



Revised Hydrogeological Assessment

**17 Sophia Street East, and 3, 5, 7, 11
Macdonald Street and 58 & 60
Clapperton Street, Barrie, Ontario**

Prepared for:
Black Creek Group

Prepared by:
Azimuth Environmental
Consulting, Inc.

Revised June 2024

AEC 21-056



Environmental Assessments & Approvals

June 6th 2024

AEC 21-056

Black Creek Group
4040 White Rock Street
Victoria, BC
V8N 2K4

Attention: Jordan Nott

Re: **Revised Hydrogeological Assessment - File # D28-088-2022**
17 Sophia Street East, and 3, 5, 7, 11 Macdonald Street and 58 & 60
Clapperton Street, Barrie, Ontario

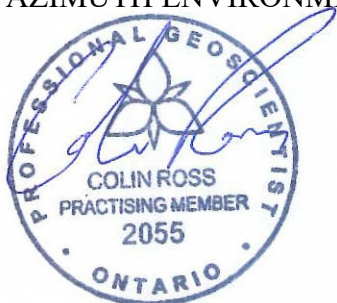
Dear Jordan,

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide our Revised Hydrogeological Assessment for the property comprised of 17 Sophia Street East, and 3, 5, 7, 11 Macdonald Street and 58 & 60 Clapperton Street, Barrie, ON (the "Site"). This evaluation focuses on the existing soil and ground water regime underlying the Site and the potential for the proposed mixed residential development to impact the existing conditions. It is noted that this report was revised to address changes to the proposed Site Plan in June of 2024.

Should you have any questions or wish to discuss the report in greater detail, please do not hesitate to contact the undersigned.

Yours truly,

AZIMUTH ENVIRONMENTAL CONSULTING, INC.



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1. INTRODUCTION

Azimuth Environmental Consulting Inc. (Azimuth) has been retained by Black Creek Group to conduct a Revised Hydrogeological Assessment for the property comprised of 17 Sophia Street East and 3, 5, 7, 11 Macdonald Street and 58 & 60 Clapperton Street, Barrie, ON (the “Site”) (Figure 1). This report has been updated to account for changes to the proposed development. One major change includes the removal of the underground parking levels. The parking is now proposed to occur above ground within floors 2 – 5.

This assessment addresses development requirements mandated by the Lake Simcoe Region Conservation Authority (LSRCA) under the *Lake Simcoe Protection Act*. This Act provides the authority for the establishment of and amendments to the Lake Simcoe Protection Plan (LSPP) which is addressed in this assessment. This assessment also addresses Source Water Protection policies developed under the *Clean Water Act* as they pertain to water quantity issues.

1.1 Background

The Site is irregular in shape, 0.3 hectares (ha) in size and is to be redeveloped as a 26-storey mixed use residential building. The Site is located on the south side of both Macdonald and Sophia Street and is bound by an apartment building to the west, Clapperton Street to the east and commercial properties to the south. Currently, there are buildings only on 58 and 60 Clapperton Street; however a gravel driveway from Macdonald Street and small paved area in the south east corner of the property remain from historical residential developments at the Site. It is also understood that the foundations for the former residential lots are still present below grade as they were just filled in during demolition. The condition / integrity of these structures are not known.

As per the proposed development plan, the development will be accessed from Clapperton Street and will include one (1) below grade level which will be used for mechanical and unit storage. The proposed Site Plan is provided in Appendix B and also illustrated on Figure 2.

The purpose of this assessment is to characterize the existing physical hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental / hydrogeological conditions. The report follows a standard format addressing typical requirements of both the City of Barrie and Lake Simcoe Conservation Authority (LSRCA) for hydrogeological submissions, including Source Water Protection and the Lake Simcoe Protection Plan (LSPP).



2. ENVIRONMENTAL SETTING

2.1 Soil

The Soil Map of South Simcoe County (Report No. 29) defines the surficial soil for the Site as the Tioga Series which are loamy sands consisting of grey, calcareous outwash sands. Tioga sands are classified within Soil Group A. Group A soils represent material with low runoff potential and high infiltration rates.

2.2 Physiography

According to Chapman and Putnam (1984) the Site falls within the Simcoe Lowlands physiographic region. It lies on one of the numerous glacial shorelines that define the Lake Simcoe basin. Further north and significantly higher in elevation are the Simcoe Uplands, which are a series of broad rolling till plains standing roughly 60 m above the surrounding lowlands. The lowlands are considered to be the former Lake Algonquin shoreline features. The lowland soils are described as being composed of sands, silt and clay. Chapman and Putnam (1984) suggest that along the northern and western shores of Lake Simcoe the lowland consist of a narrow terrace which confined the highest stage of Lake Algonquin. The glacial lake cut into the till that represents the Upland soils leaving the bluff / scarp physiographic setting. However, the topography along Bayfield Street from the Highway 400 interchange to Lake Simcoe appears as several prominent stair-stepping inclines (i.e., beach fronts) of which Sophia Street is the second lowest in this progression.

The South Simcoe Groundwater Study (Golder, 2004) suggests that the property lies on the second deepest aquifer complex present in the Barrie Area. Immediately north and also northeast of the Site are a pair of former glacial stream corridors that have cut into the topographic surface. Historically Sophia Creek, (which is the remnant stream corridor); was eventually constrained / controlled and ran along the north ditch of Sophia Street according to the historical fire insurance mapping (Azimuth, 2016).

Topographically these spillway channels appear to have had a northeast to southwest orientation based on a regional interpretative basis using NASA's shuttle radar topography mission (SRTM) data (OGSEarth, 2020) and stereographic interpretation of historical aerial photography.

Over time, Sophia Creek was engineered and incorporated into the City's storm water infrastructure such that it is now completely buried from Peel Street which is 300 m east of the Site.



2.3 Topography and Drainage

The topographic relief at the Site is quite limited with elevations ranging between approximately 234 masl at the south and 235 masl at the north. The current Site drainage is expected to follow the local topographic dip to the south, although any surface runoff exiting the Site is expected to be captured within the local municipal stormwater system as the area surrounding the Site is fully developed. Surface water run on to the Site is not expected from the north due to the presence of curb and gutters present along the northern property boundary (*i.e.* Sophia and Macdonald streets).

2.4 Bedrock Geology

The underlying bedrock geology has been described by the Ontario Geologic Survey (OGS) as being composed of interbedded bioclastic to very-fine grained limestone and grey-green calcareous shale of the Verulam Formation of the Simcoe Group (OGS, 2016). The Simcoe Group is Middle Ordovician in age. The entire overburden profile beneath the Site is estimated to be over 50 m in depth before encountering the bedrock contact.

2.5 Quaternary Geology

The Quaternary Soil Map of Ontario (Barnett *et al.*, 1991) defines the local surficial soils in the vicinity of the Site as coarse-textured glaciofluvial ice deposits consisting of sand, gravel and minor till.

Based on the Site specific soils data discussed further in Section 3.1.1, the depositional environment appears to consist of interbedded or laminated structure consisting of sands and finer grained materials (*i.e.*, silts to clay sediments). Variations were encountered across the Site and attributed to the fluvial / littoral deposition. Very thinly bedded layers predominated the subsurface environment with occasional lacustrine (*i.e.*, lake lain / quiet water) units.

The layering is relatively thin (*i.e.*, ~5 to 10 cm or less) and interdispersed with clayey sand sediments. Our interpretation is that the deposition is reflective of a braided glaciofluvial river setting which is in keeping with that found throughout the City of Barrie area within the Kempenfelt Bay vicinity.

2.6 Hydrogeology

The South Simcoe Municipal Groundwater Study was completed in 2004 and provides information on regional aquifers, ground water quality and quantity risks, and Wellhead Protection Areas (WHPAs) for municipal supplies (Golder, 2004). In general, three interconnected aquifer sequences have been identified within the local overburden, which



are characterized by coarse-grained sediments interbedded with discontinuous layers of finer-grained materials. In the vicinity of Kempenfelt Bay the deepest aquifer sequence tends to be much more coarse-grained than the sediments above. This produces a fairly complicated hydrogeological sequence that can be thought of simplistically as a series of two, and occasionally three, aquifers separated by discontinuous fine-grained layers. The upper two aquifers (A1 & A2) can generally be thought of as a larger aquifer complex in the vicinity of the Phase One Study Area although they may represent more distinct aquifers elsewhere further north and south. Drilling at the Site was completed up to ~20 mbgs, which did not encounter any defined confining unit, which would support the description of the local aquifer units presented by Golder. The lower aquifer complex (A3) is inferred as being confined by the repetitive layering of the fine-grained sediments and the upper aquifer is unconfined. The coarse-grained nature of the aquifer sediments makes them highly permeable and suitable for use as a municipal source of water. The closest municipal wells (Barrie Heritage Wells 11 & 14) are located within this lower aquifer unit approximately 500 m south of the Site. These wells are screened below 177 masl (Golder, 2004) or 57 m below grade at the Site. For reference, the geological cross-sections illustrating the local aquifer units has been provided in Appendix I.

Regional ground water flow direction in the shallow system generally mirrors the local surface drainage and has been identified to flow southwest toward Kempenfelt Bay (Golder, 2004). The ground water flow direction in the upper aquifer unit underlying the Site is considered to be in a south to southwest direction.

The Ontario Ministry of Environment, Conservation, and Parks (MECP) Water Well Records were referenced for any recorded well information within the vicinity of the Site (200 m) (MECP, 2021). The Site is likely to have been previously serviced with water and sewer utilities; however well records can be used to gain subsurface information which can provide insight into shallow geological formation within the area. The well records found in the vicinity of the Site that are pertinent to this assessment are summarized in Table 1 and are shown on Figure 3.

The surrounding wells in the MECP well record were drilled for monitoring, test holes, and industrial use. The wells were drilled to depths between 7.6 and 15.2 m. Not all actual well records were available online, but those that were available for download have been included in Appendix C. The soils identified in these records were primarily sand, which matches the geological literature outlined above, as well as the Site specific soils identified at the Site through the previous drilling program.



Table 1: MECP Water Well Database Summary (200 m radius from Site)

MECP Well Record No.	Distance from Site (m)	Direction from Site	MECP Tag No.	Ground Elevation (masl)	Borehole Depth (mbgs)	Drill Date	Well Type
7213134	175	South	241352782	229.4	10.7	26-Sep-13	Monitoring Well
7186920	175	South	240308213	229.9	12.8	23-Jul-12	Monitoring Well
7157255	130	South	241223348	230.4	12.8	6-Dec-10	Other - Industrial
7277585	70	West	241449479	236.5	7.6	4-Oct-16	Geotech Testhole
7355097	130	West	1006880903	236.4	15.2	7-May-19	Monitoring Well
7186921	175	South	240308251	229.9	10.7	23-Jul-12	Monitoring Well
7358538	140	West	1007534810	236.2	-	9-Mar-20	Unknown
7176638	175	South	241600113	229.7	-	20-Dec-11	Unknown
7358539	130	West	1007535086	236.9	-	9-Mar-20	Unknown
7254305	30	West	240298285	233.6	15.2	6-Nov-15	Monitoring Well
7277586	65	West	241449489	236.3	7.6	4-Oct-16	Geotech Testhole
7265150	150	Southeast	240831675	231.2	12.2	17-May-16	Monitoring Well

3. SOURCE WATER PROTECTION

A review of the Source Water Protection Areas as identified on the MECP Source Protection Information Atlas website indicates the Site is only partially within a Significant Ground Water Recharge Area (SGRA), fully within a Highly Vulnerable Aquifer Area (HVA), Wellhead Protection Area (WHPA-D), WHPA-Q2, an Issues Contributing Area (ICA) for chloride and an Intake Protection Zone (IPZ) 3. As such, a Salt Management Plan will be required to address Source Water Protection requirements.

4. MONITORING

4.1 Previous Site Investigations

There have been previous Site investigations undertaken at the Site in recent years (2016-2022) including a Phase I Environmental Site Assessment (ESA), Phase II ESA and Record of Site Condition (RSC) submission, as well as geotechnical investigations. Through the work completed to support these investigations, Site specific data has been collected including soils information, ground water levels and water quality which are relevant to this hydrogeological assessment. This information is summarized in the sections below.

4.1.1 Site Drilling & Monitoring Well Installations

Drilling programs were undertaken by Azimuth as part of the above-mentioned assessments in November 2015 and June 2016. A series of ground water monitors were constructed throughout the Site as illustrated on Figure 4, with borehole logs included in Appendix C. It is noted that two additional historic wells (MW-N and MW-S) are also present at the Site; however, no records for these wells are available as they predated the Phase I/II ESA work completed by Azimuth. These wells are summarized Table 1 below.



As these drilling programs were to assess potential contamination at the Site, various depths within the shallow aquifer were targeted based on the varying soil stratigraphy encountered. Although the local well records and geological literature indicated primarily granular materials in the area, the results of the drilling programs showed the surficial geology at the Site consisted of discontinuous geologic layers of silts, sands, and clays at layers of thickness ranging between 1.5 m and 3.8 m of differing stratigraphic packages of soil.

Table 2: Site Monitoring Well Construction Details

Well ID	Ground Elevation (masl)	Well Depth (mbgs)
MW-N*	235.07	7.10
MW-S*	234.40	11.16
MW-1	234.02	13.76
MW-2	235.11	11.20
MW-3	234.93	11.55
MW-4	234.97	8.71
MW-4a	234.90	12.62
MW-A1	234.45	15.26
MW-A2	234.41	11.18
MW-B1	234.29	14.96
MW-B2	234.31	10.79
MW-C1	234.33	15.65
MW-C2	234.36	12.76
BH-101	233.66	8.54
BH-102	234.03	8.75

Notes: mbgs - metres below ground surface
 masl - metres above mean sea level
 * - historic, no available BH log

These interbedded layers are found at most boreholes throughout the Site. The soil profile in general is poorly sorted interbedded layers which range from medium to dark brown medium to coarse grained sand to grey and/or mottled dense to very dense clay to fine to medium sand with silt to sandy silt to silty sand to silt and clay. Despite this stratification, the dominant material is sand as illustrated in the geological cross-sections for the Site (Figures 5 & 6). Much of the stratification was not found to be continuous across the Site such that the screened intervals are considered representative of water table conditions at the Site. This was supported by the fact that the ground water elevations were also found to be relatively consistent across the Site.

Subsequent geotechnical investigations were completed by the Azure Group in 2021 and 2022 which included the completion of additional boreholes in 2021 as well as monitoring well installations in 2022. Data from these programs has been included as part



of this assessment and summarized in the following table with borehole logs included in Appendix C & H.

4.2 Ground Water Level Monitoring

Ground water elevation data was recorded at the Site in June and September of 2016, March of 2017, March to June of 2021, and April to June of 2022. The complete data set is provided in Appendix H.

The ground water data collected at the Site over the period of monitoring indicates ground water elevations generally range between 226 and 230 masl, although as noted below, MW-N indicates isolated elevations at approximately 233 masl. The nested ground water monitoring location at MW-N and MW-2 reveals a perched ground water condition at MW-N. The water elevation at MW-N was consistently higher than MW-2 by a few metres. MW-2 being deeper in the soil profile reflects the conductive seam occurring at about 11 mbgs (*i.e.*, MW-S monitoring depth). It is assumed that the near-surface finer-grained sediments evident in the northwest corner have contributed to this perched condition. Thus, this localized perched condition at MW-N is discounted when evaluating the water table condition present elsewhere at the Site.

It is noted that the 2021 and 2022 monitoring period targeted the spring high water table period to assist in determining the high water table conditions at the Site. The max ground water elevation measured for the Site in Spring of 2021 was 229.0 masl and the max ground water elevation measured for the Site in Spring of 2022 was 229.25 masl. However, the highest condition was measured in March of 2017 which is shown on Figure 4. The seasonally high water table at the Site was previously designated as 229.2 masl which represents the seasonal high Spring 2021 and 2022. However, the March 2017 data indicates that there is the potential for elevated seasonal conditions above the previously noted 229.2 masl elevation.

The water table at each monitoring location displayed a seasonal variation. This is evident by comparing the water level measurements from September of 2016 to the elevated condition in March of 2017. The average variation was 1.7m, with a noted range across the Site between 0.3m and 2.5m.

Slight downward gradients are observed in the nested locations to the south and west portions of the Site, with an isolated reversal at MW-A1/2 in March 2017. Small upward gradients were noted at MW-4/4A on the two occasions they were measured together in 2016 and 2017. These gradients are likely the result of the interbedded deposition as noted above, but the gradients are relatively small based on the lack of defined confining layer in the profile.



4.3 Hydraulic Conductivity Testing

In order to understand the hydraulic characteristics of the underlying overburden, transient hydraulic tests were performed on the Site monitoring wells following the November 2015 drilling program. The transient test involves the instantaneous injection or withdrawal of a volume or slug of water or solid cylinder of known volume. This is accomplished by adding or displacing a known volume to/from a well and measuring water level response time to return to equilibrium. Water level measurements were recorded both manually and with automatic dataloggers, which were programmed to record the pressure of water above the data logger every 3 seconds. Data was analyzed using the Hvorslev Method (1951), which assumes a homogeneous, isotropic medium in which soil and water are incompressible. Hydraulic testing results are summarized in Table 3 (below).

Table 3: Hydraulic Testing Results

Monitoring Well	Hydraulic Conductivity (m/s)	Transmissivity (m ² /s)	Soil Description
MW-1*	1×10^{-2} to 1×10^{-4}	2×10^{-5} to 2×10^{-7}	15 cm gravel seam
MW-2	3×10^{-6}	8×10^{-6}	interbedded sand
MW-3	4×10^{-6}	8×10^{-6}	interbedded sand
MW-4	7×10^{-6}	2×10^{-5}	interbedded sand
MW-4a	4×10^{-5}	3×10^{-5}	interbedded sand
MW-S**	8×10^{-7}	2×10^{-6}	interbedded sand

Notes: Values rounded off for presentation purposes

* - It is likely that the bulk lateral hydraulic conductivity at MW-1 is at least 1×10^{-3} m/s

** - It is assumed that MW-S has a 2.9 m well screen which fully contributes to the ground water flow at this location.

The soil transmissivity for all sampling locations is roughly similar, barring MW-S which is slightly less transmissive. The differences in bulk lateral hydraulic conductivity results illustrate the variations in the bulk contributing zone used in each of the analyses. For example, a 0.15 m sand and gravel seam was used for MW-1 whereas larger intervals up to ~4 m were estimated for some of the other monitors. It is speculated that potentially all of the monitoring wells are intersecting a conductive zone with a limited thickness; but which will convey the ground water laterally through the soil profile.

4.4 Water Quality

Water quality samples have been collected across the Site part of the previous Site investigations, including the Phase II ESA (Azimuth, 2016). Sample analysis includes general inorganics, trace metals, volatile organic compounds (VOC) and petroleum hydrocarbons (PHC). The results of the laboratory ground water quality analyses are summarized in Appendix F, while the following discussion is a summary of that provided in the Phase II ESA.



The PHC analytical results for the ground water samples indicate that through three sampling events, toluene and PHC F₃ detections were detected for the initial sampling event in monitoring well MW-S; but absent from all other sampling events. All monitoring wells barring MW-N had detected concentrations of toluene in the November 2015 and June 2016 sampling events. Monitoring wells MW-3 and MW-4 also noted detectable concentrations of ethylbenzene. Total xylenes were noted in monitoring well MW-3. All measureable concentrations of the above noted detections were below Table 2 SCS.

Monitoring well MW-S had a measurable concentration of *cis*-1,2-DCE, TCE and PCE above the O.Reg. 153/04 Table 2 *Site Condition Standards* (SCS) through all three sampling events. Hexane was also detected in the first sampling event, yet this was below the applicable standards. Monitoring well MW-1 had measureable concentrations of *cis*-1,2-DCE, TCE, PCE, and hexane below Table 2 SCS. Monitoring well MW-A1 had no measureable detections of the PCE and daughter products found in MW-S; yet acetone was detected below the applicable SCS. Ground water well MW-A2 had reported concentrations of *cis*-1,2-DCE and TCE, yet these were below Table 2 SCS. Monitoring well MW-B1 had reported detections of acetone below the SCS. Ground water well MW-C1 had no reportable VOC detections. Other parameters were detected at isolated locations below Table 2 SCS.

The inorganic and trace metals analytical results (Table 7, Appendix F) show that the concentrations of the various parameters were all below the Table 2 SCS at the two (MW-N & MW-S) measured monitoring wells except for road salt parameters at MW-N. The lands have been vacant for years and it is assumed the concentrations are attributable to salt spray from the adjacent roadway and therefore exempt under O. Reg 153/04 s.48(3).

