THURBER ENGINEERING LTD.

HYDROGEOLOGICAL ASSESSMENT REPORT
HIGHWAY 404 COLLECTOR ROADS
ENVIRONMENTAL ASSESSMENT STUDY
MARKHAM, REGION OF YORK

Report

to

CIMA+

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1. INTRODUCTION

This report presents the results of a hydrogeological assessment carried out by Thurber Engineering Ltd. (Thurber) in support of the Highway 404 North Collector Roads Environmental Assessment (EA) Study presently being undertaken by CIMA+ for the City of Markham.

The purpose of the Hydrogeological Assessment is to conduct a desktop review of the geological and hydrogeological conditions in the EA study area and to discuss the potential impacts of the proposed collector road construction, and possible utility installations, on groundwater users and receptors including a preliminary discussion of potential mitigation measures. The assessment includes a review of publicly available mapping and databases, as well as the results of the associated geotechnical investigation and Contaminant Overview Study that were carried out by Thurber.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

2. PROJECT AND SITE DESCRIPTION

An Environmental Assessment (EA) study is being undertaken to confirm the final alignment of the new north-south and east-west collector roads in the Highway 404 North Planning District in Markham, Ontario. The study area extends from approximately 400 m north of 19th Avenue to 600 m north of Elgin Mills Road, between Highway 404 and Woodbine Avenue. The EA Study Area plus a 500-metre buffer was investigated for this report as indicated on Drawing 1 of Appendix A. The location of the proposed roads is provided on the geotechnical borehole location plan drawing of Appendix B.

2.1 Characterization of the Hydrogeological Setting

The project area is located within the physiographic region known as the Peel Plain. The Peel Plain is characterized by a surficial till sheet which generally consists of silty clay to clayey silt, with occasional sand to silt zones. The till is locally modified by a veneer of clay. Bedrock is expected to exist at a depth in the order of 100 m.

The general topography of this region consists of level to gently rolling terrain (bevelled till plains), sloping gradually south and east. The study area is comprised of rural farmlands and commercial properties with residential subdivisions present south of the site.

The Oak Ridges Moraine is located approximately 2.5 km north-west of the Study Area.

2.2 Quaternary and Bedrock Geology

The surficial geology in the EA Study Area as indicated in Ontario Geological Survey mapping in the EA Study Area consists predominantly of coarse-textured glaciolacustrine deposits of sand and gravel with minor silt and clay, fine-textured glaciolacustrine deposits of silt and clay with minor sand and gravel, and various till units.

The predominant bedrock of the Study Area consists of shale, limestone, dolostone and siltstone of the Georgian Bay Formation, typically at depths greater than 100 metres.

The surficial geology and bedrock geology maps for the Site and Study Area are provided in Appendix C.

The Oak Ridges Moraine north-west of the Study Area is an area of significant groundwater recharge due to the relatively permeable soils located there. The Oak Ridges Aquifer Complex (ORAC) is an aquifer that underlies the Site under a relatively thin layer of Halton Till. A regional geological cross-section of the area and general site location is provided on Drawing 1819-2 of Appendix A. The ORAC may be under artesian conditions in some areas, indicating that the water level in the confined ORAC may be higher than ground surface. This groundwater pressure exerts uplift on the overlying till. Excavations into the till reduce the downward resistance and could result in basal heave, boiling, or blow-out if uplift exceeds the resistance. This condition will need to be evaluated during later design stages.

2.3 Desktop Well Review

A search of the MECP well records indicated that there are 105 wells within the 500 m search buffer. The location of the well records is provided in Appendix C. A summary of the well records is provided in the table below, presenting the date the well was constructed, the water type and depth found, the well use, and the screen depth and length. The most common use of the wells identified was domestic; however, many were reported as not used or for monitoring.

The well record search obtained through the Physical Setting Report did not report many dewatering wells that were identified using MECP's well record mapping site, which showed a large number of dewatering wells located adjacent to Woodbine Avenue Bypass and Honda Boulevard at the intersection of Woodbine Avenue Bypass and Honda Boulevard. This area is marked on Drawing 1 of Appendix A. The well contractor license number indicated these wells were installed by Atlas Dewatering and that they were generally

installed to depths of approximately 20 m. The tight spacing and location of the well records may indicate depressurization of the Oak Ridges Aquifer Complex for construction of the roadway and associated infrastructure, which appears to have been built in 2009 based on satellite imagery accessed in November 2019 on Google Earth.

Summary of Well Records Identified in Physical Setting Report

Well ID	Date Constructed	Water Type and Depth (ft)	Well Use	Screen Depth and Length (ft)
6903209 ()	1966-09 1413	FR 0072	IR	
6903210 ()	1962-07 2407	FR 0073	ST DO	0072 4
6903211 ()	1964-07 5420	FR 0040	IR	
6903212 ()	1963-12 4305	FR 0062 FR 0121	ST DO	0124 3
6903213 ()	1965-07 5420	FR 0012 FR 0036	IR	
6903214 ()	1965-08 2407	FR 0156	PS	0156 4
6903387 ()	1963-04 2407	FR 0075	DO	
6903391 ()	1963-07 2407	FR 0083	CO	0083 4
6903399 ()	1962-07 5420	FR 0018	CO	
6908899 ()	1968-09 5420	FR 0012	DO	
6908902 ()	1968-07 5420	FR 0020	DO	
6909151 ()	1969-04 1104	FR 0108	CO	0128 4 0132 4
6910611 ()	1971-10 3108	UK 0065	DO	0065 4
6910668 ()	1971-06 5459	FR 0024	DO	
6910808 ()	1971-10 5459	FR 0030	DO	
6911852 ()	1973-11 5459	FR 0055	DO	0060 6
6912442 ()	1974-10 2214	FR 0009	IR	
6912456 ()	1974-07 5459	FR 0058	DO	0058 4
6914101 ()	1977-08 5459	FR 0211	DO	0211 3
6914842 ()	1978-03 5459	FR 0204	DO	0204 3
6914843 ()	1978-03 5459	FR 0204	DO	0204 3
6914927 ()	1978-05 5459	FR 0209	DO	0209 3
6915258 ()	1979-10 3109	FR 0013	DO	
6915652 ()	1980-12 1413	FR 0173	DO	0169 4
6915734 ()	1980-10 5459	FR 0075	DO	0078 3
6915750 () A	1980-10 5459	FR 0055	NU DO	0055 3
6915985 ()	1981-11 5459	FR 0206	DO	0206 3
6915999 ()	1981-07 5459	FR 0052	DO	0053 3
6916006 ()	1981-07 5459	FR 0162	DO	0162 3
6923464 (166852)	1995-11 5459	FR 0067	DO	0069 3
6924496 (187680)	1998-05 6874	FR 0012 FR 0028	DO	
6924904 (195481)	1999-06 5459	FR 0075	DO	0079 3
6924905 (195468)	1999-05 5459	FR 0183	DO	0185 3
6924908 (199696)	1999-06 6874	FR 0030	DO	
6926229 (241692)	2001-12 6571	FR 0004		0004 5
6926230 (241691)	2001-12 6571	FR 0003		0003 5
6926231 (241690)	2001-12 6571	FR 0003		0003 5
6926952 (245051) A	2002-12 6571			
6926953 (245052) A	2002-12 6571			
6926954 (245053) A	2002-12 6571			
6928628 (Z16095) A016032	2004-11 5459	FR 0069	DO	0069 3
6930800 (Z51528) A042072	2006-07 1663	FR 0049	NU	0055 5
6930801 (Z51527) A042071	2006-07 1663		NU	0115 5

Well ID	Date Constructed	Water Type and Depth (ft)	Well Use	Screen Depth and Length (ft)
7049053 (Z67662) A051056	2007-07 5459			
7049054 (Z67661) A051057	2007-07 5459			
7053877 (Z54281) A044732	2007-08 7190	FR 0010		0015 5 0005 5
7102537 (Z76304) A071851	2008-01 7219	FR 0085	DO	
7104953 (Z75657) A063124	2008-03 5459	0030	NU	
7104954 (Z75656) A063123	2008-03 5459	0060	NU	
7104955 (Z75658) A063125	2008-03 5459		NU	
7108205 (Z86554) A069306	2008-06 7108	FR 0160	DO IR	0166 8 0160 6
7108206 (Z86555) A069307	2008-06 7108	FR 0049	DO ST	0050 5 0055 5
7108993 (Z81673) A051069	2008-07 5459			
7108994 (Z81672) A064999	2008-07 5459	FR	NU	
7108995 (Z81674) A063084	2008-07 5459		NU	0040 10
7108996 (Z81675) A063151	2008-07 5459			
7109647 (Z83482) A075079	2008-07 1663	UT 0033	DO	0048 5
7111111 (Z80079) A066766	2008-06 6809		MO	
7112476 (M03459) A066190	2008-07 6926			
7114037 (M03462) A066192	2008-08 6926		DE	
7132014 (Z101435) A063123	2009-09 5459			
7132020 (Z101436) A063124	2009-09 5459			
7132021 (Z101437) A063125	2009-09 5459			
7140480 (Z94145) A075079	2009-10 1663	UT	NU	0048 5
7159600 (Z104643) A	2009-10 7215			
7161864 (Z128299) A113050	2011-04 7108	FR 0085	DO	0053 37
7168601 (Z115996) A	2011-01 5459			
7169253 (Z116017) A	2011-09 5459			
7172697 (Z141196) A124774	2011-11 5459	UT 0195	DO	0192 3
7177598 (Z142177) A107281	2012-02 7147	FR 0008		0005 10
7193029 (Z161022) A	2012-09 1663	UT	NU	
7193033 (Z161040) A	2012-09 1663	UT	NU	
7206227 (Z168232) A026509	2013-07 5459		NU	0052 10
7206333 (C22809) A144938	2013-06 7215			
7206334 (C22820) A145100	2013-06 7215			
7206368 (Z163866) A144930	2013-06 7215		TH	0030 10
7212612 (Z176656) A152938	2013-09 7247	UT 0015	MT	0015 10
7213920 (C22722) P	2013-12 7147			
7223175 (C19703) A137272	2013-05 7147			
7229532 (Z185203) A161588	2014-07 7247	UT 0011	TH	0025 5
7240179 (Z208601) A179699	2015-03 7472		MO	0010 5
7240180 (Z208602) A179700	2015-03 7472		MO	0015 10
7240181 (Z208603) A179701	2015-03 7472		MO	0010 5
7240182 (Z208604) A179702	2015-03 7472		MO	0010 5
7240617 (Z192087) A177404	2015-04 7360	UT 0015	MO	0020 5
7240618 (Z192088) A182088	2015-04 7360	UT 0025	MO	0023 100013 5
7240619 (Z192086) A182057	2015-04 7360	UT 0017	MO	0015 5
7243116 (C28784) A179699	2015-06 7147			
7250755 (C30888) P	2015-09 7147			
7270638 (C31962) A197131	2015-12 7215			
7270749 (C33147) A197158	2016-04 7215			
7273721 (C34032) A197131	7147			
7278629 (Z246595) A213017	2016-12 1663	UT	IR	0109 9
7281239 (C37020) A190514	2017-01 6926			

Well ID	Date Constructed	Water Type and Depth (ft)	Well Use	Screen Depth and Length (ft)
7284230 (Z225706) A	2017-02 5459		OT	
7292780 (C37694) A227556	2017-07 7464			
7295271 (C37940) A190514				
7305415	2018			
7306226	2018			
7306879	2018			
7306880	2018			
7307622	2018			
7307623	2018			
7314498	2018			
7314499	2018			

Notes: Water Types: FR Fresh UT Untested
Well Use: DO Domestic NU Not Used IR Irrigation ST Livestock DE Dewatering MT Monitoring Testhole MO Monitoring TH Test Hole PS Public OT Other

2.4 ANSIs and Local Surface Water Features

A tributary of Berczy Creek is located at the north-east portion of the Study Area. Upper reaches of the Rouge River are located west of the Study Area, within the 500 m buffer. Two storm water management ponds (SWMPs) are located within the Study Area, and additional SWMPs are located within the buffer zone. These are indicated on Drawing 1 of Appendix A.

Based on online mapping provided by the Ministry of Natural Resources and Forestry, no Areas of Natural Significance (ANSI) are located on Site or within the Study Area. A Provincially Significant Wetland is mapped at the north-east portion of the Site following a tributary to Berczy Creek, belonging to the Bruce & Berczy Creek Wetland Complex. Several Provincially Significant Wetlands are also located within the Study Area, including wetlands west of the Site of the Rouge River Headwater Wetland Complex. Their approximate locations are shown on Drawing 1 of Appendix A.

2.5 Other Background Information

Based on MECP Permit to Take Water (PTTW) mapping that was accessed in November 2019, there was one active PTTW identified on Site. The permit holder is Honda Canada Inc., and the groundwater taking was reported for miscellaneous purposes at a rate of 207,216 L/day. The mapping does not provide results for expired PTTWs. Based on MECP Source Protection Information Atlas mapping, one additional PTTW with two on-site water taking sources were identified on Highway 404 for construction dewatering. Two PTTWs were identified in the buffer zone. One is located north of the Site for surface water and groundwater taking from a pond for a food company. The second is located west of the Site

for dewatering for construction of a stormwater management pond at a rate of up to 2,365,000 L/day.

A search of MECP's Access Environment mapping that was accessed in November 2019 indicated that two Environmental Activity and Sector Registry (EASR) registrations for construction dewatering were identified within the Site, and two were located outside of the buffer zone. One on the Site was registered by Livante Holdings for construction at 11030 Victoria Square Blvd in Markham, located west of Woodbine Avenue and south of Vetmar Road. The second on the Site was registered by Enbridge Gas Inc. Two EASRs were identified on Leslie Street, registered by North Leslie Watermain Trustee Inc., which are assumed to be for the purpose of installing watermain on Leslie Street.

The Site and buffer zone are located within the Toronto and Region Conservation Authority. A significant portion of the north-east of the Site is within the TRCA Conceptual Regulated Area as indicated by a search of TRCA's online mapping that was accessed in November 2019, primarily associated with the tributary to Berczy Creek. A large area west of the Site, within the buffer zone, is also within the Conceptual Regulated Area, as are significant portions east of the Site and to some extent to the north of the Site. Ontario's online mapping service for source water protection indicated the Study Area is not within a Wellhead Protection Area in the vicinity of a municipal well, but is located within a large Wellhead Protection Area Q1 and Q2 that extends from Richmond Hill in the south to East Gwillimbury in the north and from Nobleton in the west to Uxbridge in the east.

Property uses within the Study Area consist primarily of agricultural and commercial/industrial uses, with some residential, natural/parkland, and community uses.

