 0053 HPAN 0063 GRVL 0064
NORTH DORCHESTER TOW TR S A 020	17 493554 4758733 W	1956/06 1708	6 6	FR 0068	15/21/8/8:0	DO		4102954 ()	LOAM 0002 HPAN 0068 MSND 0070
NORTH DORCHESTER TOW TR S A 020	17 493794 4758865 L	1962/07 2801	10					4102955 ()	LOAM MSND 0002 MSND 0006 CLAY MSND 0026 CLAY GRVL ROCK 0027
NORTH DORCHESTER TOW TR S A 020	17 493794 4758865 L	1962/07 2801	10					4102956 ()	LOAM MSND 0001 MSND 0006 CLAY MSND GRVL 0029 ROCK 0030
NORTH DORCHESTER TOW TR S A 020	17 493574 4758673 W	1965/07 4741	6	FR 0055	10/14/8/24:0	DO	0055 3	4102957 ()	HPAN STNS 0055 GRVL 0058
NORTH DORCHESTER TOW TR S A 020	17 493574 4758943 W	1966/08 1708	5 5	SU 0051	11/18/10/8:0	DO		4102958 ()	CLAY BLDR 0003 YLLW MSND 0016 BLUE CLAY MSND 0034 BLUE CLAY 0046 MSND SILT 0051 LMSN 0052
NORTH DORCHESTER TOW TR S A 020	17 493534 4758793 W	1968/09 1708	5	FR 0060	10/45/12/12:0	DO		4104566 ()	LOAM 0001 GRVL STNS 0011 GREY CLAY GRVL 0018 GREY CLAY 0037 GREY CLAY GRVL STNS 0060 MSND GRVL 0062
NORTH DORCHESTER TOW TR S A 019	17 494634 4758573 W	1972/11 2644	6					4106110 ()	LOAM 0001 SAND GRVL 0002 SAND 0052 SAND GRVL 0055 SILT 0058 CLAY SILT STNS 0083 GREY CLAY 0090 SILT SAND 0092 LMSN 0098
NORTH DORCHESTER TOW TR S A 020	17 493528 4758876 W	1974/10 1708	5	FR 0067	23/30/9/8:0	DO		4107012 ()	LOAM 0001 YLLW SAND 0002 GREY CLAY STNS 0010 GREY CLAY GRVL 0025 GREY CLAY SAND GRVL 0048 GREY CLAY GRVL 0053 GREY CLAY SAND SILT 0065 GREY CLAY GRVL 0066 BRWN SAND 0067
NORTH DORCHESTER TOW TR S A 020	17 493614 4758583 W	1975/08 1708	5	FR 0040	4/27/16/8:0	DO		4107534 ()	BLCK LOAM 0001 BRWN SAND 0008 GREY CLAY STNS 0020 GREY CLAY GRVL 0040 CGVL 0041
NORTH DORCHESTER TOW TR S A 020	17 493654 4758843 W	1976/06 1708	5	FR 0063	9/27/13/8:0	DO		4107861 ()	SAND 0005 CLAY GRVL STNS 0023 CLAY GRVL 0043 GREY LMSN 0045 GRVL STNS CLAY 0063 LMSN 0064
NORTH DORCHESTER TOW TR S A 020	17 493574 4758543 W	1976/10 1708	5	FR 0045	5/26/8/5:0	DO		4107872 ()	BRWN SAND 0010 GREY SAND 0018 GRVL CLAY 0038 SAND GRVL CMTD 0045 GRVL 0046
NORTH DORCHESTER TOW TR S A 019	17 494634 4758543 W	1979/06 4741	5	FR 0013	37/45/8/5:0	DO	0051 3	4108889 ()	LOAM 0001 BRWN SAND CLAY LYRD 0055 CLAY HARD 0092 LMSN 0092
NORTH DORCHESTER TOW TR S A 019	17 494534 4758823 W	1979/04 5413	8	FR 0059	48///:	DO	0061 12	4109170 ()	BRWN SAND STNS DRY 0019 GREY CLAY STNS HPAN 0032 GREY CLAY SILT SOFT 0052 GREY CLAY STNS HARD 0059 BRWN SAND WDFR STNS 0073
NORTH DORCHESTER TOW TR S B 019	17 494634 4758483 W	1981/04 4741	5	FR 0045	39/45/10/2:0	DO	0057 3	4109513 ()	BRWN SAND CLAY DRY 0045 FSND CLN 0061
NORTH DORCHESTER TOW TR S A 019	17 494614 4758763 W	1981/04 4741	5	FR 0055	45/51/10/2:0	DO	0064 5	4109514 ()	BRWN SAND CLAY DRY 0055 FSND CLN 0070
NORTH DORCHESTER TOW TR S A 019	17 494614 4758743 W	1981/04 4741	5	FR 0055	45/51/10/2:0	DO	0064 3	4109515 ()	BRWN SAND CLAY DRTY 0055 FSND CLN 0070
NORTH DORCHESTER TOW TR S A 019	17 494514 4758523 W	1981/04 4741	5	FR 0045	39/45/10/2:0	DO	0056 3	4109516 ()	BRWN SAND CLAY DRY 0045 FSND CLN 0060
NORTH DORCHESTER TOW TR S A 019	17 494514 4758783 W	1981/11 4741	6	FR 0070	//200/:	MN	0070 8	4109693 ()	LOAM 0001 BRWN SAND 0070 GRVL 0078 CLAY GRVL 0081
NORTH DORCHESTER TOW TR S A 019	17 494634 4758643 W	1982/11 4741	5	FR 0045	39/45/10/1:0	DO	0057 3	4109805 ()	LOAM FILL 0002 BRWN SAND 0045 SAND 0061
NORTH DORCHESTER TOW TR S A 019	17 494434 4758923 W	1983/07 4741	5	FR 0045	39/45/10/1:0	DO	0057 3	4109877 ()	LOAM FILL 0002 BRWN SAND 0045 SAND 0061
NORTH DORCHESTER TOW TR S A 019	17 494614 4758683 W	1983/08 4741	5	FR 0045	39/45/10/1:0	DO	0057 3	4109878 ()	LOAM FILL 0002 BRWN SAND 0045 SAND 0061