Elevated nitrate concentrations are also found at MW-N (8.51 mg/L); however, this localized elevation is likely the result of a leaking sewer main along Sophia Street as this well is located immediately adjacent to the road.

As a result of the residual contaminants present at the Site as described above and in the previous Phase II ESA, these contaminants have been delineated as required by the MECP for the Record of Site Conditions process. The MECP has a rigorous vetting process to gain acceptance of a proposed Brownfield redevelopment proposal. This process culminates in the issuance of an RSC acknowledgement. It is acknowledged by the Province that the property redevelopment as described in the RSC application would



not endanger the natural environment or those using the property in the manner present in the RSC application.

Conditions of the redevelopment of the property are included in the issued Certificate of Property Use (CPU) which is registered on title. The CPU is a legal document issued by the MECP which outlines how this Site is to be developed for the intended residential building. In the CPU are a myriad of conditions that must be met as the development is constructed and how the completed development is to be monitored and maintained to safeguard the environment. Specific issues within the CPU related to the Hydrogeological Assessment are for the use of ground water as noted below.

4.12 No ground water use Risk Management Measure:

- a) Refrain from using ground water in or under the Property as a source of water; and*
- b) Properly abandon any wells on the Property, as defined in section 35. (1) of O. Reg. 153/04, according to R.R.O. 1990, Regulation 903 (Wells) made under the Ontario Water Resources Act, R.S.O. 1990, c. O.40; and*
- c) Refrain from constructing on the Property any wells as defined in section 35. (1) of O. Reg. 153/04.*

The Site will be municipally serviced and therefore ground water use at the Site is not anticipated for potable water.

As noted in item b and c of the CPU above, all existing monitoring wells shall be properly abandoned according to O.Reg. 903 prior to any construction being initiated.

5. WATER BALANCE

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.



Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Barrie (Station 6110557), Ontario between 1974 and 2019. The calculations are based on the average conditions during this period; the average precipitation was 909 mm, rainfall was 655 mm, evapotranspiration was 430 mm and the surplus was 479 mm.

5.1 Land Use

5.1.1 Pre-Development

The pre-development Site area was classified according to land use/vegetation type. Approximate pre-development land use classification areas are provided in Table 4.

Table 4: Pre-Development Area Classification

Land Use	Land Area (m ²)
Impervious (rooftop / concrete / asphalt / gravel surfaces)*	575
Pervious (landscaped / undeveloped)	2,433
TOTAL	3,008

* - based on aerial photographs, a gravel laneway is present in the centre of Site and small impervious area at southeast corner of Site

Land within the pre-development scenario is considered 20% impervious. Gravel surfaces are considered impervious for the purpose of this assessment. The pre-development areas are shown on Figure 2.

5.1.2 Post-Development

The land classification in the post-development scenario was classified based on the Site Development Plans (Appendix B). Post-development land use classification areas are provided in Table 5:

Table 5: Post-Development Area Classification

Land Use	Land Area (m ²)
Impervious (building / driveway / walkway)	2500
Pervious (landscaped)	508
TOTAL	3,008

Land within the post-development scenario is considered 83% impervious. The post-development areas are illustrated in Appendix B.

5.2 Infiltration

Infiltration is generated one of two ways: (1) directly from rainfall impact or snowmelt on pervious surfaces; and (2) indirectly when runoff from impervious surfaces is diverted into adjacent naturalized areas.



Infiltration factors for the Site were estimated based on the underlying soil, local topography, and ground cover as per Table 2 of the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995).

The soil variable factor was determined by taking into account information obtained from the regional geologic mapping and the field work programs completed for the Site. This information suggests that the surficial material at the Site is primarily composed of a silty sand till. The infiltration factors utilized in the water balance assessment are summarized in Table 6 below.

Table 6: Summary of Pervious Land Infiltration Factor

Scenario	Land Use	Infiltration Factor	Assumption
Pre-Development	Vacant	0.65	Flat Land (0.25), sand / silty sand (0.3), landscaped grass (0.10)
Post-Development	Residential	0.65	Flat Land (0.25), sand / silty sand (0.3), landscaped grass (0.10)

5.2.1 Pre-Development Infiltration

Pre-development direct infiltration was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The pre-development annual infiltration is therefore 680 m³/year (Appendix D).

5.2.2 Post-Development Infiltration

Post-development infiltration (without mitigation) was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The post-development annual direct infiltration is therefore 142 m³/year. There is therefore a decrease in infiltration of 538 m³/year from pre- to post-development without mitigation measures employed.

5.3 Water Balance Summary

Using the climate model data and calculations mentioned above, the water balance was completed for pre-development and post-development without mitigation (Appendix D). A post-development with mitigation scenario was not included as LIDs are not part of the stormwater plan.

The pre-development infiltration volume is 680 m³/year. This assumes the Site is composed of the existing driveways, walkways, car parking, previous commercial building pad and landscaped areas. The post-development without mitigation infiltration



volume is 142 m³/year, which is a deficit of 538 m³/year. This is based on the proposed development as described in Section 1.0 of this report and illustrated in Appendix B (Site Development Plans).

LIDs are not proposed for the Site due to its compact nature and limited size. The remaining land surrounding the structure contains the driveway, pedestrian walkways, the loading zone, or the ramp to access the parking structure. The majority of the landscaped area is contained within a thin strip of land around the periphery of the structure which may not be feasible for LID design.

The overall water balance deficit is considered minor and there are no adjacent wetlands / natural features or private wells. The closest municipal wells (Barrie Heritage Wells 11 & 14) are located approximately 500 m south of the Site. These wells are screened below 177 masl (Golder, 2004) or 57 m below grade at the Site. As such, the small infiltration loss and the vertical separation resulting from the silty clay unit underlying the upper aquifer, limit the development's ability to create a quantitative influence on the municipal wells.

6. DEWATERING ASSESSMENT

The proposed development will include the construction of a 26-storey mixed use residential building. Since the previous submission in December of 2023, the Site Plan has been revised to remove the requirement for significant below ground parking. The parking is now proposed to be located within floors 2 to 5 which would represent a podium style parking facility. The proposed infrastructure depths for the revised Site Plan were obtained from the below documentation:

- Studio JCI. Architectural Drawing List. Proposed Mixed Use Building. 17 Sophia Street East, Barrie, ON. Dated June 2024;
- Gerrits Engineering. Site Servicing Plan. 17 Sophia Street. Dated June 2024.

The deepest portion of the proposed stormwater/sanitary services is found at an elevation of 230.77 masl which represents the sanitary manhole within Clapperton Street. This elevation is above the anticipated seasonal high ground water table. Construction dewatering is therefore not anticipated to be required to maintain dry working conditions during sanitary / stormwater service construction.

The below elevation depths are noted for the proposed development:

Base of P1 slab:	231.40 masl
Base of P1 raft foundation:	229.40 masl



Base of elevator shaft:	229.35 masl
Base of raft foundation in vicinity of elevator shaft:	227.75 masl

Based on the ground water data reviewed in Section 4.2 there is potential for the seasonally high ground water table to overlap with the base of P1 raft foundation, the base of the elevator shaft, and the base of the raft foundation in the vicinity of the elevator shaft. This overlap is expected to potentially occur seasonally, although more recent (2021 / 2022) data indicated the 2017 spring highs may not be reflective of annual conditions.

Due to the seasonal variation in the water table, foundation construction should be completed during the dry summer months when the water table is lowest to reduce the need for construction stage dewatering. However, ground water lowering may be required to maintain dry working conditions if foundation construction is to occur over the spring period. As such, confirmation of ground water elevations ahead of construction should be completed if the monitoring wells are still present.

Due to the potential for overlap with the seasonal high ground water table, the elevator shaft should be waterproofed to prevent the possibility of water seepage through the foundation wall. Similarly, the requirement for waterproofing of the raft foundation should be confirmed by the geotechnical consultant and/or structural engineer to ensure the stability and functionality of the foundation design.

In the event that water proofing material is added to the foundation the material has been indicated to be PRECON/MEL-ROL by W.R. Meadows or equivalent, which is designed for water proofing of foundations. There would be limited potential for leaching of contaminants from any waterproofing material into the ground water system.

Due to the size of the open excavation significant rainfall events may need to be pumped out of the excavation area. This water would be composed entirely of accumulated rainfall and would not integrate with the underlying ground water. Based on the excavation size (960 m²), a 25mm event would generate approximately 25 m³ (25,000 L) of water, while a portion of this would be expected to infiltrate following the rainfall event.

Any construction dewatering between 50,000 L/day and 400,000 L/day can be completed after registration under the Environmental Activity and Sector Registry (EASR). Any active construction dewatering above 400,000 L/day requires a Permit To Take Water (PTTW). The above water generated through rainfall accumulation within the building



footprint would therefore not meet the threshold for either a PTTW or an EASR. However, a City of Barrie Discharge Permit may still be required.

If any changes are made to the proposed site plan, foundation design, or sanitary/stormwater servicing, the current dewatering analysis should be updated to confirm the above assessment.

7. SUMMARY AND CONCLUSIONS

Azimuth was retained by the Black Creek Group to conduct a Hydrogeological Assessment for the property located at 17 Sophia Street East and 3, 5, 7, 11 Macdonald Street and 58 & 60 Clapperton Street, Barrie, ON. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental / hydrogeological conditions. The report also addresses City of Barrie, LSRCA and Source Water Protection policy requirements.

The Site is generally rectangular in shape and is approximately 0.3 hectares (ha) in size. It is located on the south side of Sophia and Macdonald Streets. Currently, the only buildings at the Site are two small residential / commercial structures fronting Clapperton Street. The remainder of the Site has been cleared; however a small impervious area is present along the southeast corner of the Site, as well as a gravel laneway from Sophia Street into the Centre of the Site. It is also understood that the former building foundations from the residential lots fronting Sophia Street are still present below grade; however, have been filled in to ground surface. The status / integrity of these structures are not known. The Site is to be redeveloped as a 26-storey mixed use residential building including one below ground storage level.

The Site is found at an elevation between 234 and 235 masl, with a slight southern slope. The existing Site drains south via overland flow towards Kempenfelt Bay. Site soils are composed of mostly granular material, although the presence of finer grained materials (*i.e.* silt and clay) is present in surficial areas of the Site as well as with vertical stratification with depth.

The inferred groundwater table in the vicinity of the Site is 226 – 230 masl varying both seasonally and spatially, creating a southwest flow path towards Kempenfelt Bay. Hydraulic conductivity testing was completed at a number of the Site monitoring wells indicating the hydraulic conductivity of the deposits varies across the Site, owing to the differing soil types ranging between 2×10^{-7} to 1×10^{-3} m/s.



A water balance assessment was completed for the Site. The pre-development infiltration volume is 680 m³/year. The post-development without mitigation infiltration volume is 142 m³/year, which is a deficit of 538 m³/year. LIDs are not proposed for the Site due to its compact nature and limited size. This deficit will therefore be mitigated through compensation under the Water Balance Offsetting Policy.

The overall deficit is considered small and there are no adjacent wetlands / natural features or private wells. The closest municipal wells (Barrie Heritage Wells 11 & 14) are located approximately 500 m south of the Site. These wells are screened below 177 masl (Golder, 2004) or 57 m below grade at the Site. As such, the small infiltration loss and the vertical separation resulting from the silty clay unit underlying the upper aquifer, limit the development's ability to create a quantitative influence on the municipal wells.

Based on the ground water data reviewed in Section 4.2 there is potential for the seasonally high ground water table to overlap with the base of P1 raft foundation, the base of the elevator shaft, and the base of the raft foundation in the vicinity of the elevator shaft. This overlap is expected to potentially occur seasonally, although more recent (2021 / 2022) data indicated the 2017 spring highs may not be reflective of annual conditions. As such, confirmation of ground water elevations ahead of construction should be completed if the monitoring wells are still present.

Due to the seasonal variation in the water table, foundation construction should be completed in dry summer months when the water table is lowest to reduce the need for construction stage dewatering. Ground water lowering may be required to maintain dry working conditions if foundation construction is to occur over the spring period.

Due to the potential for overlap with the seasonal high ground water table, the elevator shaft should be waterproofed to prevent the possibility of water seepage through the foundation wall. Similarly, the requirement for waterproofing the raft foundation should be confirmed by the geotechnical consultant and/or structural engineer to ensure the stability and functionality of the foundation design.

All existing monitoring wells which are no longer utilized at the Site will need to be properly decommissioned as per O.Reg. 903 (Wells Regulation) prior to commencement of building construction.



8. REFERENCES

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Phase One Environmental Site Assessment – 17 Sophia Street East, Barrie, ON
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- Azimuth Environmental Consulting, Inc., 2017 (Azimuth, 2017)
Phase Two Conceptual Site Model
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- Ontario Geological Survey (OGS), 2020.
OGS Earth Mapping. Obtained from: <https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth>
- Ontario Ministry of the Environment and Climate Change (MOECC), 1995.
MOEE Hydrogeological Technical Information Requirements for Land
Development Applications.



Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). 2010.
Low Impact Development Stormwater Management Planning And Design Guide.
Version 1.



APPENDICES

- Appendix A: Figures**
 - Appendix B: Proposed Development Plan**
 - Appendix C: MECP Well Records & Site Borehole Logs**
 - Appendix D: Water Balance Summary Tables**
 - Appendix E: Hydraulic Conductivity Testing**
 - Appendix F: Water Quality Data**
 - Appendix G: Ground Water Elevation Data**
 - Appendix H: Ground Water Study Figures**
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APPENDIX A

Figures



LEGEND

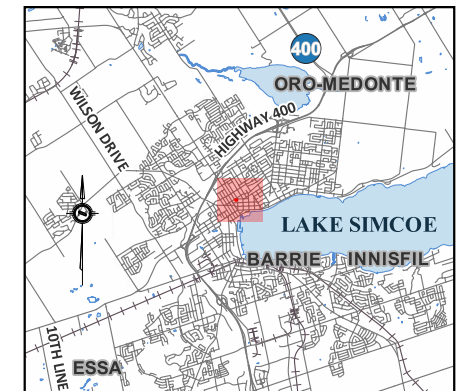
- Approx. Property Boundary
- Waterbody
- Mapped Watercourse
- Wooded Area
- Road
- Highway

NOTES

1. Watercourse, Waterbody, Wetland, Woodland and ANSI layers are derived from MNRF GIS data, retrieved December 2022.

REGIONAL MAP

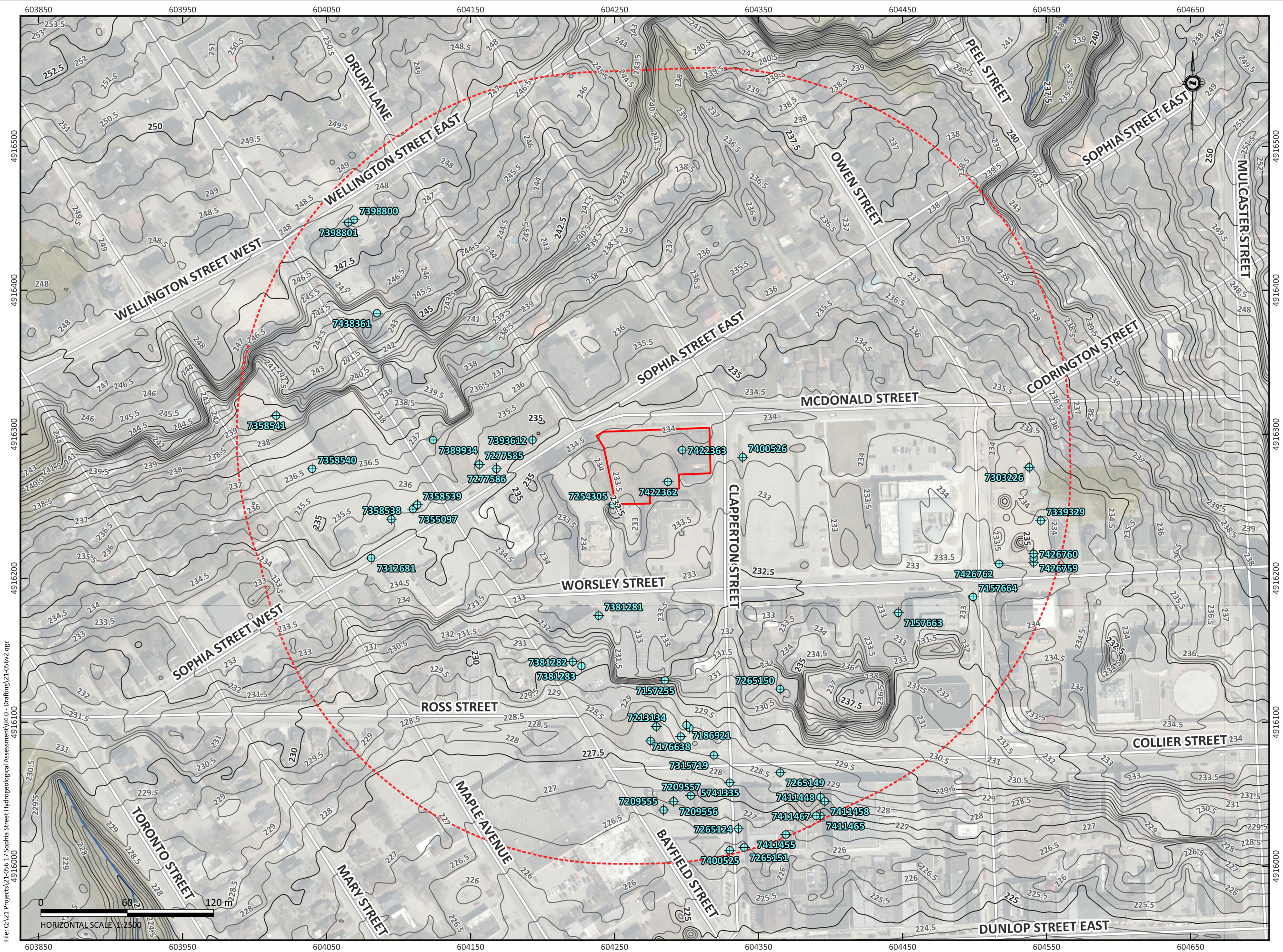
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SITE LOCATION MAP

MCDONALD ST. & SOPHIA ST.
BARRIE, ON

DATE ISSUED:	JUNE 2024	Figure No. 1
CREATED BY:	A.L.	
PROJECT NO.:	21-056	
BASE MAP:	MNRF	



LEGEND

- Approx. Property Boundary
- 250m Radius Phase I Study Area
- Mapped Watercourse
- Road

Contours (OMAFRA Lidar 2022)

- Major Contour - 2.5m Intervals
- Minor Contour - 0.5m Intervals
- MECP Water Well Location

