GEI Consultants

Consulting Engineers and Scientists

Hydrogeological Investigation

40 Wilson Avenue

Belleville, Ontario

Submitted to:
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1. Introduction

GEI Consultants (GEI) was retained by RIC (Midland Land) Inc. to complete a hydrogeological investigation and report for the proposed residential subdivision to be located at 40 Wilson Avenue and along an extension of Wilson Avenue, in Belleville, Ontario. A site location plan is enclosed as Figure 1. Revision 1 of this report was prepared to reflect the newest site plan, which now only includes the western half of the original property. The new subject site boundary is shown on Figures 2A and 2B.

The existing site is generally rectangular in shape and consists of industrial lands that are bounded by Wilson Avenue and industrial lands to the south, Palmer Road and residential lands to the west, residential lands to the north, and industrial lands to the east. A large industrial building formerly existed at 40 Wilson Avenue just east of the subject site but was recently demolished, and a large stockpile of concrete rubble and construction debris (assumed to be from the demolition) is in the northern area of the site. The site mainly consists of vacant fields with intermittent trees, stockpiles of soil and rubble, and concrete debris. A cell tower is located in the northwestern corner of the property near Palmer Road. An aerial image of the site from 2018 is provided on Figure 2A.

GEI was provided with the following drawing for review in preparation of this report: *"Draft Plan of Subdivision, Part of Lots 15, 16, 17, 2 & 27, Plan 135, Part of Lots 6 & 7, Plan 1819, Part of Wilson Avenue, Plan 6, In the City of Belleville, County of Hastings,"* dated November 6, 2020, by Innovative Planning Solutions.

The drawing shows that the subject site has an area of 7.78 ha. Proposed site conditions are shown on Figure 2B and the development will generally consist of the following:

- A variety of single detached residential lots and street townhouse units.
- A SWM facility in the southwestern corner.
- An extension to Wilson Avenue and new Streets B, C and D.

Final grading or site servicing plans were not available at the time of writing this report, but the subdivision will be municipally serviced.

GEI completed a geotechnical investigation and report under a separate cover. It is noted that a 12-month groundwater monitoring program is on-going, and the results will be reported under separate cover upon completion.

1.1 Purpose and Scope of Work

The main objectives of the Hydrogeological Investigation were to:

a) Establish the local hydrogeological settings of the site;
b) Provide an assessment of anticipated construction dewatering flow rates for a generic construction scenario;
c) Assess groundwater quality and compare the results to the applicable City of Belleville Storm Sewer Use By-Law parameters;
d) Qualitatively assess the potential impact to the nearby structures, water bodies and water uses, if any, and comment on future regulatory agency involvement;
e) Complete a water balance (pre- and post-construction) in general accordance with the Conservation Ontario requirements; and,
f) Prepare a Hydrogeological Investigation Report.

To achieve the investigation objectives, GEI proposed and initiated the following scope of work:

a) Conduct a background desktop review of pertinent geological and hydrogeological resources, Ministry of Environment, Conservation and Parks (MECP) Water Well Records, previous reports, and proposed site plan drawings.
b) Visit the site and note existing site conditions, site setting, topography, drainage, water features, and potential water wells within 500 m of the site, if any.
c) Utilization of the eight (8) boreholes and three (3) monitoring wells completed as part of the concurrent Geotechnical Investigation;
d) Revisit the site and measure groundwater levels, perform borehole permeability testing at a selected monitoring wells, and retrieve two representative groundwater sample.
e) Submit one (1) representative unfiltered and one (1) representative filtered groundwater sample for laboratory testing to compare against the City of Belleville Sewer Use By-Law.
f) Evaluate the background information, and field and laboratory data to assess construction dewatering and permanent dewatering requirements.
g) Complete a water balance (pre- and post-construction) for the proposed development.
h) Prepare a Hydrogeological Investigation report.

1.2 Regulatory Requirements

1.2.1 Water Taking – Temporary

The volume of water entering the excavation will be based on both ground water infiltration and precipitation events. Based on O.Reg. 63/16, the following dewatering limits and requirements are as follows:

- Construction Dewatering less than 50,000 L/day: The takings of both groundwater and stormwater do not require a hydrogeological report and does not require a Permit to Take Water (PTTW) from the MECP.
- Construction Dewatering greater than 50,000 L/day and less than 400,000 L/day: The taking of groundwater and/or stormwater requires a hydrogeological report and registration on the Environmental Activity and Sector Registry (EASR) but does not require a PTTW from the MECP.
- Construction Dewatering greater than 400,000 L/day: The taking of groundwater and/or stormwater requires a hydrogeological report and a PTTW from the MECP.

1.2.2 Source Water Protection

The site is within the jurisdiction of Quinte Conservation Authority (QCA). The following documents should be used in determination of the regulatory requirements when it comes to maintaining hydrogeological function at this site:

- "*Approved Quinte Region Source Protection Plan*", dated September 19, 2019, by Quinte Region Source Protection Committee.
- "*Integrated Watershed Management*", dated October, 2019, by Conservation Ontario.

Based on Source Water Protection online mapping, the following is noted:

- Wellhead Protection Area (WHPA): The site is not located within a WHPA (Figure 3).
- Intake Protection Zone (IPZ): The site is not located within an IPZ 3 (Figure 4)
- Highly Vulnerable Aquifer (HVA): The site is located within an HVA (Figure 5).
- Significant Groundwater Recharge Area (SGRA): The site is not located within an SGRA (Figure 6).
- The site is not located within the Oak Ridges Moraine or Niagara Escarpment.

2. Site Setting

2.1 Physiography, Surficial and Bedrock Geology

The site is located within the physiographic region denoted as the Napanee Plain (Chapman and Putnam, 1984). Physiographic landform mapping shows the site lies within the limestone plains, with bevelled till plains to the north.

Surficial and bedrock geology mapping of the site by the Ontario Geological Survey indicate that the is mapped as having surficial paleozoic bedrock, and north of the site glaciolacustrine deposits comprising silt and clay are noted. These findings are consistent with the subsurface soil conditions encountered in the boreholes advanced on site, as discussed in Section 4.1.

The bedrock in the general area consists of Verulam limestone and shale, and is part of the Simcoe Group. Bedrock was encountered on-site at depths of 1.1 to 4.6 m below existing grade (Elev. 99.2 to 95.2).

2.2 Topography and Drainage

The existing site slopes from the north down to the south from a local elevation of approximately 100.63 metres at the northern site limit to local elevation 97.95 metres at the southern site limit (about 2.7 metres of topographic relief across the site). As such, the site will generally drain southward and the portion of the site closest to Palmer Road (western portion of the site) will generally drain towards the existing catch-basins along Palmer. Ultimately overland flow is anticipated to flow southward towards Lake Ontario.

No water bodies are located on the site. The closest surface water is a tributary of Potter Creek, located approximately 470 m west of the site. The site is in the Moira River Watershed which drains into the Bay of Quinte, in the jurisdiction of Quinte Conservation Authority.

2.3 MECP Water Well Records

MECP water well records were obtained within approximately 500 metres of the site area to assess the general nature of the groundwater resource in near vicinity of the site, and historical/current uses of wells in the area. Two Hundred and Twenty-Six (226) well records were found, the approximate MECP well locations are shown on Figure 7 and a well records summary table is included in Appendix A.

The wells were installed for the following uses:

- Twenty-six (26) of the records indicate domestic use.

- Two (2) of the records indicate industrial use.
- Fifty-Two (5) of the records indicate monitoring/test hole use.
- Two (2) of the records indicate "not in use"
- One Hundred and Ninety-One (191) of the records did not specify the use and are considered to be of unknown use.

The stratigraphic descriptions within the MECP monitoring well records are typically inaccurate due to the methodology in which they are determined (observations of cuttings and no consistency between descriptions of soil between different drillers). Though this is the case, an overall sense of the deep stratigraphy can be determined by looking at commonalities between most stratigraphic descriptions and where the wells were terminated in an aquifer. The well records typically indicate that silt and clay, and sands with variable gravel and silt over limestone bedrock were encountered.

Limestone bedrock was noted at depths of 0.9 to 11.0m, as such it is anticipated that domestic water supply wells are completed within the limestone unit as 'open' holes. It is typical of bedrock wells to be 'open' holes rather than screening a portion of the bedrock unit.

2.4 Visual Inspection of Site

A visual site inspection was carried out on September 31, 2021, by senior GEI staff to assess site drainage, topography and presence of surface water features.

The site is approximately 7.78 hectares in size and is bounded by Palmer Road and residential lands to the west, vacant former industrial lands to the south, residential lands to the north, and industrial and residential lands to the east. The site is vacant; however, a large industrial building formerly existed at 40 Wilson Avenue just east of the subject site but was recently demolished, and a large stockpile of concrete rubble and construction debris (assumed to be from the demolition) is in the northern area of the site. The rest of the site includes fields, intermittent trees, and stockpiles of soil, rubble and concrete debris. It is noted that there is some concrete cover near the northeastern portion of the site.

It is noted that monitoring wells from a previous investigation completed on-site were observed. The monitoring well marked as "Existing Well" on Figure 2A was accessible and functional, and GEI utilized this monitoring well as part of the hydrogeological investigation.

3. Procedures and Methodology

Prior to the commencement of drilling activities, the locations of underground utilities including natural gas, electrical, telephone, water, etc. were marked out by public and private utility locating companies. The fieldwork for the drilling program was carried out on August 4 to 6, 2021. A total of eight boreholes (Boreholes 6 to 13) were advanced on the subject site using a track-mounted drill rig. To advance the boreholes, continuous flight solid stem augers and standard soil sampling equipment was utilized. All samples were collected as per ASTM D1586 *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils* to assess the strength characteristics of the substrate.

It is noted that the original investigation also included the eastern part of the 40 Wilson Avenue property and an additional five boreholes (Boreholes 1 to 5) with three monitoring well installations were advanced in the eastern area. Boreholes 1 and 4 also recovered rock core. The logs and results from Boreholes 1 to 5 are not included within Revision 1 of this report as they were advanced beyond the subject site boundary.

The boreholes were advanced to auger refusal at depths of 1.5 to 4.6 metres below existing grade. The horizontal locations were laid out in the field by GEI prior to the drilling operations and the locations are shown on Figures 2A (2018 aerial image) and 2B (proposed site plan). Ground surface elevations of the boreholes were measured using survey equipment in reference to a local site benchmark (top nut of the fire hydrant located north of Wilson Avenue to the east of the subject site) with an assumed elevation of 100.0 metres. The GPS coordinates of the borehole locations were measured with a handheld GPS unit and were referenced to the NAD 83 geodetic datum.

The field staff examined and classified characteristics of the soils encountered in the boreholes, made groundwater observations during and upon completion of the drilling, recorded observations of borehole construction, and processed the recovered samples. Soil sampling was conducted at regular intervals for the full depth of the borehole. The boreholes were backfilled upon completion. All recovered soil samples were logged in the field, carefully packaged and transported to the laboratory for more detailed examination and classification. In the laboratory, the samples were classified as to their visual and textural characteristics and geotechnical laboratory testing was carried out with the results included in Appendix C. Three (3) monitoring wells were installed to facilitate long-term groundwater monitoring. Monitoring well construction is shown on the borehole logs in Appendix B.

3.1 Groundwater Monitoring

Groundwater levels are to be measured in the six monitoring wells installed by GEI, and the one monitoring well ("Existing Well") installed by others each month for one (1) year to determine the seasonally high groundwater levels. The levels to date have been measured from September to October 2021. The remaining groundwater level measurements will be provided in a supplemental letter.

3.2 Borehole Permeability Testing

A rising head test was completed in the one monitoring well installed by others ("Existing Well") on September 31, 2021. Water was manually purged from monitoring wells using LDPE piping and a foot valve. The static water level was measured prior to the start of testing, and the change in water level was monitored using an electronic level logger. The level logger was left in the monitoring well for several hours to allow for adequate recovery of the groundwater. The tests were completed to estimate the horizontal hydraulic conductivity (K) of the soils at the well screen depths.

The semi-log plot for drawdown versus time for the test is provided in Appendix D.

3.3 Ground Water Sampling

To establish baseline conditions and assess the suitability for discharge of pumped groundwater into City of Belleville sewer systems during potential dewatering activities, the following groundwater samples were collected from the "Existing Well" on September 31, 2021 and tested relative to the City of Belleville By-Law 2019-81 Sewer Use By-Law:

- One (1) sample was collected from "Existing Well" and analyzed against The City of Belleville By-Law 2019-81 Sewer Use By-Law.
- One (1) filtered sample was collected from "Existing Well" and analyzed against The City of Belleville By-Law 2019-81 Sewer Use By-Law for metals only.

The samples were collected 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 field filtered samples were run through a 75 µm filter. The samples were submitted to CALA- accredited Caduceon Environmental Laboratories for analysis. The results of the groundwater chemistry are presented in the laboratory Certificates of Analysis provided in Appendix E.

4. Subsurface Conditions

The borehole locations are shown on Figure 2A and 2B and detailed subsurface conditions are presented on the borehole logs in Appendix B. Geotechnical laboratory test results are included as Appendix C. It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations. It should be noted that 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 and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including: visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time also may result in changes in conditions interpreted to exist at locations where sampling was conducted.

4.1 Stratigraphy

The soil conditions encountered at the borehole locations are summarized below. A stratigraphic cross-section across the property as aligned on Figures 2A and 2B, is included as Figure 8.

4.1.1 Earth Fill

Earth fill was encountered at the ground surface in Boreholes 6 to 11, and 13. The earth fill extended to depths of 0.8 to 1.5 metres below grade (local Elev. 99.9 to 96.8 metres) in Boreholes 6 to 8, 10, 11 and 13. Borehole 9 encountered auger refusal in the earth fill at 2.1 metres below grade (local Elev. 97.4 metres) due to an obstruction (possibly a buried concrete slab). The earth fill consisted of silty sand, to sandy and silt, to sand and gravel, to sand and limestone fragments. Deleterious material including concrete, bricks, plastic, and fabric was encountered within the fill in Boreholes 9 to 11 and 13. The earth fill was typically brown and moist. Standard Penetration Test (SPT) results ("N" Values) measured in the earth fill ranged from 9 to greater than 100 blows per 300 mm of penetration, indicating a loose to very dense relative density.

4.1.2 Native Soils

A native cohesionless deposit consisting of sand and limestone fragments, with trace to some silt, and trace to some gravel was predominantly encountered beneath the site above the bedrock surface. The deposit was encountered at the ground surface in Borehole 12 and underlying the earth fill in Boreholes 6 to 8, 11 and 13. The deposit extended from depths of 0 to 1.5 metres

below grade (local Elev. 99.9 to 96.8 metres) to the inferred bedrock surface at depths of 1.5 to 4.6 metres below grade (local Elev. 98.5 to 95.2 metres) in the boreholes. The sand with limestone fragments was typically damp to moist and brown, and the measured SPT "N" Values ranged from 9 to greater than 100 blows per 300 mm of penetration, indicating a loose to very dense (but typically dense to very dense) relative density.

In Borehole 10, clayey and silty sand with trace gravel and trace to some limestone fragments was encountered underlying the earth fill at 1.5 metres below grade (local Elev. 97.8 metres). The brown and wet clayey and silty sand extended to the inferred bedrock surface at 2.4 metres below grade (local Elev. 96.9 metres). The SPT "N" Values were greater than 100, indicating a hard consistency.

The augers were constantly grinding as they advanced through the overburden soils due to the amount of limestone fragments. Cobbles, boulders, and limestone slabs are expected to be encountered in the overburden across the site.

4.1.3 Inferred Weathered Bedrock

Inferred weathered bedrock was encountered in the boreholes underlying the soil overburden, at depths of 1.5 to 4.6 metres below grade (local Elev. 98.5 to 95.2). The bedrock was inferred by drilling observations, auger grinding, auger refusal, and samples recovered in the split spoon or by auger samples.

The depths of inferred bedrock and method of identification are summarized below. The bedrock surface undulates across the site but generally slopes down from north to south.

Borehole Location	Local Elev. (m) of Ground Surface	Depth / Local Elev. (m) of Inferred Weathered Bedrock Surface	Method of Bedrock Identification
6	100.63	2.1 / 98.5	Inferred by auger grinding, auger refusal, auger sample
7	99.91	4.6 / 95.3	
8	99.63	3.5 / 96.1	
9	99.51	Not encountered – refusal on obstruction in earth fill	Not encountered
10	99.32	2.4 / 96.9	Inferred by auger grinding, auger refusal, auger sample, split spoon sample
11	98.35	3.2 / 95.2	
12	96.69	1.5 / 95.2	
13	97.95	1.7 / 96.3	

It is noted that rock core was recovered from two boreholes advanced by GEI approximately 110 and 320 metres east of the current subject site as part of the original investigation. Weathered limestone bedrock of the Verulam Formation was encountered. The Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) values were recorded in accordance with the conventions used by the International Society for Rock Mechanics (ISRM). TCR ranged from 33 to 67%, SCR ranged from 0 to 32%, and RQD was 0%. The TCR was low due to the amount of weathering, rubblized zones and fractures which resulted in core loss. RQD was 0% in all core runs due to the number of fractures and rubblized zones. Sound (unweathered) bedrock was not encountered in the cored holes, and the weathered zone may be thicker than 3 metres in some locations based on the recovered core.

4.2 Groundwater

4.2.1 Groundwater Levels

Unstabilized groundwater level measurements and cave measurements were taken upon completion of drilling of each borehole as shown on the borehole logs in Appendix B. These measurements provide a rough estimate of the possible excavation and temporary groundwater control constructability considerations that may arise. The boreholes remained open and dry upon completion.

Monitoring wells were installed in Boreholes 7, 12 and 13 to facilitate the measurements of long-term, stabilized groundwater levels. The 50 mm diameter PVC wells had 0.6 to 1.5-metre-long screens as required based on the depth of soil overburden. An existing monitoring well was encountered on site near Borehole 13, as shown on Figures 2A and 2B. The purpose of this well is unknown but was measured to be 8.5 metres deep and groundwater was measured in the well. The well is screened within the limestone bedrock based on the results of nearby Borehole 13.

A summary of the groundwater level measurements is presented below:

Monitoring Well	Screened Location		Strata Screened	Depth / Local Elevation (m) of Groundwater Table		
	Depth (m)	Local Elev. (m)		August 31, 2021	October 8, 2021	March 26, 2022
7	3.1 to 4.6	96.8 to 95.3	Sand & Limestone Fragments	Dry		
12	0.9 to 1.5	95.8 to 95.2				
13	1.1 to 1.7	96.9 to 96.3				
Existing Well near BH 13	Bottom of Well at 8.5 m / 89.5 m		Limestone Bedrock	5.31 / 92.64	5.56 / 92.39	3.6 / 94.4

The highest groundwater level measured at the site to date is 3.6 metres below grade, within the limestone bedrock at the south end of the site. The site grades generally slope from a higher elevation in the north to a lower elevation in the south. Some perched water may be present at the overburn-bedrock interface following precipitation events or the spring freshet, however the other monitoring wells remained dry on site during each reading. The groundwater level will change based on seasonal fluctuations. The overburden soils are cohesionless and will allow for the free flow of water when wet. It is expected that the highly fractured bedrock will also allow for the free flow of water. GEI is measuring the water levels once per month for a year to determine the seasonally high groundwater elevation, with the results provided in a separate letter report.

It is anticipated that the regional groundwater flow within the limestone bedrock would be southward towards the Bay of Quinte.