2.6 Prior Reports

Thurber's geotechnical findings as provided in the Preliminary Geotechnical Investigation report dated March 13, 2020 were reviewed. The borehole logs from this report are provided in Appendix D and the geotechnical laboratory test results are provided in Appendix E. The key findings pertaining to hydrogeology can be summarized as follows:

- Five boreholes were drilled, each to a depth of approximately 5.2 m. In general, the subsurface stratigraphy encountered in the boreholes consisted of a topsoil layer over compact to very dense sandy silt till.
- Upon completion of drilling, groundwater was observed at one out of five borehole locations.

- In each borehole, a 25-mm diameter piezometer was installed to monitor groundwater levels. The groundwater depths varied from 0.5 m to 3.1 m below ground surface. The groundwater elevations varied from 232.0 m to 238.8 m.
- Based on observed conditions, dewatering of shallow excavations should generally be feasible using sumps and pumps.
- The investigation was for preliminary design. A detailed investigation will be required, which will need to include assessment of dewatering permitting needs.

Thurber's Contamination Overview Study, dated November 27, 2019 was reviewed. The Study Area was defined by the network of proposed roadways and a 250-metre buffer, and thus the study area was smaller than that of the hydrogeological assessment. The key findings pertaining to hydrogeology can be summarized as follows:

- Many Potentially Contaminating Activities were identified, including the application of pesticides, fill materials of unknown quality, the application of de-icing salts, possible vehicle releases, above and below-ground fuel storage, vehicle repair, possible automotive manufacturing, various liquid releases, and additional activities.
- A review of well records indicated groundwater levels to be reported from artesian conditions to 11 metres below ground surface. Many monitoring wells were noted within the study area.
- The ground surface generally sloped down towards the southeast, and regional surface water drainage was generally towards Berczy Creek.

For additional soil stratigraphy for the general area, the following reports retrieved through the Ministry of Transportation of Ontario's online Geotechnical Cross-Reference and Retrieval System (GeoCRES) were briefly reviewed:

- Draft Preliminary Foundation Investigation and Design Report, Highway 404 Northbound Off-ramp Extension, Elgin Mills Road, Town of Markham, Ontario, prepared by Thurber Engineering Ltd., dated December 23, 2009.
- Foundation Investigation Report, Hwy 404/Elgin Mills road Interchange, The Regional Municipality of York, prepared by Shaheen & Peaker Limited, dated September 2001.
- Foundation Investigation Report for 19th Avenue Underpass, 5.1 miles North of Hwy No. 7, prepared by Ministry of Transportation and Communications Ontario, dated March 24, 2077.
- Geotechnical Investigation, Proposed Watermain, Elgin Mills Rd. (Y.R. 49), Leslie St. to Woodbine Ave., The Regional Municipality of York, Geo-Canada Ltd., dated May 2003.

The borehole locations from the above-referenced GeoCRES reports were located primarily in the vicinity of Elgin Mills Road, east and west of Highway 404, and in the vicinity of 19th Avenue and Highway 404. Borehole records along Elgin Mills Road showed a greater degree of geologic variability than those reported in Thurber's limited EA investigation, wherein some coarser cohesionless soils were encountered in variable locations above and/or below till. Groundwater levels varied, including some in the vicinity of ground surface.

The borehole records from the study in the vicinity of 19th Avenue generally indicated till over silty sand, with the interface at approximate depths of 5 to 8 m. It does not appear that the report included an assessment as to whether or not the silty sand was considered part of the Oak Ridges Aquifer Complex. No piezometers or monitoring wells were installed; however, water levels in open boreholes upon completion of drilling were generally 0.3 to 1 m below ground surface. It is possible that stabilized water levels that would have been measured in piezometers or monitoring wells would have been higher than these levels, and possibly artesian given the proximity to ground surface.

3. PRELIMINARY HYDROGEOLOGICAL ASSESSMENT

A preliminary hydrogeological assessment is provided herein, based on the background information that was reviewed and the preliminary understanding of the project. A drawing illustrating the Hydrogeological Features is provided as Drawing 1 of Appendix A. The current assessment should be considered preliminary only and is subject to change based on future findings.

This preliminary assessment has been structured to include a summary of hydrogeological conditions, an assessment of the potential impacts of groundwater on the roadway and potential utility construction project, an assessment of potential impacts of the construction on groundwater resources and users, and potential mitigation measures to manage the risks identified.

3.1 Summary of Hydrogeological Conditions

The Study Area is located within the Peel Plain, which includes bevelled till plains and drumlins, and the Oak Ridges Moraine is located approximately 2.5 km to the north-west. Surficial soils are anticipated to consist of till and bedrock is anticipated at a depth in the range of approximately 100 m.

The regional geological cross-section presented on Drawing 2 of Appendix A illustrates the Study Area is located over the Oak Ridges Aquifer Complex. The ORAC in this area may be under artesian conditions. This possibility is supported by the observation that an area

of high density of dewatering wells is located within and south of the Study Area suggesting that significant ORAC depressurization took place as part of the construction work along Woodbine Avenue Bypass and Honda Boulevard.

The geotechnical investigation included five boreholes to a depth of approximately 5.2 m and confirmed that the soils within this depth consisted of a topsoil layer over compact to very dense sandy silt till. Groundwater levels measured in piezometers during the geotechnical investigation indicated that groundwater was located at depths of 0.5 to 3.1 m, suggesting that shallow excavations are likely to encounter groundwater within the till, although the anticipated flow rate through the till may be low given that only one out of five boreholes had measurable water levels upon completion of drilling.

The borehole records from the referenced GeoCRES reports, generally located along Elgin Mills Road and in the vicinity of 19th Avenue and Highway 404 showed greater variability in subsurface geology, including coarser units above and/or below till, and water levels as shallow as about ground surface. Along 19th Avenue the coarser soil was located 5 to 8 m below ground surface, suggesting that deeper investigation with the study area may encounter coarser soils, potentially including the ORAC.

The topography slopes gently towards the east and south. Regional groundwater flow is anticipated to be south towards Lake Ontario. Infiltration of rainfall will be low due to the fine-grained till. Surface water will follow local topography. A tributary of Berczy Creek flows through the Study Area towards the south. Upper reaches of the Rouge River are located west of the Study Area within the 500-m buffer zone. Many low-lying areas were identified as Provincially Significant Wetlands per online mapping, as shown on Drawing 1. Several Storm Water Management Ponds are located in the Study Area and within the buffer zone. No Areas of Natural and Scientific Interest were identified. The Study Area is located within a Wellhead Protection Area Q1 and Q2, which is of lesser concern compared to Wellhead Protection Areas in the vicinity of municipal wells.

Property uses within the Study Area consist primarily of agricultural and commercial/industrial uses, with some residential, natural/parkland, and community uses. As noted in the Contaminant Overview Study, Potentially Contaminating Activities were identified in the Study Area. The well record search indicated that domestic well records were located in the Study Area. Several rural residences are located within the Study Area and may be obtaining drinking water from groundwater wells. These residences may also have septic tile beds on their properties to release treated wastewater.

3.2 Potential Hydrogeological Impacts of Groundwater on Project

From a hydrogeological perspective, groundwater is a concern to the Project in two ways. First, groundwater may enter excavations that are required for construction, which could result in saturated to flooded ground conditions that would interfere with construction of proposed structures, compaction of granular materials and affect the stability of excavation walls. Second, potentially artesian groundwater conditions in the underlying Oak Ridges Aquifer Complex may create the risk that excavations into the overlying till result in basal heave, boiling or blow-out.

Once the construction details are known in greater detail and once detailed investigations have been completed, including identification of the till/ORAC interface elevation and ORAC groundwater pressure, it will be necessary to estimate safety factors for basal heave, and to estimate the peak water taking rate. The GeoCRES report for 19th Avenue suggested this interface in that area may be at a depth of approximately 5 to 8 m; however, the silty sand was not confirmed as being part of the ORAC.

With respect to basal heave, safety factors can be estimated based on anticipated excavation depths, till thickness, and groundwater pressure. If the safety factors are below minimum recommended levels, either redesign may be necessary to limit the depth of excavation or estimation of the water taking rate required to depressurize the ORAC to an appropriate level will be required.

The peak water taking rate will need to be estimated, which will include any ORAC depressurization, groundwater flow through the surficial soils, and appropriate safety factors and rainfall allowances will be required. If detailed investigation finds that there are some shallow coarse soil units, these would increase the water taking rate. If the investigation finds that the till/ORAC interface is relatively shallow and/or there is a particularly high groundwater pressure, this would also increase the water taking rate.

It is recommended to estimate the hydraulic conductivity of the till and ORAC based on future in-situ testing. Based on the soil descriptions and the grain size analyses, the sandy silt, some clay to clayey till may potentially have a hydraulic conductivity in the range of approximately 10^{-8} to 10^{-6} m/s. The hydraulic conductivity of the Oak Ridges Aquifer Complex may potentially be in the range of approximately 10^{-6} to 10^{-4} m/s based on prior investigations of the aquifer.

If the detailed investigation indicates that dewatering is required, then the estimated budgeted peak flow rate will determine the type of water taking permission that is required.

If the budgeted peak water taking rate is greater than 50,000 litres per day (LPD) but less than 400,000 LPD, then registration on the Environmental Activity and Sector Registry is required, and a Water Taking Plan and Water Discharge Plan are required. If the flow rate exceeds 400,000 LPD, then a Category 3 PTTW must be applied for and obtained from MECP; the application must include a Hydrogeological Study in accordance with permit requirements. The project must be considered as a whole, as opposed to subdividing the project into shorter sections to reduce the water taking rate below a target threshold.

Water that is removed from excavations for dewatering must be discharged or disposed of in accordance with current regulations, whether to the natural environment or to a sewer system. The Water Discharge Plan in the case of an EASR registration or the PTTW and associated Hydrogeological Study will specify conditions on the discharge of the groundwater to the environment.

Groundwater quality testing will be required during detailed investigation to provide a basic understanding of the groundwater quality with respect to potential discharge criteria. It is possible that sediment or naturally occurring minerals could impact water quality. The possibility of water contaminated by anthropogenic sources also exists given the Potentially Contaminating Activities that were identified in the Contaminant Overview Study. Groundwater quality observed during construction may vary from that identified in an investigation. Treatment of the water may be required in advance of disposal, along with sufficient sediment and erosion control measures.

3.3 Potential Impacts of Project

Assuming dewatering is required for construction, the removal of groundwater from the subsurface could negatively impact external receptors. The primary issues of concern include potential impacts to existing groundwater users, impacts to surface water such as creeks and wetlands, induced settlement of structures or migration of contaminated groundwater. These are discussed in greater detail below.

The detailed investigation will provide the field data necessary to estimate the radius of influence from assumed dewatering conditions. However, for preliminary purposes, dewatering from excavations in sandy silt till may have a radius of influence of potentially 10 to 30 metres while depressurization of the ORAC may result in a radius of influence of potentially 30 to 100 metres.

3.3.1 *Impacts to Existing Groundwater Users*

The records indicate that wells in the area are used for potable water supply, thus assessment of potential impact to existing groundwater users is required. It is recognized that a number of the wells indicated in the well records as for potable use are no longer in use. However, a door-to-door well survey, if one has not been completed to date, is recommended to ascertain actual usage conditions, including confirmation of well depth, and to identify wells that may be in use but for which well records were not created, subject to willing participation from residents.

3.3.2 *Impacts to Surface Water*

A tributary to Berczy Creek is located within the Study Area, and an upper reach of the Rouge River is located west of the Study Area. In addition, several areas were indicated as Provincially Significant Wetlands as shown in approximate location on Drawing 1.

The possibility that construction dewatering could decrease availability of water to the wetlands, creeks, and water bodies needs to be considered. The method of impact would be through removal of groundwater resulting in decreased release to surface water. At a preliminary level, the likelihood of a significant impact appears to be low due to the low anticipated hydraulic conductivity of the till. The scope of work herein does not address surface water taking or permitting. However, the possibility of groundwater seeps feeding surface water features from connection to the ORAC may also be considered.

Another potential impact of the dewatering process is the discharge of poor-quality water that ultimately reaches surface water and could impact the natural environment. The potential for sediment-laden water, with associated naturally occurring metals, as well as sulphate and chloride, are the primary concerns notwithstanding other sources of contamination that may be identified.

3.3.3 *Other Potential Impacts*

There may be other potential impacts from construction dewatering. One potential impact is ground settlement caused by the lowering of the groundwater table whereby there is an increase in the effective stress of the soil that may induce settlement and impact the integrity of the above-ground and below ground structures in the Study Area. Factors such as the anticipated amount of drawdown, radius of influence of dewatering, and soil composition may affect the degree of impact to structures. Given the findings of the preliminary Geotechnical Investigation that a dense to very dense sandy silt till is pervasive across the

Study Area as observed in the boreholes, the likelihood of an impact due to settlement appears low at this preliminary stage.

Another potential impact of dewatering activities is the possibility for the migration of contaminated groundwater if there is any. As water is extracted from the subsurface at an excavation, groundwater will move from other areas to enter the newly created depression in the groundwater table. If a contaminant source is nearby, this could accelerate or create the movement of contaminated groundwater towards the excavation. Groundwater quality sampling in a detailed investigation would provide additional insight into this possibility.

3.4 Potential Mitigation Measures

Potential impacts of groundwater on construction of the Project, and potential impacts of the project on external entities were identified. Mitigation measures that may be considered to reduce the risk and uncertainty related to those impacts are discussed herein at a preliminary level, subject to the completion of detailed investigation and analysis.

3.4.1 *Mitigation of Impacts of Groundwater on Project*

The uncertainty regarding the amount of water that may be required to be extracted from the subsurface can be reduced through physical investigations and testing, as well as analysis. In addition to standard geotechnical investigation, drilling, sampling, and monitoring well installation with water level measurements, testing can be conducted to collect more relevant information. This includes single-well response tests, or slug tests, to estimate the hydraulic conductivity of the soil at the screened well interval, groundwater quality testing to assess potential treatment requirements, and, if required based on future findings, pumping tests to provide a more thorough estimate of the hydraulic conductivity of a zone of soil as well as storage characteristics. It is recommended that the ORAC/till interface and the groundwater level in the ORAC be determined in several locations, in particular where the deepest excavations are anticipated, to assess the possibility of basal heave.

Once a detailed field investigation has been conducted, estimates of water taking rates can be made and the anticipated permitting requirements can be applied for, whether that corresponds to EASR registration or a PTTW. Discharge agreements or approvals, if required, can also be applied for and tender documents can present a more accurate view of construction dewatering and discharge requirements.

At locations where large dewatering rates are anticipated for surface soil dewatering or confined aquifer depressurization and/or where surface watercourses exist, the following mitigative measures may be considered for design and construction of the proposed structures:

- Revise designs to reduce the depth of excavation required;
- Utilize construction staging to limit the excavation extents at a given point in time;
- Install cofferdams to cut off flow from wetlands/water bodies; and
- Utilize additional measures as determined from examination of the detailed design and detailed investigation findings.