LOCATION MAP SCALE 1:26800

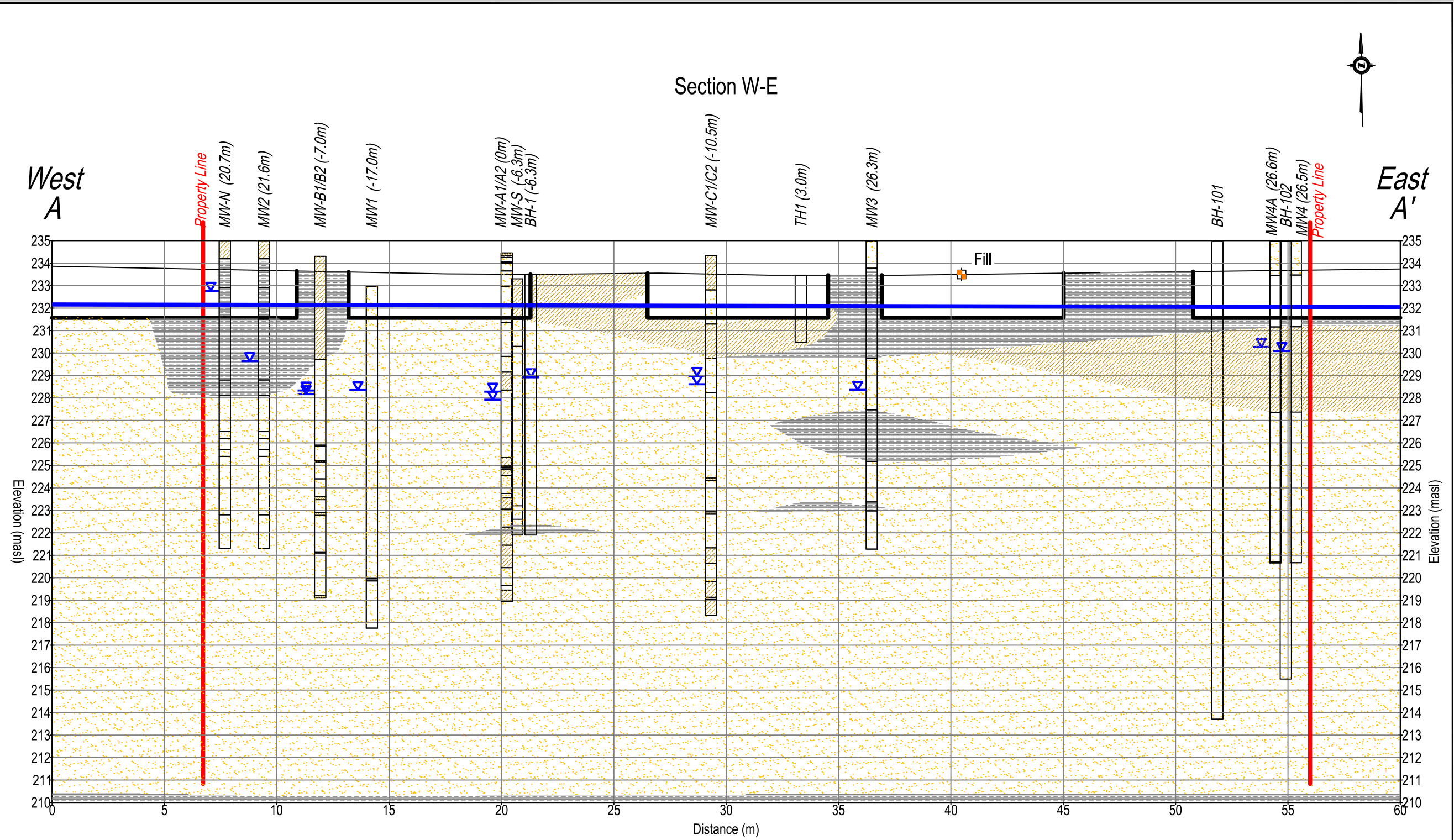
ENVIRONMENTAL ASSESSMENTS & APPROVALS

SURROUNDING WELL RECORDS

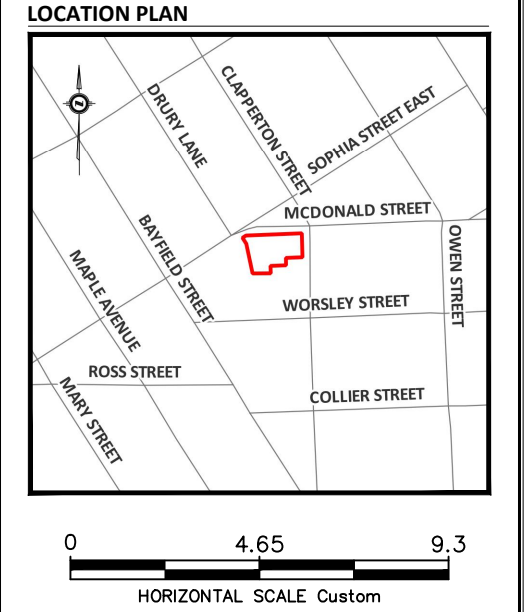
MCDONALD ST. & SOPHIA ST. BARRIE, ON

DATE ISSUED:	JUNE 2024	Figure No. 3
CREATED BY:	A.L.	
PROJECT NO.:	21-056	
BASE MAP:	SIMCOE COUNTY	

Plotted by: ALJ on June 7, 2024 at 2:35pm
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- LEGEND:
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 - SAND/SANDY SILT/SAND AND GRAVEL
 - CLAY/CLAYEY SAND/CLAY AND SILT/CLAY AND SAND
 - GROUND WATER ELEVATION (MARCH 21, 2017)
 - SCREEN LENGTH



AZIMUTH ENVIRONMENTAL CONSULTING, INC.

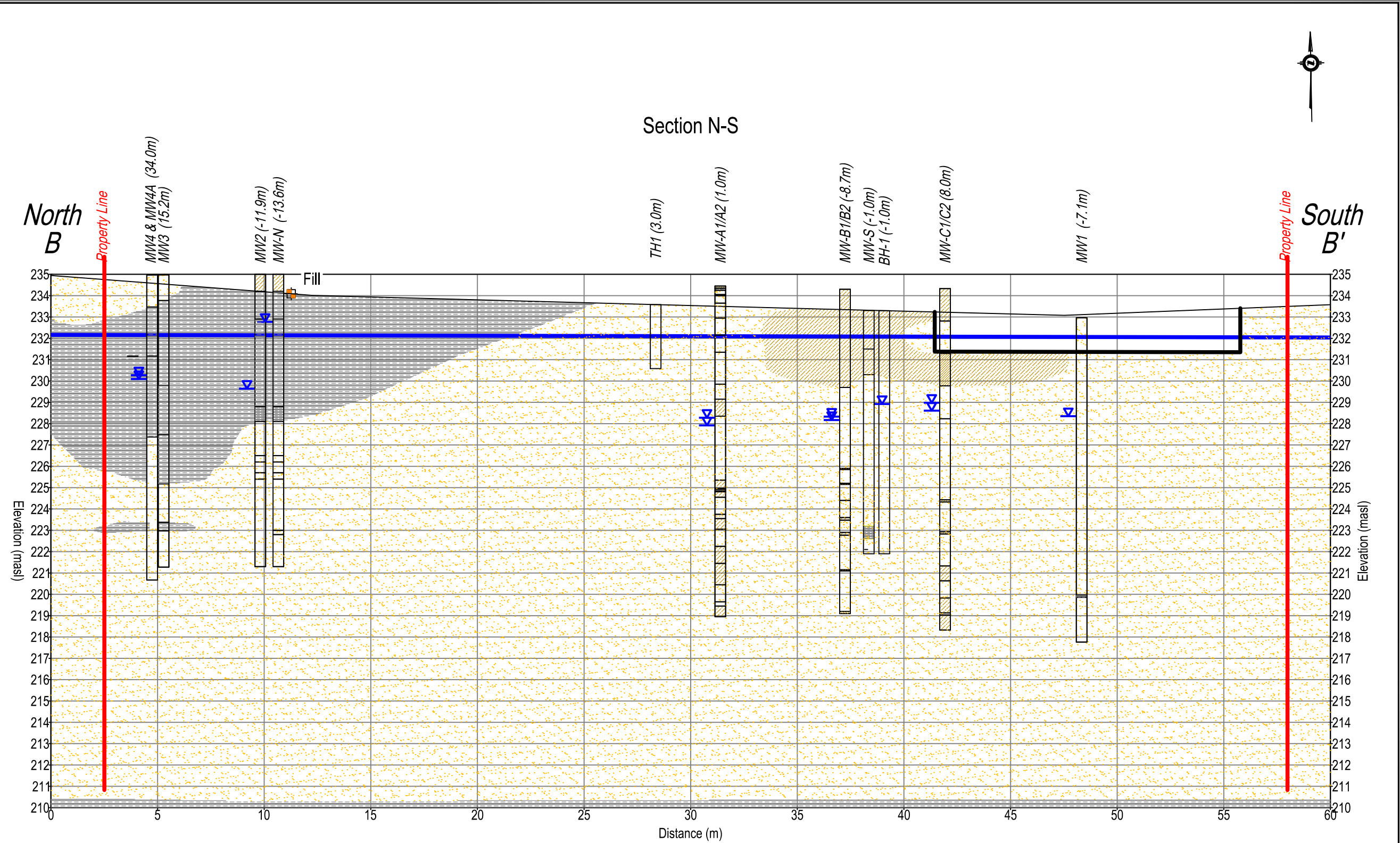
GEOLOGICAL CROSS-SECTION A-A'

MCDONALD ST. & SOPHIA ST.
BARRIE, ON

DATE ISSUED:	JUNE 2024	Figure No.
CREATED BY:	A.L.	5
PROJECT NO.:	21-056	
REFERENCE:	---	

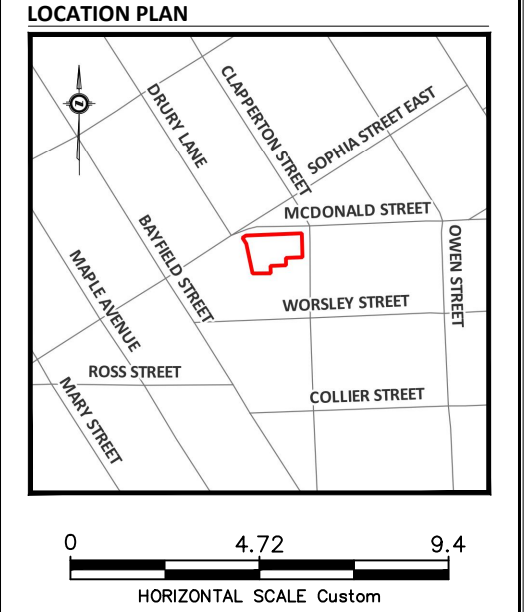
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Plotted by: ALU on June 7, 2024 at 2:35pm
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LEGEND:

- SILT/SILTY SAND/SILT AND SAND/SILT AND CLAY
- SAND/SANDY SILT/SAND AND GRAVEL
- CLAY/CLAYEY SAND/CLAY AND SILT/CLAY AND SAND
- GROUND WATER ELEVATION (MARCH 21, 2017)
- SCREEN LENGTH



AZIMUTH ENVIRONMENTAL CONSULTING, INC.

GEOLOGICAL CROSS-SECTION B-B'

**MCDONALD ST. & SOPHIA ST.
BARRIE, ON**

DATE ISSUED:	JUNE 2024	Figure No. 6
CREATED BY:	A.L.	
PROJECT NO.:	21-056	
REFERENCE:	---	

DAYSTAMP:



APPENDIX B

Proposed Development Plan



APPENDIX C

MECP Well Records & Site Borehole Logs

BOREHOLE LOG

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 3, 2015
Borehole Number	MW-1	Contractor	Walker Drilling	Elevation	234.0
Equipment	D-50 Track Mount Drill	Total depth	15.2 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	0.8	TOPSOIL, sandy, brown, pebbles, moist		0 - 0.76		5 7 7 5	
0.76	10.4	Sand, trace silt, brown/black/grey, copper mottles, moist Some silt/clay from 6.2 m to 6.9 m Rocky at 9.1 m	1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 9.1 - 9.9 1L	0.76 - 1.5 1.5 - 2.3 2.3 - 3.0 3.0 - 3.8 3.8 - 4.6 4.6 - 5.3 5.3 - 6.1 6.1 - 6.9 6.9 - 7.6 7.6 - 8.4 8.4 - 9.1 9.1 - 9.9 9.9 - 10.4	0 10 0 0 0 0 0 0 0 0 0 NS 0	2 4 5 7 1 2 4 4 2 2 3 4 3 5 7 9 7 10 14 25 8 12 21 29 14 20 24 50 13 17 23 42 20 26 +50 25 43 47 +50 18 31 +50 32 50 21 36 50	
10.4	13.0	Sand, clayey, moist-wet, massive, grey Medium sand and gravel at 11.9 m	1L 1M 1N 1O	10.4 - 10.7 10.7 - 11.4 11.4 - 12.2 12.2 - 13.0	0 75 0 15	21 36 50 22 34 50 11 35 +50 30 43 +50	MW-1-1 H ₂ O flow MW-1-2
13.0	13.1	Clay, grey, moist	1P	13.0 - 13.1	65	17 32 50	
13.1	15.2	Sand, grey, saturated	1P 1Q 1R	13.1 - 13.7 13.7 - 14.5 14.5 - 15.2	65 25 5	17 32 50 21 49 +50 21 46 +50	

Borehole terminated at 15.2m

<i>Comments</i>	<i>Water Conditions</i>	
Well Completion Details screen length 3 m (10.7 to 13.8 m bgl) 0.15 m sand seam @ 11.9 yielded water (flow)	☒ Wet upon completion ☐ Dry upon completion	

JOB No.
Borehole No.
FIELD STAFF

15-249
MW-1
Jenn Thompson

Environmental Assessments & Approvals

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 4, 2015
Borehole Number	MW-2	Contractor	Walker Drilling	Elevation	235.11
Equipment	D-50 Track Mount Drill	Total depth	13.7 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	0.8	TOPSOIL dark brown silty sand, loose, dry		0 - 0.76			
0.76	2.1	CLAY brown sandy clay, copper mottling, massive, moist	2A	0.76 - 1.5 1.5 - 2.1	15	1 2 2 4	
2.1	5.0	SAND Brown clayey sand, copper mottling, rounded pebbles, stiff, dry	2A 2B 2C	2.1 - 2.3 2.3 - 3.0 3.0 - 3.8 3.8 - 4.6 4.6 - 5.0	15 0 0	1 2 2 4 9 11 22 36 8 21	
5.0	5.3	SAND medium sand, massive, saturated	2D	5.0 - 5.3	5	28 42	
5.3	6.2	SAND Brown clayey sand, copper mottling, rounded pebbles, stiff, dry	2E	5.3 - 6.1 6.1 - 6.2	0	17	
6.2	6.9	CLAY Grey clay, blocky, stiff, dry	2E 2F	6.2 - 6.9 6.9 - 6.9	0 0	17 +50 10	
6.9	8.5	SAND Brown clayey sand, rounded pebbles, massive to platy, moist	2F 2G 2H	6.9 - 7.6 7.6 - 8.4 8.4 - 8.5	0 0 100	29 50 41 +50 28	
8.5	8.8	CLAY Grey clay, blocky, copper mottling	2I	8.5 - 8.8	0	42 +50	
8.8	9.3	SAND Brown sand, saturated	2I 2J	8.8 - 9.1 9.1 - 9.3	0 0	42 +50 27	
9.3	9.6	CLAY Grey clay, blocky, mottled, dry	2J	9.3 - 9.6	0	+50	
9.6	12.0	SAND Brown sand, gravel seam 11.2 to 11.4, loose, saturated	2K 2L 2M	9.6 - 9.9 9.9 - 10.7 10.7 - 11.4 11.4 - 12.0	50 55 65 15	32 +50 14 28 +50	MW-2-1 MW-2-2
12.0	12.2	CLAY Grey sandy clay, massive	2M	12.0 - 12.2	15		MW-2-2
12.2	13.7	SAND Brown sand & gravel, no structure, saturated	2N 2O	12.2 - 13.0 13.0 - 13.7	0 0	15 37 +50 20 39 +50	MW-2-3

Borehole terminated at 13.7 m

Comments	Water Conditions	
Well Completion Details screen length 1.5 m (10.7 to 12.2 m bgl) Borehole adjacent to MW-N	☒ Wet upon completion ☐ Dry upon completion	

JOB No.	15-249
Borehole No.	MW-2
FIELD STAFF	Jenn Thompson

Environmental Assessments & Approvals

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 5, 2015
Borehole Number	MW-3	Contractor	Walker Drilling	Elevation	234.93
Equipment	D-50 Track Mount Drill	Total depth	13.7 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	1.2	FILL Brown sand w rocks, brick, concrete, dry	3A	0 - 0.8 0.8 - 1.2	0	2 2 2 3	
1.2	5.2	CLAYEY SAND Brown clayey sand, interbedded layers, grey clay is blocky, moist to wet	3A 3B 3C	1.2 - 1.5 1.5 - 2.3 2.3 - 3.0 3.0 - 3.8 3.8 - 4.6 4.6 - 5.2	0 0 0	1 1 2 4 1 3 4 10	
5.2	7.5	SAND Brown medium sand, pebbles, trace clay, no structure, moist	3E 3F 3G	5.2 - 5.3 5.3 - 6.1 6.1 - 6.9 6.9 - 7.5	0 5 5	15 26 33 47 16 22 41 49	
7.5	9.8	CLAYEY SAND Brown clayey sand, interbedded layers, grey clay is blocky to platey, mottled, moist to saturated	3G 3H 3I 3K	7.5 - 7.6 7.6 - 8.4 8.4 - 9.1 9.1 - 9.8	35 25 30	21 39 +50 21 30 +50 24 37 48 +50	MW-3-1
9.8	11.6	SAND Brown sand, some gravel, occasion pebble, flowing, saturated	3K 3L 3M 3N	9.8 - 9.9 9.9 - 10.7 10.7 - 11.4 11.4 - 11.6	30 25 40	14 23 42 +50 40 +50 28 42	MW-3-2 MW-3-3 MW-3-4
11.6	12.0	CLAY Grey sandy clay, blocky to platey, wet	3N	11.6 - 12.0		+50	
12.0	13.7	SAND Brown medium sand, saturated	3N 3O	12.0 - 12.2 12.2 - 13.0 13.0 - 13.7	30 0	26 43 +50	MW-3-5

Borehole terminated at 13.7 m

<i>Comments</i>	<i>Water Conditions</i>	
Well Completion Details screen length 3 m (9.14 to 12.19 m bgl)	☒ Wet upon completion ☐ Dry upon completion	

JOB No.
Borehole No.
FIELD STAFF

15-249
MW-3
Jenn Thompson

BOREHOLE LOG

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 6, 2015
Borehole Number	MW-4	Contractor	Walker Drilling	Elevation	234.9
Equipment	D-50 Track Mount Drill	Total depth	14.3 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	1.5	TOPSOIL Black to brown sand, organics, rootlets	4A	0 - 0.8 0.8 - 1.5	5	1 1 2 2	
1.5	3.8	CLAYEY SAND to SAND & CLAY Brown to grey sand with varying clay content up to 50%, mottled, massive, wet	4B	1.5 - 2.3 2.3 - 3.0 3.0 - 3.8	5	1 1 1 2	
3.8	7.6	SAND to SILTY SAND Grey to brown, medium to fine sand to silty sand, occasional gravel, poorly sorted, loose, dry to moist	4C 4D 4E	3.8 - 4.6 4.6 - 5.3 4.6 - 6.1 6.1 - 6.9 6.9 - 7.6	5 5 30	10 18 22 30 15 20 29 42 23 40 +50	
7.6	10.7	SANDY SILT TILL Grey to brown medium to fine sand with silt to silt with fine sand, transitions to siltier content with depth, trace gravel, mottled, dense, moist to wet Brown clayey sand, interbedded layers, grey clay is	4F 4G 4H	7.6 - 8.4 8.4 - 9.1 9.1 - 9.9 9.9 - 10.7	190 110 130	34 45 +50 26 +50 30 46 +50	MW-4-1
10.7	14.3	SANDY SILT Grey very fine sand and silt, trace gravel, trace clay, laminated, mottled, dense, wet	4I 4J 4K 4L 4M	10.7 - 11.4 11.4 - 12.2 12.2 - 13.0 13.0 - 13.7 13.7 - 14.3	75 130 260 250 90	36 +50 23 45 +50 34 +50 21 44 +50 35 +50	MW-4-2 MW-4-3 MW-4-4

Borehole terminated at 14.3 m

<i>Comments</i>	<i>Water Conditions</i>	
Well Completion Details screen length 3 m (11.28 to 14.33 m bgl) screen length 1.5 m (7.6 to 9.1 m bgl)	☒ Wet upon completion ☐ Dry upon completion	

JOB No.
Borehole No.
FIELD STAFF

15-249
MW-4
Jenn Thompson

Environmental Assessments & Approvals

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 4, 2015
Borehole Number	BH-1	Contractor	Walker Drilling	Elevation	233.3
Equipment	D-50 Track Mount Drill	Total depth	14.3 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	1.8	SILTY SAND Black to grey, copper mottled, loose, dry		0 - 1.5 1.5 - 1.8	0	2 2 4 5	
1.8	3.0	CLAY Grey clay, copper mottled, moist	A	1.8 - 2.3			
2.3	10.1	SAND Brown sand, tace silt, occasional rounded pebble, loose, moist	B	2.3 - 3.0	15	3 3 4 5	BH-1
			C	4.6 - 5.3	15	11 16 21 27	
			D	6.1 - 6.9	5	14 26 +50	
			E	6.9 - 7.6	15	16 25 29 48	
			F	9.1 - 9.9	75	21 36 +50	
			G	9.9 - 10.1		10	
10.1	10.7	CLAY Grey clay, copper mottled, stiff, wet	G	10.1 - 10.7	30	21 35 48	BH-2
10.7	11.4	SAND Brown coarse sand, some pebbles, saturated	H	10.7 - 11.4	30	4 15 22 39	

