284-292 Plains Road East, Burlington, Ontario

Hydrogeological Investigation

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1 Introduction

1.1 Project Description

EXP Services Inc. (EXP) was retained by Corley Developments Inc. to prepare a Hydrogeological Investigation Report associated with the proposed development located at 284-292 Plains Road East, Burlington, Ontario (hereinafter referred to as the 'Site').

It is our understanding that the proposed development will consist of a mixed-use six (6)-storey building with two (2) levels of underground parking. The architectural drawing is provided in Appendix F. The Site location plan is shown on Figure 1.

EXP conducted a Geotechnical Investigation in conjunction with this investigation. Moreover, Soil Engineers Ltd. conducted a Geotechnical Investigation at the Site in 2018. The pertinent information gathered from the noted investigations is utilized for this report.

1.2 Project Objectives

The following project objectives were pursued:

- Establish the local hydrogeological settings within the Site;
- Assess construction dewatering flow rates and potential impacts (short-term);
- Assess post-construction discharge volumes from the future foundation sub-drains (long-term);
- Assess groundwater quality; and
- Prepare a Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the investigation objectives, EXP has completed the following scope of work:

- Reviewed available geological and hydrogeological information for the Site;
- Developed and conducted Single Well Response Tests (SWRT) on monitoring wells to assess hydraulic conductivities of the saturated soils at the Site;
- Completed three (3) rounds of groundwater level measurements at all monitoring wells;
- Collected one (1) groundwater sample to be analyzed for the chemical parameters, as stated in the Regional Municipality of Halton Sewer Use By-Law;
- Evaluated the information collected during the field investigation program, including borehole geological information, Water Well Records (WWR), SWRT results, groundwater level measurements and groundwater water quality;
- Prepared site plans, cross sections, geological mapping and groundwater contour mapping for the Site;
- Provided preliminary recommendations on the requirements for construction and long-term dewatering;
- Provided recommendations on the Ministry of Environment, Conservation and Parks (MECP) Water Taking Permits and Regional Municipality of Halton and/or the City of Burlington Sewer Discharge Agreements (SDA) for the construction and post-construction phases;
- Prepared a Hydrogeological Investigation Report.

The Hydrogeological Investigation was prepared in accordance with the Ontario Water Resources Act, Ontario Regulation 387/04,. The scope of work outlined above was made to assess dewatering and did not include a review of Environmental Site Assessments (ESA).

1.4 Review of Previous Reports

The following reports were reviewed as part of this Hydrogeological Investigation:

- Soil Engineers Ltd. (January 2018). Geotechnical Investigation for the Proposed Mixed-Use Building, 284-292 Plains Road East, Burlington, ON, prepared for Truss Capital 1 LP.
- EXP Service Inc. (September 10, 2020). Draft Geotechnical Investigation Report, 284-292 Plains Road East, Burlington, ON, prepared for Corley Developments Inc.
- SRM Architects Inc. (August 31, 2021), Preliminary Architectural Drawings, 284-292 Plains Road East, Burlington, ON, prepared for Corley Developments Inc.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is located within a physiographic region known as the Iroquois Plain. The physiographic landform is named Sand Plains. The Niagara Escarpment lies north of the Iroquois Plain (Chapman & Putnam, 2007).

The Iroquois Plain was created along the shores of former Lake Iroquois, an ancient glacial lake. The noted Plain primarily consists of shallow water sandy deposits. The topography of the Iroquois Plain is relatively flat with a gradual slope to the south, toward Lake Ontario.

2.1.2 Regional Geology and Hydrogeology

The surficial geology can be described as coarse textured (foreshore-basinal) glaciolacustrine deposits consisting of sand, gravel, minor silt and clay. The overburden overlays red shale and siltstone of the Queenston Formation of the Upper Ordovician (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

Groundwater across the area flows southeast, towards Lake Ontario (Oak Ridge Moraine Groundwater Program, 2020). Local deviation from the regional groundwater flow pattern may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.1.3 Existing Water Well Survey

Water Well Records (WWRs) were compiled from the database maintained by the Ministry of the Environment, Conservation and Parks (MECP) and reviewed to determine the number of water wells documented within a 500-m radius of the Site boundaries.

The MECP WWR database lists a total of thirty-five (35) offsite well records within a 500 m radius from the Site centroid. The database indicated that the offsite wells were at an approximate distance of one-hundred and thirty-five meters or greater from the Site centroid. All offsite wells were reportedly identified as observation wells, test holes, dewatering wells, water supply well, abandoned and/or listed with unknown use. The reported water levels ranged from depths of 3.6 m to 4.5 meters below ground surface (mbgs).

The Well Identification Number (Well ID No.) of the only offsite water supply well is 7274476 where it is reportedly located 370 m from the Site centroid. The noted water supply well was reportedly installed in 2016. However, it is unknown if the referred water supply well is still active.

The locations of the MECP WWRs within 500 m of the Site are shown on Figure 3. A summary of the WWR is included in Appendix A.

2.2 Site Setting

2.2.1 Site Topography

The Site is in an urban area. The topography is considered relatively flat with a regional gradual southeasterly slope towards Lake Ontario.

As indicated on the borehole logs included in Appendix B, the surface elevation of the Site ranges between approximately 98.07 to 99.46 meters above sea level (masl).

2.2.2 Local Surface Water Features

The Site is within the Lake Ontario watershed. No surface water features exist onsite. The nearest surface water feature is an unnamed creek, approximately 317 meters southeast of the Site boundary. Lake Ontario is approximately 1 (one) kilometer from the Site boundary to the southeast.

2.2.3 Local Geology and Hydrogeology

A summary of subsurface soil stratigraphy is provided in the following paragraphs. The soil descriptions are based on the geotechnical investigation report (EXP, 2020). They are summarized for the hydrogeological interpretations. As such, the information provided in this section shall not be used for construction design purposes.

The detailed soil profiles encountered in each borehole and the results of moisture content determinations are presented on the attached borehole logs (Appendix B). The interpreted geology cross-section is presented in Figure 5. The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the Hydrogeological Investigation and shall not be interpreted as exact planes of geological change.

The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report. The following is a brief description of the soil conditions encountered during the investigation.

Based on the results of the geotechnical investigation, the general subsurface soil stratigraphy consists of the following units from top to bottom:

Pavement Structure

Boreholes BH-101, BH-103, and BH-104 were advanced through the existing paved surfaces of the parking areas and driving lanes, which was found to consist of approximately 50 to 75 mm of asphalt overlying approximately 140 to 200 mm of granular fill. The granular fill consisted of crushed limestone.

Topsoil

Surficial topsoil was encountered at the surface in Borehole BH-02, and was noted to have a thickness of approximately 175 mm. It is noted that topsoil thickness would vary throughout the Site.

Fill

A layer of fill was encountered below the pavement structure or topsoil in all borehole locations, extending to depths of 0.8 to 1.8 m. The fill consisted of silty sand with trace gravel, and with traces of rootlets and organic staining noted in Boreholes BH-01 and BH-02. The fill was reddish brown and in a moist state, with moisture contents ranging from 5 to 13 percent.

Sand

Native sand was encountered at all borehole locations below the fill, extending to depths ranging from 9.2 to 10.7 m below grade. The sand contained some silt and trace gravel, was brown, and was typically in a moist to wet state, with moisture contents of the stratum ranging from 5 to 21 percent. In Boreholes BH-01, BH-02, and BH-03, at depths of approximately 6.1 to 9.2 m, the sand became wet and was noted to exhibit flowing behaviour, with moisture contents as high as 21 percent. Wet, flowing sands inside the augers led to the cutting head seizing and the termination of Borehole BH-03 at a depth of 11.3 m. Based on SPT N values ranging from 1 to over 100 blows per 305 mm penetration, the sand is classified as very loose to very dense in compactness condition. In general, the sand is loose to very loose, becoming compact below 2.3 to 4.6 m, and dense to very dense below 3.1 to 7.6 m. One (1) grain size analysis was conducted on a selected sample from sand unit. A summary of laboratory test results is provided in Table 2-1 and the grain size distribution graphs are included in Appendix B

Table 2-1: Summary of Grain Size Analysis for Sand Unit

Sample	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-04 SS6	7	14	77	2

Silty Clay Till

Silt clay till was encountered at all borehole locations below the sand, extending to the borehole termination depths of 11.3 to 15.9 at Boreholes BH-01, BH-03, and BH-04 and to the till-shale complex at 20.0 m at Borehole BH-02. The silty clay till contained trace to some sand, with occasional gravel, was grey, and in a moist state, with moisture contents of the stratum ranging from 7 to 19 percent. SPT N values ranged from 21 to greater than 100 blows per 305 mm penetration. Based on estimated undrained shear strengths greater than 225 kPa as determined by pocket penetrometer measurements, the silty clay till is classified as hard in consistency. One (1) grain size analysis was conducted on a selected sample from silty clay till. A summary of laboratory test results is provided in Table 2-2 and the grain size distribution graphs are included in Appendix B.

Table 2-2: Summary of Grain Size Analysis for Silty Clay Till

Sample	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-01 SS11	31	53	13	3

Till-Shale Complex

The till-shale complex is defined as the transition zone between the till and the underlying weathered shale bedrock and frequently contains shale inclusions. The till-shale complex was encountered in Borehole BH-02 at a depth of 20 m between the silty clay till and shale bedrock. The till-shale complex was red and grey and in a damp state with a moisture content of 9 percent. Based on an SPT N value of 89 blows per 305 mm penetration and an estimated undrained shear strength of greater than 225 kPa, the stratum is classified as hard in consistency.

Bedrock

Sampling spoon refusal on the assumed bedrock surface was encountered in Borehole BH-02 at a depth of approximately 20.7 m below grade. The bedrock was then confirmed by coring to an approximate depth of 24.9 m.

The bedrock surface depth and rock quality are summarized in the following table.

Table 2-3: Summary of Depth and Top Elevation of Bedrock

Borehole No.	Depth of Bedrock Surface (m)	Elevation of Bedrock Surface (m)	Rock Quality Designation (RQD)	Unconfined Compressive Strength (MPa)
BH-02	20.7	77.8	60% - 96%	49 - 88

3 Results

3.1 Monitoring Well Details

As part of the EXP's Geotechnical Investigations, total of five (5) monitoring wells were installed across the Site. The details of monitoring network are as follows:

- Three (3) shallow wells, including BH/MW 2, BH/MW 3-S, and BH/MW 4 were installed to an approximate depth range from 6.9 to 7.4 mbgs;
- One deep well (BH/MW 3-D) was installed to an approximate depth of 10 mbgs;
- A pair of wells, including BH/MW 3-S and 3-D were installed in a nested configuration; and
- Each well was equipped with a 50-mm(2-inch) dimeter casing and a three (3) meter-long screen and with either flush mount or over ground protective casing.

Borehole logs and monitoring well installation details are provided in Appendix B. The monitoring well locations are shown on Figure 4.

3.2 Water Level Monitoring

As part of the Hydrogeological Investigation, static water levels in the monitoring wells were recorded in three (3) monitoring events, including August 21, 24 and September 3, 2020. A summary of all static water level data as it relates to the elevation survey is given in Table 3-1 below.

Table 3-1: Summary of Measured Groundwater Elevations

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)/ Down (-)	Approximate Full Well Depth (mbgs)*	Depth	21-Aug-20	24-Aug-20	3-Sep-20
BH/MW 02	98.47	0.67	6.93	mbgs	5.01	5.01	5.05
				masl	93.47	93.46	93.43
BH/MW 3-S	98.26	-0.09	7.15	mbgs	4.88	4.90	4.93
				masl	93.38	93.37	93.34
BH/MW 3-D	98.26	-0.11	10.27	mbgs	4.90	4.92	4.95
				masl	93.36	93.35	93.32
BH/MW 4	99.02	-0.16	7.46	mbgs	4.70	5.57	5.52
				masl	94.33	93.45	93.50

Notes:
mbgs: meters below ground surface
masl: meters above mean sea level
* Based on field measurements

The groundwater elevations recorded for the shallow wells ranged from 93.32 masl (4.93 mbgs at BH/MW 3-S on September 3, 2020) to 94.33 masl (4.70 mbgs at BH/MW 4 on August 21, 2020). The groundwater elevations recoded for the deep well (BH/MW 3-D) ranged from 93.32 masl (4.95 mbgs on September 23, 2020) to 93.36 masl (4.9 mbgs on August 21, 2020).

A map shows the groundwater contours for the shallow water-bearing zone for the Site (Figure 6). Accordingly, the groundwater flow directions in the shallow zone is interpreted to be southeast of the Site, towards Lake Ontario.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions. This may also affect the direction and rate of flow. It is recommended to conduct seasonal groundwater level measurements to provide more information on seasonal groundwater level fluctuations.

3.3 Hydraulic Conductivity Testing

3.3.1 Single Well Response Test

Three (3) Single Well Response Tests (SWRT's) were completed on monitoring wells BH/MW 2, BH/MW 3-S, and BH/MW 3-D on August 24, 2020. The tests were completed to estimate the saturated hydraulic conductivity (K) of the soils at the well screen depths.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT and constant rate test data as per Hvorslev's solution included in the AQTESOLV Pro. V.4.5 software package. The semi-log plots for normalized drawdown versus time are included in Appendix C. A summary of the hydraulic conductivity (K) values estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)*	Screen Interval (mbgs)		Soil Formation Screened **	Estimated Hydraulic Conductivity (m/s)
		from	to		
BH/MW 2	6.93	3.93	6.93	Sand	3.1E-5
BH/MW 3-S	7.15	4.15	7.15	Sand	1.2E-5
BH/MW 3-D	10.27	7.27	10.27	Sand	1.0E-5
				Highest Estimated K Value	3.1E-5
				Geometric Mean of Estimated K Values	1.6E-5

Notes:
mbgs: meters below ground surface
masl: meters above mean sea level
* Based on field measurements
** Based on the geotechnical borehole logs (EXP, 2020)

SWRTs provide K-estimates of the geological formation surrounding the well screens and may not be representative of bulk formation hydraulic conductivity. As shown in Table 3-2, the highest K-value of the tested water-bearing zone is 3.1 x 10^{-5} m/s, and the geometric mean of the K values is 1.6 x 10^{-5} m/s.

3.3.1 Grain Size Analysis

In addition to SWRT, the results of two (2) grain size distribution analysis of selected soil samples were utilized to evaluate the bulk hydraulic conductivities of soil zones. In Breyer's method, the effective grain diameter of d_{10} and d_{60} of each of the selected soil samples used to estimate the K-values of each selected soil samples. In Kaubisch's approach, the grain-size distribution percentage of the soil grains with less than 0.02 mm in diameter in the selected soil sample is used to estimate the corresponding

hydraulic conductivity. Appendix B presents the results of the grain size distribution analysis. A summary of the hydraulic conductivity (K) estimates using soil grain size analysis is presented in Table 3-3 below.

3-3 Summary of Bulk Hydraulic Conductivities Based on Grain Size Distribution

Borehole and Selected Soil Sample IDs	Approximate Sample Depth (mbgs)	Soil Description	Estimated Hydraulic Conductivity (m/s)	Method of Analysis
BH-01 (SS 11)	12.2 – 12.73	Silty Clay	$< 1.0 \times 10^{-9}$	Kaubisch
BH-04 (SS 6)	4.57 – 5.18	Sand	$2.3x\ 10^{-6}$	Breyer

Notes:
mbgs: meters below ground surface

3.4 Groundwater Quality

To assess the suitability for discharging pumped groundwater into the sewers owned by the Regional Municipality of Halton and/or the City of Burlington during dewatering activities, one (1) groundwater sample was collected from monitoring well BH/MW 3-D on August 24, 2020, using a peristaltic pump. Prior to the collection of noted water sample, approximately three (3) standing well volumes of groundwater were purged from the noted well. The samples were collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted for analysis to Bureau Veritas Laboratory, a CALA certified independent laboratory in Mississauga, Ontario. Analytical results are provided in Appendix D.

Table 3-4: Summary of Analytical Results

Parameter	Units	Regional Municipality of Halton and/or the City of Burlington Sanitary and Combined Sewer Discharge Limit	City of Burlington Storm Sewer Discharge Limit	Concentration BH/MW 3-D
				August 24, 2020
Total Suspended Solids (TSS)	mg/L	350	15	**46**
Total Manganese (Mn)	mg/L	5	0.05	**0.57**

Notes:
Bold – Exceeds the City of Burlington's Storm Sewer Discharge Limit (Table 2)

When compared the analytical results to the Regional Municipality of Halton's Sanitary Combined Sewer's criteria, the concentrations of all tested parameters comply with the applicable guidelines.

When comparing the chemistry of the collected groundwater samples to the City of Burlington's Storm Sewer Discharge Criteria, the concentration of the Total Suspended Solids (TSS) and Total Manganese exceeded the applicable criteria.

Reporting detection limits (RDLs) were below the Sewer Use By-Law parameter criteria of Table 1.

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

As noted above, the water quality test results meet Halton Sanitary and Combined Sewer Discharge Criteria. However, the Region of Halton communicated that it does not accept groundwater discharge to their municipal sanitary sewer system. Therefore, the quantity and quality of any groundwater discharged to the municipal storm sewer is to be coordinated with the stormwater management design for the Site to meet the City of Burlington's Sewer Use By-Law parameters.

For the long-term dewatering discharge to the storm sewer system (post-development phase) and based on the water quality test results, the water is unsuitable to be discharged without a treatment system. The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase, as required by the City.

An agreement to discharge into the sewers owned by the Regional Municipality of Halton and/or the City of Burlington and/or the City of Burlington will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

4 Construction Dewatering Assessment

To estimate the groundwater flow rates to the proposed excavation area a numerical method using MODFLOW-NWT was utilized. It is devised for Modflow-2005 modular encoded in Visual MODFLOW Classic, Premium Version.2011.1 software, which is developed by Waterloo Hydrogeologic. MODFLOW-2005 (Harbaugh, 2005) is an industry standard software for creating three-dimensional (3D) groundwater flow and contaminant transport models using a block-centered finite difference mathematical approach (FDM). MODFLOW-NWT is based on Newton-Raphson formulation which is developed for simulating unconfined groundwater flow by rectifying the errors associated with drying and rewetting processes.

Numerical modeling results are provided in Figures 4-1 and 4-2 in this section as well as Appendix E of this report.

4.1 Construction Dewatering Assumptions

It is our understanding that the proposed development is anticipated to consist of a mixed-use six (6) storey building with two (2) levels of underground parking. Table 4-1 presents the assumptions used to calculate the dewatering rate for the Site. The architectural drawing is provided in Appendix F.

Table 4-1 Dewatering Estimate Assumptions

Input Parameter		Assumption	Units	Notes
Ground Surface Elevation		99.02	masl	Approximate average ground surface elevation at the Site based on the borehole logs
Groundwater elevation		95.33	masl	The highest recorded groundwater elevation measured at BH/MW 4 (4.7 mbgs on August 21, 2020) plus 1 meter to account for some seasonal fluctuation
Lowest Top of Slab Elevation		93.02	masl	Based on the architectural drawings, it is set at 6 mbgs (SRM ,2021)
Lowest Foundation Elevation		91.52	masl	Assumed to be 1.5 m below the lowest slab elevation
Dewatering Target Elevation	Short-Term	90.52	masl	Assumed to be approximately 1.0 m below the lowest foundation elevation
	Long-Term	92.52		Assumed to be 0.5 m below the top of the slab elevation
Bottom Elevation of Aquifer		89	masl	Average bottom elevation of sandy aquifer
Bottom Elevation of the Model		73.5	masl	Assumed to be the lowest drilling elevation into the bedrock
Excavation Area (Length x Width)		3,016 (58 x 52)	m^2 (m x m)	Approximate area (length x width) of Site for the proposed development
Hydraulic Conductivity (K)		3.1×10^{-5} 1.0×10^{-7} 5.5×10^{-7} 1.0×10^{-8}	m/s	Highest K-value for overburden Assumed K-value for silty clay Assumed K-value for fractured bedrock Assumed K-value for sound bedrock

Input Parameter	Assumption	Units	Notes
Specific Yield	0.2 0.09 0.2 0.09	1	Assumed for sand Assumed for silty clay Assumed for fractured bedrock Assumed for sound bedrock

4.2 Stormwater

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Therefore, the dewatering rates at the Site should also include removing stormwater from the excavation. The estimated volume of direct precipitation to be collected in the excavation during the construction dewatering phase is provided in Table 4-2 below.

Table 4-2 Rain Collection Volume per Event

Location	Excavation Area A (m^2)	Precipitation Event P (mm/day)	Rain Collection Volume R= (A x P) / 1000 (m^3/day)
Site Extent	3,016	15	45.24

The estimate of stormwater only includes direct precipitation into the excavation. The dimensions of the excavation are considered in the dewatering calculations. Runoff from outside of the excavation's footprint is excluded and it should be directed away from the excavation.

