Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGICAL INVESTIGATION
PROPOSED SUBDIVISION DEVELOPMENT
24 WELLINGTON STREET
COOKSTOWN, ONTARIO

Prepared for: **Paolini Supermarket Ltd.**
5096 11th Line
Cookstown, Ontario
L0L 1L0

Attention: Mr. Claudio Paolini

File No 3-17-0076-46
Issued: December 08, 2017

©Terraprobe Inc.

Terraprobe Inc.

Greater Toronto
11 Indell Lane
Brampton, Ontario L6T 3Y3
(905) 796-2650 Fax: 796-2250

Hamilton – Niagara
903 Barton Street, Unit 22
Stoney Creek, Ontario L8E 5P5
(905) 643-7560 Fax: 643-7559

Central Ontario
220 Bayview Drive, Unit 25
Barrie, Ontario L4N 4Y8
(705) 739-8355 Fax: 739-8369

Northern Ontario
1012 Kelly Lake Rd., Unit 1
Sudbury, Ontario P3E 5P4
(705) 670-0460 Fax: 670-0558

www.terraprobe.ca

EXECUTIVE SUMMARY

Terraprobe Inc. (Terraprobe) was retained by Paolini Supermarket Ltd. to conduct a hydrogeological investigation for the site located east of a commercial plaza, north of Wellington Street and Fisher Lane, west of John Drive, and south of vacant land, at 24 Wellington Street in Cookstown, Ontario (the "Site"). The purpose of the investigation is to assess the ground water conditions and dewatering requirements for the proposed construction activities at the Site.

The conclusions of the investigation are as follows:

- The subsurface investigation indicates that the Site is generally covered by surficial materials over an earth fill, underlain by clay and silt, then a silty sand till layer.
- The highest ground water elevation at the Site is approximately Elev. 97.8 m, located within the clay and silt. The elevation of the proposed excavation base is assumed to be Elev. 95.2 m based on the anticipated depth of the municipal services.

Short Term (During Construction)

- The estimated water taking volume of the excavation during construction for the Site are as follows:
    - Open Cut Excavation (i.e. sloped walls) with a drained structure when a factor of safety of 1.5 is applied.
        - 2,500± L/day of ground water seepage
    - Permeable Shoring (i.e. lagging wall or open cut) with a drained structure when a factor of safety of 1.5 is applied.
        - 2,000± L/day of ground water seepage
- The collection system should also account for a typical 2-year design storm event which will generate:
    - Approximately 350,600 L from the Site under open-cut conditions, which will result in a total of 353,100 L including ground water.
    - Approximately 228,750 L from the Site under permeable shoring conditions, which will result in a total of 230,750 L including ground water.
- According to O. Reg. 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm event which translates to:
    - Approximately 1,318,350 L from the Site under open-cut conditions.
    - Approximately 860,100 L from the Site under permeable shoring conditions.

- An application will need to be submitted to the Water Taking Environmental Activity and Sector Registry to the Ministry of the Environment and Climate Change (MOECC) due to the combined ground water seepage and potential storm water at the Site exceeding 50,000 L/day.
- No PTTW will be required for the short-term water taking.
- Treatment of the ground water will be required prior to discharge into sewers or surface water bodies due to total suspended solids, aluminum, chromium, and copper exceedances.
- Although the discharge may be directed to a surface water body, as there are no anticipated significant sources of contaminants, an Environmental Compliance Approval will not be required by the MOECC.
- A discharge and monitoring plan will need to be in place during construction.

Long Term (Post-Construction)

- Assuming the final grade of the development is to remain at existing elevations, the estimated long term water taking volume of the drained underground structures requiring maintenance of ground water levels at least 0.5 m below the bottom of the development is as follows:
    - 24,500± L/day of water seepage into drainage when a factor of safety of 1.5 is applied, including potential impacts from precipitation.
- No PTTW will be required for the long-term water taking.
- Although the discharge may be directed to a surface water body, as there are no anticipated significant sources of contaminants, an Environmental Compliance Approval will not be required by the MOECC.
- A discharge and monitoring plan will need to be in place post construction.

TABLE OF CONTENTS

SECTION PAGE

1.0 INTRODUCTION 5

2.0 SCOPE OF WORK 6

3.0 DESCRIPTION OF SITE CONDITIONS 7
3.1 Site Location and Description 7
3.2 Site Topography and Drainage 7
3.3 Regional Physiography and Geology 7
3.4 Ground Water Resources 8
3.5 Site Geology and Hydrogeology 9
3.5.1 Soil 9
3.5.2 Ground Water Elevations 10
3.5.3 Ground Water Quality 11
3.5.4 Aquifer Performance Tests 12
3.6 Site Inspection to Assess Hydrogeologic Features 13
3.7 Guelph Permeameter 14

4.0 DISCUSSION AND ANALYSIS 15
4.1 Summary of Hydrogeological Conditions 15
4.2 Proposed Development Plan 15
4.3 Short-Term Ground Water Control Requirements (Construction Dewatering) 16
4.4 Long-Term Ground Water Control Requirements (Post Construction) 17
4.5 Assessment of Potential Impacts 18
4.5.1 Short Term Discharge of Pumped Ground Water (Construction Dewatering) 18
4.5.2 Long Term Discharge of Pumped Ground Water (Post Construction) 18
4.5.3 Discharge and Monitoring Plan 19
4.5.4 Zone of Influence (ZOI) 19
4.5.5 Geotechnical Considerations 20
4.5.6 Surface Water, Wetlands and Areas of Natural Significance 20
4.5.7 Local Wells and Zone of Influence 21
4.5.8 Development 21
4.5.9 Contamination Sources 21

5.0 CONCLUSIONS AND RECOMMENDATIONS 22

FIGURES:

Figure 1	Site Location Plan
Figure 2	Borehole Location Plan
Figure 3	MOECC Water Well Location Plan
Figure 4	Cross-Section A-A' – MOECC Wells
Figure 5	Cross-Section B-B' – MOECC Wells
Figure 6	Ground Water Elevations

APPENDICES:

Appendix A	Regulatory Mapping
Appendix B	MOECC Well Records
Appendix C	Borehole Logs
Appendix D	Grain Size Analysis
Appendix E	Laboratory Certificates of Analysis
Appendix F	Aquifer Response Tests and Guelph Permeameter Test Results
Appendix G	Finite Element Model Analyses
Appendix H	Proposed Conceptual Development Plan

1.0 INTRODUCTION

Terraprobe Inc. (Terraprobe) was retained by Paolini Supermarket Ltd. to conduct a hydrogeological investigation for the site located east of a commercial plaza, north of Wellington Street and Fisher Lane, west of John Drive, and south of vacant land, at 24 Wellington Street in Cookstown, Ontario (the "Site"). The purpose of the investigation is to assess the ground water conditions and dewatering requirements for the proposed construction activities at the Site. A site location plan is provided as Figure 1.

The Site is bounded by vacant lands and agricultural use to the north, residential properties and John Drive then residential properties to the east, Wellington Street then residential properties to the south, and commercial properties then agricultural use to the west. The development at the Site is approximately 1.2 hectares in size. The Site is currently developed with residential properties and landscaped vacant areas. It is understood that the Site will be redeveloped with residential lots and a commercial lot. The lowest depth of the development is anticipated to be at approximately ±2.0 to ±3.0 m below the existing grade for the installation of site services and underground structures.

It is noted that a local benchmark used as the elevation reference. As such a geodetic elevation reference is not available for this report.

Cookstown Creek runs approximately 50 m north of the north Site boundary. It is noted that the tributary will not contribute additional dewatering volumes to the proposed development as it is located outside of the zone of influence.

2.0 SCOPE OF WORK

The scope of work for the hydrogeologic investigation consisted of the following:

- Completion of single-well response tests. Ground water measurements were completed at all monitoring wells installed as a part of the investigation. Single well response tests were completed at these monitoring well locations. The results of these tests were used to assess the ground water control requirements for the project.

- Assessment of ground water control requirements. An assessment of the ground water inflow rates and volumes for the currently proposed design was completed. The information obtained from the single well response tests and soil grain size information was utilized in order to provide an assessment of the potential ground water control requirements during construction and for the completed structures following construction, if applicable.

- Completion of ground water sampling and analysis. Ground water sampling was completed in order to identity the ground water quality. The results of the analysis were used in order to determine the presence of ground water contamination and to assess options for disposal of the pumped ground water.

- Report preparation. The hydrogeological report has been prepared for the project. A summary of the local ground water conditions in the area has been completed. An evaluation of the proposed construction methods and an assessment of the possible requirements for dewatering or depressurization were completed. Recommendations regarding the estimates of the ground water control volumes and rates are provided. Regulatory requirements for the ground water takings will be discussed.

3.0 DESCRIPTION OF SITE CONDITIONS

3.1 Site Location and Description

The Site is bounded by vacant lands and agricultural use to the north, residential properties and John Drive then residential properties to the east, Wellington Street then residential properties to the south, and commercial properties then agricultural use to the west. The development at the Site is approximately 1.2 hectares in size. The Site is currently developed with residential properties and landscaped vacant areas. It is understood that the Site will be redeveloped with residential lots and a commercial lot. The lowest depth of the development is anticipated to be at approximately ±2.0 to ±3.0 m below the existing grade for the installation of site services and underground structures. A site location plan is provided as Figure 1.

3.2 Site Topography and Drainage

The Site has an approximate ground surface elevation between Elev. 231 masl and Elev. 233 masl and slopes towards Cookstown Creek to the north and towards the west. Cookstown Creek runs approximately 50 m north of the north Site boundary. The creek flows from the east towards an assumed irrigation pond to the west and does not cross the Site. The elevation of the creek is approximately at Elev. 229 masl, or 2 to 4 m below the existing grade at the Site. The approximate depth to ground water, based on Water Well Records in the local area, is 0.6 m to 4.9 m, between Elev. ±226 masl and Elev. ±230 masl. Ground water is expected to flow towards Cookstown Creek locally. Regionally, ground water is expected to flow to the northeast towards Lake Simcoe. It is expected that the majority of the run-off is directed towards Cookstown Creek. Site features are presented in Figure 2.

3.3 Regional Physiography and Geology

The Site is located within the Town of Cookstown and is not located near any municipal wells. The Site is not located within a well head protection zone or a significant ground water recharge area. However, the Site is located within a Highly Vulnerable Aquifer and select source water protection policies may apply. The associated floodplains and mapping are shown in Appendix A.

Based on published geological information for the area, the Site was located within the physiographic region known Peterborough Drumlin Field. The surficial geology at the Site is expected to consist of fine-textured glaciolacustrine deposits including silt and clay, with minor sand and gravel. The bedrock is anticipated to be of the Lindsay Formation consisting of limestone. The approximately depth to bedrock is 86 m, at Elev. 147 metres above sea level (masl).

The geologic and hydrogeologic conditions in the vicinity of the Site were also assessed based on the Ontario Ministry of the Environment and Climate Change (MOECC) well records, attached in Appendix B. The MOECC well locations are presented in Figure 3. A geological cross section of the site was prepared from information obtained from the MOECC water well records and is presented in Figure 4.

In summary, the regional hydrogeology has the following properties:

- Low permeability cohesive deposits overlying the overburden across the Study Area;
- Medium permeability cohesionless deposits underlying the upper overburden within close vicinity of the Site;
    - It is noted that this layer is not present across the other areas within the Study Area;
- Low recharge and yield of ground water within the low permeability deposits;
- Moderate recharge and yield of ground water within cohesionless materials; and,
- No evidence of esker or other permeable deposits based on all well records.

3.4 Ground Water Resources

The MOECC well records located within approximately 500 meters of the Site were reviewed to assess the general nature and use of the ground water resource in the area, attached in Appendix B. An attempt to obtain private well records for properties within the vicinity of the Site was carried out on November 02, 2017. All private wells were either capped, decommissioned, or access was not provided by the owners. Several owners within the vicinity of the Site who replied to the private well survey noted that the water supply has been switched to municipal water. It was confirmed with the residents that water and sewer services were supplied by the Town within these areas. Select owners within the Study Area indicated the presence of a private well in use, but did not wish to participate in the survey.

A summary of the data obtained from this review is presented below. It should be noted that enforcement of the "*Ontario Water Resources Act, R.R.O. 1990, Regulation 903*" increased the number of wells that were tagged and recorded within the last 10 years creating a bias in the number of wells recorded by the MOECC during this period.

Well Construction

- Wells finished in bedrock 44
- Wells finished in overburden 1
- Unknown..... 21
- **Total..... 66**

Well Uses

- Domestic/livestock/irrigation/public..... 19
- Unknown/Not Used/Monitoring 45
- Municipal 2
- **Total..... 66**

Well Depth

- Less than 15 m 23
- 15 to 30 m 11
- Greater than 30 m 15
- Unknown or no well..... 17
- **Total..... 66**

Water services were observed across the Study Area during the site reconnaissance, but private wells were also noted to be in use based on the well survey. It is anticipated that there is some domestic use of the ground water within the vicinity of the Site. The proposed development will be serviced with municipal water. It was noted that two (2) municipal wells were located within the MOECC Well Records. However, based on the current mapping provided by the regulatory jurisdictions, no municipal wells were present within the Study Area. It is noted that no impacts from the development are anticipated to affect the water sources within the vicinity of the Site.

3.5 Site Geology and Hydrogeology

The site stratigraphy is based on the borehole findings, as well as the geotechnical laboratory testing conducted on selected representative soil samples.

In October 2017, Terraprobe advanced eight (8) boreholes at the Site. The borehole locations are shown on Figure 2. The results of the boreholes are recorded on the Borehole Logs provided in Appendix C. The grain size analyses completed for the samples are presented in Appendix D. The borehole locations were laid out in the field and borehole elevations were surveyed by Terraprobe to a local benchmark. These elevations are provided for the purpose of relating borehole stratigraphy and should not be used or relied on for other purposes.

Ground water was found within the monitoring wells installed and were used to conduct in-situ permeability tests and ground water sampling for chemical analyses.

3.5.1 Soil

The following stratigraphy is based on the Terraprobe borehole findings as well as on the geotechnical laboratory testing conducted on selected representative soil samples. It should be noted that the subsurface conditions are confirmed at the borehole locations only and may vary at other locations. In summary, the subsurface soil conditions encountered in the boreholes advanced across the Site were fairly consistent. The stratigraphy described in the subsequent sections is based on the boreholes advanced by Terraprobe in this investigation in October 2017.

Surficial Materials

A surficial layer of topsoil was encountered at all of the borehole locations. The topsoil layer was found to have a thickness of 100mm to 460mm (average 240mm).

Earth Fill

Earth fill was found at all of the borehole locations with the exception of Borehole BH7. The earth fill was identified as being clayey silt, trace sand with varied amounts of organics and trace brick rubble. The earth fill extended to a depth of 0.6 m to 1.8 m below the existing ground surface. BH5 had a buried topsoil/organics layer with a thickness of 0.6 m. This buried topsoil/organics layer was found to extend to a depth of 2.1m below existing ground surface.

Clay and Silt

A native clay and silt deposit was found at all borehole locations advanced across the Site. The native clay and silt deposit was found to be in a firm to hard, moist to wet state. The native clay and silt deposit contained varied amounts of sand (trace to some). The clay and silt deposit extends to the depth of the investigation of 6.6 m below the existing grade at the Site.

Silty Sand

A thin native silty sand deposit was found between 4.8 m and 5.0 m below existing ground surface at Borehole BH6. The silty sand deposit was found to be in a dense and wet state.

Silty Sand Till

A silty sand, some clay, trace to some gravel glacial till deposit was found at the bottom of Boreholes BH1, BH2, BH3, BH5, and BH6. The glacial till deposit was found to be in a compact and wet state.

Bedrock

Bedrock was not encountered in this investigation. Based on MOECC well records and other information available to Terraprobe, the bedrock is approximately 86 m below the existing grade at Elev. 147 masl. The bedrock is anticipated to be of the Lindsay Formation consisting of limestone.

3.5.2 Ground Water Elevations

Monitoring wells were installed at boreholes BH1, BH3, BH4, BH5, and BH7 in October 2017. A total of five (5) monitoring wells with a construction of 50 mm diameter PVC were installed at the Site as part of the investigations to facilitate ground water monitoring across the Site. The water levels measured within the monitoring wells are summarized below:

Borehole No.	Depth of Well (m)	Local Ground Elevation (m)	Stick Up (m)	Strata Captured by Well Screen	Depth (m) / Local Elevation (m) of Water Level in Well			
					2017-Oct-05	2017-Oct-10	2017-Oct-25	2017-Nov-02
BH1	6.9	98.4	0.8	Clay and Silt to Till	Dry	1.8 / 96.6	1.7 / 96.7	1.6 / 96.8
BH3	7.0	98.9	0.8	Clay and Silt to Till	5.1 / 93.8	1.4 / 97.5	1.2 / 97.7	1.2 / 97.7

Borehole No.	Depth of Well (m)	Local Ground Elevation (m)	Stick Up (m)	Strata Captured by Well Screen	Depth (m) / Local Elevation (m) of Water Level in Well			
					2017-Oct-05	2017-Oct-10	2017-Oct-25	2017-Nov-02
BH4*	6.8	99.3	0.8	Clay and Silt	Dry	Dry	4.5 / 94.8	3.6 / 95.7
BH5	6.9	98.3	0.8	Clay and Silt to Till	4.3 / 94.0	0.9 / 97.4	0.7 / 97.6	0.7 / 97.6
BH7	6.9	98.2	0.8	Clay and Silt	2.4 / 95.8	0.6 / 97.6	0.5 / 97.7	0.4 / 97.8

*Notes: * - Water Levels collecting from Borehole BH4 appeared to be unstabilized, and has not been taken into further consideration for ground water flow direction.*

Based on the above measurements, the ground water level at the site is approximately between Elev. 93.8 ± m and Elev. 97.8 ± m, and varies between 0.4 metres and 5.1 metres below grade. The ground water flow direction was determined to be towards the northwest. It was noted that the ground water level at Borehole BH4 was not stabilized during the site visits and has been omitted from use of determining the ground water elevation and direction of flow. The highest stabilized ground water level at the Site is approximately Elev. 97.8 ± m.

The clay and silt layer mainly consists of fine grained materials, and as such is considered to be of low permeability and will unlikely be able to allow flows of water. The underlying silty sand to till layer is likely to allow limited flow of water with a mixture of mainly fine and some coarse materials. This layer is considered to be of low to medium permeability and will allow some volumes of water to flow into the hydrogeological strata. This layer is considered to be a confined aquifer and will likely retain ground water within the silty sand layer.

3.5.3 Ground Water Quality

Samples of ground water were collected by Terraprobe and analysed for the Provincial Water Quality Objectives Standards. A total of one (1) ground water sample was collected for analysis from BH7. The sample was collected directly from the monitoring well and was considered a worst case sample (ID: BH7).

Untreated Sample – BH7

The untreated sample **exceeded** the Limits for Provincial Water Quality Objectives Standards for the following parameters:

- Total Suspended Solids (Limit 25 mg/L, Result 168 mg/L)
- 4AAP-Phenolics (Limit 0.001 mg/L, Result 0.003 mg/L)
    - Note that this parameter is for screening purposes only
- Aluminum (dissolved) (Limit 0.015 mg/L, Result 0.531 mg/L)
- Chromium (total) (Limit 0.001 mg/L, Result 0.00139 ug/L)
- Copper (total) (Limit 0.001 mg/L, Result 0.00157 ug/L)

The full Certificates of Analysis are presented in Appendix E.

As no sewer by-law Standards are available for the Town of Cookstown, the Provincial Water Quality Objectives were used for evaluation of discharge into a sewer or surface water bodies. In addition, these Standards also apply to discharge into surface waters such as drainage ditches and creeks. The ground water will require treatment prior to discharge into the sewers or surface water bodies. Treatment could consist of additional filter cloth wrapped weepers and/or a settlement sump to reduce the total suspended solids. The other parameters exceeding the Standards found within the samples are related to total suspended solids and it is expected that the treatment will reduce the concentrations of the parameters of concern found within the ground water to acceptable levels meeting the applicable Standards. It is noted that limits for 4AAP-Phenolics are noted to be an objective to be used primarily as a screening tool only.

3.5.4 Aquifer Performance Tests

The hydraulic conductivity was determined based on single well response tests, as per the field investigation completed in October 2017. This test involves the rapid removal of water from a single well and monitoring the water level recovery. This test was conducted in the monitoring wells installed by Terraprobe. The data from the tests were analysed using the Bouwer and Rice method (1976). The results of the analysis are presented in Appendix F. The hydraulic conductivities of the strata are as follows:

Monitoring Well	Well Screen Elevation (m)	Strata Screened Within	Hydraulic Conductivity (rising head test, m/s)
BH1	92.3-95.4	Clay and Silt to Till	4×10^{-8}
BH3	92.7-95.8	Clay and Silt to Till	1×10^{-8}
BH5	92.2-95.3	Clay and Silt to Till	3×10^{-9}
BH7	92.1-95.2	Clay and Silt	5×10^{-9}

Based on the grain size analyses completed for the soils, the hydraulic conductivities of the strata are as follows:

Sample ID	Sample Elevation (masl)	Strata Screened Within	Hydraulic Conductivity (Hazen, m/s)
BH1/SS5	95.1	Clay and Silt	3×10^{-9}
BH5/SS7	91.9	Silty Sand Till	8×10^{-9}

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

- Earth Fill (Clayey Silt) 10^{-6} m/s to 10^{-7} m/s
- Native Soil (Clay and Silt) 10^{-8} m/s to 10^{-10} m/s
- Native Soil (Silty Sand Till) 10^{-7} m/s to 10^{-9} m/s

Based on the analyses, the hydraulic conductivity calculated from the rising head test and grain size analyses are relatively consistent with the published values associated with the geological material tested. As such, the hydraulic conductivity values to be used pertaining to the water taking calculations are as follows:

- Earth Fill (Clayey Silt): 1×10^{-6} m/s
- Native Soil (Clay and Silt): 5×10^{-9} m/s
- Native Soil (Silty Sand Till): 1×10^{-8} m/s

3.6 Site Inspection to Assess Hydrogeologic Features

A detailed inspection of the Site was conducted on November 02, 2017 to assess the presence of features which are significant from a hydrogeologic view point. In particular, the Site was inspected to assess the following:

- The presence of drainage features or depressions which may allow for ponding and significant or enhanced infiltration of water.
- Areas of seasonally high ground water levels and/or water courses which may receive ground water discharge and seepage.

The results of the inspection indicated that the topography of the Site generally slopes north towards the Cookstown Creek. The surrounding areas include mainly residential buildings and roadways, with commercial uses adjacent west of the Site. Creekstown Creek was noted to be flowing north of the Site downgradient.

Domestic water wells were observed to be present during the Site reconnaissance. However, no access was provided to these wells. Fire hydrants were also observed during the Site reconnaissance within the

residential subdivisions and commercial areas within the Study Area. It was noted that the majority of the residents were using municipally supplied water.

No substantial vegetation was observed at the Site. Catch basins were observed on the major roadways but were not present within the local residential roadways. It is anticipated that discharge will need to flow to drainage ditches, which will discharge into surface water bodies.

The Site consists mainly of low grass vegetation and appears to be a landscaped area adjacent to residential development, which will be removed during redevelopment.

3.7 Guelph Permeameter

On August 31, 2017, a representative of Terraprobe conducted two (2) Guelph permeameter tests at the Site. The details are enclosed in Appendix F. The results of the Guelph Permeameter Test are summarized in the table below:

Sample ID	Depth (m)	Soil Type	Hydraulic Conductivity (Field Saturated) (mm/hr)
GP1	1.1	Silty Clay, Earth Fill	2.4
GP2	1.0	Clay, some silt to silty	0.07

It should be noted that Terraprobe assumes no responsibility for the application of the above noted percolation rate for use in design of an on-site sewage disposal system. The design of on-site sewage system must be conducted by a qualified professional with due regard for a number of site-specific conditions in addition to the percolation rate of the soil.

Terraprobe does not present the estimated percolation rate given in this report as a warranty of performance for the soil tested. The client or any third party using this information as a basis for tile field design assumes all risk associated with their evaluation of this report and all other criteria used in the design of any private disposal system.

Based on the results of the tests, it was noted that the infiltration rate is very low at the Site. It should be noted that the results of the infiltration rates refer only to the specific locations where the tests were conducted, and the infiltration rates may vary between and beyond the locations of the test locations.

4.0 DISCUSSION AND ANALYSIS

4.1 Summary of Hydrogeological Conditions

The results of the investigation completed by Terraprobe indicate the following hydrogeologic features for the site:

- The highest stabilized ground water level at the Site is approximately Elev. 97.8 ± m.
- The clay and silt layer mainly consists of fine grained materials, and as such is considered to be of low permeability and will unlikely be able to allow flows of water. The underlying silty sand to till layer is likely to allow limited flow of water with a mixture of mainly fine and some coarse materials. This layer is considered to be of low to medium permeability and will allow some volumes of water to flow into the hydrogeological strata. This layer is considered to be a confined aquifer and will likely retain ground water within the silty sand layer.
- Based on a review of the in-situ test and published values, the hydraulic conductivity applicable to the Site are:
    - Earth Fill (Clayey Silt): 1×10^{-6} m/s
    - Native Soil (Clay and Silt): 5×10^{-9} m/s
    - Native Soil (Silty Sand Till): 1×10^{-8} m/s

4.2 Proposed Development Plan

Prevailing Site grade is taken between Elev. 98.2 m and Elev. 99.3 m, as per the local benchmark. Note that these are not geodetic elevations. The proposed development will include a street and condo townhomes, and a future commercial development block. The lowest elevation of the development is anticipated to be at approximately ±2.0 to ±3.0 m below the existing grade for the installation of site services and underground structures (between Elev. ±95.2 m and Elev. ±97.3 m, based on the location on the Site).

It is assumed that either an open cut or permeable shoring will be used during construction. The open cut has assumed a slope ratio of 3:1 to account for the minimum requirements to maintain stable slopes within the excavation.

The assumed relevant construction details for the development are as follows:

Bottom of anticipated excavation ..... Elev. 95.2± masl
Approximate area for dewatering: open cut, existing grade ..... 14,025 m^2 (165 m x 85 m)
Approximate area for dewatering: open cut, base of excavation ..... 12,100 m^2 (157 m x 77 m)
Approximate area for dewatering: permeable shoring, base of excavation ..... 9,150 m^2 (122 m x 75 m)

4.3 Short-Term Ground Water Control Requirements (Construction Dewatering)

It is recommended that the ground water levels be reduced to approximately 1.0 m below the bottom of the proposed excavation in order to achieve a stable working base for construction. Excavation for the foundation will extend to Elev. 95.2± m, with the dewatering requirement of Elev. 94.2± m.

A numerical analysis was conducted utilizing computer software (Slide 7.014, released March 30, 2016, developed by Rocscience Inc.), utilizing the finite element modelling method. The finite element model (FEM) for ground water seepage indicates the short-term (construction) dewatering requirements as provided below. The finite element model results are presented in Appendix G.