4.2.2 In-Situ Permeability

A hydraulic conductivity value was calculated from the rising head data using Hvorslev's solution (1951). It is noted that the monitoring wells installed by GEI as part of the geotechnical investigation did not encountered groundwater, and only the "Existing Well" completed by others could be utilized for in-situ permeability testing. The semi-log plot for drawdown versus time for the test is provided in Appendix D and are summarized in the table below.

Table 3: Summary of Hydraulic Conductivity (K) Testing Results

Monitoring Well	Well Depth (m bgs)	Strata Screened	Hydraulic Conductivity (m/s)
Existing Well near BH13	8.5	Limestone Bedrock (inferred)	4.0×10^{-6}

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

- Silty Sand: 10^{-3} m/s to 10^{-7} m/s
- Sand: 10^{-2} m/s to 10^{-5} m/s
- Limestone 10^{-5} m/s to 10^{-9} m/s

The actual measured hydraulic conductivity of the limestone bedrock is within the expected range. For design purposes, the hydraulic conductivity of the limestone is 4.0×10^{-6} m/s.

4.2.3 Baseline Groundwater Chemistry Testing

To establish baseline conditions and assess the suitability for discharge of pumped groundwater into City of Belleville sewer systems during potential dewatering activities, the following groundwater samples were collected from the "Existing Well" monitoring well on September 31, 2021 and tested relative to the City of Belleville By-Law 2019-81 Sewer Use By-Law:

- One (1) sample was collected from "Existing Well" and analyzed against The City of Belleville By-Law 2019-81 Sewer Use By-Law.
- One (1) filtered sample was collected from "Existing Well" and analyzed against The City of Belleville By-Law 2019-81 Sewer Use By-Law for metals only.

The samples were collected 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 field filtered samples were run through a 75 µm filter. The samples were submitted to CALA- accredited Caduceon Environmental Laboratories for analysis. The results of the groundwater chemistry are presented in the laboratory Certificates of Analysis provided in Appendix E.

A summary of the results is presented in the table below for samples relative to The City of Belleville By-Law 2019-81 Sewer Use By-Law.

Sample Location	Parameters Tested	City of Belleville Storm Sewer Use By-Law Criteria Exceedances	City of Belleville Sanitary Sewer Use By-Law Criteria Exceedances
Existing Well (Unfiltered)	All Parameters Required per By-Law	TSS	TSS
Existing Well (Filtered)	Metals	None	None

The unfiltered groundwater sample collected from the "Existing Well" met The City of Belleville By-Law 2019-81 Sewer Use By-Law Discharge for both Storm and Sanitary criteria with the exception of TSS. The filtered groundwater sample tested for only metals showed a further reduction in metal concentrations (even though the unfiltered sample met the concentrations in the City By-law).

The above chemical results suggest treatment of the dewatering discharge water by filtration will reduce the concentration of suspended solids sufficiently to meet the applicable City of Belleville Storm and Sanitary Sewer Use By-Law Criteria.

It is understood that during construction dewatering, the pumped water is to be first discharged to a silt bag or sedimentation tank at a minimum before being discharged to surface and/or existing storm sewer infrastructure.

4.3 Infiltration

Determination of percolation rates are based on the "*Ministry of Municipal Affairs and Housing (MMAH) Supplementary Guidelines SB-6, Percolation Time and Soil Descriptions, September 14, 2012*". The boreholes indicate the sand, sandy silt, and/or silty and clayey sand soils were encountered near the ground surface. The Unified Soil Classification System classifications for the predominant soils encountered on-site are summarized below with the interpreted unfactored percolation rates (T-Time) and unfactored infiltration rates:

Unified Soil Classification System Classification	Unfactored Percolation Rate (T-Time) (mins/cm)	Unfactored Infiltration Rate (mm/hr)
S.P. Poor graded sands with little fines	2 to 8	75 to 300
S.M. Silty sands, sand-silt mixtures	8 to 20	30 to 75
S.C. Clayey sands, sand-clay mixtures	12 to 50	12 to 50

This infiltration rate is not applicable below the groundwater table and is not applicable to the existing zones of earth fill across the site. Appendix C of *"Low Impact Development Stormwater Management and Planning Design Guide"* (Version 1.0, 2010, by CVC and TRCA) suggests safety factors to be applied to infiltration rates. The safety factor applicable to the site is expected to be 2.5 but this must be confirmed once the final location and elevation of LID measures are known. If LID infiltration measures will be designed and constructed on site, GEI can further refine the infiltration rates by excavating test pits and conducting Guelph Permeameter tests in the exact footprints and elevations of the LID measures.

5. Discussion and Analysis

The conceptual site drawing shows that the subject site has an area of 7.78 ha. Proposed site conditions are shown on Figure 2B and the development will generally consist of the following:

- A variety of single detached residential lots and street townhouse units.
- A SWM facility in the southwestern corner.
- An extension to Wilson Avenue and new Streets B, C and D.

Preliminary utility plans and proposed residential building plans were not available to GEI, as such site servicing, and potential basement excavation depths have been assumed to extend to a depth of 3.0m below existing grade.

5.1 Temporary Construction Dewatering

It is expected that the groundwater table is located at a depth of 3.6 metres below grade across the site or deeper, within the limestone bedrock. Some perched water may be present at the overburden-bedrock interface following precipitation events or the spring freshet. The groundwater level will change based on seasonal fluctuations. The overburden soils are cohesionless and will allow for the free flow of water when wet. It is expected that the highly fractured bedrock will also allow for the free flow of water. GEI is measuring the water levels once per month for a year to determine the seasonally high groundwater elevation, with the results provided in a separate letter report.

On a preliminary basis, excavations are not expected to extend below the groundwater table. Any seepage from the overburden or runoff from precipitation events can be controlled using a conventional sump pump system.

It is not anticipated that dewatering volumes more than 50,000 L/day would take place. Therefore, neither an application to the Environmental Activity and Sector Registry nor a Permit to Take Water from the MECP are expected to be required. This assessment must be confirmed once final site grading and servicing plans are available.

5.2 Permanent Building Drainage

For new structures that will be slab-on-grade with no basement levels, perimeter and under-slab drainage at the foundation level is not required, provided that the underside of concrete slab is at least 200 mm above the prevailing grade of the site and the surrounding surfaces slope away from the building at a gradient of at least 2% to promote surface water run-off and to reduce

groundwater infiltration adjacent to foundations. To minimize infiltration of surface water, the upper 150 mm of backfill could consist of less permeable, compacted clayey soil.

Where basements are constructed, all basement foundation walls must be provided with damp-proofing provisions in conformance to the Ontario Building Code. Backfill along the foundation wall must consist of Granular 'B' Type 1 (OPSS 1010) for a minimum lateral distance of 600 mm out from the foundation wall. Alternatively, if a filtered cellular drainage media is provided adjacent to the foundation wall, the backfill may consist of common earth fill.

A perimeter drainage system must be installed that will remove any water that infiltrates into the building backfill, to ensure that any water does not infiltrate into the basement. The perimeter drains must consist of minimum 100 mm diameter perforated pipes wrapped in filter socks, sufficiently covered on all sides by 19 mm clear stone. Perimeter drains should be directed to the sump underneath the basement floor in solid pipes so as not to surcharge the underfloor drainage layer with water. One run of subfloor drainage pipe trenched below the slab granular drainage layer is recommended for the single residential dwellings, and 6 metre on-centre spacing is recommended for the townhouses. All sump pumps should be on emergency power for redundancy in case of a power outage. A typical basement drainage detail is included in Appendix F.

It is common practice to set the basement level a minimum of 0.5 metres above the seasonally high groundwater level. If the basement level is set near or within the prevailing groundwater level, it is possible that perimeter drainage issues may occur in the future (e.g. sump pump failure, blockage of drainage pipes, etc.), which would lead to potential foundation cracking and basement flooding. Basements can be set below the groundwater table provided these risks are fully acknowledged and all obligations set by the governing bodies in the jurisdiction are met which stipulate minimum clearance distances between basement slab elevation and seasonal high groundwater table.

The water level is expected to be 3.6 metres or deeper below grade, and basements are not expected to extend below the groundwater table. GEI is measuring groundwater levels each month for a year to determine the seasonally high groundwater level, and the results will be included in a supplemental groundwater monitoring letter.

5.3 Preliminary Water Balance

5.3.1 Water Balance Components

A water balance is an accounting of the water resources within a given area. The water balance equates the precipitation (P) over a given area to the summation of the change in ground water storage (S), evapotranspiration/evaporation (ET), surface water runoff (R) and infiltration (I) using the following equation:

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

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (i.e., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). For example, runoff occurs at a higher percentage during periods of snowmelt when the ground is frozen or during intense rainfall events.

Precise measurement of the water balance components is difficult, and as such, approximations and simplifications are made to characterize the water balance of a property. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important inputs to the water balance calculations.

- Precipitation (P): For the purposes of approximating the annual precipitation at this site, the monthly rainfall between 1981 and 2010 was used based on Environment Canada historical weather data for the Belleville weather station (Climate ID 6150689, Latitude 44.09 N, Longitude -77.39 W, Elevation 76.2 metres), which is located about 8 km south of the site.
- Storage (S): Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero.
- Evapotranspiration/Evaporation (PET): The evapotranspiration and evaporation components vary based on the characteristics of the land surface cover (i.e., type of vegetation, soil moisture conditions, perviousness of surfaces, etc.). Potential evapotranspiration refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. Evaporation occurs from a hard surface (such as flat rooftops, asphalt, gravel parking areas, etc.).
- Water Surplus (R + I): The difference between the mean precipitation and evapotranspiration is referred to as the water surplus. The water surplus is divided into two parts: as surface or overland runoff (R) and the infiltration into the surficial soil (I). The infiltration is comprised of two end member components: one component that moves vertically downward to underlying aquifers (referred to as percolation, deep infiltration or net recharge) and a second component that moves laterally through the near surface soil profile or shallow soils as interflow that re-emerges locally to surface (i.e., as runoff) at some short distance and time following precipitation.

5.3.2 Approach and Methodology

The analytical approach to calculate the water balance involves monthly soil-moisture balance calculations to determine the pre-development infiltration volumes. The detailed water balance calculation is provided in Appendix G, which is summarized in this and subsequent sections of

the report. The following assumptions were used as part of the soil-moisture balance calculations:

- A soil moisture balance approach assumes that soils do not release water as potential recharge while a soil moisture deficit exists.
- During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Considering the nature of the near surface soils (sand/sandy silts), a soil moisture storage capacity of 75 mm was used for the site which is vegetated with shrubs, grasses and some trees. It is assumed that post-construction permeable areas will be shallow urban vegetation and the same storage capacity was used post-development for the permeable areas.
- Once the soil moisture deficit is overcome, any further excess water can then pass through the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

Monthly potential evapotranspiration calculations accounting for latitude, climate and the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions was calculated. The *MECP SWM Planning and Design Manual* (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used, and a corresponding infiltration factor was calculated for pre and post-development conditions. The water surplus was multiplied by the infiltration factor to determine both the pre-existing and post-condition annual volumes for run-off and infiltration for the property.

The post-development water balance scenario was estimated based on the preliminary drawing "*Draft Plan of Subdivision, Part of Lots 15, 16, 17, 2 & 27, Plan 135, Part of Lots 6 & 7, Plan 1819, Part of Wilson Avenue, Plan 6, In the City of Belleville, County of Hastings*" dated November 6, 2020, by Innovative Planning Solutions. This preliminary plan shows general information about the potential locations of features such as roadways, parkland, residential areas, etc. The total site area is 7.78 hectares. It was assumed that about 80% of the residential areas will consist of impermeable components (e.g., houses, driveways, buildings), and 20% is considered to be permeable. The final site configuration may change and the water balance must be updated to reflect the final site plans.

It is noted that the infiltration and runoff values presented in Appendix G are estimates only. Single values are used for the water balance calculations, but it is important to understand that infiltration rates are dependent upon the hydraulic conductivity of the surficial soils which may vary over several orders of magnitude. As such, the margins of error for the calculated infiltration and runoff component values are potentially quite large. These margins of error are recognized, but for the purposes of this assessment, the numbers used in the water balance calculations are considered reasonable estimates based on the site-specific conditions and useful for comparison of pre- to post-development conditions.

5.3.3 Pre and Post Development Water Balance

The detailed water balance calculations are included in Appendix G. The pre and post development calculations are summarized in this section are preliminary only and must be updated once site plans are finalized.

The table below summarizes the pre and post construction water balance for the 7.78 hectares of the site being developed.

Condition	Permeable Areas	Impermeable Areas	Average Annual Runoff Volume (m^3/year)	Average Annual Infiltration Volume (m^3/year)
Pre-Development Land Use	90% (vegetated area)	10% (Paved areas, access routes, concrete cover)	11,304.3	21,095.6
Post-Development Land Use (Preliminary Plan)	20% (Green space, parks, lawns)	80% (Buildings, paved areas, SWM facilities)	49,415.1	4,687.9

These calculations suggest that, without mitigation such as low impact development (LID) measures, the proposed development will decrease average infiltration by about 16,407.7 m^3/year (78% decrease). The proposed development will increase runoff by about 38,110.8 m^3/year (337% increase). This means about 16,408 m^3/year of infiltration is required to maintain the water balance. The potential impacts of these changes and recommended mitigation measures are discussed below.

5.4 Recommended Mitigation Measures

The three broad categories which typically need to be mitigated and accounted for are:

- Reducing the volume and speed in which additional surface water runoff occurs;
- Increasing the amount of infiltration to match pre-development conditions; and
- Ensuring that the quality of existing surface water features and groundwater will not be adversely impacted.

5.4.1 Runoff Quantity

Urban development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (e.g. roads, parking lots, driveways, rooftops). Impervious surfaces prevent infiltration of water into the underlying soils and the removal of the vegetation reduces the evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor (estimated to

be 15% of precipitation) compared to the evapotranspiration component that occurs with vegetation in this area (up to two thirds of precipitation). So, the net effect of the urbanization of the site is that most of the precipitation that falls onto impervious surfaces increases the surplus water resulting in more direct runoff from developed areas and reduced natural infiltration.

In conjunction with increased runoff, there is a reduction in infiltration to the shallow groundwater system. A reduction in infiltration can potentially lead to a lowering of the local water table and reduce the potential for this seasonal water table intersection and discharge.

Methods which do not necessarily increase infiltration rate, but decrease the volume and concentration of surface water runoff can be considered at this site include (but are not limited to):

- Increasing the topsoil thickness by about two times the normal thickness (up to 30 cm) to retain more water in storage; and
- Implementation of rainwater harvesting which intercepts, diverts and stores roof runoff (i.e. cisterns) for future use.

5.4.2 Mitigation Measures for Maintaining Infiltration

The increases in surface water runoff that will occur with urban development and mitigation of the potential impacts to the local water table due to reduction of infiltration may be minimized by using appropriate stormwater management and using LID measures to promote infiltration. These measures can be implemented on-site.

The basic premise for low impact development is to try to minimize changes to runoff and infiltration. As outlined in the *MECP SWMP Design Manual* (2003) and *Low Impact Development Stormwater Management Planning and Design Guide* published by the Credit Valley Conservation (CVC) and TRCA (2010), there are a suite of techniques that may be considered to promote infiltration and reduce runoff.

In order to maintain ground water function at the site the following typical LID measures can be considered as part of typical site developments (can depend on land use):

- Collection of runoff from the building rooftops and redirection to grass areas and overland flow. If feasible, it is recommended that there be a minimum 5 metre flow path over pervious areas to allow this mitigation method to be fully effective;
- Provision of gentle slopes in open areas or along grass swales in order to allow time for water infiltration;
- Construction of engineered infiltration measures such as soakaway pits, infiltration galleries or bioswales. Subsurface infiltration methods can only be considered in

areas where there is sufficient soil permeability and depth to water table to accommodate the systems within the unsaturated zone (typically the infiltration elevation must be kept 1 metre or more above the seasonal high groundwater level).

- Construction of grass channels or filter strips which allow infiltration, discharge at a lower rate and direct roof runoff to overland flow.

Implementation of LID measures will not only allow for infiltration of the surface water into the near-surface groundwater regime but will also allow for increase in natural filtration of surficial runoff, prevent sedimentation transport and potential erosion, and help reduce flooding by increasing the transit time for water on the site. These types of LID techniques promote natural infiltration by providing additional water volumes in the pervious areas. This is particularly effective in the summer months when natural infiltration would not generally occur because the additional water overcomes the natural soil moisture deficit.

Details and designs for LID measures will be provided in a stormwater management report for the site (by others). This includes demonstrating through plans and sections (including all dimensions, materials used and including the seasonal high groundwater level) how this infiltration deficit will be mitigated.

As it is typically a requirement of maintaining the same levels of infiltration post construction, no appreciable change in the groundwater table elevation should occur over the long-term condition.

If the water balance cannot be fully maintained due to low soil permeability or higher groundwater levels, minimal impacts are expected for the following reasons:

- The site is not within a Significant Groundwater Recharge Area.
- Future development of the land surrounding the site is expected to be serviced by City water supply instead of domestic wells.
- Groundwater recharge and baseflow to creeks is anticipated to be low due to the existing City of Belleville stormwater management systems in the area.

5.4.3 Groundwater Quality

Depending on land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, phosphorous, bacteria and viruses. For groundwater, generally except for the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater flow through the soils.

LID measures or end treatments such as oil/grit separators or wet ponds also help to remove suspended solids and other contaminants in runoff prior to infiltration or conveying the flows

off the site, especially when a treatment train approach is taken for stormwater management. The stormwater management facilities (to be designed by others) must be designed such that the water quality is maintained or improved prior to discharging water from the site or infiltrating water into the ground.

Runoff from residential developments (e.g. rooftops, landscaped areas) are typically considered "clean" and can be collected an infiltrated where possible. Further, infiltration-based practices would likely be permitted for impervious areas such as roads and driveways for the low-density residential development.

Since only clean or pre-treated runoff will be infiltrated, the groundwater quality will not be degraded and will not impact nearby domestic wells, watercourses or other nearby environmental features. The surficial aquitard present across the site also limits the amount of water infiltrating deeper below grade as recharge.

6. Limitations and Conclusions

6.1 Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, GEI should be contacted to assess the situation and additional testing and reporting may be required.

GEI should be retained for a general review of the final design drawings and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, GEI will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of the design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This report was prepared by GEI for the account of RIC (Midland Land) Inc. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GEI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

6.2 Conclusion

It is recognized that municipal/regional governing bodies, in their capacity as the planning and building authority under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both as are expressed and implied.