NORTH DORCHESTER TOW TR S A 019	17 494434 4758903 W	1983/07 4741	5	FR 0045	39/45/10/1:0	DO	0057 3	4109879 ()	LOAM FILL 0002 BRWN SAND 0045 SAND 0061
NORTH DORCHESTER TOW TR S A 019	17 494554 4758823 W	1979/07 4741	5	FR 0055	47/53/12/2:0	DO	0074 3	4108888 ()	LOAM 0001 BRWN SAND HARD 0055 BRWN SAND 0070 GRVL 0078 CLAY 0078
NORTH DORCHESTER TOW TR S A 019	17 494494 4758743 W	1984/05 4741	5	FR 0052	42/51/10/1:0	DO	0066 4	4110043 ()	BRWN SAND 0052 SAND 0070
NORTH DORCHESTER TOW TR S A 019	17 494494 4758723 W	1984/05 4741	5	FR 0048	40/48/10/1:0	DO	0063 4	4110044 ()	BRWN SAND 0048 SAND 0067
NORTH DORCHESTER TOW TR S A 019	17 494494 4758683 W	1984/05 4741	5	FR 0048	40/48/10/1:0	DO	0064 3	4110045 ()	BRWN SAND 0048 SAND 0067
NORTH DORCHESTER TOW TR S A 018	17 494594 4758883 W	1984/12 4741	5	FR 0040	41/42/10/2:0	DO	0060 3	4110125 ()	BRWN SAND 0040 BRWN CSND 0064
NORTH DORCHESTER TOW TR S A 018	17 494674 4758883 W	1984/12 4741	5	FR 0040	41/43/10/2:0	DO		4110126 ()	BRWN SAND 0040 BRWN CSND 0067
NORTH DORCHESTER TOW TR S A 018	17 494634 4758923 W	1984/12 4741	5	FR 0040	40/41/10/1:0	DO	0057 3	4110143 ()	BRWN SAND 0040 BRWN CSND 0060
NORTH DORCHESTER TOW TR S A 018	17 494634 4758743 W	1985/05 4741	5	FR 0035	//10/1:0	DO	0066 3	4110217 ()	BRWN SAND 0035 GREY CSND 0069
NORTH DORCHESTER TOW TR S A 018	17 494654 4758703 W	1985/07 4741	5	FR 0040	45/47/10/2:0	DO	0067 3	4110324 ()	BRWN SAND 0040 GREY SAND 0070
NORTH DORCHESTER TOW TR S A 018	17 494654 4758603 W	1985/07 4741	5	FR 0038	45/47/10/2:0		0060 3	4110325 ()	BRWN SAND 0038 BRWN SAND WBRG 0063 CLAY 0065
NORTH DORCHESTER TOW TR S A 018	17 494654 4758683 W	1985/07 4741	5	FR 0040	45/47/10/2:0	DO	0065 3	4110326 ()	BRWN SAND 0040 GREY SAND 0070
NORTH DORCHESTER TOW TR S A 018	17 494614 4758783 W	1985/07 4741	5	FR 0040	45/47/10/2:0	DO	0067 3	4110327 ()	BRWN SAND 0040 GREY SAND 0070
NORTH DORCHESTER TOW TR S A 019	17 494634 4758543 W	1985/08 4741	5	FR 0035	35/39/10/0:1	DO	0048 3	4110328 ()	BRWN SAND 0035 GREY SAND 0055
NORTH DORCHESTER TOW TR S A 019	17 494214 4758883 W	1985/05 4741	1	FR 0027	4///:	NU	0023 3	4110329 ()	SAND 0022 GRVL 0027 CLAY 0030
NORTH DORCHESTER TOW TR S A 019	17 494194 4758883 W	1985/05 4741	2	FR 0027	4///:		0022 4	4110330 ()	SAND 0022 GRVL 0027 CLAY 0030
NORTH DORCHESTER TOW TR S A 019	17 494454 4758863 W	1985/05 4741	7	FR 0070				4110333 ()	BRWN SAND 0030 CLAY SAND 0050 SAND WBRG 0070
NORTH DORCHESTER TOW TR S A 019	17 494194 4758783 W	1985/05 4741	7					4110335 ()	SAND 0025 CLAY 0052 GRVL STNS 0054 CLAY 0085
NORTH DORCHESTER TOW TR S A 019	17 494454 4759263 W	1985/05 4741	7					4110336 ()	GRVL 0012 BRWN CLAY 0017 BLUE CLAY STNS 0040
NORTH DORCHESTER TOW TR S A 019	17 494314 4758963 W	1985/05 4741						4110337 ()	BRWN SAND 0006 BRWN FSND SILT 0016 BRWN FSND SILT 0043 BRWN FSND MSND 0051 BRWN SAND GRVL 0053 GREY CLAY 0063 GREY CLAY GRVL 0073 GREY GRVL CLAY HARD 0079 GREY LMSN 0081
NORTH DORCHESTER TOW TR S A 020	17 493974 4759063 W	1985/05 4741	5	FR 0016	5/11/20/24:0		0013 3	4110338 ()	BRWN CLAY SNDY 0010 CGVL 0016
NORTH DORCHESTER TOW TR S A 019	17 494074 4759143 W	1985/10 4741	5	FR 0010	2/10/10/1:0		0006 4	4110339 () A	BRWN CLAY SLTY 0006 BRWN GRVL 0010
NORTH DORCHESTER TOW TR S A 019	17 494494 4758623 W	1985/07 4741	5	FR 0036	36/45/10/1:0	DO	0059 3	4110340 ()	BRWN SAND 0036 SAND WBRG 0062 CLAY 0066
NORTH DORCHESTER TOW TR S A 019	17 494514 4758583 W	1985/08 4741	5	FR 0038	38/45/10/1:0	DO	0057 3	4110341 ()	BRWN CLAY 0038 GREY SAND 0055 CSND 0062