The short-term (construction) dewatering estimates for the Site are as follows:

- Open Cut Excavation (i.e. sloped walls) with a drained structure when a factor of safety of 1.5 is applied.
    - 2,500± L/day of ground water seepage
- Permeable Shoring (i.e. lagging wall or open cut) with a drained structure when a factor of safety of 1.5 is applied.
    - 2,000± L/day of ground water seepage

The above estimate does not take into account storm water management from rainfall events. The collection system should also account for a typical 2-year design storm event which will generate:

- Approximately 350,600 L from the Site under open-cut conditions, which will result in a total of 353,100 L including ground water.

- Approximately 228,750 L from the Site under permeable shoring conditions, which will result in a total of 230,750 L including ground water.

The dewatering system should be designed to take into account removal of rainfall from the excavation. According to O. Reg. 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm event which translates to:

- Approximately 1,318,350 L from the Site under open-cut conditions.

- Approximately 860,100 L from the Site under permeable shoring conditions.

The applicable discharge should be posted to the Water Taking Environmental Activity and Sector Registry (EASR) for approval by the MOECC.

Based on the potential ground water seepage and precipitation volumes expected at the Site, a Permit to Take Water is not required in the short term based as the discharge rate is below 400,000 L/day.

However, a posting on the EASR will be required as the ground water discharge combined with the potential storm water exceeds 50,000 L/day.

Although the discharge may be directed to a surface water body, as there are no anticipated significant sources of contaminants, an Environmental Compliance Approval will not be required by the MOECC. It is noted that a discharge and monitoring plan for the dewatering will be required during construction. The details are described in a separate section. The final discharge location will need to be determined by the Client with the appropriate Regulatory Jurisdictions.

4.4 Long-Term Ground Water Control Requirements (Post Construction)

The development is anticipated to consist of drained underground structures and will require maintaining ground water levels below the drainage layer at least 0.5 m below the bottom of the development as per the Geotechnical Investigation completed by Terraprobe entitled "*Geotechnical Investigation Proposed Residential Development 24 Wellington Street Cookstown, Ontario*" dated October 30, 2017, which will require permanent dewatering across the Site to Elev. 94.7 masl. The FEM for ground water seepage indicates the long-term (post construction) drainage requirements as provided below. It is noted that once the development is complete, one (1) model will be sufficient to describe the Site conditions. The finite element model results are presented in Appendix F.

The long-term (post construction) drainage estimates for the Site are as follows:

- 1,000± L/day of water seepage into underground structures across the Site when a factor of safety of 1.5 is applied

Although rainfall is expected to be directed away from the structure, a potential runoff volume was calculated in the event substantial rainfall volumes enter the drainage through cracks. The expected additional runoff from rainfall is not anticipated to exceed approximately 23,500 L/day, which accounts for potential variability of flows due to influxes of water from a 2-year storm event. This results in a total of:

- 24,500± L/day of water seepage into drainage when a factor of safety of 1.5 is applied, including potential impacts from precipitation.

Based on the potential ground water seepage expected at the Site, a Permit to Take Water is not required in the long term as the discharge rate is below 50,000 L/day.

As there are no anticipated significant sources of contaminants, an Environmental Compliance Approval will not be required by the MOECC. It is noted that a discharge and monitoring plan for the dewatering will be required post-construction. The details are described in a separate section. The final discharge location will need to be determined by the Client with the appropriate Regulatory Jurisdictions.

4.5 Assessment of Potential Impacts

4.5.1 Short Term Discharge of Pumped Ground Water (Construction Dewatering)

The water control system should consist of sumps lined with filter material within the excavations.

The dewatering system must be appropriately filtered in order to prevent the pumping of fines and loss of ground during the dewatering activities and should be designed by a Dewatering Contractor.

As per the results from the ground water quality sampling, treatment will be required prior to discharge into surface water bodies or sewers. It is recommended that samples of the discharge water be collected on a regular frequency during dewatering to ensure the water quality meets the applicable Standards.

Visual monitoring of the dewatering discharge should be conducted daily when active. Adjustments to the dewatering system should be made if an increase in turbidity or sediment is noted. As noted within the potential discharge of ground water and storm water, a posting on the EASR will be required to be submitted to the MOECC for review and approval.

4.5.2 Long Term Discharge of Pumped Ground Water (Post Construction)

Currently the development is assumed to be designed as drained structures and a permanent drainage system will be required. Water takings of approximately 24,500 L/day (0.28 L/s) are possible. Any discharge to the surface waters sewer system must comply with the City of Toronto's Sewer Use by-law based on the final discharge location.

As per the discharge below 50,000 L/day over the long term period, a PTTW will not be required for the proposed development.

Any discharge to the sewer system or natural water bodies must comply with the PWQO or other Standards applicable to the proposed discharge location. A PTTW is not anticipated for the long term discharge. No impacts are expected to affect the surrounding properties.

4.5.3 Discharge and Monitoring Plan

In general, the following plan should be implemented during construction dewatering and during the long term dewatering activities:

- An erosion and sediment control plan should be implemented and maintained throughout the construction works and thereafter until the project is complete. These features should be maintained for the long term discharge.
    - Discharge from the systems must allow for dissipation of flow in a form that reduces the potential for scouring and erosion.
- Visual monitoring of the dewatering discharge should be conducted weekly during construction when active and monthly during long term monitoring. Adjustments to the dewatering systems should be made if an increase in turbidity or sediment is noted.
- Water to be discharged from the Site towards the surface water bodies must be treated by a system that has been tested and verified to be able to meet the PWQO. The system will require bi-weekly sampling during construction and quarterly samples post-development for the following parameters of concern:
    - Total suspended solids, aluminum (dissolved) , chromium (total), and copper (total)
- Monthly visual monitoring and quarterly sampling during the long term monitoring may be ceased after two (2) years of compliance. However, the treatment system must be left in place and maintained for operation during the long term monitoring.

4.5.4 Zone of Influence (ZOI)

The Zone of Influence (ZOI) was calculated based on the estimated ground water taking rate and the anticipated hydraulic conductivity recorded at the site. The stratigraphy with water at the Site consists of a clay and silt. The ZOI (also known as Radius of Influence or R_0 Calculation) calculation is as follows:

Equation: $R_0 = 3000*dH*K^{0.5}$ Where dH is the dewatering thickness (m)
K is the hydraulic conductivity (m/s)

Zone of Influence (also known as Radius of Influence or R_0) Calculation:

The ZOI applicable for the Site under the discharge required for the development is:

$R_0 = 3000*3.6\ m*5 \times 10^{-9}\ m/s^{0.5}$

$R_0 = \pm 0.8\ m$

It is noted that as the dewatering depth is lower during the short term discharge in comparison to the long term discharge, the maximum zone of influence is considered to be captured by the short term discharge requirements and is considered to be conservative.

Cookstown Creek and the existing developments located adjacent of the Site will not be affected by the dewatering activities, as indicated in Figures 2 and Figure 3.

4.5.5 Geotechnical Considerations

The Site is located in an area surrounded with residential land use, vacant land use, and minor commercial land use. The Site is bounded by vacant lands and agricultural use to the north, residential properties and John Drive then residential properties to the east, Wellington Street then residential properties to the south, and commercial properties then agricultural use to the west.

The ZOI from the development extends beyond the limits of the Site boundaries and into the sidewalks and parking lots adjacent to the Site. However, no impacts are anticipated at any structures and municipal roads outside of the Site due to the limited ZOI. The residential building located within the Site to be retained is also unlikely to be affected due to the low permeability of the existing soils. Potential impacts to nearby structures should be re-evaluated once the dewatering details have been finalized.

Measurement of ground water levels across the Site is recommended to assess dewatering effectiveness and confirm that the desired water level has been achieved at each part of the Site. The temporary construction dewatering system must be properly installed and screened to ensure the sediment and fine soils will not be removed during the dewatering activities.

4.5.6 Surface Water, Wetlands and Areas of Natural Significance

The nearest watercourse is Cookstown Creek, which runs approximately 50 m north of the north Site boundary. Cookstown Creek ultimately flows into Innisfil Creek. As indicated previously, the ground water control activities will result in localized depression of the ground water table. However, as Cookstown Creek is located outside of the zone of influence from the dewatering activities, there is limited potential that the nearby surface water features will be affected by the development.

As the discharge from the Site may be directed towards Cookstown Creek, monitoring is recommended to confirm the resulting level of impacts from the dewatering operations. Mitigation measures should be implemented if impacts are observed at the surface water body. Monitoring should include visual inspections and measurement of total suspended solids, water depths, and flow rates.

Due to the low permeability values across the soils at the Site and as Cookstown Creek is located below the ground water table at the Site and is downgradient from the Site, there is limited potential for Cookstown Creek to contribute additional dewatering volumes to the proposed development. It is noted that the creek is also located outside of the ZOI. Ground water is expected to flow towards Cookstown Creek from the north of the Site locally, away from the development. Regionally, ground water is

expected to flow to the northeast towards Lake Simcoe. It is expected that the majority of the run-off is directed towards Cookstown Creek. There are no other surface water bodies, wetlands or other sensitive features within the vicinity of the site that may be affected by the dewatering activities.

4.5.7 Local Wells and Zone of Influence

The Site is located within a residential area of Cookstown. Some areas of the Study Area for the Site appears to be serviced with municipal piped water supply. As per the private well survey, several homes appeared to be using private water supplies. However, no tenants or residents utilizing private water supplies provided Terraprobe with access to collect water levels, well depths, or water samples to determine baseline conditions.

The MOECC well records database was searched through the MOECC online Water Well Database for records located on the Site and within a 500 m radius, and are attached in Appendix B. According to the Water Well record search, there are a total of 19 water wells for domestic, livestock, public, municipal, or irrigation use located within 500 m of the Site. It is noted that two (2) municipal wells were present within the Study Area based on the MOECC Well Records. However, as per the regulatory mapping in Appendix A, no municipal wells were present within 3 km of the Site.

Based on the findings, only one (1) well being used for domestic purposes was found within the ZOI at the residential property being retained at the Site. However, as per the private well study, the residents at this address have already switched to municipally supplied water and the well is likely no longer in use.

Potential impacts from the dewatering are unlikely to be present within the wells found within the Study Area. No monitoring program is required as there are no wells in use that may be impacted within the Study Area.

4.5.8 Development

Once the Site is developed with the proposed infrastructures and residential subdivision, there may be preferential groundwater flow along the granular bedding materials where the underground services are located due to the higher permeability in comparison to the native soils at the Site. This can be prevented by installing low permeability barriers across the service trenches cross-section such as clay plug or non-shrinkable grout to prevent ground water migration along the granular bedding. These barriers should be compacted and extend for a minimum length of 750 mm along the utility trench and across its full width. The plug should extend to the base of the overlying cap barrier. It is recommended that these barriers be installed at each utility connection at each maintenance hole.

4.5.9 Contamination Sources

The Site and immediately surrounding area currently consists of residential areas, vacant land, and commercial retail plazas. No Records of Site Conditions (RSCs) have been filed for the Site or the surrounding properties. No significant contamination sources are anticipated.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions of the investigation are as follows:

- The subsurface investigation indicates that the Site is generally covered by surficial materials over an earth fill, underlain by clay and silt, then a silty sand till layer.
- The highest ground water elevation at the Site is approximately Elev. 97.8 m, located within the clay and silt. The elevation of the proposed excavation base is assumed to be Elev. 95.2 m based on the anticipated depth of the municipal services.

Short Term (During Construction)

- The estimated water taking volume of the excavation during construction for the Site are as follows:
    - Open Cut Excavation (i.e. sloped walls) with a drained structure when a factor of safety of 1.5 is applied.
        - 2,500± L/day of ground water seepage
    - Permeable Shoring (i.e. lagging wall or open cut) with a drained structure when a factor of safety of 1.5 is applied.
        - 2,000± L/day of ground water seepage
- The collection system should also account for a typical 2-year design storm event which will generate:
    - Approximately 350,600 L from the Site under open-cut conditions, which will result in a total of 353,100 L including ground water.
    - Approximately 228,750 L from the Site under permeable shoring conditions, which will result in a total of 230,750 L including ground water.
- According to O. Reg. 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm event which translates to:
    - Approximately 1,318,350 L from the Site under open-cut conditions.
    - Approximately 860,100 L from the Site under permeable shoring conditions.
- An application will need to be submitted to the Water Taking Environmental Activity and Sector Registry to the Ministry of the Environment and Climate Change (MOECC) due to the combined ground water seepage and potential storm water at the Site exceeding 50,000 L/day.
- No PTTW will be required for the short-term water taking.
- Treatment of the ground water will be required prior to discharge into sewers or surface water bodies due to total suspended solids, aluminum, chromium, and copper exceedances.

- Although the discharge may be directed to a surface water body, as there are no anticipated significant sources of contaminants, an Environmental Compliance Approval will not be required by the MOECC.
- A discharge and monitoring plan will need to be in place during construction.

Long Term (Post-Construction)

- Assuming the final grade of the development is to remain at existing elevations, the estimated long term water taking volume of the drained underground structures requiring maintenance of ground water levels at least 0.5 m below the bottom of the development is as follows:
    - 24,500± L/day of water seepage into drainage when a factor of safety of 1.5 is applied, including potential impacts from precipitation.
- No PTTW will be required for the long-term water taking.
- Although the discharge may be directed to a surface water body, as there are no anticipated significant sources of contaminants, an Environmental Compliance Approval will not be required by the MOECC.
- A discharge and monitoring plan will need to be in place post construction.

We trust this report meets with your requirements. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Yours truly,

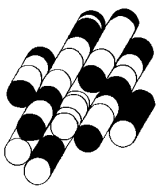
Terraprobe Inc.

Zenith Wong, P.Eng., QP_{ESA}
Project Manager

Matthew J. Bielaski, P.Eng., QP_{RA}
Associate

FIGURES

TERRAPROBE INC.



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:
Microsoft Streets & Trips Map

Notes:

Legend:
Site Boundary

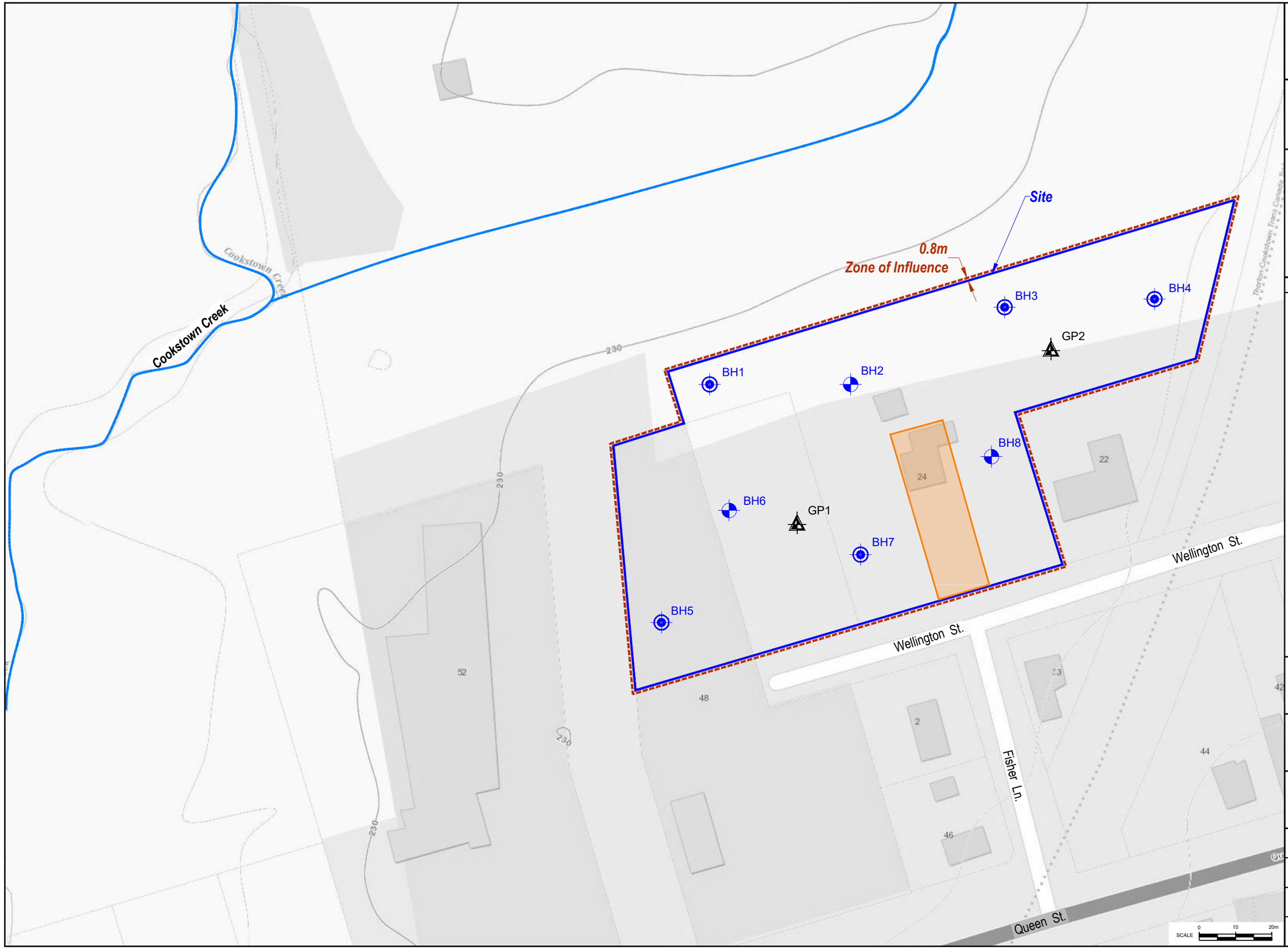
Project Title:
Hydrogeological Investigation

Site Location:
24 Wellington Street, Cookstown, Ontario

Figure Title:
SITE LOCATION PLAN

Designed By: ZW	***File No.:*** 3-17-0076-46
Drawn By: SK	***Scale:*** As Shown
Reviewed By: MB	***Figure No.:*** 1
Date: November 2017	

T:\1-Projs\Files\2017\Admin\Folder\3-17-0076-24 Wellington St, Cookstown\4-Hydro\5-GIS_Dwgs\Jpeg\ArcGIS\3-17-0076-46 Hydro-01.mxd, 24



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:
Google Earth Pro 2017

Notes:

Legend:

- Site Boundary
- Monitoring Well Locations
- Borehole Locations
- Guelph Permeameter Test Locations
- Development to be Retained On-Site
- Water Body
- Zone of Influence, 0.8 m

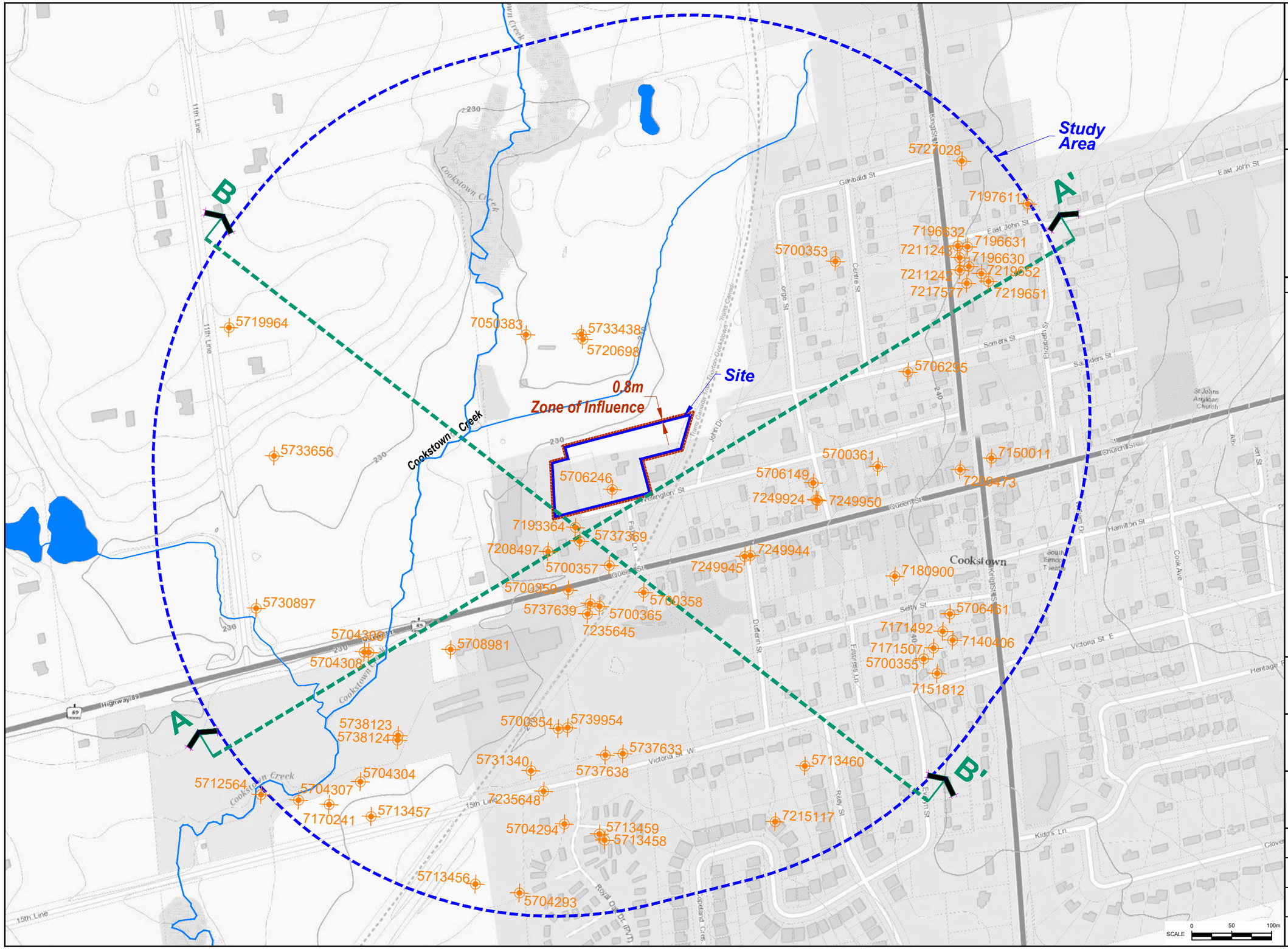
Project Title:
Hydrogeological Investigation

Site Location:
24 Wellington Street, Cookstown, Ontario

Figure Title:
BOREHOLE LOCATION PLAN

Designed By: ZW	*File No.:* 3-17-0076-46
Drawn By: JB	*Scale:* As Shown
Reviewed By: MB	*Figure No.:* 2
Date: November 2017	

T:\Projects\Active\3-Barrie\Archive\3-17-0076-24 Wellington St, Cookstown\4-Hydro-GA Dwgs\Hydro-GA Dwgs.dwg\Hydro-GA Dwg. 3-17-0076-46 Wellington St, Cookstown.dwg, 3-17-0076-46 Wellington St, Cookstown, 3-17-0076-46 Wellington St, Cookstown



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:
Google Earth Pro 2017

Notes:

Legend:

- Site Boundary
- Approximate MOECC Water Well Location
- 7149879 — MOECC Well Record Reference
- Approximate Cross Section Location
- Water Body
- Zone of Influence, 0.8 m

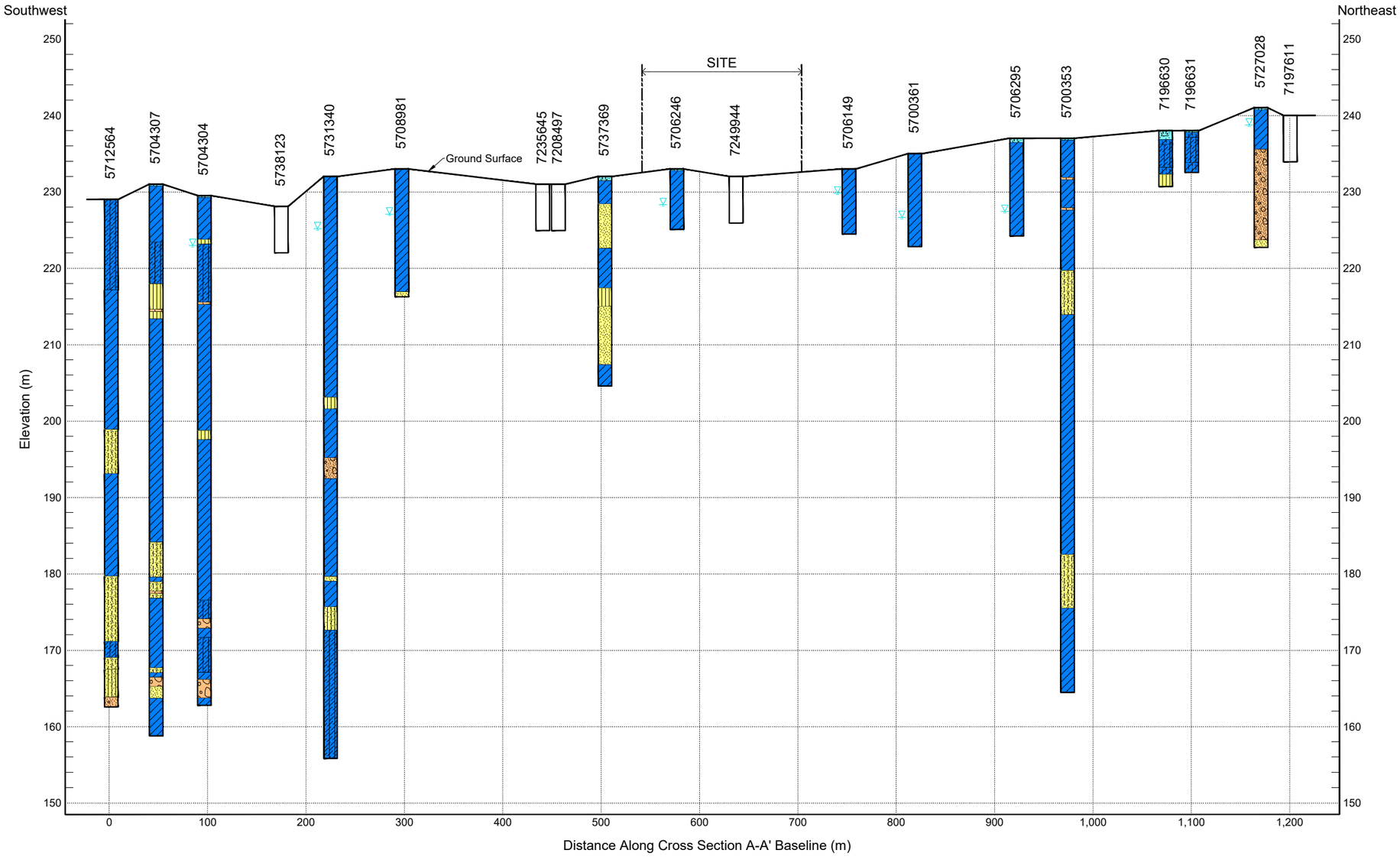
Project Title:
Hydrogeological Investigation

Site Location:
24 Wellington Street, Cookstown, Ontario

Figure Title:
MOECC WATER WELL LOCATION PLAN

Designed By: ZW	**File No.:** 3-17-0076-46
Drawn By: JB	**Scale:** As Shown
Reviewed By: MB	**Figure No.:** 3
Date: November 2017	