3.4.2 *Mitigation of Impacts to Existing Groundwater Users*

A door-to-door survey of private water wells is an important step in mitigating the risk of affecting private water wells. This would help to confirm actual well existence and usage in the area, and would allow the determination of well depth, water level, and baseline water quality where permitted. This is subject to well owner participation.

The detailed investigation and analysis will provide a more accurate estimate of the radius of influence of dewatering than what has been provided at this preliminary stage, and the wells that are located within or close to the radius of influence would be identified. Long-term monitoring of private wells, where permitted, would be recommended for wells within and close to the radius of influence of dewatering. Monitoring should commence in advance of construction to establish baseline conditions, and the use of dataloggers may be warranted in addition to manual water level measurements. Monitoring would continue during and following the end of construction in the area.

Identification of at-risk wells and monitoring help to protect people and organizations that rely on the groundwater. Once impacts are identified, or have commenced, there may be options to alter the construction approach, or in some cases a water supply may need to be provided to those affected. Monitoring can also help to protect the interests of stakeholders from potential claims. Where necessary, the monitoring of wells installed for construction may be required, to either provide advance notice of impact or in cases where permission to monitor private wells is not obtained.

3.4.3 *Mitigation of Impacts to Surface Water*

The primary potential impact to surface water is from the discharge of water that is of poor quality, or from erosion caused by poorly controlled discharge flow. The Water Taking Plan and Water Discharge Plan in the case of an EASR registration or the Hydrogeological Study

in the case of a Category 3 PTTW would identify operating conditions, monitoring requirements, and a contingency plan in terms of the taking and discharging of water. A PTTW may stipulate additional terms and conditions that must be followed. Water taking and discharge must be conducted in accordance with all applicable regulations.

The operational conditions may include performance criteria that need to be met, such as maintaining the water taking rate below the permitted value, and target concentrations for particular parameters in the discharge, such as a total suspended solids (TSS) limit and other parameters (e.g. PWQO limits). Discharge to land surface is typically required to be at least 30 metres from a receiving water body such as a creek.

Water taking or discharge within the area regulated by TRCA will require discussions with TRCA and applicable permits. Confirmation of the status of the mapped Provincially Significant Wetlands with the Ministry of Natural Resources and Forestry will be required, and any applicable permits will be required. Additional terms and conditions may be applicable based on the jurisdiction of these entities.

Reductions of flows to surface water from groundwater, including potential seeps from the underlying ORAC, were also identified as a potential concern. Surface water / groundwater interactions will need to be considered in design of structures at all surface water crossings where there is a potential for impact. One potential mitigation measure that could be considered if there would be an unacceptable flow reduction would be to ensure that water that is removed for dewatering is returned to land surface that drains to the given surface water feature, ensuring that erosion and sediment control measures and any required treatment provides for acceptable water quality.

If dewatering is required, a monitoring plan may be developed, which would recommend tasks to be completed at indicated frequencies. These may include visual inspections of the discharge location and water quality, measurements of turbidity, measurements of water quality parameters to ensure compliance with discharge requirements and recording of water taking volumes.

A contingency plan may also be developed, if dewatering is required, which would provide recommended actions, or a series of actions, to initiate when an operating condition or monitored parameter is not in compliance with the project requirements.

3.4.4 *Mitigation of Other Potential Impacts*

At this preliminary stage, the likelihood of unacceptable settlement risk due to dewatering appears to be low based on soil conditions observed to date. The detailed geotechnical and hydrogeological investigations would identify the potential for settlement of structures in greater detail. While unlikely at this stage, an outcome of that detailed analysis may be to conduct a pre-condition survey whereby the condition of structures prior to the construction project is assessed. If required, this provides a documented understanding of the characteristics of key structures which can be surveyed again during and following construction. In addition, operational constraints to the dewatering and construction methods can be considered.

Groundwater levels at wells located between dewatering areas and key structures can also be monitored, and trigger values can be determined with a contingency plan, if required.

To mitigate the risk for the migration of contaminated groundwater, if any, the subsurface soil and groundwater quality conditions can be assessed in boreholes advanced near potentially contaminated activities identified in the Contaminant Overview Study during the detailed investigation. Further, if risks are identified and dewatering may be expected to cause the migration of impacted groundwater, additional water level and water quality sampling and testing could be performed.

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4. CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this report, please do not hesitate to contact us.

Thurber Engineering Ltd.

David Hill, M.A.Sc., P.Eng., P.Geo.
Senior Hydrogeologist / Environmental Engineer

Murray R. Anderson, M.Eng., P.Eng.
Senior Geotechnical Engineer / Associate

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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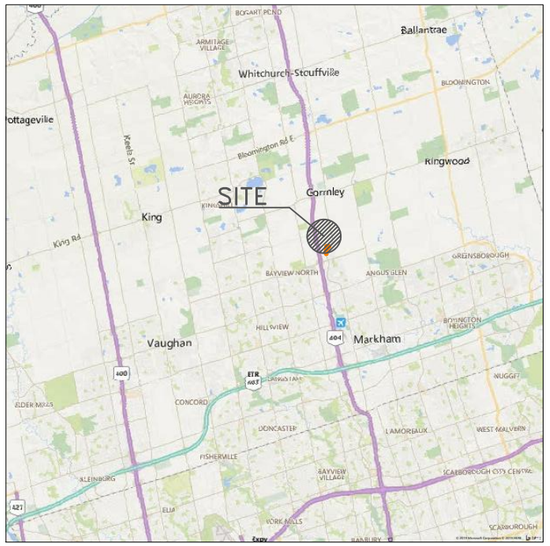
APPENDIX A

Drawings



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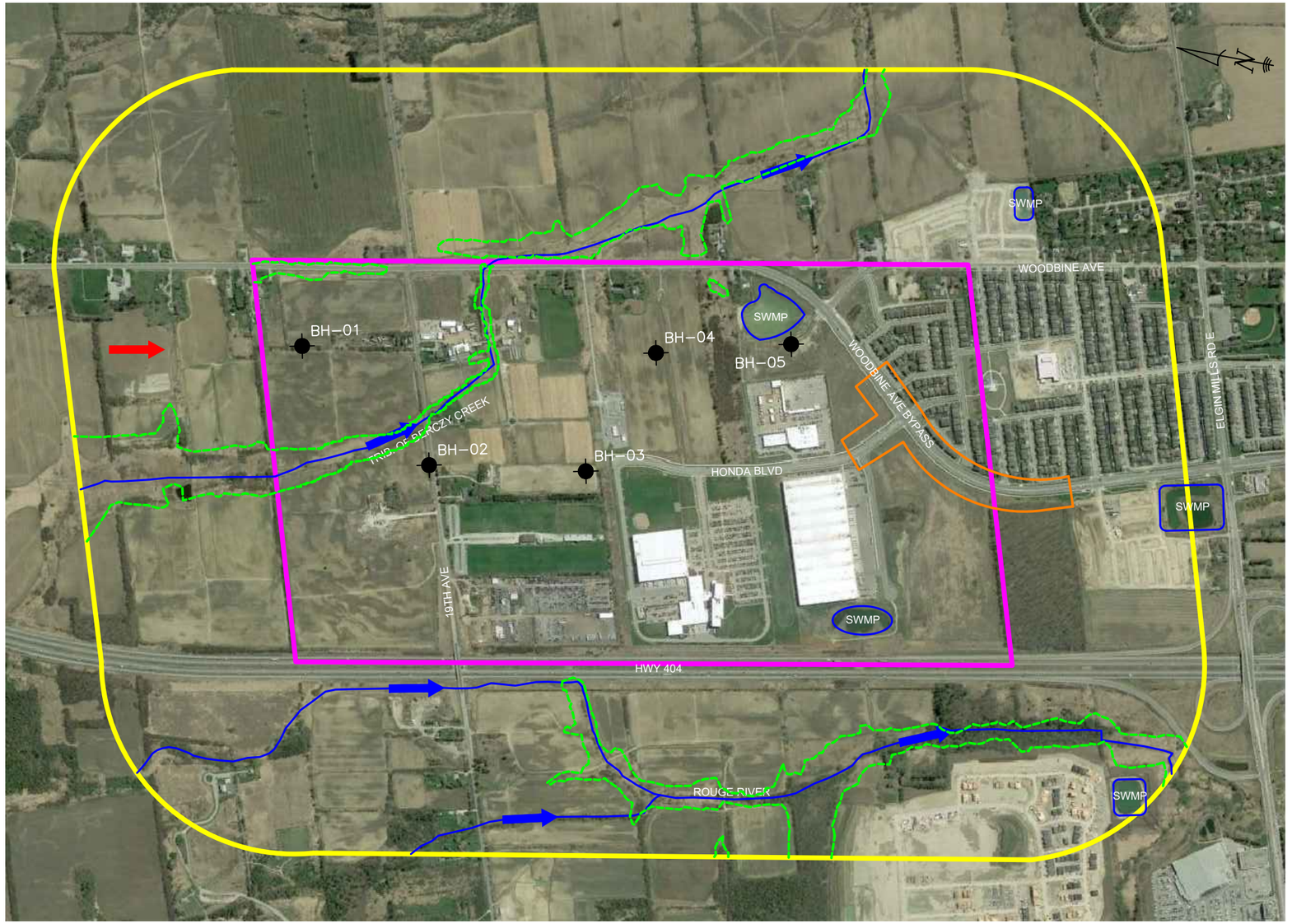

LEGEND:

- Study Area
- 500m Buffer
- Water Course and Surface Water Flow Direction
- Provincially Significant Wetlands
- Assumed Regional Groundwater Flow Direction
- Area of High Density Of Dewatering Well Records

REFERENCES:

Google Earth Image 2018-05-07
Accessed Nov. 2019

PLAN

250 0 250 500M

SCALE 1:12500

CIMA+

HYDROGEOLOGICAL ASSESSMENT REPORT
HIGHWAY 404 COLLECTOR ROADS
ENVIRONMENTAL ASSESSMENT STUDY
CITY OF MARKHAM
HYDROGEOLOGICAL FEATURES

JOB# 18189

THURBER ENGINEERING LTD.

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DH	BH	MA
DATE :	SCALE :	DRAWING No.
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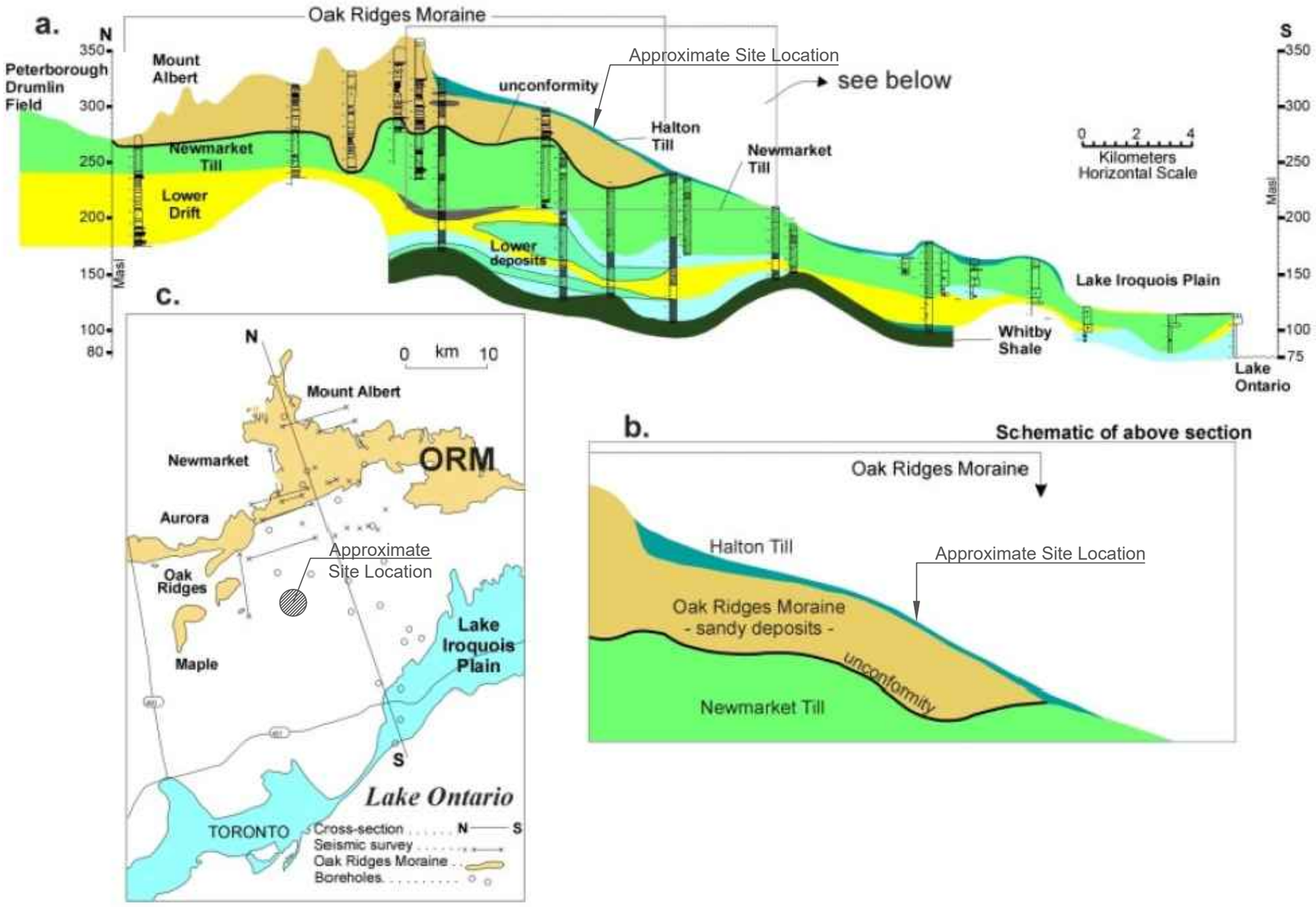

REFERENCES:

Sharpe et al., Regional Geological Mapping at the Oak Ridges Moraine Greater Toronto Area, Southern Ontario.