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Yours Truly,

GEI Consultants

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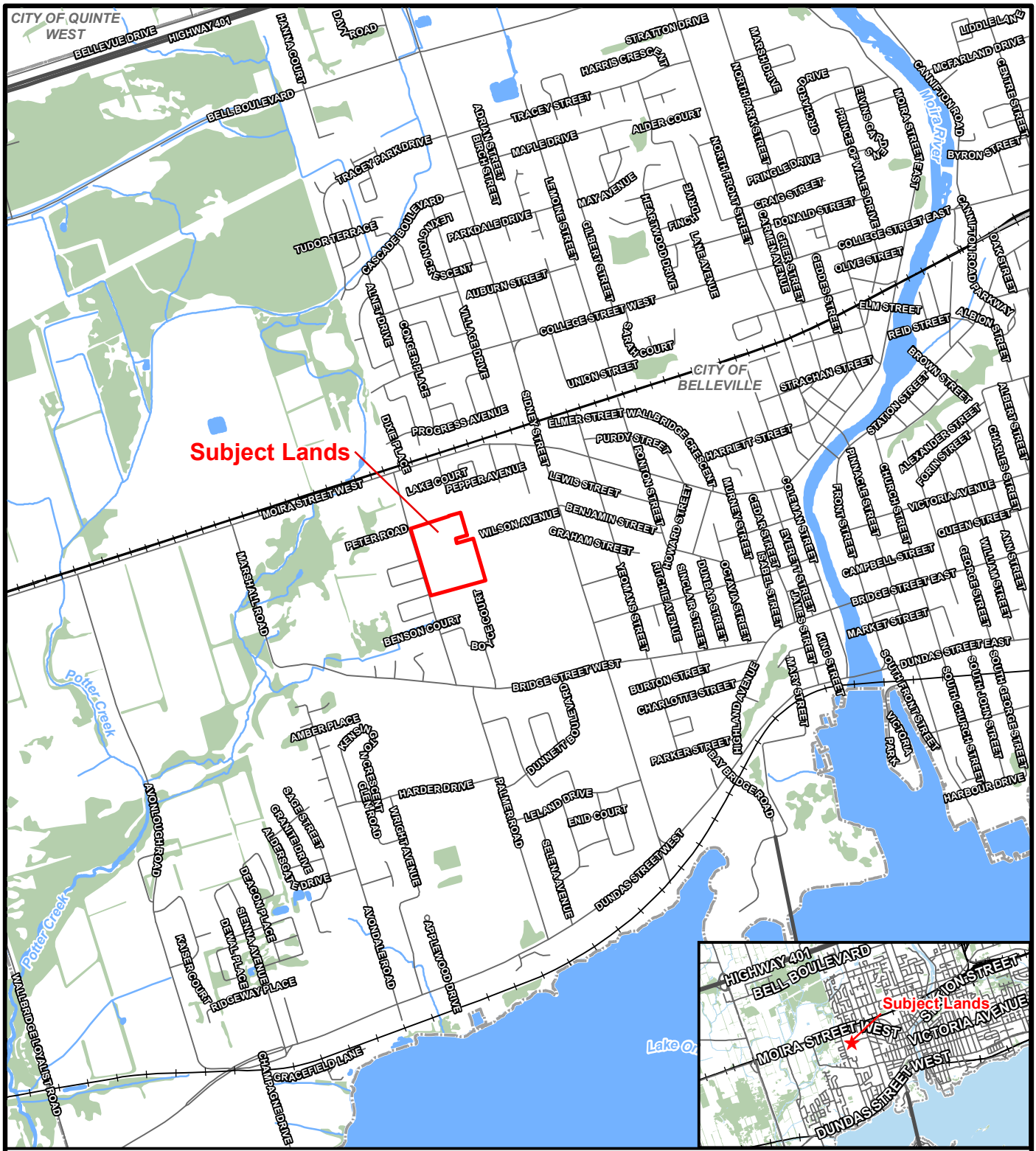
Reviewed By:

Russell Wiginton, P.Eng.
Senior Geotechnical Engineer

Figures



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.

Legend

- Subject Lands
- Municipal Boundary, Lower/Single Tier
- Municipal Boundary, Upper Tier
- Railway
- Highway
- Road
- Watercourse
- Waterbody
- Wooded Area

N

0 310 620 m

1:25,000

Wilson Avenue Extension, Belleville, ON

RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

SITE LOCATION PLAN

May 2022

Fig. 1

NOTES:

1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3. Orthoimagery © First Base Solutions, 2022. Imagery taken in 2008.

Legend

- Subject Lands
- Cross Section Location
- Approximate Borehole Location
- Approximate Borehole and Monitoring Well Location
- Approximate Monitoring Well Location (From Others, Unknown Details)

N

0 25 50 m

1:2,000

Wilson Avenue Extension, Belleville, ON

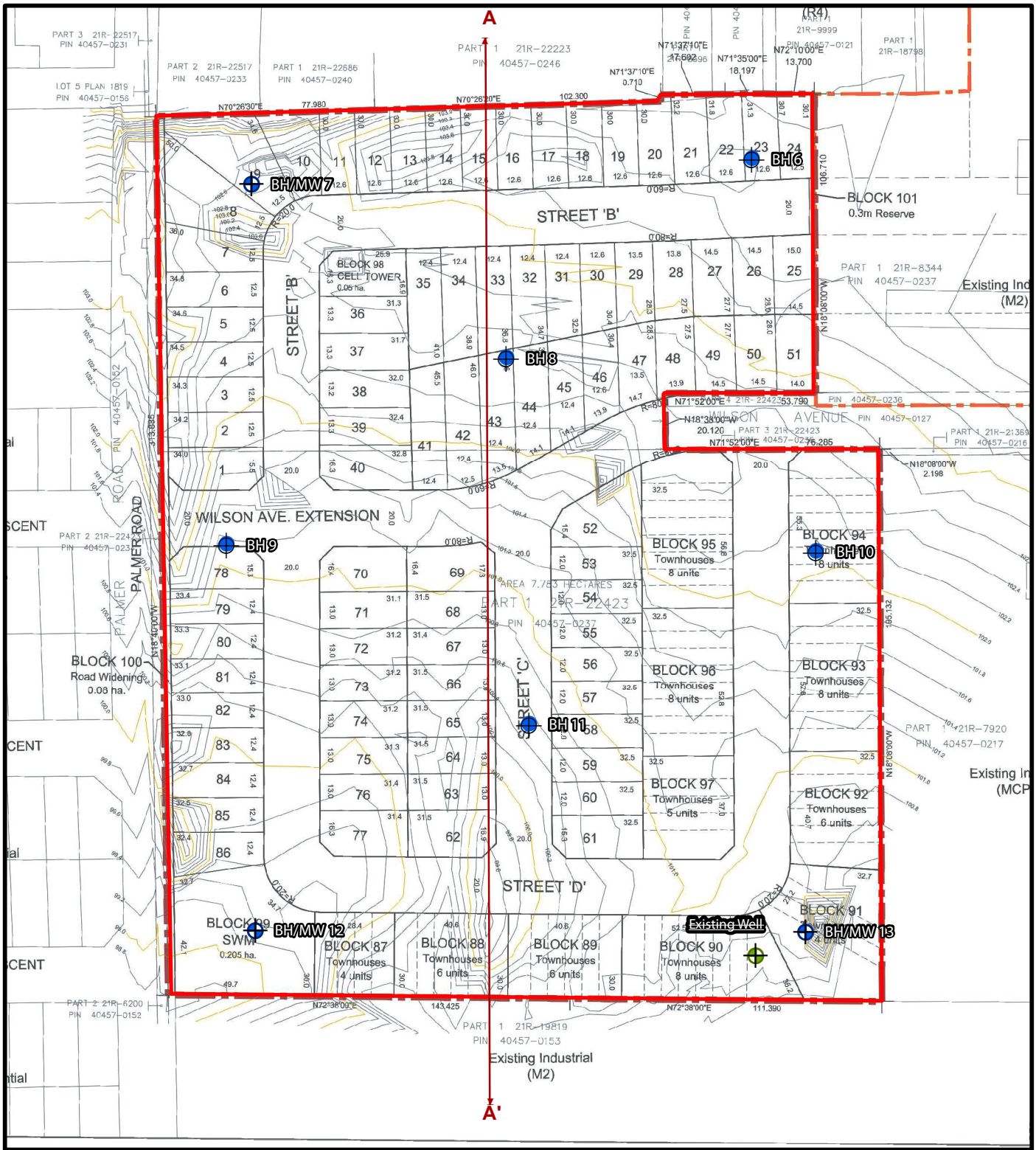
RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

BOREHOLE LOCATION PLAN (AERIAL)

May 2022 Fig. 2A



<BOL><UND><ITA>NOTES:</ITA></UND></BOL>
1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3. "Draft Plan of Subdivision, Part of Lots 15, 16, 17, 26 & 27, Plan 135, Part of Lots 6 & 7, Plan 1819, Part of Wilson Avenue, Plan 6, in the City of Belleville, County of Hastings" dated November 06, 2020, by Innovative Planning Solutions.

Legend

- Subject Lands
- Cross Section Location
- Approximate Borehole Location
- Approximate Borehole and Monitoring Well Location
- Approximate Monitoring Well Location (From Others, Unknown Details)

N

0 25 50 m

1:2,000

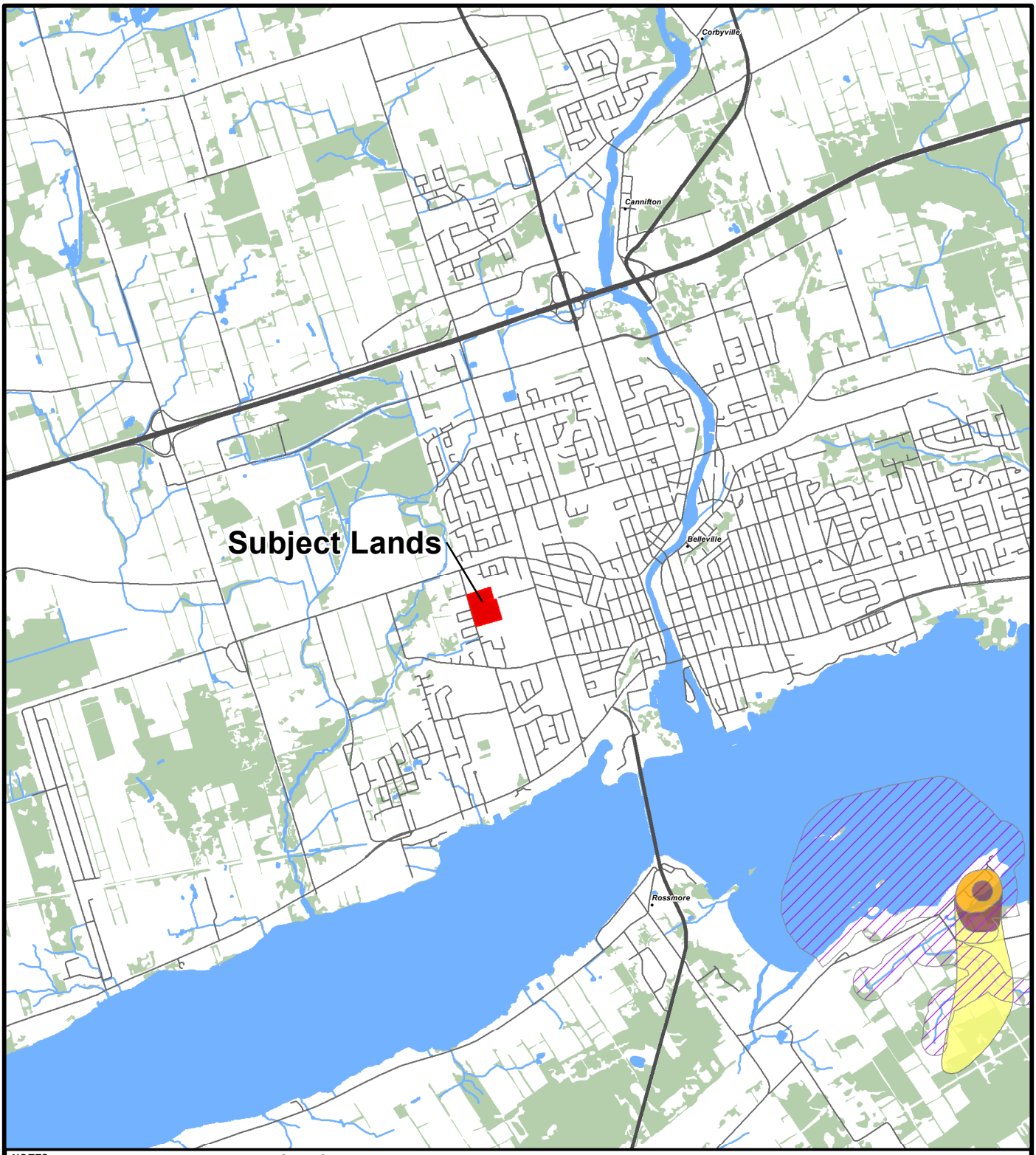
Wilson Avenue Extension,
Belleville, ON

RIC (Midland Land) Inc.

GEI Consultants

BOREHOLE LOCATION PLAN (PROPOSED SITE PLAN)

Project: 2102519 | May 2022 | Fig. 2B



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3.Source Water Protection Mapping: QUINTE CONSERVATION AUTHORITY, (2021).
4. Site is not within a Wellhead Protection Area.

Legend
- Subject Lands
- Watercourse
- Waterbody
- Wooded Area
- Highway
- Road

Wellhead Protection Area (QCA 2021)
Zone
- A
- B
- C
- D
- E

N

0 660 1,320 m

1:55,000

Wilson Avenue Extension, Belleville, ON

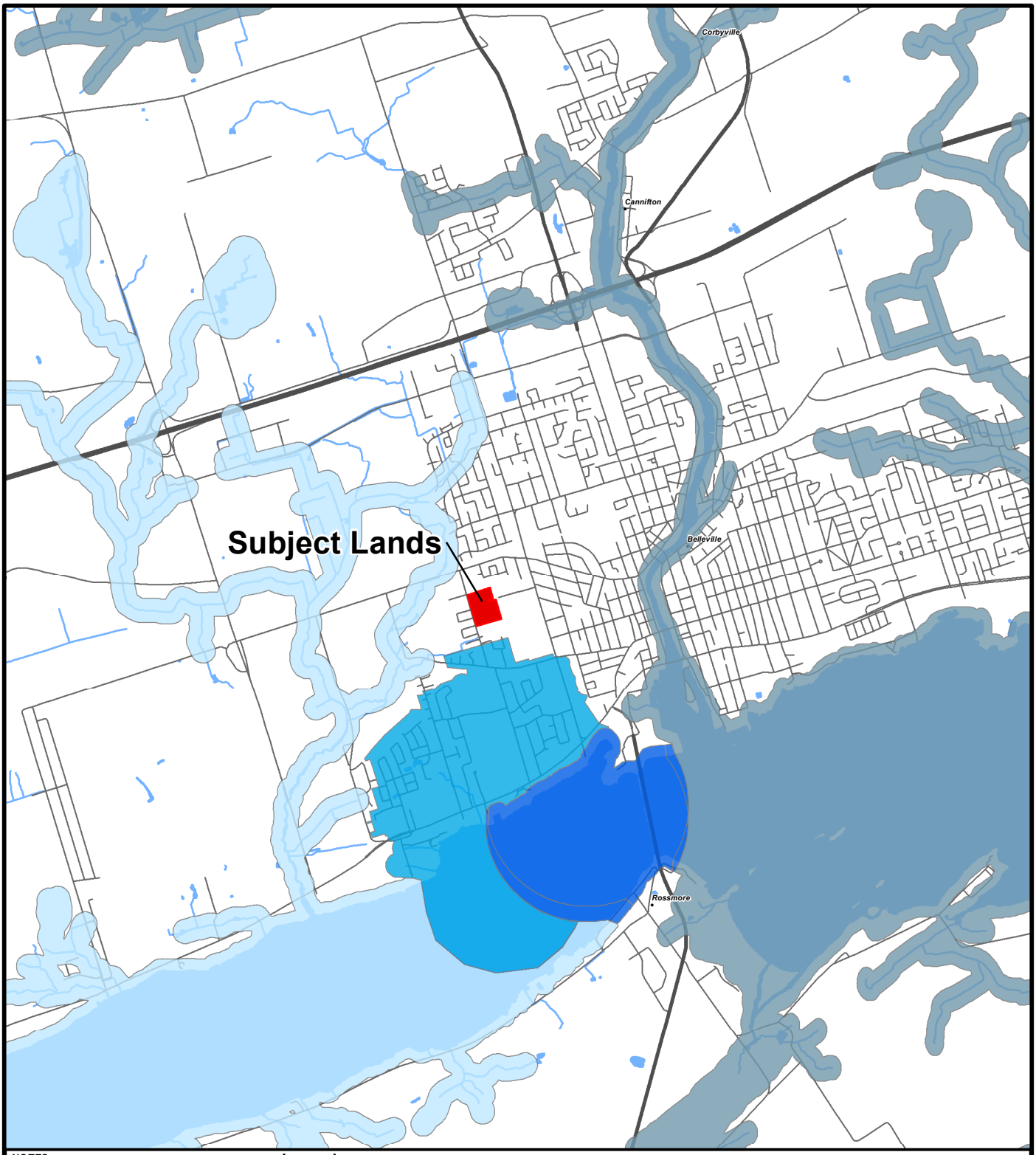
RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

WELLHEAD PROTECTION AREAS

May 2022 Fig. 3



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3.Source Water Protection Mapping: QUINTE CONSERVATION AUTHORITY, (2021).
4. Site is not within an Intake Protection Zone.

Legend
- Subject Lands
- Watercourse
- Waterbody
- Highway
- Road

Intake Protection Zone (QCA 2021)

Zone
- 1
- 2
- 3
- 3a

N

0 660 1,320 m

1:55,000

Wilson Avenue Extension, Belleville, ON

RIC (Midland Land) Inc.

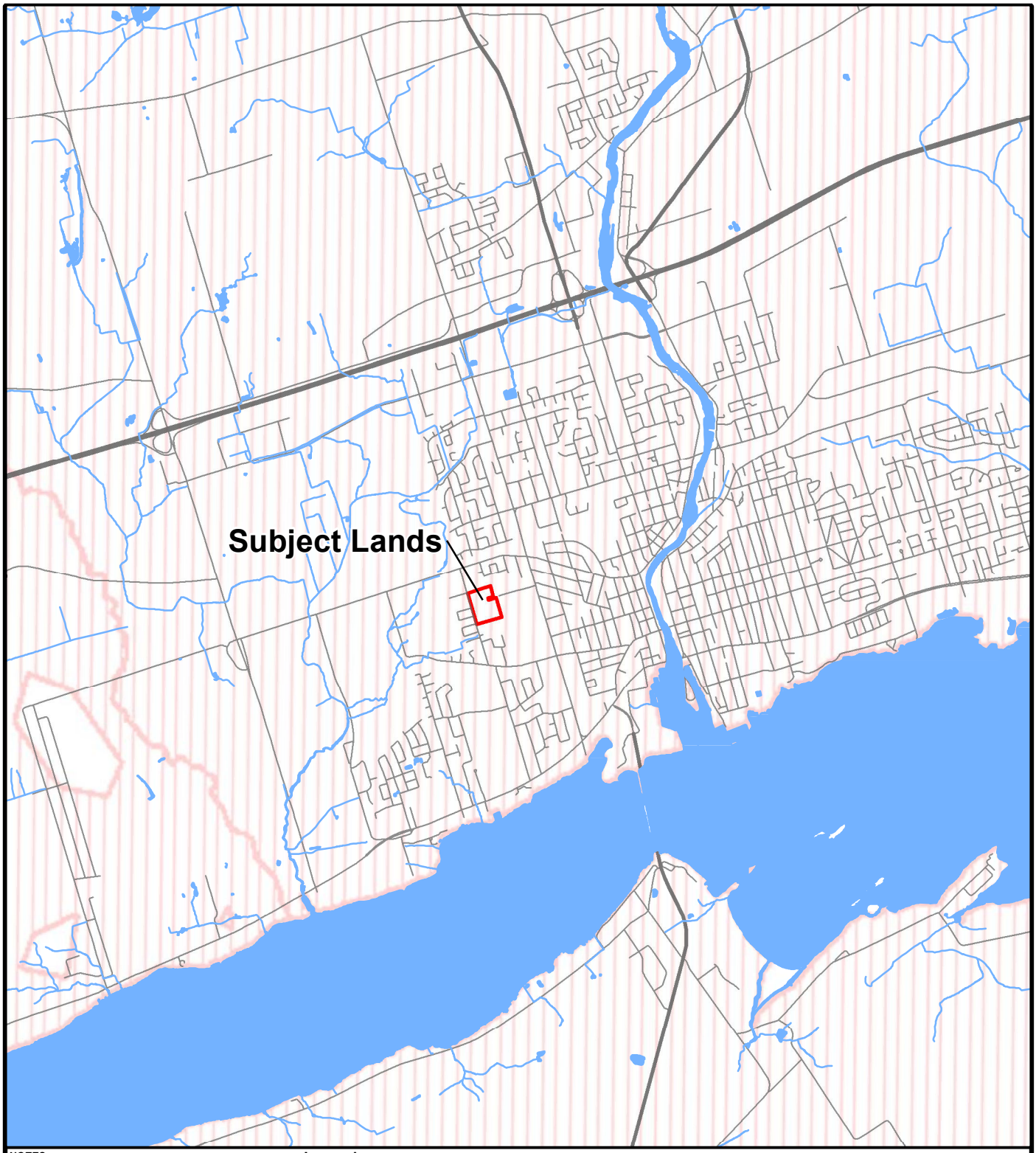
GEI Consultants

INTAKE PROTECTION ZONES

Project: 2102519

May 2022

Fig. 4



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3. Source Water Protection Mapping Layers derived from LIO Source Protection Information Atlas Image (2021, Approximate)
4. Site is within a Highly Vulnerable Aquifer.