T:\1-Projects\Files\2017\Admin\Visio\3-17-0076-47\Wellington St, Cookstown\Hydro GIS\Arcy_Logs\Arcs\3-17-0076-46 Hydro GIS.dwg, 24



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:

Notes:

Legend:

- TOPSOIL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- No Information per MOECC Well Records
- Water Level "Found At"
- 5700361 MOECC Well Record Reference

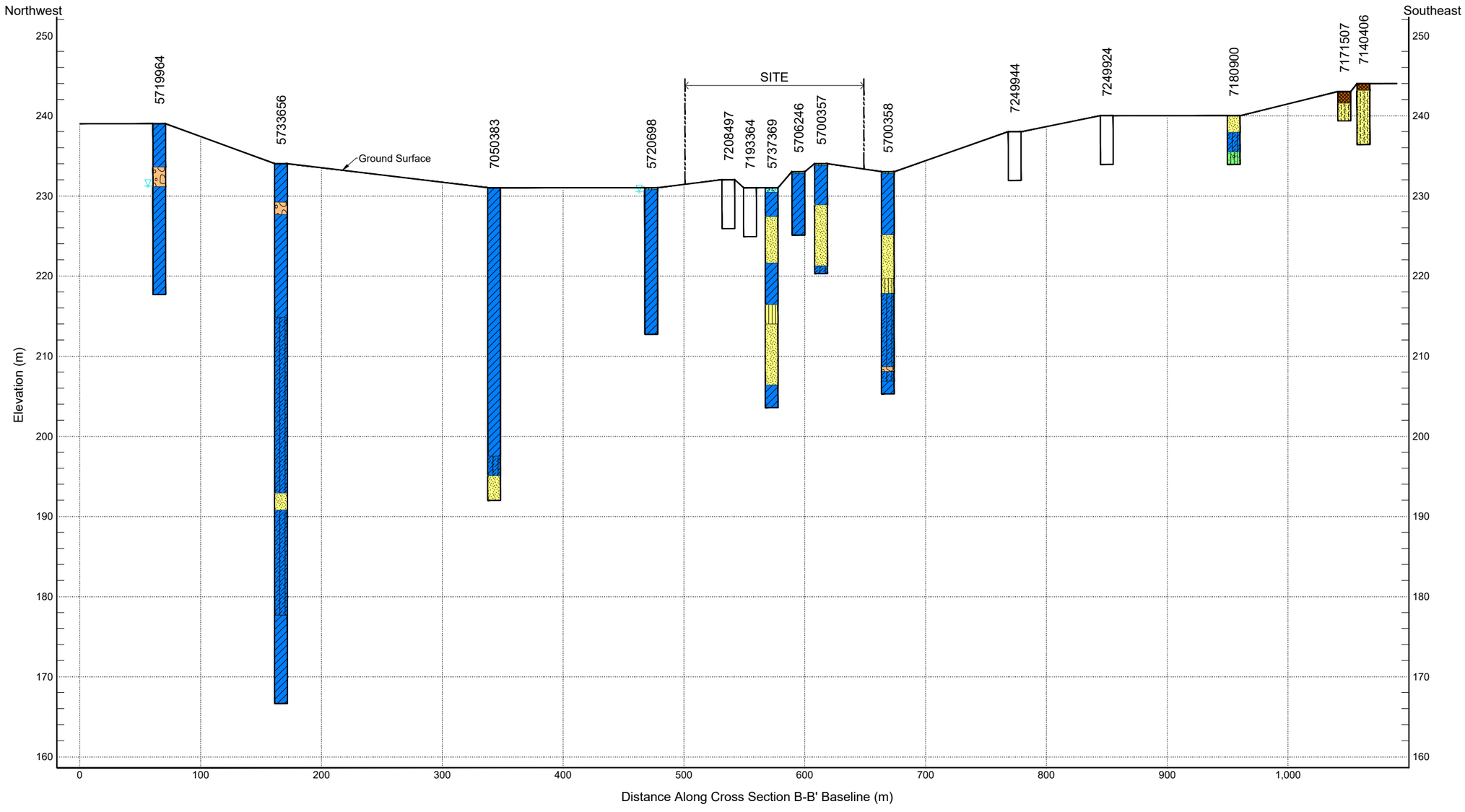
Project Title:
Hydrogeological Investigation

Site Location:
24 Wellington Street, Cookstown, Ontario

Figure Title:
CROSS SECTION A-A'
MOECC WELLS

Designed By: ZW	***File No.:*** 3-17-0076-46
Drawn By: SK	***Scale:*** As Shown
Reviewed By: MB	***Figure No.:*** 4
Date: November 2017	

T:\1-Projects\Nov2017\Barrett Hydro\3-17-0076-24 Wellington St, Cookstown\4b Hydro\5A Chart\ Logs\AutoCAD\3-17-0076-46 Hydro 4 Geo.SK



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:

Notes:

Legend:

	TOPSOIL
	FILL
	GRAVELS (gravel to gravelly sand)
	SILT TO SAND (not till)
	COHESIVE SOILS (clayey silt to clay, incl. tills)
	COHESIONLESS TILLS
	No Information per MOECC Well Records
▽	Water Level "Found At"
5700357	MOECC Well Record Reference

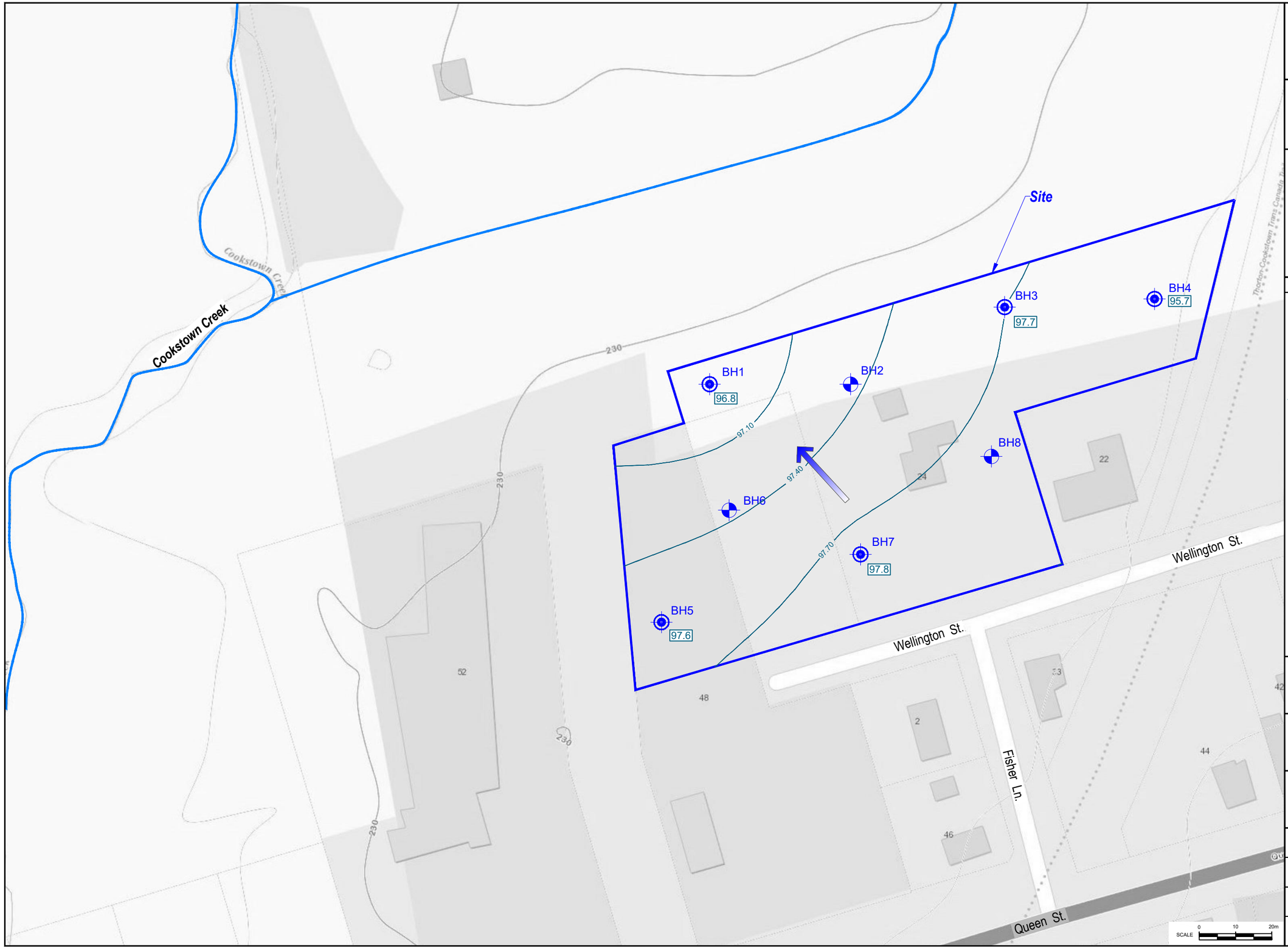
Project Title:
Hydrogeological Investigation

Site Location:
24 Wellington Street, Cookstown, Ontario

Figure Title:
CROSS SECTION B-B'
MOECC WELLS

Designed By: ZW	***File No.:*** 3-17-0076-46
Drawn By: SK	***Scale:*** As Shown
Reviewed By: MB	***Figure No.:*** 5
Date: November 2017	

T:\1 Projects\Files\2017\Branch\Vistas\3-17-0076-14 Wellington St, Cookstown\04 Hydro\03-4 Drwg\ Logs\AutoCAD\3-17-0076-46 Hydro-G-Dwg.S4



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:
Google Earth Pro 2017

Notes:
BH 4 -Ground Water Level not Stabilized

Legend:

- Site Boundary
- Monitoring Well Locations
- Borehole Locations
- 96.5 — Ground Water Elevation (m)
- 96.5 — Ground Water Elevation Contour
- Ground Water Flow Direction
- Water Body

Project Title:
Hydrogeological Investigation

Site Location:
24 Wellington Street, Cookstown, Ontario

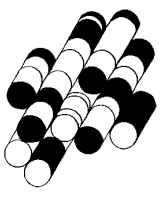
Figure Title:
GROUND WATER ELEVATIONS

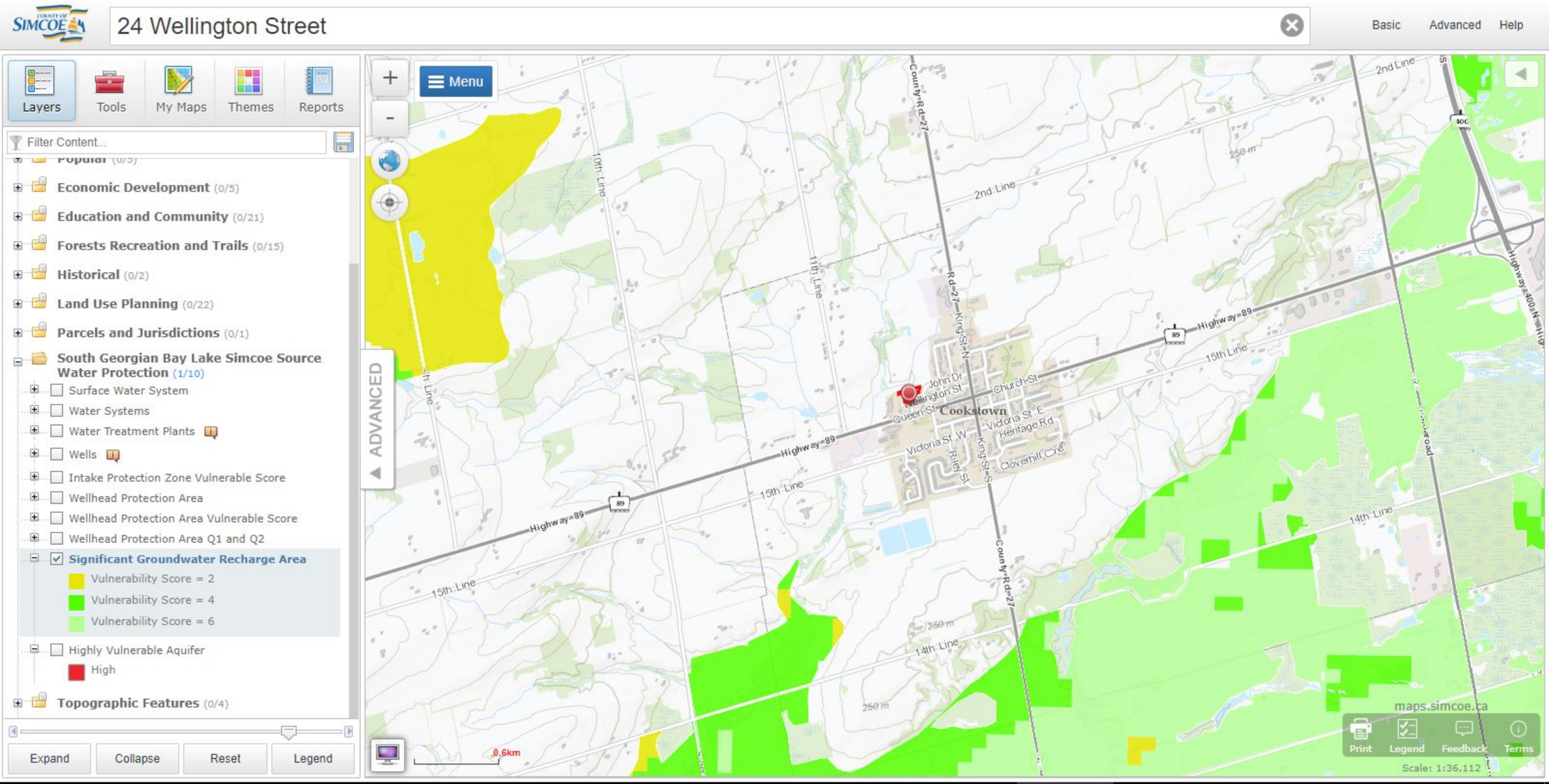
Designed By: ZW	***File No.:*** 3-17-0076-46
Drawn By: JB	***Scale:*** As Shown
Reviewed By: MB	***Figure No.:*** 6
Date: November 2017	

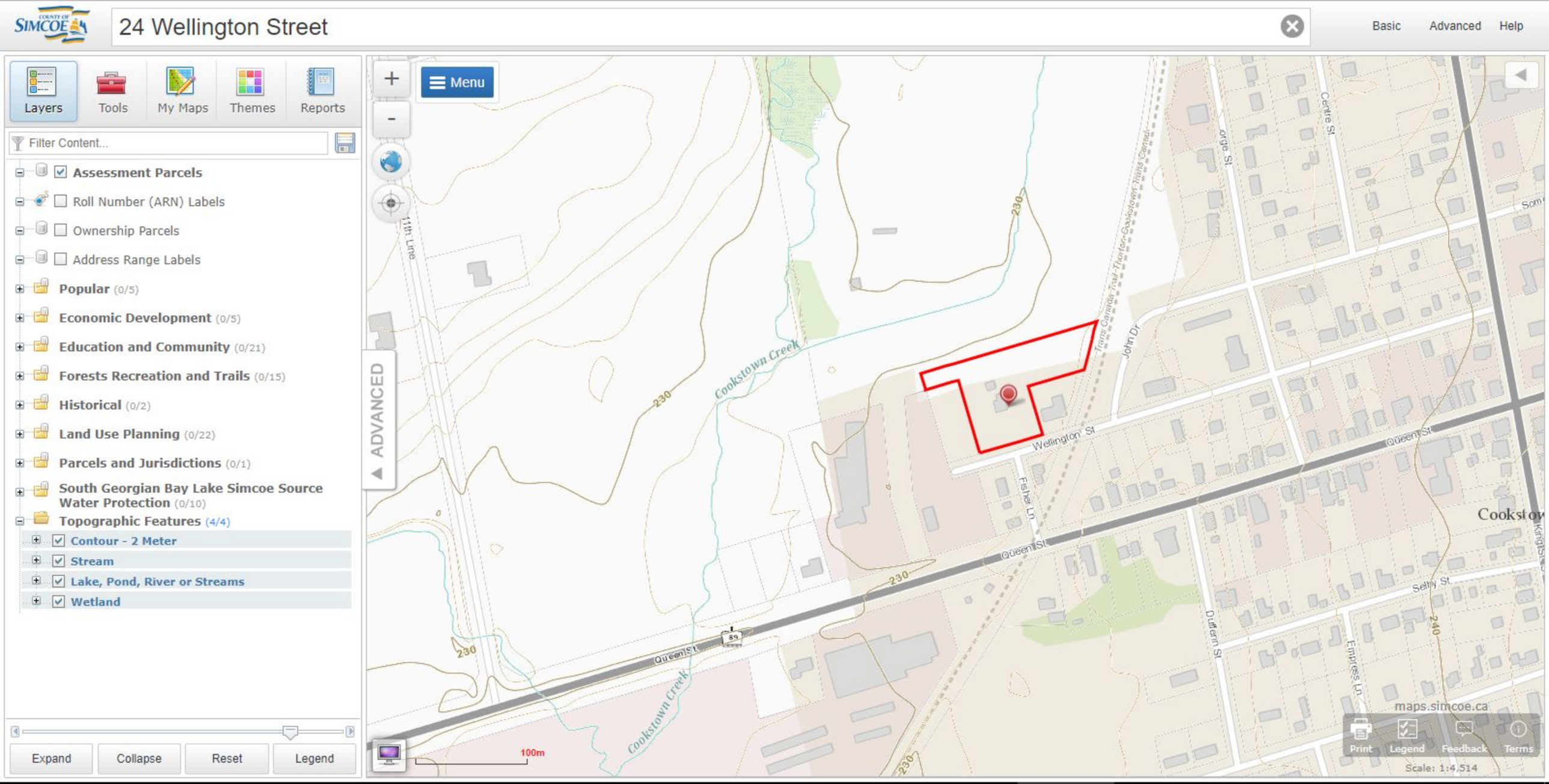
D:\Project Files\2017\Barrie\Orders\3-17-0076-X Wellington St, Cookstown\06- Hydro\04-Dwgs Logs\AutoCAD\3-17-0076-46 Hydro-6.dwg 1:X

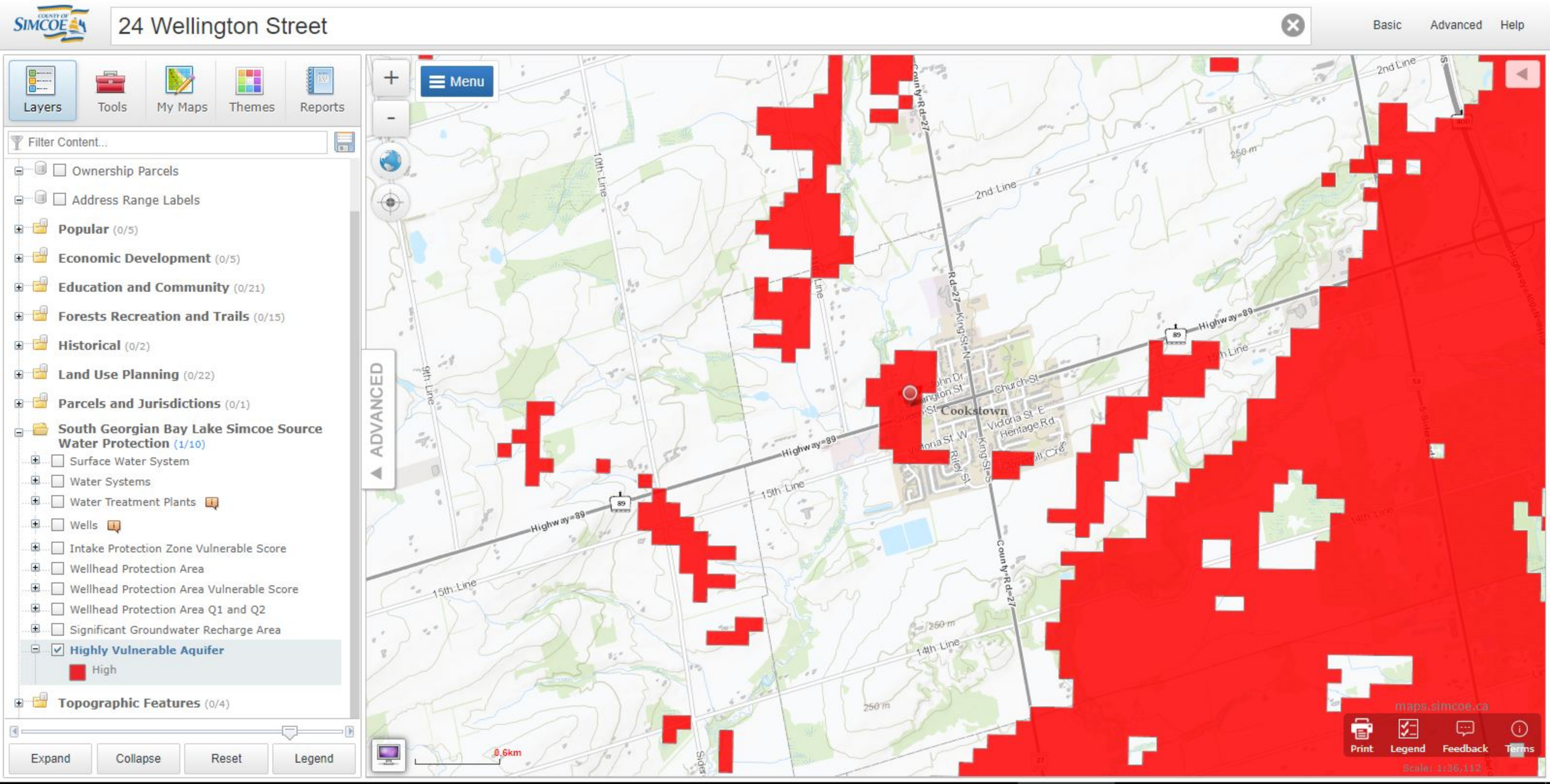
APPENDIX A

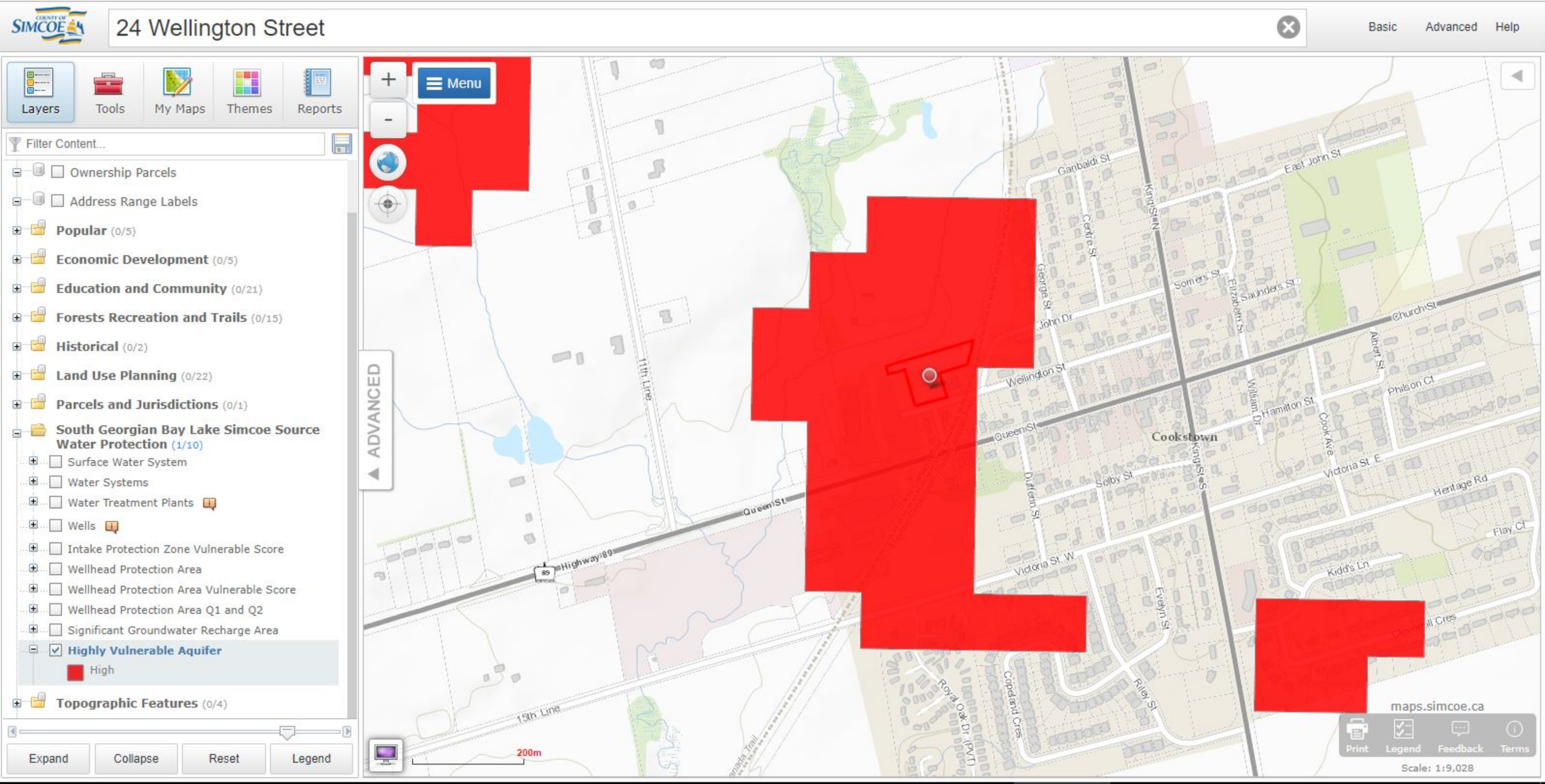
TERRAPROBE INC.