During precipitation events greater than 15 mm (e.g., 100-year storm), measures should be taken by the contractor to retain stormwater onsite in a safe manner to not exceed the allowable water taking and discharge limits, as necessary. A two (2) and a one hundred (100) year storm event over a 24-hour period are 56 and 121.6 mm, respectively, which would correspond to 169 and 367 m^3 of water from direct precipitation on the Site, respectively.

4.3 Results of Construction Dewatering Rate Estimate

Based on the assumptions provided in this report, the estimated (transient) zone of influence, and the resulting transient dewatering rates are provided in Table 4-3 and Table 4-4, respectively.

Table 4-3 Summary of Zone of Influence from the Sides of Proposed Excavation

Location	Zone of Influence (Rounded-Up) (m)
	Two Years (730 Days)
Excavation Area (without cut-off walls)	400

Table 4-4 Summary of Dewatering Flow Rate Estimates

Location	Simulation Time (Days)	Peak Dewatering Flow Rate (Rounded-Up) (m^3/day)			
		Dewatering Rate Without Safety Factor	**With Stormwater, excluding Safety Factor**	**With Safety Factor, excluding Stormwater**	**With Stormwater and Safety Factor of 1.5 (rounded)**
Excavation Area	15	354	399	531	576
	365	146	191	219	264
	730	128	173	192	237

Figure 4-1: Three (3) Dimensional View of Construction Dewatering using Numerical Model

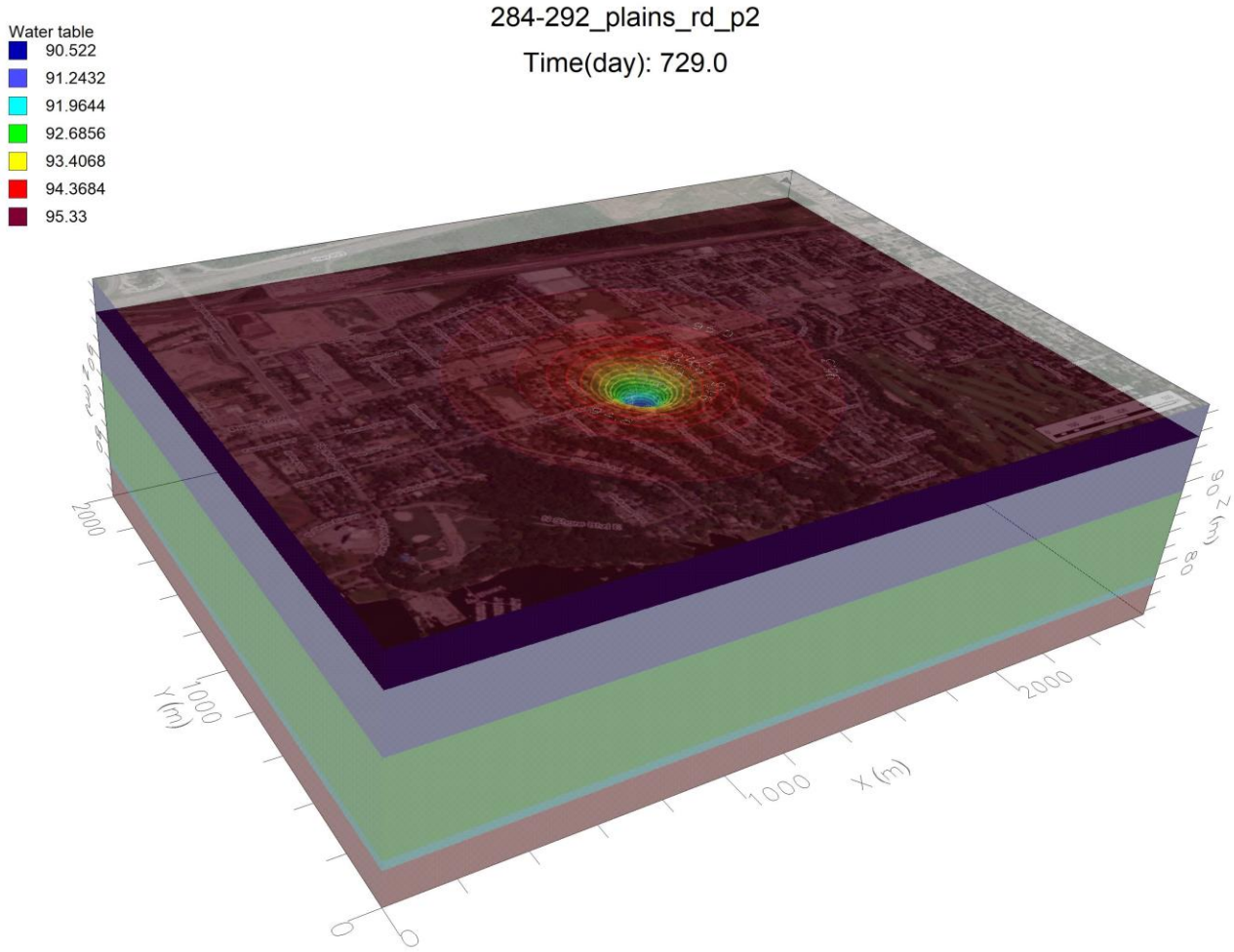
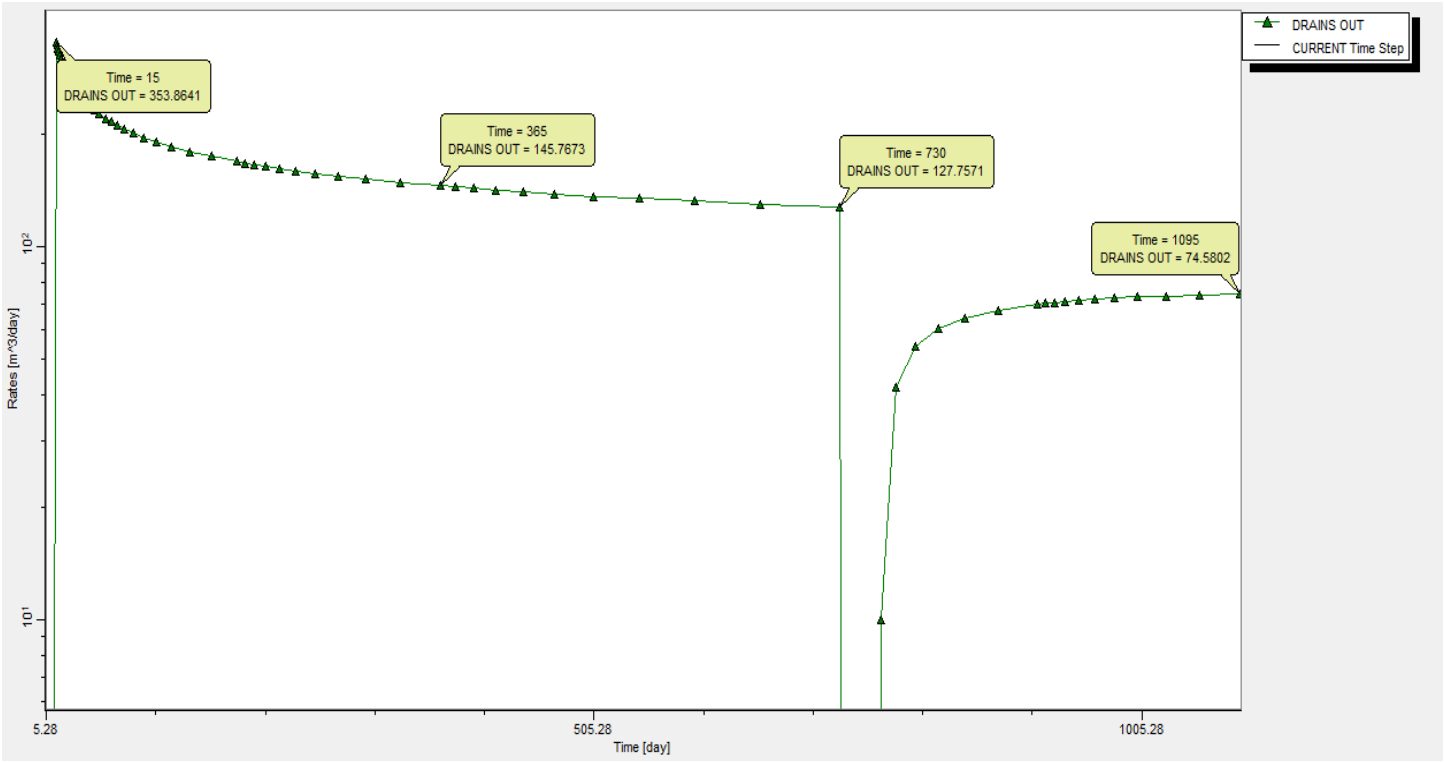


Figure 4-2: Flow Rate Estimates versus Time using Numerical Modeling



The estimates for construction dewatering flow rates are provided in Appendix E. This peak dewatering flow rates does not account for flow from utility beddings and variations in hydrogeological properties beyond those encountered during this investigation.

For this assessment, it was assumed that the proposed construction plans include an excavation with shoring extending to the Site boundaries. EXP should be retained to review the assumptions outlined in this section, should the proposed shoring design change.

Pits (elevator, sump pits) are assumed to have the same excavation depth and dewatering target as the main excavation; deeper pits may require localized dewatering and revised dewatering estimates.

Local dewatering may be required for pits (elevator pits, sump pits) if they extend deeper than the dewatering target. Local dewatering is not considered to be part of this assessment. Dewatering estimates should be reviewed once the pit dimensions are available.

All grading around the perimeter of the Site should be graded away from the shoring the systems. The dewatering assumptions are based on using shoring system without open cuts.

The maximum flow estimate calculated with a high K value, provides a conservative estimate to account for higher than expected flow rates during the construction dewatering.

If caisson walls are installed, they should be designed for full hydrostatic pressure for shallow and deep water levels, without dewatering on the outside. Soldier pile and lagging and caisson wall systems should be designed to account for shallow groundwater conditions and take into consideration that dewatering systems may not provide fully dewatered conditions.

If caisson walls are used for decreasing long-term dewatering rates, these should be designed as permanent structures to allow for groundwater cutoff in the long-term. All perforations should be sealed permanently (ex: tiebacks, breaches and cold joints) with no leakages and inspected. Fillers should extend into low permeability deposits (ex: sound bedrock or till) to cutoff groundwater from water bearing zones. Inspections should be conducted to confirm depth of low permeability deposits along shoring system and that fillers are keyed into low permeability soil deposits.

All grading around the perimeter of the construction Site should be graded away from the shoring the system.

The contractor is responsible to ensure that dry conditions are always maintained within the excavation at all costs.

4.4 Construction MECP Water Taking Permit

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is more than 50 m^3/day but less than 400 m^3/day, then an online registration in the Environmental Activity and Sector Registry (EASR) with the MECP will be required. If groundwater dewatering rates onsite exceed 400 m^3/day, a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

As of July 1, 2021, an amendment of O. Reg. 63/16 has come into effect replaced the current subsection 7 (5) such that the water taking limit of 400,000 L/day would apply to takings of groundwater only for each area of influence for each dewatered work area.

It is recognized that the maximum flow estimate calculated with a high K-value, provides a conservative estimate to account for higher-than-expected flow rates during construction dewatering. The dewatering estimates including a safety factor and excluding precipitation is stated below. The MECP construction dewatering rate excludes the precipitation amount and is the rate used for the permit application. Based on the MECP construction dewatering a Category 3 PTTW will required to facilitate the construction dewatering program of the Site.

Table 4-5: MECP Construction Dewatering Flow Rate

Scenario	Flow Rate (L/day
MECP Construction Dewatering Flow Rate **with Safety Factor** of 1.5 (Excluding rainwater collection)	531,000

A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. Monitoring of both water quantity, water quality, and daily precipitation must be carried out for the entire duration of the construction dewatering phase. During this phase, the Discharge Plan and the daily water taking records must be available onsite. The PTTW, Discharge Plan, monitoring data, hydrogeological investigation report, and geotechnical assessment of settlements must also be available at the construction Site during the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design, since the PTTW will need to be updated to reflect these modifications. Altogether, the hydrogeological report, PTTW, Discharge Plan and geotechnical assessment constitute the Water Taking Plan which needs to be available onsite during the construction dewatering.

5 Sub-Drain Discharge Estimate

To estimate the groundwater flow rates to the proposed excavation area a numerical method using MODFLOW-NWT was utilized. It is devised for Modflow-2005 modular encoded in Visual MODFLOW Classic, Premium Version.2011.1 software, which is developed by Waterloo Hydrogeologic. MODFLOW-2005 (Harbaugh, 2005) is an industry standard software for creating three-dimensional (3D) groundwater flow and contaminant transport models using a block-centered finite difference mathematical approach (FDM). MODFLOW-NWT is based on Newton-Raphson formulation which is developed for simulating unconfined groundwater flow by rectifying the errors associated with drying and rewetting processes.

Numerical modeling results are provided in Appendix E of this report.

5.1 Long-Term Dewatering Assumptions

It is our understanding that the development plan includes permanent drainage of the foundation with a sub-drain system that will ultimately discharge to the municipal sewer system, if conventional footings are installed. A summary of assumptions for dewatering estimates is provided in Table 4-1; however, the lowest dewatering target for post-construction is assumed to be 0.5 meter below the lowest top slab elevation.

5.2 Sub-Drain Flow Rate Estimate

Based on the assumptions provided in this report, the preliminary sub-drain discharge volume estimates are presented in Table 5-1. This estimate is an indication of average discharge volumes. Seasonal and daily fluctuations are expected. These estimates may be affected by hydrogeological conditions beyond those encountered at the time this preliminary investigation was made, including fluctuations in groundwater regimes, surrounding Site alterations, and existing and future infrastructures.

Table 5-1 Summary of Long-Term Discharge Flow Rate (after 3 years)

Flow Rate	Long-Term Peak Flow Rate with Factor Safety of 1.5 (m^3/day) (rounded)	Notes
Flow into Sub-drain without caisson wall	112	High Hydraulic Conductivity scenario

Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. A safety factor was applied to the flow rate to accommodate the variability in seasonal water level fluctuations.

Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. A safety factor was applied to the flow rate to account for water level fluctuations due to seasonal changes.

These estimates assume that pits (elevator, sump pits) are made as watertight structures (without drainage) if their depths extend below the dewatering target, as previously stated. The dewatering assumptions are based on using shoring system without open cuts. It is noted that open cuts can act as preferential groundwater pathways in the long term and cause foundation drainage volumes to increase.

If caisson walls are used for decreasing long-term dewatering rates, these should be designed as permanent structures to allow for groundwater cutoff in the long-term. All perforations should be sealed permanently (ex: tiebacks, breaches and cold joints)

with no leakages and inspected. Fillers should extend into low permeability deposits (ex: sound bedrock or till) to cutoff groundwater from water bearing zones. Inspections should be conducted to confirm the depth of low permeability deposits along shoring system and that the fillers are keyed into low permeability soil deposits.

The sub-drain rate estimate is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this investigation may significantly influence the sub-drain discharge volumes. It is recommended that once the sub-drain system is in place, that a flow meter be installed at the sump(s) to record daily discharge volumes during the commissioning stage of the system.

5.3 Post-Development MECP Water Taking Permit

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is more than 50 m^3/day, then an application for a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

It is recognized that the maximum flow rate calculated with a high K-value, provides a conservative estimate to account for higher-than-expected flow rates during the post-development dewatering. Based on the dewatering estimate of approximately 112 m^3/day for this project, a Category 3 Permit to Take Water (PTTW) will be required to facilitate the post-development phase.

6 Environmental Impact

6.1 Surface Water Features

The Site is within the Lake Ontario watershed. No surface water features exist onsite. The nearest surface water feature is an unnamed creek, approximately 317 meters southeast of the Site boundary. Lake Ontario is approximately 1 (one) kilometer from the Site boundary to the southeast.

Due to the extent of zone of influence up to 417 m, it is likely the unnamed creek on the southeast to be impacted during the construction dewatering phase. As such, it is recommended that the water levels, water quality and quantity of the noted creek be monitored during the construction operation.

6.2 Groundwater Sources

Well Records from the MECP Water Well Record (WWR) Database were reviewed to determine the presence and number of water supply wells within a 500 m radius of the Site boundaries. Given that the dewatering zone of influence is large, a dewatering related impact on the water supply well in the area is likely. As such, it is recommended that the water quality and quantity of the noted water supply well be monitored during the construction operation

6.3 Geotechnical Considerations

As per the MECP technical requirement for PTTW and EASRs, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence, etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities, etc.).

A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.

6.4 Groundwater Quality

It is our understanding that the potential effluent from the dewatering system during the construction will be released to the municipal sewer system. As such, the quality of groundwater discharge is required to conform the Regional Municipality of Halton and/or the City of Burlington Sewer Use By-Law.

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

The water quality test results meet Halton Sanitary and Combined Sewer Discharge Criteria. However, the Region of Halton communicated that it does not accept groundwater discharge to their municipal sanitary sewer system. Therefore, the quantity and quality of any groundwater discharged to the municipal storm sewer is to be coordinated with the stormwater management design for the Site to meet the City of Burlington's Sewer Use By-Law parameters.

For the long-term dewatering discharge to the storm sewer system (post-development phase), and based on the water quality test results, the water is unsuitable to be released without a treatment system.

Dewatering (short and long-term) may induce migration of contaminants within the zone of influence and beyond due to changing hydraulic gradients, hydrogeological conditions beyond Site boundaries and preferential pathways in utility beddings etc. The water quality sampling conducted as part of this assessment was performed under static conditions. As a result,

monitoring may be required during dewatering activities (short and long-term) to monitor potential migration, and this should be performed more frequently during early dewatering stages.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase as required by the City.

An agreement to discharge into the sewers owned by the Regional Municipality of Halton and/or the City of Burlington and/or the City of Burlington will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

6.5 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

7 Conclusions and Recommendations

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

- When compared the analytical results to the Regional Municipality of Halton's Sanitary Combined Sewer's criteria, the concentrations of all tested parameters comply with the applicable guidelines.
- When comparing the chemistry of the collected groundwater samples to the City of Burlington's Storm Sewer Discharge Criteria, the concentration of the Total Suspended Solids (TSS) and Total Manganese exceeded the applicable criteria.
- Based on the assumptions outlined in this report, the estimated peak dewatering rate for proposed construction activities is approximately 576,000 L/day. This is the rate which will be required to be discharged to the municipal sewer system.
- Based on the assumptions outlined in this report, the estimated peak dewatering pumping rate for proposed construction activities is approximately 531 m^3/day. As the dewatering flow rate estimate is greater than 400 m^3/day, a Category 3 PTTW will be required to facilitate the construction dewatering program for the Site.
- The long-term flow rate of the foundation sub-drain is estimated to be approximately 112 m^3/day. It is recommended that once the sub-drain system is in place, a flow meter be installed at the sump(s) to record daily discharge volumes during the commissioning stage of the system. Regular maintenance/cleaning of the sub-drain system is recommended to ensure its proper operation. A PTTW will be required for long-term discharge.
- The construction dewatering and long-term estimate of sub-drain discharge volumes is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this preliminary investigation may significantly influence the discharge volumes.
- For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.
- The Region of Halton does not allow for long-term dewatering discharge to the sanitary sewer system.
- For the long-term dewatering discharge to the sanitary sewer system (post-development phase) and based on the water quality test results, the water is suitable to be discharged without a treatment system.
- As per the MECP technical requirement for PTTW and EASRs, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities etc.). A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.
- An agreement to discharge into the sewers owned by the Regional Municipality of Halton and/or the City of Burlington will be required prior to releasing dewatering effluent.
- The PTTW registration allows construction dewatering discharge of greater than 400,000 L/day. A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. The Discharge Plan and monitoring for both water quantity and water quality must be carried at the Site during the entire construction dewatering phase. The daily water taking records must be maintained onsite for the entire construction dewatering phase. The PTTW, Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must always also be available at the construction Site for the entire construction dewatering. EXP should

be notified immediately about any changes to the construction dewatering schedule or design, since EASR will need to be updated to reflect these modifications. The hydrogeological report, PTTW, Discharge Plan and geotechnical assessment constitutes the Water Taking Plan which needs to be available onsite for the duration of construction dewatering

- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

The conclusions and recommendations provided above should be reviewed in conjunction with the entirety of the report. They assume that the present design concept described throughout the report will proceed to construction. This report is solely intended for the construction and long-term dewatering assessments. Any changes to the design concept may result in a modification to the recommendations provided in this report.