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
NORTH DORCHESTER TOW TR S A 019	17 494454 4758663 W	1985/08 4741	5	FR 0040	40/47/10/2:0	DO	0059 3	4110342 ()	BRWN SAND 0040 GREY SAND 0058 CSND GRVL 0065
NORTH DORCHESTER TOW TR S A 019	17 494494 4758703 W	1985/08 4741	5	FR 0040	39/47/10/1:0	DO	0059 3	4110343 ()	BRWN CLAY 0040 GREY SAND 0058 CSND 0064
NORTH DORCHESTER TOW TR S A (	17 494374 4759343 W	1985/10 4741	10	SU 0064	///24:0			4110332 ()	GRVL 0003 BRWN CLAY 0017 BLUE CLAY STNS 0045 GREY LMSN 0078
NORTH DORCHESTER TOW TR S A 019	17 494144 4758788 W	1986/09 4741	5	FR 0005	3/17/30/72:0	MN	0026 4	4110676 (NA)	BRWN SAND SILT 0005 BRWN SAND 0022 GREY FSND 0025 CGVL SNDS 0029 GRVL CLAY 0030
NORTH DORCHESTER TOW TR S A 019	17 494134 4758783 W	1986/09 4741	5	FR 0005	3/13/30/72:0	MN	0026 4	4110677 (NA)	BRWN SAND SILT 0005 BRWN SAND 0022 GREY FSND 0025 CGVL SAND 0029 GRVL CLAY 0030
NORTH DORCHESTER TOW TR S A 019	17 494147 4758789 W	1986/09 4741	5	FR 0005	3//20/1:0	NU	0019 4	4110678 (NA)	BRWN SAND SILT 0005 BRWN SAND 0018 GREY GRVL SAND 0023 GRVL CLAY 0024
NORTH DORCHESTER TOW TR S A 019	17 494179 4758798 W	1986/11 4741	5	FR 0005	6/14/25/24:0	DO	0018 4	4110679 (NA)	BRWN SAND SILT 0005 BRWN SAND 0018 GREY GRVL SAND 0023 GRVL SAND 0024
NORTH DORCHESTER TOW TR S A 019	17 494164 4758793 W	1986/09 4741	5	FR 0005	3/16/25/72:0	MN	0018 4	4110680 (NA)	BRWN SAND SILT 0005 BRWN SAND 0017 GRVL SAND 0022 GRVL CLAY 0023
NORTH DORCHESTER TOW TR S A 019	17 494659 4758653 W	1986/09 4741	5	FR 0038	32/43/10/1:0	DO	0064 3	4110681 (NA)	BRWN SAND 0038 GREY CSND 0067
NORTH DORCHESTER TOW TR S A 019	17 494679 4758563 W	1986/09 4741	5	FR 0038	32/43/10/1:0	DO	0057 3	4110682 (NA)	BRWN SAND 0038 GREY CSND 0060
NORTH DORCHESTER TOW TR S B 018	17 495009 4758573 W	1987/06 1708	5	FR 0051	28/41/5/4:0	DO	0047 4	4110864 (NA)	BRWN SAND 0022 YLLW SAND 0041 STNS GRVL 0045 BRWN SAND SLTY 0047 SAND GRVL 0051 SAND GRVL CMTD 0052
NORTH DORCHESTER TOW TR S A 018	17 494694 4758543 W	1987/11 5466	5	FR 0061	39/47/12/6:0	DO	0058 3	4111046 (03859)	BRWN SAND PCKD 0056 BRWN CSND GRVL LOOS 0061
NORTH DORCHESTER TOW TR S A 021	17 493424 4758983 W	1988/08 4741	5	SU 0005	29/35/12/1:0	CO	0059 3	4111489 (39807)	BRWN SAND 0012 BLUE CLAY STNS 0059 GRVL 0062
NORTH DORCHESTER TOW TR S B 020	17 493720 4757866 W	1988/06 5466	6	FR 0123	49/68/15/24:0	DO ST		4111587 (39942)	BRWN SAND PCKD 0008 BRWN CLAY SAND PCKD 0010 BRWN SAND PCKD 0074 GREY FSND CLAY 0093 GREY GRVL SAND CLAY 0115 GREY GRVL CLAY PCKD 0122 GREY GRVL PORS 0123
NORTH DORCHESTER TOW TR S A 018	17 494332 4758917 W	1989/03 5466	5 4 4	FR 0050	30/38/12/1:0	DO	0043 3 0043 :	4112086 (46703)	BLCK LOAM PORS 0001 BRWN SAND GRVL PCKD 0006 BRWN SAND PCKD 0043 BRWN MSND LOOS 0050 GREY GRVL PCKD 0052
NORTH DORCHESTER TOW TR S A 019	17 494312 4758889 W	1990/06 3563	5	FR 0049	30/46/12/2:0	DO	0046 3	4112087 (75626)	BRWN SAND 0006 GREY SAND 0046 GREY GRVL 0049
NORTH DORCHESTER TOW TR S A 019	17 494320 4758854 W	1990/06 3563	5	FR 0051	31/48/12/5:0	IR	0049 49	4112101 (75639)	BRWN SAND 0050 GREY STNS SAND 0051
NORTH DORCHESTER TOW TR S B 020	17 494045 4757560 L	2003/05 7190	2			NU	0006 10	4115301 (255950)	BRWN SAND LOAM 0001 UNKN UNKN 0010 GREY SILT 0016
NORTH DORCHESTER TOW	17 494569 4758985 W	2007/05 3366	1.25	FR 0025	25//8/1:	IR	0032 4	7046016 (Z52840) A046982	SAND 0036
NORTH DORCHESTER TOW	17 494506 4758957 W	2007/05 3366	1.25	FR 0027	27//10/1:	IR	0034 4	7046017 (Z52849) A046981	SAND 0038
NORTH DORCHESTER TOW A 21	17 493400 4758765 W	2007/11 7090	30.6	FR 0017 FR 0026	17/27/5/2:30	DO		7101341 (Z75041) A047822	BLCK LOAM LOAM 0002 BRWN SAND GRVL 0026 GREY GRVL HPAN HARD 0050
NORTH DORCHESTER TOW	17 494552 4758960 W	2009/05 3366	1.25	FR 0026	26/26/5/1:0	IR	0032 4	7124369 (Z92693) A068895	SAND 0036
NORTH DORCHESTER TOW TR S B 018	17 494539 4758103 W	2009/05 7190	2			MO	0005 15	7124841 (Z91226) A047892	BRWN SAND DRY 0005 BRWN SAND 0010 BRWN SAND 0015 GREY CLAY SOFT 0020
NORTH DORCHESTER TOW	17 493625 4758402 W	2010/09 3366	6					7153878 (Z113673) A086008 A	
NORTH DORCHESTER TOW TR S A (	17 493074 4758983 W	1971/11 2607	36	FR 0020	20///:	DO		4105677 ()	BRWN MSND 0017 GRVL BLDR 0022 BLUE CLAY 0025
NORTH DORCHESTER TOW TR S A (	17 493064 4758963 W	1960/11 3410	5	FR 0063	13/40/4/24:0	DO		4102961 ()	BLCK LOAM 0002 GRVL 0012 HPAN 0053 STNS GRVL 0063 GRVL 0064
NORTH DORCHESTER TOW TR S A 021	17 493154 4758963 W	1960/10 1708	5 5	SU 0067	23/58/7/8:0	DO		4102960 ()	CLAY STNS 0029 HPAN 0065 BRWN LMSN 0069