Borehole terminated at 11.4 m

Comments	Water Conditions	
Borehole drilled to document soil profile at MW-S No monitor installed	☒ Wet upon completion ☐ Dry upon completion	

JOB No.	15-249
Borehole No.	BH-1
FIELD STAFF	Jenn Thompson

BOREHOLE LOG

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-A1	Contractor	Lantech Drilling Services	Elevation	234.45 masl
Equipment	CME 75	Borehole Depth	15.5 m	Datum	
Temperature	21 °C	Weather	Cloudy, chance rain	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
0	0.8	0-4' TOPSOIL Silty Sand, brown with grass rootlets, moist, dense 4-8" white clearstone gravel 16" brown coarse grained sand, loose, dry 16-18" clearstone and sand	G	1		0		
0.8	1.5	SAND AND SILT fine grained, brown, loose to compact, dry to moist	G	2	- - -	0		
1.5	2.3	SAND AND SILT banded layers, fine grained, roughly 5-10 cm thick, moist to wet, loose to firm, slight mottling, brown, black, grey, oxidized	G	3	- - - -	0	2 1 2 2	
2.3	3.1	Aggregate sample stuck in head of splitspoon, followed by 3" of Sample No. 3	N/A	4	- - - -		W O R	
3.1	3.7	SAND WITH SILT brown, fine grained, fairly uniform, slight banding, dry to damp, loose to compact	G	5	- - - -	0	4 3 6 2	
3.7	4.6	SANDY SILT brown, fine grained, fairly uniform, slight banding, dry to damp, loose to compact	G	6	- - -	0	5 10 13 13	
4.6	5.3	SANDY SILT brown, fine grained, gravel, fairly uniform, slight banding, dry to damp, loose to compact. Does not ribbon, more sandy	G	7	- - -	0	11 20 20 16	
5.3	6.1	0-10" SAND with silt, brown, fine grained, gravel, fairly uniform, slight banding, dry to damp, loose to compact 10- 24" SILT AND SAND brown, mottled red and grey with trace gravel and laminations, moist to wet, dense	G	8	- - -	0	5 7 11 15	
6.1	6.9	SAND brown, fine grained with trace silt and trace (-) gravel, moist to saturated, loose	G	9	- - -	10	11 19 20 27	PHC's & VOC's

BOREHOLE LOG

CONTINUED

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-A1	Contractor	Lantech Drilling Services	Elevation	234.45 masl
Equipment	CME 75	Borehole Depth	15.5 m	Datum	
Temperature	21 °C	Weather	Cloudy, chance rain	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
6.9	7.6	SAND brown, fine grained with trace silt and trace (-) gravel, moist to saturated, loose	G	10	-	5	19 23 25 32	
7.6	8.4	2-6" smashed cobble 24" SAND brown, fine grained with trace silt and trace (-) gravel, increased silt at 18", almost ribbons, oxidation dense	G	11	-	0	27 16 13 13	
8.4	9.1	SAND fine to medium grained, brown, growing more coarse with depth, trace silt with trace rounded cobbles, loose to dense, moist	G	12	-	0	11 32 50 14	
9.1	9.9	0-8" SAND fine to medium grained, brown, growing more coarse with depth, trace silt with trace rounded cobbles, loose to dense, moist 8-15" SILT with sand seam grey to brown dense dry	G	13	-	10	21 44 50 14	PHC's & VOC's
9.9	10.7	0-10" SAND coarse, brown, moist to wet, loose 10-21" SILT with trace sand trace (-) gravel, grey, dense, dry, trace clay	G	14	-	15	8 28 40 50	
10.7	11.4	0-8" SAND coarse grained, brown/grey, loose, saturated 11" SILT with sand trace (-) gravel, brown-grey, dense dry	G	15	-	60	16 27 24 27	PHC's & VOC's & FOC
11.4	12.2	0-3" FLUFF and aggregate piece 3-15" SILT with clay, grey, dry, very dense, slight mottling	G	16	-	10	21 27 40 50	
12.2	13.0	0-12" SAND fine to coarse grained, grey with tracerounded gravel, loose, saturated 12-24" SILT AND CLAY grey, dense, dry	G	17	-	10	5 15 30 30	
13.0	14.0	0-16" FLUFF 24" SAND AND SILT grey silt and clay till, very dense, dry. Layer is very dense, will act as impermeable barrier	G	18	-	20		
14.0	14.8	0-11" SAND fine to medium grained, dense, moist, brown/grey 11-24" SAND AND SILT with trace clay, grey, very dense, dry, oxidized and mottled black to brown	G	19	-	10		
14.8	15.5	0-8" SAND coarse grained, brown to grey, dense 8-24" SILT AND CLAY till, grey brown, very dense, moist	G	20	-	25		PHC's & VOC's

BOREHOLE LOG

CONTINUED

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-A1	Contractor	Lantech Drilling Services	Elevation	234.45 masl
Equipment	CME 75	Borehole Depth	15.5 m	Datum	
Temperature	21 °C	Weather	Cloudy, chance rain	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis				
From (m)	To (m)		Type	No.	Depth (mbg)							
Borehole terminated at 15.5 m												
Comments			Water Conditions									
Well Completion Details Screen length 0.30 m (15.1 to 12.0 m bgl)			☒ Wet upon completion ☐ Dry upon completion									

JOB No.
Borehole No.
FIELD STAFF

16-180
BH-A1
Steven Krbavcic

BOREHOLE LOG

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-B1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	15.2 m	Datum	
Temperature	16 °C	Weather	Cloudy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
0	1.5	Bored to 2.13 m. Thunder and lightning, shut down site at 5:30pm Resumed drilling Tuesday June 7, 2016 at 7:30am. Advanced to 6.1 m before resuming.			- -			
1.5	4.6	SILT AND SAND grey, loose, moist, occasional cobble			- - -			
4.6	6.1	SAND with some silt, till, grey, loose to compact, dry, cobbles			- - - -			
6.1	6.9	SAND with some silt, till with gravel, dense, brown, dry to moist	1	G	- - -	0	11 31 32 31	
6.9	7.6	0-20" SAND with some silt, till with gravel, dense, brown, dry to moist 20-22" deoxidization marks with coarse sand	2	G	- - - -	0	11 15 30 30	
7.6	8.4	0-10" SAND medium to coarse grained, grey/brown, laminations, dense, dry to moist, oxidization banding at 10" 10-15" SILT with clay, grey brown, very dense	3	G	- - -	5	18 46 50 4"	PHC's VOC's
8.4	9.1	0-2" SILT with clay, grey brown, very dense 2-18" SAND with some clay, grey, dense, moist to wet, laminated	4	G	- - -	5	22 40 50 4"	
9.1	9.9	0-2" SAND with some clay and silt, grey, dense, moist to wet, laminated 2-10" SILT AND CLAY grey, very dense, dry to moist	5	G	- - -	0	35 50 3"	
9.9	10.7	SAND coarse to medium, grey, dense, saturated	6	G	- - -	5	13 32 50 3"	GS
10.7	11.4	0-5" SAND coarse to medium, grey, dense, moist to saturated 5-9" SILT and trace sand, grey, very dense, dry	7	G	- - -	0	31 50 3"	
11.4	12.2	SAND and trace silt, trace rounded gravel, grey, compact to dense, wet	8	G	- - -	0	25 50 5"	PHC's & VOC's, FOC, 65

BOREHOLE LOG

CONTINUED

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Consession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-B1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	15.2 m	Datum	
Temperature	16 °C	Weather	Cloudy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
12.2	13.0	SAND and trace silt, trace rounded gravel, grey, compact to dense, wet to slightly saturated	9	G	- - -	0	36 50 4"	
13.0	13.7	0-6" SAND and trace silt, trace rounded gravel, grey, compact to dense, wet to slightly saturated 6-8" SILT AND CLAY very dense, grey, dry 8-12" SAND coarse, grey, loose, saturated	10	G	- - -	0	45 50 5"	
13.7	14.5	0-8" SAND coarse, with pebbles, grey, loose, saturated 8-12" SAND medium, trace silt, grey, dense to moist 12-17" SAND and ground water with a cobble, very	11	G	- - -	0	16 25 65 *	
14.5	15.2	0-12" SAND with trace silt, grey, dense, wet 12-18" SILT AND CLAY, very dense, grey, dry to moist	12	G	- - -	0	36 50 3"	PHC's VOC's

Borehole terminated at 15.2 m

Comments	Water Conditions
Well Completion Details Screen length 3.3 m (15.2 to 11.9 m bgl)	☐ Wet upon completion ☐ Dry upon completion

JOB No.
Borehole No.
FIELD STAFF

16-180
BH-B1
Steven Krbavcic

BOREHOLE LOG

Environmental Assessments & Approvals

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-C1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	16.0 m	Datum	
Temperature	10 °C	Weather	Cloudy and windy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
0	6.1	Augered to 20' (6.1 m) 0-5' TOPSOIL with silty sand & trace gravel, black to brown, loose, dry 5-10' SAND with some silt, brown to grey, loose, dry 10-15' SILTY SAND with trace rounded gravel, brown grey, loose to dense with depth, moist to wet 15-20' SANDY SILT brown/grey, loose, moist			- - - - -			
6.1	6.9	Split Spoon empty, suspect rock, augered through to 22.5' (6.9 m)			- -			
6.9	7.6	0-9" SAND AND SILT grey, very dense, dry to moist 9-14" SAND AND SILT tan to brown, very dense, dry to moist 14-24" SAND AND SILT grey, very dense, dry to moist, trace rounded gravel	G	1	- - - -	0	27 34 29 24	
7.6	8.4	SAND AND SILT grey, very dense, dry to moist	G	2	- - -	0	18 30 50 5"	
8.4	9.1	0-7" SAND AND SILT grey, very dense, dry to moist. Rock in top of spoon	G	3	- - -	0	34 50 5"	
9.1	9.9	0-8" SAND AND SILT grey, very dense, wet to saturated 24" SILT with some sand, with trace gravel, grey, very dense, dry, mottled grey to brown and black	G	4	- - -	5	10 15 16 17	PHC's & VOC's
9.9	11.4	32.5-35' (9.9-10.7 m) Split spoon empty 0-3" SILT brown to grey, trace sane, very loose, saturated 15" SAND with trace silt, trace gravel, loose, saturated, slight mottling	G	5	- - -	0	11 32 50 5"	
11.4	13.0	0-4" SAND medium to coarse, grey, loose, saturated 4-12" SILT AND CLAY grey, very dense, moist 15" SAND medium to coarse with trace gravel, loose, saturated Rock in tip of split spoon, some sand	G	6	- - - -	0	35 50	

BOREHOLE LOG

CONTINUED

Environmental Assessments & Approvals

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-C1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	16.0 m	Datum	
Temperature	10 °C	Weather	Cloudy and windy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
13.0	13.7	0-6" SAND coarse to medium with trace gravel, grey. Loose, saturated 32" SILT with trace sand, trace clay, grey, very dense, moist	G	7	- - -	0	15 18 17 17	
13.7	14.5	0-5" SAND coarse, loose, grey, moist 32" SILT with trace sand, dense, grey, mottled, brown and orange, moist	G	8	- - -	5	16 17 21 50	
14.5	15.2	SAND with trace silt and trace gravel, grey, loose to completely saturated	G	9		15		PHC's & VOC's + dup FOC
15.2	16.0	0-4" SAND coarse with trace silt and trace gravel, grey, loose, laminations, saturated 4-32" SILT with trace sand and trace clay, grey, very dense, dry to moist	G	10			10 16 27 25	

Borehole terminated at 16.0 m

Comments	Water Conditions
Well Completion Details Screen length 1.5 m (15.8 to 14.3 m bgl)	☐ Wet upon completion ☐ Dry upon completion

JOB No.
Borehole No.
FIELD STAFF

16-180
BH-C1
Steven Krbavcic

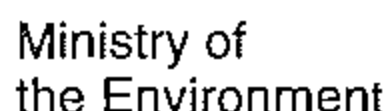
AZURE GROUP**DRAWING NO. 7****JOB NUMBER 2203-002****BH101****PROJECT LOCATION: 58 & 60 Clapperton Street, BARRIE, ONTARIO****Client:** **C_u = Shear Strength (kPa) G% = Gravel, S% = Sand, F% = Fines (Silt and Clay), M = Moisture Content****Temperature: 5°C**

Started/Date April 25, 2022 **Time:** 9.30 am **Sheet** 1 **of** 1
Finished/Date April 26, 2022, **Time:** 4:15 pm
Azure Rep: Amit Pal **Auger Type:** 150 mm Open
Ground Surface El: 233.66 m **G.W. Depth:** 5.63 m **G.W. Elevation:** 228.03 m **April 26, 2022** **Time:** 4 pm

Depth/Elev. (m)	Soil Description	Type/No	N	C_u (kPa)	G.W.T	Remark
0	233.7	100 mm Topsoil	SS 1	4		
		Fill: Loose to very loose silty sand, trace clay, gravel, bricks and organics (0.1 m to 2.0 m)				
0.75	233.0		SS 2	3		
1.5	232.2	Loose to compact SILTY SAND, trace clay, moist (1.8 m to 3.4 m)	SS 3	12		
2.25	231.5		SS 4	19		G%= 1.8
						S%=59.6
3.0	230.7		SS 5	47		F%=38.6
4.6	229.1	Dense brown SILTY SAND trace clay and gravel, below 4.0 m, moist	SS 6	45		
					5.63 m	
6.00	227.7	V. dense, grey SILTY SAND trace clay below 6.5 m	SS 7	42		G%=4.4
						S%=59.4
7.60	226.1		SS 8	53		F%=36.2
		Very dense SAND/SILTY SAND				
9.20	224.5	V. dense grey SAND trace silt and gravels	SS 9	63		
10.7	223.0		SS 10	75		
		Hard CLAYEY SILT/SILTY CLAY, SILT trace gravels below 11.5 m				
12.2	221.5		SS 11	>80		
		V. dense SAND/SILTY SAND				
13.7	220.0		SS 12	>80		
		V. dense SAND and gravel below 13.5 m				
15.2	218.5		SS 13	>80	>225	
16.8	216.9		SS 14	>80	>225	
18.3	213.9		SS 15	>80		
19.8	213.9	V. dense SAND and gravel	SS 16	>80		
	213.9	E.O.B				

PROJECT LOCATION: 58 & 60 Clapperton Street, BARRIE, ONTARIO**Client:** **C_u = Shear Strength (kPa) G% = Gravel, S% = Sand, F% = Fines (Silt and Clay), M = Moisture Content****Temperature: 5°C****Started/Date April 25, 2022 Time: 9:30 am Sheet 1 of 1****Finished/Date April 26, 2022 Time: 4:15 pm****Azure Rep: Amit Pal Auger Type: 150 mm Open****Ground Surface El: 234.03 m G.W. Depth: 5.63 m G.W. Elevation: 228.4 m April 26, 2022 Time: 4 pm**

Depth/Elev. (m)	Soil Description	Type/No	N	C_u (kPa)	G.W.T	Remark
0	234.0	100 mm Topsoil	SS 1	4		
		Fill: Loose to very loose silty sand, trace clay, gravel, bricks and organics (0.1 m to 2.0 m)				
0.75	233.3		SS 2	3		
1.5	232.5	Loose to compact SILTY SAND, trace clay, moist	SS 3	12		
2.25	231.8		SS 4	19		
3.0	231.0		SS 5	47		
		Dense brown SILTY SAND trace clay and gravel, below 4.0 m, moist				
4.6	229.4		SS 6	45		G%=1.1
						S%=46.6
6.00	228.0	V. dense, grey SILTY SAND trace clay and gravel	SS 7	>80	5.63 m	F%=52.3
7.60	226.4		SS 8	>80		
8.00	226.0	V. dense, grey SILTY SAND trace clay and gravel	SS 9	>80		
9.20	224.8	V. dense, grey SILTY SAND trace clay and gravel	SS 10	>80		G%=0.4
						S%=64.1
10.7	233.3	Very dense SAND/SILTY SAND	SS 11	>80		F%=35.5
12.2	221.8	V. dense grey SAND trace silt and gravels	SS 12	>80		
13.7	220.32	V. dense SILTY SAND trace clay and gravel	SS 13	>80		
15.2	218.8	V. dense SILTY SAND trace clay and gravel	SS 14	>80		
16.8	217.2	V. dense SAND/SILTY SAND	SS 15	>80		
18.3	215.7	V. dense SAND/SILTY SAND	SS 16	>80		
18.9	215.1	V. dense SAND and GRAVEL	SS 18	>80		
18.9		E.O.B				



Well Tag No. for Master Well (Place Sticker and/or Print Below)

A110288

Master Well Record for Cluster Well Construction

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Master Well Owner's and Land Owner's Information

First Name Suncor Energy Products		Last Name		E-mail Address			
Mailing Address (Street Number/Name, RR) 275 Rebecca St.		Municipality Oakville		Province ON	Postal Code L6L 6N5	Telephone No. (inc. area code) 905 469 3749	

Location and Construction of the Master Well in the Cluster

Address of Well Location (Street Number/Name, RR) 0-14 Collier st.				Township		Lot		Concession	
County/District/Municipality Barrie				City/Town/Village Barrie		Province Ontario		Postal Code + + + + +	
UTM Coordinates NAD 83		Zone 17		Easting 604285		Northing 4916129		GPS Unit Make Garmin	
						Model etrex		Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify _____	

Overburden and Bedrock Materials (see instructions on the back of this form)

[illegible]

Hole Details

Depth (Metres)		Diameter (Centimetres)
From	To	
○	12.8	21

Water Use

☐ Public ☐ Industrial ☐ Not used ☐ Other, *specify*
☐ Domestic ☐ Commercial ☐ Dewatering
☐ Livestock ☐ Municipal ☒ Monitoring
☐ Irrigation ☐ Test Hole ☐ Cooling & Air Conditioning

Method of Construction

☐ Cable Tool	☐ Air Percussion	☐ Digging
☐ Rotary (Conventional)	☐ Diamond	☒ Boring
☐ Rotary (Reverse)	☐ Jetting	☐ Other, <i>specify</i>
☐ Rotary (Air)	☐ Driving	

Status of Well

☒ Test Hole	☐ Abandoned, Insufficient Supply
☐ Replacement Well	☐ Abandoned, Poor Water Quality
☐ Dewatering Well	☐ Other, <i>specify</i> _____
☐ Alteration (Construction)	☐ Abandoned, other, <i>specify</i> _____

No Casing and Screen Used

Open Hole	☐ Yes ☒ No	10.7 Metres
-----------	---	-------------

Static Water Level Test

10.7 Metres

Screen

☐ Galvanized ☐ Steel ☐ Fibreglass ☐ Concrete ☒ Plastic	
Outside Diameter (Centimetres) 6.4	Slot No. 20

Water Details

Water found at Depth 10.7 Metres ☐ Gas	Kind of Water ☒ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

Annular Space/Abandonment Sealing Record

[illegible]

Well Contractor and Well Technician Information

Business Name of Well Contractor <i>Geo-Environmental</i>		Well Contractor's Licence No. <i>6607</i>	
Business Address (Street No./Name, number, RR) <i>340 Market St.</i>		Municipality <i>Milton</i>	
Province <i>Ont</i>	Postal Code <i>L9T5A4</i>	Business E-mail Address	
Bus. Telephone No. (inc. area code) <i>905 876 3388</i>		Name of Well Technician (Last Name, First Name) <i>Collins, Tim</i>	
Well Technician's Licence No. <i>2059</i>	Signature of Technician <i>[Signature]</i>	Date Submitted (yyyy/mm/dd) <i>2010/12/06</i>	

Cluster Information (Please also fill out the additional Cluster Well Information for Well Construction for each parcel of land and cluster.)

Total Wells in Cluster <u>3</u>	Please indicate Number of Cluster Well Information Log Sheets Submitted
Total Wells on this Property <u>3</u>	

Location of Well Cluster

Detailed Map must be provided as an attachment no larger than legal size (8.5" x 14"). Sketches are not allowed.