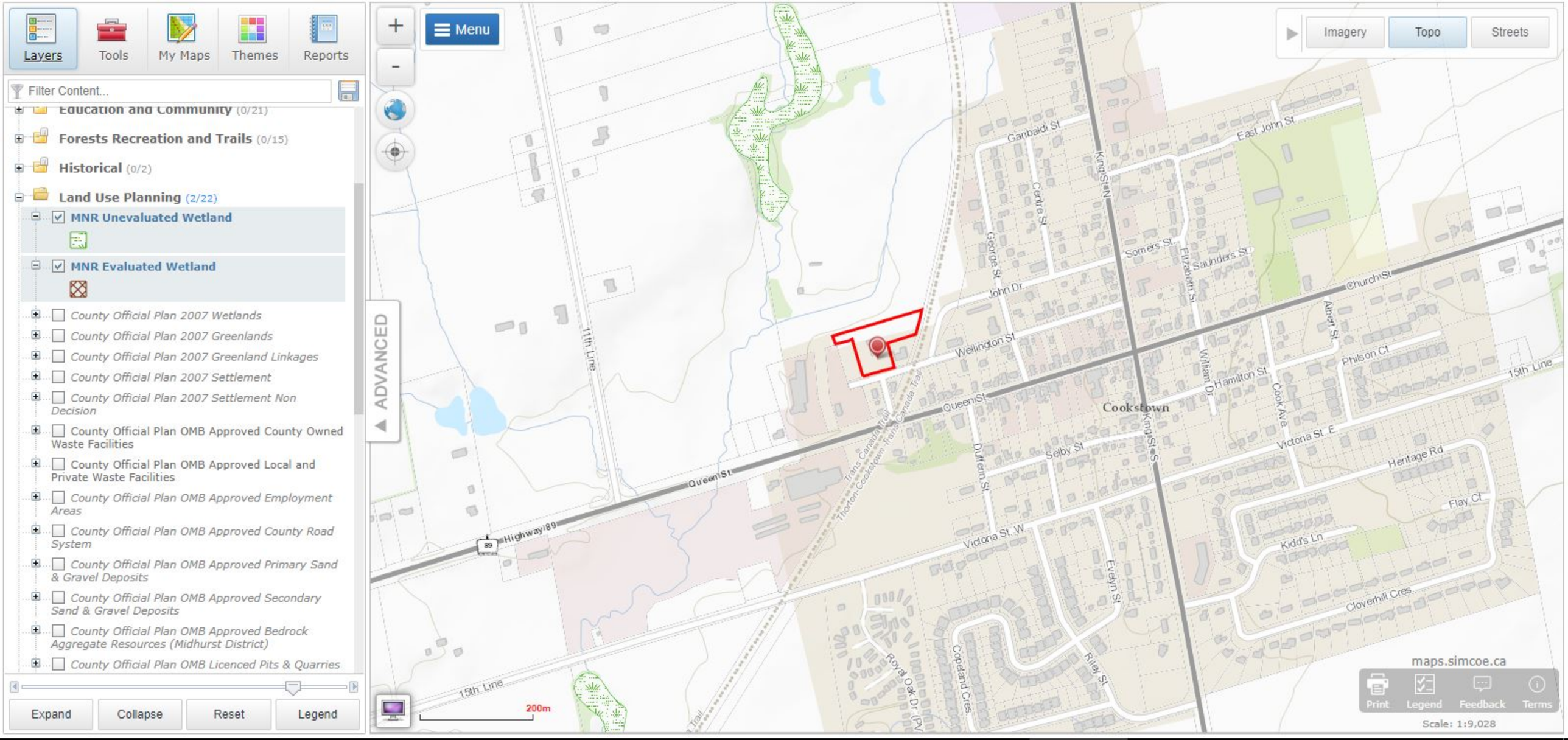


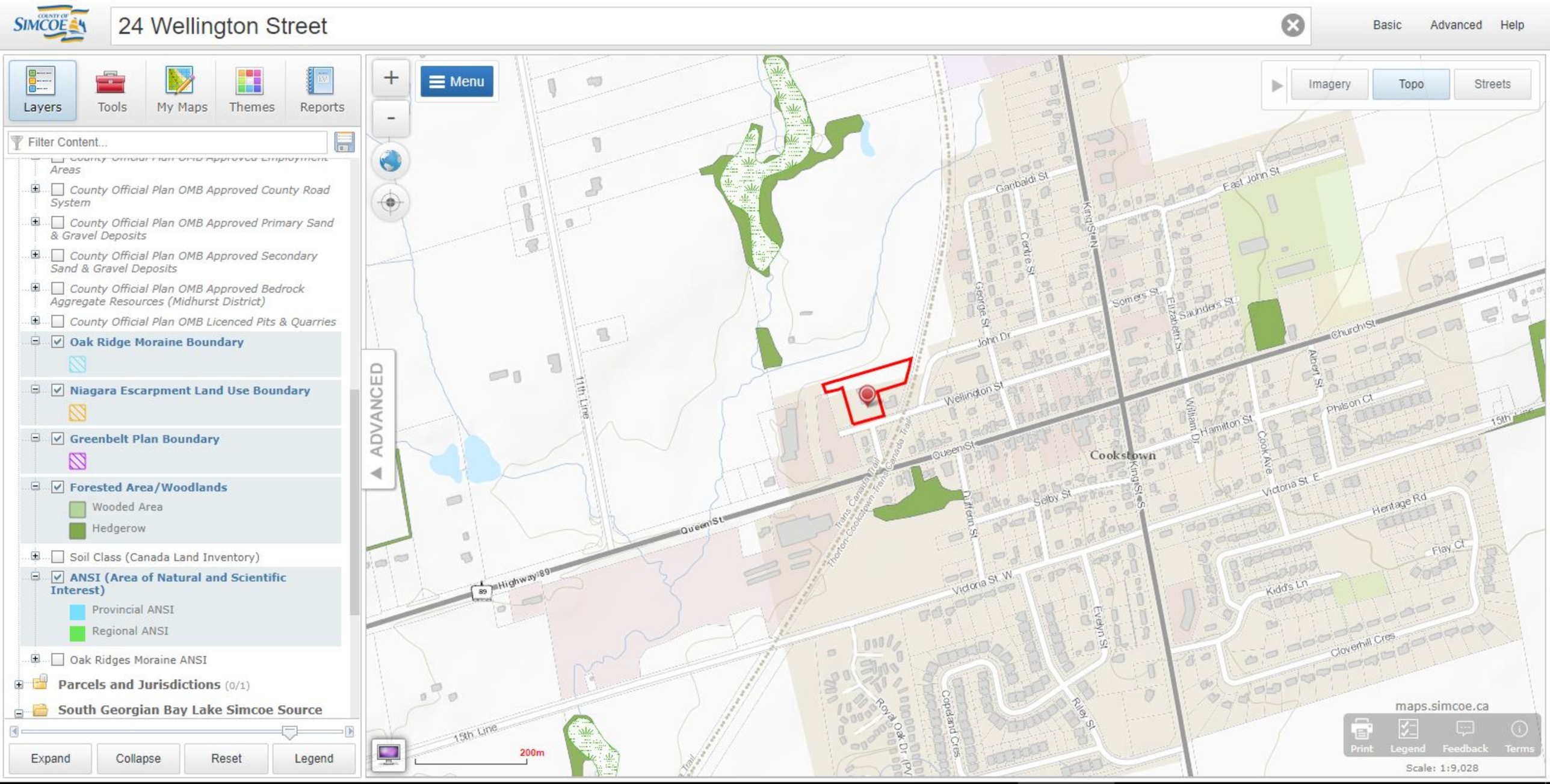

24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Economic Development (0/5)
Education and Community (0/21)
Forests Recreation and Trails (0/15)
Historical (0/2)
Land Use Planning (0/22)
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (1/10)
Surface Water System
Water Systems
Water Treatment Plants
Wells
Intake Protection Zone Vulnerable Score
Wellhead Protection Area
Wellhead Protection Area Vulnerable Score
Wellhead Protection Area Q1 and Q2
Significant Groundwater Recharge Area
Vulnerability Score = 2
Vulnerability Score = 4
Vulnerability Score = 6
Highly Vulnerable Aquifer
High
Topographic Features (0/4)
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Cookstown
Highway 89
2nd Line
10th Line
11th Line
15th Line
14th Line
County Rd 27
King St N
King St S
Victoria St W
Victoria St E
Heritage Rd
Church St
John Dr
Wellington St
Queen St
Riley St
Clovehill Cres
250 m
0.6km
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:36,112

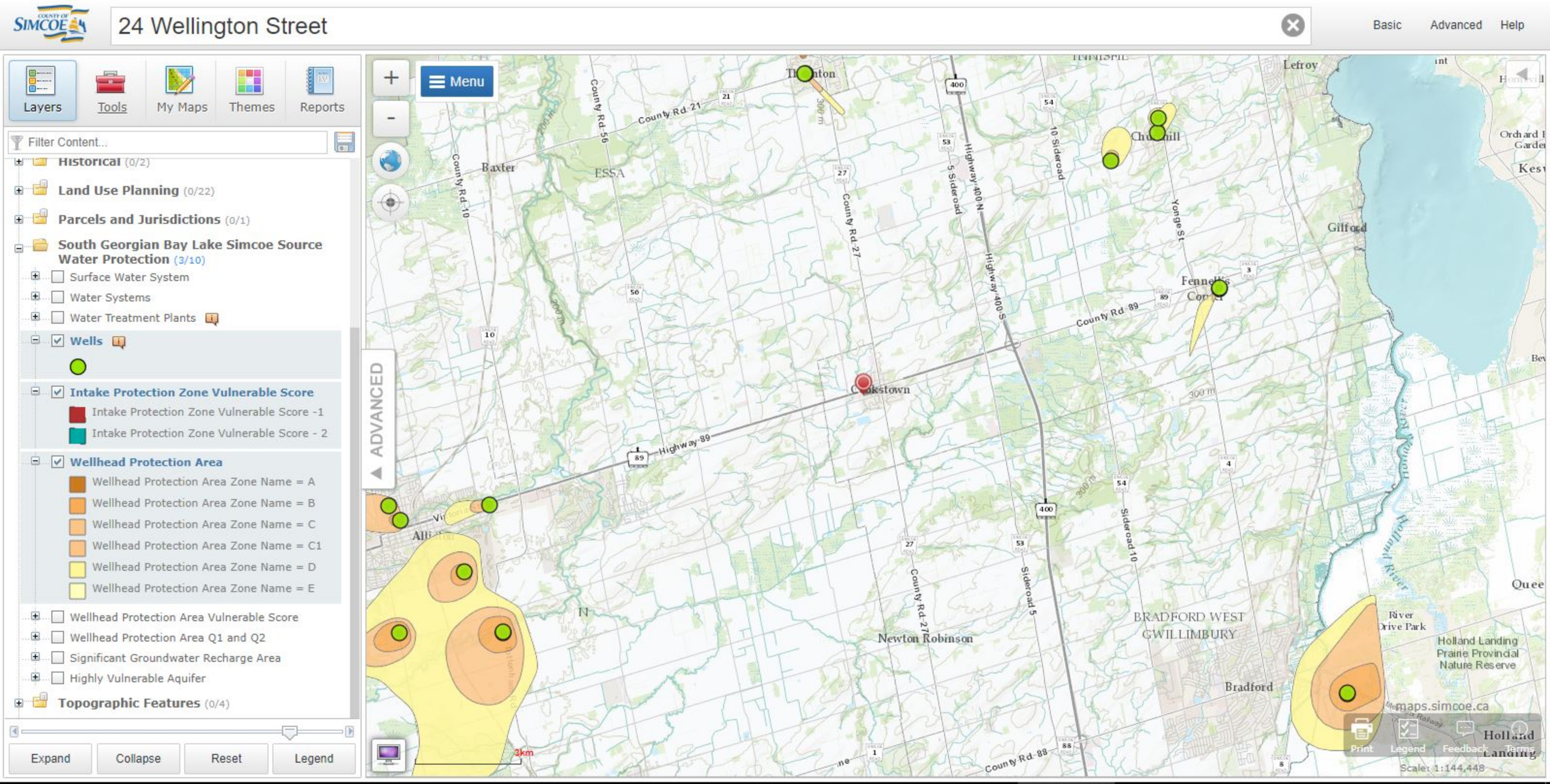

24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Assessment Parcels
Roll Number (ARN) Labels
Ownership Parcels
Address Range Labels
Popular (0/5)
Economic Development (0/5)
Education and Community (0/21)
Forests Recreation and Trails (0/15)
Historical (0/2)
Land Use Planning (0/22)
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (0/10)
Topographic Features (4/4)
Contour - 2 Meter
Stream
Lake, Pond, River or Streams
Wetland
Expand
Collapse
Reset
Legend
ADVANCED
Menu
11th Line
Cookstown Creek
230
Wellington St
Queen St
Fisher Ln
John Dr
Trans Canada Trail-Thorton-Cookstown Trans Canada
Centre St
Dufferin St
Selby St
Empress Ln
240
89
100m
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:4,514

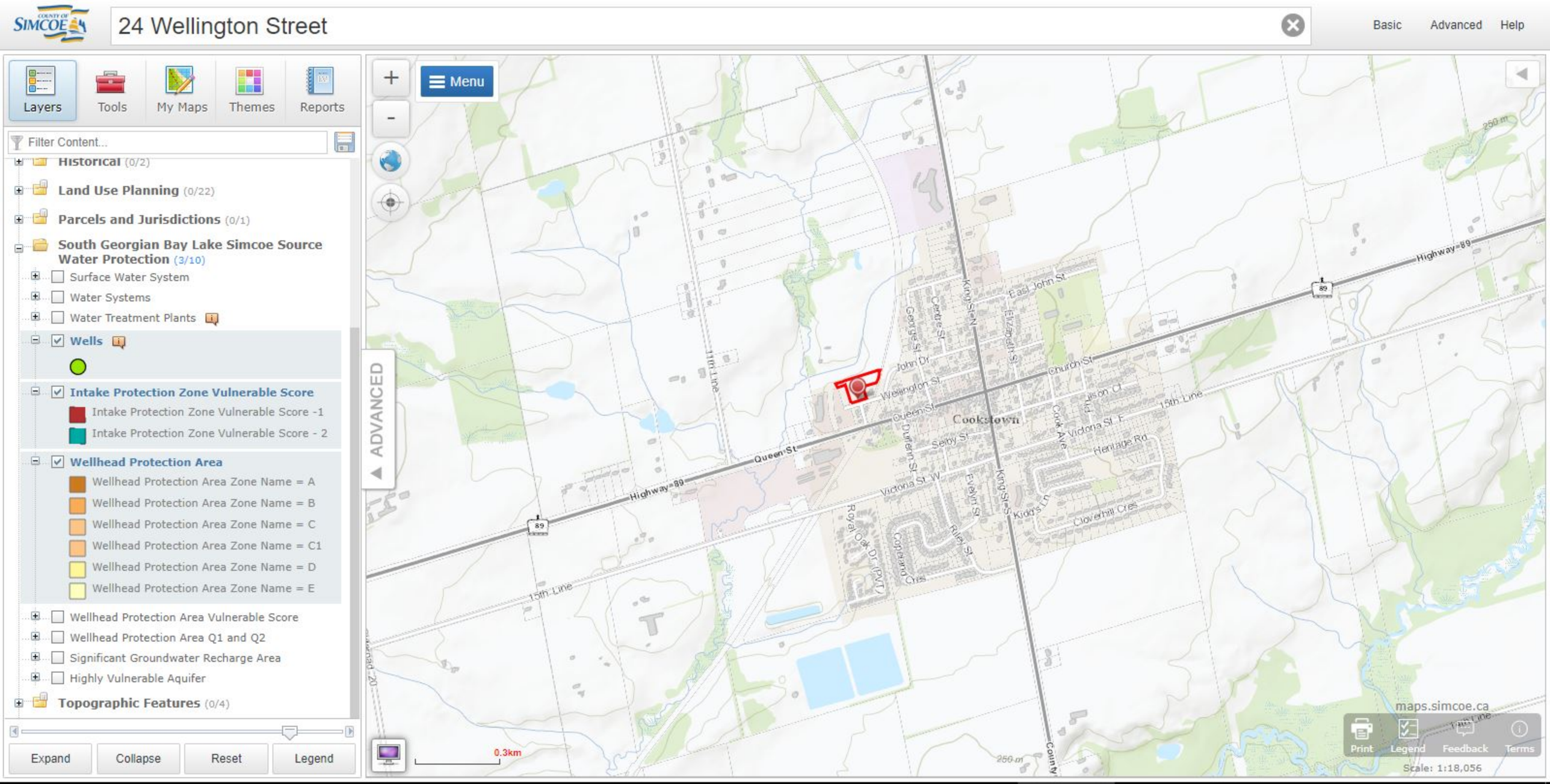

24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Ownership Parcels
Address Range Labels
Popular (0/5)
Economic Development (0/5)
Education and Community (0/21)
Forests Recreation and Trails (0/15)
Historical (0/2)
Land Use Planning (0/22)
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (1/10)
Surface Water System
Water Systems
Water Treatment Plants
Wells
Intake Protection Zone Vulnerable Score
Wellhead Protection Area
Wellhead Protection Area Vulnerable Score
Wellhead Protection Area Q1 and Q2
Significant Groundwater Recharge Area
Highly Vulnerable Aquifer
High
Topographic Features (0/4)
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Cookstown
Highway 89
2nd Line
10th Line
9th Line
15th Line
14th Line
King St N
King St S
Church St
Victoria St E
Victoria St W
Heritage Rd
County Rd 27
250 m
0.6km
maps.simcoe.ca
Print
Legend
Feedback
Terms

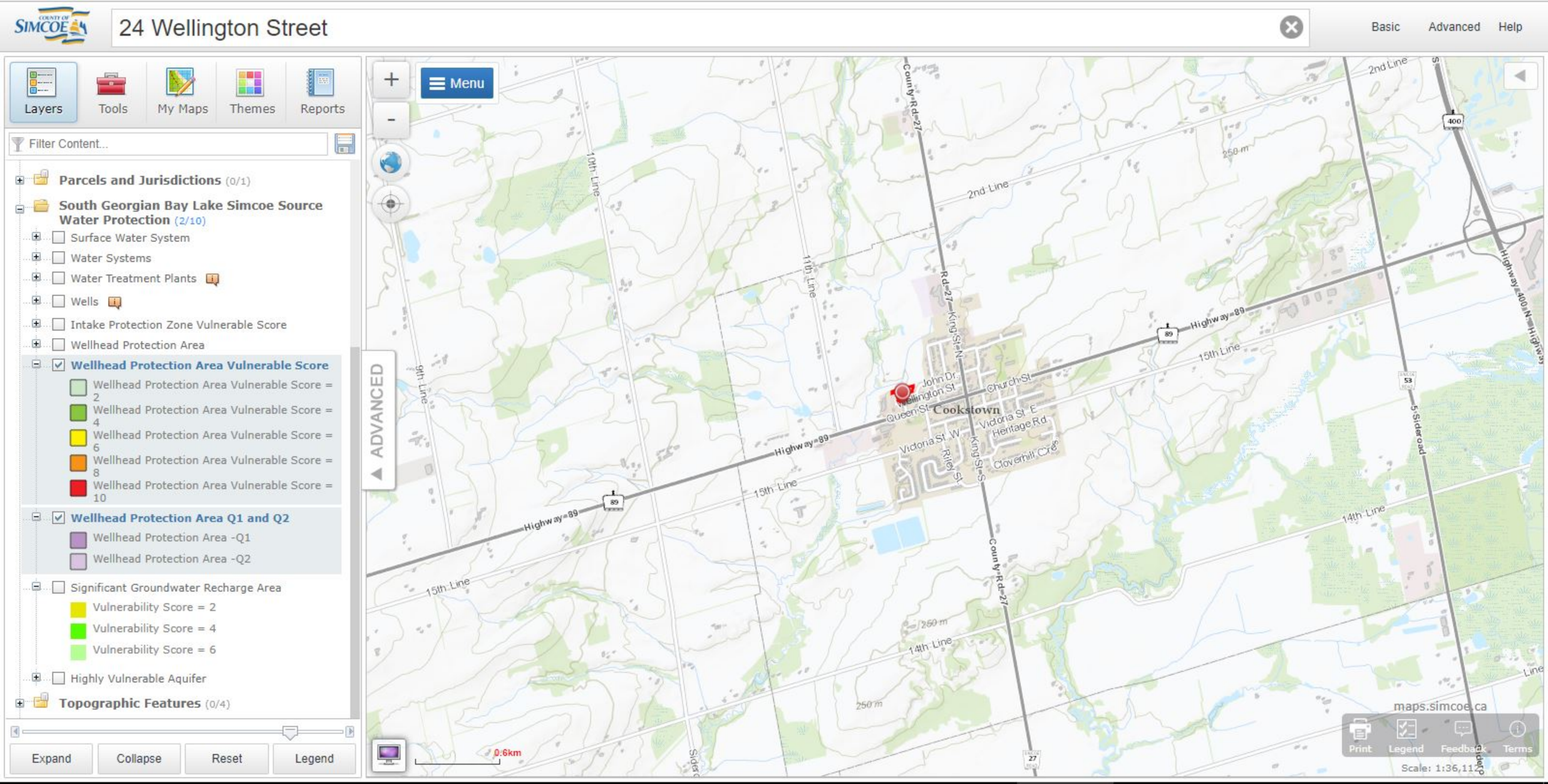

24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Ownership Parcels
Address Range Labels
Popular (0/5)
Economic Development (0/5)
Education and Community (0/21)
Forests Recreation and Trails (0/15)
Historical (0/2)
Land Use Planning (0/22)
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (1/10)
Surface Water System
Water Systems
Water Treatment Plants
Wells
Intake Protection Zone Vulnerable Score
Wellhead Protection Area
Wellhead Protection Area Vulnerable Score
Wellhead Protection Area Q1 and Q2
Significant Groundwater Recharge Area
Highly Vulnerable Aquifer
High
Topographic Features (0/4)
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Garibaldi St
East John St
King St N
Centre St
George St
Somers St
Elizabeth St
Saunders St
John Dr
Church St
Albert St
Wellington St
Philson Ct
William Dr
Hamilton St
Cook Ave
Queen St
Cookstown
King St S
Victoria St E
Heritage Rd
Selby St
Dufferin St
Flay Ct
Victoria St W
Kidd's Ln
Evelyn St
Riley St
Copeland Cres
Royal Oak Dr (PVT)
11th Line
Highway 89
15th Line
200m
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:9,028


Layers
Tools
My Maps
Themes
Reports
Filter Content...
Education and Community (0/21)
Forests Recreation and Trails (0/15)
Historical (0/2)
Land Use Planning (2/22)
MNR Unevaluated Wetland
MNR Evaluated Wetland
County Official Plan 2007 Wetlands
County Official Plan 2007 Greenlands
County Official Plan 2007 Greenland Linkages
County Official Plan 2007 Settlement
County Official Plan 2007 Settlement Non Decision
County Official Plan OMB Approved County Owned Waste Facilities
County Official Plan OMB Approved Local and Private Waste Facilities
County Official Plan OMB Approved Employment Areas
County Official Plan OMB Approved County Road System
County Official Plan OMB Approved Primary Sand & Gravel Deposits
County Official Plan OMB Approved Secondary Sand & Gravel Deposits
County Official Plan OMB Approved Bedrock Aggregate Resources (Midhurst District)
County Official Plan OMB Licenced Pits & Quarries
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Imagery
Topo
Streets
Cookstown
Queen St
Highway 89
11th Line
15th Line
Victoria St W
Victoria St E
King St N
King St S
Church St
Wellington St
Garibaldi St
East John St
Somers St
Saunders St
Hamilton St
Selby St
Heritage Rd
Kidd's Ln
Cloverhill Cres
Flay Ct
Evelyn St
Riley St
Copeland Cres
Royal Oak Dr
Trans Canada Trail
Thorton Cookstown Trans Canada Trail
200m
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:9,028


24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
County Official Plan OMB Approved Employment Areas
County Official Plan OMB Approved County Road System
County Official Plan OMB Approved Primary Sand & Gravel Deposits
County Official Plan OMB Approved Secondary Sand & Gravel Deposits
County Official Plan OMB Approved Bedrock Aggregate Resources (Midhurst District)
County Official Plan OMB Licenced Pits & Quarries
Oak Ridge Moraine Boundary
Niagara Escarpment Land Use Boundary
Greenbelt Plan Boundary
Forested Area/Woodlands
Wooded Area
Hedgerow
Soil Class (Canada Land Inventory)
ANSI (Area of Natural and Scientific Interest)
Provincial ANSI
Regional ANSI
Oak Ridges Moraine ANSI
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source
Expand
Collapse
Reset
Legend
Menu
ADVANCED
Imagery
Topo
Streets
Cookstown
Queen St
Highway 89
11th Line
15th Line
Garibaldi St
East John St
King St N
Centre St
George St
John Dr
Somers St
Elizabeth St
Saunders St
Church St
Wellington St
Abner St
Philson Ct
William Dr
Hamilton St
Cook Ave
Victoria St E
Heritage Rd
Flay Ct
Kidd's Ln
Cloverhill Cres
Victoria St W
Selby St
King St S
Dufferin St
Evelyn St
Riley St
Copeland Cres
Royal Oak Dr
Trans Canada Trail
Thorton-Cookstown Trans Canada Trail
200m
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:9,028

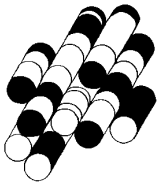

24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Historical (0/2)
Land Use Planning (0/22)
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (3/10)
Surface Water System
Water Systems
Water Treatment Plants
Wells
Intake Protection Zone Vulnerable Score
Intake Protection Zone Vulnerable Score -1
Intake Protection Zone Vulnerable Score - 2
Wellhead Protection Area
Wellhead Protection Area Zone Name = A
Wellhead Protection Area Zone Name = B
Wellhead Protection Area Zone Name = C
Wellhead Protection Area Zone Name = C1
Wellhead Protection Area Zone Name = D
Wellhead Protection Area Zone Name = E
Wellhead Protection Area Vulnerable Score
Wellhead Protection Area Q1 and Q2
Significant Groundwater Recharge Area
Highly Vulnerable Aquifer
Topographic Features (0/4)
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Cookstown
Newton Robinson
BRADFORD WEST GWILLIMBURY
Bradford
Gilford
Lefroy
Baxter
ESSA
Holland Landing Prairie Provincial Nature Reserve
maps.simcoe.ca
Print
Legend
Feedback
Terms
3km


24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Historical (0/2)
Land Use Planning (0/22)
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (3/10)
Surface Water System
Water Systems
Water Treatment Plants
Wells
Intake Protection Zone Vulnerable Score
Intake Protection Zone Vulnerable Score -1
Intake Protection Zone Vulnerable Score - 2
Wellhead Protection Area
Wellhead Protection Area Zone Name = A
Wellhead Protection Area Zone Name = B
Wellhead Protection Area Zone Name = C
Wellhead Protection Area Zone Name = C1
Wellhead Protection Area Zone Name = D
Wellhead Protection Area Zone Name = E
Wellhead Protection Area Vulnerable Score
Wellhead Protection Area Q1 and Q2
Significant Groundwater Recharge Area
Highly Vulnerable Aquifer
Topographic Features (0/4)
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Cookstown
Highway 89
Queen St
Wellington St
Church St
King St N
King St S
East John St
John Dr
George St
Centre St
Elizabeth St
Durham St
Selby St
Victoria St W
Victoria St E
Evelyn St
Riley St
Cook Ave
Jason Ct
Heritage Rd
Kidd's Ct
Cloverhill Cres
Copeland Cres
Royal Oak Dr (PVT)
11th Line
15th Line
Concession 20
0.3km
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:18,056


24 Wellington Street
Basic
Advanced
Help
Layers
Tools
My Maps
Themes
Reports
Filter Content...
Parcels and Jurisdictions (0/1)
South Georgian Bay Lake Simcoe Source Water Protection (2/10)
Surface Water System
Water Systems
Water Treatment Plants
Wells
Intake Protection Zone Vulnerable Score
Wellhead Protection Area
Wellhead Protection Area Vulnerable Score
Wellhead Protection Area Vulnerable Score = 2
Wellhead Protection Area Vulnerable Score = 4
Wellhead Protection Area Vulnerable Score = 6
Wellhead Protection Area Vulnerable Score = 8
Wellhead Protection Area Vulnerable Score = 10
Wellhead Protection Area Q1 and Q2
Wellhead Protection Area -Q1
Wellhead Protection Area -Q2
Significant Groundwater Recharge Area
Vulnerability Score = 2
Vulnerability Score = 4
Vulnerability Score = 6
Highly Vulnerable Aquifer
Topographic Features (0/4)
Expand
Collapse
Reset
Legend
ADVANCED
Menu
Cookstown
Highway 89
15th Line
14th Line
2nd Line
10th Line
11th Line
9th Line
County Rd 27
King St N
King St S
Victoria St E
Victoria St W
Queen St
Church St
John Dr
Wellington St
Heritage Rd
Cloverhill Cres
Riley St
5 Sideroad
Highway 400 N
400
53
250 m
0.6km
maps.simcoe.ca
Print
Legend
Feedback
Terms
Scale: 1:36,111

APPENDIX B

TERRAPROBE INC.



