



PROPOSAL

GEOTECHNICAL DESKTOP STUDY REPORT

*Consulting Services
Class Environmental Assessment
Water System Upgrades for the Community of Stouffville,
York Region, Ontario*

Submitted to:

The Municipal Infrastructure Group

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Submitted by:

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1668667

May 17, 2018

Distribution List

1 e-copy - Regional Municipality of York

1 e-copy - Golder Associates Ltd.

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1.0 INTRODUCTION

This report presents the results of the desktop geotechnical study carried out by Golder Associates Ltd. (Golder) for the Community of Stouffville, York Region, Ontario, as shown on the Key Plan, Figure 1. This desktop study was carried out in general conformance with our proposal dated November 16, 2016. Authorization to proceed was given in the form of an email by Mr. Kevin Brown, P.Eng. of the Municipal Infrastructure Group (TMIG) on May 10, 2017.

TMIG is proceeding to undertake a Municipal Class Environmental Assessment (EA) for the Community of Stouffville in York Region. As part of this study, a geotechnical desktop study is required for planning purposes.

This report provides the results of our review of the available background information and should be read in conjunction with the *“Important Information and Limitations of This Report”* (Appendix A, attached). The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location.

2.0 SITE AND PROJECT DESCRIPTION

The study area for this project is shown on Figure 1. The study area is bordered on the east by York Durham Line, on the south by 19th Avenue, on the west by McCowan Road and on the north by Vandorf Sideroad. This site is located within the boundaries of the Town of Whitchurch-Stouffville.

The study area is located within the Oak Ridges Moraine Conservation Area and consists of mixed use – agricultural areas, mining pits, protected areas and residential areas. In particular, the Town of Whitchurch-Stouffville, Sleepy Hollow Golf & Country Club and multiple small waterbodies and waterways are all within the study area.

The aim of this desktop study is to provide general information about the subsurface conditions within the study area and it is one of the inputs to the EA process to be used for planning purposes. The Schedule B Municipal Class EA is being carried out to support the goal of refining Regional infrastructure needs to service long term water demands for all three Stouffville water zones, as the 2009 York Region Water and Wastewater Plan Update identified the need for additional water storage. This will include an elevated tank, upgrades to the Zone 2 booster pumping station, and major rehabilitation of the existing Zone 2 elevated tank.

3.0 BACKGROUND INFORMATION AND AVAILABLE DATA

For the purpose of this desktop study, information about the subsurface conditions was obtained from the following sources:

- Chapman, L.J., and Putnam, D.F., 2007, *“The Physiography of Southern Ontario”*, Ontario Geological Survey.
- Ontario Geological Survey 2010, *“Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release – Data 128 – Revised”*;
- Holden, K.M., Thomas, J. and Karrow, P.F. 1993, *“Bedrock Topography, Newmarket Area, Southern Ontario Geological Survey,”* Preliminary Map P3214, Scale 1:50,000.
- Ministry of Natural Resources district offices in Aurora, Peterborough and Midhurst, the Ministry of Municipal Affairs and Housing, *“Oak Ridges Moraine Conservation Plan Land Use Designation Map, Map 4 – Towns of East Gwillimbury, Markham & Whitchurch- Stouffville,”* Scale 1:120,000; and

- Geotechnical investigations carried out historically by Golder within the study area.

4.0 SUBSURFACE CONDITIONS

The generalized description of the subsurface conditions are mostly based on a review of existing available published surficial geology and bedrock geology maps as well as Golder's previous experience in the area.

4.1 Geology

The surficial geology and the physiographic regions of Southern Ontario for the study area are presented on Figures 2 and 3, respectively.

4.1.1 Physiographic Regions of Southern Ontario¹

According to the above noted references, physiographic mapping indicates that the northern side of the study area lies within a physiographic region known as the Oak Ridges Moraine, while the remainder of the site is within the region called the South Slope.

The Oak Ridges Moraine region as defined by Chapman and Putnam (1984), extends from the Niagara escarpment to the Trent River, forming the height of land dividing the streams of Lake Ontario drainage basin from those flowing into Georgian Bay and Trent River. The surface in this region is generally hilly and the hills are composed of sandy or gravelly materials, though this is not always the case such as along the southern boundary of this study area which is comprised of tills of silt, sand and gravel. The Oak Ridges Moraine region can be considered as the source for many streams which drain the till plains on either side of it. However, as Carman (1940) pointed out, there is a virtual lack of streams in the moraine since the water drains vertically through the sand and gravel, moving laterally only when it reaches less pervious beds and reappearing as springs along the slopes of the moraine.

The South Slope, as defined by Chapman and Putnam (1984) is the southern slope of the Oak Ridges Moraine, and extends from the Niagara Escarpment to Trent River and is that of a drumlinized till plain. Drumlins are scattered throughout and are long and thin, pointing directly up the slope. Streams flow directly down the slope and have cut sharp valleys into the till. In York Region specifically, ground moraine with irregular knolls and hollows are observed. The South Slope contains soils developed upon tills which are sandier and calcareous East of Pickering and clayey West of Oshawa, with increasing shale content moving west. East of Brampton, black and grey shale is commonly found, while red shale is found west of there.