☐ Check box to confirm detailed map is provided as per Section 11.1 (3)

Consent to release additional information concerning the cluster to the Director upon request

Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2010/12/06

Master Well Owner's/Land Owner's consent to use Cluster Form

Signature	Date (yyyy/mm/dd)
-----------	-------------------

Ministry Use Only

Audit No. M 07428	Well Contractor No.
Date Received (yyyy/mm/dd) JAN 07 2011	Date of Inspection (yyyy/mm/dd)
Remarks	



A 110 2888

Regulation 903 Ontario Water Resources Act

Page i of 1

First Name	Last Name	Mailing Address (Street No./Name, RR)	Municipality
Suncor Energy Products		3275 Rebecca st.	Oakville
Province	Postal Code	E-mail Address	Telephone No. (inc. area code)
Ontario	L6L6N5		9054693740

Address of Well Location (Street Number/Name, RR) 10-14 Collier st.			Lot	Concession	Township	County/District/Municipality Barrie	
City/Town/Village Barrie	Province Ontario	Postal Code	GPS Unit Make Garmin	Model etrex	Unit Mode of Operation ☐ Undifferentiated ☒ Averaged		

Signature	Date (yyyy/mm/dd)
-----------	-------------------

Signature of Technician/Contractor 	Date (yyyy/mm/dd) 2010/12/07
---	---------------------------------

[illegible]

Business Name of Well Contractor <i>Geo-Environmental</i>		Business Address (Street Number/Name, RR) <i>340 Market Dr.</i>		Municipality <i>Milton</i>	Province <i>Ont</i>
Postal Code <i>L9T 5T4</i>	Business Telephone No. (inc. area code) <i>905 876 3388</i>	Well Contractor's Licence No. <i>6607</i>	Business E-mail Address		
Name of Well Technician (First Name, Last Name) <i>Tim Collins</i>		Well Technician's Licence No. <i>2059</i>	Date Submitted (yyyy/mm/dd) <i>2010/12/10</i>	Signature of Technician <i>[Signature]</i>	

Date 1st Well in Cluster Constructed (yyyy/mm/dd)	Date Last Well in Cluster Constructed (yyyy/mm/dd)
2010/12/07	2010/12/09

Date Received (yyyy/mm/dd)	Date Inspected (yyyy/mm/dd)
Audit No. 07 2011 C 13382	Remarks m157428

Master Well Owner's and Land Owner's Information

First Name Suncor Energy Products Partnership		Last Name		E-mail Address	
Mailing Address (Street Number/Name) & RR 3275 Rebecca St		Municipality Oakville		Province On	Postal Code L6L6N5
				Telephone No. (inc. area code) 905 469 3754	

Location and Construction of the Master Well in the Cluster

Address of Well Location (Street Number/Name, RR) 10-14 Collier St.		Township	Lot	Concession	
County/District/Municipality		City/Town/Village		Province	Postal Code

UTM Coordinates	Zone	Easting	Northing	GPS Unit Make	Model	Mode of Operation: ☐ Undifferentiated ☒ Averaged
NAD 83	17	606509	4908532	Magellan	Sportrak	☐ Differentiated, specify _____

Overburden and Bedrock Materials (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (Metres)	
				From	To
Brown	Sand	Silt		0	9
Grey	Sand	Clay		9	12.3
BH307					

Hole Details

Depth (Metres)		Diameter (Centimetres)
From	To	
0	12.3	21

Water Use

☐ Public ☐ Industrial ☐ Not used ☐ Other, specify _____
☐ Domestic ☐ Commercial ☐ Dewatering
☐ Livestock ☐ Municipal ☐ Monitoring
☐ Irrigation ☒ Test Hole ☐ Cooling & Air Conditioning

Method of Construction

☐ Cable Tool ☐ Air Percussion ☐ Digging
☐ Rotary (Conventional) ☐ Diamond ☒ Boring
☐ Rotary (Reverse) ☐ Jetting ☐ Other, specify _____
☐ Rotary (Air) ☐ Driving

Status of Well

☒ Test Hole	☐ Abandoned, Insufficient Supply
☐ Replacement Well	☐ Abandoned, Poor Water Quality
☐ Dewatering Well	☐ Other, <i>specify</i> _____
☐ Alteration (Construction)	☐ Abandoned, other, <i>specify</i> _____

No Casing and Screen Used

Open Hole ☐ Yes ☒ No

Static Water Level Test

Screen

☐ Galvanized ☐ Steel ☐ Fibreglass ☐ Concrete ☒ Plastic

Outside Diameter (Centimetres)	Slot No.
6.4	20

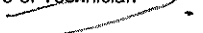
Water Details

Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

Annular Space/Abandonment Sealing Record

[illegible]

Well Contractor and Well Technician Information

Business Name of Well-Contractor		Well Contractor's Licence No.	
Geo-Environmental		661017	
Business Address (Street No./Name, number, RR)		Municipality	
17 Manswood Crt		Halton Hills	
Province	Postal Code	Business E-mail Address	
Ont	L7R0A1		
Bus. Telephone No. (inc. area code)		Name of Well Technician (Last Name, First Name)	
905 876 3388		McDonald, Neil	
Well Technician's Licence No.	Signature of Technician	Date Submitted (yyyy/mm/dd)	
201717		2011/12/20	

Consent to release additional information concerning the cluster to the Director upon request

Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2011/12/20

Master Well Owner's/Land Owner's consent to use Cluster Form

Signature	Date (yyyy/mm/dd)
-----------	-------------------

Ministry Use Only

Audit No. M 10518	Well Contractor No.
Date Received (yyyy/mm/dd) FEB 14 2012	Date of Inspection (yyyy/mm/dd)
Remarks	



Job # 111232

Ministry of
the Environment

Well Tag No. for Master Well (Print Well Tag No.)

A115215

115215

Cluster Well Information for Cluster Well Construction

Regulation 903 Ontario Water Resources Ac

Page 2 of 2

Property Owner's Information

First Name	Last Name		Mailing Address (Street No./Name, RR)	Municipality
Suncor	Energy Products Partnership		3275 Rebecca St	Oakville
Province	Postal Code	E-mail Address	Telephone No. (inc. area code)	
On.	L6L 6N5		905 469 3754	

Cluster Well Information

Address of Well Location (Street Number/Name, RR) 10-14 Collier St.		Lot	Concession	Township		County/District/Municipality	
City/Town/Village Barrie	Province Ontario	Postal Code [][][][][][]	GPS Unit Make Maxwell	Model Sportrak	Unit Mode of Operation ☐ Differentiated, specify: _____	☐ Undifferentiated	☒ Averaged

Consent

Property Owner's Consent to use cluster form

Signature	Date (yyyy/mm/dd)
-----------	-------------------

Consent to release additional information to the Director upon request

Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2011/12/1

[illegible]

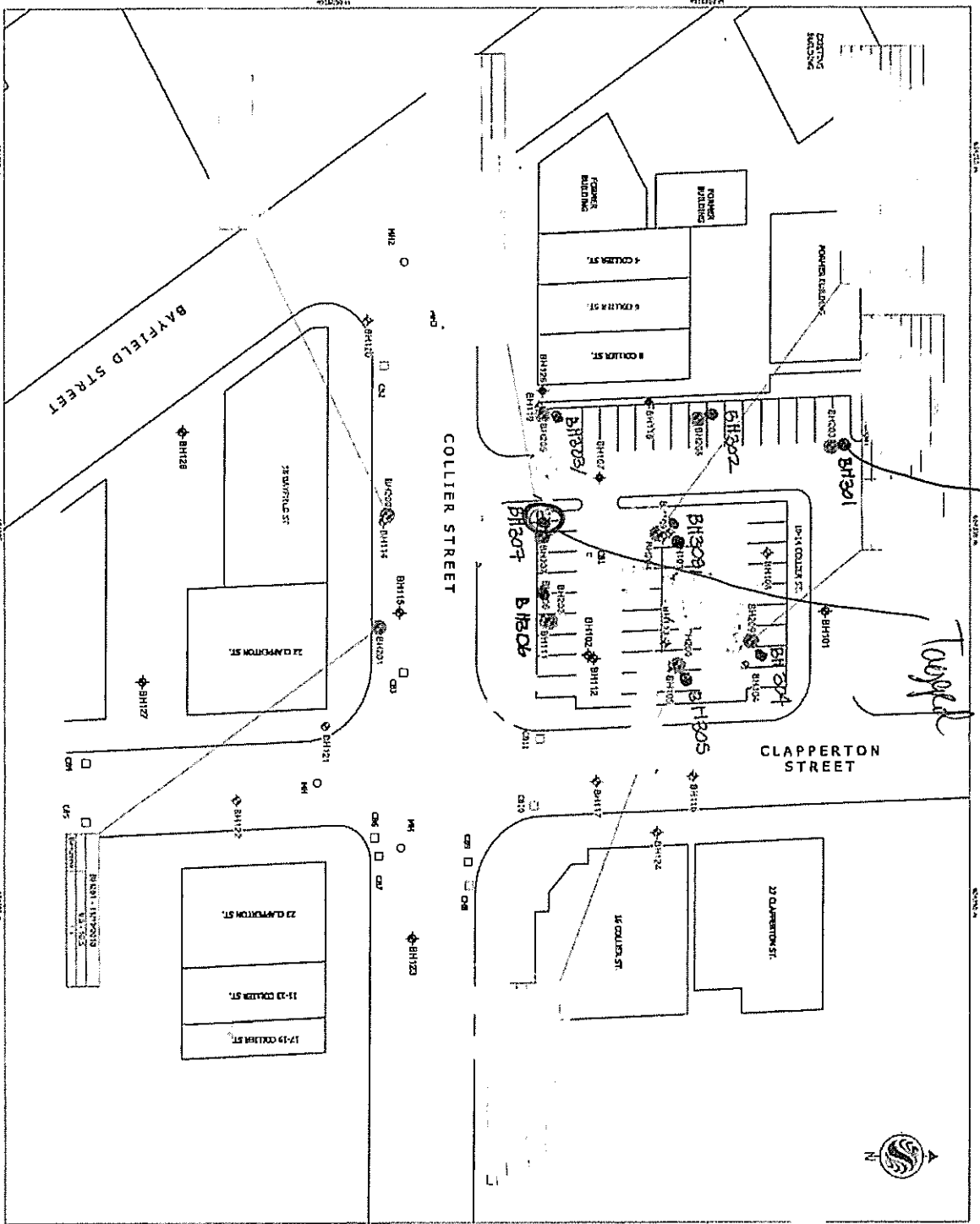
Well Contractor and Well Technician Information

Business Name of Well Contractor <i>Geo-Environmental</i>				Business Address (Street Number/Name, RR) <i>17 Monsewood Cte</i>				Municipality <i>Dalton Hills</i>				Province <i>Ont</i>			
Postal Code <i>L7R 0A1</i>				Business Telephone No. (inc. area code) <i>905 876 3388</i>				Well Contractor's Licence No. <i>6607</i>				Business E-mail Address			
Name of Well Technician (First Name, Last Name) <i>Neil McDonald</i>								Well Technician's Licence No. <i>2077</i>				Date Submitted (yyyy/mm/dd) <i>2011/12/20</i>			
												Signature of Technician 			

Date 1st Well in Cluster Constructed (yyyy/mm/dd)	2011/12/16	Date Last Well in Cluster Constructed (yyyy/mm/dd)	2011/12/21
--	------------	---	------------

Ministry Use Only

Date Received (yyyy/mm/dd) FEB 14 2012	Date Inspected (yyyy/mm/dd)
Audit No. C 14726	Remarks 110518



Legend

- Property Use
- Borehole (By Others)
- Borehole (Santec, Dec 2010)
- Monitoring Well (By Others)
- Monitoring Well (Santec, Dec 2010)
- Monitoring Well Assumed Destroyed
- Tested Parameters Below Regulatory
- Standards O.Reg. 571/03 Table 2 SCS
- One or More Tested Parameters Exceeds Regulatory Standards O.Reg. 571/03 Table 2 SCS

Sampling ID and Date

Sampling ID	Date



Notes

1. Coordinate system: UTM NAD 83, Zone 17 (N).



Santec

Client:
Santec Energy Products Partnership
14 Collier Street
Burlington, Ontario

Date:

Page:

4

6667
M10518
C14726
FEB 14 2012



Tag#: A126223 A126223

Regulation 903 Ontario Water Resources Act

Page 6 of 6

Measurements recorded in: ☒ Metric ☐ Imperial

Well Owner's Information

First Name Suncor Energy	Last Name / Organization Products	E-mail Address			☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name) 3375 Belterra St.		Municipality Oakville	Province ON	Postal Code L6L 6N5	Telephone No. (inc. area code) 905 46 93 749

Well Location

Address of Well Location (Street Number/Name) 10-14 Collier St.				Township		Lot		Concession			
County/District/Municipality Simcoe				City/Town/Village Barrie				Province Ontario		Postal Code 	
UTM Coordinates NAD 83		Zone 17		Easting 6043024		Northing 916096		Municipal Plan and Sublot Number		Other	

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Brown	sand	Gravel	loose	0	2.4
Brown	sand	Gravel / stones	loose	2.4	5.1
Brown	sand	sand	dense	5.1	6.3
Grey	silt	sand	soft	6.3	12.8

Annular Space			
Depth Set at (m/ft)		Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
From	To		
0	0.3	concrete	
0.3	9.1	Bentonite chips	

Method of Construction		Well Use		
☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☐ Rotary (Conventional)	☐ Jetting	☐ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☒ Monitoring
☒ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, <i>specify</i> _____		☐ Other, <i>specify</i> _____		

Construction Record - Casing					Status of Well
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply
			From	To	
S.1	Plastic	0.65	0	9.7	☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply

Construction Record - Screen				
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To
6.4	Plastic	20	9.7	12.8

☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify* _____
☐ Other, *specify* _____

☐ Insufficient Supply

Water Details		Hole Diameter		
Water found at Depth 11 (m/ft) ☐ Gas	Kind of Water: ☒ Fresh ☐ Untested ☐ Other, specify _____	Depth (m/ft) From	To	Diameter (cm/in)
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____	0	12.8	21
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____			

Well Contractor and Well Technician Information

Business Name of Well Contractor Geo-Environmental Drilling inc		Well Contractor's Licence No. 6607	
Business Address (Street Number/Name) 1 Mansewood crt		Municipality Halton	
Province ON	Postal Code L9G0A1	Business E-mail Address	
Bus. Telephone No. (inc. area code) 905 876 3388		Name of Well Technician (Last Name, First Name) Collins Tim	
Well Technician's Licence No. T3694	Signature of Technician and/or Contractor 	Date Submitted 20120703	

Results of Well Yield Testing

After test of well yield, water was:	Draw Down		Recovery	
☐ Clear and sand free	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
☐ Other, <i>specify</i> _____				
If pumping discontinued, give reason:	Static Level			
	1		1	
Pump intake set at (m/ft)	2		2	
Pumping rate (l/min / GPM)	3		3	
	4		4	
Duration of pumping _____ hrs + _____ min	5		5	
Final water level end of pumping (m/ft)	10		10	
If flowing give rate (l/min / GPM)	15		15	
	20		20	
Recommended pump depth (m/ft)	25		25	
Recommended pump rate (l/min / GPM)	30		30	
	40		40	
Well production (l/min / GPM)	50		50	
Disinfected?	60		60	
☐ Yes ☐ No				

Map of Well Location

Please provide a map below following instructions on the back.

see attached map

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
Embee Properties Limited			
Mailing Address (Street Number/Name)	Municipality	Province	Postal Code
88 Sheppard Ave. W., Ste 200	Toronto	ON	M5H 1B6
		Telephone No. (inc. area code)	416 250 5858

Well Location

Address of Well Location (Street Number/Name) 4-8 Collier St.			Township		Lot		Concession		
County/District/Municipality			City/Town/Village Barrie			Province Ontario		Postal Code	
UTM Coordinates Zone Easting Northing NAD 83 17 604279 4916097			Municipal Plan and Sublot Number			Other			

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

[illegible]

Annular Space

Depth Set at (m/ft)		Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
From	To		
35'	18'	Sand	
18'	2'	Hole Plug	
2'	0'	Sand	

Method of Construction

☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☒ Rotary (Conventional)	☐ Jetting	☐ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☒ Monitoring
☐ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, <i>specify</i> _____		☐ Other, <i>specify</i> _____		

Well Use

☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☒ Rotary (Conventional)	☐ Jetting	☐ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☒ Monitoring
☐ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, <i>specify</i> _____		☐ Other, <i>specify</i> _____		

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned,
			From	To	
2"	Plastic		25'	0'	

Status of Well

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned,
			From	To	
2'	Plastic		25'	0'	

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)		☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify _____ ☐ Other, specify _____
			From	To	
2'	Plastic		35'	25'	

Water Details

Water found at Depth <i>20'</i> (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, <i>specify</i> _____
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, <i>specify</i> _____
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, <i>specify</i> _____

Hole Diameter

Depth (m/ft)		Diameter (cm/in)
From	To	

Well Contractor and Well Technician Information

Business Name of Well Contractor London Soil test LTD.		Well Contractor's Licence No. 7190
Business Address (Street Number/Name) 3336 Whit Oak Rd, UNIT 16		Municipality LONDON
Province	Postal Code	Business E-mail Address

ONT NL0E279
Bus. Telephone No. (inc. area code) Name of Well Technician (Last Name, First Name)
5194553777 Sayers James
Well Technician's Licence No. Signature of Technician and/or Contractor Date Submitted

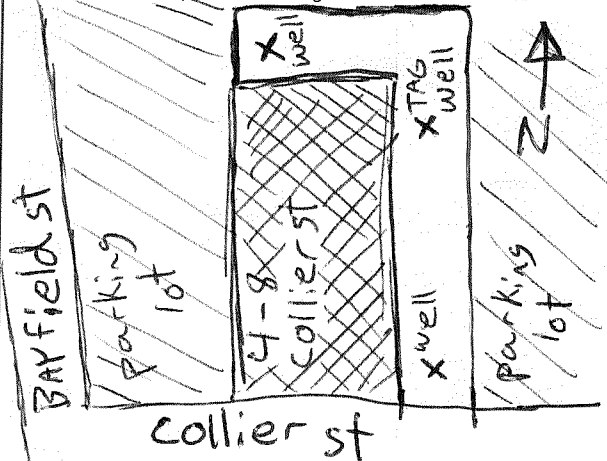
0506E (2007/12) © Queen's Printer for Ontario, 2007

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, <i>specify</i> _____	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason:	Static Level			
	1		1	
Pump intake set at (m/ft)	2		2	
	3		3	
Pumping rate (l/min / GPM)	4		4	
	5		5	
Duration of pumping _____ hrs + _____ min	10		10	
Final water level end of pumping (m/ft)	15		15	
If flowing give rate (l/min / GPM)	20		20	
	25		25	
Recommended pump depth (m/ft)	30		30	
	40		40	
Recommended pump rate (l/min / GPM)	50		50	
	60		60	
Well production (l/min / GPM)				
Disinfected? ☐ Yes ☐ No				

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

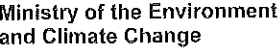
Well owner's information package delivered ☐ Yes ☐ No

Date Package Delivered Y Y Y Y M M D D

Date Work Completed 3/13/09

Ministry Use Only

Audit No. **Z 169392**
Received **DEC 17 2011**



Regulation 903 Ontario Water Resources Act

All measurements recorded in: ☐ Metric ☐ Imperial

Follow instructions on the front and back of this form. Print or Type

Well Tag#: A139474 (Int Well Tag No.)