8 Limitations

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

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

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

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

Sincerely,

EXP Services Inc.



Peyman Sayyah, M.Sc., P.Geo
Senior Hydrogeologist
Environmental Services



Francois Chartier, M.Sc., P.Geo.
Senior Hydrogeologist
Environmental Services

9 References

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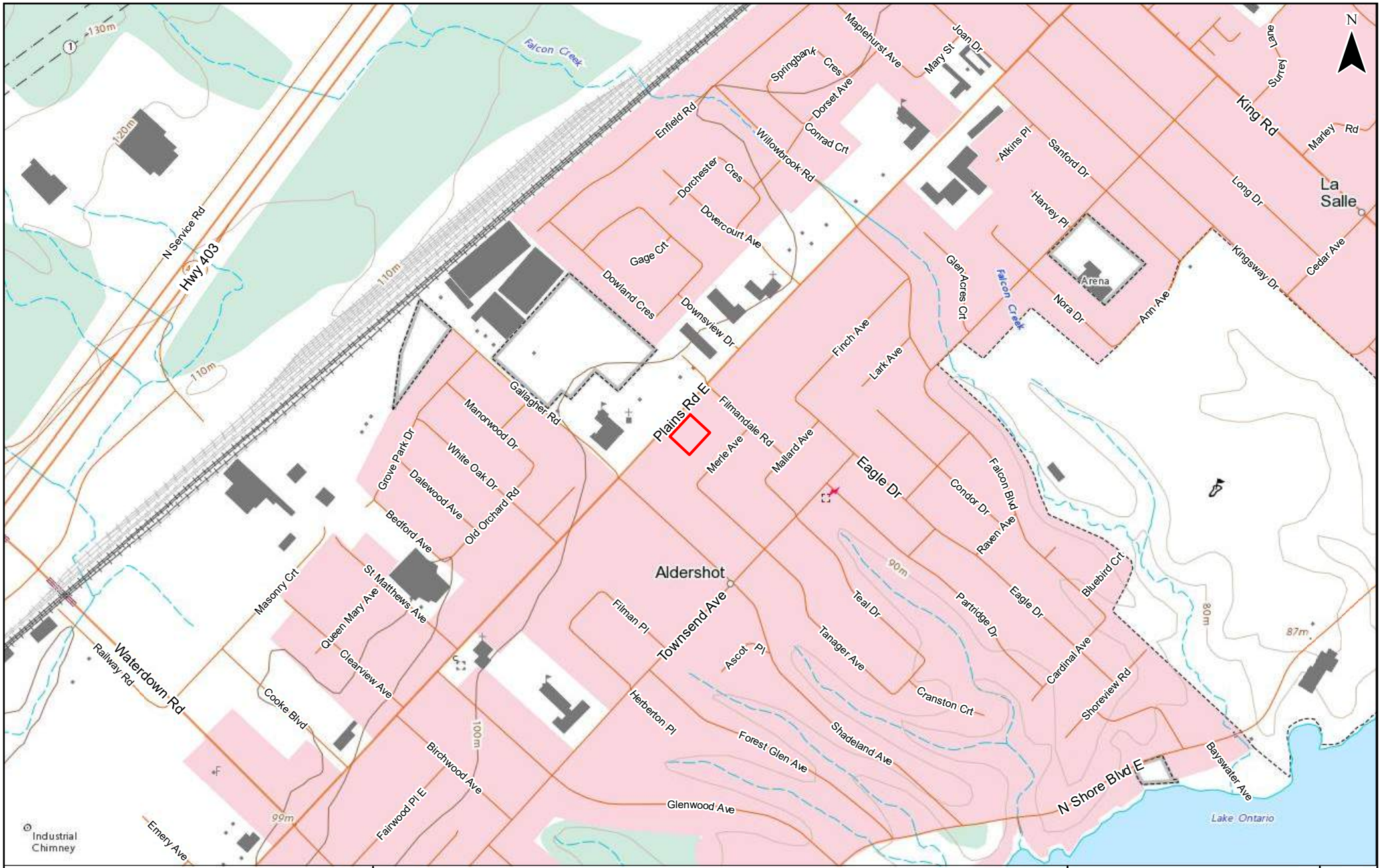
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Figures



SCALE:

0 100 200 300 400 500 m

LEGEND:

APPROXIMATE SITE BOUNDARY

SITE LOCATION PLAN

FIGURE: 1

HYDROGEOLOGICAL INVESTIGATION
284 -292 PLAINS ROAD EAST
BURLINGTON, ONTARIO

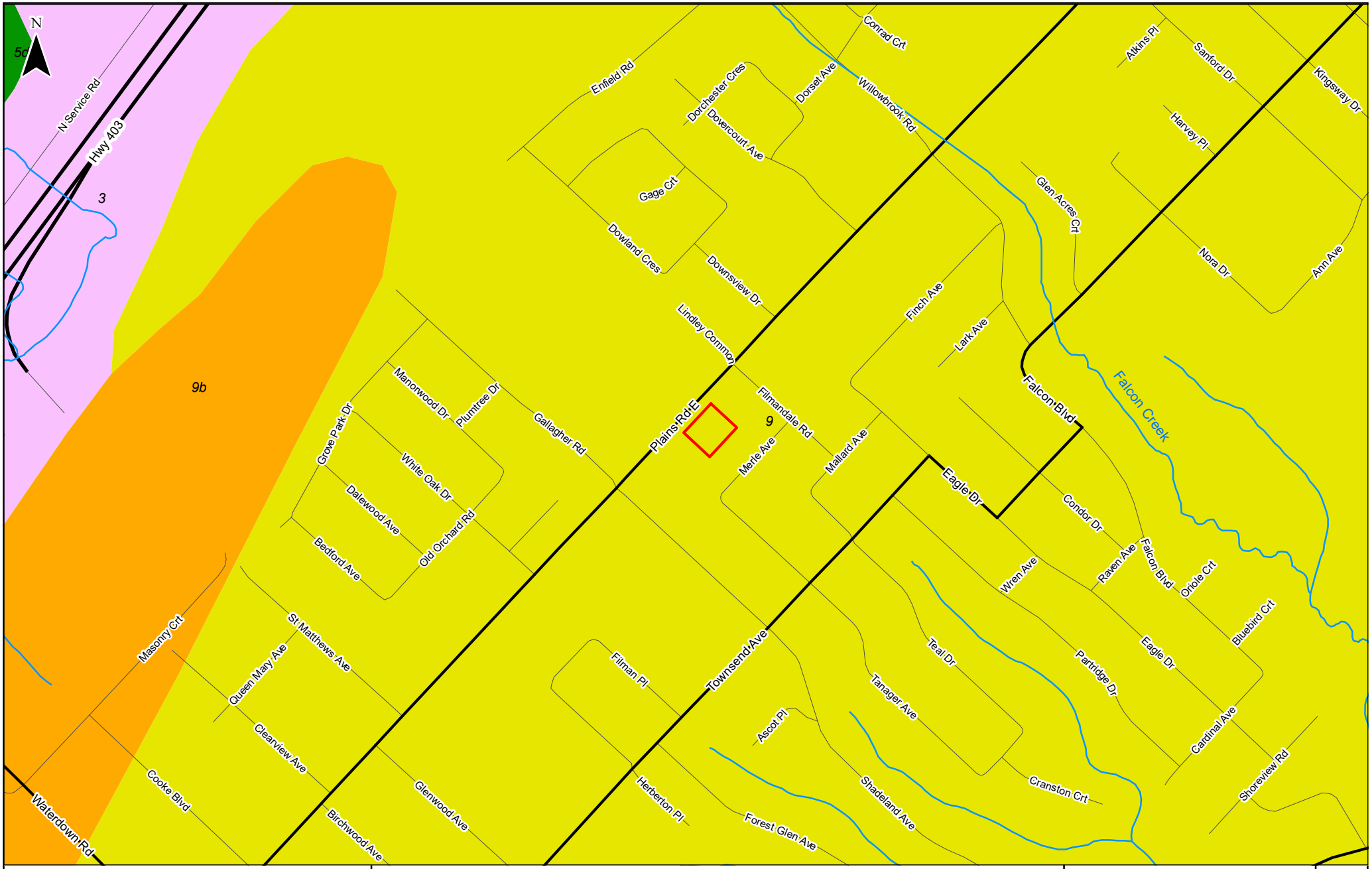
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DRAWN BY: AC

CHECKED BY: PS

PROJECT NUMBER: BRM-00258353-A0

DATE: AUGUST 2020



SCALE:

0 100 200 300 400 500 m

SOURCE:

BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2010

exp.

DRAWN BY:	CHECKED BY:
AC	PS

LEGEND:

- APPROXIMATE SITE BOUNDARY
- 9: COARSE-TEXTURED GLACIOLACUSTRINE DEPOSITS
- 9B: COARSE-TEXTURED GLACIOLACUSTRINE DEPOSITS (LITTORAL-FORESHORE DEPOSITS)
- 5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL
- 3: PALEOZOIC BEDROCK

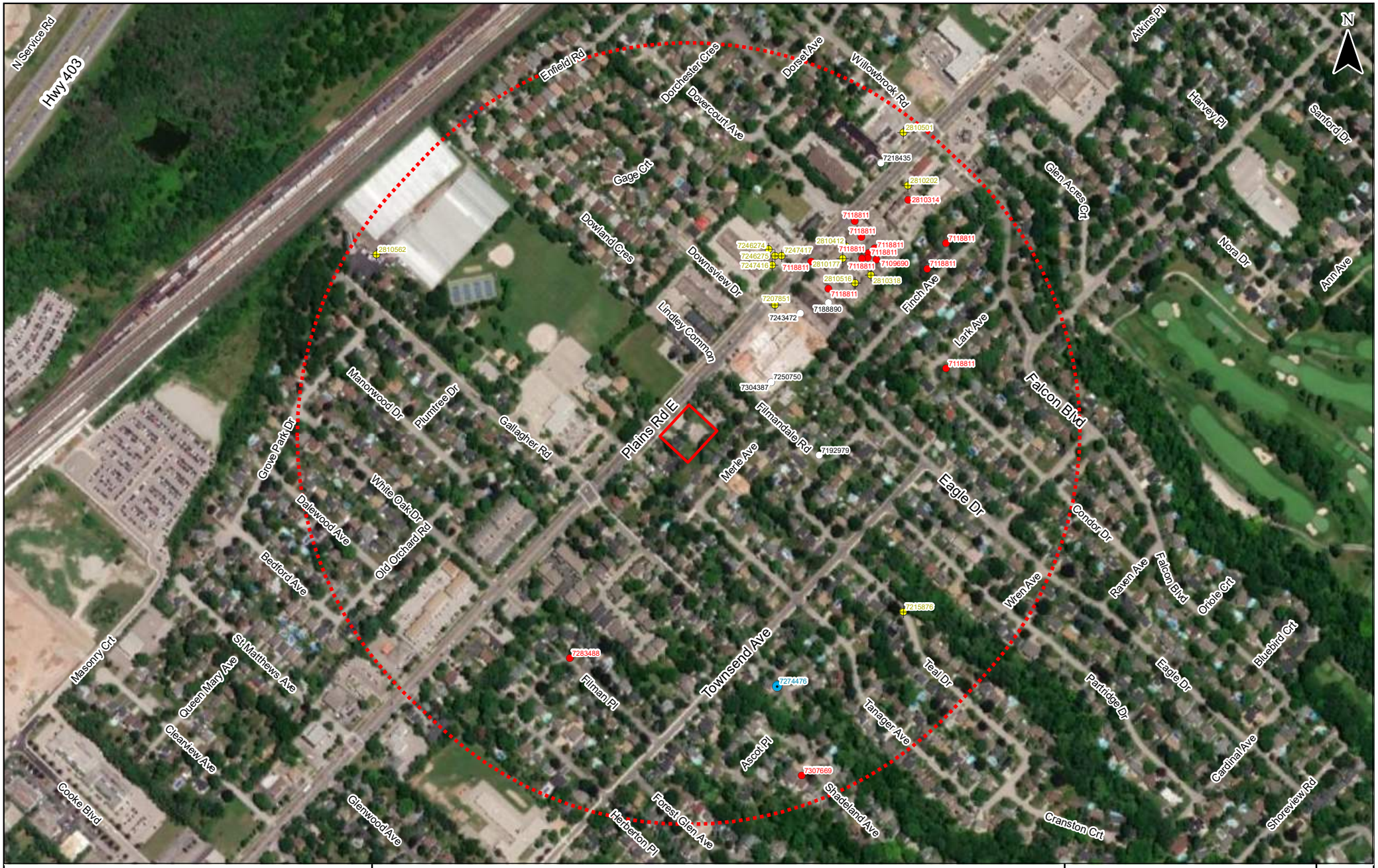
SURFICIAL GEOLOGY

FIGURE: 2

HYDROGEOLOGICAL INVESTIGATION
284 - 292 PLAINS ROAD EAST
BURLINGTON, ONTARIO

PROJECT NUMBER: BRM-00258353-A0

DATE: AUGUST 2020



SCALE:
0 80 160 240 320 400 m

SOURCE:
BASED ON GOOGLE EARTH IMAGERY DATED 2018,
AVAILABLE WELL RECORD INFORMATION AS OF SEPTEMBER 2019

exp.

DRAWN BY:	CHECKED BY:
AC	PS

LEGEND:

- MONITORING WELL / TEST HOLE
- WATER SUPPLY WELL
- ABANDONED WELL
- UNCLASSIFIED / UNFINISHED WELL
- APPROXIMATE SITE BOUNDARY
- 500 m ZONE

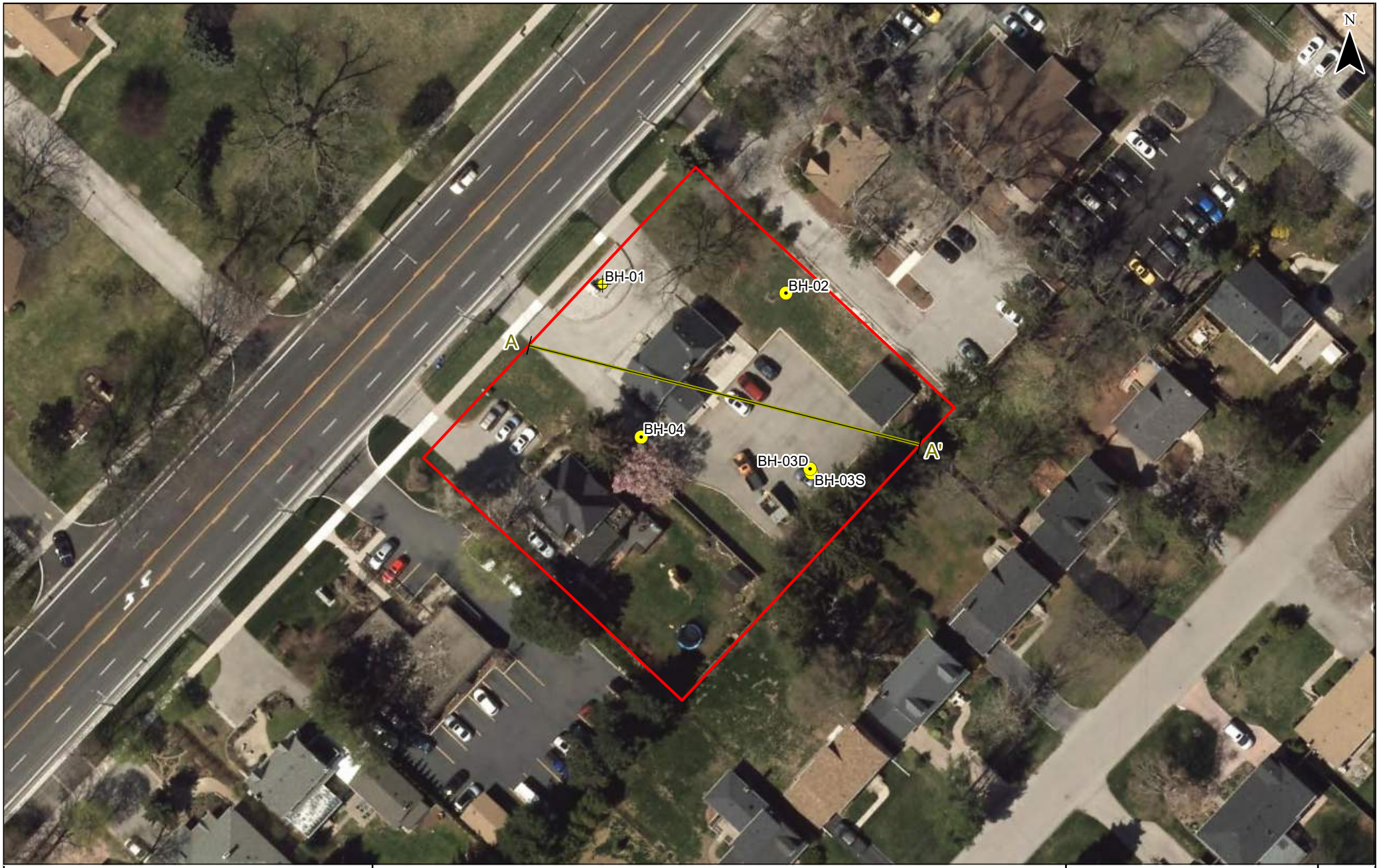
MECP WATER WELL RECORDS MAP

FIGURE: 3

HYDROGEOLOGICAL INVESTIGATION
284 - 292 PLAINS ROAD EAST
BURLINGTON, ONTARIO

PROJECT NUMBER: BRM-00258353-A0

DATE: AUGUST 2020



SCALE:

0 10 20 30 40 50 m

LEGEND:

- BOREHOLE
- BOREHOLE / MONITORING WELL
- CROSS SECTION AXIS
- APPROXIMATE SITE BOUNDARY

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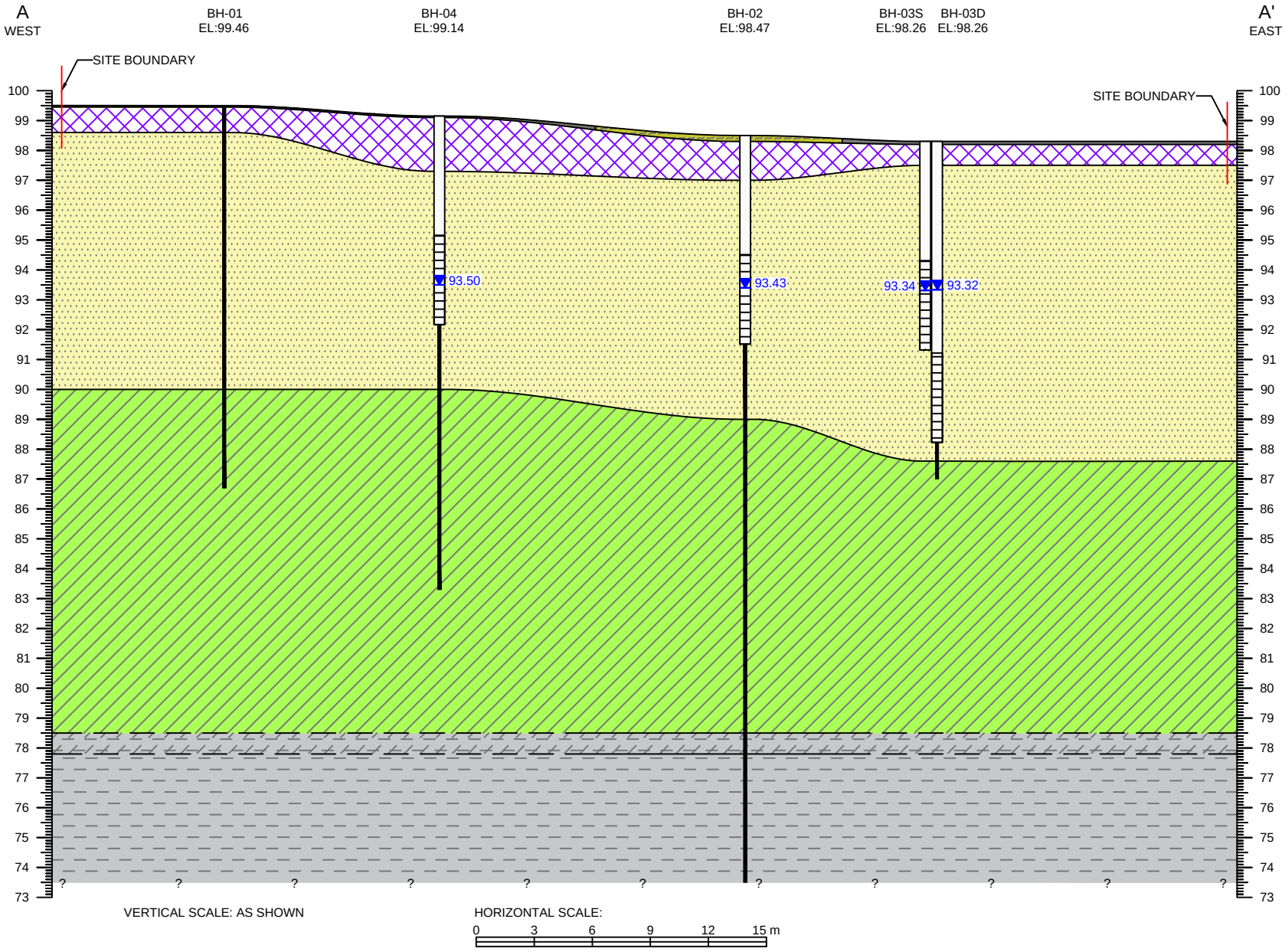
BOREHOLE / MONITORING WELL LOCATION PLAN