Water Well Records

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
COOKSTOWN VILLAGE	17 603296 4893606 W	1961/09 2801	10		2/27/50/48:0		0037 5	5700365 ()	LOAM 0001 BRWN CLAY GRVL 0013 CLAY SILT 0015 CLAY GRVL 0017 CLAY BLDR GRVL 0018 CSND GRVL 0041 MSND GRVL CLAY 0042 CLAY GRVL 0043
COOKSTOWN VILLAGE	17 603750 4893600 W	2010/01 6607	2.00			MO		7140406 (M06479) A094836	BRWN SAND GRVL FILL 0003 BRWN SILT SAND SOFT 0009 GREY SILT SAND SOFT 0025
COOKSTOWN VILLAGE	17 603776 4893818 W	2010/01 6607	2.00	FR 0005		MO	0033 3	7150011 (Z101296) A094903	BRWN SAND GRVL 0004 BRWN SILT CLAY SOFT 0010 GREY SILT CLAY SAND 0036
COOKSTOWN VILLAGE	17 603725 4893547 W	2010/06 6607	2.00			MO		7151812 (M06640) A100986	BRWN SAND FILL SOFT 0005 GREY SILT SAND SOFT 0012
COOKSTOWN VILLAGE	17 603803 4893367 W	1957/01 4501	4 2	FR 0225	4/200/3/:	CO	0234 6	5700352 ()	MSND FILL 0012 CLAY MSND GRVL 0045 CLAY 0090 CLAY QSND 0165 CLAY 0225 CLAY GRVL MSND 0240
COOKSTOWN VILLAGE	17 603730 4893598 W	2011/09 6607						7171492 (M10420) A115365 P	
COOKSTOWN VILLAGE	17 603719 4893577 W	2011/09 6607	2.00			MO	0002 10	7171507 (Z130516) A115311	BRWN SAND SILT LOOS 0002 GREY SAND SILT SOFT 0012
COOKSTOWN VILLAGE	17 603665 4893665 W	2012/04 7190	2	UT 0009		MO	0020 10	7180900 (Z146947) A105875	BRWN SAND 0007 GREY CLAY SLTY 0015 GREY SAND TILL SLTY 0020
COOKSTOWN VILLAGE	17 603594 4894393 W	1969/09 4608	30	FR 0007 FR 0022	7/15/2/1:0	DO		5706679 ()	BRWN CLAY STNS 0012 GREY CLAY 0020 GREY GRVL STNS 0022
COOKSTOWN VILLAGE	17 603734 4893623 W	1969/07 1830	30	FR 0034	34/39/2/1:0	DO		5706461 ()	BRWN LOAM MSND 0002 BRWN MSND 0005 GREY CLAY 0008 BRWN MSND 0034 BRWN CSND 0042
COOKSTOWN VILLAGE	17 603738 4893801 W	2013/10 7201	2.5		5///:	NU	0021 10	7209473 (Z141626) A	
COOKSTOWN VILLAGE	17 603636 4893798 W	1960/06 5420	30	FR 0036	28//2/:	PS		5700361 ()	YLLW CLAY 0010 BLUE CLAY 0030 BLUE CLAY STNS 0040
COOKSTOWN VILLAGE	17 603742 4893588 W	1958/08 2625	18	FR 0015	8///:	DO		5700355 ()	CLAY 0015 MSND 0019
COOKSTOWN VILLAGE	17 603474 4893679 W	2015/08 6607	2.00	UT 0010		MO	0003 10	7249945 (Z147898) A	
COOKSTOWN VILLAGE	17 603478 4893680 W	2015/08 6607	2.00	UT 0016		MO	0021 5	7249944 (Z147901) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
COOKSTOWN VILLAGE	17 603565 4894053 W	1958/05 2801	5					5700353 ()	LOAM 0001 GREY CLAY 0017 GRVL 0018 GREY CLAY 0030 GRVL 0031 CLAY 0057 SILT 0076 CLAY 0100 CLAY GRVL 0108 CLAY 0135 CLAY GRVL 0140 CLAY GRVL BLDR 0179 SILT FSND 0202 CLAY GRVL BLDR 0231 HPAN 0238
COOKSTOWN VILLAGE	17 603256 4893451 W	1958/05 2801	5					5700354 ()	LOAM 0001 GREY CLAY 0017 GRVL 0018 GREY CLAY 0030 GRVL 0031 CLAY 0057 SILT 0076 CLAY 0100 CLAY GRVL 0108 CLAY 0135 CLAY GRVL 0140 CLAY GRVL BLDR 0179 SILT FSND 0202 CLAY GRVL BLDR 0231 HPAN 0238
COOKSTOWN VILLAGE	17 603719 4894062 W	2013/11 7201	2			NU		7211243 (Z174562) A	
COOKSTOWN VILLAGE	17 603695 4894314 W	1959/05 2801	5	FR 0089 UK 0206	/26/10/2:0	NU		5700356 ()	LOAM 0001 GREY CLAY 0014 GREY CLAY GRVL 0023 CLAY GRVL BLDR 0029 FSND 0034 CLAY GRVL 0075 CLAY GRVL HPAN 0080 CLAY 0089 FSND 0091 CLAY 0092 GRVL 0093 CLAY 0097 CLAY BLDR 0101 CLAY 0105 FSND CLAY 0111 CLAY BLDR 0113 CLAY 0130 CLAY MSND 0139 CLAY 0206 SILT MSND 0212 CLAY GRVL BLDR 0272
COOKSTOWN VILLAGE	17 603306 4893657 W	1959/06 2801	2	FR 0017	-1///:	NU	0034 10	5700357 ()	LOAM 0001 BRWN CLAY GRVL 0007 BLUE CLAY 0014 CLAY 0017 FSND MSND 0042 CLAY SILT 0045
COOKSTOWN VILLAGE	17 603351 4893627 W	1959/06 2801	2	FR 0026	0///:	NU	0035 10	5700358 ()	LOAM 0001 BRWN CLAY GRVL BLDR 0009 BLUE CLAY GRVL BLDR 0026 FSND MSND 0040 CSND FSND 0044 FSND SILT 0050 CLAY SILT 0080 GRVL 0082 CLAY SILT 0086 CLAY GRVL 0091
COOKSTOWN VILLAGE	17 603256 4893626 W	1959/06 2801	2	FR 0017	-1/9/23/24:0	NU	0032 10	5700359 ()	LOAM 0001 BRWN CLAY GRVL 0009 BLUE CLAY GRVL 0012 CLAY SILT 0015 CLAY GRVL 0017 MSND 0043 CLAY GRVL SILT 0045 SILT 0047 CLAY GRVL 0051
COOKSTOWN VILLAGE 15 024	17 603224 4893398 W	1994/11 5528	2	UK 0123	23/115/3/3:0	MN NU	0123 5	5731340 (144075)	BRWN CLAY SOFT 0015 GREY CLAY SOFT 0038 GREY CLAY GRVL 0095 GREY SILT 0100 GREY CLAY 0121 GREY SAND GRVL 0130 GREY CLAY 0172 GREY FSND 0174 GREY CLAY 0185 GREY SAND SILT 0195 GREY CLAY SILT 0250
ESSA TOWNSHIP	17 603261 4893702 W	2012/11 6454	6			CO		7193364 (Z142684) A	
ESSA TOWNSHIP	17 603228 4893672 W	2013/09 6454	6			CO		7208497 (Z142689) A000365 A	
ESSA TOWNSHIP	17 603562 4893752 W	2015/08 6607	2.00	UT 0010		MO	0003 10	7249924 (Z206127) A	
ESSA TOWNSHIP	17 603563 4893751 W	2015/08 6607	2.00	UT 0020		MO	0021 5	7249950 (Z206126) A	
ESSA TOWNSHIP 11 001	17 603253 4893943 L	1985/11 4919	30 30	UK 0020	2/58//0:30	DO		5720698 ()	BRWN LOAM HARD 0001 BRWN CLAY HARD 0020 GREY CLAY HARD 0060
ESSA TOWNSHIP 11 002	17 602834 4894137 W	2008/01 3030	36 24	0010 0035 0015	///:	DO		7101927 (Z70286) A054816	BRWN CLAY 0010 GREY SILT 0014 GREY SAND SILT 0020 GREY CLAY HARD 0035 GREY CLAY SAND LYRD 0049

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
ESSA TOWNSHIP CON 10 001	17 602714 4894023 W	1971/06 1830	30	FR 0050	10/12/1/1:0	DO		5708018 ()	LOAM CLAY MSND 0001 BRWN CLAY 0025 BRWN CLAY MSND 0050 BRWN CLAY STNS MSND 0062
ESSA TOWNSHIP CON 10 001	17 602691 4893658 W	1998/07 5528	6	FR 0008	5/25/30/12:0	MN	0086 10	5733655 (190225)	BRWN CLAY GRVL TILL 0016 GREY CLAY SILT 0080 FSND MGRD 0090 MSND CGRD 0095 FSND MGRD 0107 GREY CLAY SILT 0122
ESSA TOWNSHIP CON 10 001	17 602710 4893464 W	1994/07 5528		UK 0229		MN		5730896 (144049)	BRWN CLAY SILT 0011 GREY CLAY SILT 0031 GREY CLAY STNS 0038 GREY CLAY SILT GRVL 0055 CLAY SAND GRVL 0066 CLAY DNSE 0096 SILT CLAY 0112 SILT FSND 0116 SILT CLAY 0229 GREY SAND STNS 0233 CLAY SILT STNS 0241
ESSA TOWNSHIP CON 11 001	17 603554 4893773 W	1969/02 4608	30	FR 0020	11///:	DO		5706149 ()	BRWN CLAY 0012 GREY CLAY 0028
ESSA TOWNSHIP CON 11 001	17 602869 4893580 W	1994/07 5528	2	UK 0092	-7/87/115/4:0	NU	0087 5	5730897 (144048)	BRWN CLAY 0012 CLAY SILT STNS 0035 GREY CLAY SILT GRVL 0042 CLAY SILT GRVL 0071 FSND 0072 CLAY SILT 0073 BRWN SAND 0075 GREY CLAY 0085 BRWN SAND SILT 0092 GREY CLAY SILT 0095 GREY SILT CLAY 0172 GREY SILT 0191 SAND CMTD SILT 0260
ESSA TOWNSHIP CON 11 001	17 603664 4893923 W	1969/05 4608	30	UK 0032	32/40//1:30	DO		5706295 ()	BLCK LOAM 0002 BRWN CLAY STNS 0042
ESSA TOWNSHIP CON 11 001	17 603304 4893753 W	1969/04 4608	30	FR 0012	16///:	DO		5706246 ()	LOAM 0001 BRWN CLAY 0010 GREY CLAY 0026
ESSA TOWNSHIP CON 11 001	17 602814 4893923 W	1985/07 3413	30 30 24	FR 0018	26/60/3/4:0	DO		5719964 ()	BRWN CLAY 0018 GRVL 0026 BLUE CLAY 0070
ESSA TOWNSHIP CON 11 001	17 603185 4893937 W	2007/07 6409	6.25 5		///:	DO	0119 9	7050383 (Z72878) A047005	BRWN CLAY FSND 0008 BRWN CLAY 0023 GREY CLAY GRVL 0052 GREY CLAY 0110 GREY CLAY SILT 0118 GREY FSND CLAY 0128
ESSA TOWNSHIP CON 11 001	17 603253 4893943 L	1998/05 5528				NU		5733438 (181619) A	
ESSA TOWNSHIP CON 11 001	17 602881 4893770 W	1998/08 5528				NU		5733656 (190228) A	BRWN CLAY GRVL TILL 0016 BRWN GRVL 0021 GREY CLAY STKY DNSE 0063 GREY CLAY SILT 0135 BRWN SAND 0142 GREY CLAY SILT 0185 GREY CLAY STKY DNSE 0221
ESSA TOWNSHIP CON 11 002	17 602814 4894373 W	1979/07 4919	30 30	UK 0035	7/40//0:30	DO		5716329 ()	BRWN LOAM HARD 0001 BRWN CLAY HARD 0015 GREY CLAY HARD 0035 GREY SAND LOOS 0037 GREY CLAY HARD 0045
ESSA TOWNSHIP CON 11 002	17 602764 4894373 W	1979/08 2514						5716667 () A	PRDG 0045 GREY SILT SAND STNS 0067 GREY SILT SAND BLDR 0108 GREY CLAY 0114 GREY CLAY SAND HARD 0126
ESSA TOWNSHIP CON 11 002	17 602853 4894203 W	2004/06 3030	36	0010 0024	///:	DO		5738876 (Z09495) A009459	BRWN LOAM 0001 BRWN CLAY 0010 GREY CLAY SAND SILT 0024 GREY CLAY SAND SILT 0035
ESSA TOWNSHIP CON 11 002	17 602767 4894305 W	1991/11 4919	30 30	UK 0050	10/30/10/1:0	DO		5728839 (77322)	BRWN LOAM HARD 0001 BRWN CLAY HARD 0020 GREY CLAY HARD 0050 GREY GRVL LOOS 0060
INNISFIL TOWNSHIP	17 603758 4894041 W	2014/03 7324	1.97			MO	0006 10	7219651 (Z168340) A154732	BRWN GRVL SAND FILL 0002 BRWN SILT SAND SNDY 0008 BRWN CLAY SILT SLTY 0016

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
INNISFIL TOWNSHIP	17 603720 4894053 W	2012/01 7324	1.99	FR 0002		MO	0019 5	7196630 (Z159596) A139154	BRWN SILT SAND LOAM 0004 BRWN SILT CLAY 0006 BRWN CLAY SILT 0016 BRWN SILT CLAY 0019 GREY SILT LOOS 0024
INNISFIL TOWNSHIP	17 603730 4894082 W	2012/01 7324	1.99	FR 0002		MO	0014 5	7196631 (Z159565) A139154	BRWN SILT SAND LOAM 0001 BRWN SILT CLAY 0003 BRWN CLAY SILT 0014 BRWN SILT CLAY 0018
INNISFIL TOWNSHIP	17 603801 4894140 W	2012/11 7499	5					7197611 (Z151930) A	
INNISFIL TOWNSHIP	17 603719 4894069 W	2012/01 7324	1.99	FR 0004		MO	0011 5	7196632 (Z159589) A139154	BRWN SILT LOAM 0001 BRWN SILT CLAY 0003 BRWN SILT CLAY 0005 BRWN CLAY SILT 0011 BRWN SILT CLAY CLYY 0016
INNISFIL TOWNSHIP	17 603745 4894047 W	2014/03 7324	1.97			MO	0005 10	7219652 (Z168341) A154732	BRWN GRVL SAND FILL 0002 BRWN SILT SAND SNDY 0008 BRWN CLAY SILT SLTY 0016
INNISFIL TOWNSHIP	17 603726 4894051 W	2013/11 7201	2			NU		7211242 (Z167955) A	
INNISFIL TOWNSHIP CON 01 001	17 603715 4894188 W	1990/05 2514	6	FR 0057	8/50/5/2:0	DO	0057 3	5727028 (59385)	BLCK LOAM 0001 BRWN CLAY SNDY 0018 BRWN SAND GRVL CLAY 0057 BRWN SAND 0060
INNISFIL TOWNSHIP CON 01 001	17 603730 4894038 W	2014/02 7147	1.97	FR 0007		MO	0010 5	7217577 (Z180518) A149714	BLCK 0001 BRWN SILT SAND 0015
INNISFIL TOWNSHIP CON 11 019	17 603267 4893686 W	2002/10 6300	6 5	FR 0073	0//4/10:0	CO	0074 6	5737369 (242071)	LOAM 0002 BRWN CLAY 0012 BRWN SAND 0031 BLUE CLAY 0048 SILT 0056 BRWN SAND 0073 SAND CLN 0081 BLUE CLAY 0090
TECUMSETH TOWNSHIP	17 603029 4893329 W	2011/08 6607						7170241 (M10357) A110326 P	
TECUMSETH TOWNSHIP	17 603768 4893301 W	2016/11 7464						7281188 (Z237677) A208246 P	
TECUMSETH TOWNSHIP CON 11 018	17 603268 4893453 W	2005/06 6300	6	0055	2/46/2/20:10	CO	0044 9	5739954 (Z23541) A000365	BRWN FILL CLAY 0006 BRWN CLAY SOFT 0023 BLUE CLAY 0038 BLCK SAND GRVL CLN 0043 BLCK SAND 0055 BLUE CLAY SOFT 0095
TECUMSETH TOWNSHIP CON 13 024	17 603531 4893351 W	2013/11 4645	36					7215117 (Z176621) A	
TECUMSETH TOWNSHIP CON 14 023	17 603277 4893316 W	1964/11 3903	30	FR 0020	25//2/:	DO		5704294 ()	BRWN CLAY 0015 BLUE CLAY STNS FSND 0060
TECUMSETH TOWNSHIP CON 14 023	17 603164 4893253 W	1976/06 3203	6	FR 0075	34/40/25/10:0	DO	0075 6	5713456 ()	BRWN LOAM 0001 BRWN SAND CLAY 0017 YLLW GRVL SAND CLAY 0075 YLLW GRVL SAND 0081 GREY CLAY 0081
TECUMSETH TOWNSHIP CON 14 023	17 603164 4893323 W	1975/08 3203	6	FR 0235	12/66/20/12:0	CO	0235 6	5713457 ()	BRWN LOAM 0001 CLAY SOFT 0019 GREY CLAY GRVL 0129 GRVL CLAY 0151 CLAY 0185 SILT 0206 GRVL CLAY HARD 0235 SAND 0241 CLAY 0241

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
TECUMSETH TOWNSHIP CON 14 023	17 602864 4893213 W	1972/06 2801	2	FR 0170	///:	NU	0210 10	5709017 ()	BLCK LOAM 0002 BRWN CLAY 0005 BRWN SAND GRVL CLAY 0010 GREY CLAY GRVL 0097 GREY CLAY 0170 GREY CLAY GRVL 0205 GREY GRVL CLAY 0209 BRWN GRVL 0213 GREY GRVL CLAY 0215 GREY CLAY GRVL 0242
TECUMSETH TOWNSHIP CON 14 023	17 603319 4893419 W	2003/02 2801						5737638 (249803) A	
TECUMSETH TOWNSHIP CON 14 023	17 603217 4893246 W	1964/10 3414	4		12///:			5704293 () A	PRDG 0015 CLAY 0038 SILT 0065 SILT GRVL 0085 CLAY 0089 SILT 0189 CLAY 0199 SILT 0263
TECUMSETH TOWNSHIP CON 14 024	17 603564 4893423 W	1975/06 3203	6	FR 0197	-1/83/15/5:30	DO	0197 8	5713460 ()	BRWN LOAM 0001 BRWN CLAY SNDY 0011 GREY CLAY GRVL STNS 0112 GREY GRVL SAND 0115 GREY SAND CLAY 0123 GREY CLAY SOFT 0183 GREY SILT 0197 GREY FSND 0205 GREY CLAY 0205
TECUMSETH TOWNSHIP CON 14 024	17 603314 4893323 W	1975/06 3203						5713459 () A	BRWN LOAM 0001 BRWN CLAY SNDY 0016 GREY CLAY SAND GRVL 0078 GREY CLAY 0203 CLAY SILT LYRD 0238 CLAY GRVL 0264 GRVL CLAY HARD 0283 LMSN 0283
TECUMSETH TOWNSHIP CON 14 024	17 603810 4893192 W	2012/08 7147	1.97	FR 0010			0005 10	7186980 (Z142253) A	
TECUMSETH TOWNSHIP CON 14 024	17 603314 4893323 W	1975/06 3203				NU		5713458 ()	BRWN LOAM 0001 BRWN CLAY SOFT 0016 GREY CLAY 0028 GREY CLAY SAND GRVL 0100
TECUMSETH TOWNSHIP CON 15 023	17 603014 4893373 W	1958/06 2801	2	FR 0208	-22/4/30/4:0	NU		5704304 ()	LOAM 0001 GREY CLAY 0019 SILT 0021 CLAY SILT 0046 GRVL 0047 CLAY 0101 SILT 0105 CLAY 0174 CLAY SILT 0182 GRVL CLAY 0186 CLAY GRVL 0190 CLAY SILT 0205 CLAY GRVL 0208 GRVL 0216 CLAY GRVL 0219
TECUMSETH TOWNSHIP CON 15 023	17 603282 4893597 W	2014/12 2801						7235645 (Z174081) A	
TECUMSETH TOWNSHIP CON 15 023	17 602837 4893272 W	2014/12 2801						7235646 (Z174082) A	
TECUMSETH TOWNSHIP CON 15 023	17 603241 4893375 W	2014/12 2801						7235648 (Z174084) A	
TECUMSETH TOWNSHIP CON 15 023	17 602706 4893244 W	1959/05 2801	5	FR 0070	///:	NU		5704305 ()	LOAM 0003 SILT BLDR 0006 SILT CLAY BLDR 0012 CLAY SILT BLDR 0024 CLAY GRVL BLDR 0040 GRVL 0041 CLAY GRVL BLDR 0044 CLAY GRVL 0054 SILT MSND GRVL 0057 CLAY GRVL 0100 CLAY SILT 0104 CLAY 0165 CLAY SILT 0183 CLAY GRVL 0185 GRVL 0188 CLAY GRVL 0195 CLAY BLDR 0205 CLAY GRVL BLDR 0207 GRVL 0213 CLAY GRVL BLDR 0232 CLAY GRVL 0251 HPAN 0255
TECUMSETH TOWNSHIP CON 15 023	17 602706 4893244 W	1959/06 2801	5	FR 0208		NU		5704306 ()	LOAM 0001 BRWN CLAY MSND 0004 BLUE CLAY BLDR 0017 CLAY GRVL BLDR 0025 CLAY SILT 0037 CLAY 0055 CLAY GRVL 0064 CLAY GRVL BLDR 0067 CLAY GRVL 0101 CLAY 0158 CLAY SILT 0183 CLAY GRVL 0197 CLAY GRVL BLDR 0200 CLAY 0208 GRVL CLAY 0212 GRVL 0215 GRVL CLAY 0218 CLAY 0227

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
TECUMSETH TOWNSHIP CON 15 023	17 602976 4893340 W	1959/06 2801	5	UK 0213		NU		5704307 ()	LOAM 0001 CLAY GRVL 0025 CLAY SILT 0043 SILT 0054 GRVL 0055 SILT 0058 CLAY GRVL BLDR 0070 CLAY GRVL 0086 CLAY 0154 SILT MSND 0169 CLAY 0171 SILT MSND 0175 GRVL 0176 SILT MSND 0178 CLAY GRVL 0185 CLAY GRVL BLDR 0189 CLAY 0208 SILT MSND 0210 CLAY 0212 GRVL 0216 FSND 0221 CLAY GRVL 0237
TECUMSETH TOWNSHIP CON 15 023	17 603011 4893531 W	1959/06 2801	2	FR 0060	/31/11/2:0	NU		5704308 ()	LOAM 0001 BRWN CLAY GRVL 0003 MSND 0005 BLUE CLAY GRVL BLDR 0040 SILT 0047 CLAY 0060 MSND 0070 SILT MSND 0077 CLAY GRVL BLDR 0081
TECUMSETH TOWNSHIP CON 15 023	17 603011 4893531 W	1959/06 2801	5					5704309 ()	LOAM 0001 BRWN CLAY GRVL 0003 MSND 0005 BLUE CLAY GRVL BLDR 0040 SILT CLAY 0044 SILT 0048 CLAY GRVL BLDR 0050 CLAY 0060 MSND CLAY 0070 SILT CLAY 0083 CLAY GRVL 0094 SILT 0097 CLAY 0102 SILT 0104 CLAY 0169 CLAY SILT GRVL 0191 CLAY 0199 CLAY GRVL BLDR 0213 MSND GRVL 0214 CLAY 0216 MSND 0218 CLAY GRVL BLDR 0235
TECUMSETH TOWNSHIP CON 15 023	17 602714 4893323 W	1969/06 1830	30	FR 0028	22///:	DO		5706365 ()	CLAY 0025 MSND 0050 CLAY 0052
TECUMSETH TOWNSHIP CON 15 023	17 602834 4893283 W	1972/07 2801	2	FR 0170	/101/12/5:0	NU	0204 10	5709018 ()	BLCK LOAM 0001 BRWN CLAY 0005 BRWN SAND GRVL BLDR 0010 GREY CLAY SILT GRVL 0061 GREY GRVL CLAY 0064 GREY CLAY GRVL 0102 GREY SILT CLAY 0105 GREY CLAY 0173 GREY SILT CLAY 0187 GREY CLAY SILT GRVL 0212 BRWN GRVL 0215 GREY CLAY GRVL 0245
TECUMSETH TOWNSHIP CON 15 023	17 602844 4893273 W	1972/07 2801	7	FR 0195 FR 0200 FR 0209 FR 0215	/10/31/24:0	NU	0194 9	5709019 ()	BLCK LOAM 0001 BRWN CLAY 0005 BRWN SAND GRVL CLAY 0009 GREY CLAY GRVL 0127 GREY CLAY 0171 GREY SILT CLAY 0182 GREY CLAY GRVL 0195 BRWN SAND GRVL CLAY 0200 GREY CLAY GRVL 0209 BRWN SAND GRVL CLAY 0215 BRWN GRVL CLAY 0216 GREY CLAY GRVL 0221
TECUMSETH TOWNSHIP CON 15 023	17 602889 4893348 W	1975/10 2801	10	FR 0209	/82/150/48:0	MN		5712564 ()	GREY CLAY SILT SAND 0039 GREY CLAY STNS SAND 0062 GREY CLAY HARD 0082 GREY CLAY SAND LYRD 0099 GREY SILT SAND LYRD 0118 GREY CLAY HARD 0162 GREY SILT SAND STNS 0190 GREY CLAY SILT STNS 0197 GREY SILT SAND DNSE 0202 GREY SAND SILT CLAY 0209 GREY SAND FGVL SILT 0214 GREY GRVL SAND LOOS 0218
TECUMSETH TOWNSHIP CON 15 023	17 603337 4893426 W	2003/03 2801						5737633 (249805) A	
TECUMSETH TOWNSHIP CON 15 023	17 603284 4893607 W	2003/02 2801						5737639 (249804) A	
TECUMSETH TOWNSHIP CON 15 023	17 603055 4893431 L	2003/08 2801				NU		5738123 (258588) A	
TECUMSETH TOWNSHIP CON 15 023	17 603055 4893431 L	2003/08 2801				NU		5738124 (258589) A	
TECUMSETH TOWNSHIP CON 15 023	17 603114 4893543 W	1972/06 1830	30	FR 0055	20/23/2/1:0	DO		5708981 ()	BRWN CLAY 0020 GREY CLAY 0053 GREY MSND CSND 0055

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

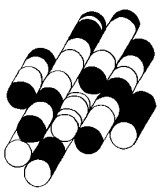
Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

APPENDIX C

TERRAPROBE INC.