Well No. on Drawing of Deepest Well:

☐ Dewatering wells

☐ Test holes

No. of wells reported _____

Page 2 of 3

Well Cluster Location Information														Mandatory Attachments/Additional Information					
Address of Well Location (Street Number(s)/Name(s), RR, if available)						Lot(s)		Concession(s)		Geographic Township			County/District/Upper Tier Municipality			☒ Land Owner Consent Form must be attached. ☒ Detailed Drawing of All Well Locations must be attached. I, the person constructing the well, will promptly submit to the Director, on request, any additional information in my custody or control related to any well in the well cluster that I have constructed.			
City, Town, Village or Hamlet						Province		GPS Unit Make		Model		Unit Mode of Operation ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify: _____			Signature of Technician/Contractor _____ Date (yyyy/mm/dd) _____				
Well Details																			
Well # on Drawing	UTM Coordinates				Hole Depth (m/ft)	Hole Diameter (cm/in)	Method of Construction	Casing Material; Diameter (cm/in)	Casing (m/ft)		Screen Interval (m/ft)		Annular Space Material (m/ft)			Overburden/Bedrock or Abandonment Filling Material Intervals (m/ft)	Static Water Level (m/ft)	Date of Completion (yyyy/mm/dd)	
	Zone	Easting	Northing						From	To	From	To	From	To	Material:				
BH1	17	60410811	4916214		20	15	BORING	2"	0	10	10	20				MASTER WELL	17	2018/05/10	
						#													
BH2	17	60384949	16294		20	15		2"	0	15	15	20					8.6	2018/05/10	
BH3	17	603951	4916362		18	15	✓	2"	0	15	15	20					7	2018/05/10	
Well Contractor and Well Technician Information														Date First Well in Cluster Constructed or Abandoned (yyyy/mm/dd)		Date Last Well in Cluster Completed (yyyy/mm/dd)		Ministry Use Only	
Business Name of Well Contractor				Business Address (Street Number/Name, RR)				Municipality		Province						Date Received (yyyy/mm/dd)		Audit No.	
1617168 ONT INC				557 MAPLEVIEW DR				BARRIE		ON						JUN 14 2018		C 38608	
Postal Code		Bus. Telephone No.		Well Contractor's Licence No.				Business E-mail Address						Well Abandonment		Comments			
L9A10K1R		7057915351		7314				ontariosolidrillings@inc.ca											
Name of Well Technician (First Name, Last Name)				Well Technician's Licence No.				Signature of Well Technician		Date Submitted (yyyy/mm/dd)						Name			
MICHAEL BISSON				3266				Mike B		2018/05/31						(Print or Type) - See instruction 11 on the back of this form			



APPENDIX D

Water Balance Summary Tables

Table A: Pre-Development

Catchment Designation	Landscaped Grass	Impervious (parking, driveway and former foundation)	Total
Area (m ²)	2,433	575	3,008
Pervious Area (m ²)	2,433	0	2,433
Impervious Area (m ²)	0	575	575
Infiltration Factors			
Topography Infiltration Factor	0.25	0	
Soil Infiltration Factor	0.3	0	
Land Cover Infiltration Factor	0.1	0	
Infiltration Factor	0.65	0	
Run-Off Coefficient	0.35	1	
Run-Off From Impervious Surfaces	0.8	0.8	
Inputs (Per Unit Area)			
Precipitation (mm/yr)	909	909	909
Rainfall (mm/yr)	655	655	655
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	909	909	909
Outputs (Per Unit Area)			
Precipitation Surplus (mm/yr)	430	727	487
Net Surplus (mm/yr)	430	727	487
Evapotranspiration (mm/yr)	479	182	422
Infiltration (mm/yr)	280	0	226
Surplus Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	280	0	226
Run-Off Pervious Areas (mm/yr)	151	0	122
Run-Off Impervious Areas (mm/yr)	0	727	139
Total Run-Off (mm/yr)	151	727	261
Total Outputs (mm/yr)	909	909	909
Difference (Inputs - Outputs)	0	0	0
Inputs (Volumes)			
Precipitation (m ³ /yr)	2,212	523	2,734
Run-On (m ³ /yr)	0	0	0
Other Inputs (m ³ /yr)	0	0	0
Total Inputs (m³/yr)	2,212	523	2,734
Outputs (Volumes)			
Precipitation Surplus (m ³ /yr)	1,046	418	1,464
Net Surplus (m ³ /yr)	1,046	418	1,464
Evapotranspiration (m ³ /yr)	1,165	105	1,270
Infiltration (m ³ /yr)	680	0	680
Surplus Infiltration (m ³ /yr)	0	0	0
Total Infiltration (m³/yr)	680	0	680
Run-Off Pervious Areas (m ³ /yr)	366	0	366
Run-Off Impervious Areas (m ³ /yr)	0	418	418
Total Run-Off (m ³ /yr)	366	418	784
Total Outputs (m³/yr)	2,212	523	2,734
Difference (Inputs - Outputs)	0	0	0

Table B: Post-Development (no mit)

Catchment Designation	Landscaped Grass	Roof, Parking, Laneway, Other Imperivous	Total
Area (m ²)	508	2,500	3,008
Pervious Area (m ²)	508	0	508
Impervious Area (m ²)	0	2,500	2,500
Infiltration Factors			
Topography Infiltration Factor	0.25	0	
Soil Infiltration Factor	0.3	0	
Land Cover Infiltration Factor	0.1	0	
Infiltration Factor	0.65	0	
Run-Off Coefficient	0.35	1	
Run-Off From Impervious Surfaces	0.8	0.8	
Inputs (Per Unit Area)			
Precipitation (mm/yr)	909	909	909
Rainfall (mm/yr)	655	655	655
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	909	909	909
Outputs (Per Unit Area)			
Precipitation Surplus (mm/yr)	430	727	677
Net Surplus (mm/yr)	430	727	677
Evapotranspiration (mm/yr)	479	182	232
Infiltration (mm/yr)	280	0	47
Surplus Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	280	0	47
Run-Off Pervious Areas (mm/yr)	151	0	25
Run-Off Impervious Areas (mm/yr)	0	727	604
Total Run-Off (mm/yr)	151	727	630
Total Outputs (mm/yr)	909	909	909
Difference (Inputs - Outputs)	0	0	0
Inputs (Volumes)			
Precipitation (m ³ /yr)	462	2,273	2,734
Run-On (m ³ /yr)	0	0	0
Other Inputs (m ³ /yr)	0	0	0
Total Inputs (m³/yr)	462	2,273	2,734
Outputs (Volumes)			
Precipitation Surplus (m ³ /yr)	218	1,818	2,036
Net Surplus (m ³ /yr)	218	1,818	2,036
Evapotranspiration (m ³ /yr)	243	455	698
Infiltration (m ³ /yr)	142	0	142
Surplus Infiltration (m ³ /yr)	0	0	0
Total Infiltration (m³/yr)	142	0	142
Run-Off Pervious Areas (m ³ /yr)	76	0	76
Run-Off Impervious Areas (m ³ /yr)	0	1,818	1,818
Total Run-Off (m ³ /yr)	76	1,818	1,894
Total Outputs (m³/yr)	462	2,273	2,734
Difference (Inputs - Outputs)	0	0	0

Table C: Water Balance Summary Table

Characteristic	Site			
	Pre-Development	Post-Development	Change (Pre to Post)	
Inputs (Volume)				
Precipitation (m ³ /yr)	2,734	2,734	0	0%
Run-On (m ³ /yr)	0	0	0	NA
Other Inputs (m ³ /yr)	0	0	0	NA
Total Inputs (m ³ /yr)	2,734	2,734	0	0%
Outputs (Volume)				
Precipitation Surplus (m ³ /yr)	1,464	2,036	572	39%
Net Surplus (m3/yr)	1,464	2,036	572	39%
Evapotranspiration (m ³ /yr)	1,270	698	-572	-45%
Infiltration (m ³ /yr)	680	142	-538	-79%
Rooftop Infiltration (m ³ /yr)	0	0	0	NA
Total Infiltration (m ³ /yr)	680	142	-538	-79%
Run-Off Pervious Areas (m ³ /yr)	366	76	-290	-79%
Run-Off Impervious Areas (m ³ /yr)	418	1,818	1,400	335%
Total Run-Off (m ³ /yr)	784	1,894	1,110	142%
Total Outputs (m ³ /yr)	2,734	2,734	0	0%

Barrie

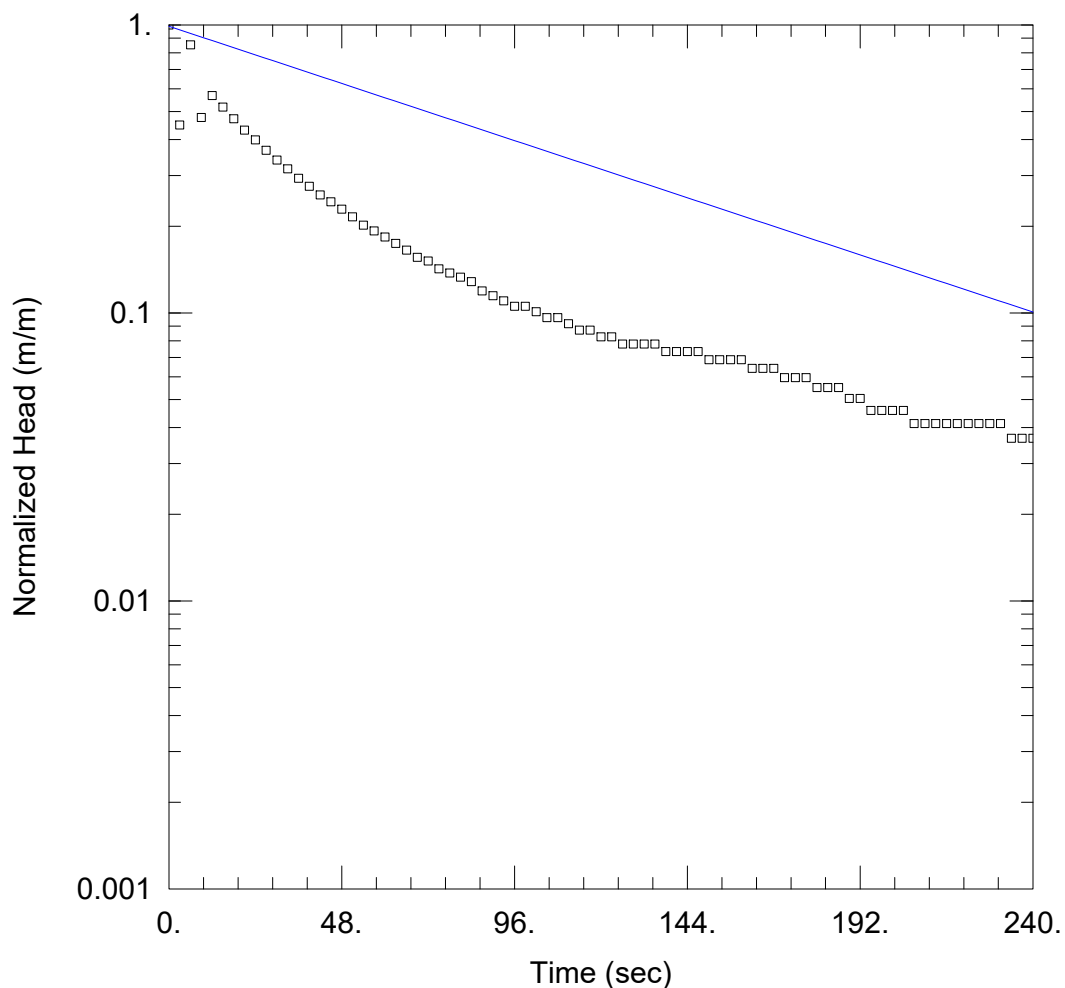
Period of Record (1970-2021)

Year	Precipitation	Rainfall	ET	Total Surplus**
1970	955	701	566	376
1971	700	413	409	303
1972	856	556	447	389
1973	766	632	424	397
1974	833	622	485	353
1975	806	509	421	313
1976	900	581	452	402
1977	964	692	490	445
1978	1,032	538	472	604
1979	975	686	411	613
1980	929	623	494	338
1981	883	675	507	502
1982	954	699	515	486
1983	775	556	397	293
1984	880	543	433	409
1985	1,041	671	532	540
1986	1,095	878	549	533
1987	916	785	575	334
1988	925	653	475	433
1989	845	620	444	385
1990	860	686	463	401
1991	770	623	448	340
1992	829	615	467	343
1993	919	644	490	480
1994	802	558	465	316
1995	1,297	972	569	635
1996	1,106	821	529	632
1997	855	517	438	479
1998	853	717	495	353
1999	875	691	582	256
2000	1,047	853	550	438
2001	928	719	495	535
2002	883	702	454	381
2003	995	697	532	428
2004	988	681	479	507
2005	848	603	480	373
2006	888	670	429	540
2007	913	532	380	366
2008	957	612	504	577
2009	918	659	501	396
2010	954	831	589	388
2011	911	620	502	372
2012	639	519	477	194
2013	1,214	871	549	630
2014	864	647	525	365
2015	718	560	430	282
2016	824	596	413	375
2017	1,075	717	480	560
2018	916	680	362	618
2019	803	528	379	340
2020	889	573	477	460
2021	793	634	481	309
Ave	907	653	479	425
SD	119	107	55	108
-99%	628	405	352	173
99%	1,185	902	606	677



APPENDIX E

Hydraulic Conductivity Testing



MW-1

Data Set: L:\...\160209 - MW-1 - Hvorslev - Confined.aqt

Date: 03/23/21

Time: 16:18:42

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-1

AQUIFER DATA

Saturated Thickness: 0.15 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-1)

Initial Displacement: -2.18 m

Static Water Column Height: 4.77 m

Total Well Penetration Depth: 4.77 m

Screen Length: 0.15 m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

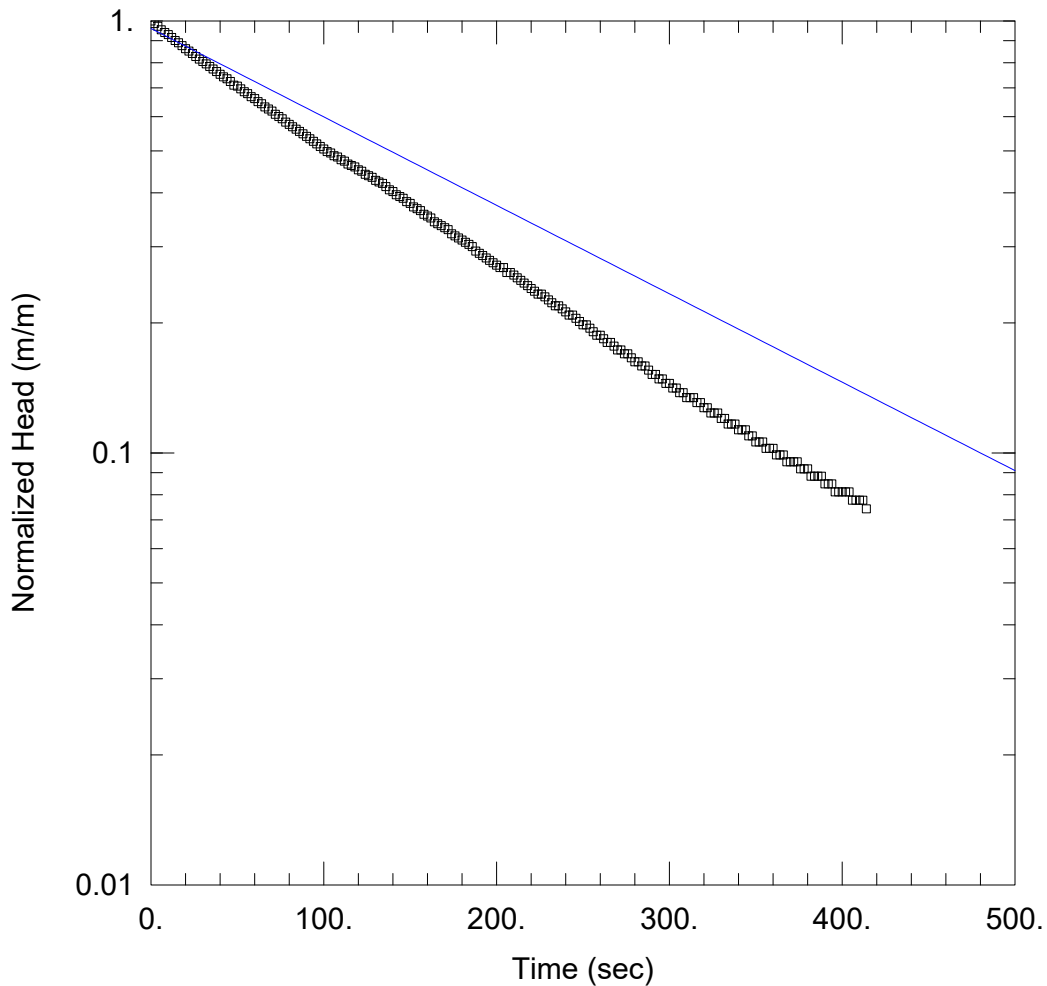
SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

$K = 0.0001136$ m/sec

$y_0 = -2.156$ m



WELL TEST ANALYSIS

Data Set: L:\...\160222 - MW-2 - Hvorslev - Confined.aqt

Date: 03/23/21

Time: 16:19:33

PROJECT INFORMATION

Company: Azimuth Environmental

Test Well: MW-2

AQUIFER DATA

Saturated Thickness: 2.75 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-2)

Initial Displacement: -2.83 m

Static Water Column Height: 3.27 m

Total Well Penetration Depth: 3.27 m

Screen Length: 2.75 m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

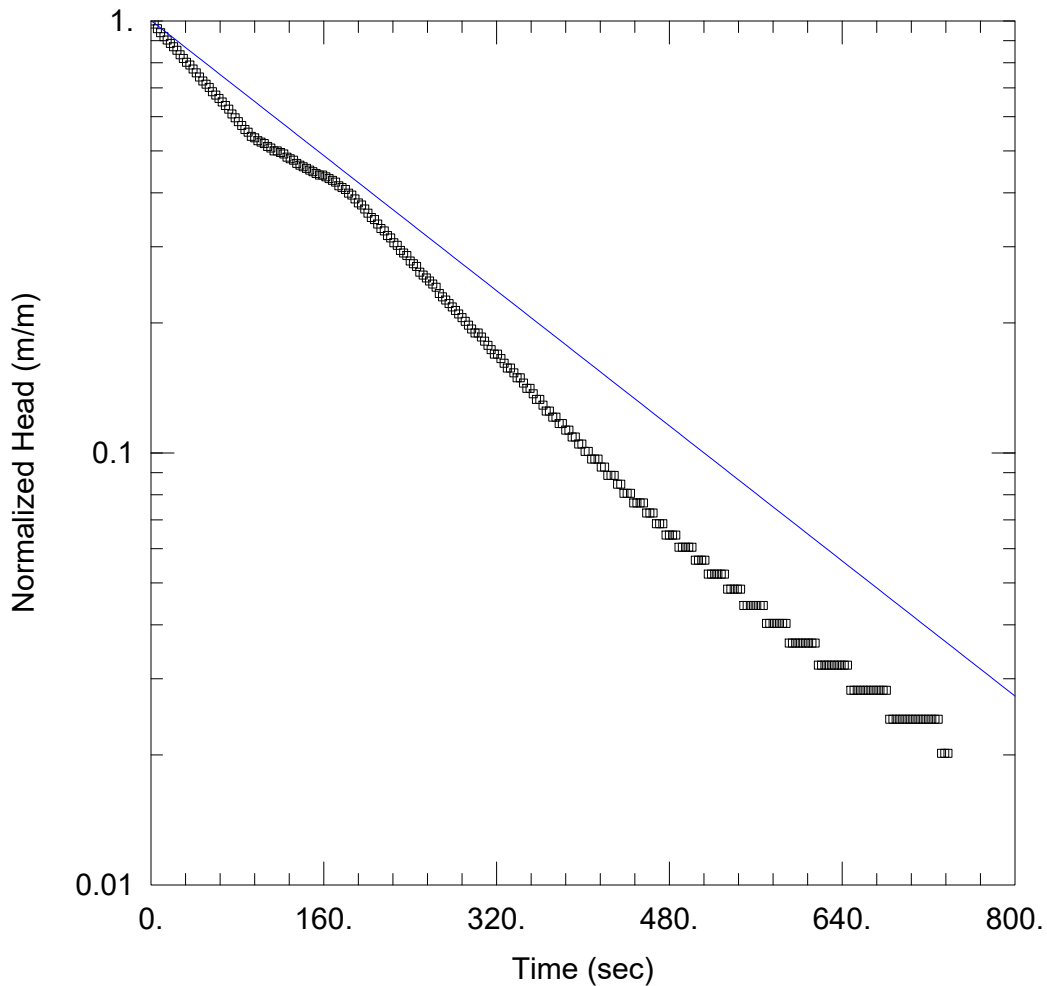
SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

$K = 3.069E-6$ m/sec

$y_0 = -2.718$ m



MW-3 RISING HEAD

Data Set: L:\...\160209 - MW-3 - Hvorslev.aqt

Date: 03/23/21

Time: 16:18:49

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-3

AQUIFER DATA

Saturated Thickness: 1.8 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-3)