FIGURE: 4

HYDROGEOLOGICAL INVESTIGATION
284 -292 PLAINS ROAD EAST
BURLINGTON, ONTARIO

PROJECT NUMBER: BRM-00258353-A0

DATE: AUGUST 2020



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LEGEND:

- TOPSOIL
- ASPHALT
- FILL
- SAND
- SILTY CLAY TILL
- TILL-SHALE COMPLEX
- SHALE BEDROCK
- GROUNDWATER ELEVATION (masl) AS MEASURED ON SEPTEMBER 3, 2020

TITLE AND LOCATION:

CROSS SECTION A-A'

HYDROGEOLOGICAL INVESTIGATION
284-292 PLAINS ROAD EAST
BURLINGTON, ONTARIO

PROJECT NO.:	DWN.:
BRM-0025853-A0	JA
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
SEPTEMBER 2020	5

X:\258000\258300\258353\258353A\HG Investigation\September 2020\BRM-0025853-A0.dwg



SCALE:

0 10 20 30 40 50 m

LEGEND:

- BOREHOLE / MONITORING WELL
- XX.XX GROUNDWATER ELEVATION (m asl) AS MEASURED ON SEPTEMBER 3, 2020
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	PS

GROUNDWATER CONTOUR PLAN

FIGURE: 6

HYDROGEOLOGICAL INVESTIGATION
284 -292 PLAINS ROAD EAST
BURLINGTON, ONTARIO

PROJECT NUMBER: BRM-00258353-A0

DATE: SEPTEMBER 2020

Appendix A – MECP WWR Summary Table

Off-Site															
BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m asl)	LOCATION ACCURACY	STREET	CITY	DISTANCE FROM SITE CENTROID (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
11319132	2810177	2/24/2005	594046	4796536	97.5	margin of error : 30 m - 100 m	380 PLAINS RD E	BURLINGTON	322	Boring	5.2	3.6	5.1			Observation Wells
11319273	2810318	7/19/2005	594085	4796513	97.0	margin of error : 30 m - 100 m	380 PLAINS RD E	BURLINGTON	333	Boring	6.0	4.5	5.1			Observation Wells
11319367	2810412	6/3/2005	594051	4796553	97.6	margin of error : 30 m - 100 m	380 PLAINS RD E	BURLINGTON	338	Boring	6.0	4.5	5.1			Observation Wells
11552411	2810501	2/12/2006	594130	4796710	98.0	margin of error : 10 - 30 m	380 PLAINS RD E	BURLINGTON	511	Boring	6.6	4.5	5.1			Observation Wells
11552472	2810562	6/16/2006	593403	4796542	105.2	margin of error : 10 - 30 m		BURLINGTON	497	Boring	6.1	4.0	5.0	Not Used		Observation Wells
1004565741	7207851	1/13/2013	593953	4796472	99.0	margin of error : 100 m - 300 m	348 PLAMS RD. E.	Burlington	214	Boring	7.6		4.6	Monitoring		Observation Wells
1004704433	7215876	10/1/2013	594130	4796048	92.1	margin of error : 30 m - 100 m	TOWNSENO AVENUE	Burlington	385	Rotary (Convent.)	6.7		5.1	Monitoring and Test Hole		Test Hole
11319157	2810202	3/17/2005	594136	4796637	97.5	margin of error : 30 m - 100 m	402 PLAINS RD E	BURLINGTON	457	Boring	5.5		5.0	Not Used		Test Hole
11552426	2810516	10/4/2005	594063	4796502	97.3	margin of error : 10 - 30 m	380 PLAINS RD EAST	BURLINGTON	310	Other Method	6.7		5.1			Observation Wells
11319269	2810314	6/16/2005	594137	4796617	97.2	margin of error : 30 m - 100 m	396-402 PLAINS RD E	BURLINGTON	443	Boring		4.5	5.0	Not Used		Abandoned-Other
1001726489	7109690	6/16/2008	594093	4796535	96.9	margin of error : 10 - 30 m	380 PLAINS RD EAST	Burlington	354		4.3					Abandoned-Other
1005550348	7246274	7/14/2015	593944	4796549	98.9	margin of error : 30 m - 100 m	355 PLAINS RD E	Burlington	278	Boring	6.1			Monitoring		Observation Wells
1005550351	7246275	7/14/2015	593953	4796540	98.7	margin of error : 30 m - 100 m	355 PLAINS RD E	Burlington	274	Boring	6.1			Monitoring		Observation Wells
1005657072	7247416	8/5/2015	593949	4796527	98.7	margin of error : 30 m - 100 m	355 PLAINS RD. E	BRLINGTON	260	Boring	7.6			Monitoring		Observation Wells
1005657075	7247417	8/5/2015	593962	4796540	98.6	margin of error : 30 m - 100 m	355 PLAINS RD. E	BURLINGTON	278	Boring	6.7			Monitoring		Observation Wells
1001980227	7118811	5/20/2008	594090	4796550	97.1	margin of error : 30 m - 100 m	380 PLAINS RD E	Burlington	362	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594082	4796544	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	352	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594063	4796588	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	373	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594072	4796566	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	362	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594003	4796532	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	292	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594081	4796537	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	347	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594189	4796557	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	442	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594163	4796522	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	401	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594073	4796536	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	340	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594189	4796384	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	367	Boring				Monitoring		Abandoned-Other
1001980227	7118811	5/20/2008	594027	4796494	97.1	margin of error : 10 - 30 m	380 PLAINS RD E	Burlington	278	Boring				Monitoring		Abandoned-Other
1004198201	7188890	5/18/2012	594027	4796475	98.0	margin of error : 30 m - 100 m			265							
1004216240	7192979	7/18/2012	594014	4796264	96.5	margin of error : 30 m - 100 m			183							
1004725906	7218435	3/10/2014	594099	4796668	98.1	margin of error : 30 m - 100 m			459							
1005439091	7243472	1/22/2015	593988	4796460	98.6	margin of error : 30 m - 100 m			227							
1006288039	7274476	10/7/2016	593956	4795945	94.9	margin of error : 30 m - 100 m	906 SHADELAND AVE	Burlington	370					Domestic		Water Supply
1006369856	7283488	4/21/2016	593670	4795984	98.6	margin of error : 30 m - 100 m	966 FILMAN PLACE CRES	Burlington	350	Boring				Domestic		Abandoned-Supply
1007004380	7307669	4/7/2017	593990	4795822		margin of error : 30 m - 100 m	878 SHADELAND AVE	Burlington	497							Abandoned-Supply
1005759996	7250750	9/22/2015	593948	4796365	98.1	margin of error : 30 m - 100 m			135							
1006976792	7304387		593948	4796365		margin of error : 30 m - 100 m			135							

Appendix B – Borehole Logs

Log of Borehole BH-01

Project No. BRM-00258353-A0 Drawing No. 3

Project: Proposed Multi-Storey Residential Development Sheet No. 1 of 1

Location: 284 - 292 Plains Road East, Burlington, ON

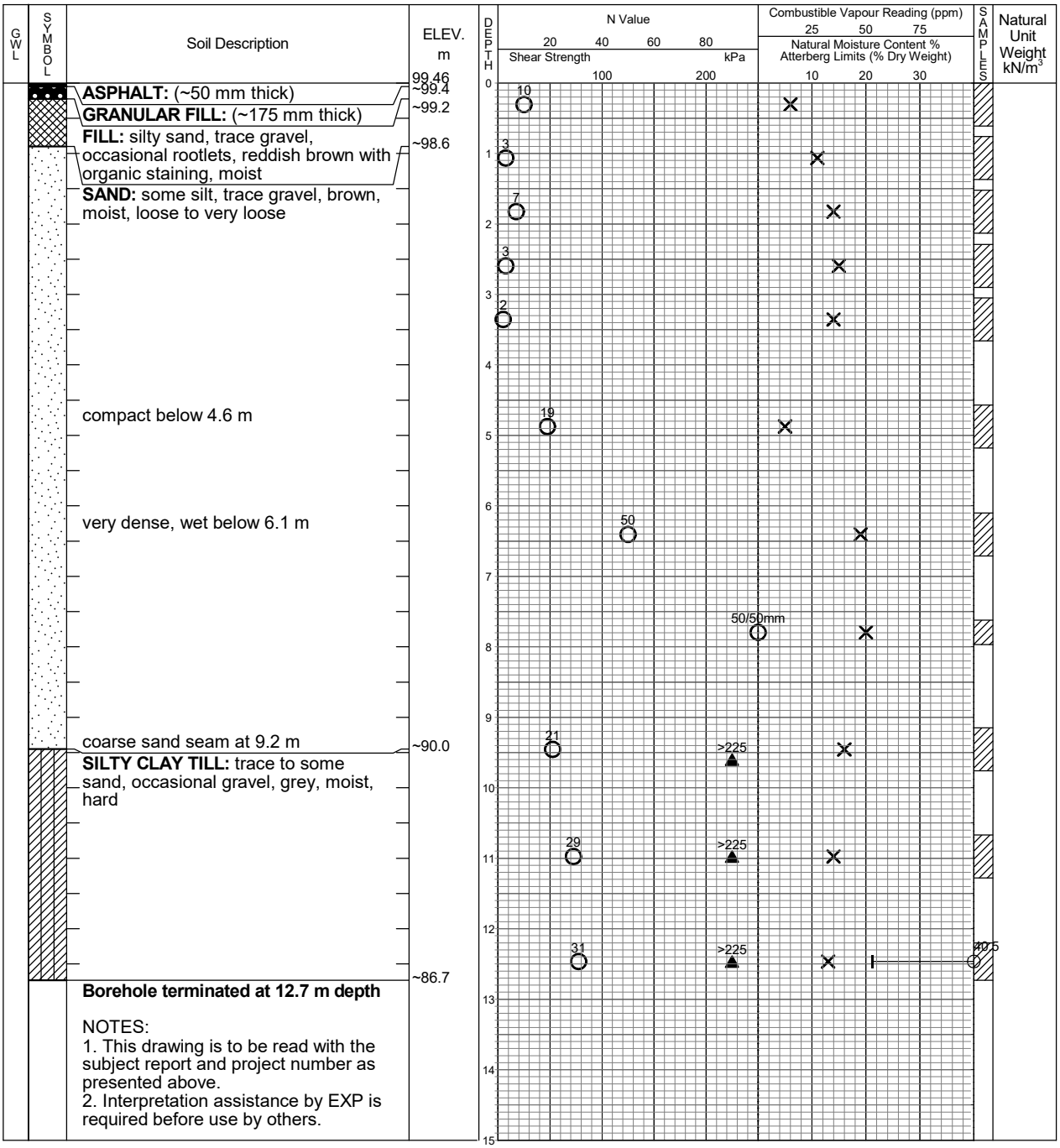
Date Drilled: August 19, 2020

Drill Type: D-50 Track Mount. Solid Stem.

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



NOTES:
1. This drawing is to be read with the subject report and project number as presented above.
2. Interpretation assistance by EXP is required before use by others.

LAGWGLJFHAM-EXP BHLOGS.GPJ NEW.GDT 9/8/20

EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	6.1	no cave

Log of Borehole BH-02

Project No. BRM-00258353-A0 Drawing No. 4

Project: Proposed Multi-Storey Residential Development Sheet No. 1 of 2

Location: 284 - 292 Plains Road East, Burlington, ON

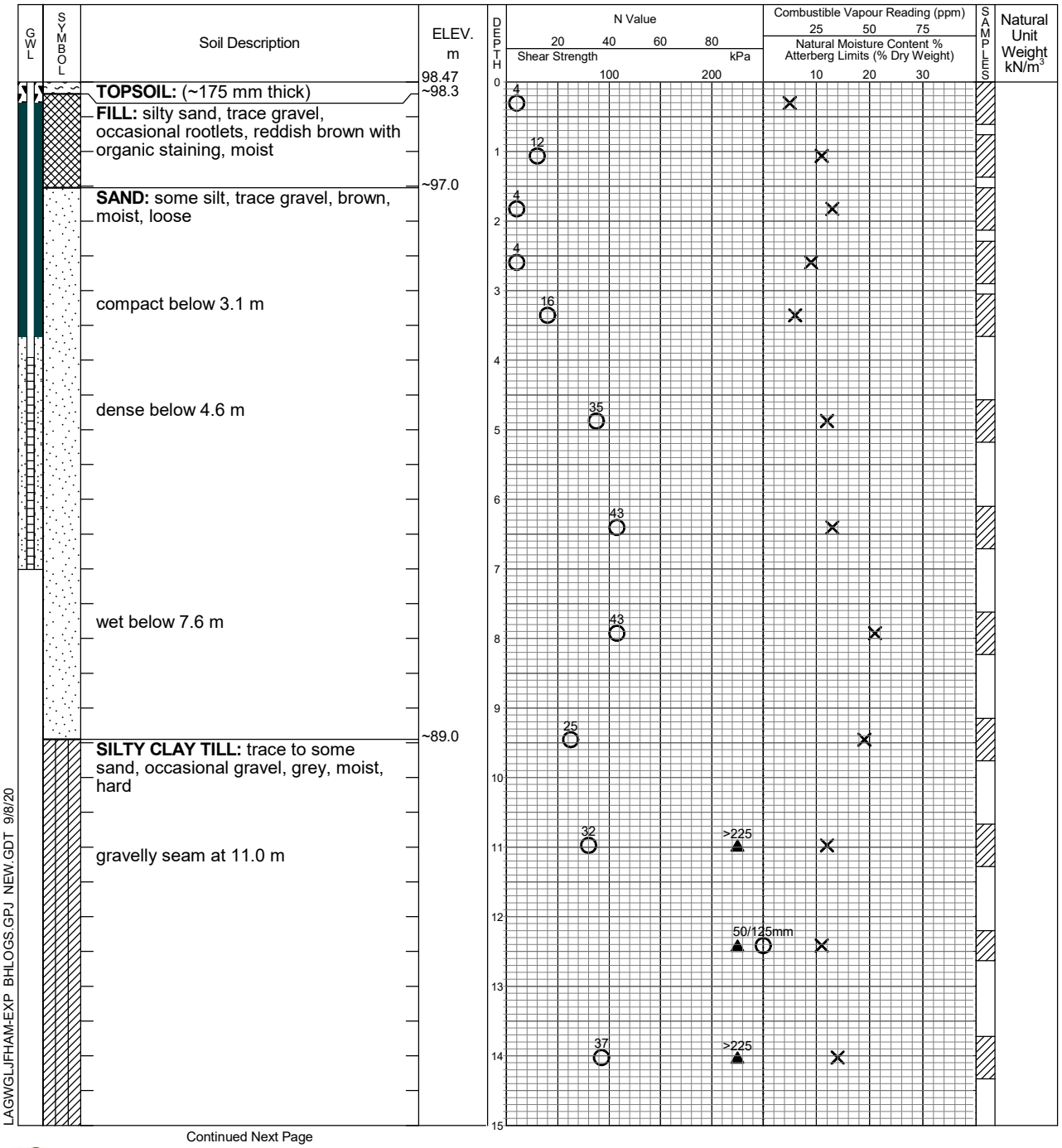
Date Drilled: August 17, 2020

Drill Type: D-50 Track Mount. Solid Stem.

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Continued Next Page

LAGWGLJFHAM-EXP BHLOGS.GPJ NEW.GDT 9/8/20

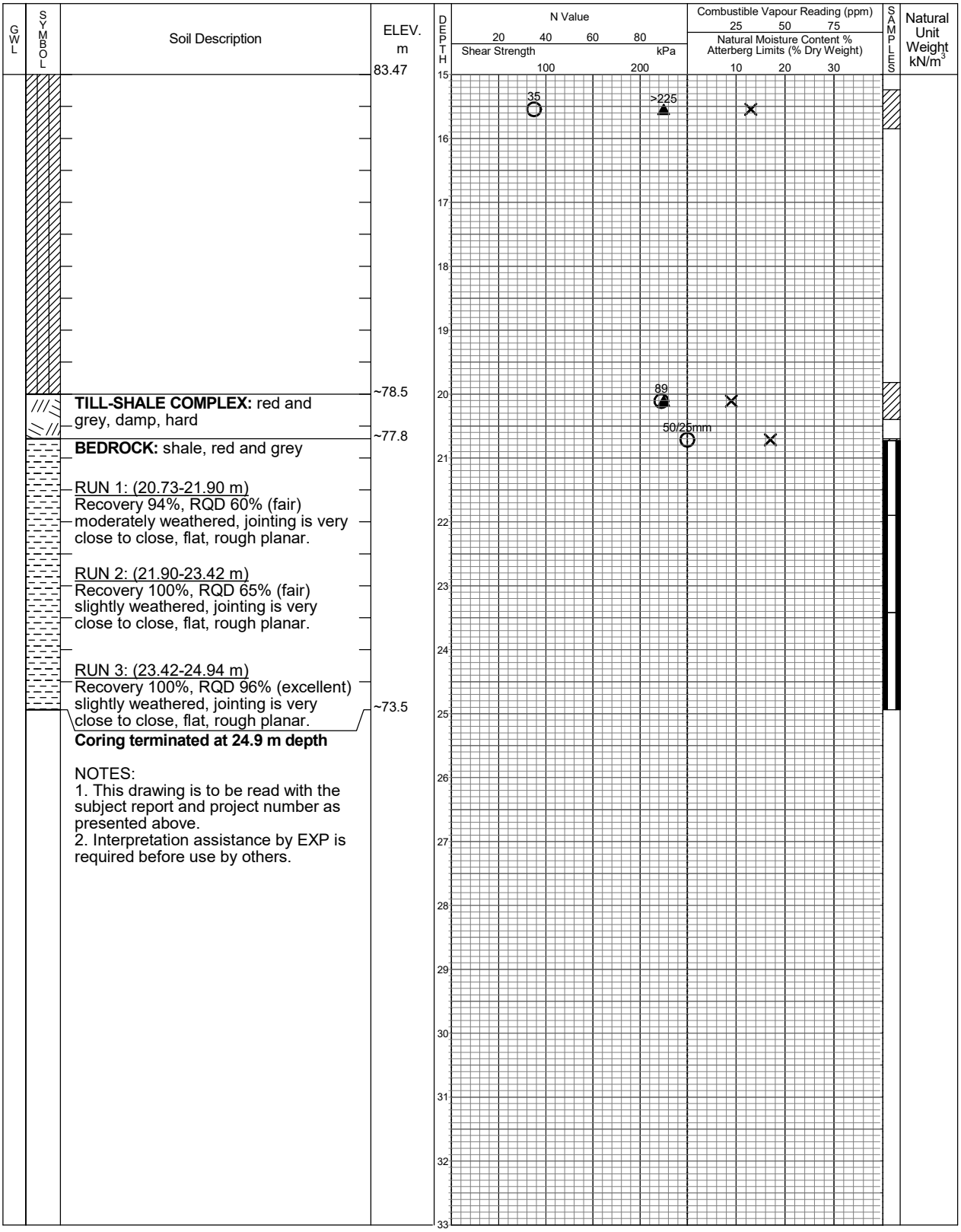
EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	4.6	no cave
August 21, 2020	5.01	
August 24, 2020	5.01	
September 3, 2020	5.05	

Log of Borehole BH-02

Project No. BRM-00258353-A0 Drawing No. 4

Project: Proposed Multi-Storey Residential Development Sheet No. 2 of 2



LAGWGLJFHAM-EXP BHLOGS.GPJ NEW.GDT 9/8/20

EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	4.6	no cave
August 21, 2020	5.01	
August 24, 2020	5.01	
September 3, 2020	5.05	