LOG OF BH1

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 5, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603238, N: 4893801 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	**98.4**	**GROUND SURFACE**				
	98.2	180mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, hard, brown, moist		1	SS	14
	97.5					
1	0.9	**CLAY AND SILT**, some sand, trace gravel, stiff, brown to grey, moist to wet		2	SS	42
				3	SS	14
2				4	SS	13
3				5	SS	14
4	93.8					
	4.6	**SILTY SAND**, some clay, trace to some gravel, compact, grey, wet (GLACIAL TILL)		6	SS	15
5						
6				7	SS	13
	91.8					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 98, 97, 96, 95, 94, 93, 92

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

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

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR	SA	SI	CL
1	17	39	43

Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
10' screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2017	dry	n/a
Oct 10, 2017	1.8	96.6
Oct 25, 2017	1.7	96.7
Nov 2, 2017	1.6	96.8

file: 3-17-0076-46 bh logs.gpj

LOG OF BH2

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 4, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603275, N: 4893793 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	99.2	**GROUND SURFACE**				
		150mm **TOPSOIL**				
		FILL, clayey silt, trace sand, very stiff, brown, moist		1	SS	14
	98.3					
1	0.9	**CLAY AND SILT**, some sand, hard to stiff, brown to grey, moist to wet		2	SS	25
				3	SS	40
2				4	SS	40
3				5	SS	24
4						
5				6	SS	14
6	93.2					
	6.0	**SILTY SAND**, some clay, trace to some gravel, compact, grey, wet (GLACIAL TILL)		7	SS	15
	92.6					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 99, 98, 97, 96, 95, 94, 93

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

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

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

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

Unstabilized water level measured at 5.8 m below ground surface; borehole was open upon completion of drilling.

file: 3-17-0076-46 bh logs.gpj

LOG OF BH3

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 5, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603327, N: 4893816 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	**98.9**	**GROUND SURFACE**				
	98.7	180mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, hard, brown, moist		1	SS	16
	98.3					
	0.6	**CLAY AND SILT**, trace sand, trace gravel, hard to very stiff, brown to grey, moist		2	SS	51
1				3	SS	35
2				4	SS	27
3				5	SS	15
4				6A	SS	13
	94.0			6B	SS	
5	4.9	**SILTY SAND**, some clay, trace to some gravel, compact, grey, wet (GLACIAL TILL)				
6				7	SS	13
	92.3					
	6.6					

Elevation Scale (m): 98, 97, 96, 95, 94, 93

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

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

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

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

END OF BOREHOLE

Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
10' screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2017	5.1	93.8
Oct 10, 2017	1.4	97.5
Oct 25, 2017	1.2	97.7
Nov 2, 2017	1.2	97.7

file: 3-17-0076-46 bh logs.gpj

LOG OF BH4

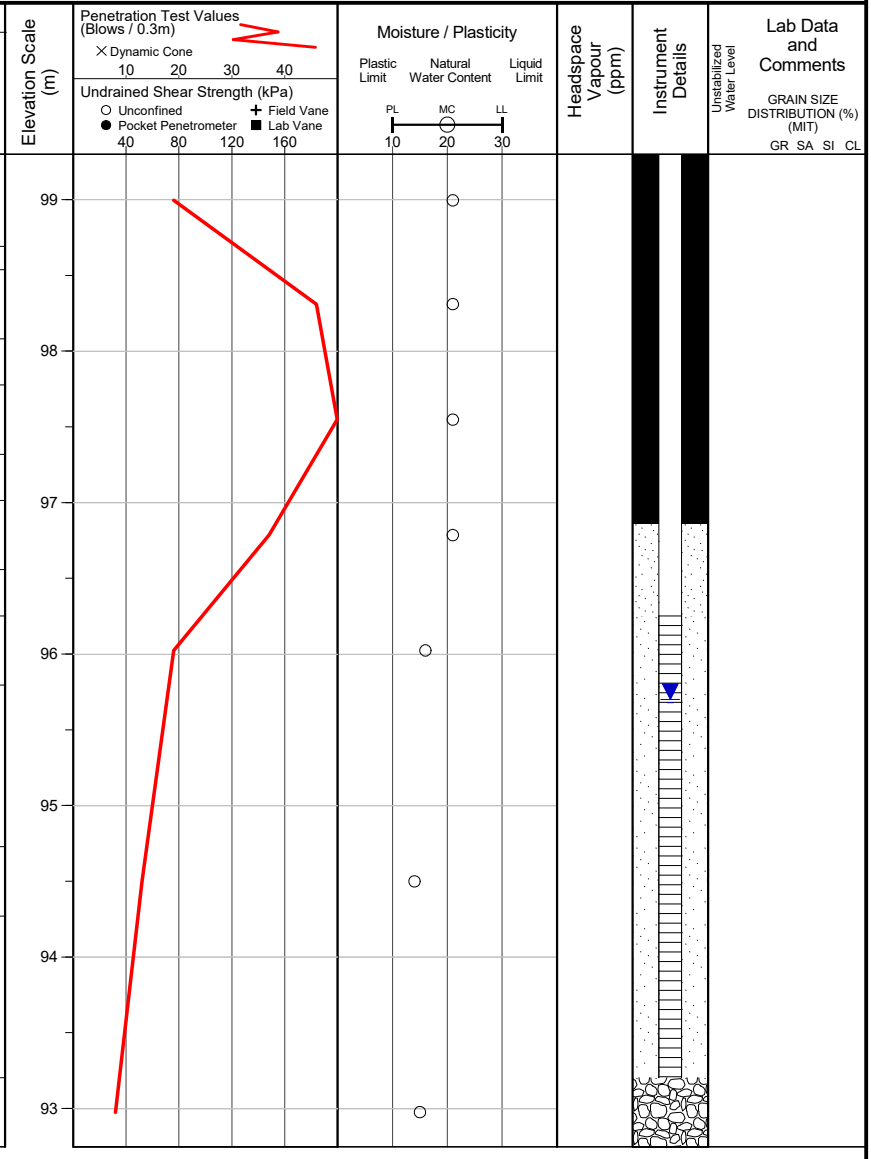
Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 5, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603361, N: 4893818 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	99.3	**GROUND SURFACE**				
	99.1	200mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, hard, brown, moist		1	SS	19
	98.7					
	0.6	**CLAY AND SILT**, trace sand, trace gravel, hard to stiff, brown to grey, moist to wet		2	SS	46
				3	SS	55
				4	SS	37
				5	SS	19
				6	SS	13
				7	SS	8
	92.7					
	6.6	**END OF BOREHOLE**				



Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
10' screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2017	dry	n/a
Oct 10, 2017	dry	n/a
Oct 25, 2017	4.5	94.8
Nov 2, 2017	3.6	95.7

file: 3-17-0076-46 bh logs.gpj

LOG OF BH5

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 4, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603240, N: 4893761 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	98.3	**GROUND SURFACE**				
		100mm **TOPSOIL**				
		FILL, clayey silt, trace gravel, trace sand, trace organics, compact, brown, moist		1	SS	27
				2	SS	11
	96.8					
	1.5	**ORGANICS**, loose, black, wet		3	SS	4
	96.2					
	2.1	**CLAY AND SILT**, trace gravel, trace sand, very stiff to stiff, brown to grey, moist to wet		4	SS	30
				5	SS	18
				6	SS	14
	92.3					
	6.0	**SILTY SAND**, some clay, some gravel, compact, grey, wet (GLACIAL TILL)		7	SS	12
	91.7					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 98, 97, 96, 95, 94, 93, 92

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

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

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

20 37 25 18

Unstabilized water level measured at 5.8 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
10' screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2017	4.3	94.0
Oct 10, 2017	0.9	97.4
Oct 25, 2017	0.7	97.6
Nov 2, 2017	0.7	97.6

file: 3-17-0076-46 bh logs.gpj

LOG OF BH6

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 4, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603251, N: 4893758 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	98.9	**GROUND SURFACE**				
	98.7	250mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace to some organics, trace gravel, trace brick rubble, hard, brown, moist		1	SS	21
1				2	SS	34
	97.1			3	SS	32
	1.8	**CLAY AND SILT**, trace sand, trace gravel, hard to very stiff, brown to grey, moist				
2				4	SS	34
3				5	SS	19
4						
	94.1			6A	SS	48
	4.8					
	93.9	**SILTY SAND**, trace gravel, trace clay, dense, grey, wet		6B	SS	
5	5.0					
		SILTY SAND, some clay, trace to some gravel, compact, grey, wet (GLACIAL TILL)				
6				7	SS	18
	92.3					
	6.6	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 98, 97, 96, 95, 94, 93

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

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

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

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

file: 3-17-0076-46 bh logs.gpj

LOG OF BH7

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 4, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603295, N: 4893744 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	98.2	**GROUND SURFACE**				
		460mm **TOPSOIL**		1	SS	8
	97.7 / 0.5	**CLAY AND SILT**, trace gravel, trace to some sand, hard to firm, brown to grey, moist to wet		2	SS	28
1				3	SS	42
2				4	SS	20
3				5	SS	14
4		...at 4.5 m, wet seam		6	SS	9
5						
6	91.6 / 6.6			7	SS	6

Elevation Scale (m): 98, 97, 96, 95, 94, 93, 92

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

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

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

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

END OF BOREHOLE

Unstabilized water level measured at 5.8 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
10' screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2017	2.4	95.8
Oct 10, 2017	0.6	97.6
Oct 25, 2017	0.5	97.7
Nov 2, 2017	0.4	97.8

file: 3-17-0076-46 bh logs.gpj

LOG OF BH8

Terraprobe

Project No. : 3-17-0076-46	Client : Paolini Supermarket Ltd.	Originated by : BH
Date started : October 4, 2017	Project : 24 Wellington St.	Compiled by : BH
Sheet No. : 1 of 1	Location : Cookstown, Ontario	Checked by : SO

Position : E: 603329, N: 4893768 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : CME 55, track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	99.4	**GROUND SURFACE**				
0		460mm **TOPSOIL**		1	SS	12
	98.9 / 0.5	**FILL**, clayey silt, trace sand, trace organics, trace brick rubble, compact, brown, moist		2	SS	18
1	98.2 / 1.2	**CLAY AND SILT**, trace gravel, trace sand, very stiff to stiff, brown to grey, moist to wet		3	SS	29
2				4	SS	26
3		...at 3.0 m, wet seam		5	SS	15
4						
5				6	SS	12
6	92.8 / 6.6	**END OF BOREHOLE**		7	SS	9

Borehole was dry and open upon completion of drilling.

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

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

Elevation Scale (m): 99, 98, 97, 96, 95, 94, 93

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

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

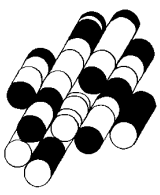
Lab Data and Comments

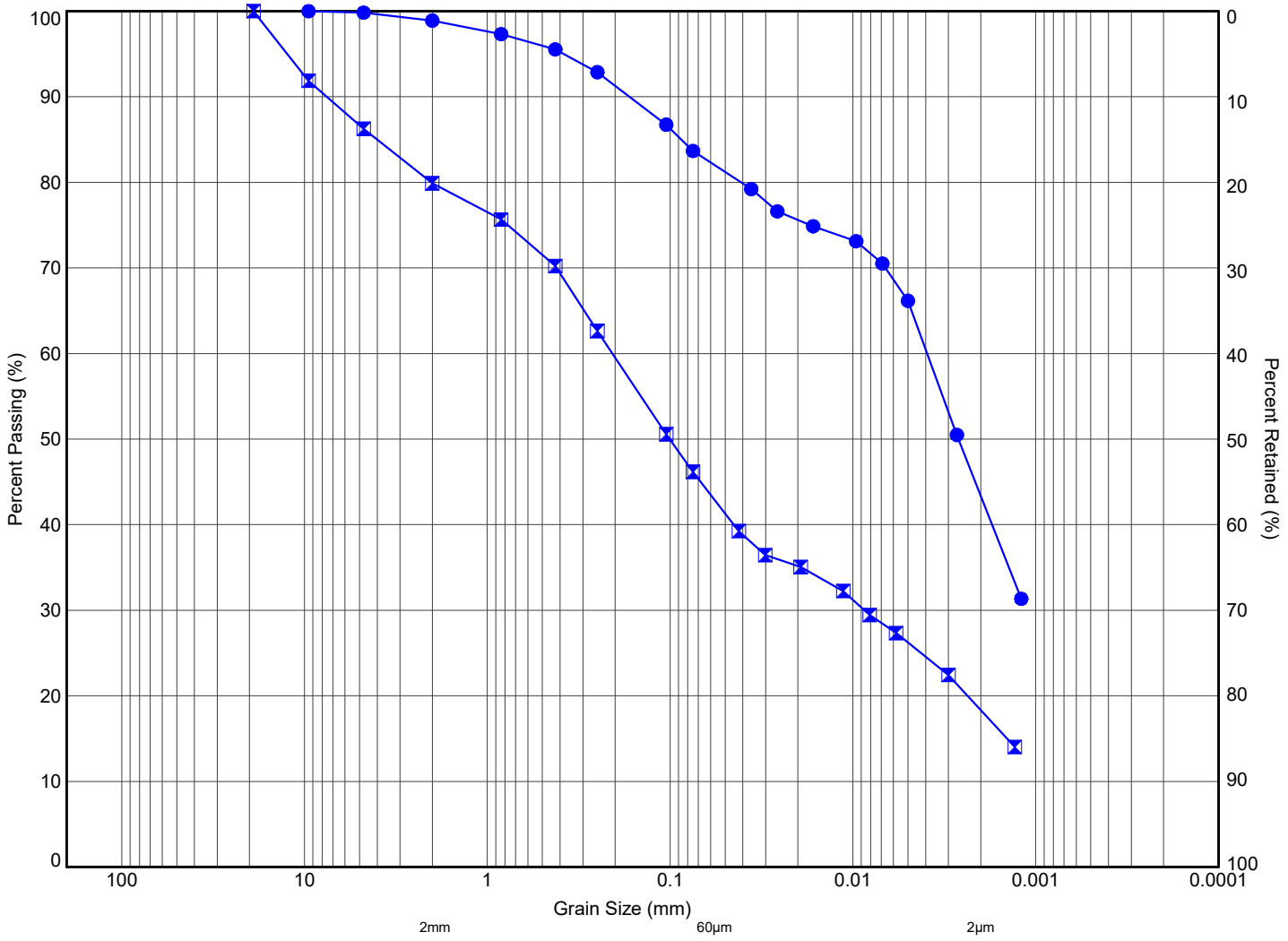
GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

file: 3-17-0076-46 bh logs.gpj

APPENDIX D

TERRAPROBE INC.





MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

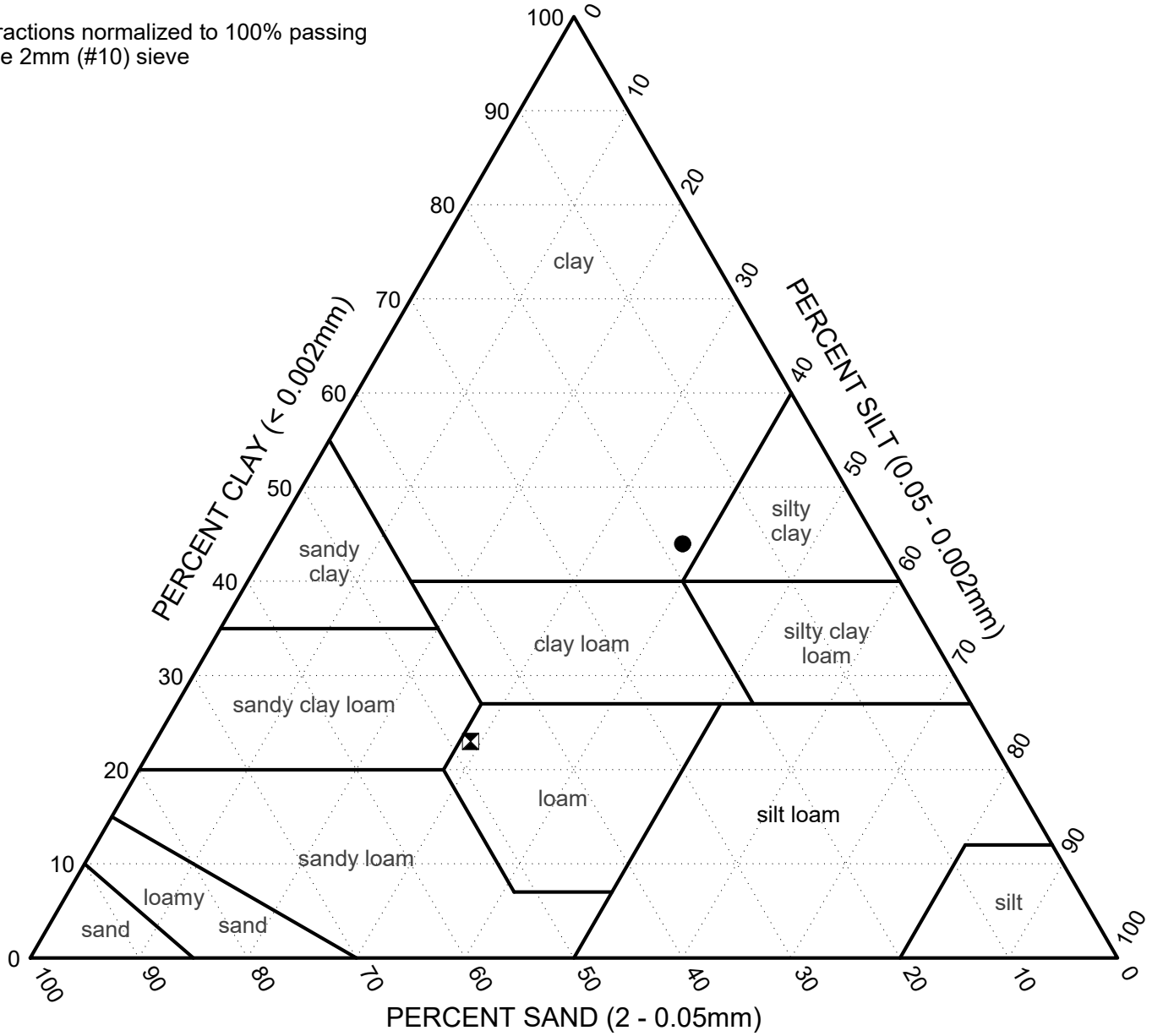
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**BH1**	SS5	3.3	95.1	1	17	39	43	
⧓	**BH5**	SS7	6.3	92.0	20	37	25	18	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title: **GRAIN SIZE DISTRIBUTION**

File No.: **3-17-0076-46**

Fractions normalized to 100% passing the 2mm (#10) sieve



	Borehole	Depth (m)	USDA Classification	Sand (%)	Silt (%)	Clay (%)
●	**BH1**	**3.3**	**CLAY**	**18**	**38**	**44**
⧓	**BH5**	**6.3**	**LOAM**	**48**	**29**	**23**

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

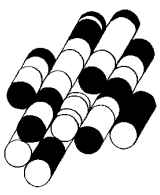
Title: **GRAIN SIZE DISTRIBUTION - TERNARY DIAGRAM**

File No.: **3-17-0076-46**

file: 3-17-0076-46 bh logs.gpj

APPENDIX E

TERRAPROBE INC.



FINAL REPORT

CA15568-OCT17 R1

3-17-0076-46 Cookstown, ON

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane, Brampton Canada, L6T 3Y3 Phone: (905) 796-2650. Fax:(905) 796-2250
Contact	Zenith Wong
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	zwong@terraprobe.ca
Project	3-17-0076-46 Cookstown, ON
Order Number	
Samples	Ground Water (1)

LABORATORY DETAILS

Project Specialist	Brian Graham B.Sc.
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brian.graham@sgs.com
SGS Reference	CA15568-OCT17
Received	10/27/2017
Approved	11/10/2017
Report Number	CA15568-OCT17 R1
Date Reported	11/10/2017

COMMENTS

SIGNATORIES

Brian Graham B.Sc.

TABLE OF CONTENTS

First Page..... 1

Index..... 2

Results..... 3-7

Holding Time Summary..... 8-9

QC Summary..... 10-23

Legend..... 24

Annexes..... 25-26

RESULTS

Sample Number	6
Sample Name	BH7
Sample Matrix	Ground Water
Sampled By	Nicholas G
Sample Date	25/10/2017

Parameter	Units	RL	Result	
Alkalinity				
Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006				
Alkalinity	mg/L as CaCO3	2	233	
Ammonia by SFA				
Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007				
Ammonia+Ammonium (N)	as N mg/L	0.1	< 0.1	
Anions by IC				
Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001				
Chloride	mg/L	0.2	130	
Sulphate	mg/L	0.2	31	
Nitrite (as N)	as N mg/L	0.03	< 0.03	
Nitrate (as N)	as N mg/L	0.06	< 0.06	
Nitrate + Nitrite (as N)	as N mg/L	0.06	< 0.06	
Colour				
Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002				
Colour	TCU	3	3	
Conductivity				
Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006				
Conductivity	uS/cm	2	874	
Cyanide by SFA				
Method: SM4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005				
Cyanide (free)	mg/L	0.005	< 0.005	
Cyanide (total)	mg/L	0.01	< 0.01	
Flouride by Specific Ion Electrode				
Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014				
Fluoride	mg/L	0.06	0.11	
Hexavalent Chromium by IC				
Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008				
Chromium VI	µg/L	0.2	< 0.2	
Mercury by CVAAS				

RESULTS

Sample Number	6
Sample Name	BH7
Sample Matrix	Ground Water
Sampled By	Nicholas G
Sample Date	25/10/2017

Parameter	Units	RL	Result	
Mercury by CVAAS (continued)				
Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004				
Mercury (total)	mg/L	0.00001	< 0.00001	
Metals in aqueous samples - ICP-MS				
Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-006				
Silver (total)	mg/L	0.00005	< 0.00005	
Aluminum (dissolved)	mg/L	0.001	0.531	
Arsenic (total)	mg/L	0.0002	0.0015	
Boron (total)	mg/L	0.002	0.068	
Barium (total)	mg/L	0.00002	0.202	
Beryllium (total)	mg/L	0.000007	0.000008	
Cadmium (total)	mg/L	0.000003	0.000005	
Cobalt (total)	mg/L	0.000004	0.000138	
Chromium (total)	mg/L	0.00003	0.00139	
Copper (total)	mg/L	0.00002	0.00157	
Iron (total)	mg/L	0.007	0.215	
Molybdenum (total)	mg/L	0.00001	0.00320	
Magnesium (total)	mg/L	0.001	25.2	
Nickel (total)	mg/L	0.0001	0.0005	
Lead (total)	mg/L	0.00001	0.00055	
Antimony (total)	mg/L	0.0002	0.0003	
Strontium (total)	mg/L	0.00002	0.807	
Selenium (total)	mg/L	0.00004	0.00031	
Thallium (total)	mg/L	0.000005	0.000024	
Titanium (total)	mg/L	0.00005	0.01047	
Uranium (total)	mg/L	0.000002	0.00171	
Vanadium (total)	mg/L	0.00001	0.00165	
Tungsten (total)	mg/L	0.00002	< 0.00002	
Zinc (total)	mg/L	0.002	0.003	
Zirconium (total)	mg/L	0.002	< 0.002	
Nonylphenol and Ethoxylates				
Method: ASTM D7065-06 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-015				
Nonylphenol	µg/L	1.0	< 1	
Nonylphenol diethoxylate	µg/L	10	< 10	

RESULTS

Sample Number	6
Sample Name	BH7
Sample Matrix	Ground Water
Sampled By	Nicholas G
Sample Date	25/10/2017

Parameter	Units	RL	Result	
Nonylphenol and Ethoxylates (continued)				
Method: ASTM D7065-06 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-015				
Nonylphenol Ethoxylates	µg/L	10	< 10	
Nonylphenol monoethoxylate	µg/L	10	< 10	
Petroleum Hydrocarbons (F1)				
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010				
CCME F1 (C6-C10)	µg/L	25	< 25	
Petroleum Hydrocarbons (F2-F4)				
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010				
CCME F2 (C10-C16)	µg/L	100	< 100	
CCME F3 (C16-C34)	µg/L	200	< 200	
CCME F4 (C34-C50)	µg/L	200	< 200	
Chromatogram returned to baseline at nC50	Yes / No	-	YES	
pH				
Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006				
pH	no unit	0.05	7.94	
Phenols by SFA				
Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006				
4AAP-Phenolics	mg/L	0.002	0.003	
Polychlorinated Biphenyls				
Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-[ENV]GC-LAK-AN-001				
Polychlorinated Biphenyls (PCBs) - Total	µg/L	0.04	< 0.04	
Semi-Volatile Organics				
Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005				
Bis(2-ethylhexyl)phthalate	µg/L	2	< 2	
di-n-Butyl Phthalate	µg/L	2	< 2	
Fluorene	µg/L	0.1	< 0.1	
2,4-Dichlorophenol	µg/L	1	< 1	
Phenol	µg/L	1	< 1	
Bisphenol A	µg/L	1	< 1	
Acenaphthene	µg/L	0.1	< 0.1	
Acenaphthylene	µg/L	0.1	< 0.1	

RESULTS

Sample Number	6
Sample Name	BH7
Sample Matrix	Ground Water
Sampled By	Nicholas G
Sample Date	25/10/2017

Semi-Volatile Organics (continued)

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	Units	RL	Result	
Benzo(a)pyrene	µg/L	0.01	< 0.01	
Naphthalene	µg/L	0.5	< 0.5	
Phenanthrene	µg/L	0.1	< 0.1	

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	Units	RL	Result	
Total Suspended Solids	mg/L	2	168	

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	Units	RL	Result	
Total Kjeldahl Nitrogen	as N mg/L	0.5	< 0.5	

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	Units	RL	Result	
Turbidity	NTU	0.10	9.56	