CIMA+

HYDROGEOLOGICAL ASSESSMENT REPORT
HIGHWAY 404 COLLECTOR ROADS
ENVIRONMENTAL ASSESSMENT STUDY
CITY OF MARKHAM
REGIONAL GEOLOGY CROSS-SECTION

JOB# 18189

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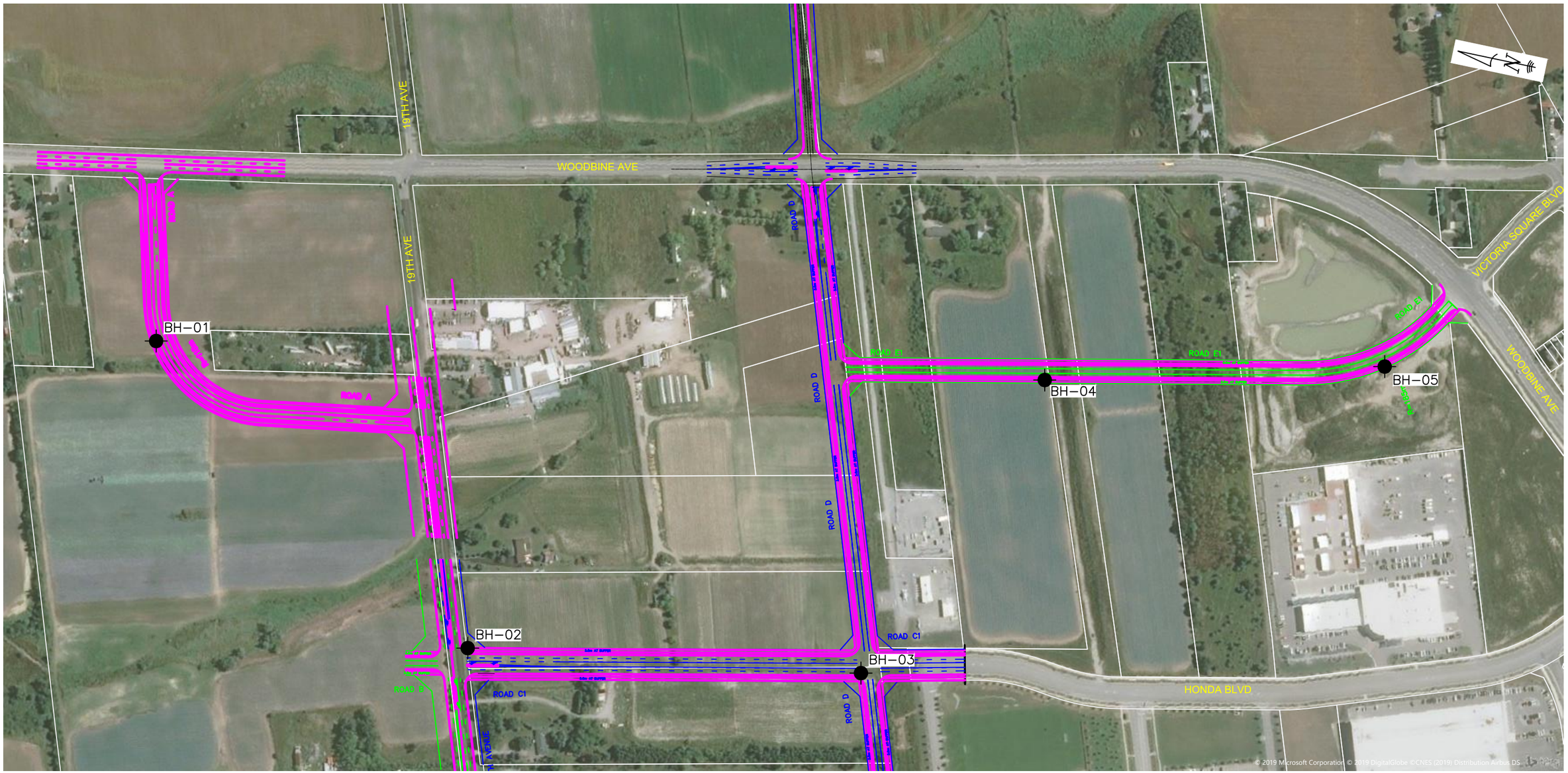
APPENDIX B

Borehole Location Plan with Proposed Road Locations



PLAN

80 0 80 160m

SCALE 1:4000

LEGEND

BOREHOLE LOCATION

BASE PLAN PROVIDED BY

CIMA Canada Inc.

HIGHWAY 404 NORTH COLLECTOR ROADS
CITY OF MARKHAM

BOREHOLE LOCATION PLAN

JOB# 18189

THURBER ENGINEERING LTD.

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APPENDIX C

Physical Setting Report Excerpts

PSR
PHYSICAL SETTING REPORT

Property Information

Order Number:	20191119017p
Date Completed:	November 19, 2019
Project Number:	18189-20
Project Property:	Highway 404 Collector Roads Highway 404 Collector Roads Markham ON
Coordinates:	
Latitude:	43.91634422
Longitude:	-79.38127046
UTM Northing:	4863854.99097 Metres
UTM Easting:	629963.095092 Metres
UTM Zone:	UTM Zone 17T
Elevation:	239.85 m
Slope Direction:	E

Property Information....1
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Hydrologic Information....16
Geologic Information....23
Soil Information....41
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Detail Report....84
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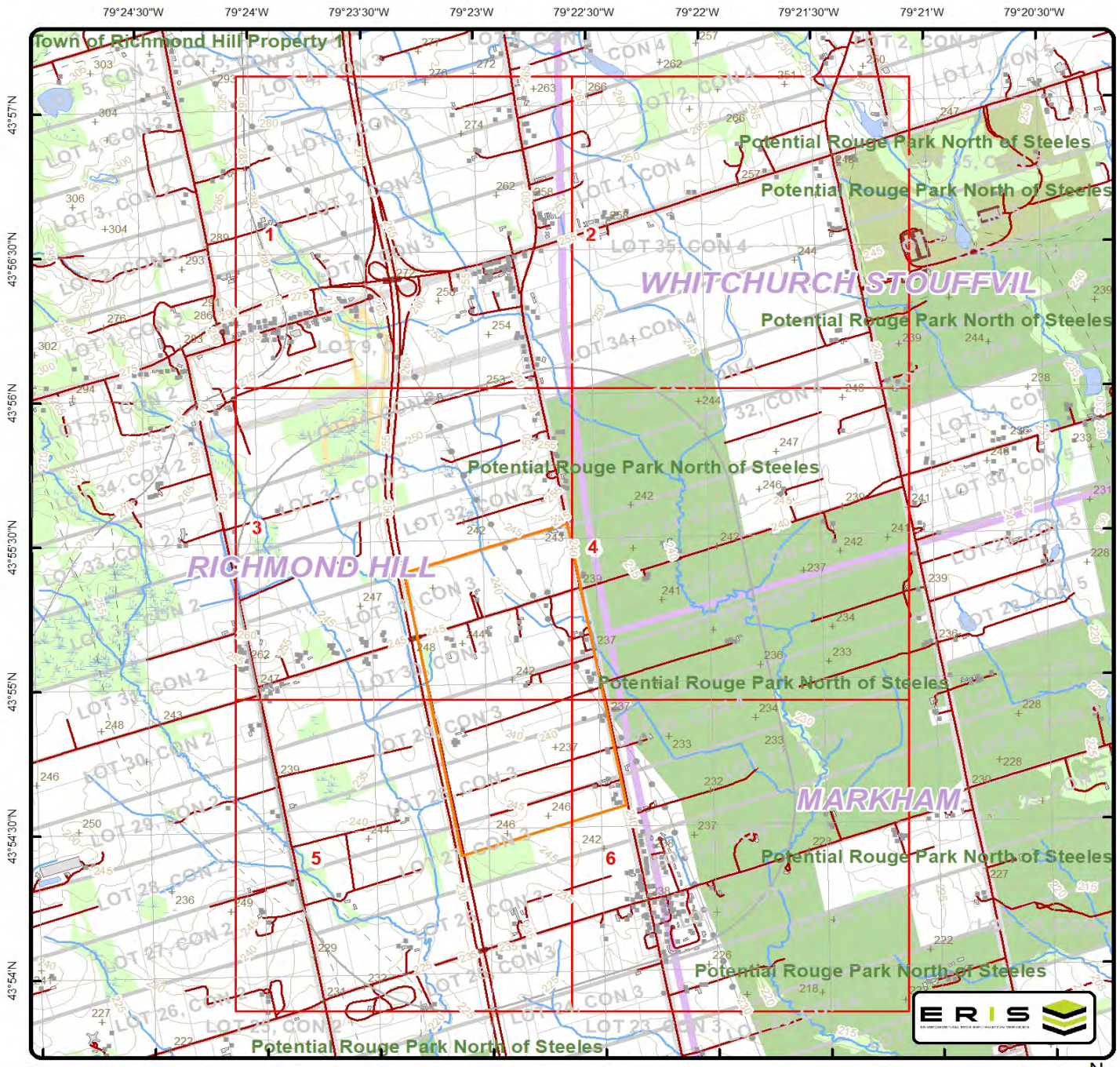
The ERIS ***Physical Setting Report - PSR*** provides comprehensive information about the physical setting around a site and includes a complete overview of topography as well as hydrologic, geologic and soil characteristics. The location and detailed attributes of oil and gas wells, water wells, and radon are also included for review.

The compilation of both physical characteristics of a site and additional attribute data is useful in assessing the impact of migration of contaminants and subsequent impact on soils and groundwater.

Disclaimer

This Report does not provide a full environmental evaluation for the site or adjacent properties. Please see the terms and disclaimer at the end of the Report for greater detail.

Topographic Information



Topographic Map

Address: Highway 404 Collector Roads,Markham,ON

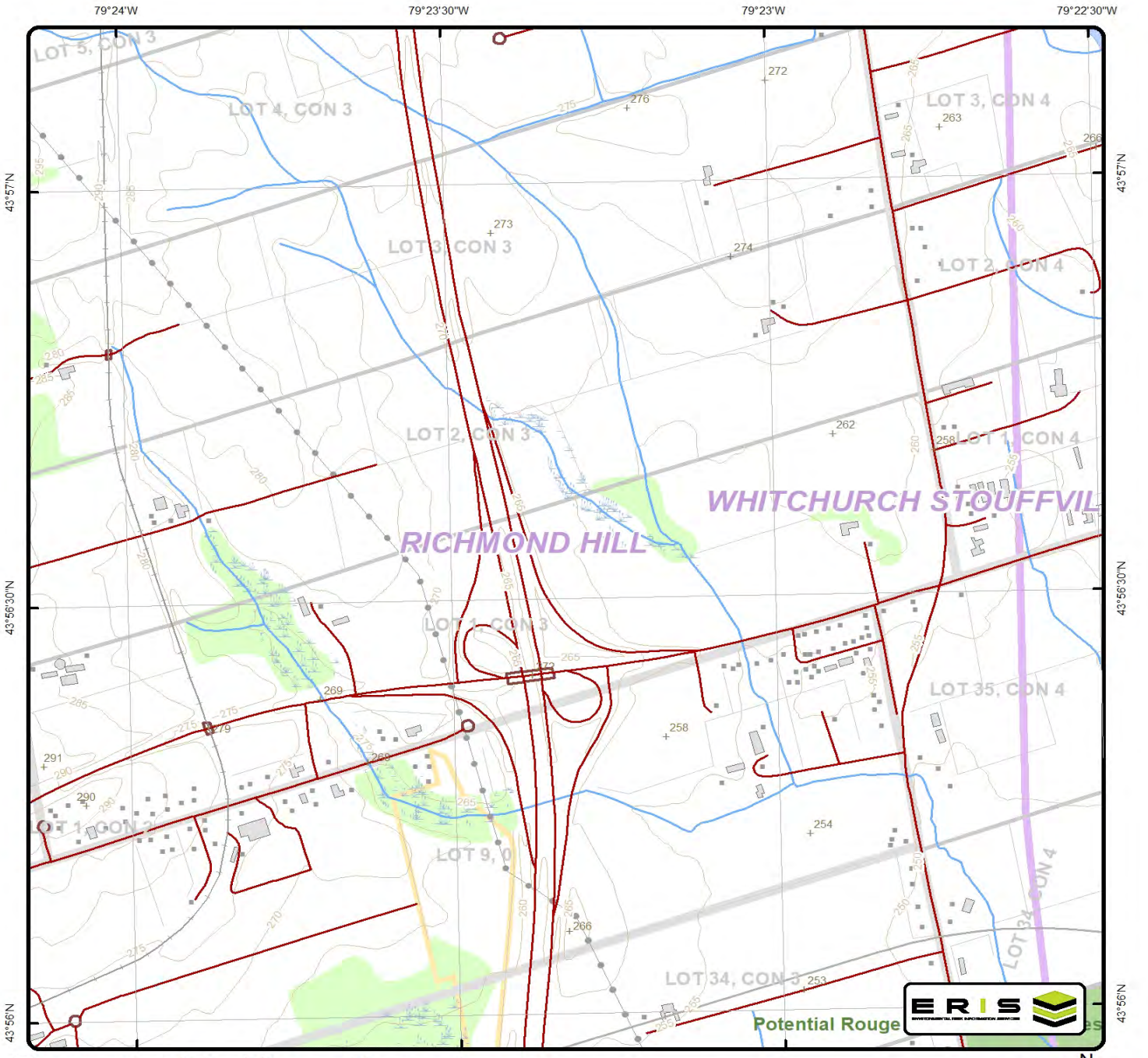
0 0.5 1 2 KM

N

Spot Height (metre)	Transportation Structure	Contour Line	Wooded Area
Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
Utility Site Point	Drainage Line Feature	Wetlands	Municipal Park
Misc. Line	River or Stream	Concession	Provincial Park
Railroads	Airports	Lots	National Park
Roads	Tanks	Municipalitiy	Nature Reserve
Trail	Building to Scale	Land Ownership	

Data source: Ontario Base Mapping (OBM) by Ontario Ministry of Natural Resources.

Topographic Information



Topographic Map - Page 1

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Spot Height (metre)	Transportation Structure	Contour Line	Wooded Area
Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
Utility Site Point	Drainage Line Feature	Wetlands	Municipal Park
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Roads	Tanks	Municipalitiy	Nature Reserve
Trail	Building to Scale	Land Ownership	

Data source: Ontario Base Mapping (OBM) by Ontario Ministry of Natural Resources.