NORTH DORCHESTER TOW TR S B 020	17 493750 4757788 W	2017/06 7090	6 6	UT 0082	37/44/15/1:0	DO	0069 12	7290286 (Z260360) A216698	BLCK LOAM LOAM 0001 BRWN SAND SILT LYRD 0014 BRWN FSND 0034 BRWN SAND LOOS 0070 BRWN FSND CLN 0082 GREY SILT SOFT 0086
NORTH DORCHESTER TOW TR S B 020	17 493779 4757758 W	2017/06 7090	6 6	UT 0082	29/40/15/1:30	DO	0069 12	7290287 (Z260363) A216697	BLCK LOAM LOAM 0001 BRWN SAND ---- DRY 0012 BRWN FSND 0035 BRWN FSND CLN 0069 BRWN SAND ---- 0082 GREY SILT CLAY LYRD 0086
NORTH DORCHESTER TOW TR S B 020	17 493786 4757725 W	2017/06 7090	6 6	UT 0080	19/30/15/1:30	DO	0068 12	7290288 (Z260362) A216696	BLCK LOAM LOAM 0001 BRWN SAND ---- 0011 BRWN FSND CLN 0062 BRWN SAND ---- 0080 GREY SAND ---- 0085
NORTH DORCHESTER TOW TR S B (	17 495294 4758023 W	1986/02 1708	2	FR 0025	7//20/1:0		0026 5	4110619 (NA)	LOAM 0002 BRWN SAND SILT 0018 BRWN GRVL SAND 0025 GREY GRVL SAND 0031 GREY CLAY GRVL CMTD 0042
NORTH DORCHESTER TOW TR S B (	17 493750 4757885 W	2017/06 7090	6 6	UT 0079	42/49/10/1:30	OT OT	0067 12	7290291 (Z260370) A216692	BLCK LOAM LOAM 0002 BRWN CLAY ---- LYRD 0011 BRWN FSND ---- 0029 BRWN SAND CLN 0066 GREY FSND CLN 0079 GREY CLAY SOFT 0084
NORTH DORCHESTER TOW TR S B (	17 495249 4757858 W	2021/05 7534	1.25	FR 0015	//15/1:	IR	0024 3	7413606 (WDLH6ZWD) A325180	BRWN SAND 0015
NORTH DORCHESTER TOW TR S B 018	17 495245 4758461 W	2021/03 7190	2 4	UT 0012	12///:	MO	0020 5	7384169 (NPDDT895) A316308	BRWN SAND LOOS 0025
NORTH DORCHESTER TOW TR S B (	17 495161 4758141 W	2021/03 4876						7408332 (Z352355) A229683 A P	
NORTH DORCHESTER TOW TR S B (	17 495156 4758119 W	2021/03 4876						7408331 (Z352353) A238071 A P	
NORTH DORCHESTER TOW TR S B (	17 494637 4757680 L	2003/07 3563	6 5	FR 0058	37/46/10/3:0	DO	0050 8	4115364 (259605)	BRWN SAND 0059
NORTH DORCHESTER TOW TR S B 019	17 494637 4757680 L	2003/07 3563				DO		4115365 (259604) A	
NORTH DORCHESTER TOW TR S B 020	17 493908 4758277 W	2019/07 7190	4 2	UT 0025	25///:	MO	0030 5	7354509 (DRFMRBD4) A273374	BRWN SAND DNSE 0025 BRWN SAND 0034
NORTH DORCHESTER TOW TR S B 020	17 494247 4757763 W	2019/08 7190	4 2	UT 0028	9///:	MO	0025 5	7354510 (6RDHYBAG) A273379	BRWN LOAM LOOS 0001 BRWN SILT CLAY HARD 0010 GREY SILT CLAY SOFT 0028 BRWN FSND LOOS 0029 GREY SILT CLAY TILL 0030
NORTH DORCHESTER TOW TR S B (	17 494454 4756843 W	1978/11 1708	5	FR 0083	32/33/15/4:0	DO	0088 3	4108771 ()	FILL 0008 BRWN SAND 0044 GREY CLAY 0074 GREY CLAY GRVL 0083 GRVL SAND 0091 GREY CLAY DNSE 0092
NORTH DORCHESTER TOW TR S B 020	17 494494 4756883 W	1984/06 1708	5	FR 0075 UK 0089	34/35/10/3:0	DO	0084 4	4110139 ()	BRWN CLAY 0018 BRWN SAND FSND 0054 GREY CLAY 0066 GREY CLAY GRVL 0075 GRVL SAND 0089
NORTH DORCHESTER TOW TR S A 020	17 494078 4758532 W	2019/07 7190	4 2	UT 0014	14///:	MO	0014 5	7354654 (Q8TXQJHH) A273373	BRWN SAND DNSE 0006 BRWN CLAY SLTY TILL 0014 BRWN SAND 0018
NORTH DORCHESTER TOW TR S A 020	17 493604 4758383 W	2020/07 7090	6 6	UT 0077	18/29/10/:	DO		7363010 (Z331271) A237007	BRWN LOAM 0001 BRWN CLAY 0014 GREY CLAY STNS 0042 GREY CLAY SAND 0077 GREY LMSN 0080
NORTH DORCHESTER TOW	17 494967 4758102 W	7675						7393805 (C50345) A323494 P	
NORTH DORCHESTER TOW TR S A 021	17 493343 4758394 W	2021/06 7190	2 4	UT 0013	13///:	MO	0012 5	7394925 (UMU9P268) A323649	BLCK LOAM 0001 BRWN SAND GRVL 0014 GREY SILT SAND 0016 GREY SILT TILL HARD 0018
NORTH DORCHESTER TOW TR S A 021	17 493522 4758315 W	2021/06 7190	2 4	UT 0005	5///:	MO	0008 5	7394926 (HVLAPFPK) A323650	BLCK LOAM 0001 BRWN SAND SILT 0012
NORTH DORCHESTER TOW TR S A 021	17 493242 4758913 W	2021/06 7190	2 4	UT 0010	10///:	MO	0010 5	7394927 (WJOVCAWD) A323660	BLCK LOAM SAND 0001 BRWN SAND SILT 0015
NORTH DORCHESTER TOW TR S A 021	17 493497 4758765 W	2021/06 7190	2 4			MO	0015 5	7394928 (DWJE6URC) A323663	BLCK LOAM 0001 BRWN SILT TILL 0008 GREY SILT TILL 0020
NORTH DORCHESTER TOW TR S A 021	17 493530 4758578 W	2021/06 7190	2 4			MO	0015 5	7394929 (XB32QEF6) A323670	BLCK LOAM 0001 BRWN SILT TILL 0003 GREY SILT TILL 0020
NORTH DORCHESTER TOW TR S B 018	17 495040 4758061 W	2021/08 7534	1.25	FR 0017	///1:	IR	0025 3	7405032 (3RLHYDRG) A329459	BRWN SAND 0017
NORTH DORCHESTER TOW TR S A 019	17 494540 4759029 W	2021/06 7534	1.25	FR 0025	///1:	IR	0030 4	7405040 (VVW9LR5A) A325149	BRWN SAND 0025
WESTMINSTER TOWNSHIP NTRE	17 475582 4750813 W	2004/09 2604	12		56///:			4115786 (Z08238) A	PRDR 0131
WESTMINSTER TOWNSHIP NTRE 065	17 477002 4748890 W	2004/06 7215					0010 5	4115699 (Z13052) A012971	