¹ Chapman, L.J., & Putnam, D.F., (1984), "The Physiography of Southern Ontario," 3 Ed., Ontario Geological Survey Special Volume 2

4.1.2 Surficial Geology

Based on the surficial geology mapping, the near surface soils within the study area are variable, but in general are predominantly comprised of non-cohesive and frequently granular deposits. Mapped deposits of shale and calcareous clay till with few stones, mostly consisting of lacustrine clay and silt reworked by glacier comprise most of the study area. The northern portion of the study area mostly consists of deposits of fine textured glaciolacustrine silty and clayey till with organic deposits; however, ice-contact stratified deposits of sand and gravel and older alluvial deposits are also mapped. The surficial geology mapping indicates man-made deposits which are described as fill/sewage lagoon/landfill/urban development area located between Highway 48 and Ninth Line and south east of the intersection of Vandorf Sideroad and Highway 48. Based on general public background information, this area was previously used as a dump site which was closed in 1983² and was referred to as York Sanitation Site #4.

In the south western portion of the site, the subsurface conditions consist of massive to well laminated interbedded flow till with rainout deposits and silt and clay. Foreshore-basinal deposits are found in the south western portion of the site, and localized organic deposits are found throughout.

4.1.3 Oak Ridges Moraine Conservation Plan Area

The study area mostly lies within the Oak Ridges Moraine Conservation Plan Area as defined by Ontario Regulation 140/02 and shown on Figure 4.

4.1.4 Golder Local Experience

Historically, Golder has carried out multiple geotechnical investigations involving over two hundred boreholes throughout the site area as shown on Figure 6. In general, the results are consistent with the surficial geology as described in **Section 4.1.2**. A summary of the investigations carried out by Golder in the study area are as follows.

In the northern portion of the site, which falls within the Oak Ridges Moraine, sand and gravel materials are most commonly found. Deep deposits of sand and gravel and some fines are encountered to depths of 40 m below ground surface, underlying shallow deposits of silt and clay. Occasionally, fine sands, silts and cohesive clay materials are encountered in this portion of the site. In this area, water levels measured in monitoring wells installed in deep sands and sand and gravel are generally at depths of some 28 m below ground surface and lower.

In the southern portion of the site, which falls within the South Slope, silt, fine sand, clay and till are most commonly found. The stratigraphy of these materials is complex and variable. In general, the water levels measured in monitoring wells and standpipes are shallow or near ground surface, with artesian conditions (above ground surface) locally encountered.

4.1.5 Bedrock

The Ministry of Northern Development and Mines, "Map P.3214, Bedrock Topography, Newmarket Area, Southern Ontario", published in 1993, indicates the bedrock surface in the area varies from between Elevations of 140 m and 170 m. Typically bedrock is mapped at depths of 140 m below ground surface within the study area.

Based on "Ontario Geological Survey 2011 Map; 1:250 000 scale; Bedrock Geology of Ontario; Ontario Geological Survey, Miscellaneous Release-Data 126-Revision 1," the bedrock consists of shale, limestone, dolostone and

² May 10, 2018 at 3:30pm; <https://en.wikipedia.org/wiki/Whitchurch-Stouffville>.

siltstone of the Georgian Bay Formation, Blue Mountain Formation, Billings Formation, Collingwood Member and Eastview Member.

4.2 General Comments

Based on the results of our review, we offer the following generalized comments:

- Glacially derived till soils should be expected to contain cobbles and boulders which could affect excavations.
- In general, it is expected that the overburden soils can be excavated using conventional hydraulic equipment, although excavating into very dense tills may affect progress rates and may require cobble/boulder removal.
- In the southern portions of the study area, groundwater is typically found at shallow depths below the ground surface, but locally will be measured in standpipes to be above the ground surface (artesian). Site specific geotechnical investigations should address these conditions as required.
- Conventional bedding for underground utility installation are generally anticipated; however, bedding thickness may be required to maintain basal stability of trenches during construction.

5.0 LIMITATIONS

This report has been prepared for the exclusive use of TMIG and their agents for specific application to the Community of Stouffville Water System Upgrades for York Region, Ontario. The findings presented in this report were prepared in accordance with generally accepted geotechnical engineering practice at the time of this study. It is stressed that the information in this report is provided for planning purposes only. This report is not intended for preliminary or detailed design or construction purposes.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

6.0 CLOSURE

This report is intended to summarise available data on subsurface soil and groundwater conditions for the Study Area as identified in Figure 1 Key Plan. The data contained in this report was obtained from published geological data and previous subsurface investigations carried out by Golder in the study area.