Legend

- Subject Lands
- Watercourse
- Waterbody
- Highway
- Road
- Highly Vulnerable Aquifer (LIO Atlas 2021)

N

0 660 1,320 m

1:55,000

Wilson Avenue Extension, Belleville, ON

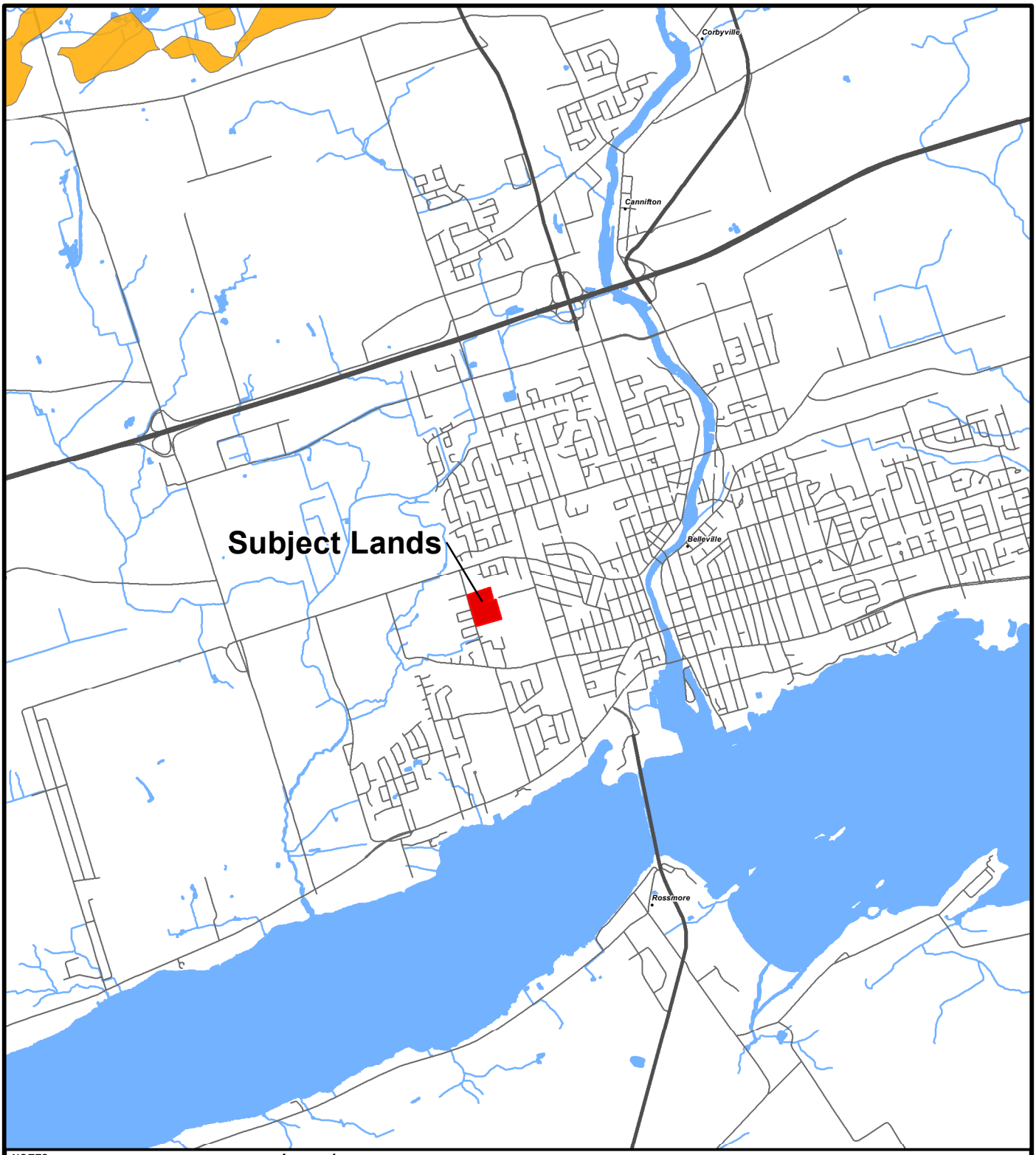
RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

HIGHLY VULNERABLE AQUIFERS

May 2022 Fig. 5



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3.Source Water Protection Mapping: QUINTE CONSERVATION AUTHORITY, (2021).
4. Site is not within a Significant Groundwater Recharge Area.

Legend

- Subject Lands
- Watercourse
- Waterbody
- Highway
- Road
- Significant Groundwater Recharge Area (QCA 2021)

N

0 660 1,320 m

1:55,000

Wilson Avenue Extension, Belleville, ON

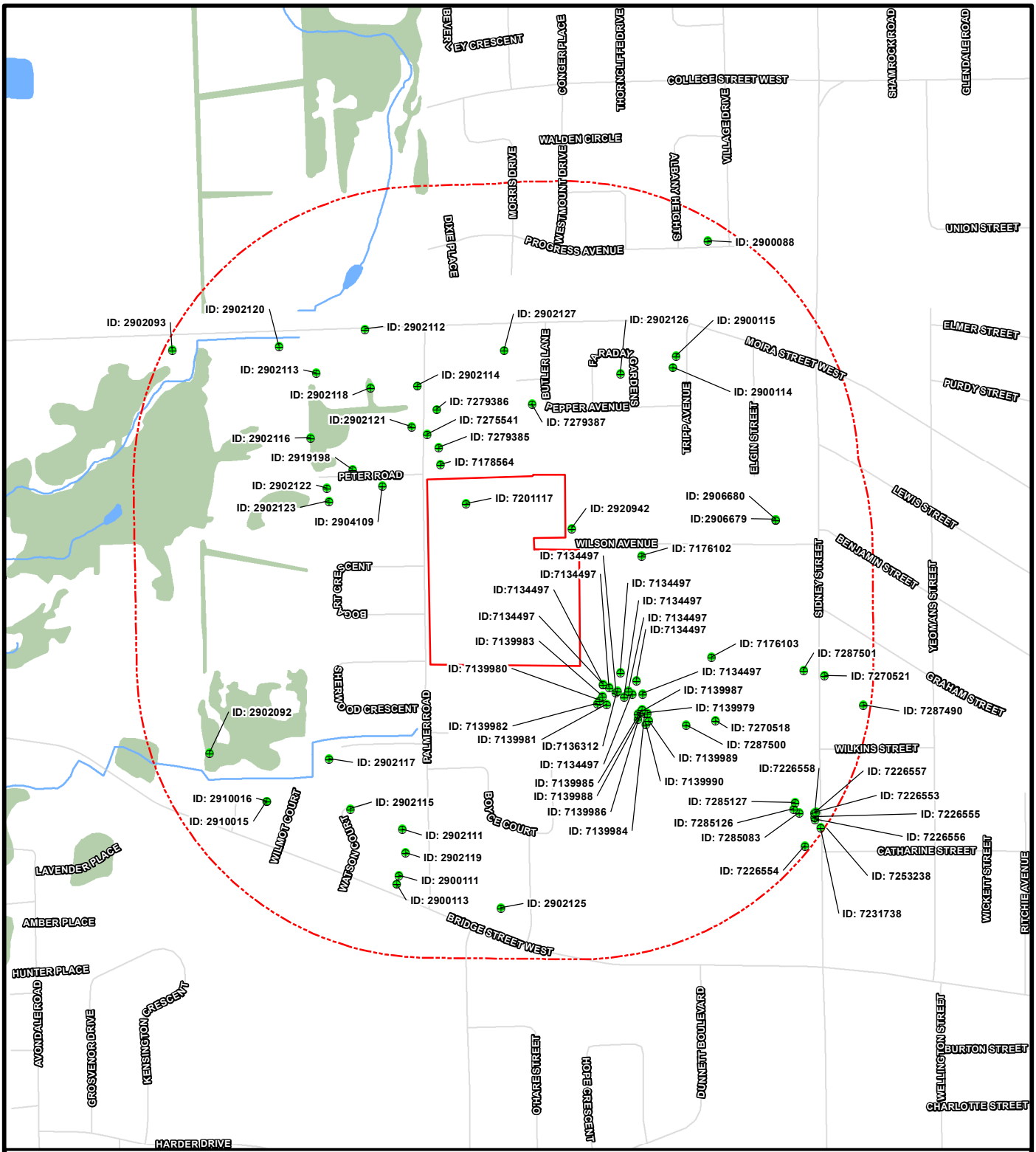
RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

SIGNIFICANT GROUNDWATER RECHARGE AREAS

May 2022 Fig. 6



NOTES:

1. Coordinate System: NAD 1983 UTM Zone 18N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2022.
3. Orthoimagery © First Base Solutions, 2022. Imagery taken in 2008.

Legend

- Subject Lands
- Subject Lands +500m
- MECP Well Record (WWIS 2021)
- Road
- Watercourse
- Waterbody
- Wooded Area

N

0 110 220 m

1:9,500

Wilson Avenue Extension, Belleville, ON

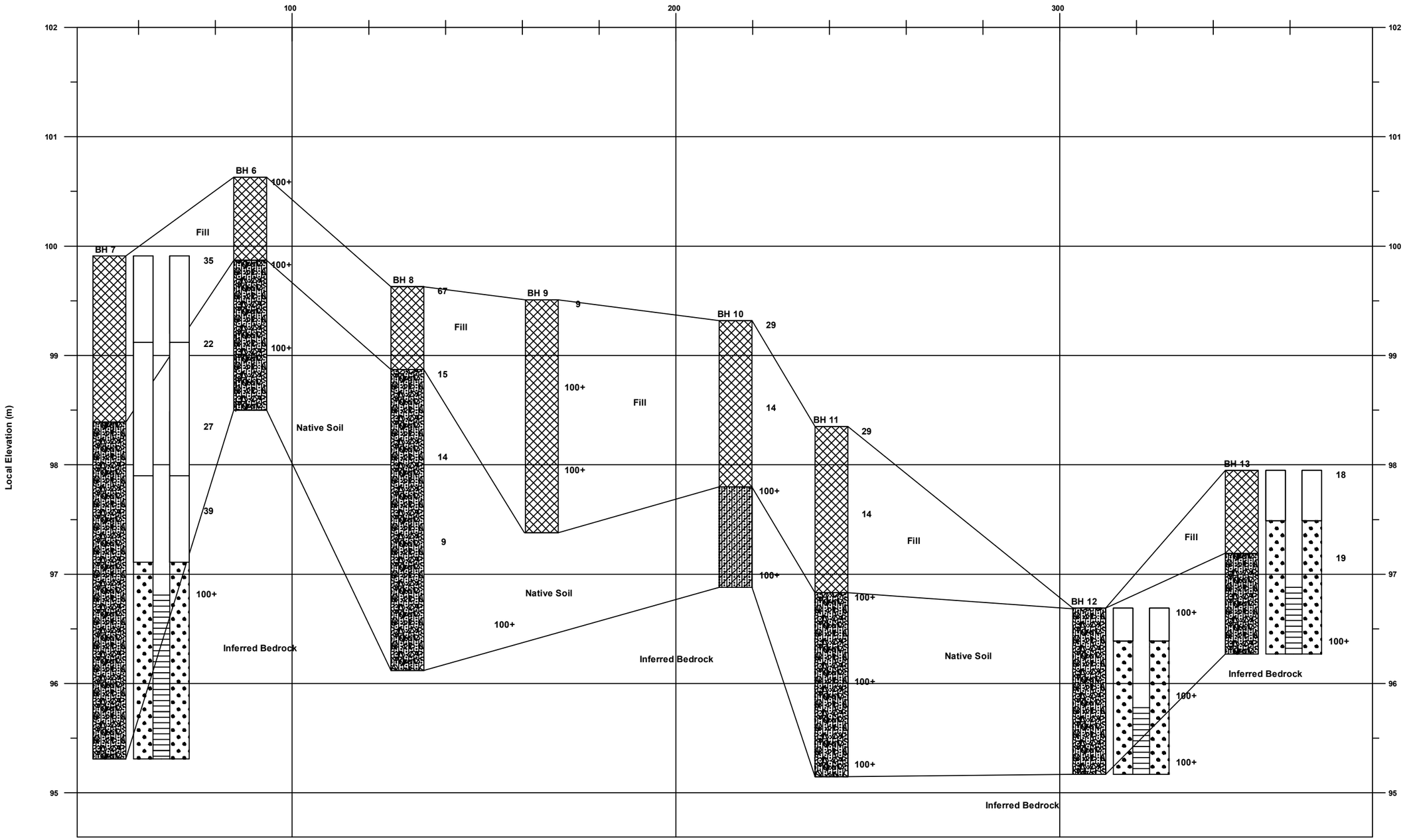
RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

MECP WELL RECORD LOCATIONS

May 2022 Fig. 7



1. Numbers shown next to boreholes are SPT "N" Values.
2. Subsurface conditions known only at borehole locations.
3. Horizontal distance between boreholes is not to scale.

Strata symbols

- Fill
- Sand & Limestone Fragments
- Clayey & Silty Sand

Wilson Avenue Extension, Belleville, ON

RIC (Midland Land) Inc.

GEI Consultants

Project: 2102519

GEOLOGICAL CROSS SECTION A-A'

May 2022 Fig. 8

Appendix A

MECP Well Record Summary Table

GEI Consultants

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307930 4893221 W	1974/12 4922	6 6	UK 0029	//5/:	IN		2906680 ()	BRWN CLAY GRVL 0028 GREY GRVL 0030 BRWN LMSN SHLE 0031 BRWN LMSN 0038
BELLEVILLE CITY	18 307930 4893221 W	1974/12 4922	6 6	UK 0028	//5/:	IN		2906679 ()	BRWN CLAY GRVL 0027 GREY GRVL 0029 BRWN LMSN SHLE 0031 BRWN LMSN 0038
BELLEVILLE CITY	18 307214 4893103 W	2001/09 6362						2919198 (126592) A	
BELLEVILLE CITY	18 307806 4892842 W	2008/04 1129	6.30 4.01			MO		7139984 (Z105705) A067450	LOAM 0001 BRWN SAND GRVL SILT 0003 BRWN SILT CLYY GRVL 0010 BRWN SILT CLYY GRVL 0011 BRWN SAND GRVL SILT 0013 BRWN SILT CLYY GRVL 0015
BELLEVILLE CITY	18 307800 4892846 W	2008/04 1129	6.30 4.01			MO		7139985 (Z105704) A067449	LOAM 0001 BRWN SAND GRVL SILT 0004 BRWN SILT CLYY SAND 0015
BELLEVILLE CITY	18 307799 4892843 W	2008/04 1129	6.30 4.01			MO		7139986 (Z105701) A067448	LOAM 0000 BRWN SAND GRVL SILT 0004 BRWN CLAY SLTY GRVL 0009 BRWN SAND GRVL SILT 0010 BRWN CLAY SLTY SILT 0029
BELLEVILLE CITY	18 307795 4892837 W	2008/04 1129	6.30 4.01			MO		7139987 (Z105700) A067447	LOAM 0001 BRWN SAND GRVL SILT 0004 BRWN CLAY SLTY SAND 0011 BRWN SAND GRVL SILT 0013 BRWN CLAY SLTY SILT 0024 GREY SAND SILT 0030
BELLEVILLE CITY	18 307798 4892829 W	2008/04 1129	6.30 4.01			MO		7139988 (Z105699) A067445	LOAM 0001 BRWN SAND SILT 0005 0009 BRWN SILT CLYY SAND 0010 BRWN SAND GRVL SILT 0012 BRWN CLAY SLTY SAND 0021 GREY SAND SILT CLAY 0028 GREY SILT CLYY GRVL 0029

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307816 4892832 W	2008/04 1129	6.30 4.01			MO		7139989 (Z105703) A067430	LOAM 0002 BRWN SAND SILT ---- 0004 BRWN SILT CLAY GRVL 0015 GREY SAND GRVL ---- 0015 0025 BRWN SAND SLTY GRVL 0027
BELLEVILLE CITY	18 307813 4892825 W	2008/04 1129	6.30 4.01			MO		7139990 (Z105702) A060937	LOAM 0002 BRWN SAND GRVL SILT 0006 BRWN SILT CLYY GRVL 0010 BRWN SAND SILT GRVL 0021
BELLEVILLE CITY	18 307740 4892838 W	2008/04 1129	6.30 4.01			MO		7139981 (Z105643) A067458	LOAM 0000 BRWN SAND SILT 0007 BRWN SILT CLYY CLAY 0014 BRWN SAND GRVL SILT 0015 BRWN CLAY SLTY GRVL 0019 BRWN SAND GRVL SILT 0019 GREY CLAY SLTY GRVL 0029 GREY SAND CLAY SILT 0031 ROCK LMSN 0031
BELLEVILLE CITY	18 307729 4892850 W	2008/04 1129	6.30 4.13			MO		7139983 (Z105698) A067456	LOAM 0002 BRWN SILT CLYY CLAY 0004 BRWN SILT SNDY SAND 0012 LMSN ROCK 0015
BELLEVILLE CITY	18 307724 4892835 W	2008/04 1129	6.30 4.01			MO		7139982 (Z105696) A067457	LOAM 0001 BRWN SAND SLTY 0002 BRWN CLAY SLTY SAND 0004 BRWN SAND SILT CLAY 0009 BRWN CLAY SLTY SAND 0025 GREY SAND SLTY GRVL 0031
BELLEVILLE CITY	18 307751 4892865 W	2009/10 6032				MO	0018 5	7136312 (Z095915) A083944	BRWN SAND GRVL PCKD 0005 GREY LMSN DNSE 0026
BELLEVILLE CITY	18 307810 4892843 W	2008/04 1129	6.30 4.01			MO		7139979 (Z105642) A072175	LOAM 0001 BRWN SAND GRVL SILT 0005 BRWN SILT CLYY GRVL 0008 BRWN SAND GRVL SILT 0009 BRWN CLAY SLTY SAND 0014 GREY SILT SNDY CLAY 0024 ROCK 0027
BELLEVILLE CITY	18 307726 4892842 W	2008/04 1129	6.30 4.01			MO		7139980 (Z105697) A072169	LOAM 0001 BRWN SAND SILT 0002 BRWN SILT CLYY SAND 0004 BRWN SAND SLTY GRVL 0010 BRWN SILT CLYY CLAY 0019 GREY SAND SLTY SILT 0032