Log of Borehole BH-03

Project No. BRM-00258353-A0 Drawing No. 5

Project: Proposed Multi-Storey Residential Development Sheet No. 1 of 1

Location: 284 - 292 Plains Road East, Burlington, ON

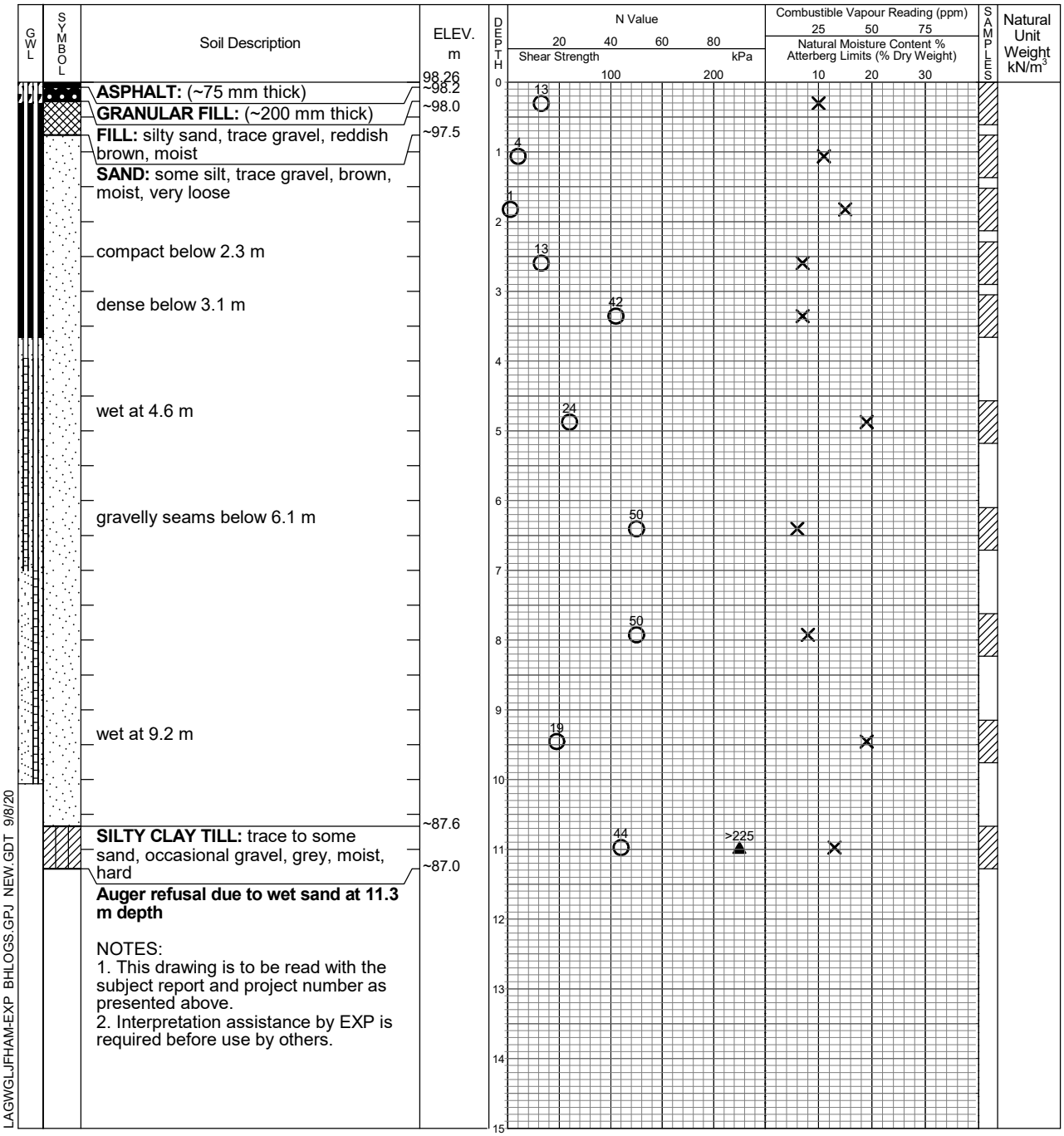
Date Drilled: August 18, 2020

Drill Type: D-50 Track Mount. Solid Stem.

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



NOTES:
1. This drawing is to be read with the subject report and project number as presented above.
2. Interpretation assistance by EXP is required before use by others.

LAGWGLJFHAM-EXP BHLOGS.GPJ NEW.GDT 9/8/20

EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	4.6	no cave
Aug 21/20 (shallow)	4.88	
Aug 21/20 (deep)	4.90	
Aug24/20 (shallow)	4.90	
Aug 24/20 (deep)	4.92	

Log of Borehole BH-04

Project No. BRM-00258353-A0 Drawing No. 6

Project: Proposed Multi-Storey Residential Development Sheet No. 1 of 2

Location: 284 - 292 Plains Road East, Burlington, ON

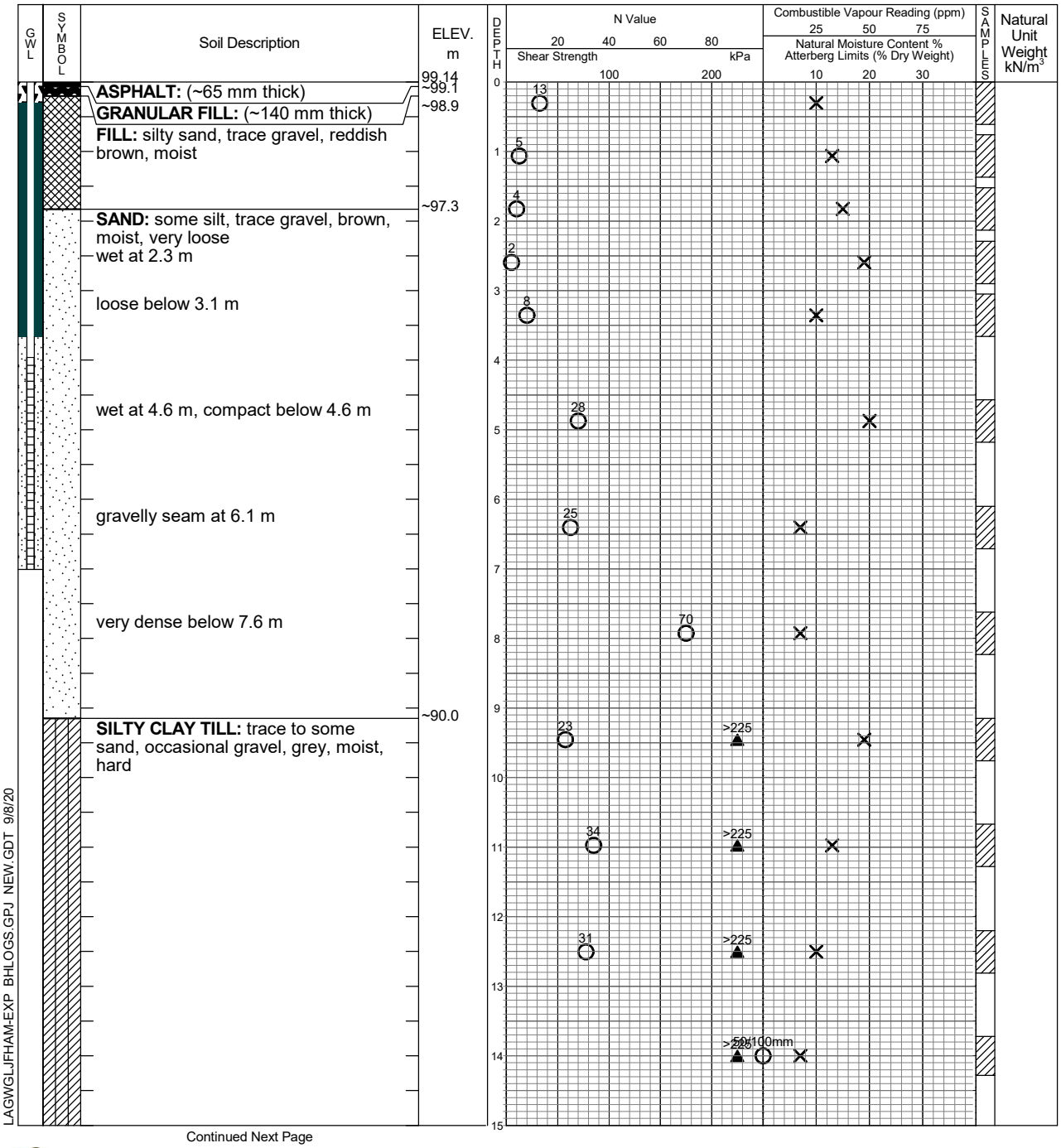
Date Drilled: August 19, 2020

Drill Type: D-50 Track Mount. Solid Stem.

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Continued Next Page

LAGWGLJFHAM-EXP BHLOGS.GPJ NEW.GDT 9/8/20

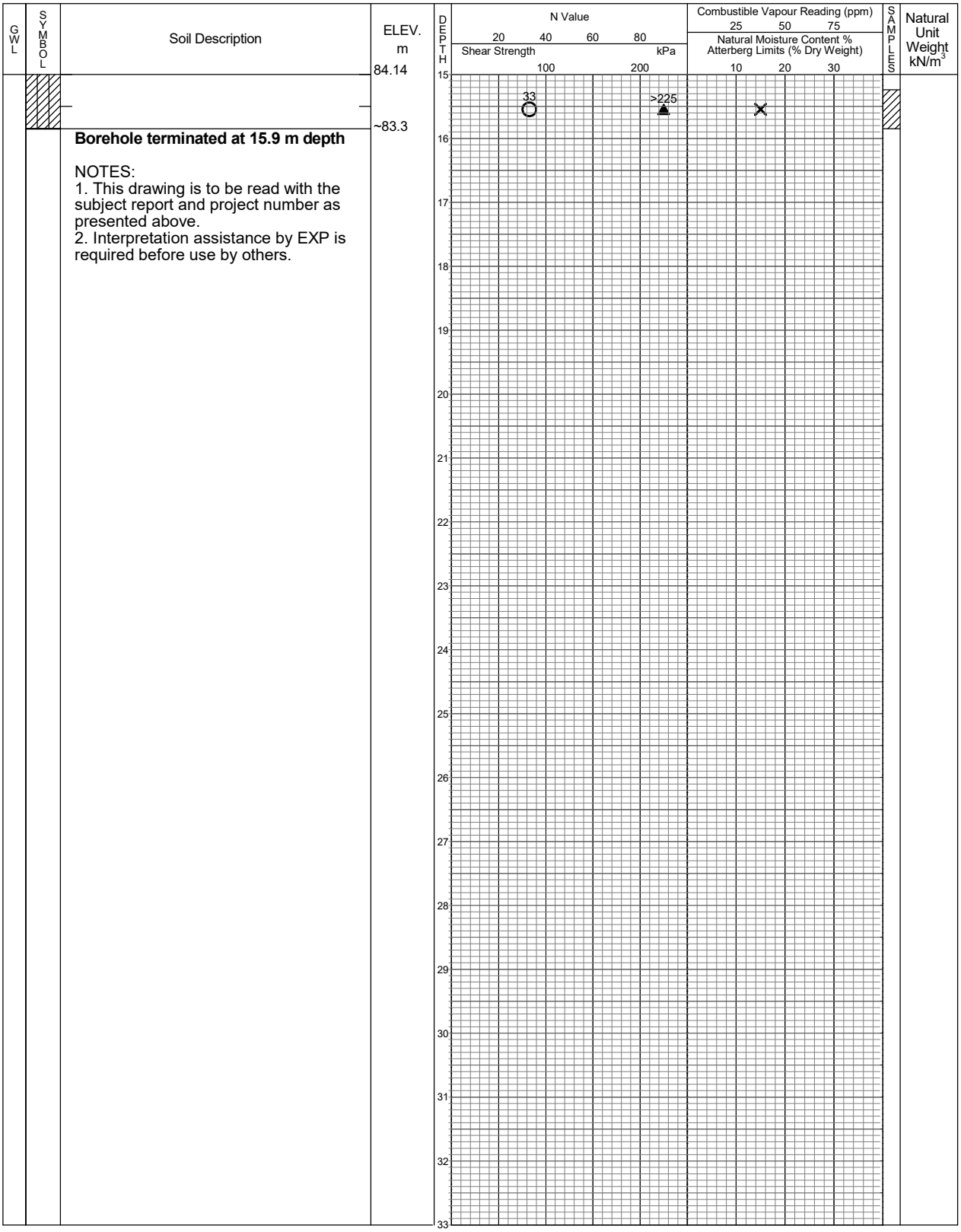
EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	4.6	no cave
August 21, 2020	4.70	
August 24, 2020	5.57	
September 3, 2020	5.52	

Log of Borehole BH-04

Project No. BRM-00258353-A0 Drawing No. 6

Project: Proposed Multi-Storey Residential Development Sheet No. 2 of 2



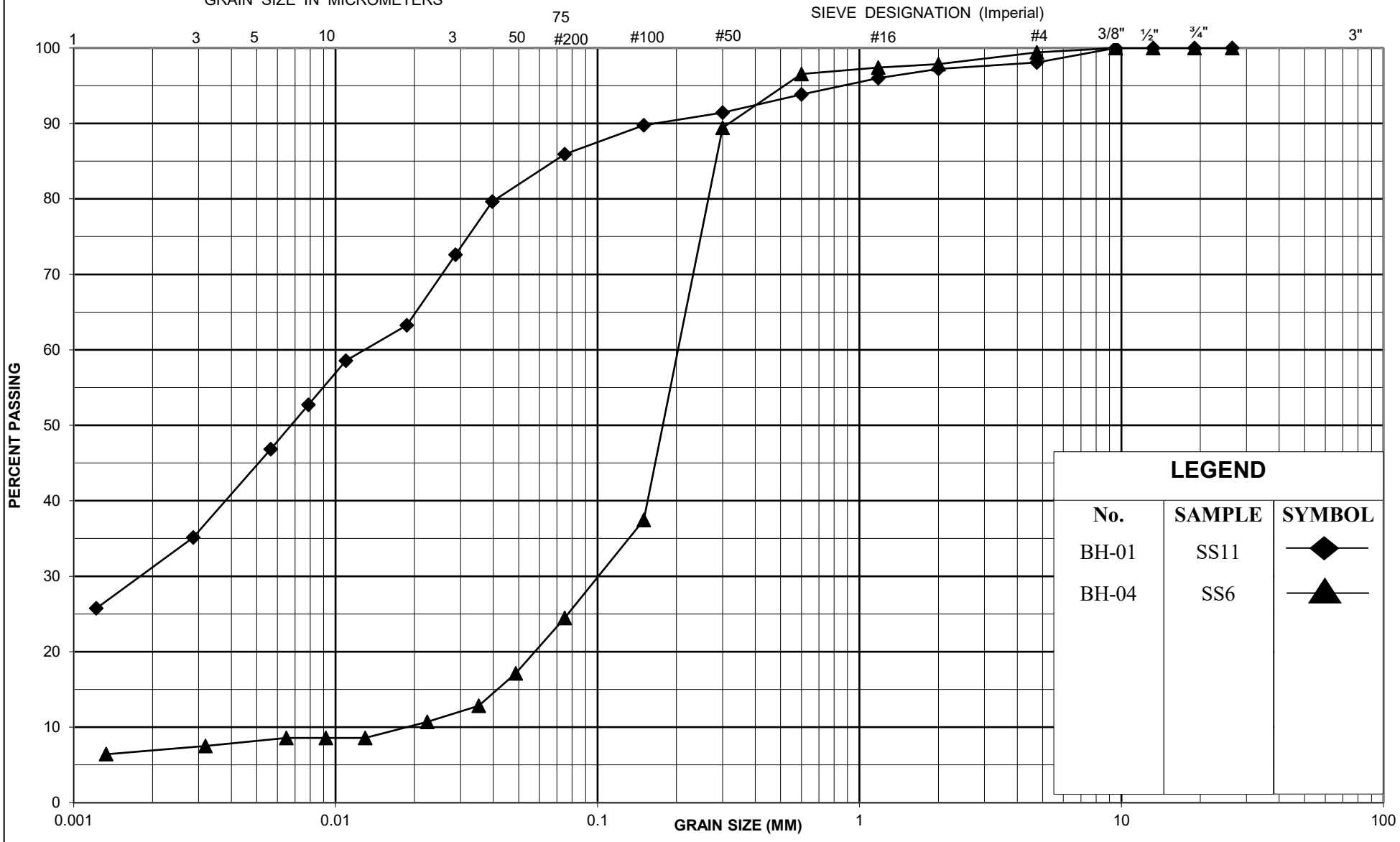
LAGWGLJFHAM-EXP BHLOGS.GPJ NEW.GDT 9/8/20

EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	4.6	no cave
August 21, 2020	4.70	
August 24, 2020	5.57	
September 3, 2020	5.52	

ISSMFE SOIL CLASSIFICATION SYSTEM

CLAY	SILT			SAND			GRAVEL			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



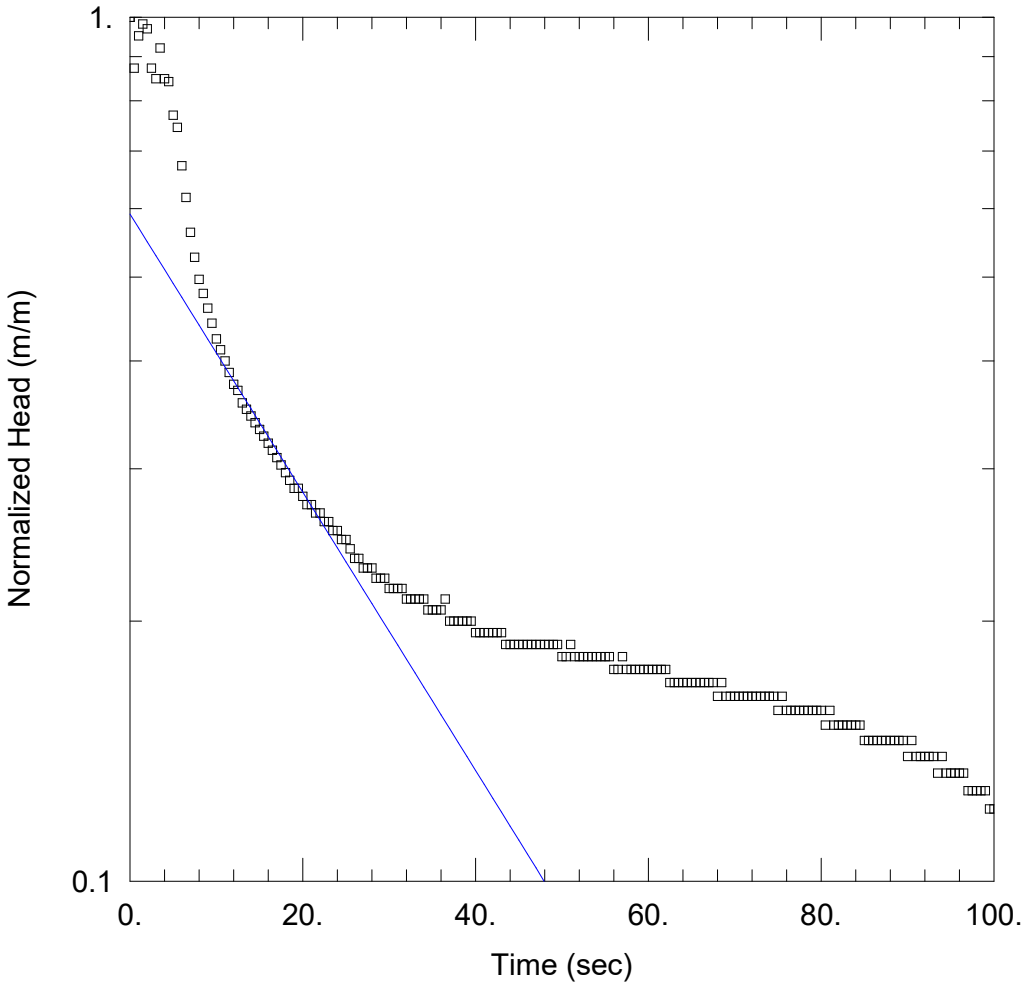
GRAIN SIZE DISTRIBUTION

DRAWING NO.: B1

PROJECT NO.: BRM-00258353-A0

DATE: September 2020

Appendix C – SWRT Procedures and Results



BH/MW 2_FALLING HEAD SWRT

Data Set: C:\Working Projects\284-292 Plains Rd\BHMW 2.aqt
Date: 08/25/20 Time: 14:05:16

PROJECT INFORMATION

Company: EXP Services Inc.
Client: Auburn Developments
Project: BRM-00258353-C0
Location: 284-292 Palins Rd,Burllington
Test Well: BH/MW 2
Test Date: Aug 28, 2020

AQUIFER DATA

Saturated Thickness: 1.96 m Anisotropy Ratio (Kz/Kr): 1.