Appendix H
Residential development and sewer plans

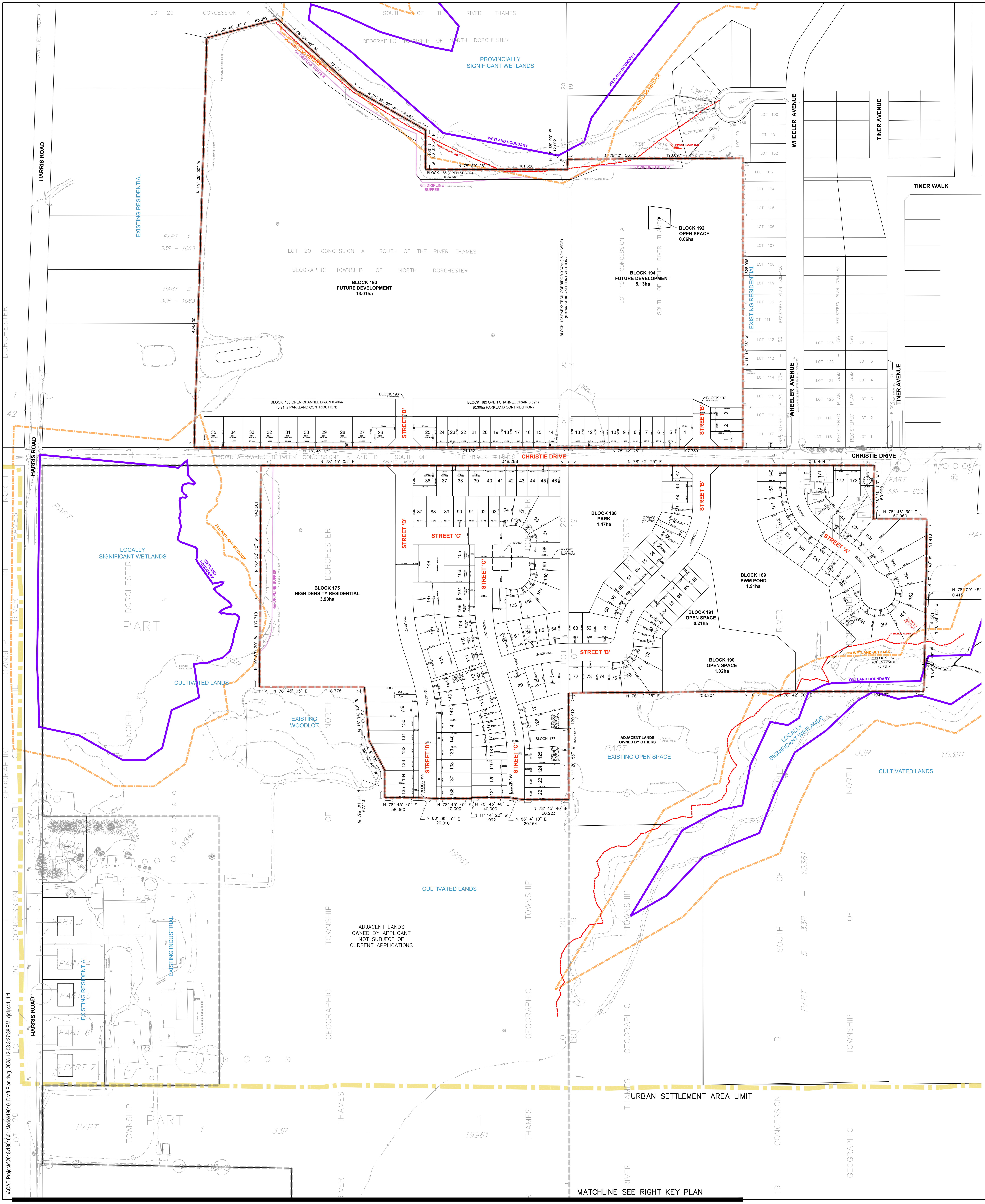
ENGLOBE

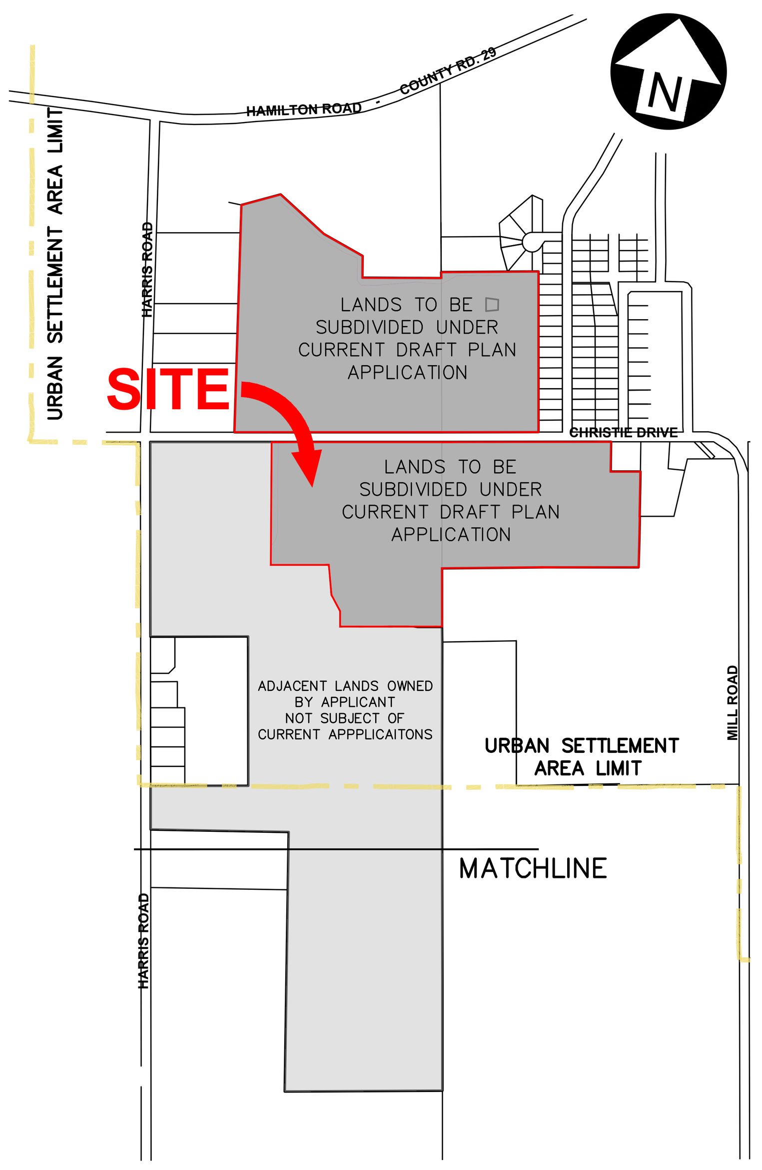
DRAFT PLAN OF SUBDIVISION

PART OF LOT 19 & 20 CONCESSION 'A' &
PART OF LOT 19 & 20 CONCESSION 'B'
SOUTH OF THE RIVER THAMES
GEOGRAPHIC TOWNSHIP OF NORTH DORCHESTER
MUNICIPALITY OF THAMES CENTRE
COUNTY OF MIDDLESEX

INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT RSO 1990
(A) ON PLAN
(B) ON PLAN
(C) ON PLAN
(D) AS SHOWN ON LAND USE SCHEDULE
(E) NORTH – EXISTING RESIDENTIAL & WETLAND,
WEST – EXISTING RESIDENTIAL & WETLAND,
EAST – EXISTING RESIDENTIAL, CULTIVATED LANDS,
SOUTH – CULTIVATED LANDS, FUTURE RESIDENTIAL
(F) ON PLAN
(G) ON PLAN
(H) MUNICIPAL WATER AVAILABLE
(I) CLAY LOAM, GRAVEL
(J) ON PLAN
(K) STORM SEWERS, SANITARY SEWERS, TELEPHONE, GAS, T.V. CABLE
(L) MUNICIPALITY OF THAMES CENTRE OFFICIAL PLAN AND ZONING BY-LAWS

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





KEY PLAN

SCALE: 1:10,000

LAND USE SCHEDULE

	DESCRIPTION	AREA (ha)
LOTS 1–25, 36, 40–104, 113–144, 149–174	SINGLE DETACHED RESIDENTIAL	8.99
LOTS 26–35, 37–39, 105–112	SEMI-DETACHED RESIDENTIAL	1.49
LOTS 145–148	TOWNHOME RESIDENTIAL	0.51
BLOCK 175	HIGH DENSITY RESIDENTIAL	3.93
DEDICATED STREETS	STREETS 'A'–'D'	3.24
BLOCK 176, 177	FUTURE ROAD ALLOWANCE	0.10
BLOCK 178–181	WALKWAY/ SERVICING BLOCKS	0.06
BLOCK 182, 183	OPEN CHANNEL DRAIN/TRAIL CORRIDOR	1.18
BLOCK 184, 185	PARK/ TRAIL CORRIDOR	0.14
BLOCK 186, 187	OPEN SPACE	1.47
BLOCK 188	PARK	1.47
BLOCK 189	STORMWATER MANAGEMENT	1.91