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 308020 4893702 W	2006/07 7085	2 2				0007 10 0010 5	2921357 (Z42337) A028238	BLCK SAND CLAY GRVL 0007 BRWN SAND CLAY GRVL 0015 GREY SILT GRVL SAND 0017
BELLEVILLE CITY	18 307724 4892870 W	2009/10 3651	6.25			TH		7134497 (M00303) A086550	BRWN LOAM 0001 GREY CLAY 0003 GREY LMSN FCRD 0008 GREY LMSN 0030
BELLEVILLE CITY	18 307600 4893110 W	2005/08 6607	1.25	15			0018 10	2920942 (Z32314) A026560	BLCK 0000 BRWN GRVL SAND FILL 0000 BRWN SAND GRVL 0004 GREY LMSN 0027
BELLEVILLE CITY	18 307690 4893421 W	1967/10 1805	6	SU 0040	20/42/2/0:30	NU		2900114 () A	CLAY BLDR 0019 GREY LMSN 0042
BELLEVILLE CITY	18 307688 4893645 W	1960/09 1813	6 6	FR 0040	18/40/1/1:0	DO		2900088 ()	CLAY 0016 LMSN 0040
BELLEVILLE CITY	18 307480 4892446 W	1967/10 1806	6 6					2900113 () A	GRVL 0013 LMSN 0053
BELLEVILLE CITY	18 307488 4893824 W	1960/10 1813	6 6	FR 0030	4/30/3/1:0	DO		2900090 ()	CLAY 0018 LMSN 0030
BELLEVILLE CITY	18 307480 4892461 W	1967/09 1806	6 6					2900111 () A	GRVL 0008 LMSN 0090

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307690 4893441 W	1967/10 1805	6 6	FR 0040	25/45/2/2:0	DO		2900115 ()	CLAY BLDR 0015 GREY LMSN 0045
BELLEVILLE CITY	18 308163 4892739 W	2019/12 7329						7349527 (Z312773) A138101 A	
BELLEVILLE CITY	18 308083 4892988 W	2016/06 6032						7270521 (C29112) A202524 P	
BELLEVILLE CITY	18 308214 4892770 W	2019/06 7329						7335921 (Z312617) A	
BELLEVILLE CITY	18 307946 4893853 W	2016/03 7241	2.04			MT	0010 10	7260374 (Z222316) A168713	BRWN GRVL SAND LOOS 0002 BRWN SAND SILT SOFT 0013 GREY TILL HARD 0020
BELLEVILLE CITY	18 308221 4892758 W	2019/06 7329						7335922 (Z312618) A	
BELLEVILLE CITY	18 308181 4892708 W	2019/06 7329						7335915 (Z312611) A	
BELLEVILLE CITY	18 307771 4892841 W	2019/12 7329						7351638 (Z333277) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307925 4892863 W	2016/05 6032						7270518 (C29109) A202522 P	
BELLEVILLE CITY	18 308096 4892774 W	2019/12 7329						7351377 (Z333257) A	
BELLEVILLE CITY	18 308214 4892771 W	2019/06 7329						7335916 (Z312612) A	
BELLEVILLE CITY	18 308053 4892987 W	2019/11 7329						7349843 (Z312775) A	
BELLEVILLE CITY	18 308284 4892731 W	2019/06 7329						7335380 (Z304389) A	
BELLEVILLE CITY	18 307773 4892870 W	2019/12 7329						7351334 (Z333287) A	
BELLEVILLE CITY	18 307790 4892878 W	2019/12 7329						7351326 (Z333295) A	
BELLEVILLE CITY	18 307765 4892858 W	2019/12 7329						7351327 (Z333294) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307735 4892864 W	2019/12 7329						7351328 (Z333293) A	
BELLEVILLE CITY	18 307720 4892865 W	2019/12 7329						7351329 (Z333292) A	
BELLEVILLE CITY	18 307751 4892860 W	2019/12 7329						7351330 (Z333291) A	
BELLEVILLE CITY	18 307751 4892866 W	2019/12 7329						7351331 (Z333290) A083944 A	
BELLEVILLE CITY	18 307749 4892885 W	2019/12 7329						7351333 (Z333288) A	
BELLEVILLE CITY	18 307816 4892830 W	2019/12 7329						7351335 (Z333282) A	
BELLEVILLE CITY	18 307733 4892887 W	2019/12 7329						7351336 (Z333281) A	
BELLEVILLE CITY	18 307775 4892870 W	2019/12 7329						7351337 (Z333280) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307744 4892839 W	2019/12 7329						7351635 (Z333274) A	
BELLEVILLE CITY	18 307783 4892842 W	2019/12 7329						7351637 (Z333276) A	
BELLEVILLE CITY	18 307756 4892889 W	2019/12 7329						7351332 (Z333289) A	
BELLEVILLE CITY	18 307740 4892840 W	2019/11 7329						7351196 (Z333299) A	
BELLEVILLE CITY	18 308228 4892735 W	2019/06 7329						7335923 (Z312619) A	
BELLEVILLE CITY	18 308229 4892733 W	2019/06 7329						7335926 (Z312624) A	
BELLEVILLE CITY	18 308214 4892769 W	2019/06 7329						7335925 (Z312621) A	
BELLEVILLE CITY	18 307768 4892903 W	2019/12 7329						7351325 (Z333296) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307723 4892835 W	2019/11 7329						7351195 (Z333298) A	
BELLEVILLE CITY	18 307810 4892847 W	2019/11 7329						7351200 (Z333304) A	
BELLEVILLE CITY	18 307799 4892843 W	2019/11 7329						7351201 (Z333305) A067449 A	
BELLEVILLE CITY	18 307805 4892846 W	2019/11 7329						7351202 (Z333306) A067450 A	
BELLEVILLE CITY	18 307727 4892843 W	2019/11 7329						7351203 (Z333300) A072169 A	
BELLEVILLE CITY	18 307795 4892840 W	2019/11 7329						7351204 (Z333301) A	
BELLEVILLE CITY	18 307795 4892850 W	2019/11 7329						7351205 (Z333302) A067448 A	
BELLEVILLE CITY	18 307815 4892833 W	2019/11 7329						7351206 (Z333303) A067430 A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307845 4892823 W	2019/11 7329						7350436 (Z312796) A	
BELLEVILLE CITY	18 307738 4892845 W	2019/11 7329						7351194 (Z333297) A	
BELLEVILLE CITY	18 307664 4893052 W	2019/07 6571	2			DO	0024 12	7339157 (Z251234) A169550	BRWN GRVL SAND LOOS 0008 GREY LMSN WTHD 0036
BELLEVILLE CITY	18 307674 4893093 W	2019/07 6571	2			MO	0019 10	7339154 (Z251237) A169556	BRWN GRVL SAND LOOS 0006 GREY LMSN WTHD 0029
BELLEVILLE CITY	18 307687 4893066 W	2019/07 6571	2			MO	0022 10	7339155 (Z251236) A169555	BRWN GRVL SAND LOOS 0008 GREY LMSN WTHD 0032
BELLEVILLE CITY	18 307677 4893058 W	2019/07 6571	2			MO	0019 10	7339156 (Z251235) A169554	GREY GRVL PGVL LOOS 0029
BELLEVILLE CITY	18 307966 4893891 W	2016/03 7241	2.04			MT	0010 10	7260384 (Z222319) A168710	BLCK GRVL LOOS 0002 BRWN CLAY SILT SOFT 0010 GREY TILL HARD 0020
BELLEVILLE CITY	18 308260 4892745 W	2019/06 7329						7335919 (Z312615) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 308254 4892765 W	2016/06 7329						7335920 (Z312616) A	
BELLEVILLE CITY	18 308229 4892743 W	2016/06 6032						7270523 (C29111) A202523 P	
BELLEVILLE CITY	18 308232 4892700 W	2016/06 6032						7270522 (C29117) A202525 P	
BELLEVILLE CITY	18 308213 4892763 W	2019/02 7241	2			MT	0015 10	7335223 (Z219666) A192115	BRWN LOAM SOFT 0001 BRWN SILT CLAY DNSE 0004 GREY LMSN ROCK 0025
BELLEVILLE CITY	18 308221 4892740 W	2019/02 7241	2			MT	0015 10	7335222 (Z219665) A192116	BRWN LOAM SOFT 0001 BRWN SILT CLAY DNSE 0004 GREY LMSN ROCK 0025
BELLEVILLE CITY	18 308245 4892729 W	2019/02 7241	1.37			MT	0009 10	7335214 (Z302799) A261129	GREY ---- GRVL SAND 0000 GREY CLAY SILT SOFT 0003 GREY LMSN SHLE HARD 0019
BELLEVILLE CITY	18 308158 4892739 W	2015/08 6032						7253238 (C29063) A138101 P	
BELLEVILLE CITY	18 308243 4892742 W	2019/02 7241	1.37			MT	0010 10	7335213 (Z302885) A261262	BRWN ---- GRVL HARD 0001 BRWN FSND SOFT LOOS 0002 BRWN CLAY SILT SOFT 0004 GREY LMSN SHLE HARD 0020

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 308242 4892753 W	2019/02 7241	1.37			MT	0009 10	7335212 (Z302786) A261263	GREY ---- GRVL HARD 0001 BRWN FSND SOFT LOOS 0002 BRWN CLAY SILT GRVL 0003 BRWN LMSN SHLE HARD 0019
BELLEVILLE CITY	18 307726 4892834 W	2019/12 7329						7351636 (Z333275) A	
BELLEVILLE CITY	18 308220 4892759 W	2019/06 7329						7335917 (Z312613) A	
BELLEVILLE CITY	18 308227 4892734 W	2019/06 7329						7335918 (Z312614) A	
BELLEVILLE CITY	18 307727 4893098 W	2012/01 7241	1.59			MT	0020 10	7176102 (Z134450) A087217	GREY GRVL LOOS 0001 GREY MSND STNS SOFT 0007 GREY LMSN FCRD 0017 BRWN LMSN FCRD 0023 GREY LMSN FCRD 0030
BELLEVILLE CITY	18 307675 4893088 W	2019/02 7323	1.5					7331243 (Z300177) A236186	BRWN CLAY FILL 0005 GREY TILL HARD 0011 GREY LMSN LOOS 0022
BELLEVILLE CITY	18 308017 4893757 W	2019/07 7085						7344103 (C45373) A268546 P	
BELLEVILLE CITY	18 308185 4892728 W	2019/12 7329						7349523 (Z312751) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307773 4892838 W	2019/12 7329						7351639 (Z333278) A	
BELLEVILLE CITY	18 307695 4892882 W	2019/12 7329						7351634 (Z333273) A	
BELLEVILLE CITY	18 308172 4892709 W	2019/12 7329						7349526 (Z312760) A	
BELLEVILLE CITY	18 308171 4892710 W	2019/12 7329						7349525 (Z312754) A	
BELLEVILLE CITY	18 308184 4892728 W	2019/12 7329						7349524 (Z312753) A	
BELLEVILLE CITY	18 308161 4892744 W	2019/12 7329						7349522 (Z312750) A	
BELLEVILLE CITY	18 308200 4892684 W	2017/09 7610						7297006 (Z254447) A	
BELLEVILLE CITY	18 308162 4892744 W	2019/12 7329						7349521 (Z312749) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 308299 4892745 W	2018/06 7329						7335381 (Z304388) A	
BELLEVILLE CITY	18 308255 4892765 W	2019/06 7329						7335924 (Z312620) A	
BELLEVILLE CITY	18 308168 4892992 W	2017/02 6607	2.04	UT 0014		MO	0015 5	7309368 (Z248154) A217887	BRWN SAND LOOS 0001 BRWN CLAY SILT 0007 BLCK SHLE LMSN 0020
BELLEVILLE CITY	18 308274 4892762 W	2019/06 7329						7335379 (Z304387) A	
BELLEVILLE CITY	18 308087 4892812 W	2019/11 7329						7349854 (Z312762) A	
BELLEVILLE CITY	18 307703 4892786 W	2019/11 7329						7350430 (Z312803) A	
BELLEVILLE CITY	18 307741 4892842 W	2019/11 7329						7350429 (Z312804) A	
BELLEVILLE CITY	18 307780 4892845 W	2019/11 7329						7350428 (Z312805) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307802 4892838 W	2019/11 7329						7350427 (Z312806) A	
BELLEVILLE CITY	18 307700 4892828 W	2019/11 7329						7350426 (Z312807) A	
BELLEVILLE CITY	18 307772 4892843 W	2019/11 7329						7350425 (Z312808) A	
BELLEVILLE CITY	18 307736 4892844 W	2019/11 7329						7350424 (Z312809) A	
BELLEVILLE CITY	18 307772 4892849 W	2019/11 7329						7350423 (Z312810) A	
BELLEVILLE CITY	18 307978 4892708 W	2019/11 7329						7349855 (Z312761) A	
BELLEVILLE CITY	18 307714 4892798 W	2019/11 7329						7350433 (Z312799) A	
BELLEVILLE CITY	18 307934 4892700 W	2019/11 7329						7349853 (Z312763) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307957 4892758 W	2019/11 7329						7349852 (Z312764) A	
BELLEVILLE CITY	18 308069 4892939 W	2019/11 7329						7349919 (Z312778) A	
BELLEVILLE CITY	18 308053 4893003 W	2020/01 7329						7351673 (Z333248) A	
BELLEVILLE CITY	18 307786 4892816 W	2019/12 7329						7351640 (Z333279) A	
BELLEVILLE CITY	18 307782 4892818 W	2019/12 7329						7351641 (Z333283) A	
BELLEVILLE CITY	18 307840 4893037 W	2020/01 7329						7351665 (Z333256) A	
BELLEVILLE CITY	18 307985 4892988 W	2020/01 7329						7351668 (Z333253) A	
BELLEVILLE CITY	18 307851 4892999 W	2020/01 7329						7351666 (Z333255) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307999 4893032 W	2020/01 7329						7351667 (Z333254) A	
BELLEVILLE CITY	18 308037 4893014 W	2020/01 7329						7351669 (Z333252) A	
BELLEVILLE CITY	18 308028 4893089 W	2020/01 7329						7351670 (Z333251) A	
BELLEVILLE CITY	18 307853 4892828 W	2019/11 7329						7350431 (Z312802) A	
BELLEVILLE CITY	18 308053 4893001 W	2020/01 7329						7351672 (Z333249) A	
BELLEVILLE CITY	18 307844 4892853 W	2019/11 7329						7350432 (Z312801) A	
BELLEVILLE CITY	18 308038 4893025 W	2020/01 7329						7351674 (Z333247) A	
BELLEVILLE CITY	18 308039 4893024 W	2020/01 7329						7351675 (Z333246) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307991 4893008 W	2020/01 7329						7351676 (Z333245) A	
BELLEVILLE CITY	18 307990 4893009 W	2020/01 7329						7351677 (Z333244) A	
BELLEVILLE CITY	18 307972 4892978 W	2020/01 7329						7351678 (Z333243) A	
BELLEVILLE CITY	18 307971 4892981 W	2020/01 7329						7351679 (Z333242) A	
BELLEVILLE CITY	18 307792 4892919 W	2019/11 7329						7350435 (Z312798) A	
BELLEVILLE CITY	18 307763 4892803 W	2019/11 7329						7350434 (Z312800) A	
BELLEVILLE CITY	18 308053 4893000 W	2020/01 7329						7351671 (Z333250) A	
BELLEVILLE CITY	18 308100 4892746 W	2019/11 7329						7349851 (Z312765) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 307323 4893242 W	2016/12 1507	6.25	UT 0040	6/10/15 /1:	MO		7279386 (Z235935) A208023	BRWN SAND LOOS 0002 BRWN CLAY PCKD 0006 BRWN CLAY TILL PCKD 0009 GREY CLAY TILL PCKD 0018 GREY LMSN HARD 0063
BELLEVILLE CITY	18 307344 4893180 W	2016/12 1507	6.25	UT 0038	9/18/12 /1:	MO		7279385 (Z235934) A208022	BRWN CLAY PCKD 0006 BRWN CLAY TILL PCKD 0009 GREY LMSN FCRD 0022 GREY LMSN HARD 0051
BELLEVILLE CITY	18 308033 4892980 W	2019/11 7329						7349842 (Z312776) A	
BELLEVILLE CITY	18 307990 4892753 W	2019/11 7329						7349845 (Z312771) A	
BELLEVILLE CITY	18 308087 4892806 W	2019/11 7329						7349848 (Z312768) A	
BELLEVILLE CITY	18 307476 4893296 W	2016/12 1507	6.25	UT 0041	11/23/2 /1:	DO MO		7279387 (Z235936) A208025	BRWN CLAY TILL PCKD 0014 GREY LMSN HARD 0064
BELLEVILLE CITY	18 308032 4892982 W	2019/11 7329						7349844 (Z312777) A	
BELLEVILLE CITY	18 308078 4892882 W	2019/11 7329						7349846 (Z312770) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BELLEVILLE CITY	18 308114 4892778 W	2019/11 7329						7349847 (Z312769) A	
BELLEVILLE CITY	18 308097 4892783 W	2019/11 7329						7349849 (Z312767) A	
BELLEVILLE CITY	18 308054 4892718 W	2019/11 7329						7349850 (Z312766) A	
BELLEVILLE CITY (SID CON 01 036	18 307480 4892501 W	1959/04 1813	6 6	FR 0050	4/40/15 /1:0	DO		2902119 ()	CLAY 0010 SHLE LMSN 0015 LMSN 0050
BELLEVILLE CITY (SID CON 01 036	18 307311 4892619 W	1957/06 1507	6	FR 0024	15/18/17/5:0	DO		2902117 ()	MSND GRVL 0023 GRVL 0024
BELLEVILLE CITY (SID CON 01 037	18 307662 4892455 W	1954/11 3550	5 5	FR 0039	8/20/2/ 0:30	DO		2902125 ()	CLAY BLDR 0018 LMSN 0041
BELLEVILLE CITY (SID CON 01 037	18 307607 4893387 W	1956/08 3516	6 6	FR 0042	15/45/1 /:	DO		2902126 ()	CLAY GRVL 0023 LMSN 0045
BELLEVILLE CITY (SID CON 01 037	18 307406 4893370 W	1958/09 3516	6 6	FR 0015	6/23/5/ 0:30	DO		2902127 ()	CLAY GRVL 0003 GREY LMSN 0023