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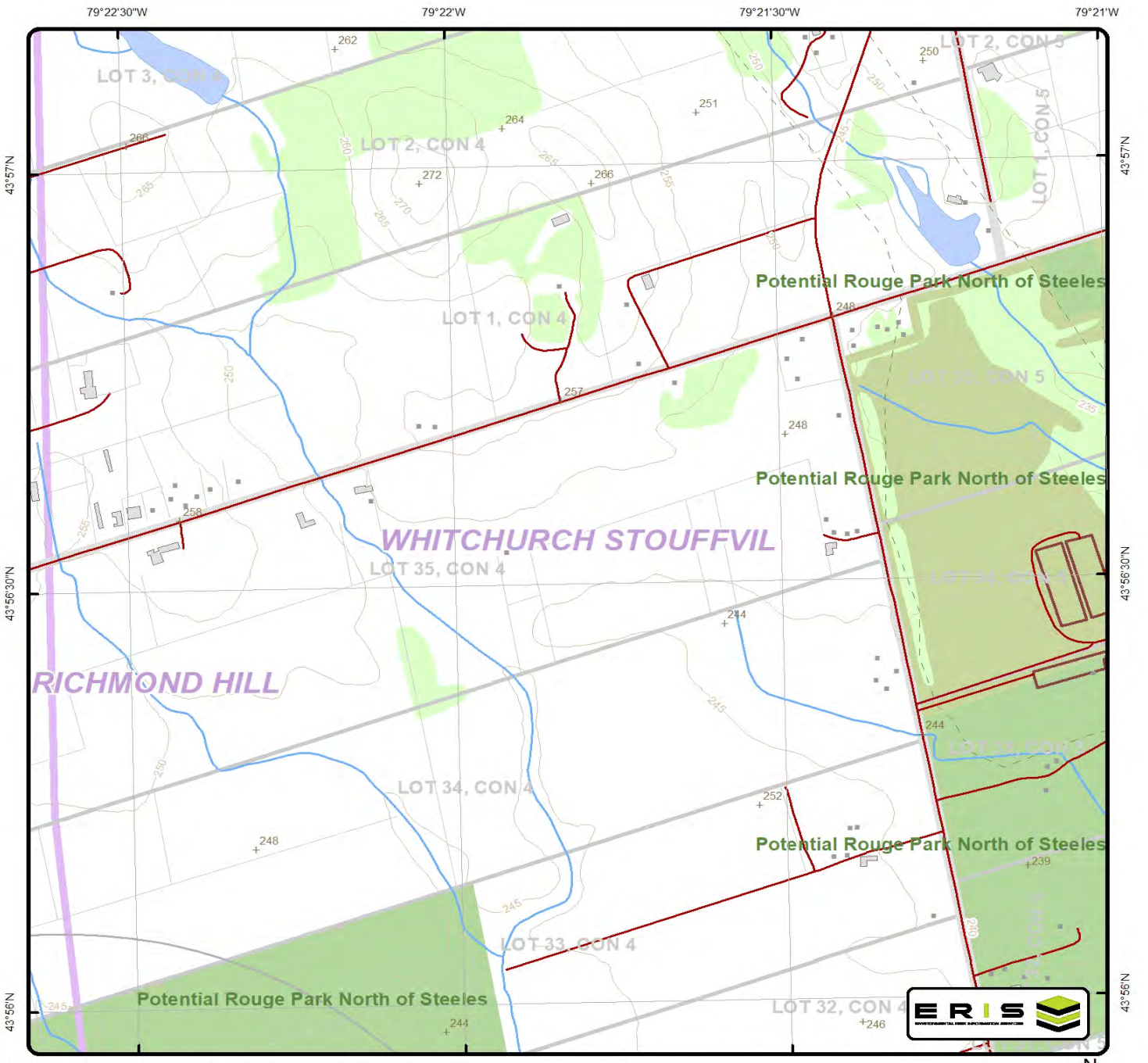

Topographic Map - Page 2

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Spot Height (metre)	Transportation Structure	Contour Line	Wooded Area
Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
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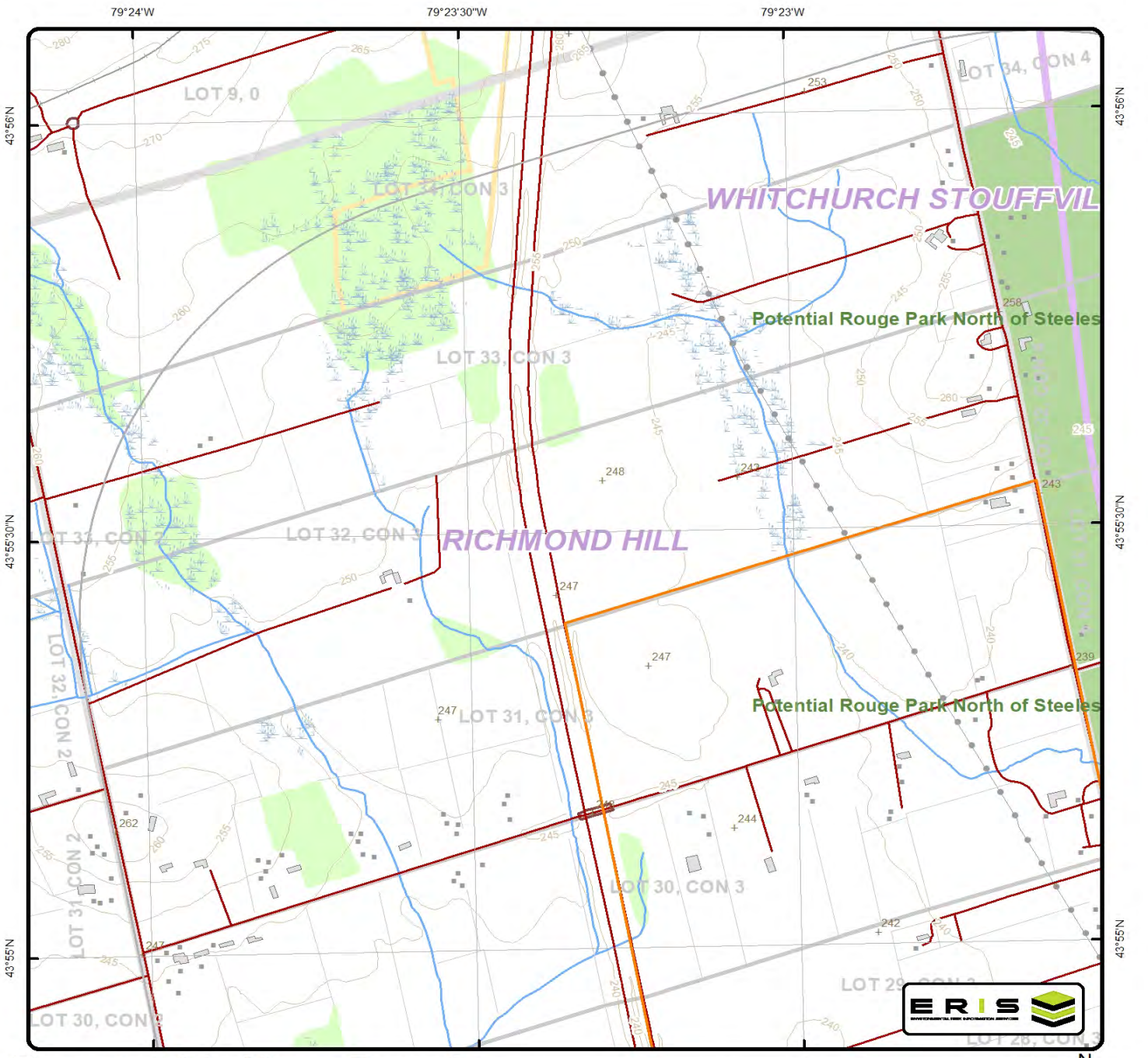
Topographic Information



Topographic Map - Page 3

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Spot Height (metre)	Transportation Structure	Contour Line	Wooded Area
Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
Utility Site Point	Drainage Line Feature	Wetlands	Municipal Park
Misc. Line	River or Stream	Concession	Provincial Park
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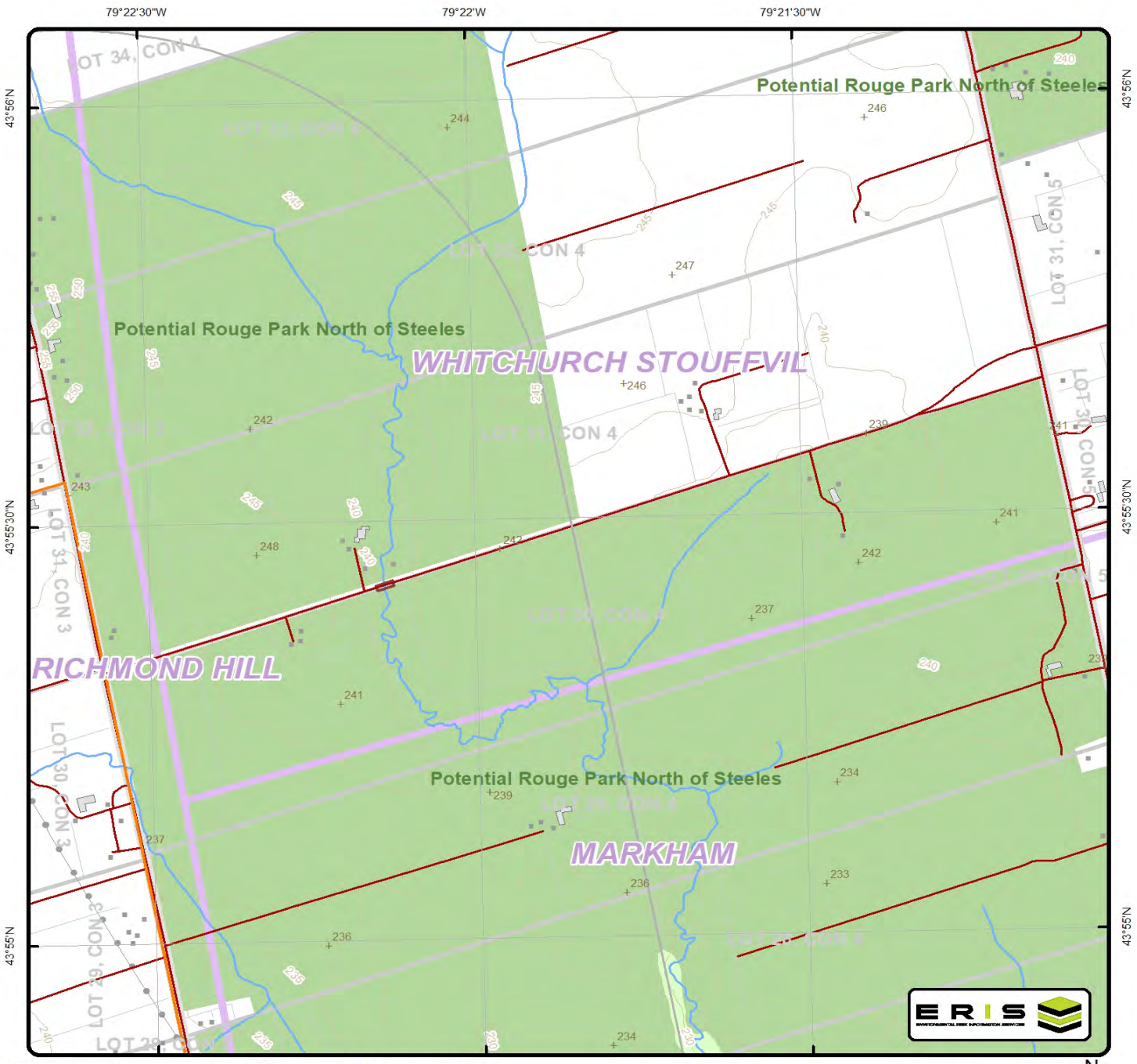
Trail	Building to Scale	Land Ownership	

Data source: Ontario Base Mapping (OBM) by Ontario Ministry of Natural Resources.

Topographic Information



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Spot Height (metre)	Transportation Structure	Contour Line	Wooded Area
Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
Utility Site Point	Drainage Line Feature	Wetlands	Municipal Park
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Roads	Tanks	Municipalitiy	Nature Reserve
Trail	Building to Scale	Land Ownership	

Data source: Ontario Base Mapping (OBM) by Ontario Ministry of Natural Resources.

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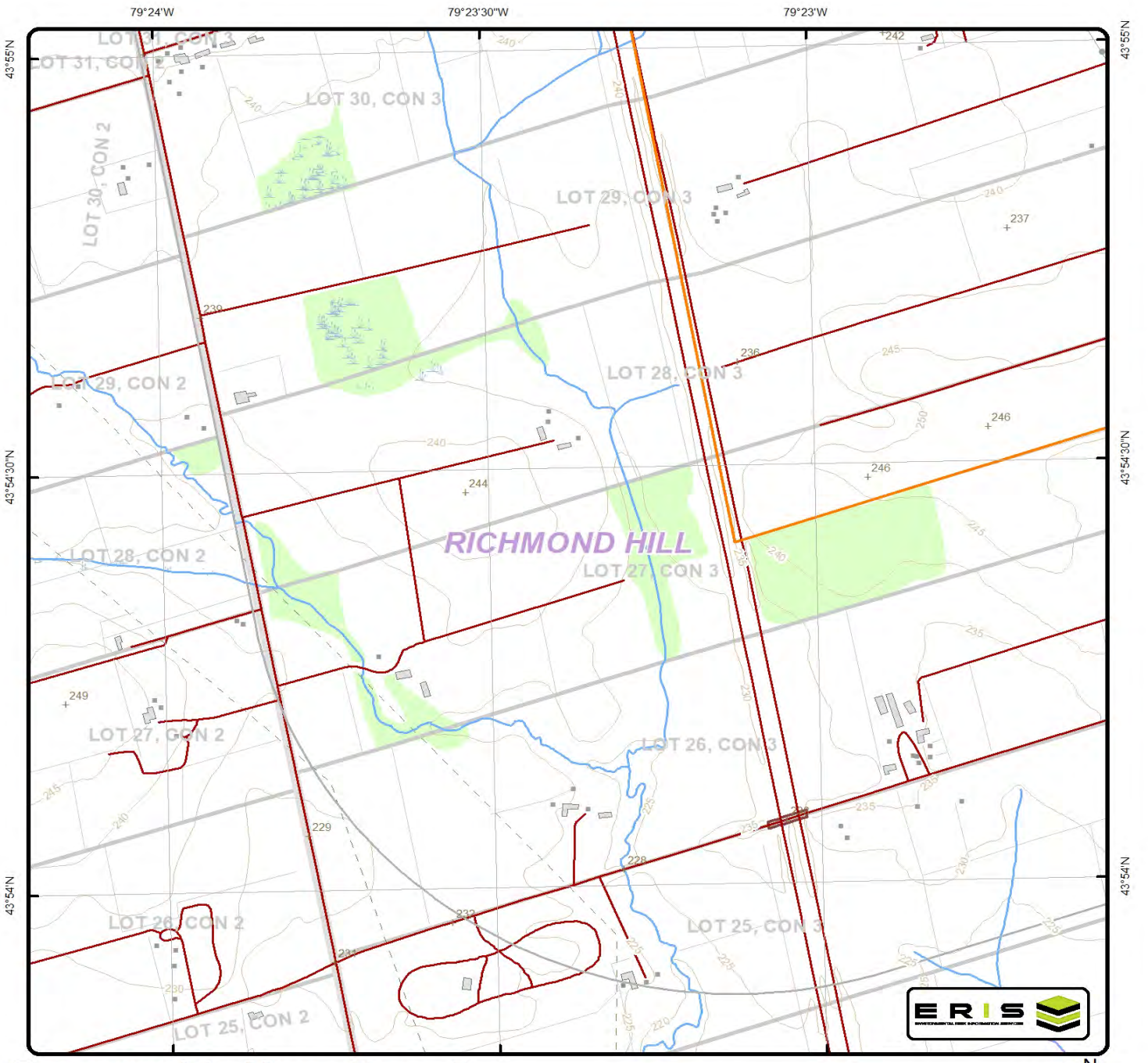

Topographic Map - Page 5

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Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
Utility Site Point	Drainage Line Feature	Wetlands	Municipal Park
Misc. Line	River or Stream	Concession	Provincial Park
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Roads	Tanks	Municipalitiy	Nature Reserve
Trail	Building to Scale	Land Ownership	

Data source: Ontario Base Mapping (OBM) by Ontario Ministry of Natural Resources.