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	Units	RL	Result	
Bromodichloromethane	µg/L	0.5	< 0.5	
Bromoform	µg/L	0.5	< 0.5	
Bromomethane	µg/L	0.5	< 0.5	
Chlorobenzene	µg/L	0.5	< 0.5	
Dibromochloromethane	µg/L	0.5	< 0.5	
Chloroform	µg/L	0.5	< 0.5	
Chloromethane	µg/L	5.0	< 5	
1,2-Dichlorobenzene	µg/L	0.5	< 0.5	
1,3-Dichlorobenzene	µg/L	0.5	< 0.5	
1,4-Dichlorobenzene	µg/L	0.5	< 0.5	
1,1-Dichloroethane	µg/L	0.5	< 0.5	
1,2-Dichloroethane	µg/L	0.5	< 0.5	
1,1-Dichloroethylene	µg/L	0.5	< 0.5	
trans-1,2-Dichloroethene	µg/L	0.5	< 0.5	
trans-1,3-Dichloropropene	µg/L	0.5	< 0.5	
Ethylenedibromide	µg/L	0.2	< 0.2	
Methyl ethyl ketone	µg/L	20	< 20	
Methylene Chloride	µg/L	0.5	< 0.5	
Methyl-t-butyl Ether	µg/L	2.0	< 2	

RESULTS

Sample Number	6
Sample Name	BH7
Sample Matrix	Ground Water
Sampled By	Nicholas G
Sample Date	25/10/2017

Volatile Organics (continued)

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	Units	RL	Result	
Styrene	µg/L	0.5	< 0.5	
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5	
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5	
Tetrachloroethylene	µg/L	0.5	< 0.5	
1,2,3-Trichlorobenzene	µg/L	0.9	< 0.9	
1,2,4-Trichlorobenzene	µg/L	0.5	< 0.5	
1,3,5-Trichlorobenzene	µg/L	0.5	< 0.5	
Trichloroethylene	µg/L	0.5	0.7	
Vinyl Chloride	µg/L	0.2	< 0.2	
Dibromomethane	µg/L	1.0	< 1	
Acetone	µg/L	30	< 30	
n-Hexane	µg/L	1.0	< 1	
Methyl Isobutyl Ketone	µg/L	20	< 20	
Trichlorofluoromethane	µg/L	5.0	< 5	
cis-1,2-Dichloroethylene	µg/L	0.5	< 0.5	
1,1,1-Trichloroethane	µg/L	0.5	< 0.5	
1,2-Dichloropropane	µg/L	0.5	< 0.5	
1,1,2-Trichloroethane	µg/L	0.5	< 0.5	
Carbon tetrachloride	µg/L	0.2	< 0.2	
Benzene	µg/L	0.5	< 0.5	
Ethylbenzene	µg/L	0.5	< 0.5	
Toluene	µg/L	0.5	< 0.5	
Xylene (total)	µg/L	0.5	< 0.5	
m/p-xylene	µg/L	0.5	< 0.5	
o-xylene	µg/L	0.5	< 0.5	

HOLDING TIME SUMMARY

Sample Name	QC Batch Reference	Sample Number	Sampled	Received	Extracted/ Prepared	Analysed	Holding Time	Approved
Alkalinity								
Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006								
BH7	EWL0446-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/08/2017	10/31/2017
Ammonia by SFA								
Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007								
BH7	SKA0003-NOV17	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	11/22/2017	11/01/2017
Anions by IC								
Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001								
BH7	DIO0488-OCT17	6	10/25/2017	10/27/2017	11/02/2017	11/02/2017 †	11/01/2017	11/03/2017
Colour								
Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002								
BH7	EWL0445-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/01/2017	10/31/2017
Conductivity								
Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006								
BH7	EWL0446-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/22/2017	10/31/2017
Cyanide by SFA								
Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005								
BH7	NA	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	11/08/2017	11/01/2017
Flouride by Specific Ion Electrode								
Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014								
BH7	EWL0442-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/22/2017	10/31/2017
Hexavalent Chromium by IC								
Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008								
BH7	DIO0489-OCT17	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	11/08/2017	11/02/2017
Mercury by CVAAS								
Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004								
BH7	EHG0053-OCT17	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	11/22/2017	10/31/2017
Metals in aqueous samples - ICP-MS								
Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-006								
BH7	EMS0217-OCT17	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	12/24/2017	11/01/2017
Nonylphenol and Ethoxylates								
Method: ASTM D7065-06 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-015								
BH7	GCM0476-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/22/2017	11/01/2017

HOLDING TIME SUMMARY

Sample Name	QC Batch Reference	Sample Number	Sampled	Received	Extracted/ Prepared	Analysed	Holding Time	Approved
Petroleum Hydrocarbons (F1)								
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010								
BH7	GCM0483-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/08/2017	11/02/2017
Petroleum Hydrocarbons (F2-F4)								
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010								
BH7	GCM0474-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/08/2017	11/01/2017
pH								
Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006								
BH7	EWL0446-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/01/2017	10/31/2017
Phenols by SFA								
Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006								
BH7	SKA0015-NOV17	6	10/25/2017	10/27/2017	11/01/2017	11/01/2017	11/22/2017	11/02/2017
Polychlorinated Biphenyls								
Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-[ENV]GC-LAK-AN-001								
BH7	GCM0473-OCT17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/14/2017	11/02/2017
Semi-Volatile Organics								
Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005								
BH7	GCM0487-OCT17	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	11/08/2017	11/02/2017
Suspended Solids								
Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004								
BH7	EWL0022-NOV17	6	10/25/2017	10/27/2017	10/30/2017	10/30/2017	11/01/2017	11/03/2017
Total Nitrogen								
Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002								
BH7	SKA0079-NOV17	6	10/25/2017	10/27/2017	11/07/2017	11/07/2017	11/22/2017	11/09/2017
Turbidity								
Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003								
BH7	EWL0437-OCT17	6	10/25/2017	10/27/2017	10/27/2017	10/27/2017	10/27/2017	10/30/2017
Volatile Organics								
Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004								
BH7	GCM0490-OCT17	6	10/25/2017	10/27/2017	10/31/2017	10/31/2017	11/08/2017	11/02/2017

QC SUMMARY

Alkalinity

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0446-OCT17	mg/L as CaCO3	2	< 2	1	10	102	90	110	NA		

Ammonia by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0003-NOV17	mg/L	0.1	<0.1	ND	10	95	90	110	100	75	125

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0038-NOV17	mg/L	0.2	<0.2	1	20	106	80	120	99	75	125
Sulphate	DIO0038-NOV17	mg/L	0.2	<0.2	ND	20	102	80	120	97	75	125
Nitrate + Nitrite (as N)	DIO0488-OCT17	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0488-OCT17	mg/L	0.03	<0.03	ND	20	101	80	120	102	75	125
Nitrate (as N)	DIO0488-OCT17	mg/L	0.06	<0.06	1	20	103	80	120	103	75	125

Colour

Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0445-OCT17	TCU	3	< 3	ND	10	95	90	110	NA		

QC SUMMARY

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0446-OCT17	uS/cm	2	< 2	0	10	100	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0210-OCT17	mg/L	0.01	<0.01	ND	10	97	90	110	93	75	125

Flouride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0442-OCT17	mg/L	0.06	<0.06	ND	10	99	90	110	95	75	125

QC SUMMARY

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0489-OCT17	ug/L	0.2	<0.2	ND	20	95	80	120	99	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0053-OCT17	mg/L	0.00001	< 0.00001	ND	20	82	80	120	99	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Boron (total)	EMS0206-OCT17	mg/L	0.002	<0.002	1	20	98	90	110	NV	70	130
Silver (total)	EMS0217-OCT17	mg/L	0.00005	< 0.1	ND	20	96	90	110	NV	70	130
Aluminum (dissolved)	EMS0217-OCT17	mg/L	0.001	< 0.1	10	20	96	90	110	110	70	130
Arsenic (total)	EMS0217-OCT17	mg/L	0.0002	< 0.1	ND	20	96	90	110	113	70	130
Barium (total)	EMS0217-OCT17	mg/L	0.00002	< 0.1	1	20	101	90	110	NV	70	130
Beryllium (total)	EMS0217-OCT17	mg/L	0.000007	< 0.1	ND	20	104	90	110	98	70	130
Boron (total)	EMS0217-OCT17	mg/L	0.002	< 0.1	9	20	101	90	110	NV	70	130
Cadmium (total)	EMS0217-OCT17	mg/L	0.000003	< 0.1	ND	20	94	90	110	102	70	130
Cobalt (total)	EMS0217-OCT17	mg/L	0.000004	< 0.1	12	20	94	90	110	105	70	130
Chromium (total)	EMS0217-OCT17	mg/L	0.00003	< 0.1	0	20	94	90	110	100	70	130
Copper (total)	EMS0217-OCT17	mg/L	0.00002	< 0.1	2	20	94	90	110	81	70	130
Iron (total)	EMS0217-OCT17	mg/L	0.007	< 0.1	3	20	102	90	110	NV	70	130
Magnesium (total)	EMS0217-OCT17	mg/L	0.001	< 0.1	2	20	96	90	110	NV	70	130
Molybdenum (total)	EMS0217-OCT17	mg/L	0.00001	< 0.1	12	20	99	90	110	106	70	130
Nickel (total)	EMS0217-OCT17	mg/L	0.0001	< 0.1	2	20	95	90	110	103	70	130
Lead (total)	EMS0217-OCT17	mg/L	0.00001	< 0.1	ND	20	103	90	110	99	70	130
Antimony (total)	EMS0217-OCT17	mg/L	0.0002	< 0.1	3	20	101	90	110	93	70	130
Selenium (total)	EMS0217-OCT17	mg/L	0.00004	< 0.1	2	20	103	90	110	111	70	130
Strontium (total)	EMS0217-OCT17	mg/L	0.00002	< 0.1	2	20	96	90	110	NV	70	130
Titanium (total)	EMS0217-OCT17	mg/L	0.00005	< 0.1	ND	20	97	90	110	NV	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Thallium (total)	EMS0217-OCT17	mg/L	0.000005	< 0.1	ND	20	102	90	110	104	70	130
Uranium (total)	EMS0217-OCT17	mg/L	0.000002	< 0.1	11	20	103	90	110	101	70	130
Vanadium (total)	EMS0217-OCT17	mg/L	0.00001	< 0.1	ND	20	94	90	110	105	70	130
Tungsten (total)	EMS0217-OCT17	mg/L	0.00002	< 0.1	2	20	98	90	110	NV	70	130
Zinc (total)	EMS0217-OCT17	mg/L	0.002	< 0.1	2	20	97	90	110	93	70	130
Zirconium (total)	EMS0217-OCT17	mg/L	0.002	< 0.1	ND	20	90	90	110	NV	70	130

Metals Prep

|

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Recov.Metals	EMS0217-OCT17	Prep	-	< 0.1								

QC SUMMARY

Nonylphenol and Ethoxylates

Method: ASTM D7065-06 | Internal ref.: ME-CA-IENVIGC-LAK-AN-015

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nonylphenol	GCM0476-OCT17	ug/L	1.0	< 1			88	55	120			
Nonylphenol diethoxylate	GCM0476-OCT17	ug/L	10	< 10			87	55	120			
Nonylphenol Ethoxylates	GCM0476-OCT17	ug/L	10	< 10								
Nonylphenol monoethoxylate	GCM0476-OCT17	ug/L	10	< 10			85	55	120			

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-IENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
CCME F1 (C6-C10)	GCM0483-OCT17	ug/L	25	<25	ND	30	97	60	140	95	60	140

QC SUMMARY

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
CCME F2 (C10-C16)	GCM0474-OCT17	ug/L	100	<100	NSS	30	98	60	140	NSS	60	140
CCME F3 (C16-C34)	GCM0474-OCT17	ug/L	200	<200	NSS	30	98	60	140	NSS	60	140
CCME F4 (C34-C50)	GCM0474-OCT17	ug/L	200	<200	NSS	30	98	60	140	NSS	60	140

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0446-OCT17	no unit	0.05	NA	0		101			NA		

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0015-NOV17	mg/L	0.002	<0.002	ND	10	103	90	110	92	75	125

QC SUMMARY

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-[ENV]GC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0473-OCT17	ug/L	0.04	< 0.04	NSS	30	106	60	140	NSS	60	140

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
2,4-Dichlorophenol	GCM0487-OCT17	ug/L	1	< 1	NSS	30	83	50	140	NSS	50	140
Acenaphthene	GCM0487-OCT17	ug/L	0.1	< 0.1	NSS	30	70	50	140	NSS	50	140
Acenaphthylene	GCM0487-OCT17	ug/L	0.1	< 0.1	NSS	30	69	50	140	NSS	50	140
Benzo(a)pyrene	GCM0487-OCT17	ug/L	0.01	< 0.01	NSS	30	80	50	140	NSS	50	140
Bis(2-ethylhexyl)phthalate	GCM0487-OCT17	ug/L	2	< 2	NSS	30	84	50	140	NSS	50	140
Bisphenol A	GCM0487-OCT17	ug/L	1	< 1	NSS	30	86	50	140	NSS	50	140
di-n-Butyl Phthalate	GCM0487-OCT17	ug/L	2	< 2	NSS	30	86	50	140	NSS	50	140
Fluorene	GCM0487-OCT17	ug/L	0.1	< 0.1	NSS	30	72	50	140	NSS	50	140
Naphthalene	GCM0487-OCT17	ug/L	0.5	< 0.5	NSS	30	63	50	140	NSS	50	140
Phenanthrene	GCM0487-OCT17	ug/L	0.1	< 0.1	NSS	30	79	50	140	NSS	50	140
Phenol	GCM0487-OCT17	ug/L	1	< 1	NSS	30	33	20	130	NSS	20	130

QC SUMMARY

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0022-NOV17	mg/L	2	< 2	6	10	97	90	110	NA		
Total Suspended Solids	EWL0458-OCT17	mg/L	2	< 2	5	10	99	90	110	NA		

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENVISFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0059-NOV17	as N mg/L	0.5	<0.5	0	10	102	90	110	115	75	125
Total Kjeldahl Nitrogen	SKA0079-NOV17	as N mg/L	0.5	<0.5	2	10	110	90	110	109	75	125

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0437-OCT17	NTU	0.10	< 0.10	0	10	98	90	110	NA		

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzene	GCM0483-OCT17	ug/L	0.5	<0.5	ND	30	92	60	130	89	50	140
Ethylbenzene	GCM0483-OCT17	ug/L	0.5	<0.5	ND	30	105	60	130	80	50	140
m/p-xylene	GCM0483-OCT17	ug/L	0.5	<0.5	ND	30	107	60	130	88	50	140
o-xylene	GCM0483-OCT17	ug/L	0.5	<0.5	ND	30	105	60	130	90	50	140
Toluene	GCM0483-OCT17	ug/L	0.5	<0.5	ND	30	104	60	130	93	50	140
1,1,1,2-Tetrachloroethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	100	60	130	NSS	50	140
1,1,1-Trichloroethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	102	60	130	NSS	50	140
1,1,2,2-Tetrachloroethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
1,1,2-Trichloroethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	102	60	130	NSS	50	140
1,1-Dichloroethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
1,1-Dichloroethylene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	98	60	130	NSS	50	140
1,2,3-Trichlorobenzene	GCM0490-OCT17	ug/L	0.9	<0.9	NSS	30	103	60	130	NSS	50	140
1,2,4-Trichlorobenzene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	100	60	130	NSS	50	140
1,2-Dichlorobenzene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	99	60	130	NSS	50	140
1,2-Dichloroethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
1,2-Dichloropropane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	103	60	130	NSS	50	140
1,3,5-Trichlorobenzene	GCM0490-OCT17	ug/L	0.5	< 0.5	NSS	30	90	60	130	NSS	50	140
1,3-Dichlorobenzene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
1,4-Dichlorobenzene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	100	60	130	NSS	50	140
Acetone	GCM0490-OCT17	ug/L	30	<30	NSS	30	98	60	130	NSS	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromodichloromethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	103	60	130	NSS	50	140
Bromoform	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	99	60	130	NSS	50	140
Bromomethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	109	50	140	NSS	50	140
Carbon tetrachloride	GCM0490-OCT17	ug/L	0.2	<0.2	NSS	30	102	60	130	NSS	50	140
Chlorobenzene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	100	60	130	NSS	50	140
Chloroform	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
Chloromethane	GCM0490-OCT17	ug/L	5.0	<5	NSS	30	106	60	130	NSS	50	140
cis-1,2-Dichloroethylene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	100	60	130	NSS	50	140
Dibromochloromethane	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
Dibromomethane	GCM0490-OCT17	ug/L	1.0	<1	NSS	30	103	60	130	NSS	50	140
Ethylenedibromide	GCM0490-OCT17	ug/L	0.2	<0.2	NSS	30	101	60	130	NSS	50	140
n-Hexane	GCM0490-OCT17	ug/L	1.0	<1	NSS	30	85	60	130	NSS	50	140
Methyl ethyl ketone	GCM0490-OCT17	ug/L	20	<20	NSS	30	101	60	130	NSS	50	140
Methyl Isobutyl Ketone	GCM0490-OCT17	ug/L	20	<20	NSS	30	100	50	140	NSS	50	140
Methyl-t-butyl Ether	GCM0490-OCT17	ug/L	2.0	<2	NSS	30	96	60	130	NSS	50	140
Methylene Chloride	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
Styrene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	99	60	130	NSS	50	140
Tetrachloroethylene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
trans-1,2-Dichloroethene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	101	60	130	NSS	50	140
trans-1,3-Dichloropropene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	108	60	130	NSS	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Trichloroethylene	GCM0490-OCT17	ug/L	0.5	<0.5	NSS	30	102	60	130	NSS	50	140
Trichlorofluoromethane	GCM0490-OCT17	ug/L	5.0	<5	NSS	30	103	50	140	NSS	50	140
Vinyl Chloride	GCM0490-OCT17	ug/L	0.2	<0.2	NSS	30	104	60	130	NSS	50	140

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

SGS

Request for Laboratory Services and CHAIN OF CUSTODY

No: 00019

Page ___ of ___

SGS Environment, Health and Safety
- Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361 Web: www.ca.sgs.com

Received By: K Hetherton
Received Date: 10 / 26 / 17 (mm\dd\yy)
Received Time: ___ : ___ am / pm (circle)

Laboratory Information Section - Lab use only
Received By (signature): K Hetherton
Custody Seal Present: Y / (N) (circle)
Custody Seal Intact: Y / (N)
Cooling Agent Present: (Y) / N Type: Ice packs
Temperature Upon Receipt (°C): 12 x 3
LAB LIMS #: CA15568-Oct17

REPORT INFORMATION

Company: Terraprobe Inc.
Contact: Zeith Wong
Address: 11 Indell Lane
Brampton, ON
Phone:
Fax:
Email: zwong@terraprobe.ca

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #: P.O. #:
Project #: 3-17-0076-46 Site Location/ID: Cookstown, ON

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 3pm or on weekends : TAT begins the next business day

RUSH TAT (Additional Charges May Apply) ☐ 1 Day ☐ 2 Days ☐ 3-4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153 (2011):
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☑ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium
☐ Table ___ ☐ Fine

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☑ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

DRINKING WATER SAMPLES (POTABLE WATER FOR HUMAN CONSUMPTION) MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

RECORD OF SITE CONDITION (RSC) ☐ YES ☑ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	PWQO	COMMENTS: Field Filtered (F) Preserved (P)
1	BH7	Oct. 25	PM	20	GW	✓	
2							
3							
4							
5							
6							
7							
8							
9							
10							

Observations/Comments/Special Instructions

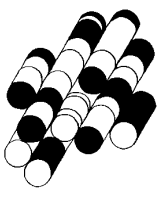
Sampled By (NAME): Bo Hwang	**Signature:**	Date: 10 / 25 / 17 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Bo Hwang	**Signature:**	Date: 10 / 26 / 17 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 25 July, 2016

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

APPENDIX F

TERRAPROBE INC.



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

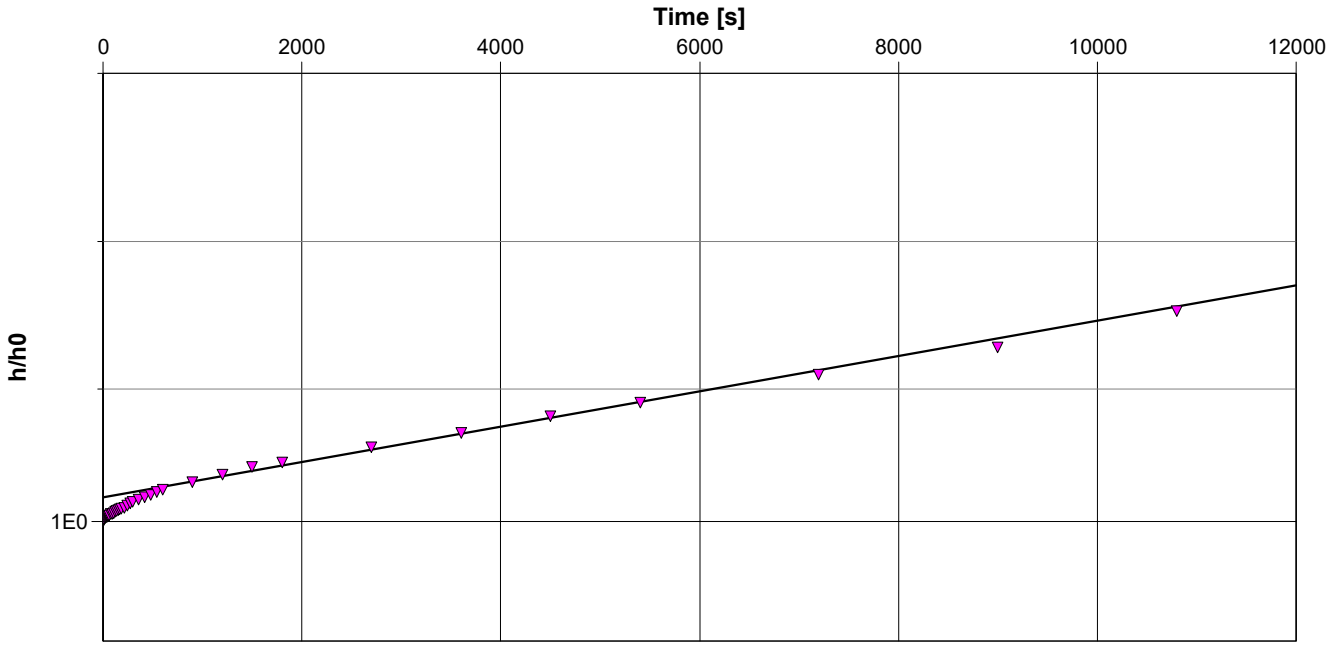
Slug Test Analysis Report

Project: 24 Wellington St

Number: 3-17-0076-46

Client: Paolini Supermarket Ltd.

Location: Cookstown	Slug Test: BH7	Test Well: BH7
Test Conducted by: NG		Test Date: 10/11/2017
Analysis Performed by: ZW	Rising Head Test BH7	Analysis Date: 11/21/2017
Aquifer Thickness: 39.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH7	5.30×10^{-9}	

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

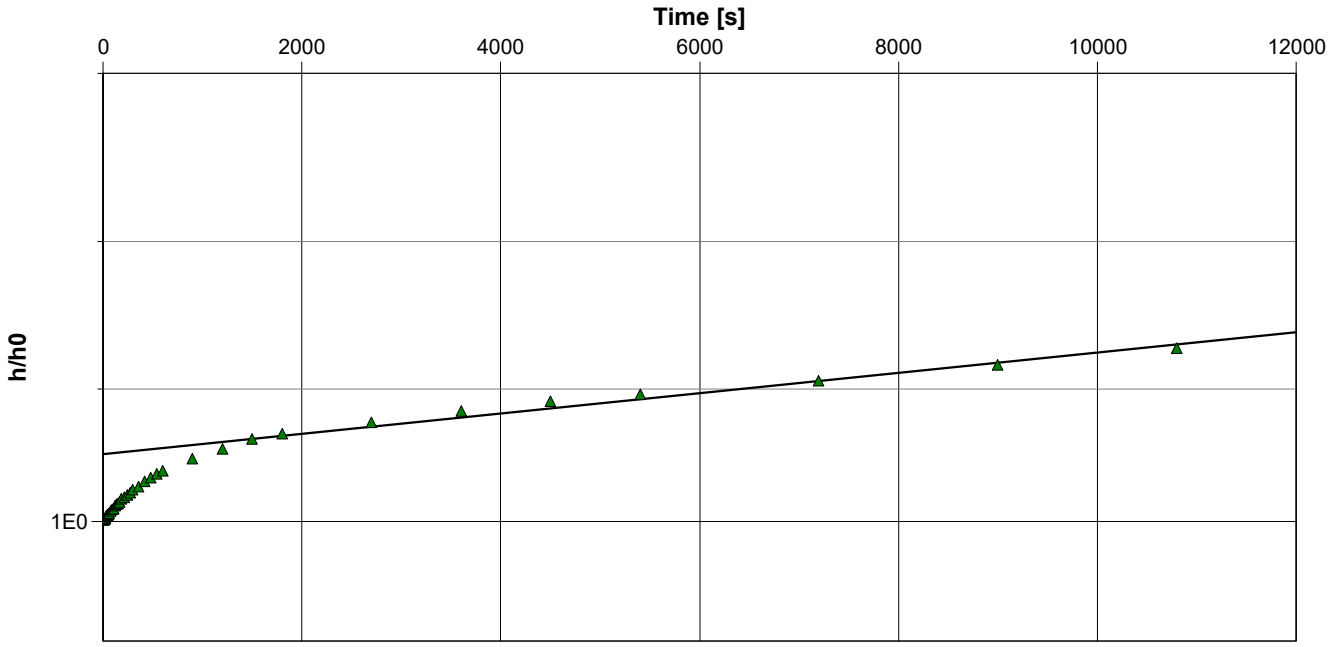
Slug Test Analysis Report

Project: 24 Wellington St

Number: 3-17-0076-46

Client: Paolini Supermarket Ltd.

Location: Cookstown	Slug Test: BH5	Test Well: BH5
Test Conducted by: NG		Test Date: 10/11/2017
Analysis Performed by: ZW	Rising Head Test BH5	Analysis Date: 11/21/2017
Aquifer Thickness: 39.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH5	3.04×10^{-9}	

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

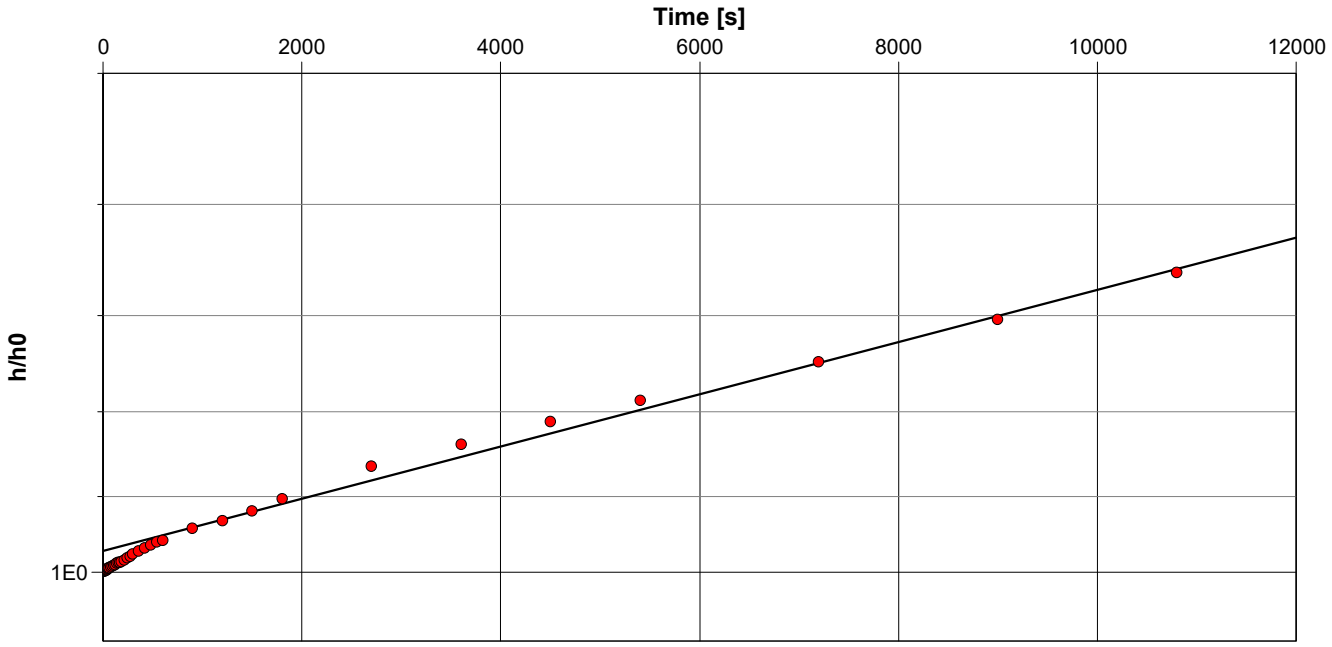
Slug Test Analysis Report

Project: 24 Wellington St

Number: 3-17-0076-46

Client: Paolini Supermarket Ltd.