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP	18 307415 4893101 W	2013/04 7085	6 2	UT 0017		TH	0013 10	7201117 (Z169644) A146349	BRWN GRVL SAND FILL 0001 BRWN SAND SILT TILL 0016 BRWN SAND GRVL 0023
SIDNEY TOWNSHIP	18 308135 4892748 W	2014/07 2662	2				0010 6	7226556 (Z195045) A159035	BLCK 0000 BRWN SAND GRVL 0004 BRWN SAND GRVL ROCK 0006 GREY LMSN 0016
SIDNEY TOWNSHIP	18 308133 4892752 W	2014/07 2662	2			MO	0036 5	7226555 (Z195044) A159034	BLCK 0000 BRWN SAND GRVL 0004 BRWN SAND GRVL ROCK 0006 GREY LMSN 0040
SIDNEY TOWNSHIP	18 308131 4892700 W	2014/07 2662	2			MO	0035 5	7226554 (Z195040) A159030	BLCK 0000 BRWN SAND GRVL 0006 GREY LMSN 0040
SIDNEY TOWNSHIP	18 308131 4892758 W	2014/07 2662	2			MO	0036 5	7226557 (Z195042) A159032	BLCK 0000 BRWN SAND GRVL 0000 GREY 0002 BRWN SAND GRVL 0006 GREY LMSN 0040
SIDNEY TOWNSHIP	18 308131 4892759 W	2014/07 2662	2			MO	0011 5	7226558 (Z195043) A159033	BLCK 0000 BRWN SAND GRVL 0000 GREY 0002 BRWN SAND GRVL 0006 GREY LMSN 0016
SIDNEY TOWNSHIP	18 308046 4892986 W	2016/07 6032						7287501 (C29126) A202547 P	
SIDNEY TOWNSHIP	18 308133 4892760 W	2014/07 2662	2			MO	0011 5	7226553 (Z195041) A159031	BLCK 0000 BRWN SAND GRVL 0006 GREY LMSN 0016

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP	18 308148 4892737 W	2014/11 6032						7231738 (C24637) A138146 P	
SIDNEY TOWNSHIP	18 307984 4893123 W	2019/10 7323	1.5			TH MO	0030 10	7363074 (Z322220) A236166	BRWN CLAY 0003 GREY LMSN SOFT LYRD 0040
SIDNEY TOWNSHIP	18 307879 4892842 W	2016/07 6032						7287500 (C29125) A202504 P	
SIDNEY TOWNSHIP	18 307355 4893153 W	2012/02 1507	6		12///:	DO		7178564 (Z141051) A	
SIDNEY TOWNSHIP	18 307551 4892757 W	2019/12 7329						7351376 (Z333265) A	WHIT
SIDNEY TOWNSHIP	18 307461 4892800 W	2019/12 7329						7351380 (Z333261) A	
SIDNEY TOWNSHIP	18 307527 4892843 W	2019/12 7329						7351379 (Z333260) A	
SIDNEY TOWNSHIP	18 307468 4892808 W	2019/12 7329						7351371 (Z333268) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP	18 307483 4892733 W	2019/12 7329						7351372 (Z333269) A	
SIDNEY TOWNSHIP	18 307536 4892844 W	2019/12 7329						7351378 (Z333284) A	
SIDNEY TOWNSHIP	18 307474 4892732 W	2019/12 7329						7351374 (Z333263) A	
SIDNEY TOWNSHIP	18 307551 4892757 W	2019/12 7329						7351369 (Z333266) A	
SIDNEY TOWNSHIP	18 307546 4892762 W	2019/12 7329						7351375 (Z333264) A	
SIDNEY TOWNSHIP	18 308094 4892766 W	2017/03 7148						7285127 (Z248072) A	
SIDNEY TOWNSHIP	18 307460 4892808 W	2019/12 7329						7351373 (Z333262) A	
SIDNEY TOWNSHIP	18 307319 4893196 W	2016/11 3750						7275541 (Z239320) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP	18 308095 4892755 W	2017/03 7148						7285126 (Z248075) A	
SIDNEY TOWNSHIP	18 308106 4892752 W	2017/03 7148						7285083 (Z248074) A	
SIDNEY TOWNSHIP	18 307619 4892765 W	2019/12 7329						7351364 (Z333270) A	
SIDNEY TOWNSHIP	18 307995 4892854 W	2019/12 7329						7351365 (Z333272) A	
SIDNEY TOWNSHIP	18 307990 4892880 W	2019/12 7329						7351366 (Z333271) A	
SIDNEY TOWNSHIP	18 307662 4892783 W	2019/12 7329						7351367 (Z333258) A	
SIDNEY TOWNSHIP	18 307645 4892806 W	2019/12 7329						7351368 (Z333259) A	
SIDNEY TOWNSHIP CON 01 035	18 307229 4892520 W	1981/07 1507	6 6			NU		2910015 () A	BRWN LOAM LOOS 0001 BRWN CLAY HARD PCKD 0007 BRWN HPAN STNS HARD 0018 GREY HPAN STNS PCKD 0033 GREY LMSN HARD 0063

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP CON 01 035	18 307229 4892520 W	1981/07 1507	6 6	FR 0039	12/39/12/3:0	DO		2910016 ()	BRWN LOAM LOOS 0001 BRWN CLAY PCKD 0007 BRWN HPAN HARD PCKD 0018 GREY HPAN STNS HARD 0029 GRVL LOOS 0031 GREY SHLE LOOS 0038 GREY LMSN HARD 0042
SIDNEY TOWNSHIP CON 01 035	18 306879 4892747 W	1962/11 1813	6	FR 0024	10/28/3/1:0	DO		2902102 ()	SHLE LMSN 0015 GRVL 0028
SIDNEY TOWNSHIP CON 01 035	18 307113 4892572 W	1956/08 3516	6 6	FR 0024	5/10/6/0:30	DO		2902092 ()	CLAY LOAM 0020 LMSN 0026
SIDNEY TOWNSHIP CON 01 035	18 306862 4893215 W	1957/03 1821	6 6					2902093 () A	CLAY GRVL 0012 LMSN 0150
SIDNEY TOWNSHIP CON 01 036	18 307270 4893091 W	1968/09 1806	6	FR 0030	12/25/5/1:0	DO		2904109 ()	GRVL 0033
SIDNEY TOWNSHIP CON 01 036	18 307290 4893201 W	1962/11 1813	6 6	FR 0043	35/49/3/1:0	DO		2902121 ()	GRVL 0040 LMSN 0049
SIDNEY TOWNSHIP CON 01 036	18 307464 4892538 W	1955/11 3516	6 6	FR 0034	6/35/17/:	DO		2902111 ()	CLAY GRVL 0015 LMSN 0035
SIDNEY TOWNSHIP CON 01 036	18 307205 4893246 W	1958/07 1821	6	FR 0035	20/40/1/1:0	DO		2902118 ()	GRVL 0040

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP CON 01 036	18 307130 4893136 W	1957/03 1821	6	FR 0018	12/14/17/1:0	DO		2902116 ()	GRVL 0030
SIDNEY TOWNSHIP CON 01 036	18 307168 4893339 W	1955/11 3516	6 6	FR 0025	10/35/2/:	DO		2902112 ()	CLAY MSND BLDR 0033 LMSN 0035
SIDNEY TOWNSHIP CON 01 036	18 307109 4893245 W	1956/05 1821	6	FR 0026	18/20/5/0:30	DO		2902113 ()	GRVL 0026
SIDNEY TOWNSHIP CON 01 036	18 307280 4893271 W	1956/07 3010	6 6	FR 0036	16/26/4/2:0	DO		2902114 ()	CLAY 0003 CLAY STNS 0011 HPAN BLDR 0028 GRVL 0036 LMSN 0038
SIDNEY TOWNSHIP CON 01 036	18 307035 4893271 W	1962/10 1813	6 6	FR 0011	2/55/2/1:0	DO		2902120 ()	CLAY 0011 LMSN 0055
SIDNEY TOWNSHIP CON 01 036	18 307190 4893041 W	1967/07 1813	6	FR 0030	22/32/5/1:0	DO		2902123 ()	GRVL 0012 CLAY GRVL 0028 GRVL 0032
SIDNEY TOWNSHIP CON 01 036	18 307180 4893061 W	1963/07 1805	6	FR 0015	16/16/15/1:0	DO		2902122 ()	CLAY STNS 0015 GRVL 0025
SIDNEY TOWNSHIP CON 01 036	18 307369 4892547 W	1956/08 3516	6 6	FR 0035	8/9/6/0:30	DO		2902115 ()	CLAY LOAM 0033 LMSN 0042

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
SIDNEY TOWNSHIP CON 01 038	18 307889 4892965 W	2012/01 7241	1.59			MT	0020 10	7176103 (Z134449) A087219	BLCK LOAM SOFT 0001 BRWN MSND STNS SOFT 0004 GREY LMSN FCRD 0012 BRWN LMSN FCRD 0016 GREY LMSN FCRD 0030
THURLOW TOWNSHIP	18 308070 4893675 W	2014/04 7230	1.97	UT 0009		MT	0040 10	7226773 (Z182184) A163737	BLCK LOAM LOOS 0000 BRWN SILT CLAY LOOS 0005 GREY SILT SAND HARD 0018 GREY SAND SILT HARD 0022 ROCK 0050
THURLOW TOWNSHIP	18 308021 4893480 W	2014/04 7230	1.97	34		MO		7226774 (Z121165) A139265 A	LOAM 0000 BRWN SILT SAND 0008 GREY SAND SILT 0025 ROCK DNSE 0039
THURLOW TOWNSHIP	18 308223 4893564 W	2014/03 7239						7226540 (C22747) A133418 A P	
THURLOW TOWNSHIP	18 308250 4892632 W	2017/09 7610						7297003 (Z254444) A	
THURLOW TOWNSHIP	18 308223 4893551 W	7239						7222221 (Z172427) A	
THURLOW TOWNSHIP	18 308270 4892762 W	2016/07 6032						7287491 (C29052) A202505 P	
THURLOW TOWNSHIP	18 308160 4892958 W	2016/07 6032						7287490 (C29106) A202503 P	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
THURLOW TOWNSHIP	18 308222 4893563 W	2015/05 7239						7242343 (C29156) A133418 A P	
THURLOW TOWNSHIP	18 308216 4892679 W	2016/03 7241	2.06			MT	0004 6	7260381 (Z222355) A170460	GREY GRVL DNSE 0001 BRWN SAND CLAY SOFT 0005 GREY LMSN WTHD 0010
THURLOW TOWNSHIP	18 308180 4892667 W	2016/03 7241	2.04			MT	0004 6	7260380 (Z222357) A170461	BRWN LOAM SOFT 0001 BRWN CLAY SILT SOFT 0004 GREY LMSN WTHD 0010
THURLOW TOWNSHIP	18 308177 4892691 W	2016/03 7241	2.04			MT	0004 6	7260379 (Z222356) A170462	GREY GRVL 0001 BRWN SAND CLAY GRVL 0005 GREY LMSN 0010
THURLOW TOWNSHIP	18 307979 4893810 W	2016/03 7241	2.04			MT	0010 10	7260385 (Z222318) A168711	BRWN GRVL LOOS 0002 BRWN SILT SAND SOFT 0013 GREY TILL HARD 0020
THURLOW TOWNSHIP	18 307910 4893737 W	2016/03 7241	2.04			MT	0010 5	7260378 (Z222300) A168717	GREY GRVL LOOS 0001 BRWN SAND SILT SOFT 0006 GREY TILL HARD 0015
THURLOW TOWNSHIP	18 308008 4893832 W	2016/03 7241	2.04			MT	0014 10	7260377 (Z222306) A168716	BLCK LOAM SOFT 0001 BRWN SAND SILT SOFT 0010 BRWN TILL HARD 0024
THURLOW TOWNSHIP	18 307908 4893885 W	2016/03 7241	2.04			MT	0005 10	7260376 (Z222314) A168715	GREY GRVL LOOS 0002 BRWN SILT SOFT 0008 BRWN TILL SILT HARD 0015

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
THURLOW TOWNSHIP	18 308249 4892632 W	2017/09 7610						7297004 (Z254445) A	
THURLOW TOWNSHIP	18 308248 4892632 W	2017/09 7610						7297005 (Z254446) A	
THURLOW TOWNSHIP	18 308199 4892684 W	2017/09 7610						7297007 (Z254448) A	
THURLOW TOWNSHIP	18 308257 4892711 W	2016/03 7241	2.04			MT	0004 6	7260382 (Z222358) A170463	GREY GRVL 0001 BRWN SAND CLAY GRVL 0005 GREY LMSN 0010
THURLOW TOWNSHIP	18 307941 4893837 W	2016/03 7241	2.04			MT	0005 10	7260386 (Z222317) A168712	
THURLOW TOWNSHIP	18 308198 4892684 W	2017/09 7610						7297008 (Z254449) A	
THURLOW TOWNSHIP	18 307929 4893857 W	2016/03 7241	2.04			MT	0010 10	7260375 (Z222315) A168714	GREY GRVL LOOS 0003 BRWN SAND SILT SOFT 0010 GREY TILL SILT HARD 0020
THURLOW TOWNSHIP	18 308248 4892623 W	2016/04 7148						7264139 (Z218592) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
THURLOW TOWNSHIP CON 01 001	18 308238 4892761 W	2019/02 7241	2			MT	0015 10	7335330 (Z219664) A192122	BRWN FILL SAND GRVL 0001 BRWN SILT CLAY DNSE 0004 GREY LMSN ROCK 0025

Appendix B

Borehole Logs

RECORD OF BOREHOLE No. 6

Project Number:	**2102519**				
Project Client:	**RIC (Midland Land) Inc.**				
Project Name:	**40 Wilson Avenue**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Belleville, Ontario**	Logged By: **MH**	Northing: **4893168**	Date Started: **Aug. 4, 2021**	
Drilling Location:	**See Figure 2**	Reviewed By: **AW**	Easting: **307551**	Date Completed: **Aug. 4, 2021**	

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)				
Lithology Plot	DESCRIPTION Local 100.63m	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT	Combustible Organic Vapour (ppm), Combustible Organic Vapour (%LEL), Total Organic Vapour (ppm); Atterberg Limits: PL, LL, Water Content (%)	Instrumentation Installation		GR	SA	SI	CL
	FILL: Sand & Gravel, Trace Limestone Fragments, Very Dense, Brown, Damp 0.8 99.9	SS	1	25	100+	0	100	100+	3		Auger Grinding				
	SAND & LIMESTONE FRAGMENTS, Some Silt, Very Dense, Brown, Damp	SS	2	100	100+	1	99	100+	1						
	2.1 98.5	SS	3	100	100+	2		100+	3		Auger Grinding				
	Auger Refusal on Inferred Bedrock at 2.1m														

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

RECORD OF BOREHOLE No. 7

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Project Number: **2102519**
Project Client: **RIC (Midland Land) Inc.**
Project Name: **40 Wilson Avenue**
Project Location: **Belleville, Ontario**
Drilling Location: **See Figure 2**

Drilling Method: **Solid Stem Augers** Drilling Machine: **Track Mount**
Logged By: **MH** Northing: **4893106** Date Started: **Aug. 5, 2021**
Reviewed By: **AW** Easting: **307399** Date Completed: **Aug. 5, 2021**

Lithology Plot	DESCRIPTION (Local 99.91m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING (Shear Strength Testing (kPa); Penetration Testing SPT/DCPT)	LAB TESTING (Combustible Organic Vapour (ppm); Combustible Organic Vapour (%LEL); Total Organic Vapour (ppm); Atterberg Limits PL–LL; Water Content (%))	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	FILL: Silty Sand, Some Gravel, Some Limestone Fragments, Dense to Compact, Brown, Moist	SS	1	100	35	0		35						
		SS	2	100	22	1	99	22	7					
	1.5 98.4													
	SAND & LIMESTONE FRAGMENTS, Some Silt, Trace Clay, Compact to Dense, Brown, Moist	SS	3	100	27	2	98	27	4		43	35	14	8
		SS	4	100	39			39	7		Auger Grinding			
	--- Very Dense ---	SS	5	100	100+	3	97	100+	7		Auger Grinding and Spoon Bouncing			
	4.6 95.3	AS	6	100		4	96		5					
	Auger Refusal on Inferred Bedrock at 4.6m													

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Groundwater depth encountered on completion of drilling: **Dry**
Cave depth after auger removal: **Open**
Groundwater depth observed on **Aug. 31/21** at a depth of: **Dry**
Observed on **Oct. 8/21** at a depth of: **Dry**

Scale: **1 :50**

RECORD OF BOREHOLE No. 8

Project Number:	**2102519**				
Project Client:	**RIC (Midland Land) Inc.**				
Project Name:	**40 Wilson Avenue**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Belleville, Ontario**	Logged By: **MH**	Northing: **4893066**	Date Started: **Aug. 4, 2021**	
Drilling Location:	**See Figure 2**	Reviewed By: **AW**	Easting: **307487**	Date Completed: **Aug. 4, 2021**	

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	Local 99.63m							Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded); 40 80 120 160. Penetration Testing: ○ SPT ● DCPT; 10 20 30 40	△ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ✳ Total Organic Vapour (ppm); 100 200 300 400. Atterberg Limits: PL ○ LL. Water Content (%); 10 20 30 40		GR SA SI CL
	FILL: Sand & Limestone Fragments, Silty, Very Dense, Grey, Damp	SS	1	100	67	0	99	67	1		
	0.8 98.9										
	SAND, Some Silt, Some Limestone Fragments, Some Gravel, Compact, Brown, Moist	SS	2	100	15	1	98	15	12		
		SS	3	100	14			14	7		Auger Grinding
	--- Loose ---	SS	4	100	9	2	97	9	10		
	--- With Limestone Fragments, Very Dense ---	SS	5	100	100+	3		100+	8		
	3.5 96.1										
	Auger Refusal on Inferred Bedrock at 3.5m	AS									

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

RECORD OF BOREHOLE No. 9

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Project Number:	**2102519**				
Project Client:	**RIC (Midland Land) Inc.**				
Project Name:	**40 Wilson Avenue**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Belleville, Ontario**	Logged By: **MH**	Northing: **4892980**	Date Started: **Aug. 5, 2021**	
Drilling Location:	**See Figure 2**	Reviewed By: **AW**	Easting: **307404**	Date Completed: **Aug. 5, 2021**	

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	Local 99.51m							Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded); 40 80 120 160. Penetration Testing: ○ SPT ● DCPT; 10 20 30 40	△ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ✳ Total Organic Vapour (ppm); 100 200 300 400. Atterberg Limits: PL ○ Water Content (%) LL; 10 20 30 40		GR SA SI CL
	FILL: Sand & Gravel, Some Concrete Fragments, Trace Silt, Loose, Brown, Moist	SS	1	100	9	0	99	9	13		
	--- Trace Brick Fragments & Fabric, Very Dense ---	SS	2	100	100+	1		100+	10		Auger Grinding on Obstruction at 0.6m
		SS	3	100	100+		98	100+	6		Auger Grinding
	2.1 97.4					2					
	Auger Refusal on Burried Obstruction (Possible Concrete Slab) at 2.1m										

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Scale: **1 :50**

RECORD OF BOREHOLE No. 10

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Project Number: **2102519**
Project Client: **RIC (Midland Land) Inc.**
Project Name: **40 Wilson Avenue**
Project Location: **Belleville, Ontario**
Drilling Location: **See Figure 2**