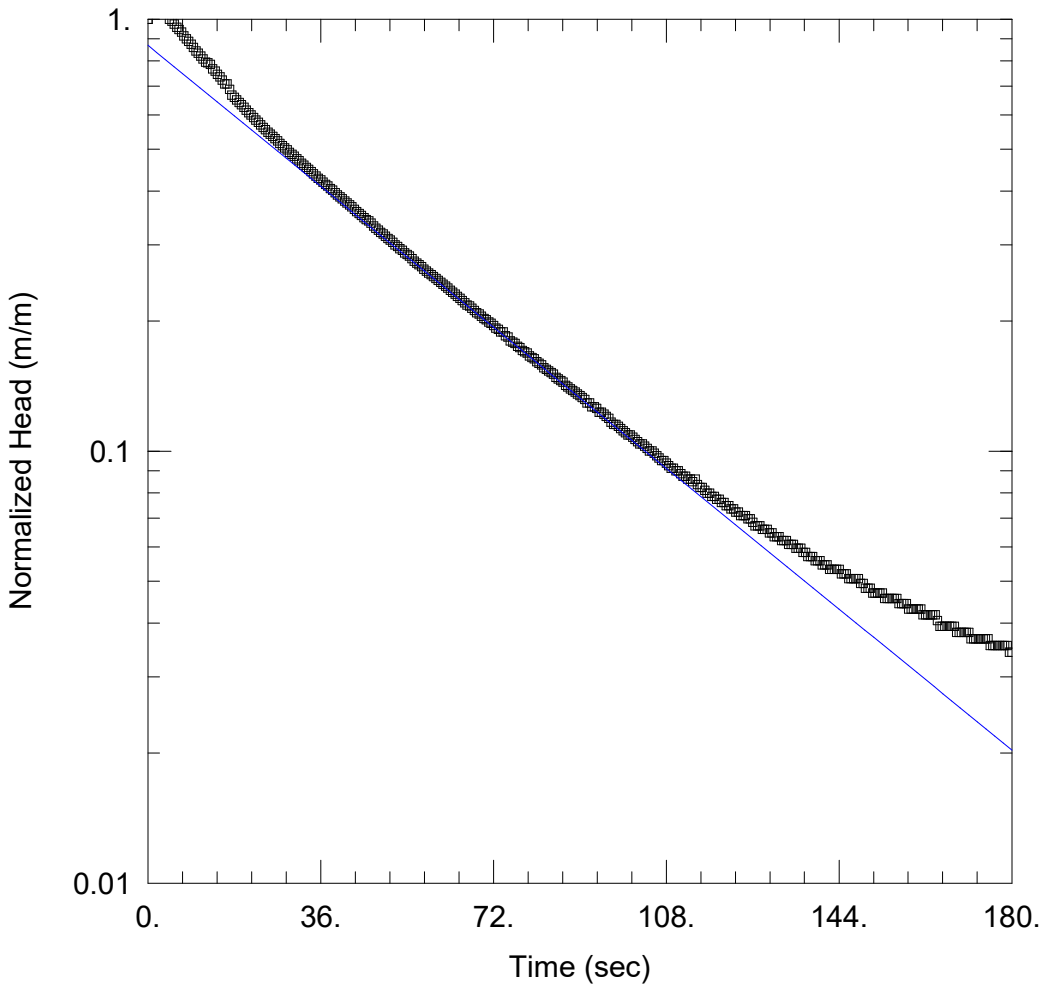
WELL DATA (BH/MW 2)

Initial Displacement: 0.495 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.025 m
Static Water Column Height: 1.96 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 3.133E-5 m/sec y0 = 0.293 m



BH/MW 3-D_FALLING HEAD SWRT

Data Set: C:\Working Projects\284-292 Plains Rd\BHMW 3-D.aqt
Date: 08/25/20 Time: 14:10:06

PROJECT INFORMATION

Company: EXP Services Inc.
Client: Auburn Developments
Project: BRM-00258353-C0
Location: 284-292 Palins Rd,Burllington
Test Well: BH/MW 3-D
Test Date: Aug 28, 2020

AQUIFER DATA

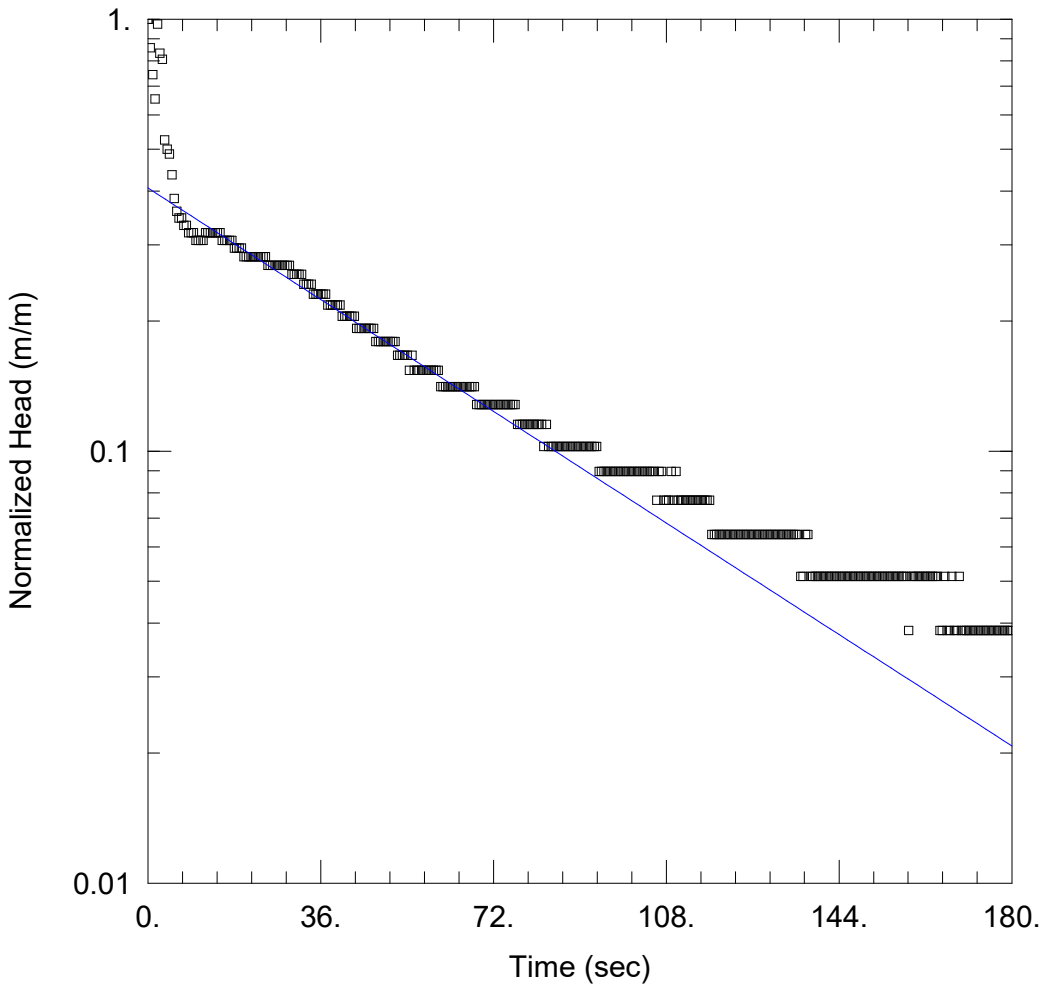
Saturated Thickness: 5.36 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 3-D)

Initial Displacement: 2.367 m
Total Well Penetration Depth: 5.36 m
Casing Radius: 0.025 m
Static Water Column Height: 5.36 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.041E-5 m/sec
y0 = 2.058 m



BH/MW 3-S_FALLING HEAD SWRT

Data Set: C:\Working Projects\284-292 Plains Rd\BHMW 3-S.aqt
Date: 08/25/20 Time: 14:14:50

PROJECT INFORMATION

Company: EXP Services Inc.
Client: Auburn Developments
Project: BRM-00258353-C0
Location: 284-292 Palins Rd,Burllington
Test Well: BH/MW 3-S
Test Date: Aug 28, 2020

AQUIFER DATA

Saturated Thickness: 2.33 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 3-S)

Initial Displacement: 0.234 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.025 m
Static Water Column Height: 2.33 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

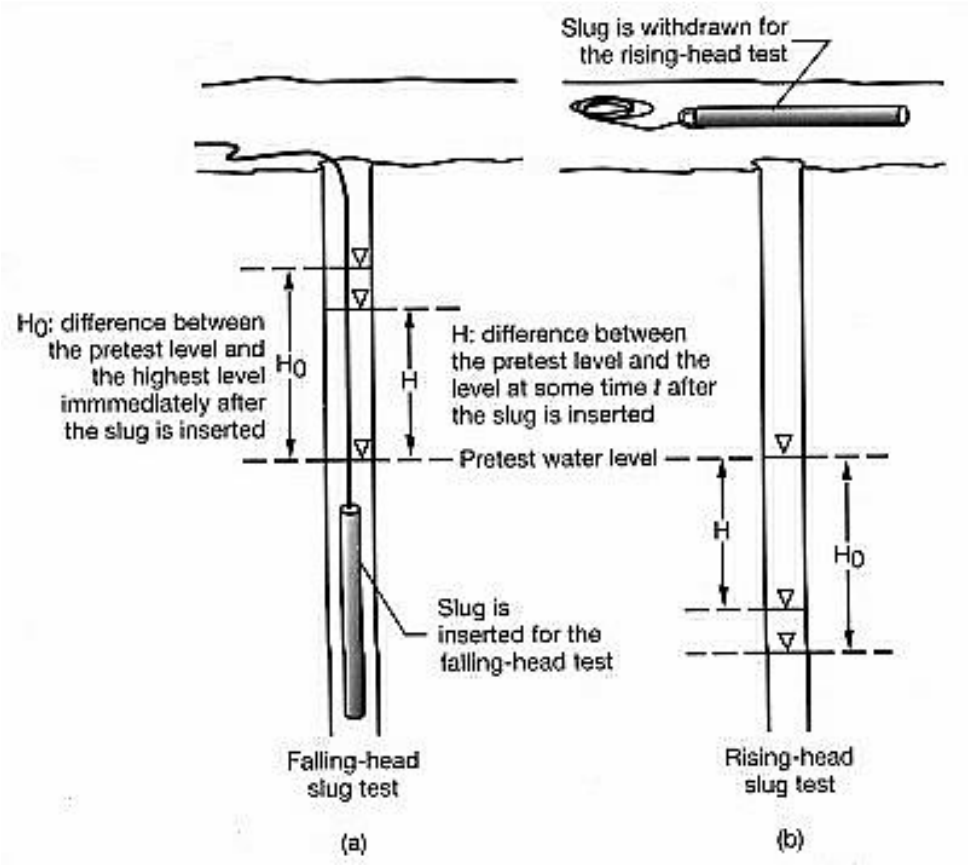
K = 1.174E-5 m/sec y0 = 0.09513 m

Single Well Response Test Procedure

A Single Well Response Test (SWRT), also known as a bail test or a slug test, is conducted in order to determine the saturated hydraulic conductivity (K) of an aquifer. The method of the SWRT is to characterize the change of groundwater level in a well or borehole over time.

In order to ensure consistency and repeatability, all **exp** employees are to follow the procedure outlined in this document when conducting SWRTs.

The figure below depicts a schematic of a slug and bail test and the respective water level changes.



Initials ___

Slug Test Procedure

Equipment Required

- Copy of a signed health and safety plan
- Copy of the work program
- PPE as required by Site-Specific HASP
- Copy of the monitoring well location plan/site plan
- Waterproof pen and bound field note book
- SWRT field data Entry form
- Disposable gloves
- Duct tape
- Deionized water
- Alconox (phosphate free detergent)
- Spray bottles
- Electronic water level meter and spare batteries
- Solid PVC or stainless steel slug of known volume or clean water
- String (nylon)
- Water pressure transducer (data logger) and baro-logger
- Watch or stop watch with second hand
- Plastic sheeting

Testing Procedure

1. Remove cap from well and collect static water level
2. Remove waterra tubing/bailer and place in garbage bag. Record static water level measurement again.
3. Lower the slug into the well and record the dynamic water level.
4. Record the drawdown (for the slug test) at set five (5) second intervals for the first five (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown until 95% recovery is reached. To calculate this value: Find the difference between the dynamic water level and the static water level, then multiply by 95% (.95). Add the resulting value to the dynamic water level.

   (Static Water Level – Dynamic Water Level).95 + Static Water Level = 95% Recovery Value
6. Once complete, replace the waterra tubing/bailer and re-secure the well cap.

Note: If the well is deep, more than one slug may be inserted by attaching the slugs to a series.

Slugs must be washed with methanol, then lab grade soap, and then rinsed with de-ionized water after each use.

Based on the recorded observations, the hydraulic conductivity (in m/s) of the aquifer will be determined. In order to determine the hydraulic conductivity; the well diameter, radius of the borehole and length of the screen will also be required.

Bail Test Procedure

Equipment Required

- 20 L (5 gal) Graduated pail
- Stop watch or watch with seconds
- Garbage bags
- Water level meter
- Field sheets/log book
- Latex Gloves
- Bailer and Rope

Procedure

1. Remove cap from well and collect static water level.
2. If using a **bailer**:
    a. Affix the rope to the bailer.
    b. Remove the waterra tubing and place in garbage bag
    c. Record static water level measurement again.
    d. Record how much water was removed by either counting the number of full bailers or emptying removed water into a container.
    e. Quickly lower the bailer into the well and remove.
    f. Continue this process until the water level will reduce no further.
    g. Record the dynamic water level.
3. If using **waterra** to bail the water:
    a. Pump the water into graduated bucket until the water level will reduce no further.
    b. Record how much water has been removed.
    c. Record the dynamic water level.
4. Record the recovery at set five (5) second intervals for the first (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown/recovery until 95% recovery is reached.
6. Once complete, replace any waterra tubing that may have been removed from the well and re-secure the well cap.

Appendix D – Laboratory Certificates of Analysis

Your Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Your C.O.C. #: 788245-01-01

Attention: Kelsey Proks

exp Services Inc
1266 South Service Rd
Suite C1-1
Stoney Creek, ON
CANADA L8E 5R9

Report Date: 2020/09/04
Report #: R6319569
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C0L8060
Received: 2020/08/25, 15:05

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonaceous BOD	1	2020/08/27	2020/09/01	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2020/08/27	2020/08/27	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2020/08/27	2020/08/28	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2020/08/28	2020/08/28	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2020/08/27	2020/08/27	CAM SOP-00408	EPA 6010D m
E.coli, (CFU/100mL)	1	N/A	2020/08/25	CAM SOP-00552	MOE LSB E3371
Animal and Vegetable Oil and Grease	1	N/A	2020/08/28	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2020/08/28	2020/08/28	CAM SOP-00326	EPA1664B m,SM5520B m
PAH Compounds in Water by GC/MS (SIM)	1	2020/08/27	2020/08/28	CAM SOP-00318	EPA 8270D m
pH	1	2020/08/27	2020/08/28	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2020/08/27	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2020/08/28	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2020/08/27	2020/08/31	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2020/08/28	2020/08/28	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2020/08/27	2020/08/28	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2020/08/28	CAM SOP-00228	EPA 8260C m

Remarks:

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

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

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

Your Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Your C.O.C. #: 788245-01-01

Attention: Kelsey Proks

exp Services Inc
1266 South Service Rd
Suite C1-1
Stoney Creek, ON
CANADA L8E 5R9

Report Date: 2020/09/04
Report #: R6319569
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C0L8060
Received: 2020/08/25, 15:05

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

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bvlabs.com
Phone# (519)652-9444
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C0L8060
Report Date: 2020/09/04

exp Services Inc
Client Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				NLN760		
Sampling Date				2020/08/24 12:20		
COC Number				788245-01-01		
	UNITS	**Criteria**	**Criteria-2**	**MW03-D**	**RDL**	**QC Batch**
Calculated Parameters						
Total Animal/Vegetable Oil and Grease	mg/L	150	-	<0.50	0.50	6908938
Inorganics						
Total Carbonaceous BOD	mg/L	300	-	<2	2	6913450
Fluoride (F-)	mg/L	10	-	0.17	0.10	6913839
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	<0.50 (1)	0.50	6913522
pH	pH	6.0:10.0	6.5:8.5	7.91		6913844
Phenols-4AAP	mg/L	1	-	<0.0010	0.0010	6912514
Total Suspended Solids	mg/L	350	-	46	10	6912832
Dissolved Sulphate (SO4)	mg/L	1500	-	48	1.0	6914463
Total Cyanide (CN)	mg/L	2	-	<0.0050	0.0050	6912757
Petroleum Hydrocarbons						
Total Oil & Grease	mg/L	-	-	<0.50	0.50	6914862
Total Oil & Grease Mineral/Synthetic	mg/L	-	-	<0.50	0.50	6914877
Metals						
Total Aluminum (Al)	mg/L	50	-	0.6	0.1	6912407
Total Antimony (Sb)	mg/L	5	-	<0.02	0.02	6912407
Total Arsenic (As)	mg/L	1	-	<0.01	0.01	6912407
Total Beryllium (Be)	mg/L	5	-	<0.0005	0.0005	6912407
Total Cadmium (Cd)	mg/L	1	-	<0.002	0.002	6912407
Total Chromium (Cr)	mg/L	3	-	<0.01	0.01	6912407
Total Cobalt (Co)	mg/L	5	-	<0.002	0.002	6912407
Total Copper (Cu)	mg/L	3	-	<0.01	0.01	6912407
Total Iron (Fe)	mg/L	50	-	1.2	0.02	6912407
Total Lead (Pb)	mg/L	3	-	<0.01	0.01	6912407
Total Manganese (Mn)	mg/L	5	-	0.57	0.001	6912407
Mercury (Hg)	mg/L	0.05	-	<0.00010	0.00010	6915068
Total Molybdenum (Mo)	mg/L	5	-	0.006	0.005	6912407
Total Nickel (Ni)	mg/L	3	-	<0.005	0.005	6912407
Total Phosphorus (P)	mg/L	10	-	<0.05	0.05	6912407
Total Selenium (Se)	mg/L	5	-	<0.02	0.02	6912407

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
Criteria-2: Halton Storm Sewer ByLaw
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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

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

BV Labs Job #: C0L8060
Report Date: 2020/09/04

exp Services Inc
Client Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				NLN760		
Sampling Date				2020/08/24 12:20		
COC Number				788245-01-01		
	UNITS	**Criteria**	**Criteria-2**	**MW03-D**	**RDL**	**QC Batch**
Total Silver (Ag)	mg/L	5	-	<0.01	0.01	6912407
Total Tin (Sn)	mg/L	5	-	<0.02	0.02	6912407
Total Titanium (Ti)	mg/L	5	-	0.016	0.005	6912407
Total Zinc (Zn)	mg/L	3	-	0.013	0.005	6912407
Polyaromatic Hydrocarbons						
Naphthalene	ug/L	140	-	<0.050	0.050	6913741
Volatile Organics						
Benzene	ug/L	10	-	<0.40	0.40	6911044
Chloroform	ug/L	40	-	0.42	0.40	6911044
1,4-Dichlorobenzene	ug/L	80	-	<0.80	0.80	6911044
Ethylbenzene	ug/L	160	-	<0.40	0.40	6911044
Methylene Chloride(Dichloromethane)	ug/L	2000	-	<4.0	4.0	6911044
Tetrachloroethylene	ug/L	1000	-	<0.40	0.40	6911044
Toluene	ug/L	16	-	<0.40	0.40	6911044
Trichloroethylene	ug/L	400	-	<0.40	0.40	6911044
Surrogate Recovery (%)						
D10-Anthracene	%	-	-	113		6913741
D14-Terphenyl (FS)	%	-	-	102		6913741
D8-Acenaphthylene	%	-	-	90		6913741
4-Bromofluorobenzene	%	-	-	87		6911044
D4-1,2-Dichloroethane	%	-	-	102		6911044
D8-Toluene	%	-	-	97		6911044

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
Criteria-2: Halton Storm Sewer ByLaw

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

BV Labs Job #: C0L8060
Report Date: 2020/09/04

exp Services Inc
Client Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

MICROBIOLOGY (WATER)

BV Labs ID			NLN760		
Sampling Date			2020/08/24 12:20		
COC Number			788245-01-01		
	UNITS	**Criteria**	**MW03-D**	**RDL**	**QC Batch**
Microbiological					
Escherichia coli	CFU/100mL	200	<10	10	6909272

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Halton Storm Sewer ByLaw

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Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

TEST SUMMARY

BV Labs ID: NLN760
Sample ID: MW03-D
Matrix: Water

Collected: 2020/08/24
Shipped:
Received: 2020/08/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	6913450	2020/08/27	2020/09/01	Nusrat Naz
Total Cyanide	SKAL/CN	6912757	2020/08/27	2020/08/27	Louise Harding
Fluoride	ISE	6913839	2020/08/27	2020/08/28	Surinder Rai
Mercury in Water by CVAA	CV/AA	6915068	2020/08/28	2020/08/28	Meghaben Patel
Total Metals Analysis by Axial ICP	ICPX	6912407	2020/08/27	2020/08/27	Jolly John
E.coli, (CFU/100mL)	PL	6909272	N/A	2020/08/25	Farhana Rahman
Animal and Vegetable Oil and Grease	BAL	6908938	N/A	2020/08/28	Automated Statchk
Total Oil and Grease	BAL	6914862	2020/08/28	2020/08/28	Francis Afonso
PAH Compounds in Water by GC/MS (SIM)	GC/MS	6913741	2020/08/27	2020/08/28	Bibin Alias Paul
pH	AT	6913844	2020/08/27	2020/08/28	Surinder Rai
Phenols (4AAP)	TECH/PHEN	6912514	N/A	2020/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	6914463	N/A	2020/08/28	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	6913522	2020/08/27	2020/08/31	Rajni Tyagi
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	6914877	2020/08/28	2020/08/28	Francis Afonso
Total Suspended Solids	BAL	6912832	2020/08/27	2020/08/28	Massarat Jan
Volatile Organic Compounds in Water	GC/MS	6911044	N/A	2020/08/28	Rebecca McClean

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BV Labs Job #: C0L8060
Report Date: 2020/09/04

exp Services Inc
Client Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

GENERAL COMMENTS

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

Package 1	3.3°C

Revised report (2020/09/04): Includes Halton Sewer bylaw criteria.