BLOCK 190, 191	OPEN SPACE	1.41
BLOCK 192, 193	FUTURE DEVELOPMENT	18.01
BLOCK 194	PARK/ TRAIL CORRIDOR	0.37
BLOCK 195–198	RESERVES	0.002
TOTAL		44.28

PRELIMINARY

SCALE: 1:1500

0 10 25 50 METRE 100

NOTE: ORIGINAL CONTOURS SHOWN FROM 2020 CJDL SURVEY

OWNER'S CERTIFICATE

DOUG TARRY LIMITED., THE REGISTERED OWNER OF THE LANDS TO BE SUBDIVIDED, HEREBY AUTHORIZE CYRIL J. DEMEYERE LIMITED TO SUBMIT THIS DRAFT PLAN OF SUBDIVISION FOR APPROVAL.

DATE

DOUG TARRY. PRESIDENT,
DOUG TARRY LIMITED

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN ON THIS PLAN.

DATE

KIM HUSTED. ONTARIO LAND SURVEYOR

PLAN PREPARED BY:
CJDL Consulting Engineers
Cyril J. Demeyere Limited
P.O. Box 460, 261 Broadway
Tillsonburg, Ontario. N4G 4H8
Tel: 519-688-1000
866-302-9886
cjdl@cjdleng.com

JOB No. 18010

8 DECEMBER 2025

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Appendix I
Water balance

1. Climate Information

Precipitation (collected from Env. Canada data)	1011,5	mm/a
Evapotranspiration	598,2	mm/a
Water Surplus	413,3	mm/a

2. Infiltration Rates

Infiltration Factors (Table 2, Chapter 4 of MOE, 1995)		
Rolling land (modified)	0,2	
Open sandy loam	0,3	
Cover (cultivated land)	0,1	
TOTAL	0,6	
Infiltration (0.55 x 446.5 mm/a)	248,0	mm/a
Run-off (Water Surplus - Infiltration)	165,3	mm/a
Typical Recharge Rates (Table 3, Chapter 4, MOE, 1995)		
silty sand to sandy silt	150-200	mm/a
fine to medium sand	200-250	mm/a
coarse sand and gravel	250+	mm/a

Site development area is underlain by glaciolacustrine material (sand).