We trust this report provides sufficient information for your requirements. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.

for *RA Abdulla*

Lindsay Palmer, B.A.Sc.
Geotechnical Group



[Signature]
Andrew J. Hagner, P.Eng., Associate
Senior Geotechnical Engineer

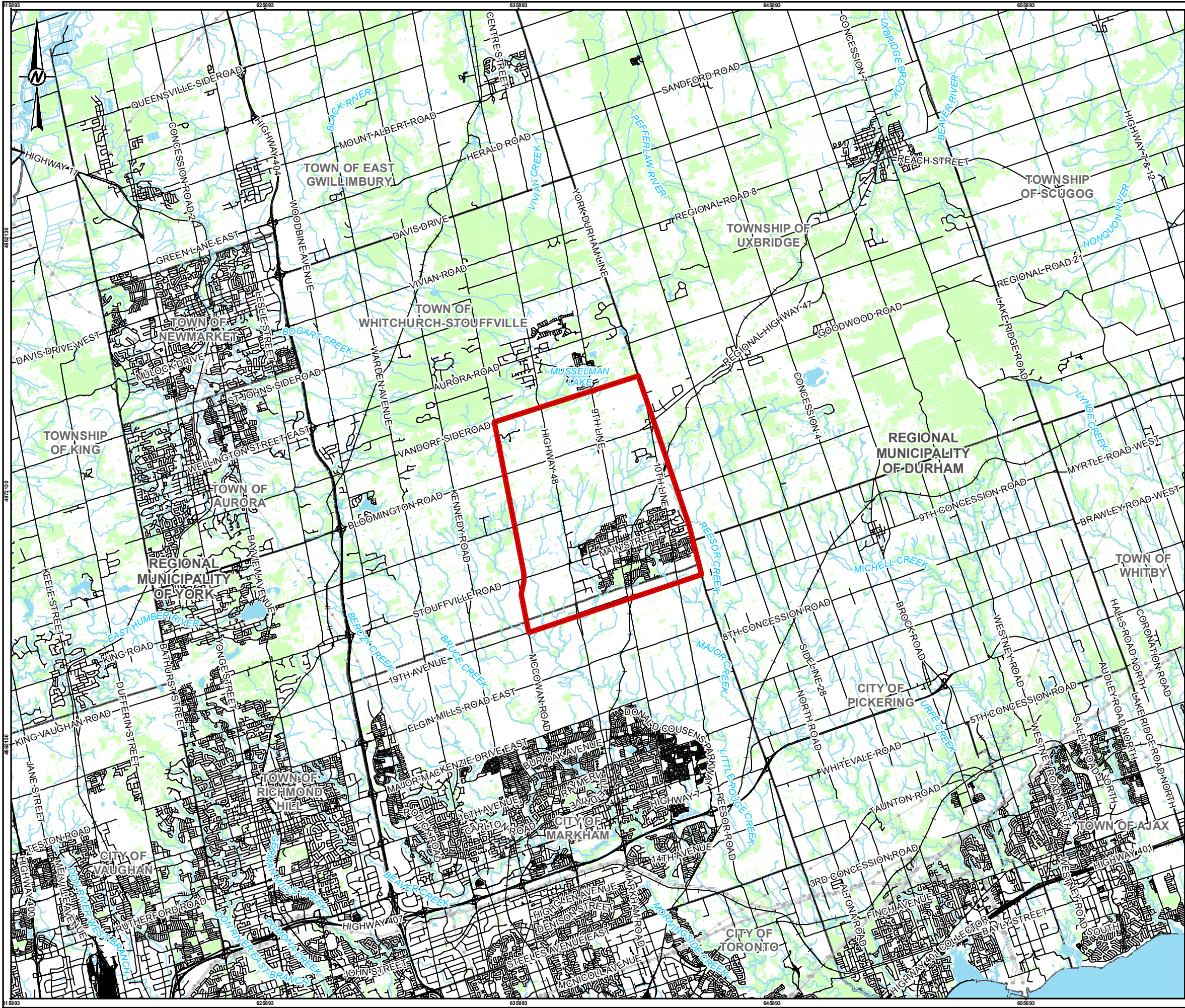
RA/LP/AJH/lh

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https://golderassociates.sharepoint.com/sites/13234g/4000/geotechnical/desktop/study/report/final/1668667_rpt_2018'05'17_tmrig_stouffville/desktop/geotech.docx

ATTACHMENTS

- Figure 1 – Key Plan
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- Figure 4 – Oak Ridges Moraine
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LEGEND

- ROAD
- RAILWAY
- UTILITY LINE
- WATERCOURSE
- APPROXIMATE STUDY AREA
- WATERBODY
- MUNICIPAL BOUNDARY
- WOODED AREA

0 5 10
1:150,000 KILOMETRES

REFERENCE(S)
BASE DATA - MNR L.I.O. OBTAINED 2016
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
YORK REGION /THE MUNICIPAL INFRASTRUCTURE GROUP LTD. (TMIG)