Drilling Method: **Solid Stem Augers** Drilling Machine: **Track Mount**
Logged By: **MH** Northing: **4893037** Date Started: **Aug. 5, 2021**
Reviewed By: **AW** Easting: **307611** Date Completed: **Aug. 5, 2021**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)				
Lithology Plot	DESCRIPTION Local 99.32m	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): × Other Test, + Pocket Penetrometer, ▲ Field Vane (Intact), △ Field Vane (Remolded); 40 80 120 160 Penetration Testing: ○ SPT ● DCPT; 10 20 30 40	△ Combustible Organic Vapour (ppm), ▲ Combustible Organic Vapour (%LEL), ✳ Total Organic Vapour (ppm); 100 200 300 400 Atterberg Limits: PL ○ Water Content (%) LL; 10 20 30 40	Instrumentation Installation		GR	SA	SI	CL
	FILL: Sand & Gravel, Some Limestone Fragments, Compact, Brown, Moist 0.8 98.6	SS	1	100	29	0	99	29	10		Auger Grinding				
	FILL: Silty Sand, Some Concrete Fragments, Trace Plastic, Compact, Dark Brown, Moist 1.5 97.8	SS	2	100	14	1	98	14	25						
	CLAYEY & SILTY SAND, Trace Gravel, Trace Limestone Fragments, Hard, Brown, Wet	SS	3	100	100+			100+ →	42						
	2.4 --- Some Limestone Fragments --- 96.9	SS	4	100	100+	2	97	100+ →	5		Auger Gridning & Spoon Bouncing				
	Auger Refusal on Inferred Bedrock at 2.4m														

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

RECORD OF BOREHOLE No. 11

Project Number: **2102519**
Project Client: **RIC (Midland Land) Inc.**
Project Name: **40 Wilson Avenue**
Project Location: **Belleville, Ontario**
Drilling Location: **See Figure 2**

Drilling Method: **Solid Stem Augers** Drilling Machine: **Track Mount**
Logged By: **MH** Northing: **4892958** Date Started: **Aug. 5, 2021**
Reviewed By: **AW** Easting: **307520** Date Completed: **Aug. 5, 2021**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT	Combustible Organic Vapour (ppm), Combustible Organic Vapour (%LEL), Total Organic Vapour (ppm); Atterberg Limits: PL, LL, Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	Local 98.35m													
	FILL: Silty Sand, Some Gravel, Some Concrete Fragments, Compact, Brown, Moist	SS	1	100	29	0	98	29	6					
	--- Gravelly ---	SS	2	100	14	1	97	14	8					
	1.5 96.8													
	SAND & LIMESTONE FRAGMENTS, Trace Silt, Very Dense, Brown, Moist	SS	3	100	100+	2	96	100+	4		Auger Grinding	54	39	(7)
		SS	4	100	100+			100+	10					
	3.2 95.2	SS	5	100	100+	3		100+	5		Auger Grinding & Spoon Bouncing			
	Auger Refusal in Inferred Bedrock at 3.2m													

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

RECORD OF BOREHOLE No. 12

Project Number:	**2102519**						
Project Client:	**RIC (Midland Land) Inc.**						
Project Name:	**40 Wilson Avenue**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Track Mount**		
Project Location:	**Belleville, Ontario**	Logged By:	**MH**	Northing:	**4892850**	Date Started:	**Aug. 5, 2021**
Drilling Location:	**See Figure 2**	Reviewed By:	**AW**	Easting:	**307477**	Date Completed:	**Aug. 5, 2021**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)				
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded); 40 80 120 160; Penetration Testing: ○ SPT ● DCPT; 10 20 30 40	△ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ✳ Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits: PL ○ Water Content (%) LL; 10 20 30 40	Instrumentation Installation		GR	SA	SI	CL
	Local 96.69m														
	SAND & LIMESTONE FRAGMENTS, Trace Silt, Very Dense, Brown, Moist	SS	1	100	100+	0		100+	16		Auger Grinding				
	--- Grey, Damp ---	SS	2	100	100+	1	96	100+	6						
	1.5 95.2	AS	3	100	100+			100+	4		Auger Grinding				
	Auger Refusal on Inferred Bedrock at 1.5m														

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **Aug. 31/21** at a depth of: **Dry**

Observed on **Oct. 8/21** at a depth of: **Dry**

Scale: **1 :50**

RECORD OF BOREHOLE No. 13

Project Number:	**2102519**				
Project Client:	**RIC (Midland Land) Inc.**				
Project Name:	**40 Wilson Avenue**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Belleville, Ontario**	Logged By: **MH**	Northing: **4892905**	Date Started: **Aug. 5, 2021**	
Drilling Location:	**See Figure 2**	Reviewed By: **AW**	Easting: **307645**	Date Completed: **Aug. 5, 2021**	

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)				
Lithology Plot	DESCRIPTION Local 97.95m	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): × Other Test, + Pocket Penetrometer, ▲ Field Vane (Intact), △ Field Vane (Remolded); 40 80 120 160; Penetration Testing: ○ SPT ● DCPT; 10 20 30 40	△ Combustible Organic Vapour (ppm), ▲ Combustible Organic Vapour (%LEL), ✳ Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; ○ Water Content (%); 10 20 30 40	Instrumentation Installation		GR	SA	SI	CL
	FILL: Sand & Gravel, Some Concrete & Limestone Fragments, Compact, Brownn, Moist 0.8 97.2	SS	1	100	18	0		18	5		Auger Grinding				
	SAND & LIMESTONE FRAGMENTS, Trace Silt, Compact, Brown, Moist	SS	2	100	19	1	97	19	7			37	55	(8)	
	--- Very Dense --- 1.7 96.3	SS	3	100	100+			100+ →	5		Auger Grinding & Spoon Bouncing				
	Auger Refusal on Inferred Bedrock at 1.7m														

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **Aug. 31/21** at a depth of: **Dry**

Observed on **Oct. 8/21** at a depth of: **Dry**

Scale: **1 :50**

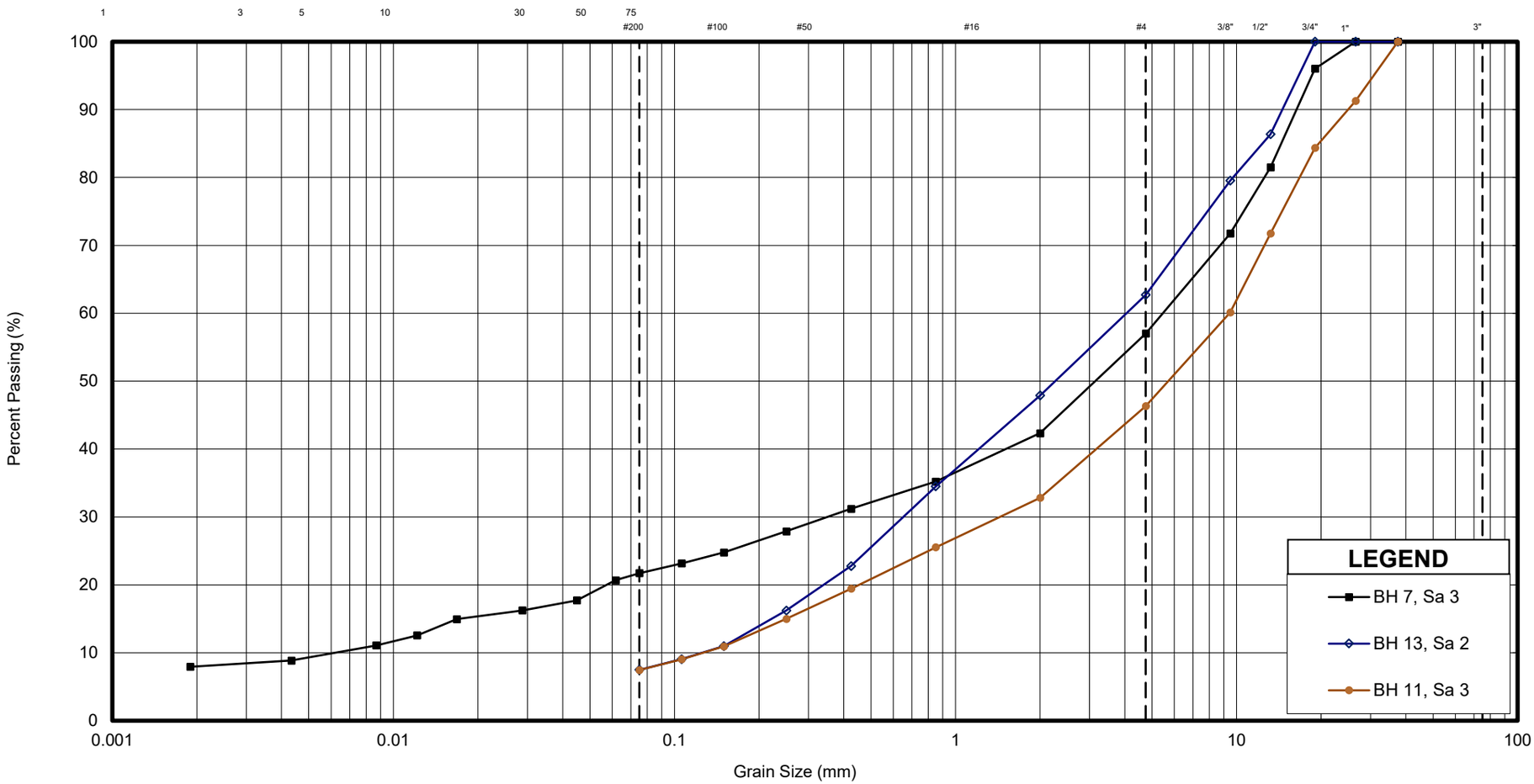
Appendix C

Geotechnical Laboratory Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS — SIEVE DESIGNATION (IMPERIAL)



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH 7, Sa 3	SAND & LIMESTONE FRAGMENTS, Some Silt, Trace Clay	43	35	14	8	0.006	0.35	5.469	883	3.62
BH 13, Sa 2	SAND & LIMESTONE FRAGMENTS, Trace Silt	37	55		8	0.126	0.651	4.058	32.28	0.83
BH 11, Sa 3	SAND & LIMESTONE FRAGMENTS, Trace Silt	54	39		7	0.126	1.438	9.436	74.66	1.73

GEI Consultants

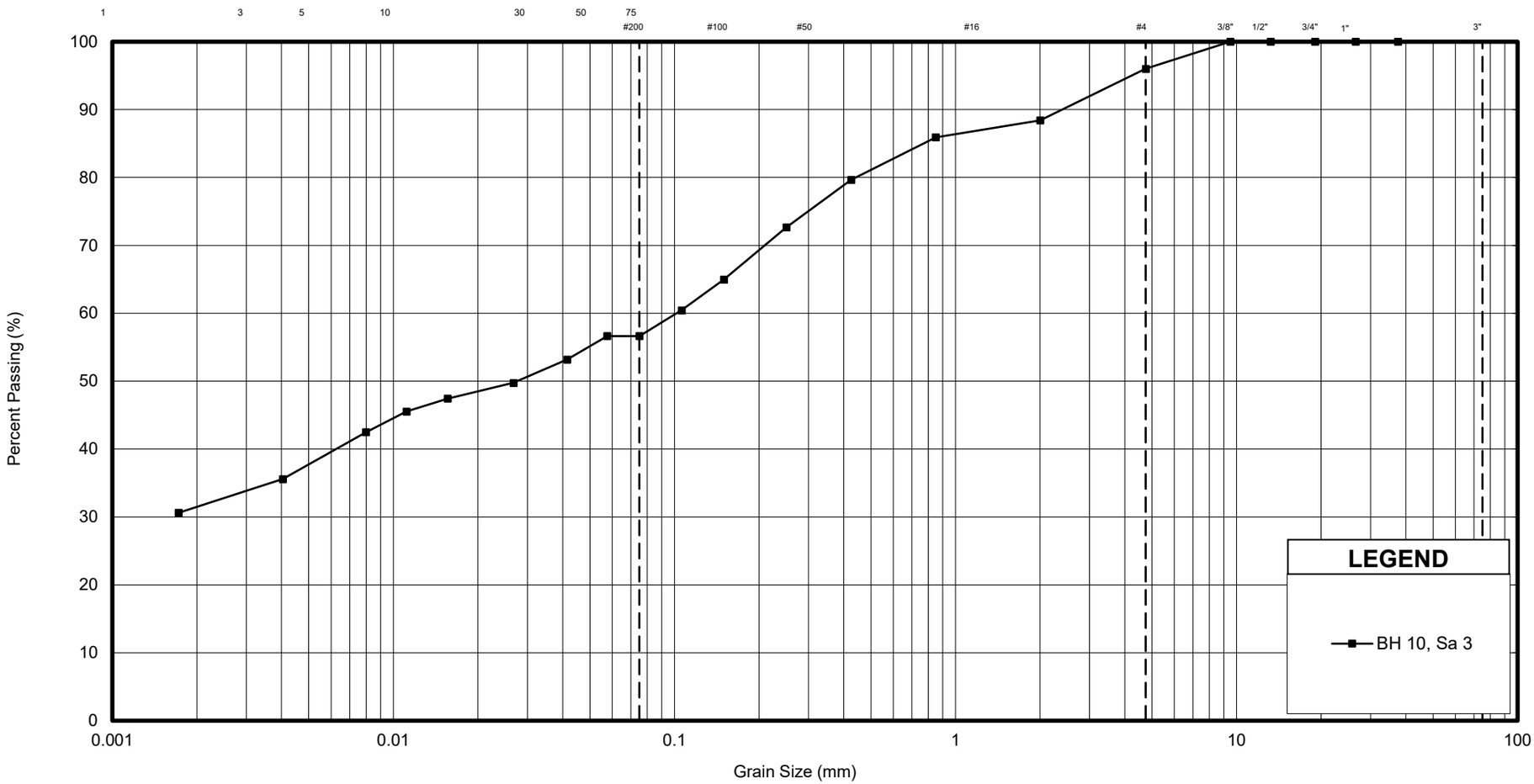
GRAIN SIZE DISTRIBUTION

SAND & LIMESTONE FRAGMENTS

APP. No.	B
REF. No.	2102519
DATE	September 2021

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH 10, Sa 3	CLAYEY & SILTY SAND, Trace Gravel	4	39	26	31	-	-	0.102	-	-

GEI Consultants

GRAIN SIZE DISTRIBUTION

CLAYEY & SILTY SAND

APP. No.	B
REF. No.	2102519
DATE	September 2021

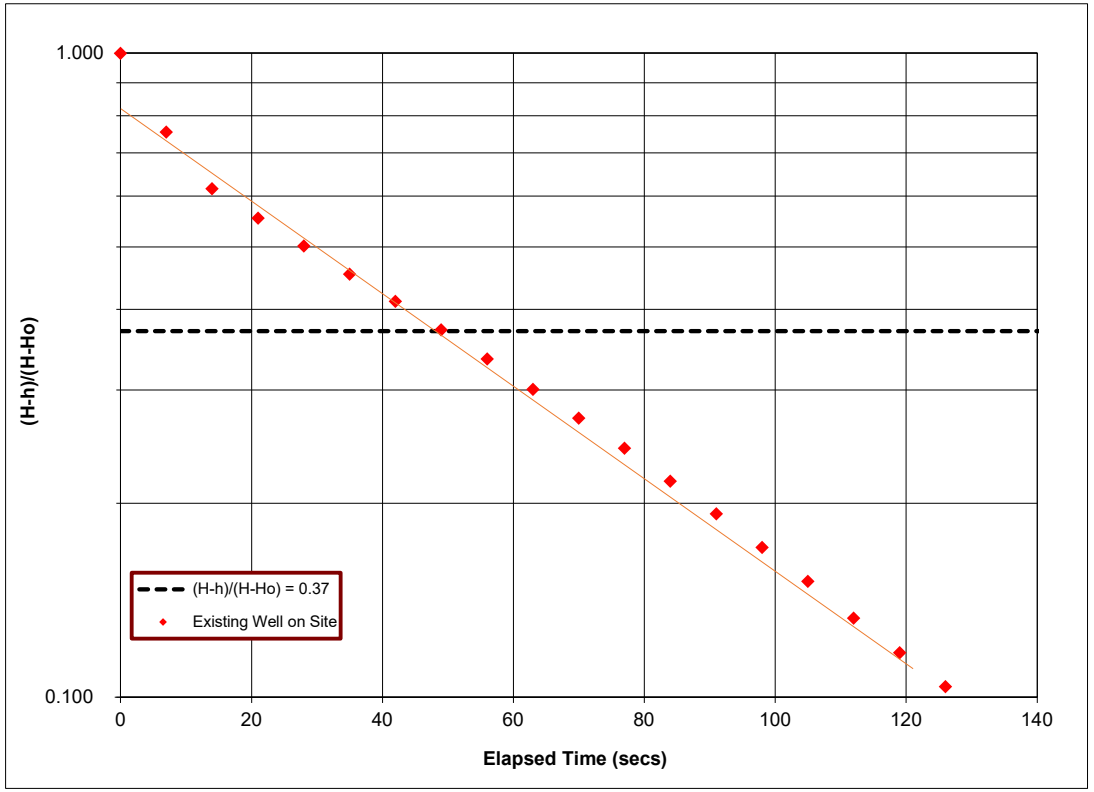
Appendix D

Rising Head Test Results

Recovery Testing - Hvorslev Method (1951)

Existing Well on Site

Time	Elapsed Time (mins)	Elapsed Time (sec)	Water Level (m)	H-h	(H-h)/(H-Ho)
			6.080		
8:21:24 AM	0.00	0	8.228	2.148	1.000
8:21:31 AM	0.12	7	7.7	1.620	0.754
8:21:38 AM	0.23	14	7.403	1.323	0.616
8:21:45 AM	0.35	21	7.272	1.192	0.555
8:21:52 AM	0.47	28	7.158	1.078	0.502
8:21:59 AM	0.58	35	7.055	0.975	0.454
8:22:06 AM	0.70	42	6.965	0.885	0.412
8:22:13 AM	0.82	49	6.879	0.799	0.372
8:22:20 AM	0.93	56	6.8	0.720	0.335
8:22:27 AM	1.05	63	6.726	0.646	0.301
8:22:34 AM	1.17	70	6.663	0.583	0.271
8:22:41 AM	1.28	77	6.603	0.523	0.243
8:22:48 AM	1.40	84	6.545	0.465	0.216
8:22:55 AM	1.52	91	6.494	0.414	0.193
8:23:02 AM	1.63	98	6.447	0.367	0.171
8:23:09 AM	1.75	105	6.405	0.325	0.151
8:23:16 AM	1.87	112	6.365	0.285	0.133
8:23:23 AM	1.98	119	6.332	0.252	0.117
8:23:30 AM	2.10	126	6.303	0.223	0.104
8:23:37 AM	2.22	133	6.275	0.195	0.091
8:23:44 AM	2.33	140	6.249	0.169	0.079
8:23:51 AM	2.45	147	6.227	0.147	0.068



K = Hydraulic Conductivity
r = radius of well casing
R = Radius of well screen or filter pack
L = Length of the well screen (in Slug Test) or the length of submerged portion of the well screen (in Rising Head)
T_0 = time for water level to rise or fall to 37% of the initial change

Notes:
1 - All water levels are in metres from ground surface
2 - R is radius of sand pack
3 - T_o is determined from plots where (H-h)/(H-Ho) = 0.37
4 - Analysis based off of Horslev (1951)

r (m) =	0.016
L (m) =	3
R (m) =	0.025
T_o (sec) =	48
K (m/s) =	**4E-06**

GEI Consultants

RISING HEAD TEST - Existing Well on Site

APPENDIX:	D
REF. No.:	2102519
DATE:	May 2022

Appendix E

Groundwater Chemistry Certificates of Analysis

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-28203

Report To:

GEI Consultants
647 Welham Rd, Unit 14,
Barrie ON L4N 0B7 Canada
Attention: Alex Winkelmann

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 02-Sep-21
DATE REPORTED: 10-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Wilson Ave. Extension
P.O. NUMBER: 2102519
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	1	Kingston	US	07-Sep-21	A-CN-001 (k)	SM 4500CN
Anions	1	Holly Lane	pcu	03-Sep-21	A-IC-01 (o)	SM4110C
pH	1	Holly Lane	SYL	03-Sep-21	A-PH-01 (o)	SM 4500H
A - Wet Chem	1	Kingston	aro	03-Sep-21	A-TPTKN-001 (N)(k)	E3199A.1
A - Wet Chem	1	Kingston	aro	03-Sep-21	A-TPTKN-001 (P)(k)	E3199A.1
Total Suspended Solids	1	Kingston	bbr	07-Sep-21	A-TSS-001 (k)	SM2540D
BOD	1	Kingston	JWF	03-Sep-21	C-BOD-001 (k)	SM 5210B
Oil & Grease	1	Kingston	TMM	08-Sep-21	C-O&G-001 (k)	SM 5520
Phenolics (4-aap)	1	Kingston	kwe	08-Sep-21	C-PHEN-01 (k)	MOEE 3179
VOC's	1	Richmond Hill	JE	03-Sep-21	C-VOC-02 (rh)	EPA 8260
Mercury	2	Holly Lane	PBK	08-Sep-21	D-HG-02 (o)	SM 3112 B
Metals - ICP-OES	2	Holly Lane	hmc	08-Sep-21	D-ICP-01 (o)	SM 3120
Metals - ICP-MS	2	Holly Lane	TPR	07-Sep-21	D-ICPMS-01 (o)	EPA 200.8

Belleville - Sani/Storm - Belleville Sanitary/Combined Sewer
Belleville - Sanitary - Belleville - Sanitary/Com/Storm Sewer
Belleville - Storm - Belleville Storm Sewer Use

Steve Garrett
Director of Laboratory Services

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Attention: Alex Winkelmann

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 02-Sep-21
DATE REPORTED: 10-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Wilson Ave. Extension
P.O. NUMBER: 2102519
WATERWORKS NO.