Based on the above, the recharge rate is approximately	248	mm/a
with runoff of	165,3	mm/a

3. Site Statistics

Pre-Development:						
Building roofs	0,00	ha	0	m^2		
Parking Areas, Roadways, Other impervious Areas	0,00	ha	0	m^2		
Green space, open space, natural areas	26,27	ha	262 700	m^2		
TOTAL	26,27	ha	262 700	m^2		
Post-Development:					Impervious surfaces	
Medium density residential	2,00	ha	20 000	m^2	15000	m^2
High density residential	3,93	ha	39 300	m^2	33405	m^2
Freehold residential	8,99	ha	89 900	m^2	58435	m^2
SWM pond	1,91	ha	19 100	m^2	19 100	m^2
Open channel, archaeological site, parks and open space	6,04	ha	60 400	m^2	0	m^2
Streets and walkways	3,40		34 000	m^2	34000	
TOTAL	26,27	ha	262 700	m^2	159 940	m^2

4. Annual Pre-Development Water Balance

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Impervious surfaces	0	0	-	-	0
Residential (without imperviou	0	0	-	-	0
Green Space	262 700	265 721	157 147	65 150	43 424
TOTAL	0	265 721	157 147	65 150	43 424

5. Annual Post-Development Water Balance without LID Techniques

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Impervious surfaces	159 940	161 779	-	-	161 779
Residential (without impervious surfaces)	42 360	42 847	25 340	10 505	7 002
Green space, open space, natural areas	60 400	61 095	36 131	14 979	9 984
TOTAL	262 700	265 721	61 471	25 484	178 766

6. Comparison of Pre-Development and Post-Development

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	265 721	157 147	65 150	43 424
Post-Development	265 721	61 471	25 484	178 766
Change	0	-95 676	-39 665	135 341

Appendix J
Peer review

Stantec Consulting Ltd.
300W-675 Cochrane Drive
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Project/File: 161414695

Ms. Amanda Storrey, Director of Planning and Development Services
Municipality of Thames Centre
4305 Hamilton Road
Dorchester, ON N0L 1O3

Ms. Storrey,

Reference: Hydrogeological Peer Review – Acorn Valley Development – 83 Christie Drive, Dorchester, ON - County File Application 39T-TC2501, O3-25, Z20-25

1 Introduction

The Municipality of Thames Centre (The Municipality) has requested that Stantec Consulting Ltd. (Stantec) complete a peer review of the hydrogeological study report prepared by Englobe Corp. (Englobe, 2024) for the proposed residential development captioned above (herein referred to as the Site). Stantec understands that the proposed residential development will be fully serviced with municipal sanitary sewers and water supply.

The opinions and comments provided herein are based on the review of the hydrogeological study report referenced. Stantec has not conducted a Site visit to confirm the conditions reported nor verified the data and information provided in the hydrogeological study report reviewed and, as such, assumes no responsibility for the information contained therein. The responsibility for the information provided in the hydrogeological study report remains with the author(s) of the report.

2 Documents Reviewed

The hydrogeological study report provided to Stantec by The Municipality for the proposed residential development is referenced as follows:

- Hydrogeological Study Report, Proposed Acorn Valley Development, 83 Christie Drive, Dorchester, Ontario, Reference 160-P-0019257=0-01-300-HD-R-0002-00, dated April 5, 2024 (Preliminary Report), prepared by Englobe Corp. for Cyril J. Demeyere Limited.

The Terms of Reference and proposal for the Hydrogeological Study Report were not made available for review.

The Draft Plan of Subdivision provided to Stantec by the Municipality for the proposed residential development was considered for general information in the context of this geotechnical peer review. The Draft Plan of Subdivision is referenced as follows:

- Draft Plan of Subdivision, Part of Lot 19 & 20 Concession ‘A’ & Part of Lot 19 & 20 Concession ‘B’ South of the River Thames, Municipality of Thames Centre, County of Middlesex, dated 24 June 2025, Job No. 18010, prepared by CJDL.

3 Subject Property

The Site is currently used for agricultural purposes and is intended to be developed into residential subdivision. The Site will be fully serviced with municipal sanitary sewers and water supply. The Site is bounded by Provincially Significant Wetland (Tamarack Swamp) to the immediate north, an existing subdivision to the east, woodland and rural residential to the west and agricultural and woodland to the south. An additional wetland area is located on the southwestern border of the Site.

Surface water features are present in the west-central portion of the Site (Shaw Drain) and in the southeastern portion of the Site (Rath Harris Drain). The existing subdivision to the east of the Site is serviced with private wells and septic systems.

The Land Use Schedule on the Draft Plan shows the development is to consist of single, semi-detached, townhome and high-density units, streets and future road allowance, walkways, trail corridors, parks, open space, a stormwater management block, and areas designated for future development. The combined development area is shown as 44.3 hectares (ha) of which approximately 25.6 ha will be developed as part of this application.

The Plan shows the bulk of the development is to be located on the parcel south of Christie Drive, with development on the parcel north of Christie Drive limited to residential lots fronting on Christie Drive and an Open Channel Drain along the rear of the residential lots.

The Plan includes contour elevations at an interval of 1.0 m (solid lines) and 0.5 m (dashed lines). The contours indicate the ground surface elevation in the planned area of development for the parcel on the north side of Christie Drive ranges from a low of approximately 259 m above mean sea level (AMSL) (at the west and east limits of the residential units fronting Christie Drive) to a localized high of 262 m AMSL (along the row of residential units). The contours indicate the ground surface elevation in the planned area of development for the parcel on the south side of Christie Drive ranges from a low of approximately 257 m AMSL to a high of 269 m AMSL, with a very general trend in the ground surface sloping down from the high in the southwest to the low in the northeast.

4 Hydrogeological Study Report Review Comments

The comments provided are referenced to the section numbers and headings provided in the report, with specific reference to paragraphs, tables, lines and/or bullets, or to specific pages/documents included in the appendices.

2 Hydrogeological Study Methodology

The scope of the hydrogeological study included:

- Review of publicly available information including topography, geological and hydrogeological mapping and water well records.
- Drilling of 14 boreholes, installation of six monitoring wells and installation of five drive-point piezometers.
- In-situ hydraulic response testing in the monitoring wells (i.e., horizontal hydraulic conductivity) as well as in-situ testing of vertical hydraulic conductivity using a Guelph Permeameter at six test pit locations. These values were used to provide estimates of soil infiltration rates.
- Grain size analysis for select soil samples.
- Measurement of groundwater levels in all monitoring wells over several years and seasons including spring 2020, which likely represents the high groundwater table for the Site.
- Collection of groundwater samples for quality analysis from the monitoring wells.
- Preparation of a pre- and post construction water balance.
- Groundwater dewatering assessment.
- Assessment of potential impacts of the proposed land development.

The scope of the study was found to be suitable for the scale of the proposed development on municipal services.