PROJECT
GEOTECHNICAL DESKTOP STUDY
WATER SYSTEM UPGRADES FOR THE COMMUNITY OF STOUFFVILLE, YORK REGION, ONTARIO

TITLE
KEY PLAN

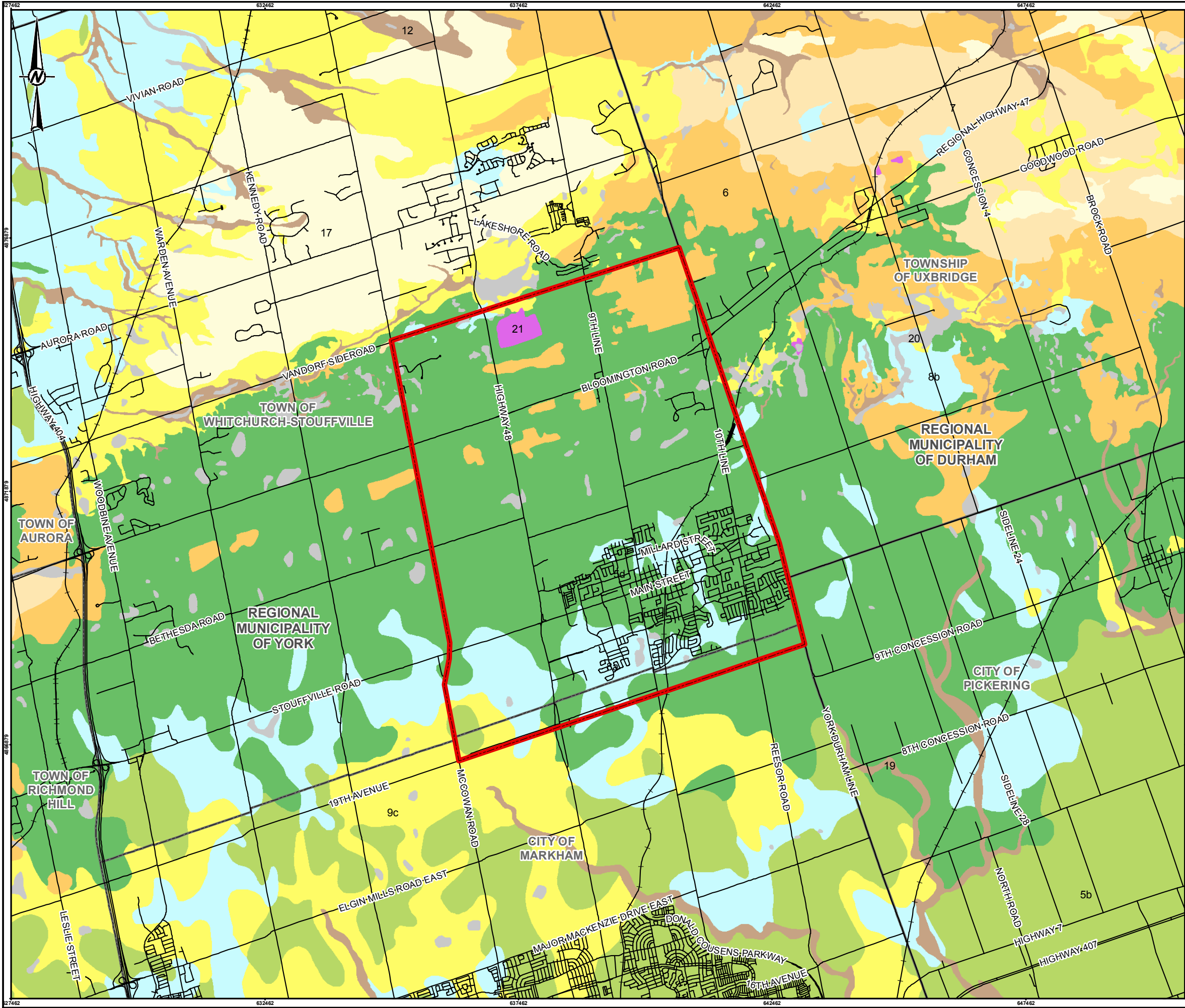
CONSULTANT	YYYY-MM-DD	2017-07-21
DESIGNED	JT	
PREPARED	JT	
REVIEWED	LP	
APPROVED		

PROJECT NO.
1668667 (4000)

CONTROL

REV.