Sample NLN760 [MW03-D] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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

BV Labs Job #: C0L8060
Report Date: 2020/09/04

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00258353-A0
Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6911044	4-Bromofluorobenzene	2020/08/28	99	70 - 130	93	70 - 130	93	%				
6911044	D4-1,2-Dichloroethane	2020/08/28	99	70 - 130	89	70 - 130	99	%				
6911044	D8-Toluene	2020/08/28	103	70 - 130	104	70 - 130	91	%				
6913741	D10-Anthracene	2020/08/28	111	50 - 130	111	50 - 130	114	%				
6913741	D14-Terphenyl (FS)	2020/08/28	99	50 - 130	100	50 - 130	105	%				
6913741	D8-Acenaphthylene	2020/08/28	94	50 - 130	94	50 - 130	91	%				
6911044	1,4-Dichlorobenzene	2020/08/28	92	70 - 130	95	70 - 130	<0.40	ug/L	NC	30		
6911044	Benzene	2020/08/28	92	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
6911044	Chloroform	2020/08/28	91	70 - 130	81	70 - 130	<0.20	ug/L	NC	30		
6911044	Ethylbenzene	2020/08/28	83	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
6911044	Methylene Chloride(Dichloromethane)	2020/08/28	99	70 - 130	79	70 - 130	<2.0	ug/L	NC	30		
6911044	Tetrachloroethylene	2020/08/28	85	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
6911044	Toluene	2020/08/28	NC	70 - 130	91	70 - 130	<0.20	ug/L	5.2	30		
6911044	Trichloroethylene	2020/08/28	95	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
6912407	Total Aluminum (Al)	2020/08/27	104	80 - 120	106	80 - 120	<0.1	mg/L	1.3	20		
6912407	Total Antimony (Sb)	2020/08/27	104	80 - 120	108	80 - 120	<0.02	mg/L	NC	20		
6912407	Total Arsenic (As)	2020/08/27	102	80 - 120	104	80 - 120	<0.01	mg/L	NC	20		
6912407	Total Beryllium (Be)	2020/08/27	95	80 - 120	103	80 - 120	<0.0005	mg/L				
6912407	Total Cadmium (Cd)	2020/08/27	102	80 - 120	105	80 - 120	<0.002	mg/L	NC	20		
6912407	Total Chromium (Cr)	2020/08/27	93	80 - 120	102	80 - 120	<0.01	mg/L	NC	20		
6912407	Total Cobalt (Co)	2020/08/27	97	80 - 120	103	80 - 120	<0.002	mg/L	NC	20		
6912407	Total Copper (Cu)	2020/08/27	94	80 - 120	101	80 - 120	<0.01	mg/L	NC	20		
6912407	Total Iron (Fe)	2020/08/27	95	80 - 120	106	80 - 120	<0.02	mg/L	6.6	20		
6912407	Total Lead (Pb)	2020/08/27	95	80 - 120	103	80 - 120	<0.01	mg/L	NC	20		
6912407	Total Manganese (Mn)	2020/08/27	91	80 - 120	102	80 - 120	<0.001	mg/L	1.3	20		
6912407	Total Molybdenum (Mo)	2020/08/27	102	80 - 120	107	80 - 120	<0.005	mg/L	NC	20		
6912407	Total Nickel (Ni)	2020/08/27	96	80 - 120	103	80 - 120	<0.005	mg/L	NC	20		
6912407	Total Phosphorus (P)	2020/08/27	106	80 - 120	107	80 - 120	<0.05	mg/L	NC	20		
6912407	Total Selenium (Se)	2020/08/27	102	80 - 120	105	80 - 120	<0.02	mg/L	NC	20		
6912407	Total Silver (Ag)	2020/08/27	95	80 - 120	100	80 - 120	<0.01	mg/L	NC	20		
6912407	Total Tin (Sn)	2020/08/27	101	80 - 120	107	80 - 120	<0.02	mg/L	NC	20		

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

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6912407	Total Titanium (Ti)	2020/08/27	95	80 - 120	103	80 - 120	<0.005	mg/L	NC	20		
6912407	Total Zinc (Zn)	2020/08/27	98	80 - 120	104	80 - 120	<0.005	mg/L	0.38	20		
6912514	Phenols-4AAP	2020/08/27	107	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
6912757	Total Cyanide (CN)	2020/08/27	89	80 - 120	94	80 - 120	<0.0050	mg/L	0.53	20		
6912832	Total Suspended Solids	2020/08/28					<10	mg/L	1.1	25	100	85 - 115
6913450	Total Carbonaceous BOD	2020/09/01					<2	mg/L	4.2	30	96	85 - 115
6913522	Total Kjeldahl Nitrogen (TKN)	2020/08/31	90	80 - 120	102	80 - 120	<0.10	mg/L	NC (1)	20	101	80 - 120
6913741	Naphthalene	2020/08/28	88	50 - 130	86	50 - 130	<0.050	ug/L	NC	30		
6913839	Fluoride (F-)	2020/08/28	111	80 - 120	103	80 - 120	<0.10	mg/L	6.6	20		
6913844	pH	2020/08/28			102	98 - 103			0.49	N/A		
6914463	Dissolved Sulphate (SO4)	2020/08/28	NC	75 - 125	104	80 - 120	<1.0	mg/L	0.69	20		
6914862	Total Oil & Grease	2020/08/28	90	75 - 125	99	85 - 115	<0.50	mg/L	NC	25		
6914877	Total Oil & Grease Mineral/Synthetic	2020/08/28			96	85 - 115	<0.50	mg/L	3.7	25		
6915068	Mercury (Hg)	2020/08/28	94	75 - 125	97	80 - 120	<0.00010	mg/L	NC	20		

N/A = Not Applicable

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

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

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

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

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

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

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

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

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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BV Labs Job #: C0L8060
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exp Services Inc
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Site Location: PLAINS RD E,BURLINGTON
Sampler Initials: MH

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Farhana Rahman

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

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Exceedance Summary Table – Halton Sanitary Sewer

Result Exceedances

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

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

Exceedance Summary Table – Halton Storm Sewer

Result Exceedances

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

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

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MICRO

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Page 1 of 1

CHAIN OF CUSTODY RECORD

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#17493 exp Services Inc	Company Name:		Quotation #:	B91716	BV Labs Job #:	Bottle Order #: 788245
Attention:	Accounts Payable	Attention:	Peyman Sayyah; Kelsey Proks	P.O. #:			
Address:	1266 South Service Rd Suite C1-1 Stoney Creek ON L8E 5R9	Address:		Project:	BRM-00258353-A0		
Tel:	(905) 573-4000 Fax:	Tel:	Fax:	Project Name:		COC #: C#788245-01-01	Project Manager: Christine Gripton
Email:	denise.vedell@exp.com, elizabeth.reyes@exp.com; Kar	Email:	Peyman.Sayyah@exp.com; Kelsey.proks@exp.com	Site #: Plains Rd E, Burlington Sampled By: MH/KP			

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

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☒ Sanitary Sewer Bylaw ☐ Reg 558 ☒ Storm Sewer Bylaw ☐ MISA Municipality Halton Region ☐ PWQO ☐ Reg 406 Table ___ ☐ Other ___	

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

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

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

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Halton Sanitary & Combined Sewer (2-03)	Halton Storm Sewer Bylaw (2-03)	# of Bottles	Comments
1		MW03-D	Aug. 24, 2020	12:20pm	GW	No	X	X	16	
2										
3										
4										
5										
6										
7										
8										
9										
10										

25-Aug-20 15:05
Christine Gripton
C0L8060
HGR ENV-916

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Recei	Custody Seal Present	Yes	No
M. Hluchaniuk C / Martin Hluchaniuk	2020/8/25	9:30am	Parsep / Parsep Khant	2020/08/25	15:05			1/5/4	Intact	✓	

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

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

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

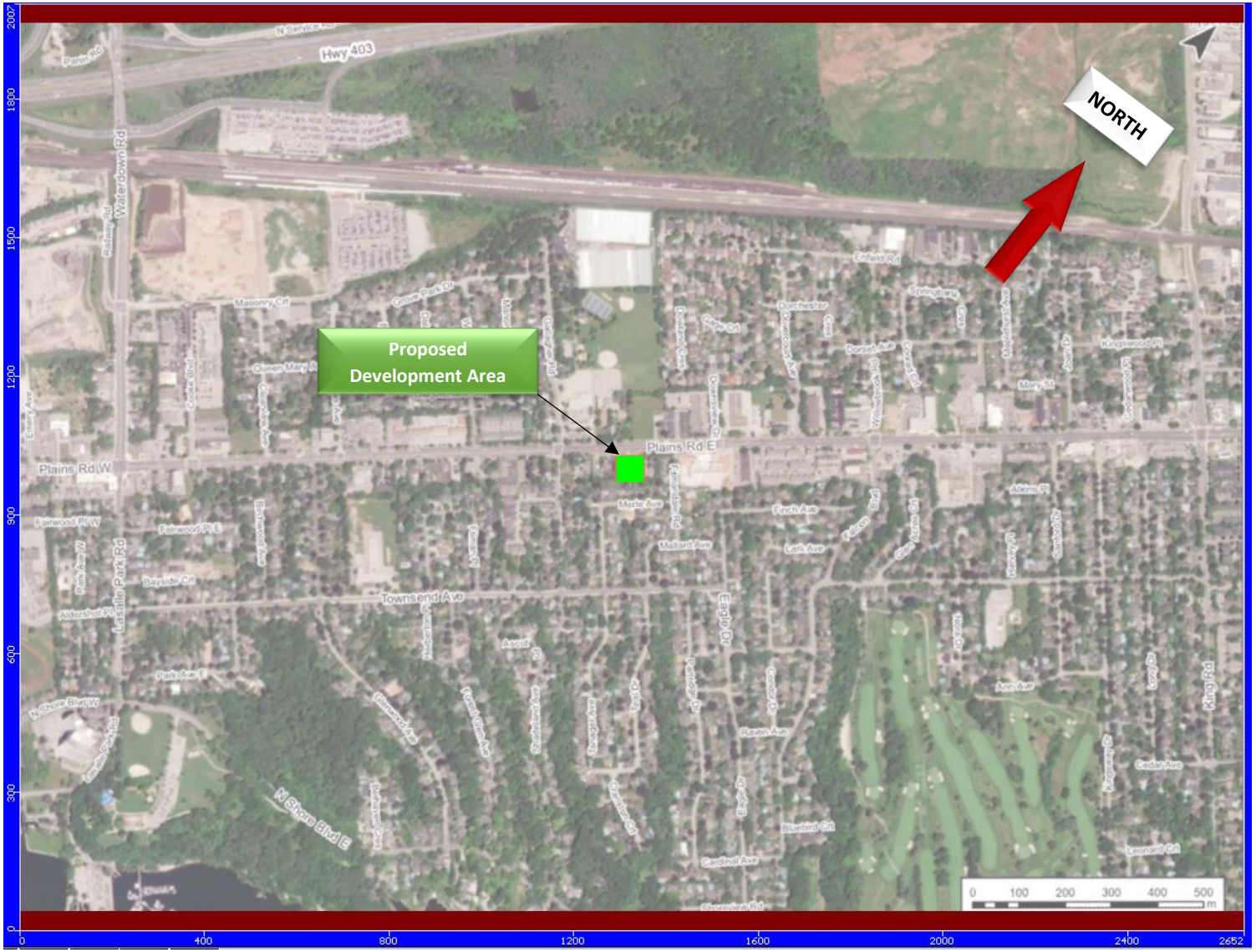
SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

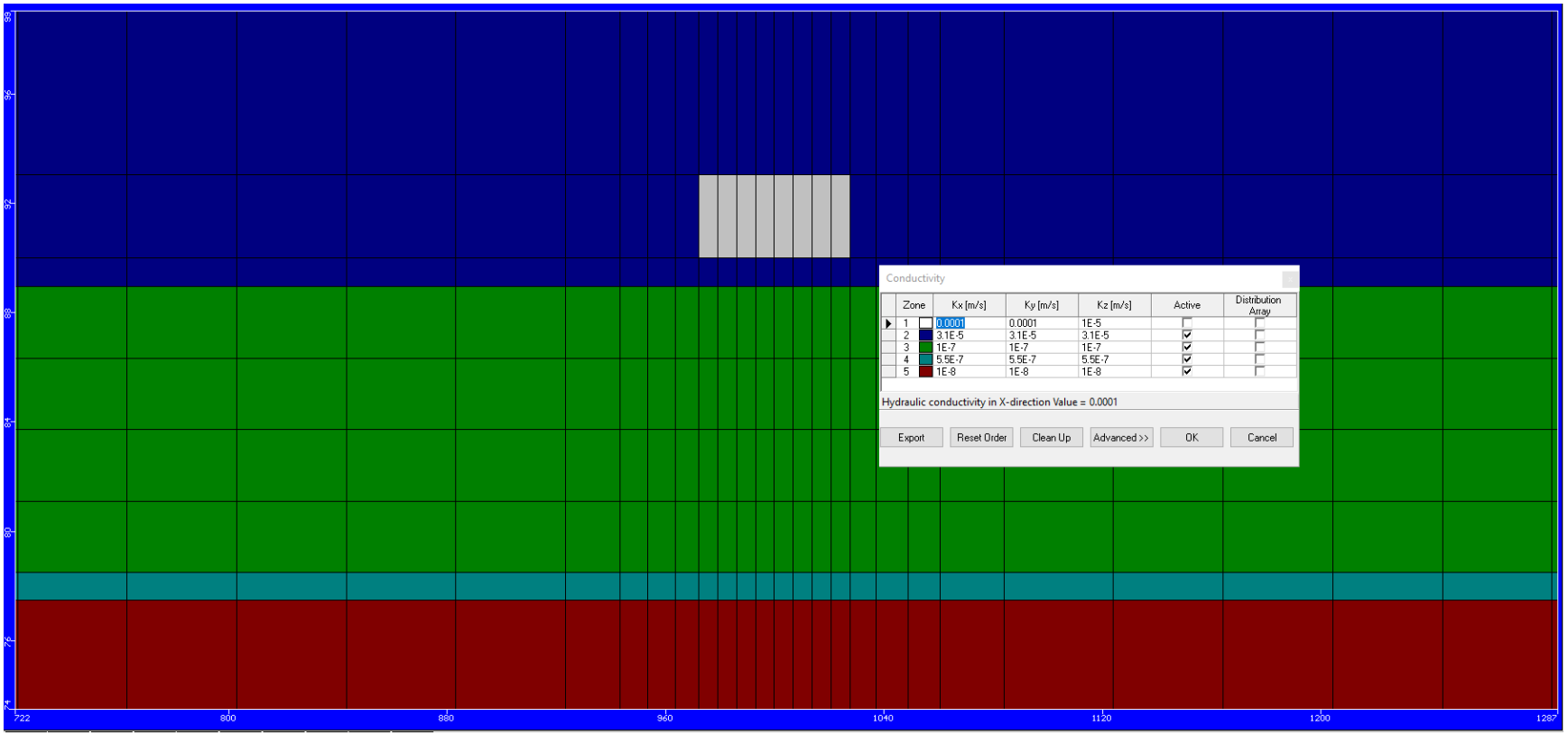
Appendix E – Numerical Modeling for Construction and Post-Construction Dewatering Estimations

1- Proposed Development Area and Constant Head Boundaries-Plan View



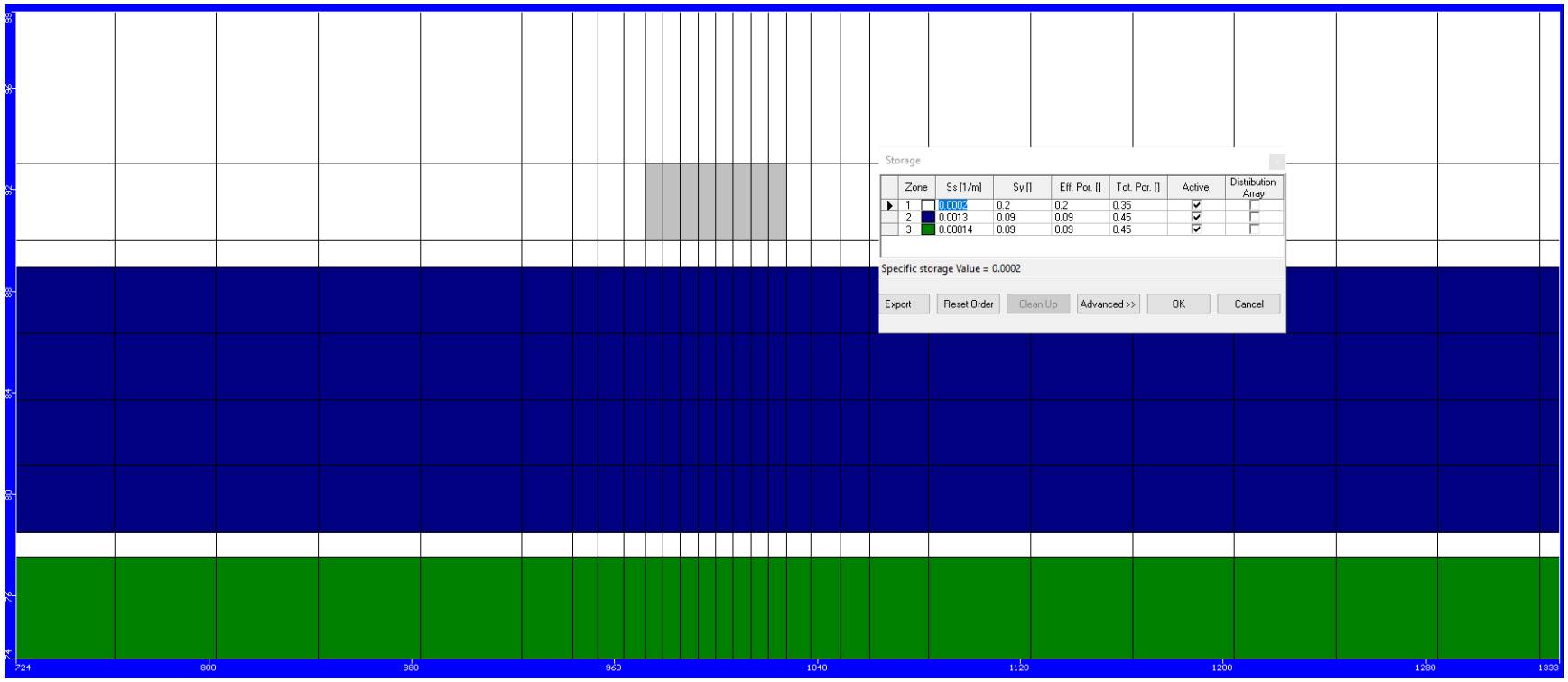
2- Geology and Drain

(Cross-Sectional View)