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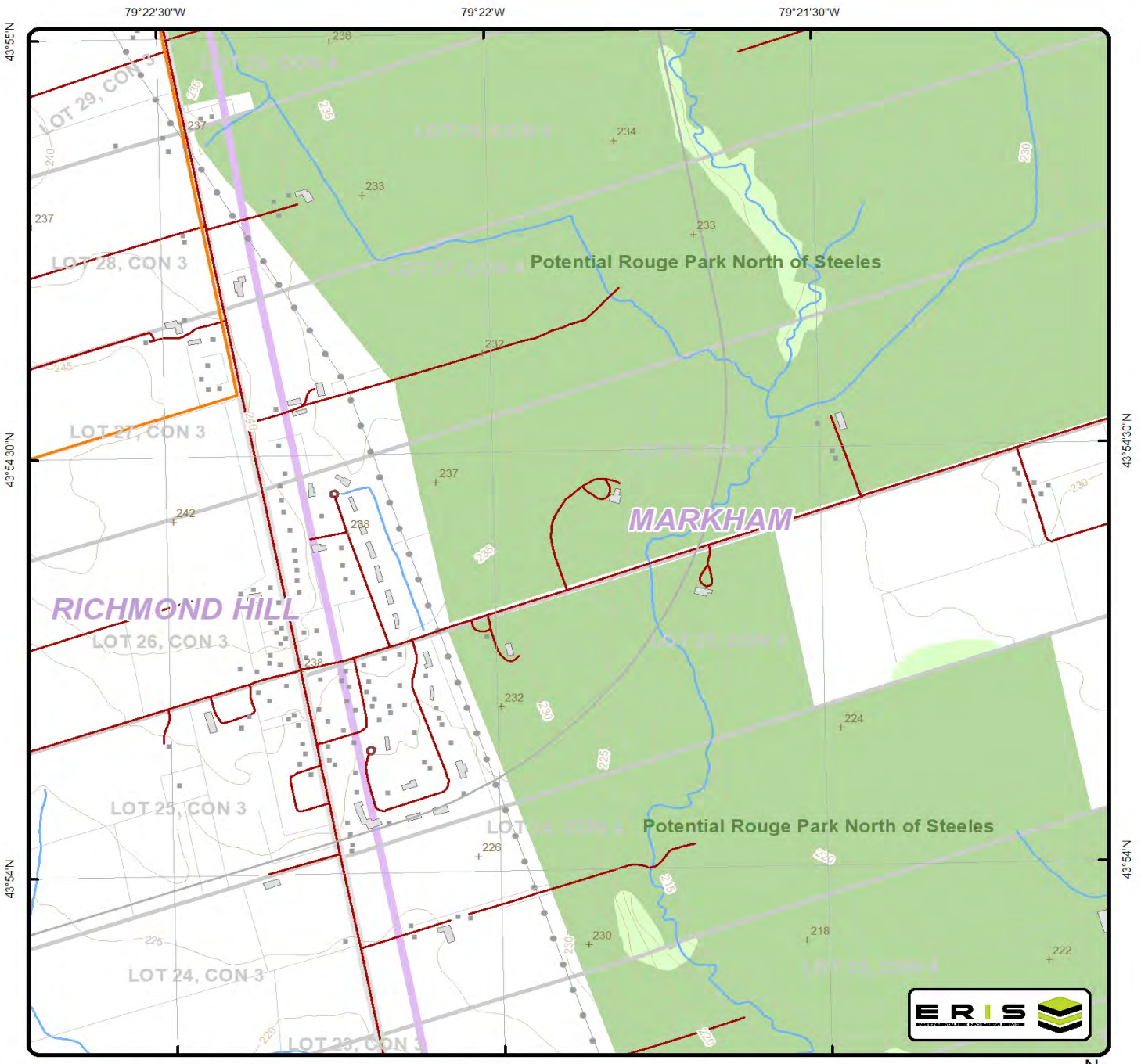

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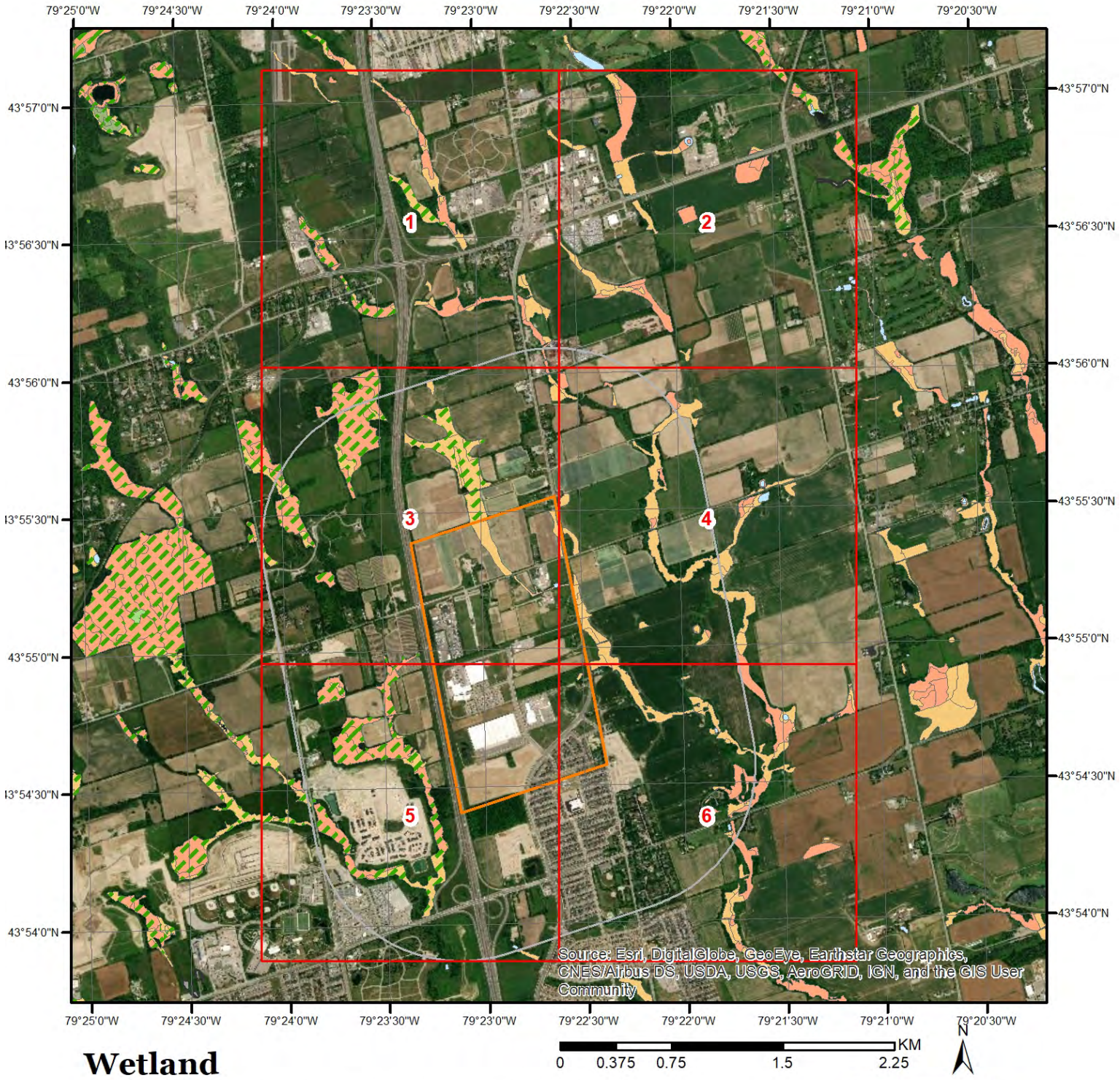
Spot Height (metre)	Transportation Structure	Contour Line	Wooded Area
Building Point	Utility Line	Pit or Quarry	Conservation Authority
Towers	Water Structure	Waterbody	Conservation Area
Utility Site Point	Drainage Line Feature	Wetlands	Municipal Park
Misc. Line	River or Stream	Concession	Provincial Park
Railroads	Airports	Lots	National Park
Roads	Tanks	Municipalitiy	Nature Reserve
Trail	Building to Scale	Land Ownership	

Data source: Ontario Base Mapping (OBM) by Ontario Ministry of Natural Resources.

Hydrologic Information



Wetland

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

- Evaluated PSW
- Bog
- Fen
- Marsh
- Open Water
- Swamp
- Unknown

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wetland Information

Wetland

0 0.125 0.25 0.5 0.75 KM

N

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

- Evaluated PSW
- Swamp
- Marsh
- Open Water

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ENVIRONMENTAL RISK INFORMATION SERVICES

Wetland Information

Wetland

0 0.125 0.25 0.5 0.75 KM

N

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

- Evaluated PSW
- Swamp
- Marsh
- Unknown
- Open Water

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ENVIRONMENTAL RISK INFORMATION SERVICES

Wetland Information

Wetland

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

Evaluated PSW
Swamp
Marsh
Open Water

0 0.125 0.25 0.5 0.75 KM

N

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wetland Information

Wetland

0 0.125 0.25 0.5 0.75 KM

N

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

- Marsh
- Open Water
- Swamp

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wetland Information

Wetland

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

- Evaluated PSW
- Swamp
- Marsh
- Open Water

0 0.125 0.25 0.5 0.75 KM

N

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wetland Information

Wetland

This map shows wetland existence. Data coverage is shown to the right.
Gray indicates no data available in the area.

- Marsh
- Open Water
- Swamp

0 0.125 0.25 0.5 0.75 KM

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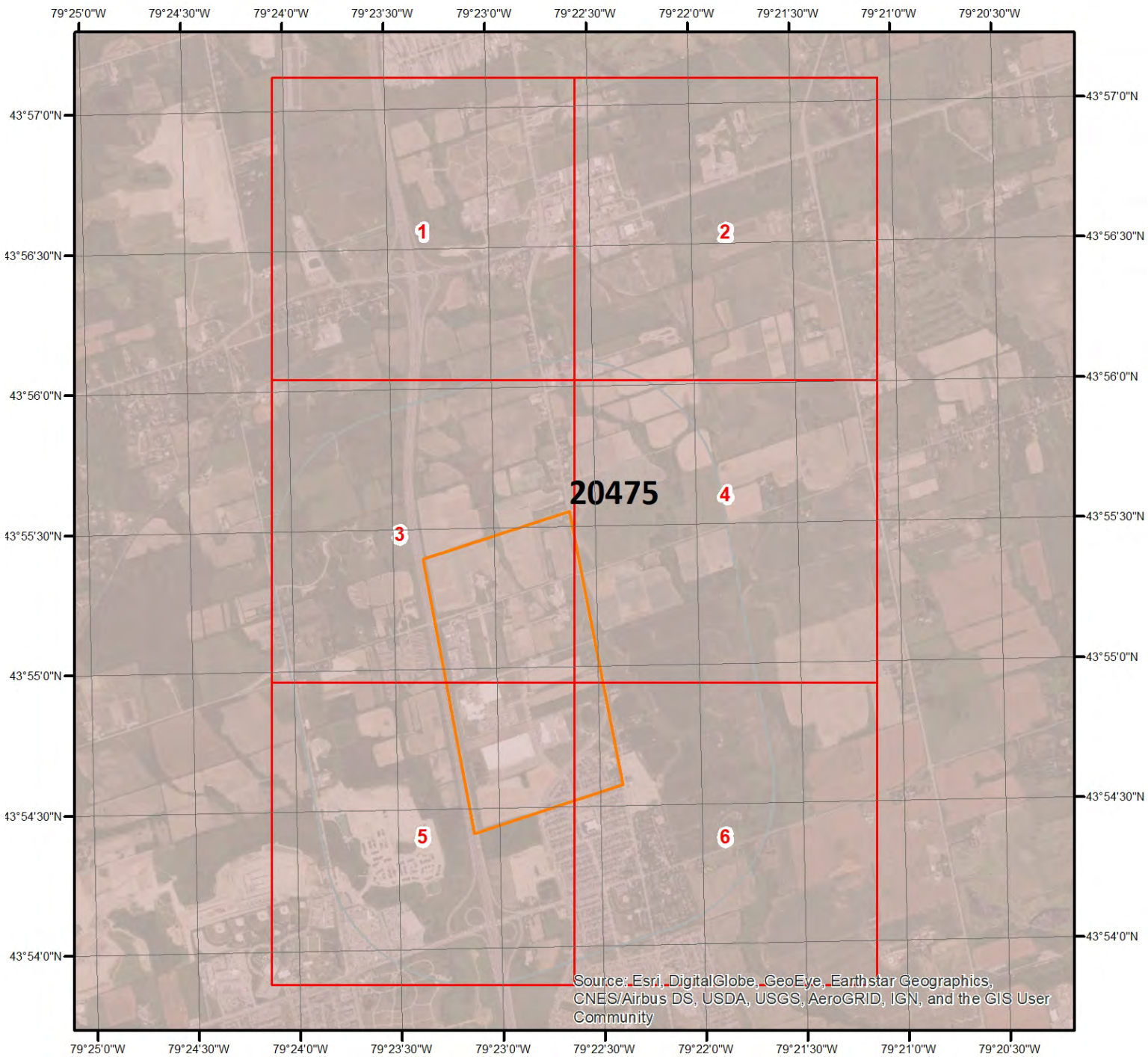
ENVIRONMENTAL RISK INFORMATION SERVICES

Geologic Information



Bedrock Geology

KM
0 0.2 0.4 0.8 1.2 1.6 2

N

This map shows bedrock geologic units in the area. Please refer to the report for detailed descriptions. Data coverage is shown to the right. Gray indicates no data available in the area.

