New Watermain to Service Downtown Brampton: Schedule B Class Environmental Assessment

Geotechnical Desktop Study

| July 3,2020

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Document history and status

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0	Dec. 2019	Draft	MK	MA	PP
1	July 2020	Final	MK	MA	PP

Contents

1. Introduction

The Regional Municipality of Peel (Region) has engaged Jacobs Engineering Group Inc. (Jacobs) to proceed with a class Environmental Assessment (EA) to evaluate routing options of proposed 750-millimetre (mm)-diameter watermain along Main Street, between Williams Parkway and Queen Street East, to identify a suitable solution for addressing the needs of the Water Division for the residents and businesses in Brampton's downtown; this will be followed by field studies and preliminary design. This stage of the project consists of the following: a desktop review of previous documents, confirmation of the problem statement, the identification and assessment of alternative solutions, and the selection of a preferred solution.

This report was prepared as a geotechnical desktop study to provide a better understanding of subsurface conditions within the project area and to prepare base information for defining the geotechnical investigation scope of work.

2. Source of Information

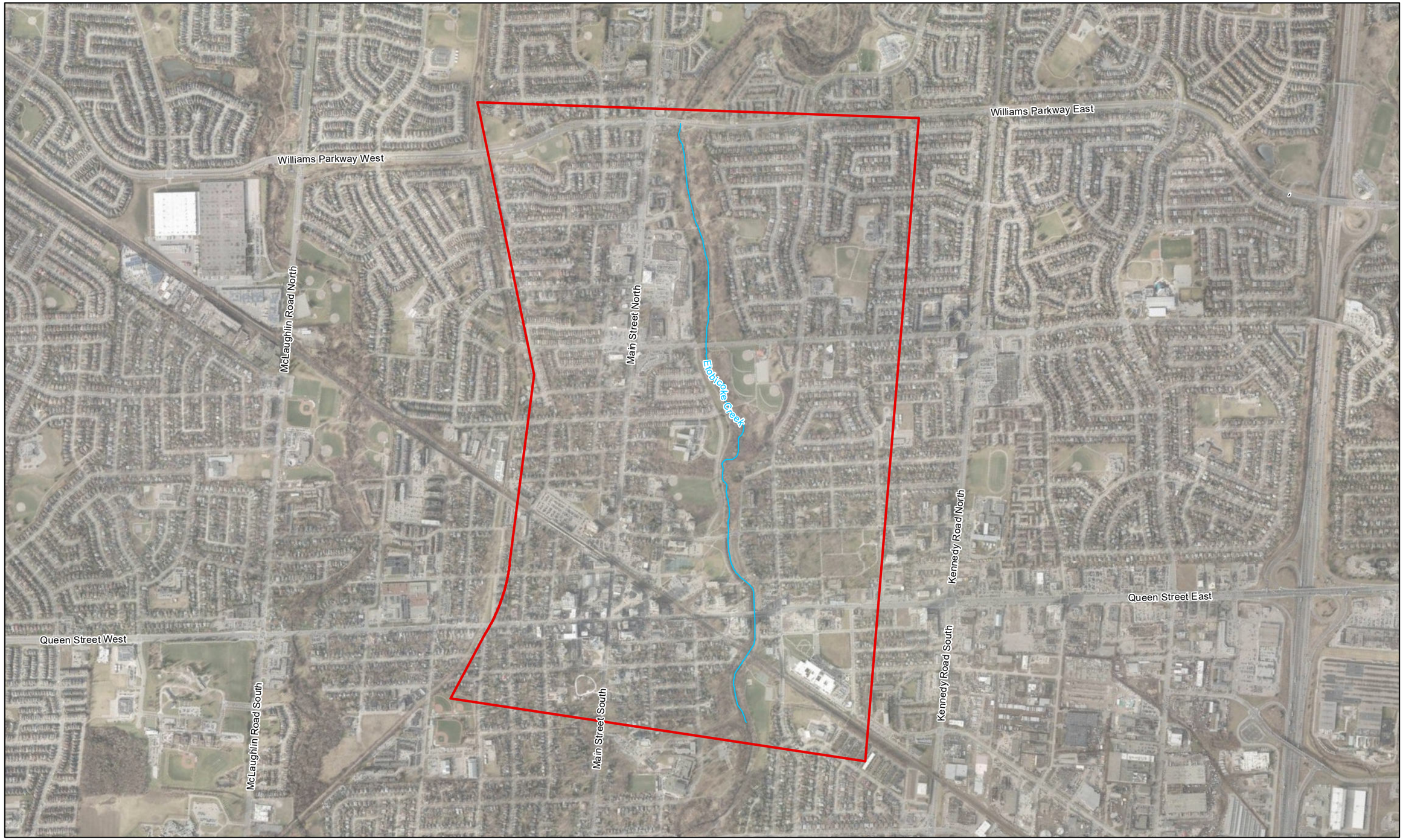
For the desktop study, Jacobs has referred to geological reports and maps that has been named in each section where used and listed at section 8- reference, as well as previous geotechnical investigations as listed on Table 4.1 .

3. Site location

The study area of 750-mm watermain is located around the geographical location latitude: 43.7, longitude: -79.75 (the Main Street North and Vodden Street intersection). The study area boundaries are West: Williams Parkway West and the Orangeville Railway line, South: Wellington Street west and the Orangeville Railway line, North: Williams Parkway East and Claypine Park, East: Centre Street and Ardglen Drive (Figure 3-1).