FIGURE
1



LEGEND

ROAD

RAILWAY

APPROXIMATE STUDY AREA

MUNICIPAL BOUNDARY

SURFICIAL GEOLOGY

5B: STONE-POOR, CARBONATE-DERIVED SILTY TO SANDY TILL

5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL

6: ICE-CONTACT STRATIFIED DEPOSITS

7: GLACIOFLUVIAL DEPOSITS

8A: MASSIVE-WELL LAMINATED

8B: INTERBEDDED FLOW TILL, RAINOUT DEPOSITS AND SILT AND CLAY

9C: FORESHORE-BASINAL DEPOSITS

12: OLDER ALLUVIAL DEPOSITS

17: EOLIAN DEPOSITS

19: MODERN ALLUVIAL DEPOSITS

20: ORGANIC DEPOSITS

21: MAN-MADE DEPOSITS



REFERENCE(S)
BASE DATA - MNR LIO, OBTAINED 2016
SURFICIAL GEOLOGY - THE PHYSIOGRAPHY OF SOUTHERN ONTARIO, THIRD EDITION BY CHAPMAN AND PUTMAN, 1984
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017
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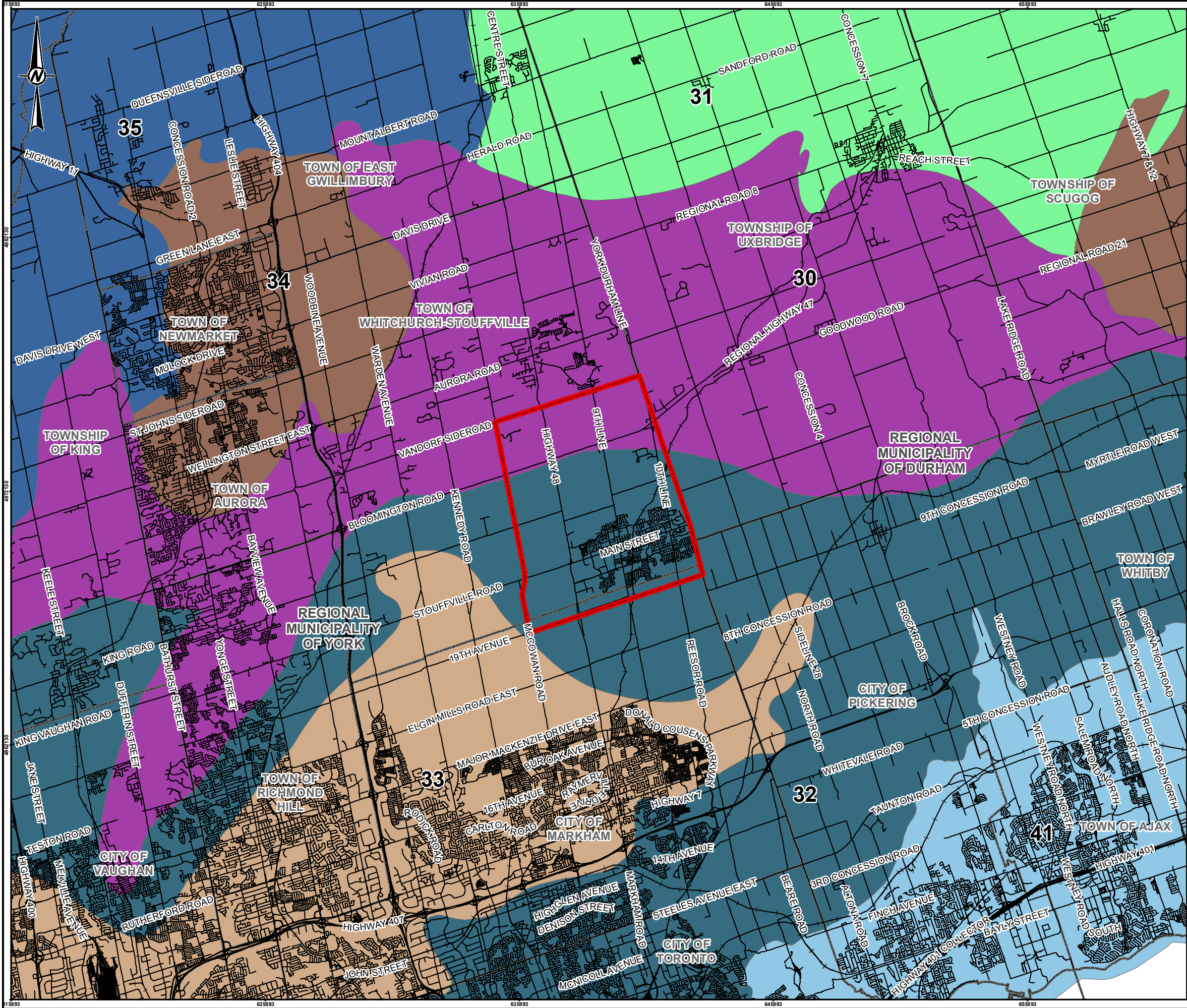
CLIENT
YORK REGION /THE MUNICIPAL INFRASTRUCTURE GROUP LTD. (TMIG)

PROJECT
GEOTECHNICAL DESKTOP STUDY
WATER SYSTEM UPGRADES FOR THE COMMUNITY OF STOUFFVILLE, YORK REGION, ONTARIO

TITLE
SURFICIAL GEOLOGY

CONSULTANT	YYYY-MM-DD	2017-07-21
DESIGNED	JT	
PREPARED	JT	
REVIEWED	LP	
APPROVED		





LEGEND

ROAD

RAILWAY

APPROXIMATE STUDY AREA

MUNICIPAL BOUNDARY

PHYSIOGRAPHIC REGIONS

UNIT, REGION

- 30, OAK RIDGES MORaine
- 31, PETERBOROUGH DRUMLIN FIELD
- 32, SOUTH SLOPE
- 33, PEEL PLAIN
- 34, SCHOMBERG CLAY PLAINS
- 35, SIMCOE LOWLANDS
- 41, IROQUOIS PLAIN

0 5 10

1:150,000 KILOMETRES

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2016

PHYSIOGRAPHY GEOLOGY - MRD228-PHYSIOGRAPHY OF SOUTHERN ONTARIO, 2007, PROVIDED BY MINISTRY OF NORTHERN DEVELOPMENT MINES

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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT

YORK REGION /THE MUNICIPAL INFRASTRUCTURE GROUP LTD. (TMIG)