	Client I.D.		Other	Other (F)			Belleville - Sani/Storm	
	Sample I.D.		B21-28203-1	B21-28203-2			Belleville - Sanitary	Belleville - Storm
	Date Collected		01-Sep-21	01-Sep-21				
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.41					9
BOD(5 day)	mg/L	3	< 3				300	15
Chloride	mg/L	0.5	103				1500	
Cyanide (Total)	mg/L	0.005	< 0.005				2	
Fluoride	mg/L	0.1	0.2				10	
Oil and Grease-Mineral	mg/L	1.0	3.6				15	
Oil and Grease-Anim/Veg.	mg/L	1.0	2.3				150	
Phenolics	mg/L	0.002	< 0.002				1	
Phosphorus-Total	mg/L	0.01	0.50				10	
Sulphate	mg/L	1	10				1500	
Total Kjeldahl Nitrogen	mg/L	0.1	0.6				100	
Total Suspended Solids	mg/L	3	**378**				350	15
Aluminum	mg/L	0.01	3.14	0.05			50	
Antimony	mg/L	0.01	< 0.01	< 0.01			5	
Arsenic	mg/L	0.02	< 0.02	< 0.02			1	
Bismuth	mg/L	0.02	< 0.02	< 0.02			5	
Cadmium	mg/L	0.005	< 0.005	< 0.005			0.7	
Chromium	mg/L	0.002	0.004	< 0.002			5	
Cobalt	mg/L	0.005	0.009	< 0.005			5	
Copper	mg/L	0.002	< 0.002	< 0.002			3	
Iron	mg/L	0.005	4.82	1.71			50	
Lead	mg/L	0.02	< 0.02	< 0.02			2	
Manganese	mg/L	0.001	0.867	0.709			5	
Mercury	mg/L	0.00002	0.00002 [1]	< 0.00002				
Molybdenum	mg/L	0.01	0.07	0.01			5	
Nickel	mg/L	0.01	< 0.01	< 0.01			3	
Selenium	mg/L	0.001	< 0.001 [2]	< 0.001 [2]			5	

Belleville - Sani/Storm - Belleville Sanitary/Combined Sewer
Belleville - Sanitary - Belleville - Sanitary/Com/Storm Sewer
Belleville - Storm - Belleville Storm Sewer Use

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Steve Garrett
Director of Laboratory Services

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Client committed. Quality assured.

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Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 02-Sep-21
DATE REPORTED: 10-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Wilson Ave. Extension
P.O. NUMBER: 2102519
WATERWORKS NO.

	Client I.D. / Sample I.D. / Date Collected		Other B21-28203-1 01-Sep-21	Other (F) B21-28203-2 01-Sep-21			Belleville - Sani/Storm Belleville - Sanitary	Belleville - Sani/Storm Belleville - Storm
Parameter	**Units**	**R.L.**						
Silver	mg/L	0.005	< 0.005	< 0.005			5	
Tin	mg/L	0.05	< 0.05	< 0.05			5	
Titanium	mg/L	0.005	0.100	< 0.005			5	
Vanadium	mg/L	0.005	< 0.005	< 0.005			5	
Zinc	mg/L	0.005	0.021	< 0.005			3	
Benzene	mg/L	0.0005	< 0.0005				0.01	
Ethylbenzene	mg/L	0.0005	< 0.0005				0.16	
Chloroform	mg/L	0.001	< 0.001				0.04	
Dichlorobenzene,1,4-	mg/L	0.0005	< 0.0005				0.47	
Dichloromethane (Methylene Chloride)	mg/L	0.005	< 0.005				0.21	
Tetrachloroethylene	mg/L	0.0005	< 0.0005				0.05	
Trichloroethylene	mg/L	0.0005	< 0.0005				0.07	
Tetrachloroethane,1,1,2,2-	mg/L	0.0005	< 0.0005				0.04	
Toluene	mg/L	0.0005	< 0.0005				0.27	
Xylene, o-	mg/L	0.0005	< 0.0005				0.52	

1 . solids present in Hg bottle

2 . Subcontracted to Paracel Labs

Belleville - Sani/Storm - Belleville Sanitary/Combined Sewer
Belleville - Sanitary - Belleville - Sanitary/Com/Storm Sewer
Belleville - Storm - Belleville Storm Sewer Use

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Director of Laboratory Services

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CERTIFICATE OF ANALYSIS

Final Report

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647 Welham Rd, Unit 14,
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Attention: Alex Winkelmann

Caduceon Environmental Laboratories
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Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 02-Sep-21
DATE REPORTED: 10-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Wilson Ave. Extension
P.O. NUMBER: 2102519
WATERWORKS NO.

Summary of Exceedances

Belleville - Sanitary/Com/Storm Sewer

Other	Found Value	Limit
Total Suspended Solids (mg/L)	378	350

Belleville Storm Sewer Use

Other	Found Value	Limit
Total Suspended Solids (mg/L)	378	15

Belleville - Sani/Storm - Belleville Sanitary/Combined Sewer
Belleville - Sanitary - Belleville - Sanitary/Com/Storm Sewer
Belleville - Storm - Belleville Storm Sewer Use

Steve Garrett
Director of Laboratory Services

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON
ENVIRONMENTAL LABORATORIES
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TESTING REQUIREMENTS

- ☐ O.Reg 153 — Table ____ ☐ Medium/Fine ☐ Coarse
- ☐ RPI ☐ ICC — ☐ Agricultural (O.Reg 153)
- ☐ Yes ☐ No — Record of Site Condition (O.Reg 153)
- ☐ Provincial Water Quality Objectives
- ☒ Sewer Use By-Law: City of Belleville, Ontario
- ☐ MISA Guidelines
- ☐ O.Reg 558 Leachate Analysis — Disposal Site: ____
- ☐ Landfill Monitoring
- ☐ Other: ____

REPORT NUMBER (Lab Use): B21-28203

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☒ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Indicate Laboratory Samples are submitted to: ☐ Kingston ☐ Ottawa ☐ Richmond Hill ☐ Windsor ☒ Barrie ☐ London

Organization: GEI Consultants	**Address and Invoicing Address (if different):** 647 Welham Road, Unit 14, Barrie, Ontario, L4N 0B7	
Contact: Alex Winkelmann		
Tel: (705) 229-4298		
Fax: -	**Quote No.:** 2020_EPD	**Project Name:** Wilson Ave. Extension
Email: awinkelmann@geiconsultants	**P.O. No.:** -	**Additional Info:** 2102519

ANALYSES REQUESTED (Print Test in Boxes): Metals Suite #2; Belleville Sanitary and S; Suspected Highly Contaminated

TURNAROUND SERVICE REQUESTED (see back page)

- ☐ Platinum 200% Surcharge
- ☐ Gold 100% Surcharge
- ☐ Silver 50% Surcharge
- ☐ Bronze 25% Surcharge
- ☒ Standard 5-7 days
- ☐ Specific Date: ____

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

Lab No:	Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	Indicate Test For Each Sample By Using A Check Mark In The Box Provided	✓	Field pH	Field Temp.	# Bottles/ Sample	Field Filtered(Y/N)
1	Other	-	GW	21-09-01	AM	✓				10	N
2	Other (F)	-	GW	21-09-01	AM	✓				4	Y
	Metals + hg → O										
#1	Gen chem, Nut, FOG, CN, Phenol → K										
	#1 VOC → RH										
	#1 Gen chem → O										

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	Bo Hwang	Bo Hwang
Sign:		
	21-09-01	21-09-01
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:

SHIPPING INFORMATION

- Client's Courier ☐
- Caduceon's Courier ☐
- Drop Off ☒
- Caduceon (Pick-up) ☐

Invoice ☐

# of Pieces: 8

REPORTING / INVOICING

- Report by Fax ☐
- Report by Email ☒
- Invoice by Email ☒
- Invoice by Mail ☐

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

- Received By (print): Madison Signature: MB
- Date Received (yy-mm-dd): 21-09-02 Time Received: 13:27
- Laboratory Prepared Bottles: ☑ Yes ☐ No
- Sample Temperature °C: 13.6
- Labeled by: AM

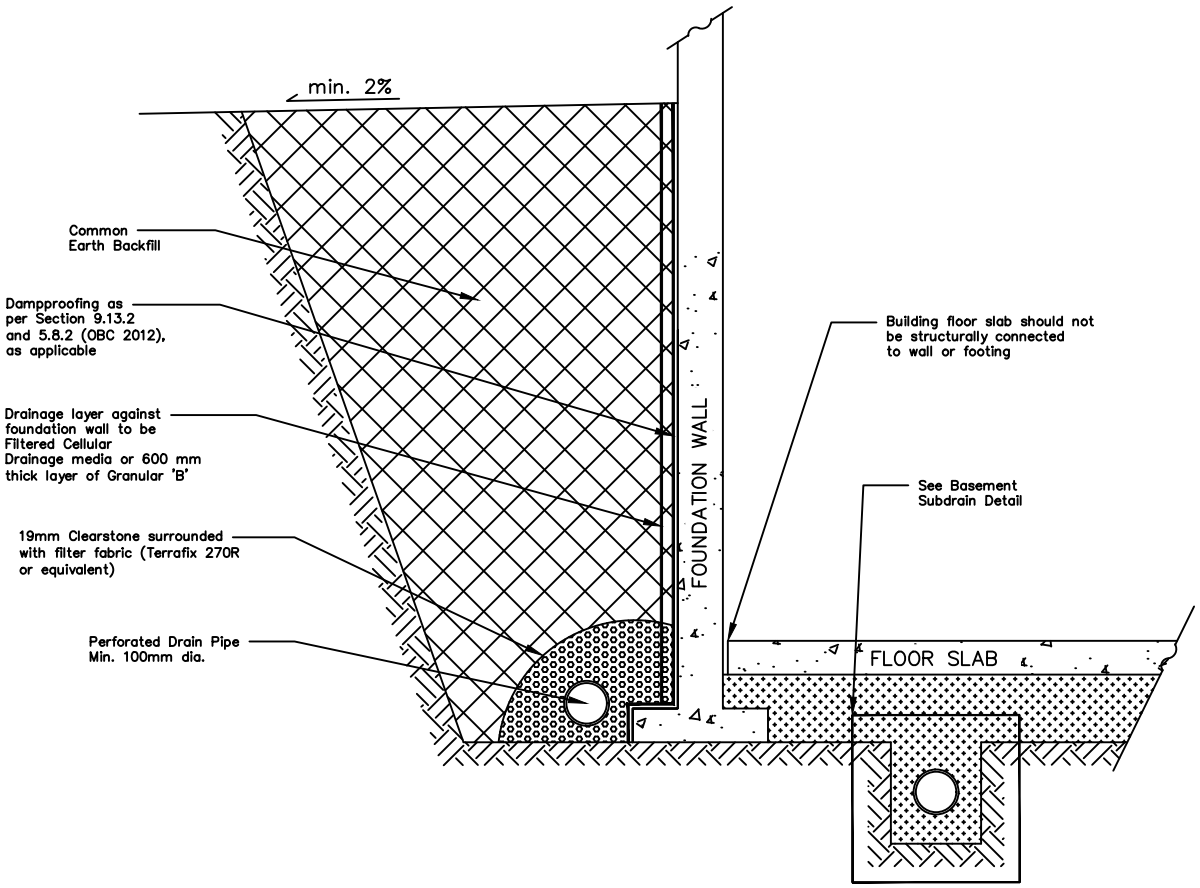
Comments:

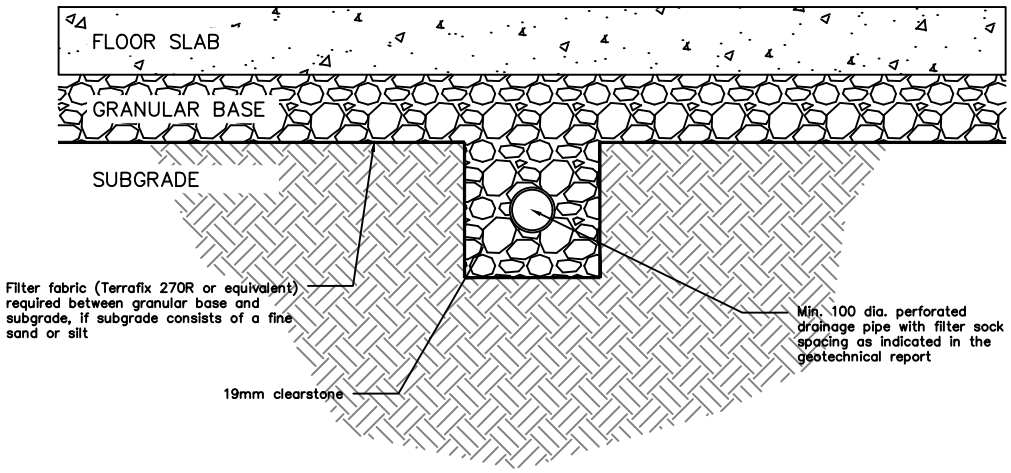
Page 1 of 1

G

Appendix F

Basement Drainage Typical Details





GEI Consultants
647 Welham Rd, Unit 14, Barrie, ON, L4N 0B7

BASEMENT FOUNDATION WALL & SUBFLOOR DRAINAGE TYPICAL DETAIL

Appendix G

Preliminary Water Balance

File No. 2102519

Water Balance - 40 Wilson Avenue

MONTHLY AND YEARLY WATER BALANCE COMPONENTS														
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Potential Evapotranspiration Calculation	Average Temperature: T (^{o}C)	-6.7	-5.1	-0.1	7.0	13.7	19.0	21.8	20.8	16.3	9.5	3.6	-2.6	8.1
	Heat Index: $i=(T/5)^{1.514}$	0.00	0.00	0.00	1.66	4.60	7.55	9.29	8.66	5.98	2.64	0.61	0.00	41.0
	Unadjusted Daily Potential Evapotranspiration: U (mm)	0.0	0.0	0.0	29.5	63.6	92.5	108.2	102.6	77.6	41.8	13.8	0.0	529.6
	Adjusting Factor for U (Latitude 44^{o})	0.81	0.81	1.02	1.13	1.27	1.28	1.30	1.20	1.04	0.94	0.80	0.76	-
	Adjusted Potential Evapotranspiration - PET (mm)	0.0	0.0	0.0	33.3	80.8	118.4	140.7	123.1	80.7	39.3	11.0	0.0	627.3
Pervious Components	Precipitation: P (mm)	67.3	58.1	62.4	75.8	81.3	74.5	65.1	75.5	91.9	85.2	95.7	79.1	911.9
	Adjusted Potential Evapotranspiration: PET (mm)	0.0	0.0	0.0	33.3	80.8	118.4	140.7	123.1	80.7	39.3	11.0	0.0	627.3
	P - PET	67.3	58.1	62.4	42.5	0.5	-43.9	-75.6	-47.6	11.2	45.9	84.7	79.1	284.6
	Change in Soil Moisture Storage (mm)	0.0	0.0	0.0	0.0	0.0	-43.9	-75.6	-47.6	11.2	45.9	0.0	0.0	-
	Water Holding Capacity (max. 75 mm)	75.0	75.0	75.0	75.0	75.0	31.1	0.0	0.0	11.2	57.1	75.0	75.0	-
	Water Surplus Available for Infiltration or Runoff	67.3	58.1	62.4	42.5	0.5	0.0	0.0	0.0	0.0	0.0	66.7	79.1	376.6
	Potential Infiltration based on MOECC Infiltration Factor (mm)	53.8	46.5	49.9	34.0	0.4	0.0	0.0	0.0	0.0	0.0	53.4	63.3	301.3
	Potential Surface Water Runoff (mm)	13.5	11.6	12.5	8.5	0.1	0.0	0.0	0.0	0.0	0.0	13.3	15.8	75.3
Impervious Components	Precipitation: P (mm)	-												911.9
	Potential Evaporation: PE (mm), Assume 15%	-												136.8
	Potential Surface Water Runoff: P - PE (mm)	-												775.1

PRE- AND POST-DEVELOPMENT WATER BALANCE (NO LOW IMPACT DEVELOPMENT MEASURES IN PLACE)							
		Total Land Area (m^2)	Est. Fraction of Land	Est. Land Area (m^2)	Runoff (m^3/annum)	Infiltration (m^3/annum)	**Runoff Increase Pre to Post**
Existing Land Use (Pre-Development)	Pervious Area	77800.0	90%	70020.0	5273.9	21095.6	337%
	Impervious Area		10%	7780.0	6030.4	0.0	**Infiltration Decrease Pre to Post**
	TOTAL	-	100%	77800.0	11304.3	21095.6	-78%
Proposed Land Use (Post-Development)	Pervious Area	77800.0	20%	15560.0	1172.0	4687.9	**Infiltration Required to Meet Pre-Development Conditions (m^3)**
	Impervious Area (Estimated from *"Concept Plan"*)		80%	62240.0	48243.2	0.0	
	TOTAL	-	100%	77800.0	49415.1	4687.9	16408

Notes

1. Both potential infiltration and surface water runoff are independent of temperature
2. Assumption is in January maximum soil moisture storage value is present (75mm)
3. Water Holding Capacity & Infiltration Factors taken from Table 3.1 of MOE SWMPDM, 2003
4. Average Temp. and Precip. taken from Environment Canada station "Belleville" between 1981 and 2010
5. Adjusting Factor for U based on Lorente, 1961

Infiltration Criteria	**Site Description**	**Infiltration Factor**
Topography	Flat Land - Average Slope Less Than 0.6 m/km	0.3
Soils	Open Sandy Loam	0.4
Cover	Cultivated Land	0.1
	Sum of Infiltration Factors	**0.8**