Initial Displacement: -2.48 m

Static Water Column Height: 3.41 m

Total Well Penetration Depth: 3.41 m

Screen Length: 1.8 m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

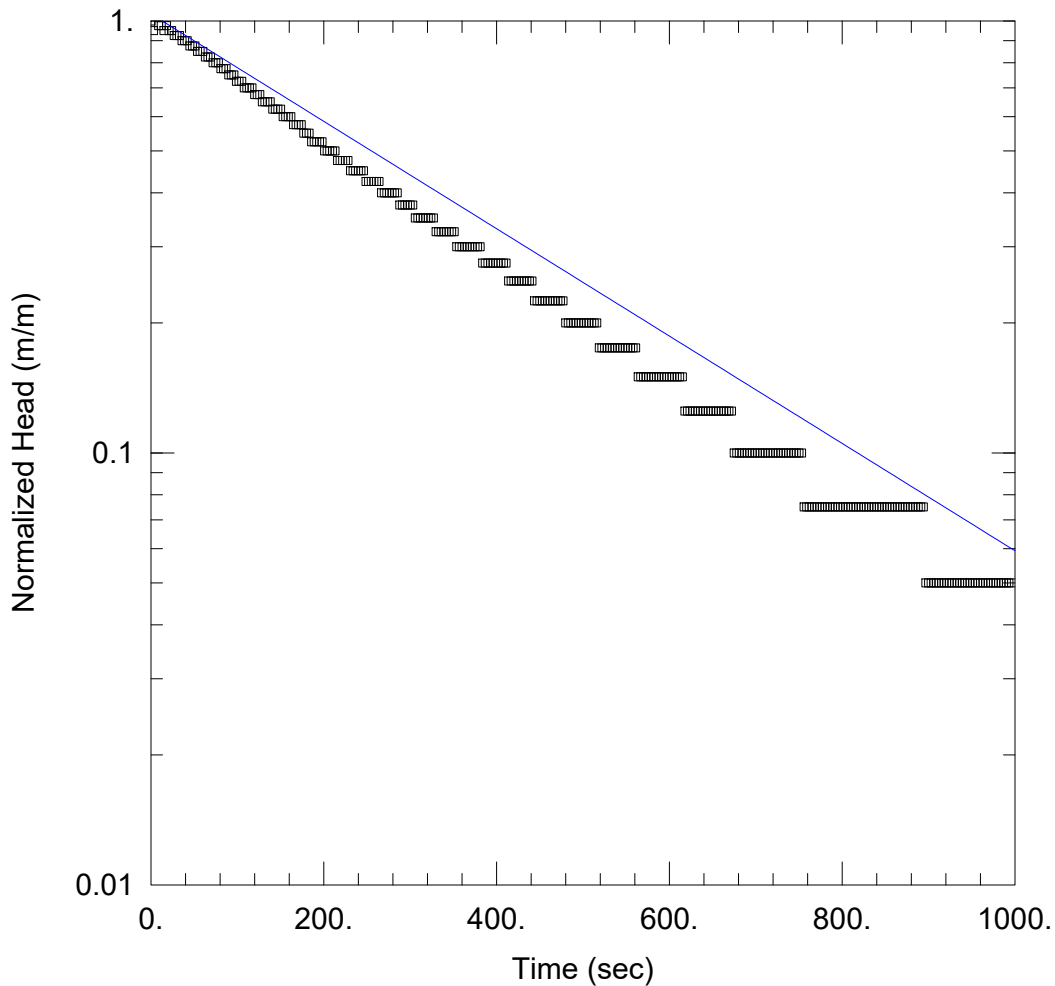
SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

$K = 4.478E-6$ m/sec

$y_0 = -2.486$ m



MW-4 RISING HEAD

Data Set: L:\...\160210 - MW-4 - Hvorslev.aqt

Date: 03/23/21

Time: 16:19:06

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-4

AQUIFER DATA

Saturated Thickness: 3.6 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-4)

Initial Displacement: -4. m

Static Water Column Height: 7.61 m

Total Well Penetration Depth: 7.61 m

Screen Length: 3. m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

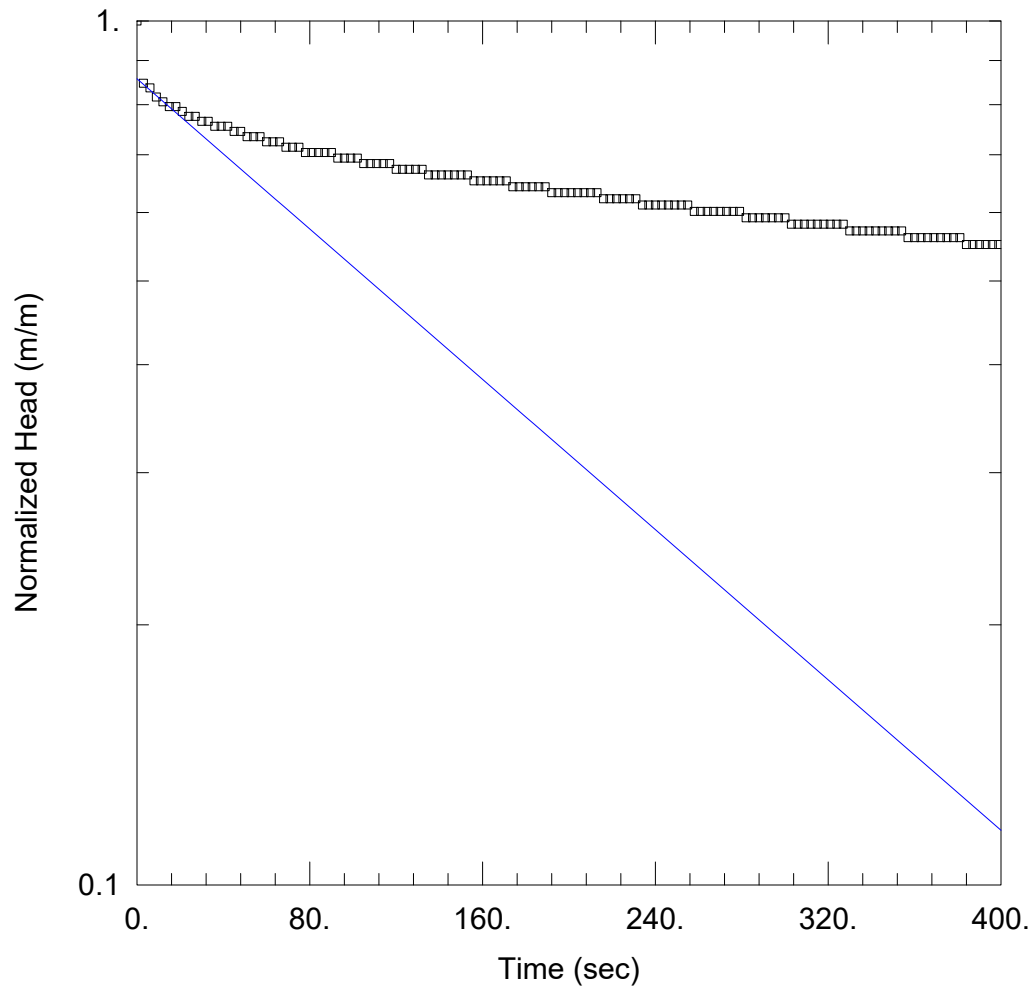
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 6.944\text{E-}6$ m/sec

$y_0 = -4.151$ m



MW-4A

Data Set: L:\...\160210 - MW-4a - Hvorslev.aqt

Date: 03/23/21

Time: 16:19:17

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-4a

AQUIFER DATA

Saturated Thickness: 0.83 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW4a)

Initial Displacement: -0.98 m

Static Water Column Height: 0.83 m

Total Well Penetration Depth: 0.83 m

Screen Length: 0.59 m

Casing Radius: 0.026 m

Well Radius: 0.1015 m

Gravel Pack Porosity: 0.3

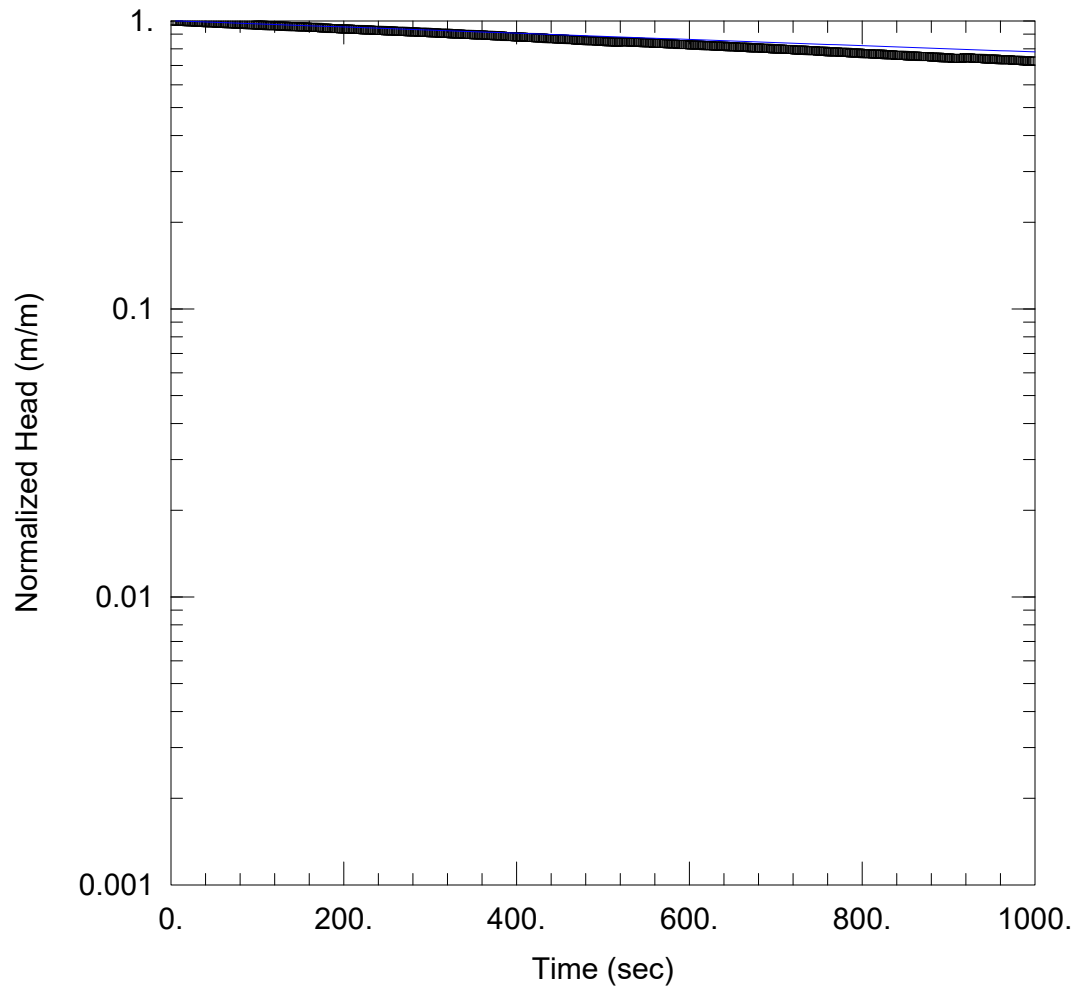
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 3.721E-5$ m/sec

$y_0 = -0.84$ m



WELL TEST ANALYSIS

Data Set: L:\...\160223 - MW-S - Hvorslev - Unconfined.aqt

Date: 03/23/21

Time: 16:19:49

PROJECT INFORMATION

Company: Azimuth Environmental

Test Well: MW-S

AQUIFER DATA

Saturated Thickness: 3. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-S)

Initial Displacement: -2.74 m

Static Water Column Height: 4.22 m

Total Well Penetration Depth: 4.22 m

Screen Length: 3. m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 7.859E-7$ m/sec

$y_0 = -2.744$ m



APPENDIX F

Water Quality Data

Table 5

Ground Water Quality Analytical Results: Hydrocarbons

PROJECT NO.: 16-180		BTEX				HYDROCARBONS				
Borehole	Date (d-m-y)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	F1 (C ₆ -C ₁₀)- BTEX (µg/L)	F1 (C ₆ -C ₁₀) (µg/L)	F2 (C ₁₀ -C ₁₆) (µg/L)	F3 (C ₁₆ -C ₃₄) (µg/L)	F4 (C ₃₄ -C ₅₀) (µg/L)
Table 1 (O.Reg. 153/04*)		0.5	0.8	0.5	72	420	---	150	500	500
Table 2 (O.Reg. 153/04**)		5.0	24	2.4	300	750	---	150	500	500
MW-N	21-Jul-15	<0.20	<20	<0.10	<0.20	<25	<25	<100	<100	<100
MW-S	21-Jul-15	<0.20	0.22	<0.10	<0.20	<25	<25	<100	450	<100
	10-Nov-15	<0.20	<0.20	<0.10	<0.20	<25	<25	<100	<100	<100
	15-Jun-16	<0.20	<0.20	<0.10	<0.20	<25	<25	<100	<100	<100
MW-1	10-Nov-15	<0.2	0.31	<0.1	<0.2	<25	<25	<100	<100	<100
	15-Jun-16	<0.20	0.33	<0.10	<0.20	<25	<25	<100	<100	<100
MW-2	10-Nov-15	<0.2	7.4	<0.1	<0.2	<25	<25	<100	<100	<100
MW-3	10-Nov-15	<0.2	0.81	0.15	0.32	<25	<25	<100	<100	<100
MW-4	10-Nov-15	<0.2	0.61	0.10	<0.2	<25	<25	<100	<100	<100
(duplicate)	10-Nov-15	<0.2	0.57	0.13	<0.2	<25	<25	<100	<100	<100
MW-4a	10-Nov-15	<0.2	0.43	<0.1	<0.2	<25	<25	<100	<100	<100
MW-A1	15-Jun-16	<0.20	0.30	<0.10	<0.20	<25	<25	<100	<100	<100
(duplicate)	15-Jun-16	<0.20	0.29	<0.10	<0.20	<25	<25	<100	<100	<100
MW-A2	15-Jun-16	<0.20	0.32	<0.10	<0.20	<25	<25	<100	<100	<100
MW-B1	15-Jun-16	<0.20	0.48	<0.10	<0.20	<25	<25	<100	<100	<100
MW-B2	15-Jun-16	<0.20	1.1	<0.10	<0.20	<25	<25	<100	<100	<100
MW-C1	15-Jun-16	<0.20	1.1	<0.10	<0.20	<25	<25	<100	<100	<100
MW-C2	15-Jun-16	<0.20	1.3	<0.10	<0.20	<25	<25	<100	<100	<100

NOTES:

1. Bold values indicate parameters above Table 2 guidelines.
2. Hi-lighted values indicate parameters above laboratory detection limits.
3. * denotes O.Reg. 153/04 Table 1 ground water standards for all types of property use.
4. ** denotes O.Reg. 153/04 Table 2 Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use.

Table 6

Ground Water Quality Analytical Results: VOCs

PROJECT NO: 16-180		VOC Parameters																																			
Borehole	Date (d-m-y)	Dichlorodifluoromethane	Vinyl Chloride	Bromomethane	Trichlorofluoromethane	Acetone	1,1-Dichloroethene	Dichloromethane (methylene chloride)	trans-1,2-Dichloroethene	Methyl tert-Butyl Ether	1,1-Dichloroethane	Methyl Ethyl Ketone	cis-1,2-Dichloroethene	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Carbon Tetrachloride	1,2-Dichloropropane	Trichloroethene	Bromodichloromethane	Methyl Isobutyl Ketone	1,1,2-Trichloroethane	Dibromochloromethane	Ethylene Dibromide	Tetrachloroethene	1,1,1,2-Tetrachloroethane	Chlorobenzene	Bromoform	Styrene	1,1,2,2-Tetrachloroethane	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	1,3-Dichloropropene (cis+trans)	n-Hexane		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µ g/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µ g/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	
Table 1 (O.Reg. 153/04*)		590	0.5	0.89	150	2700	0.5	5.0	1.6	15	0.5	400	1.6	2.0	0.5	0.5	0.2	0.5	0.5	2.0	640	0.5	2.0	0.2	0.5	1.1	0.5	5.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
Table 2 (O.Reg. 153/04**)		590	0.5	0.89	150	2700	1.6	50	1.6	15	1.6	1800	1.6	2.4	1.6	200	0.79	5.0	1.6	16	640	4.7	25	0.2	1.6	1.1	30	25	5.4	1.0	59	1.0	3.0	0.5	51		
MW-N	21-Jul-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-S	21-Jul-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	0.31	<0.20	<0.30	<1.0	4.7	<0.20	<0.20	<0.30	<0.20	<0.20	2.1	<0.20	<1.0	<0.20	<0.10	<0.10	3.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.41	
	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	0.34	<0.20	<0.30	<1.0	5.2	<0.20	<0.20	<0.30	<0.20	<0.20	3.5	<0.20	<1.0	<0.20	<0.10	<0.10	3.6	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	3.3	<0.20	<0.20	<0.30	<0.20	<0.20	2.9	<0.20	<1.0	<0.20	<0.10	<0.10	7.7	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-1	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	0.72	<0.20	<0.20	<0.30	<0.20	<0.20	0.29	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.33		
	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	0.94	<0.20	<0.20	<0.30	<0.20	<0.20	0.95	<0.20	<1.0	<0.20	<0.10	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-2	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-3	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-4	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.3		
(duplicate)	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.3		
MW-4a	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	1.4	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20			
MW-A1	24-Jun-16	<0.20	<0.17	<0.20	<0.40	68	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
(duplicate)	24-Jun-16	<0.20	<0.17	<0.20	<0.40	54	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-A2	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	0.30	<0.20	<0.20	<0.30	<0.20	<0.20	0.33	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-B1	24-Jun-16	<0.20	<0.17	<0.20	<0.40	160	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-B2	24-Jun-16	<0.20	<0.17	<0.20	<0.40	11	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-C1	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		
MW-C2	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	1.1	<0.20	<0.30	<0.20	<0.20	<0.20	0.35	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20		

NOTES:

1. Bold values denote parameters above Table 2 guidelines.
2. Hi-lighted values indicate parameters above laboratory detection limits.
3. * denotes O.Reg. 153/04 Table 1 ground water standards for all property use.
4. ** denotes O.Reg. 153/04 Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Conditions in Coarse Grained Soils for Residential/ Parkland/ Institutional Property Use.

Table 7

Ground Water Quality Analytical Results: Inorganics & Trace Metals

PROJECT NO: 16-180		Inorganics						Trace Metals																		
Borehole	Date (d-m-y)	Sodium	Chloride	Nitrate as N	Nitrite as N	Electrical Conductivity	pH	Antimony	Arsenic	Barium	Beryllium	Total Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Uranium	Vanadium	Zinc
		(mg/L)	(mg/L)	(µg/L)	(µg/L)	(µS/cm)		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/ L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Table 1 (O.Reg. 153/04 *)		490	790	---	---	---	---	1.5	13	610	0.5	1700	0.5	11	3.8	5.0	1.9	0.1	23	14	5.0	0.3	0.5	8.9	3.9	160
Table 2 (O.Reg. 153/04**)		490	790	---	---	---	---	6.0	25	1000	4.0	5000	2.7	50	3.8	87	10	0.29	70	100	10	1.5	2.0	20	6.2	1100
MW-N	21-Jul-15	1650	2770	8510	<5000	8970	7.90	<0.50	<1.0	384	<0.50	38.5	<0.20	2.9	1.3	5.0	<0.50	<0.02	0.60	5.7	2.5	<0.20	<0.30	4.6	<0.40	<5.0
MW-S	21-Jul-15	124	232	<500	<500	1490	7.93	0.60	1.6	151	<0.50	63.0	<0.20	<2.0	1.4	1.8	<0.50	<0.02	2.9	6.3	<1.0	<0.20	<0.30	2.2	3.1	5.9

NOTES:

1. **Bold values denote parameters above Table 2 guidelines.**
2. **Hi-lighted values indicate parameters above laboratory detection limits.**
3. **---** in guideline(s) row denotes no criteria, and in data row(s) indicates parameter not analyzed.
4. ***** denotes O.Reg. 153/04 Table 1 ground water standards for all property use.
5. ****** denotes O.Reg. 153/04 Table 2 Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use.