PROJECT

GEOTECHNICAL DESKTOP STUDY

WATER SYSTEM UPGRADES FOR THE COMMUNITY OF STOUFFVILLE, YORK REGION, ONTARIO

TITLE

PHYSIOGRAPHIC REGIONS

CONSULTANT	YYYY-MM-DD	2017-07-21
DESIGNED	JT	
PREPARED	JT	
REVIEWED	LP	
APPROVED		

PROJECT NO. 1668667 (4000)

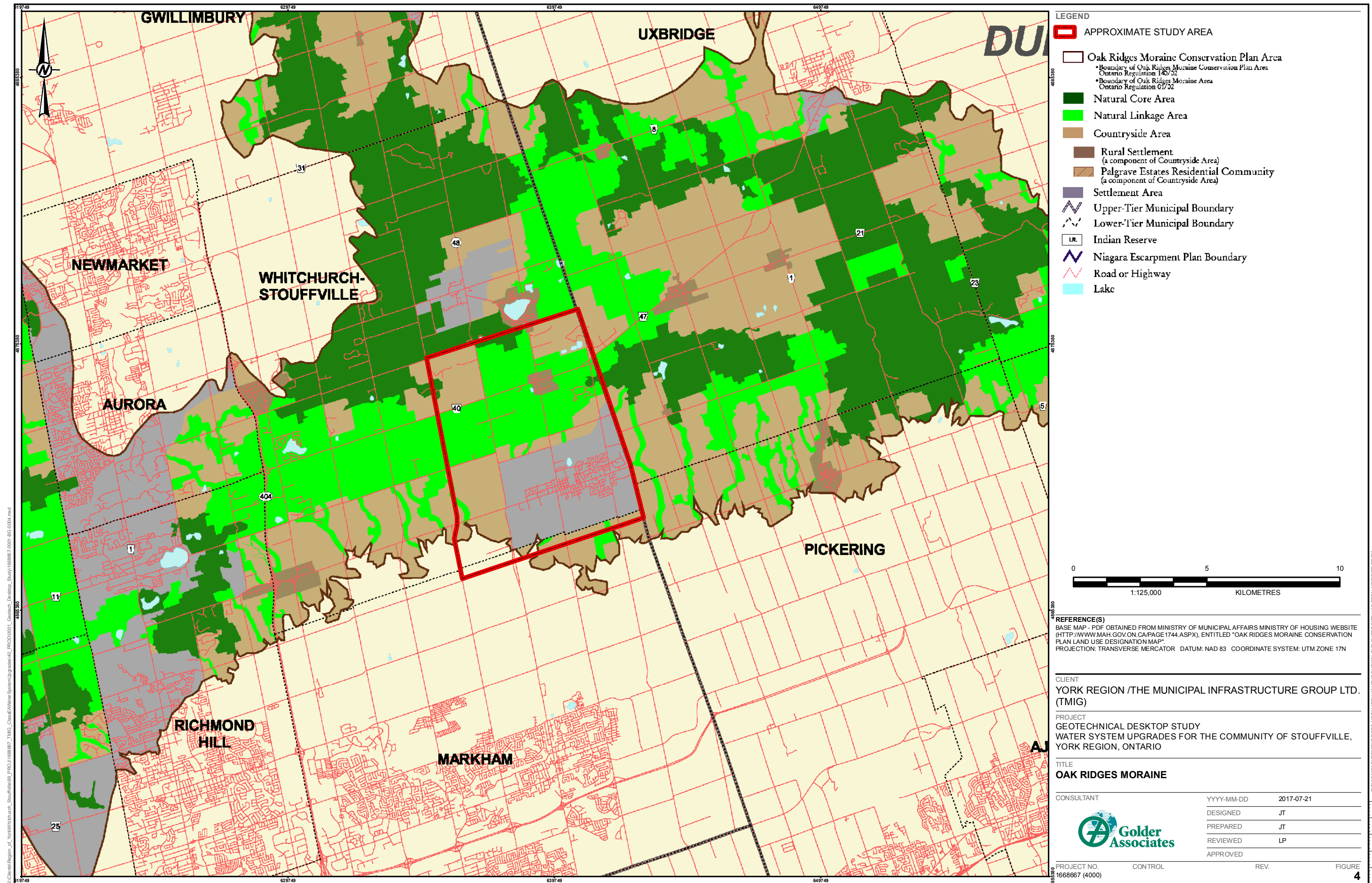
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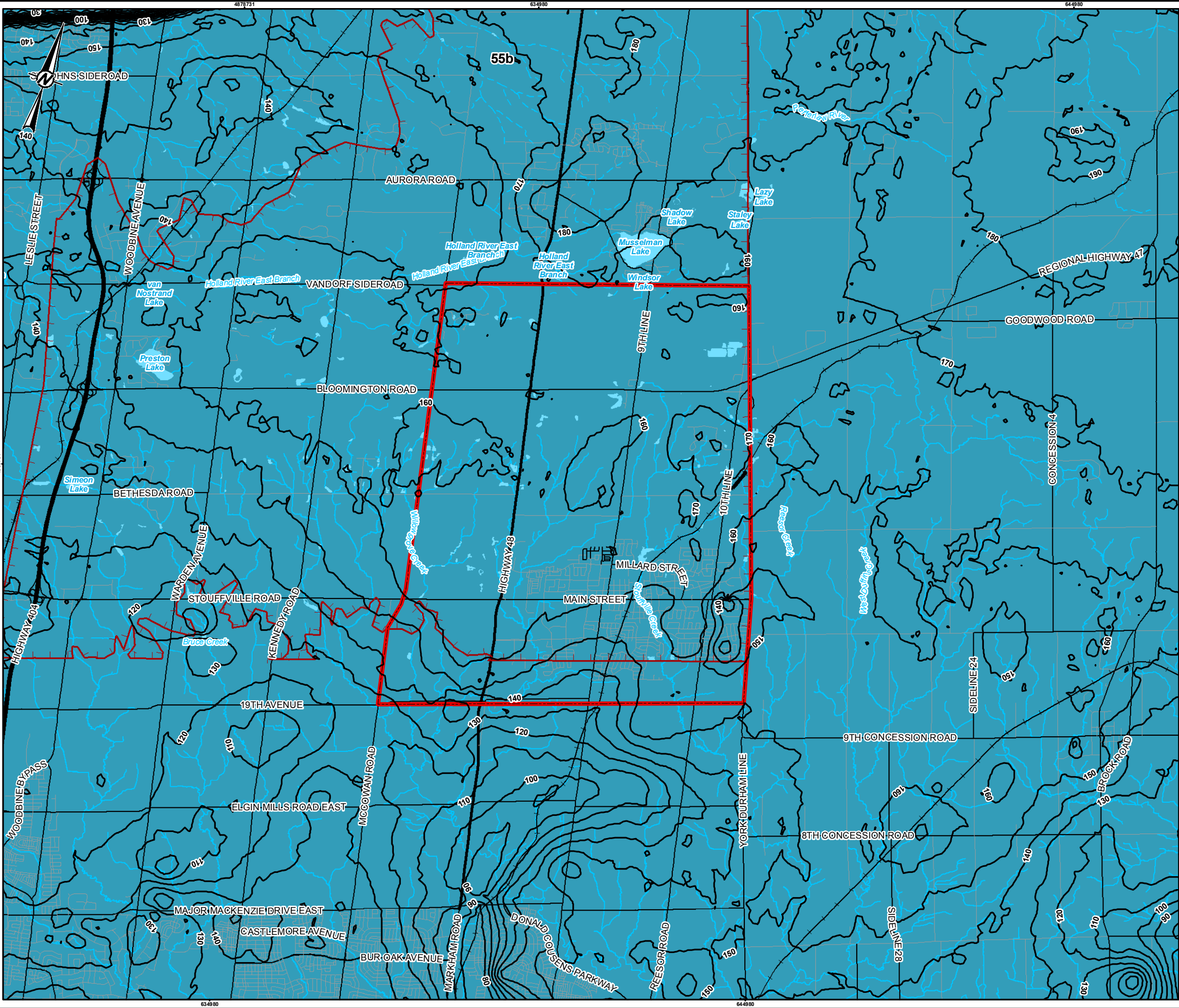
REV.