2.2.3 Guelph Permeameter Analysis

The test pit locations where the Guelph Permeameter tests were completed are not shown on the drawings.

3.1 Stratigraphy

The stratigraphy was found to consist of 0.2 m to 0.5 m of topsoil underlain by sand with variable silt content. The depth of the sand unit was determined from local Water Well Records and found to range from 20 to 55 m below ground surface (BGS). One exception was BH12-19 where 2.0 m of peat was found at surface.

3.2 Hydraulic Conductivity and Design Infiltration Rates

Hydraulic conductivity values ranged from 1.2×10^{-5} m/s to 1.3×10^{-4} m/s. Infiltration rates were estimated to range from 1.3 to 57.3 mm/hr across the Site, for a geometric mean of 27.8 mm/hr.A safety factor of three was applied to these rates when calculating the Design Infiltration Rate. These results are consistent with sand having varying amounts of silt.

Clarification is required on whether horizontal hydraulic conductivity estimates obtained from the monitoring wells were converted to vertical hydraulic conductivities prior to converting these values to an infiltration rate. The vertical hydraulic conductivity of a soil can range from an order to two orders (for clay-based soil) of magnitude lower than the corresponding horizontal hydraulic conductivity. If horizontal hydraulic conductivity estimates were not adjusted, the estimated infiltration rates from these values will be higher than expected, which could have implications on LID infiltration facility design.

3.3 Groundwater Elevations, Flow Direction

The April 29, 2020 groundwater levels are referenced and contoured in Drawing 2. This section would benefit from further discussion, including:

1. Confirmation that the April 29, 2020, groundwater levels are representative of the high groundwater table.

2. Explicitly stating the groundwater flow direction is in a northeasterly direction as opposed to just referencing Drawing 2.

3. A discussion on the depth to the high groundwater table beneath the Site. This discussion will aid in the analysis of whether high groundwater levels will be a problem for basement foundations or site servicing throughout the Site.

4. A discussion of the mini-piezometer data with respect to surface water features and wetlands. Are these features groundwater recharge or discharge features? Do they need groundwater inputs originating from the Site to maintain their function.

3.4.2 Nitrate

Stantec agrees with the statement that changing the land use from agricultural to residential is likely to lower nitrate concentrations in groundwater over time.

3.5 Pre-Development Water Balance

The pre-development water balance resulted in an average infiltration rate of 248 mm/year. Stantec agrees that this infiltration rate is likely to be conservative. The pre-development water balance shows annual infiltration of about 63,637 m^3/yr, which is consistent with the proposed development area and average infiltration rate.

3.6 Post-Development Water Balance

The post-development water balance shows an infiltration deficit of about 40,253 m^3/yr or approximately 63% of the pre-development infiltration, which is consistent with a development of this size and density.

3.7 Comments on LID measures

The proposed LID measure consists of an open channel located on the northern side of Christie Drive. Stantec requires clarification on how water would be conveyed to this channel. Further clarification is also required on whether infiltrating stormwater at one location would maintain the from and function of all the surface water features and wetlands surrounding the proposed development. A decentralized LID measure such as rear lot swales would be preferred. A pre- and post-development feature-based water balance for the surface water features and wetlands should be performed to help in assessing the most suitable LID strategy for the Site.

Stantec agrees that only high quality water from rooftops and green spaces be infiltrated. Runoff from roadways should be directed to the stormwater management pond. Stantec also agrees that a post-development groundwater monitoring program be implemented at the Site.

4 Dewatering Assessment

Englobe states that no basement foundations would be constructed below the high groundwater table as drainage would be problematic and Stantec agrees with this statement. Some preliminary dewatering rates were calculated for site services and construction of the stormwater management pond. Stantec recommends that these dewatering rates be revisited during detailed design and confirmed with pumping from open test excavations so the contractor can develop an effective dewatering plan.

Englobe suggests that a Category 3 Permit To Take Water would be required; however, recent amendments to the permitting requirements indicate that the construction dewatering can be completed with an Environmental Activity and Sector Registry (EASR).

5.1 Water Users

Englobe recommends that residents on private wells located within the predicted dewatering zone of influence be notified prior to the start of dewatering and that the contractor be prepared to deal with any groundwater interference complaints. Groundwater interference complaints should be handled by a qualified professional.

Summary

In summary, there does not appear to be any hydrogeological constraints that would prevent this development from proceeding as proposed. As part of detailed design, Stantec recommends that the dewatering assessment be revisited to confirm pumping rates and predicted zone of pumping influence. During detailed design a decentralized LID strategy should be developed in an effort to match pre-development recharge and maintain groundwater levels across the Site as close to pre-development levels as possible.

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5 Closure

If you have any questions or require clarification, please do not hesitate to contact the undersigned.

Best regards,

STANTEC CONSULTING LTD.

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Recommendation	Englobe Comment
The test pit locations where the Guelph Permeameter tests were completed are not shown on the drawings.	Test pits locations were added to Drawing 1 of Appendix A
Clarification is required on whether horizontal hydraulic conductivity estimates obtained from the monitoring wells were converted to vertical hydraulic conductivities prior to converting these values to an infiltration rate. The vertical hydraulic conductivity of a soil can range from an order to two orders (for clay-based soil) of magnitude lower than the corresponding horizontal hydraulic conductivity. If horizontal hydraulic conductivity estimates were not adjusted, the estimated infiltration rates from these values will be higher than expected, which could have implications on LID infiltration facility design.	Section 3.2 recommends the use of Guelph permeameter for infiltration rates estimation. Guelph permeameter test execution was considered representative of conditions that could occur in an open channel like the one considered in the concept at current time.
Confirmation that the April 29, 2020, groundwater levels are representative of the high groundwater table.	Added to section 3.3
Explicitly stating the groundwater flow direction is in a northeasterly direction as opposed to just referencing Drawing 2	Added to section 3.3
A discussion on the depth to the high groundwater table beneath the Site. This discussion will aid in the analysis of whether high groundwater levels will be a problem for basement foundations or site servicing throughout the Site.	Added to section 3.3
A discussion of the mini-piezometer data with respect to surface water features and wetlands. Are these features groundwater recharge or discharge features? Do they need groundwater inputs originating from the Site to maintain their function.	Added to section 3.3
Englobe suggests that a Category 3 Permit To Take Water would be required; however, recent amendments to the permitting requirements indicate that the construction dewatering can be completed with an Environmental Activity and Sector Registry (EASR).	Update to section 4.3

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