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ENVIRONMENTAL RISK INFORMATION SERVICES

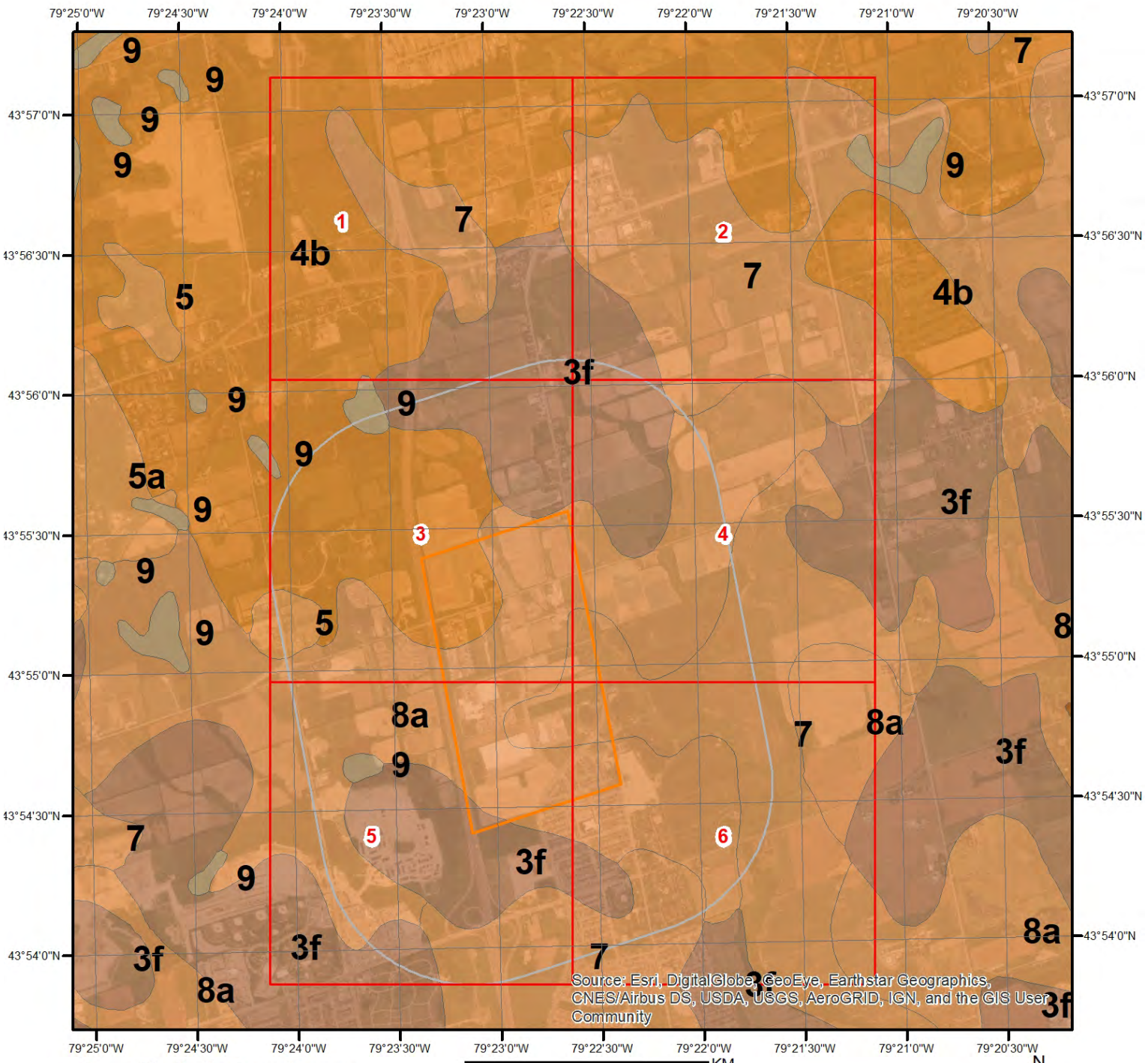
Geologic Information

Detailed bedrock geology information about each unit within the search radius is provided below.

Unit ID 20475

Unit Name:	
Rock Type:	Shale, limestone, dolostone, siltstone
Strata:	Georgian Bay Formation; Blue Mountain Formation; Billings Formation; Collingwood Member; Eastview Member
Super Eon:	
Eon:	PHANEROZOIC (Present to 542.0 Ma)
Era:	PALEOZOIC (251.0 Ma to 542.0 Ma)
Period:	ORDOVICIAN (443.7 Ma to 488.3 Ma)
Epoch:	UPPER ORDOVICIAN
Province:	
Tectonic Zone:	

Geologic Information



Surficial Geology

This map shows surficial geologic labels in the area. Please refer to the report for detailed descriptions. Data coverage is shown to the right. Gray indicates no data available in the area.

Geologic Information

Detailed surficial geology information about each unit within the search radius is provided below.

Unit ID 4b

Geological Deposit:	Glacial deposits (Halton Till)
Deposit Age:	Quaternary
Primary Material:	diamicton
Secondary Material:	
Primary General:	glacial
Primary General Modifier:	
Veneer:	
Episode:	Wisconsin
Sub Episode:	Michigan
Strata Modifier:	Surface
Provenance:	Erie-Ontario
Carbon Content:	
Formation:	Halton Till
Permeability:	Low
Material Description:	Clayey silt to silt till; 1-2% stone content; 1-15m thick; occurs in till or lake plains often with interbedded fine sand silt and clay

---

Unit ID 7

Geological Deposit:	Glacial lake deposits
Deposit Age:	Quaternary
Primary Material:	clay, silt
Secondary Material:	
Primary General:	glaciolacustrine
Primary General Modifier:	foreshore/basinal
Veneer:	
Episode:	Wisconsin
Sub Episode:	Michigan
Strata Modifier:	Surface
Provenance:	
Carbon Content:	
Formation:	
Permeability:	Low
Material Description:	Silt and clay; massive to laminated

Unit ID 3f

Geological Deposit:	Glacial deposits (Newmarket/Northern/Bowmanville Till)
Deposit Age:	Quaternary
Primary Material:	diamicton
Secondary Material:	

Geologic Information

Primary General:	glacial
Primary General Modifier:	
Veneer:	
Episode:	Wisconsin
Sub Episode:	Michigan
Strata Modifier:	Surface
Provenance:	Simcoe
Carbon Content:	
Formation:	Newmarket Till
Permeability:	Low-Medium
Material Description:	sandy silt to snd till; 3% stone content, stratified interbeds, 1-50m thick

---

Unit ID 9

Geological Deposit:	Organic deposits
Deposit Age:	Quaternary
Primary Material:	organic deposits
Secondary Material:	
Primary General:	wetland
Primary General Modifier:	
Veneer:	
Episode:	Hudson
Sub Episode:	
Strata Modifier:	Surface
Provenance:	
Carbon Content:	
Formation:	
Permeability:	High
Material Description:	Peat, muck, and marl; 1-7m thick; occurs in wetlands

---

Unit ID 8a

Geological Deposit:	Glacial lake deposits
Deposit Age:	Quaternary
Primary Material:	sand
Secondary Material:	
Primary General:	glaciolacustrine
Primary General Modifier:	foreshore/basinal
Veneer:	
Episode:	Wisconsin
Sub Episode:	Michigan
Strata Modifier:	Surface
Provenance:	
Carbon Content:	
Formation:	
Permeability:	High
Material Description:	Sand and silty sand; 1->50m thick; occurs in basin lows and nearshore flats

Geologic Information

Unit ID 5

Geological Deposit:	Moraine deposits
Deposit Age:	Quaternary
Primary Material:	sand, gravel
Secondary Material:	
Primary General:	glaciofluvial/glaciolacustrine
Primary General Modifier:	ice-contact
Veneer:	
Episode:	Wisconsin
Sub Episode:	Michigan
Strata Modifier:	Surface
Provenance:	
Carbon Content:	
Formation:	
Permeability:	High
Material Description:	Fine sand to gravel

Wells and Additional Sources

Wells & Additional Sources

0 0.425 0.85 1.7 KM

N

- Project Property
- Buffer
- Buffer
- Buffer
- Buffer
- Buffer
- Sites with Higher Elevation
- Sites with Same Elevation
- Sites with Lower Elevation
- Sites with Unknown Elevation

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wells and Additional Sources

Wells & Additional Sources - Page 1

- ▲ Sites with Higher Elevation
- ■ Sites with Same Elevation
- ▼ Sites with Lower Elevation
- ○ Sites with Unknown Elevation

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wells and Additional Sources

Wells & Additional Sources - Page 2

- ▲ Sites with Higher Elevation
- ■ Sites with Same Elevation
- ▼ Sites with Lower Elevation
- ○ Sites with Unknown Elevation

ERIS
ENVIRONMENTAL RISK INFORMATION SERVICES

Wells and Additional Sources Summary

Federal Sources

National Energy Board Wells

Map Key	ID	Distance (m)	Direction
	No records found		

Provincial Sources

Ontario Oil and Gas Wells

Map Key	ID	Distance (m)	Direction
	No records found		

Provincial Groundwater Monitoring Network

Map Key	ID	Distance (m)	Direction
	No records found		

Water Well Information System

Map Key	Well ID	Distance (m)	Direction
1	7278629	0.	-
2	6910611	0.	-
3	7284230	0.	-
4	6903211	0.	-
5	6915258	0.	-
6	7109647	0.	-
6	7140480	0.	-
7	7306880	0.	-
7	7306879	0.	-
8	7049053	0.	-
8	7049054	0.	-
9	6910668	0.	-
10	6912456	0.	-
11	6909151	0.	-
12	6903209	0.	-
13	6903214	0.	-
14	7306226	0.	-
15	7305415	0.	-
16	7169253	0.	-
17	7053877	0.	-
18	7168601	0.	-
19	6910808	0.	-
20	6915734	0.	-
21	7108205	0.	-
22	6926229	0.	-
22	6926230	0.	-
22	6926231	0.	-
22	6926952	0.	-
22	6926954	0.	-
22	6926953	0.	-
23	7307622	0.	-

24	6923464	0.	-
25	7108206	0.	-
26	6915999	0.	-
27	6928628	0.	-
28	6915750	0.	-
29	6903213	0.	-
30	6924496	0.	-
31	7240618	0.	-
32	7102537	0.	-
33	7223175	0.	-
34	7206334	0.	-
35	6911852	0.	-
36	7292780	0.	-
37	7295271	0.	-
37	7281239	0.	-
38	7212612	0.	-
39	7104954	0.	-
39	7132020	0.	-
40	7132021	0.	-
40	7104953	0.	-
41	7159600	0.	-
42	7114037	0.	-
43	7132014	0.	-
43	7104955	0.	-
44	7206333	0.	-
45	6924908	0.	-
46	7206368	0.	-
47	7240617	1.25	SE
48	6916006	2.41	NNE
49	7172697	3.24	ENE
50	7206227	3.95	NE
51	7111111	12.76	NNE
52	7240619	23.22	SE
53	7112476	30.82	S
54	6924904	37.62	SE
55	6930800	42.58	S
56	6908899	44.92	SE
57	6930801	49.54	S
58	7108996	49.55	S
59	6903212	51.18	WNW
60	6908902	57.52	SE
61	6903391	79.37	ESE
62	7193029	92.28	SE
63	7273721	105.58	SE
64	7270749	108.29	SE
65	7177598	110.75	SE
66	6915652	121.16	SE
67	7213920	123.12	SE
68	7270638	147.85	SE
69	6903210	163.53	W
70	7240182	163.67	SE
71	6914101	165.48	SSE
72	6915985	165.69	SE
72	7250755	165.69	SE
73	7243116	168.34	SE
74	7314499	169.11	ESE
75	7307623	174.81	NW
76	7193033	178.06	SE
77	7161864	181.07	WNW
78	7108995	188.7	S
79	6903387	191.69	SE
80	7108993	205.27	SSE
81	7108994	209.33	SSE
82	6903399	211.37	NNE
83	6912442	212.52	WNW
84	6914842	213.87	SE

85	7240181	221.61	SE
86	6924905	226.74	SE
87	7229532	226.92	SE
88	7240179	229.06	SE
89	6914927	230.18	SE
90	6914843	241.9	SE
91	7240180	242.53	SE
92	7314498	249.2	SE

Private Sources

Oil and Gas Wells

Map Key	ID	Distance (m)	Direction
	No records found		

Radon Information

Detailed radon information for the project property is provided below.

Radon Zone Information

ID:	144851	**Radon Rank:**	MOD

Health Canada Radon Information

Health Region:	3570
Health Region Name:	York Regional Health Unit
Province or Territory:	ON
Number Homes in Survey:	95
% Below 200 Bq/m3:	100
% Above 200 Bq/m3:	0
200 to 600 Bq/m3:	0
% Above 600 Bq/m3:	0

Area of Natural and Scientific Interest Information

There is no ANSI unit available in this area.

Area of Natural and Scientific Interest Information

Detailed ANSI information is provided below.

No records found for the project property or surrounding properties.

Appendix

Federal Sources

Bedrock Geology of Canada — **BEDROCK GEOLOGY**

The Geological Map of Canada is scaled at 1:5,000,000. This map is created by Geological Survey of Canada and published by Natural Resources Canada.

Health Canada Radon Information — **RADON**

This source is the results from the Cross-Canada Survey of Radon Concentrations in Homes, a two-year study conducted by Health Canada's National Radon Program. The aims of this study were to obtain an estimate of the proportion of the Canadian population living in homes with radon gas levels above the guideline of 200 Bq/m3, to identify previously unknown areas where radon gas exposure may constitute a health risk, and to build, over time, a map of indoor radon gas exposure levels across Canada.

National Energy Board Wells — **NEBP**

The NEBW database contains information on onshore & offshore oil and gas wells that are outside provincial jurisdiction(s) and are thereby regulated by the National Energy Board. Data is provided regarding the operator, well name, well ID No./UWI, status, classification, well depth, spud and release date.

Soil Landscapes of Canada (SLC) — **SLC**

Major characteristics of soil and land such as surface form, slope, water table depth, permafrost and lakes.

Surficial Geology of Canada — **SURFICIAL GEOLOGY**

This map contains information on surficial materials and associated landforms left by the retreat of the last glaciers and non glacial environments. It is based on compilation of existing maps. This data was authored by the Geological Survey of Canada and published by Natural Resources Canada.

Toporama — **TOPORAMA**

Toporama covers the entire area of Canada's landmass and provides topographic, geo-referenced, and symbolic information in a raster format at 1:50,000 scale. This is a digital topographic reference product made available by Natural Resources Canada (NRCan).

Provincial Sources

Area of Natural and Scientific Interest — **ANSI**

Areas of Natural and Scientific Interest (ANSIs) are lands and waters with features that are important for natural heritage protection, appreciation, scientific study or education. This dataset is made available by Ontario Ministry of Natural Resources.

Bedrock Geology of Ontario — **BEDROCK GEOLOGY**

The Bedrock Geology layer shows the distribution of bedrock units underlying Ontario at a 1:250,000 scale. The geology of the province consists of Precambrian rocks of the Canadian Shield and Phanerozoic sedimentary rocks that overlie the Canadian Shield. This layer was compiled by the Precambrian Geoscience Section of Ontario Geological Survey.

Ontario Detailed Soil Survey (DSS3) — **SOIL SURVEY**

Soil surveys have been published for most of the agricultural areas, and many surrounding areas, across Canada. Data from these surveys comprise the most detailed soil inventory information in the National Soil DataBase. Data is made available by Agriculture and Agri-Food Canada

Ontario Oil and Gas Wells — **OOGW**

In 1998, the MNR handed over to the Ontario Oil, Gas and Salt Resources Corporation, the responsibility of maintaining a database of oil and gas wells drilled in Ontario. The OGSR Library has over 20,000+ wells in their database. Information available for all wells in the ERIS database include well owner/operator, location, permit issue date, and well cap date, license No., status, depth and the primary target (rock unit) of the well being drilled. All geology/stratigraphy table information, plus all water table information is also provide for each well record.