FIGURE 3

2mm

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:





LEGEND

- BEDROCK CONTOUR (10 m)
- HIGHWAY
- MAIN ROAD
- LOCAL ROAD
- RAILWAY
- PERMANENT WATERCOURSE
- INTERMITTENT WATERCOURSE
- WATERBODY
- OAK RIDGES MORAINE
- APPROXIMATE STUDY AREA

BEDROCK GEOLOGY

- 55B GEORGIAN BAY FM.; BLUE MOUNTAIN FM.; BILLINGS FM.; COLLINGWOOD MB.; EASTVIEW MB.

REFERENCE(S)

BEDROCK CONTOURS - CONTOURED DATA SOURCED FROM TIER 3 WATER BUDGET AND LOCAL AREA RISK ASSESSMENT FOR THE REGION OF YORK MUNICIPAL SYSTEMS RISK ASSESSMENT REPORT / MODEL (EARTHFX, 2014).

BASE DATA - MNR LIO AND REGIONAL MUNICIPALITY OF YORK, OBTAINED 2016
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BEDROCK GEOLOGY - MRD207 GAO, C., SHIROTA, J., KELLY, R. I., BRUNTON, F.R., VAN HAAFTEN, S. 2006, BEDROCK TOPOGRAPHY AND OVERBURDEN THICKNESS MAPPING, SOUTHERN ONTARIO; ONTARIO GEOLOGICAL SURVEY, MISCELLANEOUS RELEASE-DATA 207. ISBN 1-4249-2550-9
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
YORK REGION /THE MUNICIPAL INFRASTRUCTURE GROUP LTD. (TMIG)

PROJECT
GEOTECHNICAL DESKTOP STUDY
WATER SYSTEM UPGRADES FOR THE COMMUNITY OF STOUFFVILLE, YORK REGION, ONTARIO

TITLE
REGIONAL BEDROCK GEOLOGY AND SURFACE

CONSULTANT	YYYY-MM-DD	2017-07-21
DESIGNED	JT	
PREPARED	PR	
REVIEWED	LP	
APPROVED		

PROJECT NO.
1668667 (4000)