Location: Cookstown	Slug Test: BH3	Test Well: BH3
Test Conducted by: NG		Test Date: 10/11/2017
Analysis Performed by: ZW	Rising Head Test BH3	Analysis Date: 11/21/2017
Aquifer Thickness: 39.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH3	1.37×10^{-8}	

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

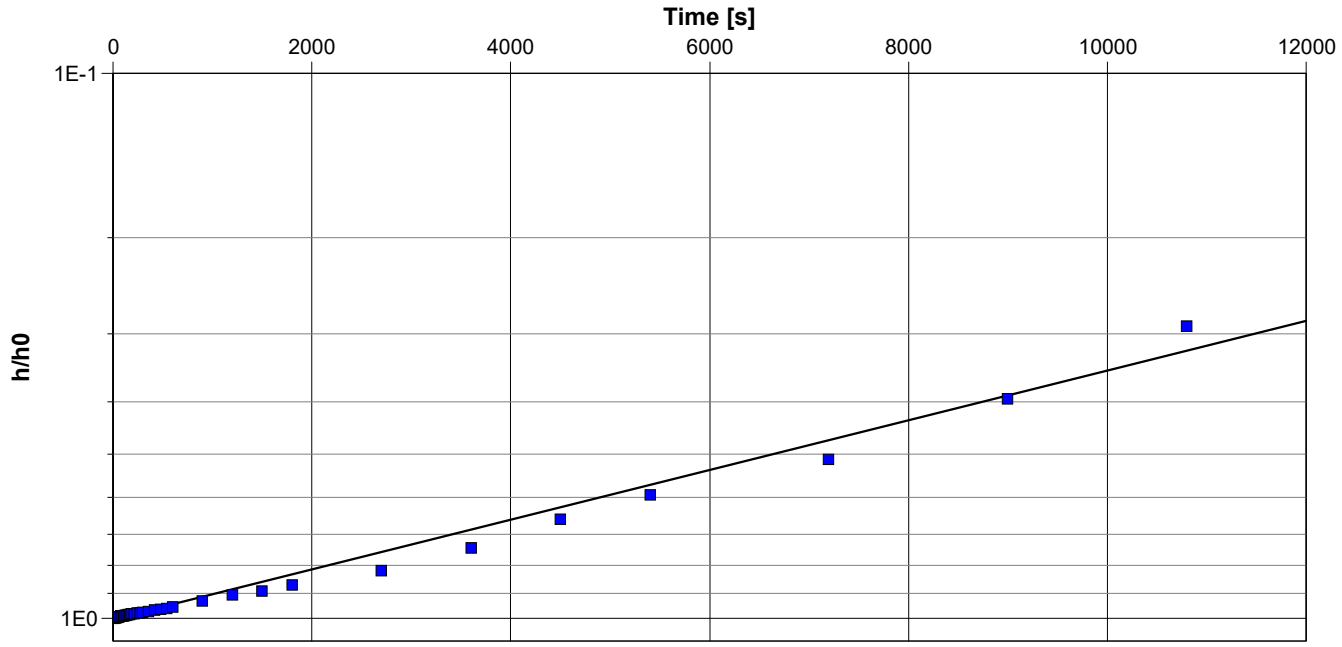
Slug Test Analysis Report

Project: 24 Wellington St

Number: 3-17-0076-46

Client: Paolini Supermarket Ltd.

Location: Cookstown	Slug Test: BH1	Test Well: BH1
Test Conducted by: NG		Test Date: 10/11/2017
Analysis Performed by: ZW	Rising Head Test BH1	Analysis Date: 11/21/2017
Aquifer Thickness: 39.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH1	3.96×10^{-8}	

Guelph Permeameter

Input

Result

Single Head Method (1)

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): 2.16

Enter water Head Height ("H" in cm): 5

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 1.2000

Res Type	2.16
H	5
a	3
H/a	1.667
a*	0.12
C0.01	0.809
C0.04	0.842
C0.12	0.803
C0.36	0.803
C	0.803
R	1.200
Q	0.043
pi	3.142

α^*= 0.12 cm^{-1}

C = 0.803154

Q = 0.0432

K_{fs} = 7.86E-05 cm/sec
4.71E-03 cm/min
7.86E-07 m/sec
1.86E-03 inch/min
3.09E-05 inch/sec

Φ_m = 6.55E-04 cm^2/min

Single Head Method (2)

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): 2.16

Enter water Head Height ("H" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 2.8000

Res Type	2.16
H	10
a	3
H/a	3.33333
a*	0.04
C0.01	1.21841
C0.04	1.29023
C0.12	1.28754
C0.36	1.28754
C	1.29023
R	2.800
Q	0.1008
pi	3.1415

α^*= 0.04 cm^{-1}

C = 1.290234

Q = 0.1008

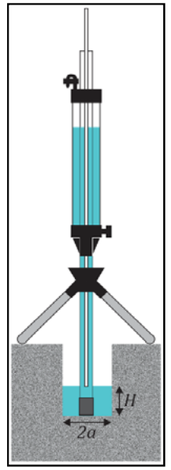
K_{fs} = 5.82E-05 cm/sec
3.49E-03 cm/min
5.82E-07 m/ses
1.37E-03 inch/min
2.29E-05 inch/sec

Φ_m = 1.45E-03 cm^2/min

Average

K_{fs} = 6.84E-05 cm/sec
4.10E-03 cm/min
6.84E-07 m/s
1.62E-03 inch/min
2.69E-05 inch/sec

Φ_m = 1.05E-03 cm^2/min



Double Head Method

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir):

Enter the first water Head Height ("H1" in cm):

Enter the second water Head Height ("H2" in cm):

Enter the Borehole Radius ("a" in cm):

Enter the soil texture-structure category (enter one of the below numbers):

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

α^*= 0 cm^{-1}

α= #DIV/0!

Steady State Rate of Water Level Change ("R1" in cm/min):

Steady State Rate of Water Level Change ("R2" in cm/min):

Res Type:	0
H1/a:	#DIV/0!
H2/a:	#DIV/0!
C1-0.01:	#DIV/0!
C2-0.01:	#DIV/0!
C1-0.04:	#DIV/0!
C2-0.04:	#DIV/0!
C1-0.12:	#DIV/0!
C2-0.12:	#DIV/0!
C1-0.36:	#DIV/0!
C2-0.36:	#DIV/0!
G-Denominator:	0

Q_1 = 0

Q_2 = 0

C_1 = 0

C_2 = 0

G_1 = #DIV/0!

G_2 = #DIV/0!

G_3 = #DIV/0!

G_4 = #DIV/0!

K_{fs} = #DIV/0! cm/sec
#DIV/0! cm/min
#DIV/0! m/sec
#DIV/0! inch/min
#DIV/0! inch/sec

Φ_m = #DIV/0! cm^2/min

Θ_{fs} = cm^3/cm^3

Θ_i = cm^3/cm^3

Sorptivity #DIV/0! ($cm\ min^{-½}$)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

Guelph Permeameter

Input

Result

Single Head Method (1)

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): 2.16

Enter water Head Height ("H" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1000

Res Type	2.16
H	10
a	3
H/a	3.333
a*	0.04
C0.01	1.218
C0.04	1.29
C0.12	1.288
C0.36	1.288
C	1.29
R	0.100
Q	0.004
pi	3.142

α^*= 0.04 cm^{-1}

C = 1.290234

Q = 0.0036

K_{fs} = 2.08E-06 cm/sec
1.25E-04 cm/min
2.08E-08 m/sec
4.91E-05 inch/min
8.18E-07 inch/sec

Φ_m = 5.19E-05 cm^2/min

Single Head Method (2)

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): 2.16

Enter water Head Height ("H" in cm): 20

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1000

Res Type	2.16
H	20
a	3
H/a	6.66667
a*	0.12
C0.01	1.7546
C0.04	1.90307
C0.12	1.98019
C0.36	1.98019
C	1.98019
R	0.100
Q	0.0036
pi	3.1415

α^*= 0.12 cm^{-1}

C = 1.980192

Q = 0.0036

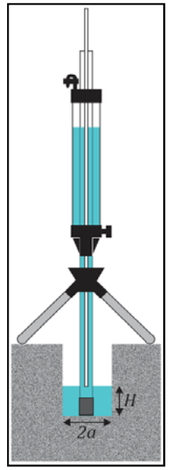
K_{fs} = 1.97E-06 cm/sec
1.18E-04 cm/min
1.97E-08 m/ses
4.66E-05 inch/min
7.76E-07 inch/sec

Φ_m = 1.64E-05 cm^2/min

Average

K_{fs} = 2.02E-06 cm/sec
1.21E-04 cm/min
2.02E-08 m/s
4.78E-05 inch/min
7.97E-07 inch/sec

Φ_m = 3.42E-05 cm^2/min



Double Head Method

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir):

Enter the first water Head Height ("H1" in cm):

Enter the second water Head Height ("H2" in cm):

Enter the Borehole Radius ("a" in cm):

Enter the soil texture-structure category (enter one of the below numbers):

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

α^*= 0 cm^{-1}

α= #DIV/0!

Steady State Rate of Water Level Change ("R1" in cm/min):

Steady State Rate of Water Level Change ("R2" in cm/min):

Res Type:	0
H1/a:	#DIV/0!
H2/a:	#DIV/0!
C1-0.01:	#DIV/0!
C2-0.01:	#DIV/0!
C1-0.04:	#DIV/0!
C2-0.04:	#DIV/0!
C1-0.12:	#DIV/0!
C2-0.12:	#DIV/0!
C1-0.36:	#DIV/0!
C2-0.36:	#DIV/0!
G-Denominator:	0

Q_1 = 0

Q_2 = 0

C_1 = 0

C_2 = 0

G_1 = #DIV/0!

G_2 = #DIV/0!

G_3 = #DIV/0!

G_4 = #DIV/0!

K_{fs} = #DIV/0! cm/sec
#DIV/0! cm/min
#DIV/0! m/sec
#DIV/0! inch/min
#DIV/0! inch/sec

Φ_m = #DIV/0! cm^2/min

Θ_{fs} = cm^3/cm^3

Θ_i = cm^3/cm^3

Sorptivity #DIV/0! ($cm\ min^{-½}$)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

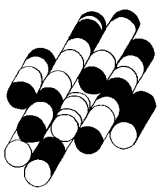
Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

APPENDIX G

TERRAPROBE INC.

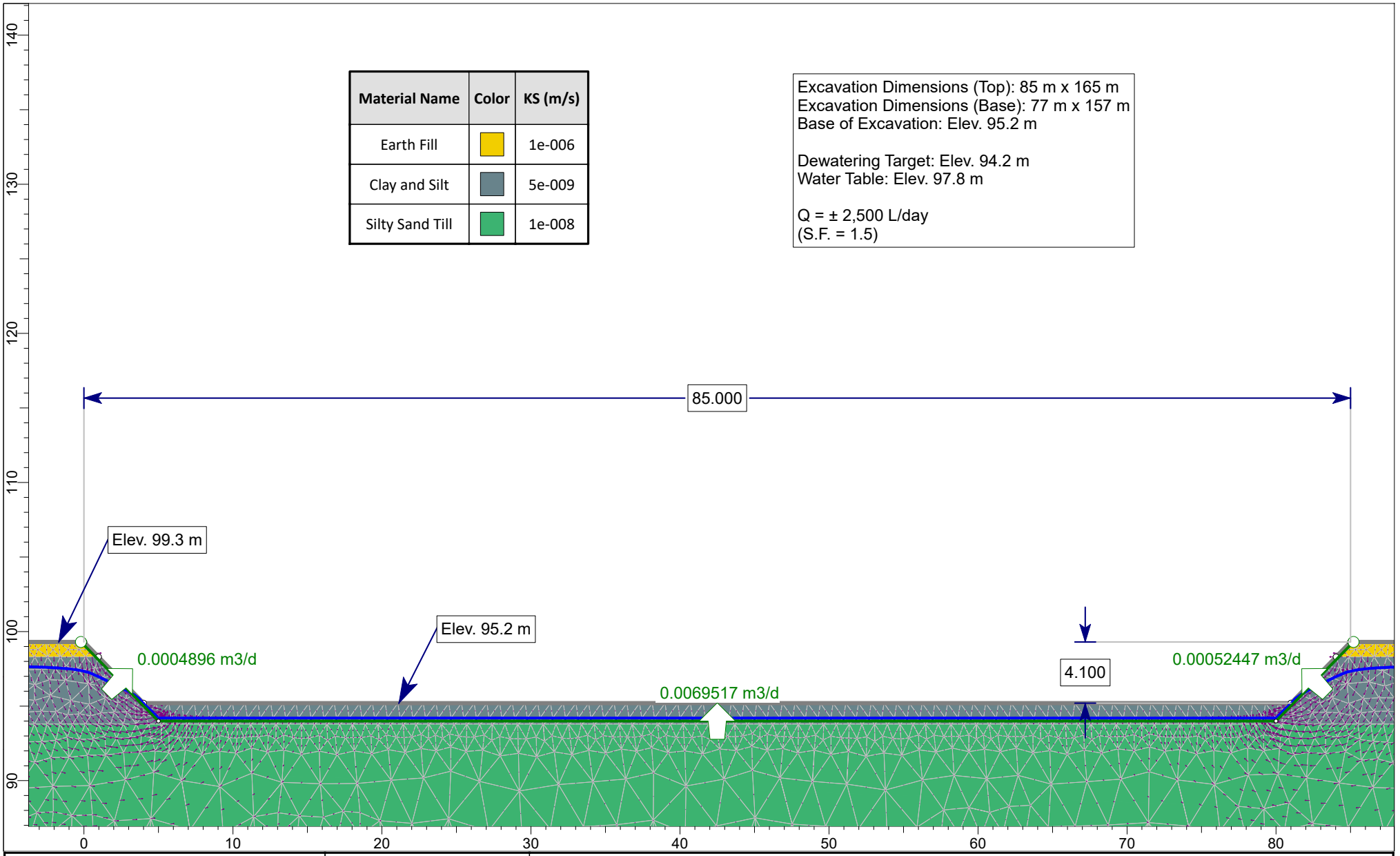


Material Name	Color	KS (m/s)
Earth Fill		1e-006
Clay and Silt		5e-009
Silty Sand Till		1e-008

Excavation Dimensions (Top): 85 m x 165 m
Excavation Dimensions (Base): 77 m x 157 m
Base of Excavation: Elev. 95.2 m

Dewatering Target: Elev. 94.2 m
Water Table: Elev. 97.8 m

Q = ± 2,500 L/day
(S.F. = 1.5)



Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

SLIDEINTERPRET 7.020

Notes
Refer to Hydrogeological Report for factual information supporting this analysis.

Project **3-17-0076-46 | 24 Wellington Street, Cookstown, ON**

Analysis FEA | Dewatering, Short Term, Open Cut Excavation

Date	Scale	File
11/28/2017	1:350	3-17-0076 24 Wellington St Dewatering.slmd

By YQ

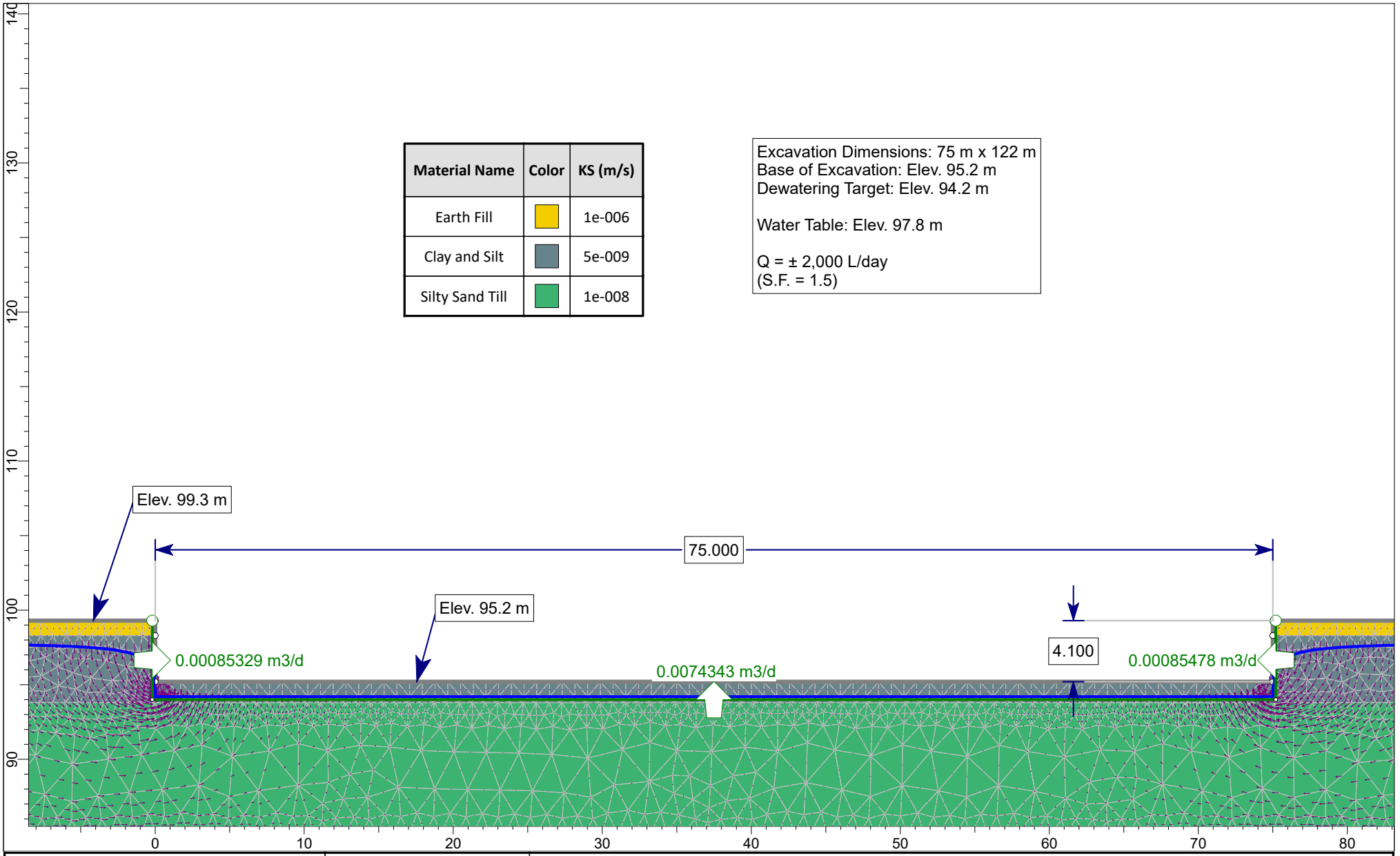
Ref.

Material Name	Color	KS (m/s)
Earth Fill		1e-006
Clay and Silt		5e-009
Silty Sand Till		1e-008

Excavation Dimensions: 75 m x 122 m
Base of Excavation: Elev. 95.2 m
Dewatering Target: Elev. 94.2 m

Water Table: Elev. 97.8 m

Q = ± 2,000 L/day
(S.F. = 1.5)



Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

SLIDEINTERPRET 7.020

Notes
Refer to Hydrogeological Report for factual information supporting this analysis.

Project **3-17-0076-46 | 24 Wellington Street, Cookstown, ON**

Analysis FEA | Dewatering, Short Term, Permeable Shoring

Date	Scale	File
11/28/2017	1:350	3-17-0076 24 Wellington St Dewatering.slmd

By YQ

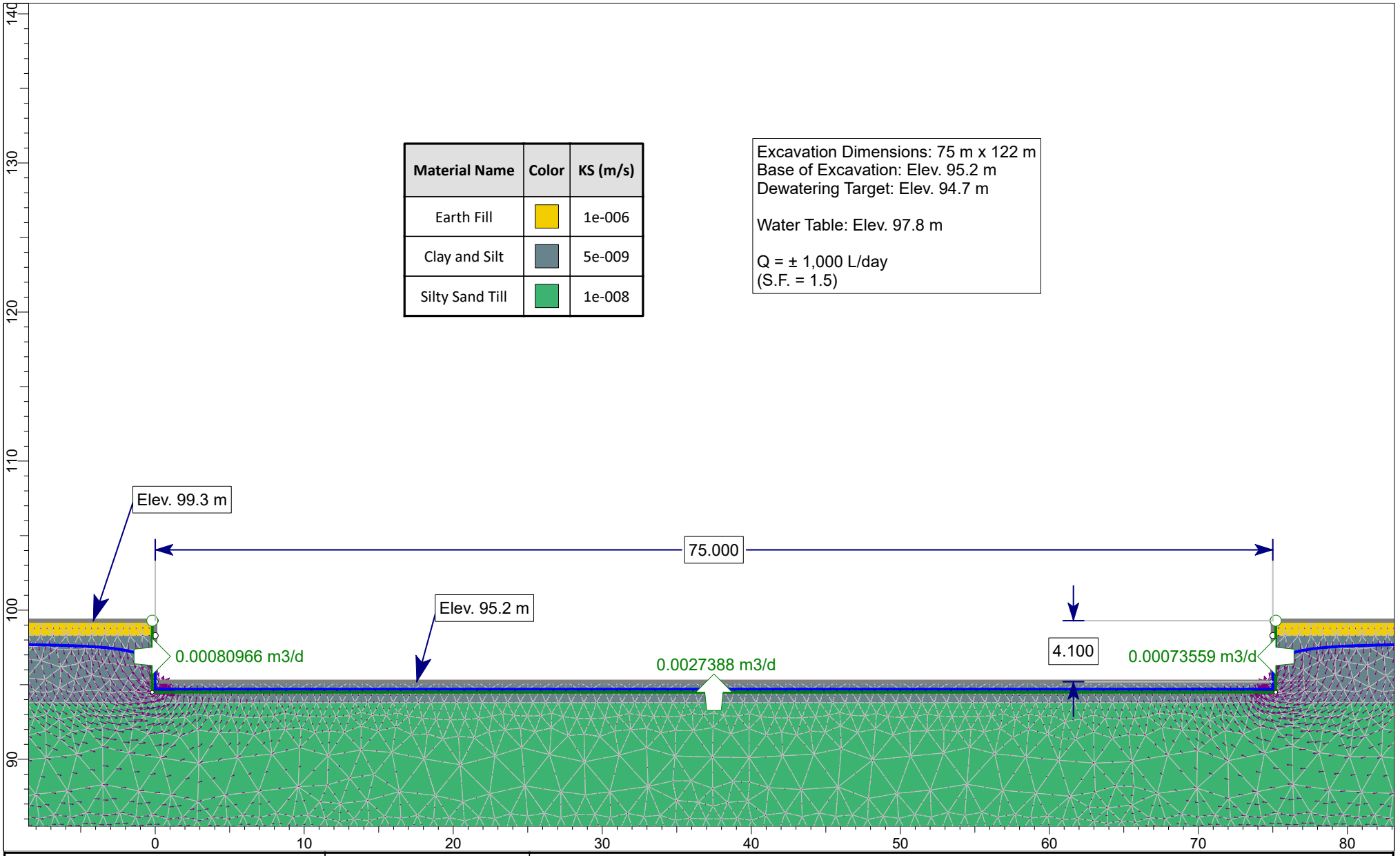
Ref.

Material Name	Color	KS (m/s)
Earth Fill		1e-006
Clay and Silt		5e-009
Silty Sand Till		1e-008

Excavation Dimensions: 75 m x 122 m
Base of Excavation: Elev. 95.2 m
Dewatering Target: Elev. 94.7 m

Water Table: Elev. 97.8 m

Q = ± 1,000 L/day
(S.F. = 1.5)



Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

SLIDEINTERPRET 7.020

Notes
Refer to Hydrogeological Report for factual information supporting this analysis.

Project **3-17-0076-46 | 24 Wellington Street, Cookstown, ON**

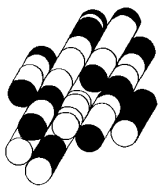
Analysis FEA | Dewatering, Long Term, Permeable Shoring

Date	Scale	File
11/28/2017	1:350	3-17-0076 24 Wellington St Dewatering.slmd

By	Ref.
YQ	

APPENDIX H

TERRAPROBE INC.



CONCEPTUAL LAYOUT 'D'

24 Wellington Street &
48 Queen Street,
Innisfil, ON

LEGEND

- Residential Development
  Area: 9,684.20m² (2.39ac)
- Street Townhomes *(6m x 19m)*
- Condo Townhomes *(6m x 15.8m)*
- Future Development Block
  Area: ±1,794.51m² (0.44ac)
- Future Commercial Building
  Area: ±278.70m² (3,000ft²)
- Connection to Multi-Use Trail

TOWNHOUSE SITE STATS

	Required	Proposed
No of Townhouse Units	n/a	31
Min. Internal Lot Area	180m²	176.0m²
Min. End Lot Area	210m²	210.5m²
Min. Internal Lot Width	6m	6m
Min. End Lot Width	7.2m	7.2m
Min. Front Yard	4.5m	5.3m
Min. Rear Yard	7.5m	7.5m
Max. Coverage	50%	54%
Common Open Space	n/a	1,022.3m²
Landscaped Open Space	35%	35.8%
Parking Spaces	63	75
Site Density	n/a	13.4 / ac

Scale: 1 : 750

0 5 10 15 20 25 30m

N

Note: All dimensions shown are in metres.

Drawn By: A.M. Date: March 14, 2017

celeste PHILLIPS PLANNING INC.
85 Bayfield Street, Suite 300,
Barrie, ON L4M 3A7
T: 705 797 8977
F: 705 730 1059
C: 705 730 8850
celeste@cplan.ca