Provincial Groundwater Monitoring Network — **GROUNDWATER**

Appendix

Groundwater level and chemistry data from monitoring wells that are part of the Provincial Groundwater Monitoring Network (PGMN) Program. Precipitation data (rain) is also available for some sites. This data is provided by 'Ontario Ministry of Environment and Climate Change.

Surficial Geology of Ontario — **SURFICIAL GEOLOGY**

The Surficial Geology dataset contains a layer depicting the distribution and characteristics of surficial deposits across southern Ontario. This data set is authored by the Ontario Geological Survey.

Topographic Map of Ontario — **TOPOGRAPHIC MAP**

The Ontario Basic Mapping program provides a relationship between topographic information and the provincial geographical referencing grid, thereby forming the foundation for a comprehensive provincial geographical referencing system. This data is made available by the Ontario Ministry of Natural Resources and Forestry. This is ERIS self-designed topographic map template at 1:10,000.

Water Well Information System — **WWIS**

This database describes locations and characteristics of water wells found within Ontario in accordance with Regulation 903. It includes such information as coordinates, construction date, well depth, primary and secondary use, pump rate, static water level, well status, etc. Also included are detailed stratigraphy information, approximate depth to bedrock and the approximate depth to the water table.

Wetlands of Ontario — **WETLAND**

The Ministry of Natural Resources and Forestry has made available a database of wetlands in Ontario. Certain attributes identify wetlands that have been evaluated with the Ontario Wetland Evaluation System (OWES), and of those which ones have been designated as Provincially Significant Wetlands (PSW).

Private Sources

Oil and Gas Wells — **OGWE**

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickle's database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at www.nickles.com.

Radon Zone Information — **RADON**

The Radon Potential Map is developed by Radon Environmental Management Corporation. Its objective was to illustrate the relative variation of radon risk across the country, and in 2011 it published its first geologic Radon Potential Map of Canada.

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THURBER

APPENDIX D

Record of Borehole Sheets

RECORD OF BOREHOLE BH-01

PROJECT : Highway 404 North Collector Roads EA Study
LOCATION : Markham, ON
STARTED : July 11, 2019
COMPLETED : July 12, 2019
N 4 864 716.0 E 630 125.8

Project No. 18189
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		238.86				
		TOPSOIL (300mm)		0.00				
		Sandy **SILT**, some clay to clayey, trace gravel, dense to very dense, brown, moist: (TILL)		238.56 0.30	1	SS	7	
1	Solid Stem Augers				2	SS	30	
2					3	SS	51	Grain Size Analysis: Gr 2%/ Sa 29%/ Si 59%/ Cl 10%
					4	SS	56	
3		becoming grey			5	SS	59	
4								
5					6	SS	50/ 0.125	
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 3.7m UPON COMPLETION. Monitoring Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		233.68 5.18				
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Bentonite
Filter Sand
Slotted Screen

WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Aug 09/19	1.15	237.71

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GF
CHECKED : GRL

THURBER

THURBER2S TEL-18189.GPJ 3/12/20

RECORD OF BOREHOLE BH-02

PROJECT : Highway 404 North Collector Roads EA Study
LOCATION : Markham, ON
STARTED : July 11, 2019
COMPLETED : July 11, 2019
N 4 864 343.2 E 629 886.8

Project No. 18189
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		238.77						
	Solid Stem Augers	**TOPSOIL** (350mm)		0.00						
		Sandy **SILT**, some clay to clayey, trace gravel, compact to dense, brown, moist: (TILL)		238.41 0.36	1	SS	9			
1					2	SS	21	Grain Size Analysis: Gr 5%/ Sa 39%/ Si 46%/ Cl 10%		Bentonite
2					3	SS	38			
3					4	SS	36			Filter Sand
					5	SS	39			Slotted Screen
4										
5					6	SS	30			
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.6m UPON COMPLETION. Monitoring Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		233.59 5.18						
6										
7										
8										
9										

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Aug 09/19	0.48	238.29

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GF
CHECKED : GRL

THURBER

THURBER2S TEL-18189.GPJ 3/12/20

RECORD OF BOREHOLE BH-03

PROJECT : Highway 404 North Collector Roads EA Study
LOCATION : Markham, ON
STARTED : July 11, 2019
COMPLETED : July 11, 2019
N 4 863 948.3 E 629 944.3

Project No. 18189
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		240.86							
		TOPSOIL (250mm)		0.00							
		Sandy **SILT**, some clay to clayey, trace gravel, compact to very dense, brown, moist: (TILL)		0.25	1	SS	16				
1					2	SS	18				Bentonite
2	Solid Stem Augers				3	SS	25				
					4	SS	59				Filter Sand
3					5	SS	84	Grain Size Analysis: Gr 7%/ Sa 34%/ Si 43%/ Cl 16%			
		becoming grey									Slotted Screen
4											
					6	SS	73				
5				235.68							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.4m AND WATER LEVEL AT 3.9m UPON COMPLETION. Monitoring Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18							
6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Aug 09/19 2.10 238.76									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GF
CHECKED : GRL

THURBER

THURBER2S TEL-18189.GPJ 3/12/20

RECORD OF BOREHOLE BH-04

PROJECT : Highway 404 North Collector Roads EA Study
LOCATION : Markham, ON
STARTED : July 12, 2019
COMPLETED : July 12, 2019
N 4 863 827.5 E 630 272.9

Project No. 18189
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		236.35				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
		TOPSOIL (200mm)		0.00							
		Sandy **SILT**, some clay to clayey, trace gravel, dense to very dense, brown, moist: (TILL)		0.20	1	SS	17				
1	Solid Stem Augers				2	SS	45				Bentonite
2					3	SS	78				
3					4	SS	37	Grain Size Analysis: Gr 6%/ Sa 36%/ Si 41%/ Cl 17%			Filter Sand
					5	SS	75/ 0.125				
4											Slotted Screen
		becoming grey			6	SS	79				
5				231.17							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 5.18m UPON COMPLETION. Monitoring Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18							
6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Aug 09/19 1.38 234.97									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GF
CHECKED : GRL

THURBER

THURBER2S TEL-18189.GPJ 3/12/20

RECORD OF BOREHOLE BH-05

PROJECT : Highway 404 North Collector Roads EA Study
LOCATION : Markham, ON
STARTED : July 12, 2019
COMPLETED : July 12, 2019
N 4 863 493.5 E 630 357.3

Project No. 18189
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		235.07							
0	Solid Stem Augers	Sandy **SILT**, some clay to clayey, trace gravel, compact to very dense, brown, moist: (TILL)			1	SS	36				
1					2	SS	20				Bentonite
2					3	SS	39	Grain Size Analysis: Gr 2%/ Sa 37%/ Si 47%/ Cl 14%			
3		becoming grey			4	SS	42				Filter Sand
					5	SS	40				Slotted Screen
4											
5				229.89	6	SS	86				
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.4m UPON COMPLETION. Monitoring Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18							
6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Aug 09/19 3.12 231.95									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GF
CHECKED : GRL

THURBER

THURBER2S TEL-18189.GPJ 3/12/20

THURBER

APPENDIX E

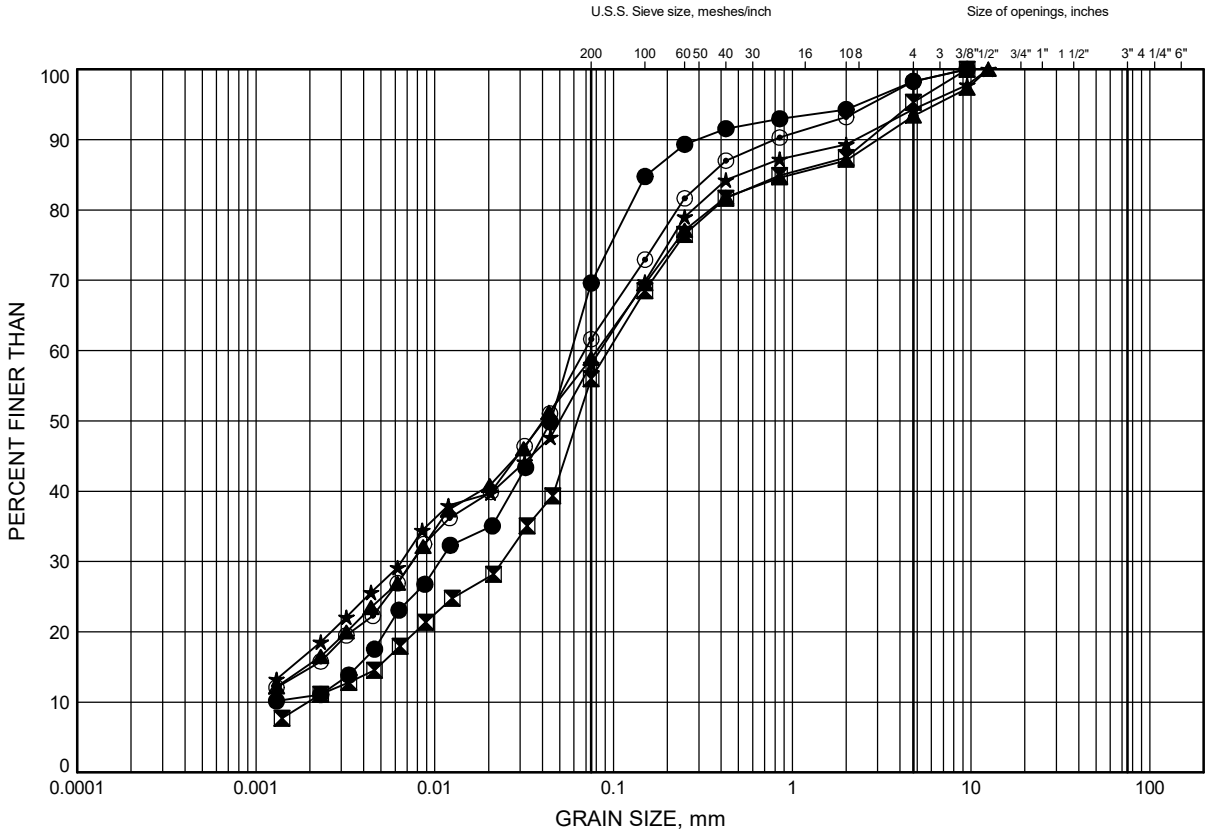
Geotechnical Laboratory Test Results

Highway 404 North Collector Roads EA Study

GRAIN SIZE DISTRIBUTION

FIGURE C1

Sandy SILT TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-01	1.83	237.03
⊠	BH-02	1.07	237.70
▲	BH-03	3.35	237.51
★	BH-04	2.59	233.76
⊙	BH-05	1.83	233.24

Date September 2019

Project 18189

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Prep'd BH

Chkd. GRL

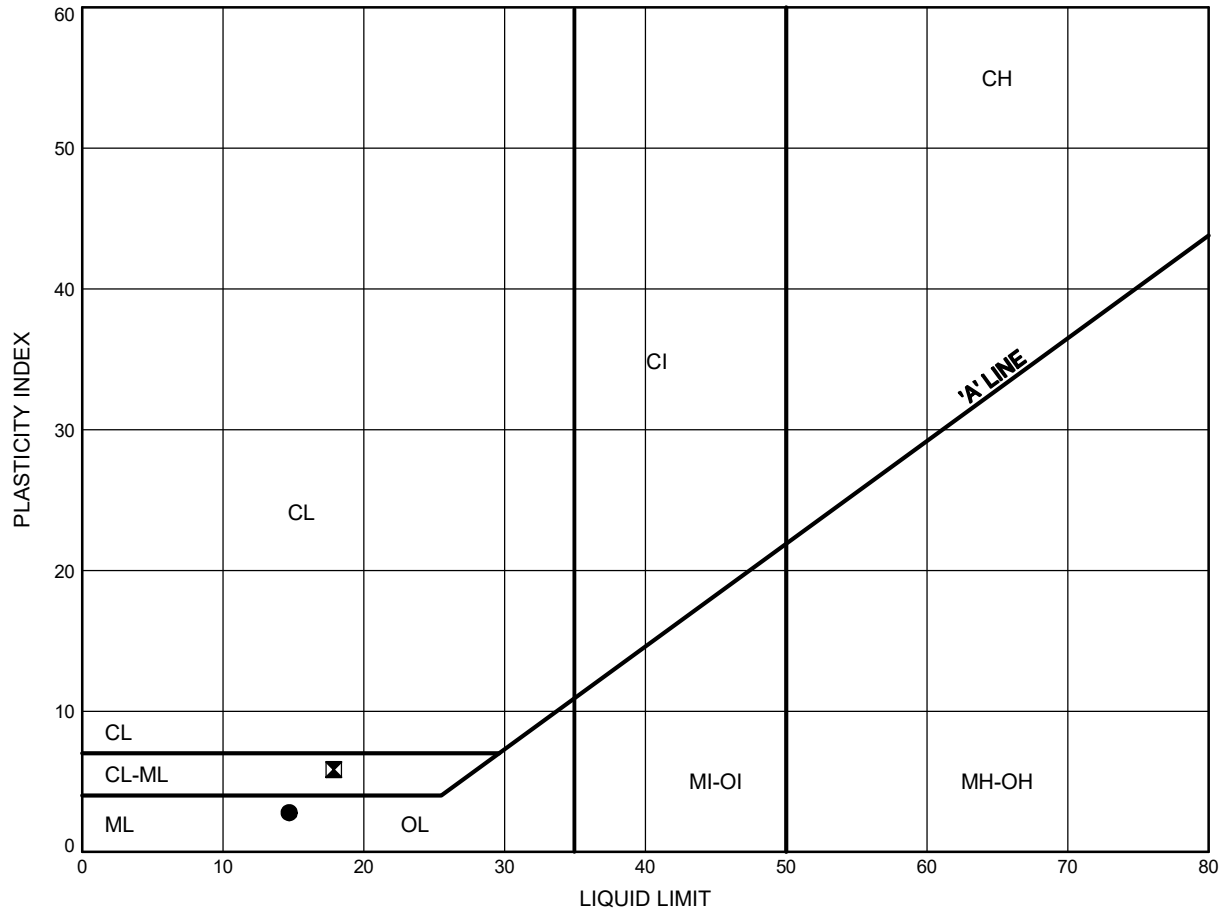
GRAIN SIZE DISTRIBUTION - THURBER TEL-18189.GPJ 9/9/19

Highway 404 North Collector Roads EA Study

ATTERBERG LIMITS TEST RESULTS

FIGURE C2

Sandy SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-02	1.07	237.70
⊠	BH-05	1.83	233.24

Date September 2019

Project 18189

THURBER

Prep'd BH

Chkd. GRL

THURBALT TEL-18189.GPJ 9/9/19