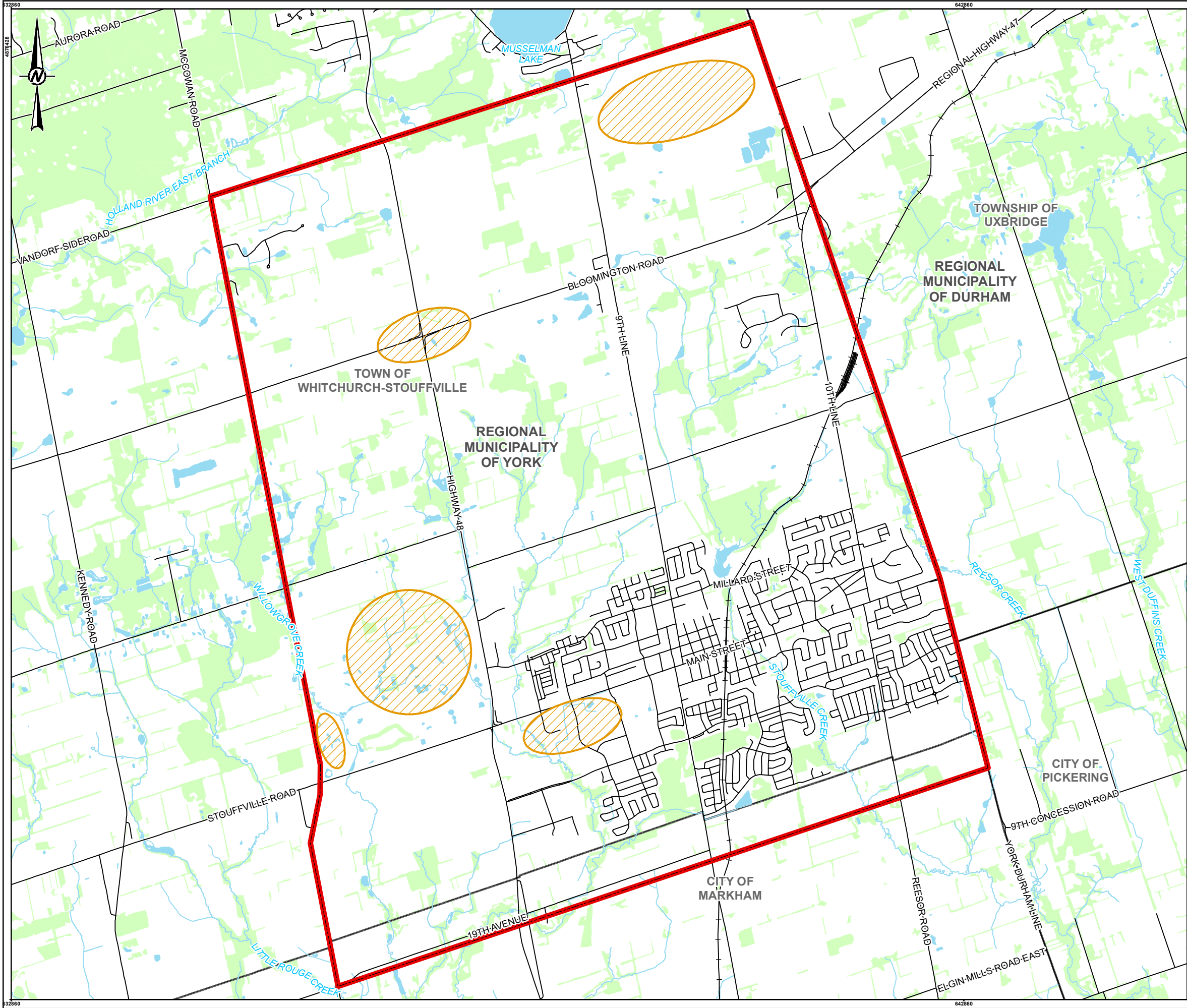
CONTROL

REV.

FIGURE
5

S:\Client\Region_of_York\Watersheds_Stouffville\GIS_FIG_1\668667_TMG_Case\WaterSystemUpgrades\40_FIG000001_General_Desktop_Study\1668667_2017_FIG_0005.mxd

20mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:



LEGEND

- ROAD
- RAILWAY
- WATERCOURSE
- APPROXIMATE STUDY AREA
- AREA OF HISTORICAL GOLDER INVESTIGATION
- WATERBODY
- MUNICIPAL BOUNDARY
- WOODED AREA




REFERENCE(S)
BASE DATA - MNR LIO, OBTAINED 2016
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
YORK REGION /THE MUNICIPAL INFRASTRUCTURE GROUP LTD. (TMIG)

PROJECT
GEOTECHNICAL DESKTOP STUDY
WATER SYSTEM UPGRADES FOR THE COMMUNITY OF STOUFFVILLE, YORK REGION, ONTARIO

TITLE
PREVIOUS GOLDER EXPERIENCE

CONSULTANT	YYYY-MM-DD	2017-07-21
DESIGNED	JT	
PREPARED	JT	
REVIEWED	LP	
APPROVED		

 PROJECT NO. 1668667 (4000) CONTROL REV. FIGURE 6

APPENDIX A

Important Information and Limitations of This Report



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



golder.com