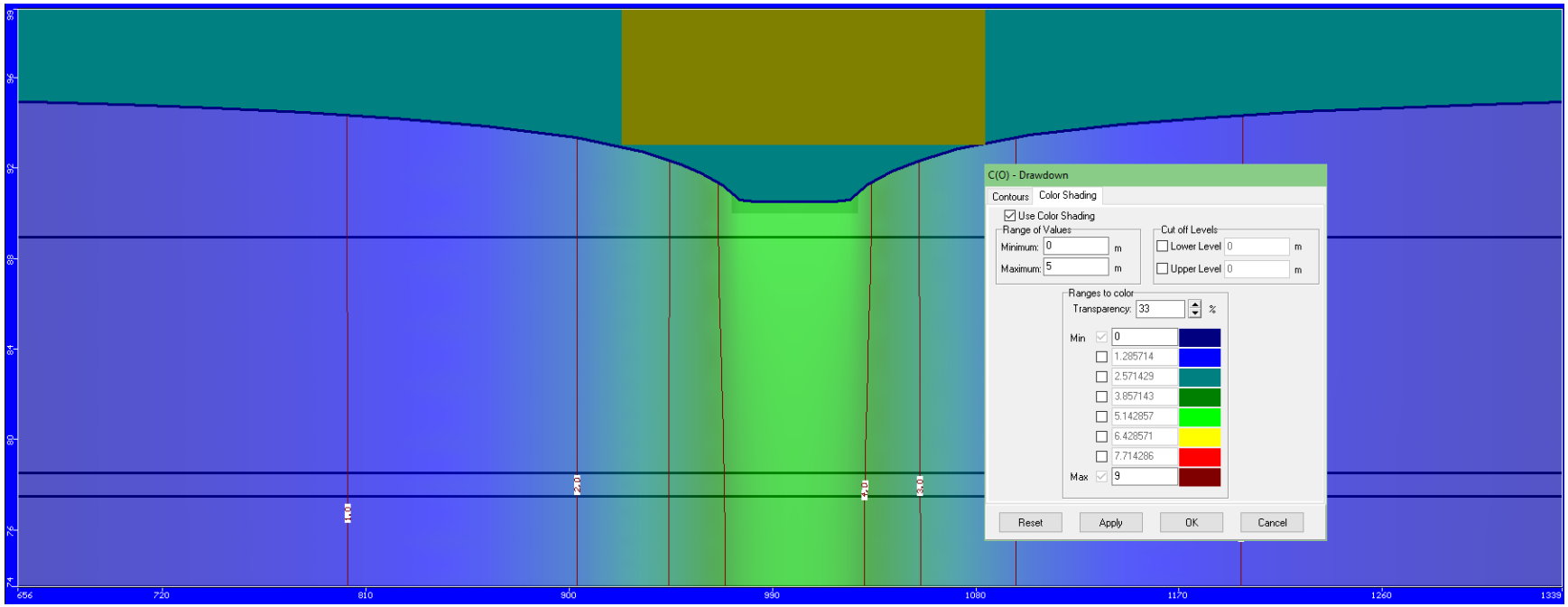
3- Storage, Porosity, and Drain

(Cross-Sectional View)



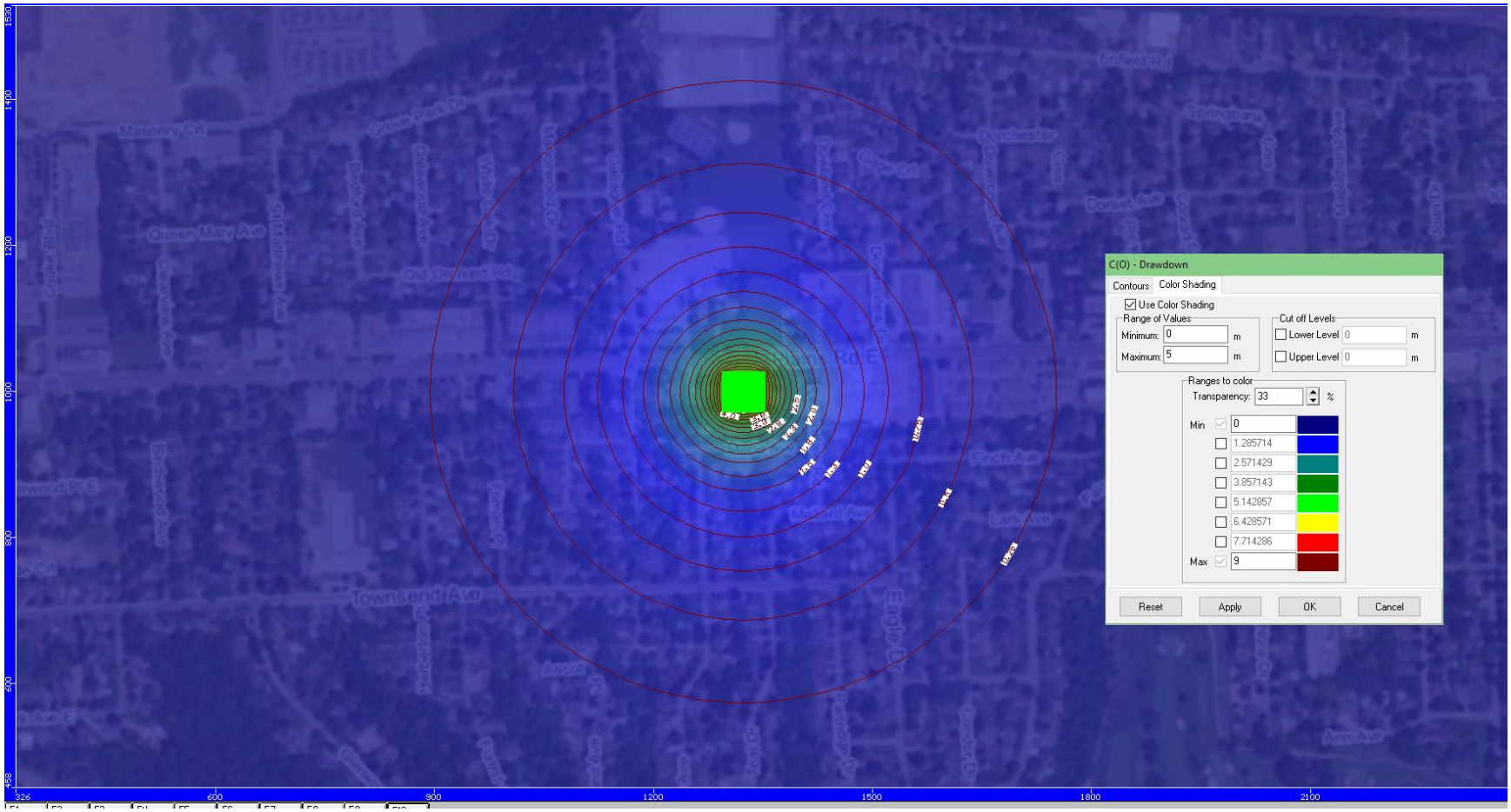
4- Short-Term Dewatering from Main Excavation without Cut-Off Walls

(After 730 Days, Cross-Sectional View)



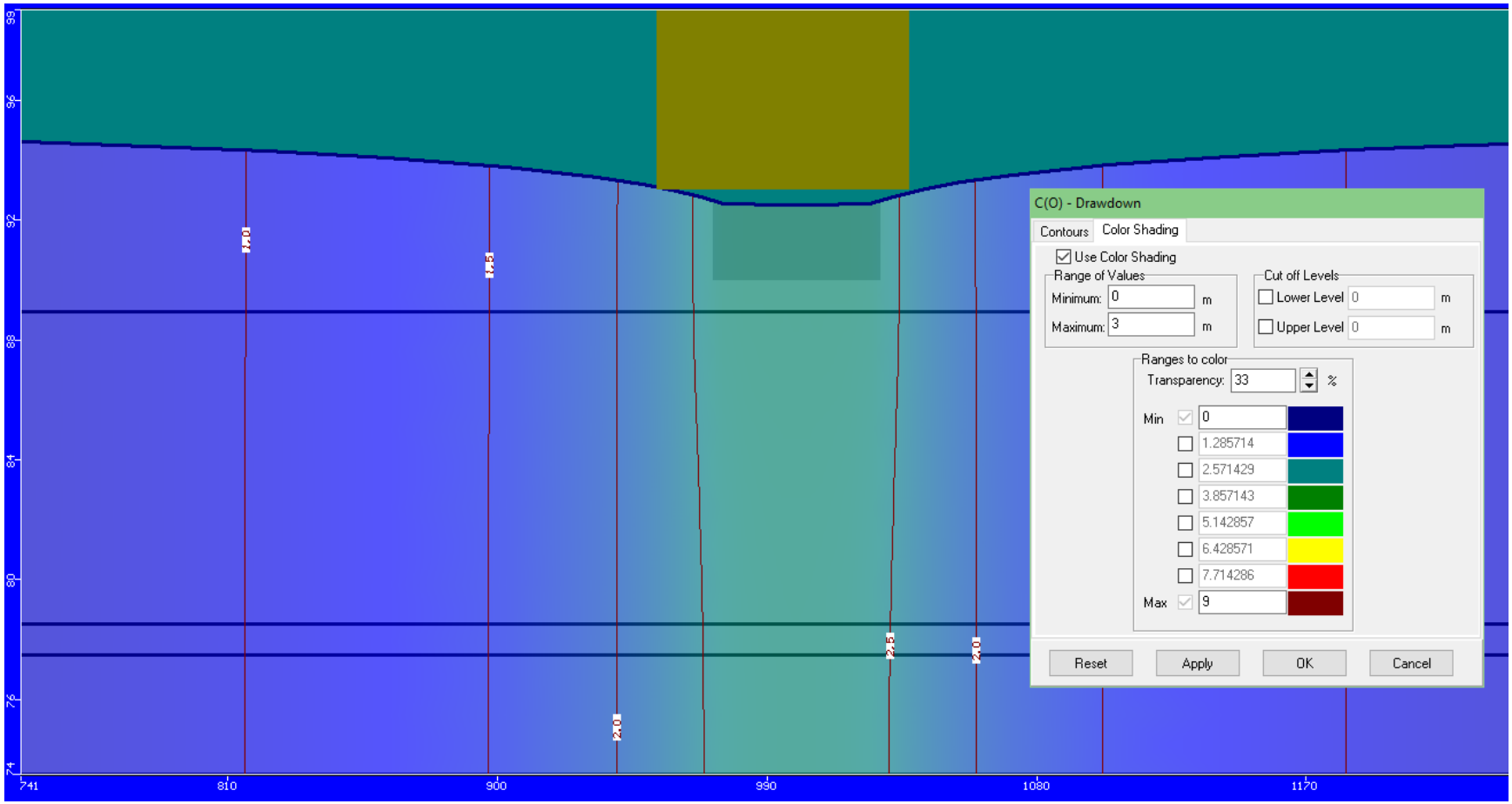
5-Zone of Influence of Short-Term Dewatering from Main Excavation without Cut-Off Walls

(After 730 Days, Plan View)



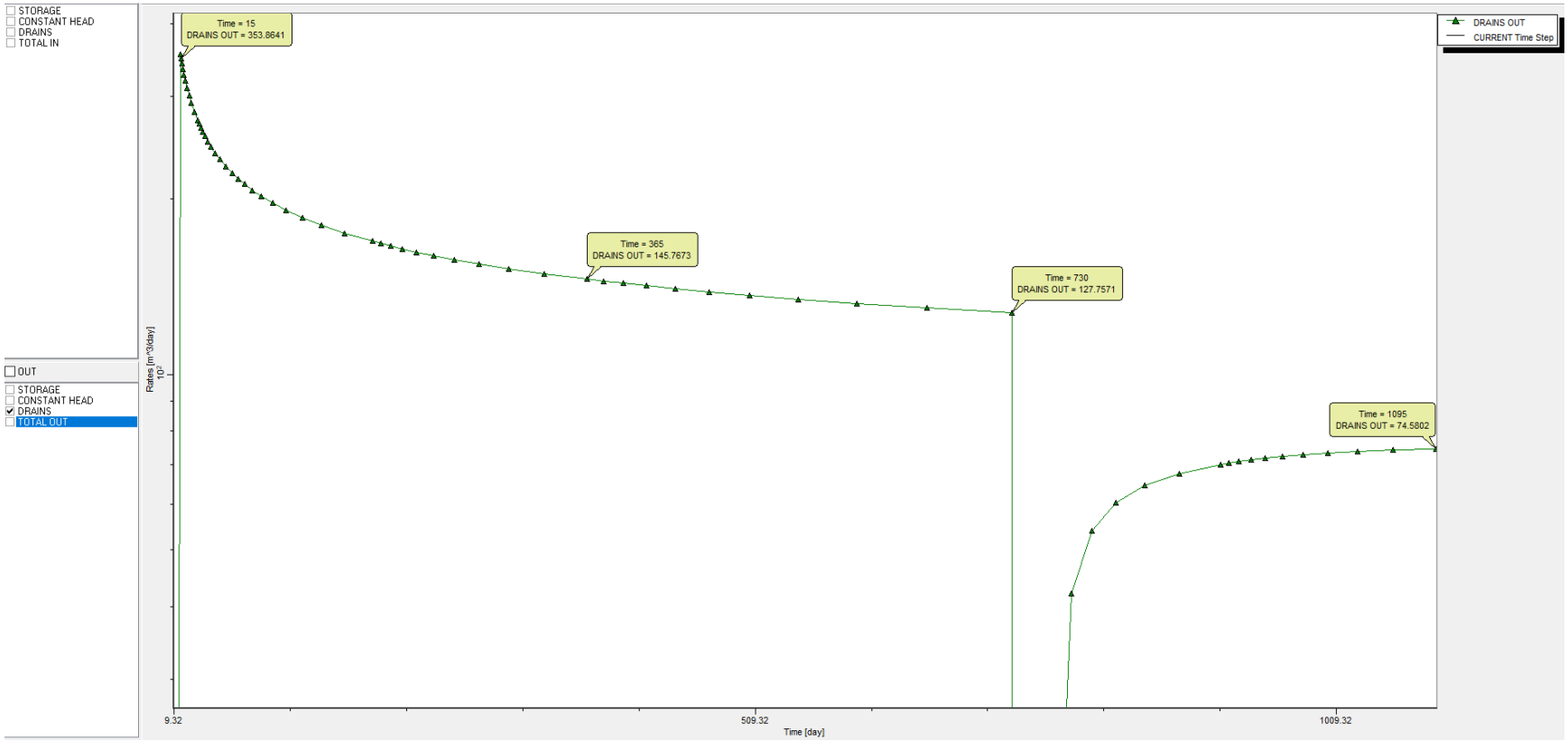
6- Long-Term Dewatering from Main Excavation without Cut-Off Walls

(After 1095 Days, Cross-Sectional View)



7- Short-Term and Long-Term Dewatering Flow Rate Estimates without Cut-Off Walls

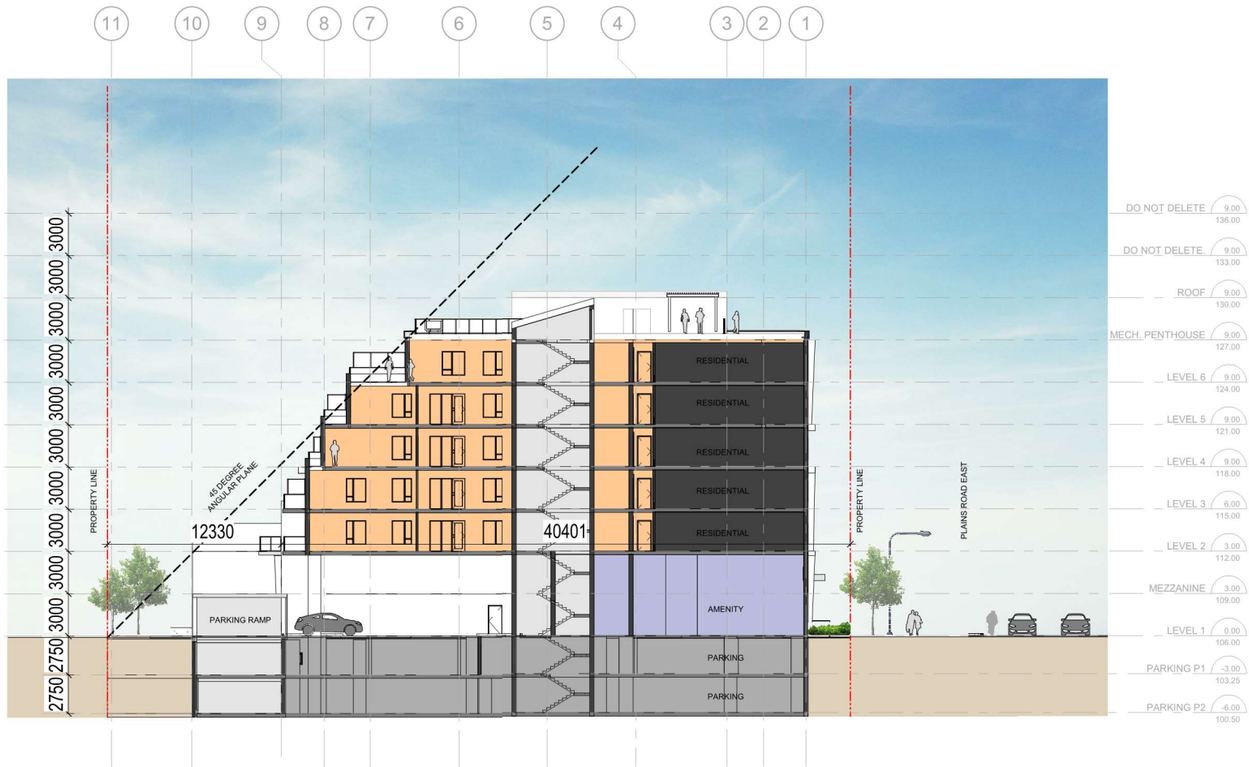
(Between 15 Days and 1095 Days)



Appendix F – Architectural Drawing

Do not scale drawings. Contractors must check and verify all dimensions and report any discrepancies to the Architect before proceeding with the work. All documents remain the property of the Architect. Unauthorized use, modification, and/or reproduction of these documents is prohibited without written permission. The Contract Documents were prepared by the Consultant for the account of the Owner.
The material contained herein reflects the Consultants best judgement in light of the information available to him at the time of preparation Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them are the responsibility of such third parties. The Consultant accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on the Contract Documents.

C:\Users\tmclean\Documents\20042 - 284-292 Plains Rd E. Burlington - V6_tmclean@srmarchitects.ca.rvt



1 **Angular Plane East**
1 : 200

GENERAL NOTES

1. **DO NOT SCALE DRAWINGS**. WRITTEN DIMENSIONS SHALL HAVE PRECEDENCE OVER SCALED DIMENSIONS.
2. ALL WORK SHALL COMPLY WITH THE 2012 ONTARIO BUILDING CODE AND AMENDMENTS.
3. CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND SPECIFICATIONS AND REPORT ANY DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.
4. ALL CONTRACTORS AND SUB-CONTRACTORS SHALL HAVE A SET OF APPROVED CONSTRUCTION DOCUMENTS ON SITE AT ALL TIMES.
5. ALL DOCUMENTS REMAIN THE PROPERTY OF THE ARCHITECT. UNAUTHORIZED USE, MODIFICATION, AND/OR REPRODUCTION OF THESE DOCUMENTS IS PROHIBITED WITHOUT WRITTEN PERMISSION. THE CONTRACT DOCUMENTS WERE PREPARED BY THE CONSULTANT FOR THE ACCOUNT OF THE OWNER.
6. THE MATERIAL CONTAINED HEREIN REFLECTS THE CONSULTANTS BEST JUDGEMENT IN LIGHT OF THE INFORMATION AVAILABLE TO HIM AT THE TIME OF PREPARATION. ANY USE WHICH A THIRD PARTY MAKES OF THE CONTRACT DOCUMENTS, OR ANY RELIANCE ON/OR DECISIONS TO BE MADE BASED ON THEM ARE THE RESPONSIBILITY OF SUCH THIRD PARTIES.
7. THE CONSULTANT ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY ANY THIRD PARTY AS A RESULT OF DECISIONS MADE OR ACTIONS BASED ON THE CONTRACT DOCUMENTS.

No.	Date	Revision

srm ARCHITECTS INC.

Project No	20042
Project Date	2021-04-22
Drawn by	Author
Checked by	Checker
Plot Date / Time	8/31/2021 12:29:33 PM

284-292 PLAINS RD. E, BURLINGTON

ANGULAR PLANE - EAST

Drawing Scale	1 : 200
Status	PRELIMINARY
Drawing No.	Revision No.
D3.4	