APPENDIX G

Ground Water Elevation Data

Ground Water Level & Elevation Data

Borehole / Monitoring Well No.	Ground Elevation	Total Borehole Depth*		TOC Elevation	Ground Water Levels									
		(mbgs)												
		(m asl)	(m bgl)		(m asl)	(m asl)	13-Jun-16	12-Sep-16	21-Mar-17	24-Mar-21	26-Apr-21	21-May-21	28-Jun-21	30-Apr-22
MW-N	235.07	6.90	228.17	235.07	-	4.45	2.30	-	-	-	-			
MW-S	234.40	11.30	223.10	234.40	6.40	7.21	5.48	-	-	-	-			
MW-1	234.02	15.20	218.82	234.02	6.14	7.22	5.67	-	-	-	-			
MW-2	235.11	13.70	221.41	235.11	-	7.62	5.47	6.50	6.30	6.63	7.06	6.14	6.02	6.73
MW-3	234.93	13.70	221.23	234.93	-	8.05	6.57	7.27	7.00	7.24	7.66	6.82	6.90	7.26
MW-4	234.97	8.60	226.37	234.97	-	6.41	4.81	-	-	-	-			
MW-4A	234.90	14.30	220.60	234.90	-	6.40	4.70	6.12	6.00	5.95	6.33	5.73	5.72	5.95
MW-A1	234.45	15.50	218.95	234.45	6.76	7.61	6.17	-	-	-	-			
MW-A2	234.41	12.04	222.37	234.41	6.71	6.85	6.49	6.94	6.50	6.85	7.19	6.43	6.42	6.84
MW-B1	234.29	15.20	219.09	234.29	6.59	7.63	6.12	6.79	6.55	6.75	7.16	6.34	6.40	6.77
MW-B2	234.31	10.36	223.95	234.31	6.55	7.63	5.98	6.80	6.53	6.75	7.16	6.36	6.40	6.78
MW-C1	234.33	16.00	218.33	234.33	6.59	8.18	5.72	7.03	6.82	7.32	7.7	6.74	6.72	7.44
MW-C2	234.36	13.11	221.25	234.36	6.60	7.50	5.38	6.63	6.40	6.65	6.97	6.2	6.25	7.01
MW101	233.66	8.54	225.12	233.66								5.98	6.09	6.36
MW102	234.03	8.75	225.28	234.03								5.59	5.54	5.77

monitoring well component of borehole

Ground Water Level & Elevation Data

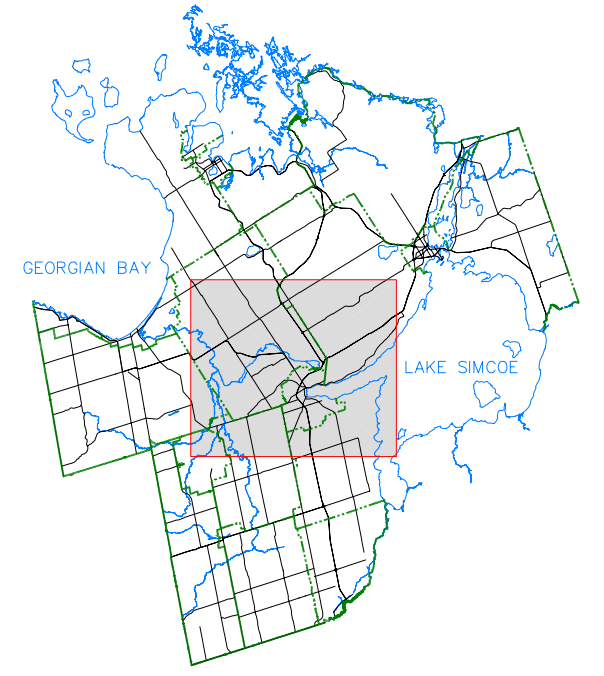
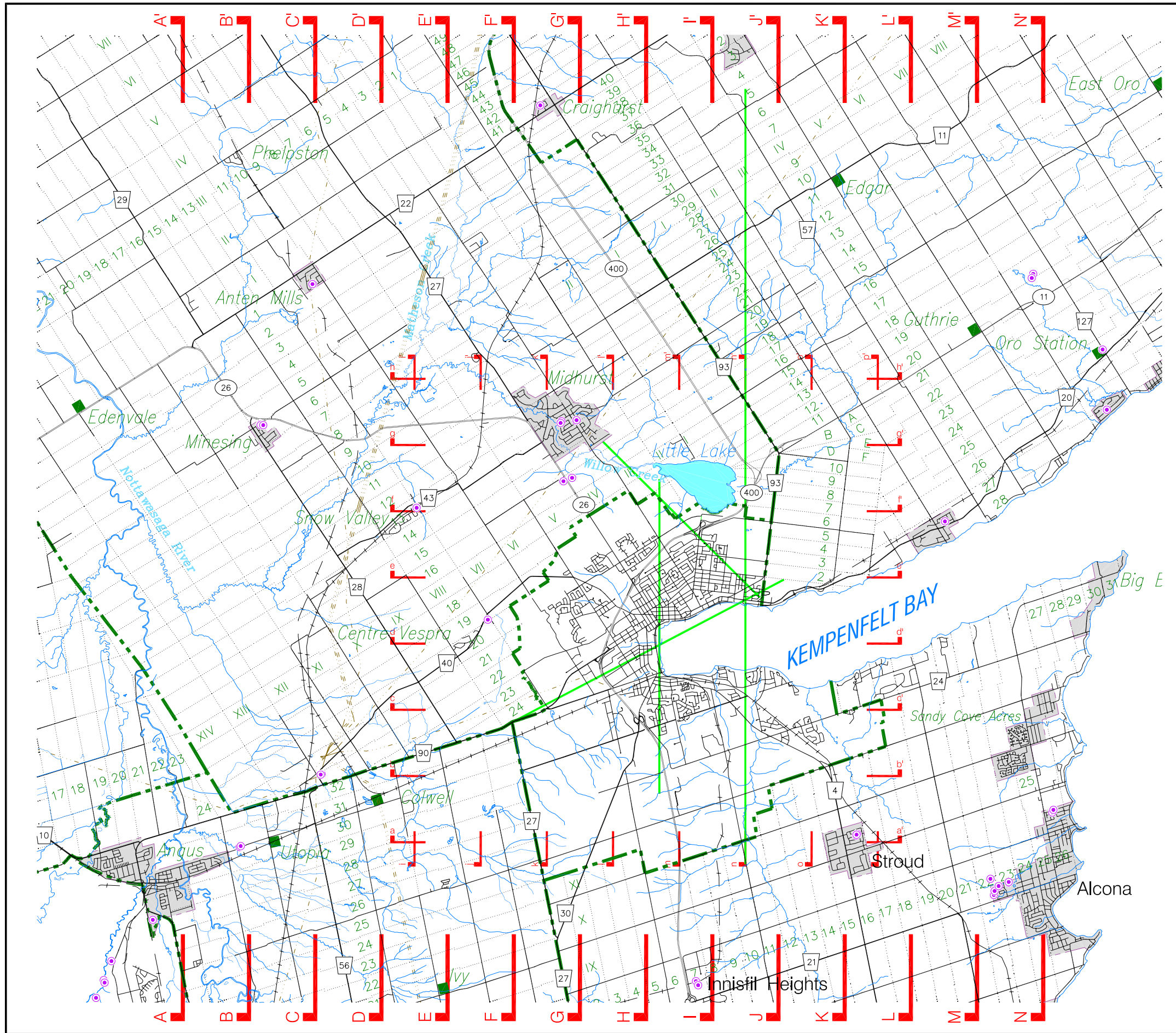
Borehole / Monitoring Well No.	Ground Elevation	Total Borehole Depth*		TOC Elevation	Ground Water Elevations									
		(masl)												
		(m asl)	(m bgl)		(m asl)	(m asl)	13-Jun-16	12-Sep-16	21-Mar-17	24-Mar-21	26-Apr-21	21-May-21	28-Jun-21	30-Apr-22
MW-N	235.07	6.90	228.17	235.07	-	230.62	232.77	-	-	-	-	-	-	-
MW-S	234.40	11.30	223.10	234.40	228.00	227.19	228.92	-	-	-	-	-	-	-
MW-1	234.02	15.20	218.82	234.02	227.88	226.80	228.35	-	-	-	-	-	-	-
MW-2	235.11	13.70	221.41	235.11	-	227.49	229.64	228.61	228.81	228.48	228.05	228.97	229.09	228.38
MW-3	234.93	13.70	221.23	234.93	-	226.88	228.36	227.66	227.93	227.69	227.27	228.11	228.03	227.67
MW-4	234.97	8.60	226.37	234.97	-	228.49	230.09	-	-	-	-	-	-	-
MW-4A	234.90	14.30	220.60	234.90	-	228.57	230.27	228.85	228.97	229.02	228.64	229.24	229.25	229.02
MW-A1	234.45	15.50	218.95	234.45	227.69	226.84	228.28	-	-	-	-	-	-	-
MW-A2	234.41	12.04	222.37	234.41	227.70	227.56	227.92	227.47	227.91	227.56	227.22	227.98	227.99	227.57
MW-B1	234.29	15.20	219.09	234.29	227.70	226.66	228.17	227.50	227.74	227.54	227.13	227.95	227.89	227.52
MW-B2	234.31	10.36	223.95	234.31	227.76	226.68	228.33	227.51	227.78	227.56	227.15	227.95	227.91	227.53
MW-C1	234.33	16.00	218.33	234.33	227.74	226.15	228.61	227.30	227.51	227.01	226.63	227.59	227.61	226.89
MW-C2	234.36	13.11	221.25	234.36	227.76	226.86	228.98	227.73	227.96	227.71	227.39	228.16	228.11	227.35
MW101	233.66	8.54	225.12	233.66								227.68	227.57	227.30
MW102	234.03	8.75	225.28	234.03								228.44	228.49	228.26

monitoring well component of borehole



APPENDIX H

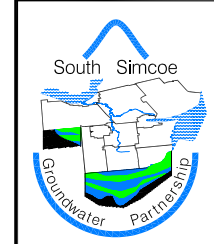
Ground Water Study Figures



- Model Boundary
- Detail Site Section Model Boundary
- Municipal Boundary



SCALE 1:125000



SOUTH SIMCOE GROUNDWATER STUDY
WELLHEAD PROTECTION AREA REPORT
CITY OF BARRIE

MUNICIPAL WELL SYSTEMS CROSS SECTION LOCATIONS

Job No. S41 W01
Date: 29 Apr 03
Drawn: J.Regier
FILE: MDLBARRIE.REG

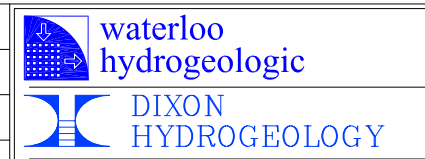
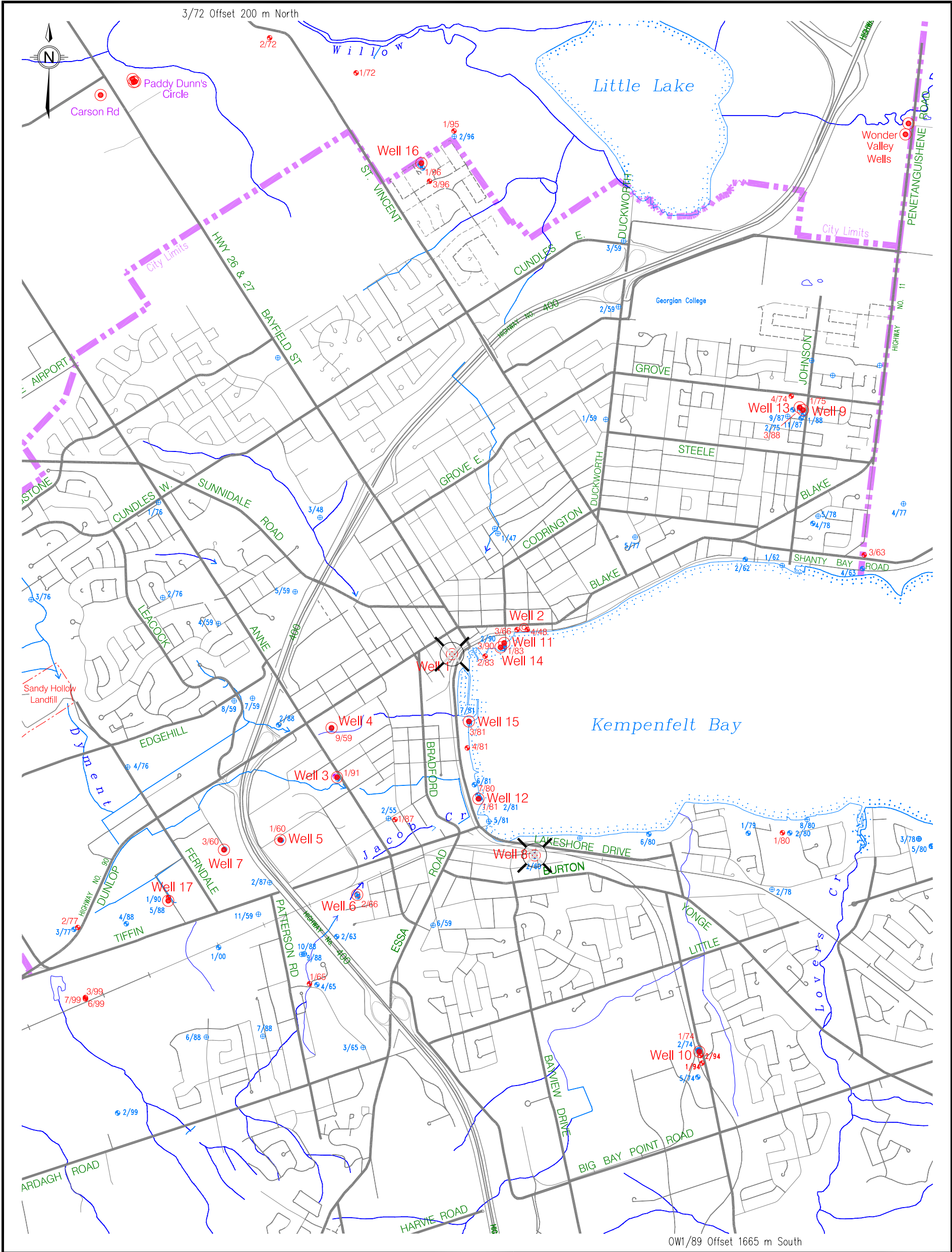
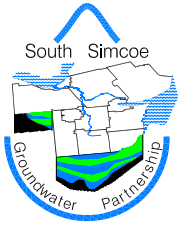
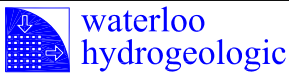
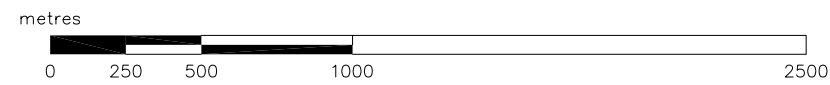
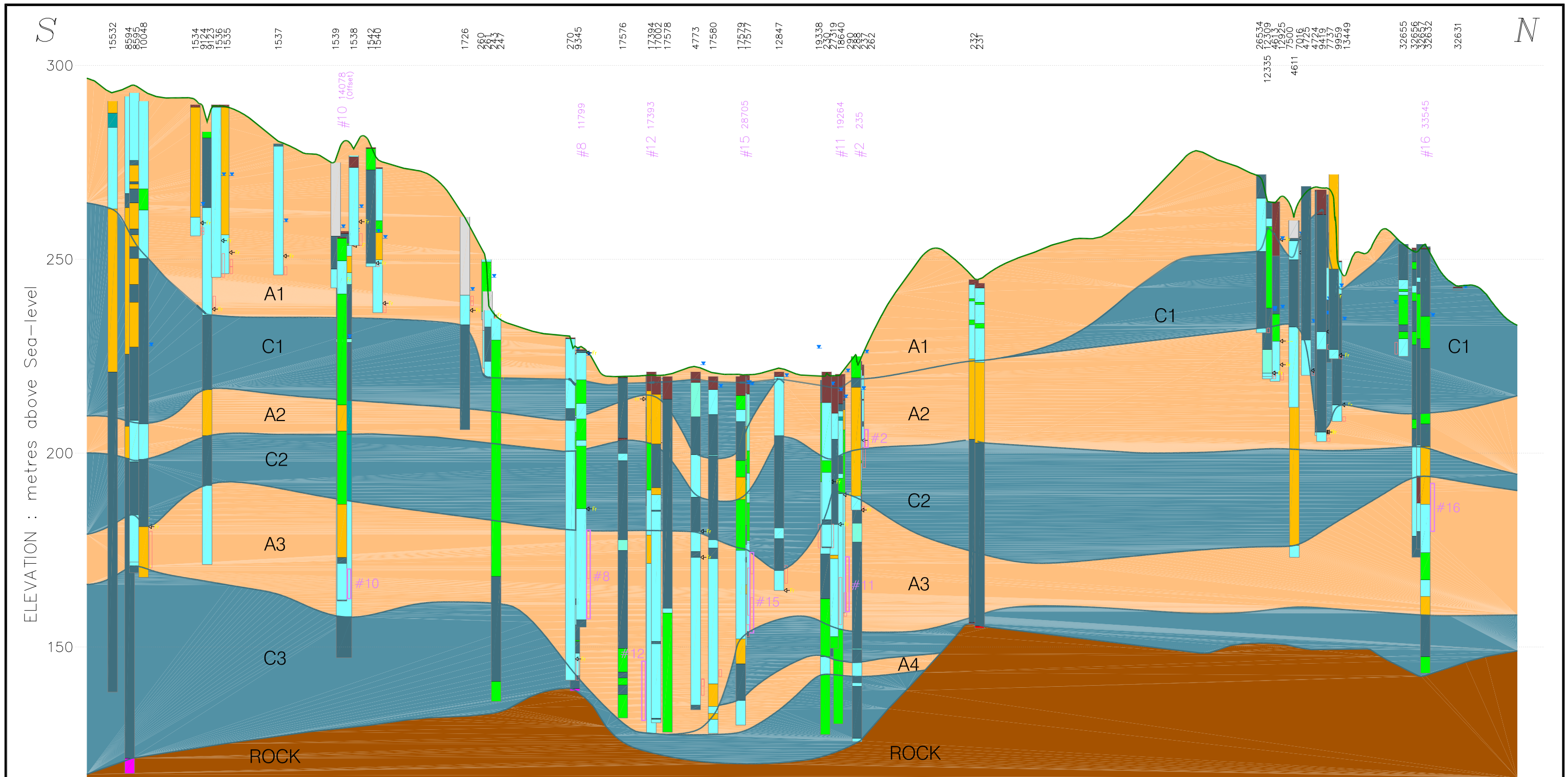


Figure 1.1

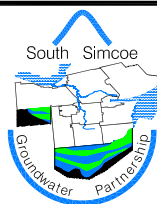


● Municipal Water Supply Well ○ Non-Operational Municipal Well ✕ Abandoned Municipal Well ● Monitored Observation Well ⊕ ⊕ Other Existing Test Hole and Observation Wells		SOUTH SIMCOE GROUNDWATER STUDY WELLHEAD PROTECTION AREA REPORT CITY OF BARRIE	
		MUNICIPAL WELL LOCATIONS OBSERVATION WELLS	
 SCALE 1: 30000	Job No.		  Figure 1.2
	Date: 15 May 03		
Drawn: J. Regier			
FILE: MDLBARRIE:BAR			



SCALE 1:25000

Refer to Figure 3.5 for Legend and Notes



SOUTH SIMCOE GROUNDWATER STUDY
WELLHEAD PROTECTION AREA REPORT
CITY OF BARRIE

Drawn: J Regier

File: MDLBARRIE:E3

Job No. S41 W01

Date: 13 May 03



waterloo
hydrogeologic



DIXON
HYDROGEOLOGY

Figure 3.3

SECTION E3 - E3'

Hydrostratigraphy

	Unknown		Silt Clayey
	Peat/Loam		Clay
	Aquifer		Till
	Aquifer Clayey		Limestones
	Silt		Shales
			Precambrian

Stratigraphy (see Note)

	Aquifer
	Hydrostratigraphic Contact
	Confining Material
	Bedrock
	Limestone or Undifferentiated

Well Section Symbols

	Screen
	Recorded Static Water Level
	Water Producing Zone
	Flowing Well
	MOE Recorded Private Well

NOTE: On all sections, boundaries between soil strata have been determined only at well and test well locations. Between the wells and test wells, boundaries are not proven but are assumed from geological evidence.

Wells are located to MOE Water Well Bulletin Data. Locations and elevations are subject to field verification.

Location Map Symbols (see Note)

	Shallow Dug or Bored <10 m
	Deep Bored Well >10 m
	Drilled Overburden Well
	Test or Observation Well
	Test Pit
	Drilled Bedrock Well
	Sandpoint
	Municipal / Public Supply

HYDROGEOLOGICAL SYMBOLS

Drawn	Job No.	Date: 14 Aug 03
Reviewed	File: HYDSYM_2	Dwg No.



Figure 3.5