4. Historical Exploratory Hole Records

The Ontario Ministry of Transportation (MTO) has recorded some historical boreholes located in the vicinity of the study area. These historical boreholes are summarized in Table 4-1.



Notes:
1. Aerial Source: City of Brampton, 2018.
2. Watercourse Source: Land Information Ontario.

DRAFT

Figure 3-1
Study Area
Schedule B Municipal Class EA: Downtown Brampton New 750 mm Feedermain
Region of Peel
Brampton, Ontarioo

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Table 4.1: Historical Boreholes Summary

Reference	Year Drilled	Prepared By	Number of Boreholes In Study Area	Overburden Thickness (m)	Ground Water Level (mbgl)	Depth (mbgl)
Foundation Investigation Report for HWY 410 underpass at existing Hwy. 7 site #24-343, Town of Brampton- 30M12-098	1974	MTO	6	13.9 – 15.2	0.5 – 2.1	15.7 – 16.8
Foundation Investigation report for Culvert Sta. 13+125 under Hwy 410, W.P. 21-79-03- 30M12-103	1982	MTO	5	3.4 – 4.1	1 – 2.4	3.8 – 6.4
Foundation Investigation Report for Proposed Storm Sewer Along Hwy. 410. W.P. 21-79-03, District 6, Toronto- 30M12-149	1974	MTO	22	3.5 – 13.9 Some boreholes were terminated in soil	1 – 8	3.5 m – 15.7 m
Foundation Investigation Hwy. 7 new Widening over Etobicoke Creek, Site 24-72- W.P. 23-79-04- 30M12-162	1982	MTO	5	1.8 – 6.1	Etobicoke Creek water level in each season	5.9 – 12.2
Foundation Investigation Report for HWY 410 underpass at new Hwy. 7 site #24-469, 30M12-163	1982	MTO	3	2.6 m – 4.9 m	8.4 – 9.2	12.4 – 15.4
Foundation Investigation Report for William Parkway Underpass Hwy. 410, W.P. 21-79-07, Site 24-145-474 30M12-163	1983	MTO	10	6.6 – 24.3 All boreholes were terminated in soil	2.2 –13.2	6.6 -- 27.1
Foundation Investigation Report for Francheschini (Private) Drive Underpass 30M12-179, 30M12-181	1983	MTO	8	3.9 – 25.5 Some boreholes were terminated in soil	0 – 16.2	3.9 – 28.9
Foundation Investigation Report for Vodden Street Extension Underpass Hwy, 410 And Brampton Esker Outlet Extension Hwy 410	1988	MTO	6	7.7 – 14.3 Boreholes were terminated in soil	1.4 – 11.5	7.7 – 14.3

Reference	Year Drilled	Prepared By	Number of Boreholes In Study Area	Overburden Thickness (m)	Ground Water Level (mbgl)	Depth (mbgl)
and Williams Parkway, Etobicoke Creek Bridges, HWY #410 Widening – 30M12-180						
Foundation Investigation Report for Brampton Esker Outlet Extension Hwy 410 and Williams Parkway, Etobicoke Creek Bridges, HWY #410 Widening – 30M12-197	1987	MTO	13	7.8 – 16.5 Boreholes were terminated in soil	2.1 – 13.8	7.8 – 16.5
Geotechnical Investigation Proposed Grade Separation Centre Street at CN Railway- 30M12-198 30M12-251	1985	TROW LTD., prepared for City of Brampton	12	3.5 – 10.0 Some boreholes were terminated in soil	2 – 7	3.5 – 10.7
Foundation Investigation and Design Report for Hwy 410 Settlements Between Williams Parkway – Bovaird Drive- 30M12-209	1988	MTO	4	7.7 – 17.2 Boreholes were terminated in soil	5.5 – 16.0	7.7 – 17.2
Draft Foundation investigation and Design Report, Brampton Hydro One Duct installations, Hwy 410/Queen Street interchange	2016	Terraprobe Consulting Geotechnical & Environmental Engineering	4	7.9 – 12.3 Boreholes were terminated in soil	2 – 7.1	7.9 – 12.3

Reference	Year Drilled	Prepared By	Number of Boreholes In Study Area	Overburden Thickness (m)	Ground Water Level (mbgl)	Depth (mbgl)
Geotechnical Investigation, Sanitary Sewer Installation Clarence Street from Centre Street South to Kennedy Road South, Windmill Boulevard from Kingknoll Drive to Tulip Drive and Main Street South from Clarence Street to Guest Street	2019	Geo pro Consulting Limited	11	5.2 – 8.1 Boreholes were terminated in soil	0.8 – 6.1	5.2 – 8.1
Geotechnical Investigation, Hurontario Street Watermain Extension between Olde Base Line Road and Inglewood Well#3	2014	Peto MacCallum Ltd.	11	6.7 – 15.8 Boreholes were terminated in soil	1.7 – 5.5	6.7 – 15.8
Note: mbgl = metre(s) below ground level						

5. Regional Geology

The Physiography of Southern Ontario by Chapman and Putnam (1984) indicates that the study area is situated in the physiographic region identified as the Peel Plain that generally consists of glacial Till soils (**Error! Reference source not found.**) and is characterized as a level to undulating tract of clayey soils covering approximately 800 square kilometres across central portions of the Regional Municipalities of York, Peel, and Halton. These sediments represent the bottom of the former glacial Lake Peel, which formed between an ice front to the north, the Niagara Escarpment to the west, and the Trafalgar Moraine to the east. The Peel Plain Sediments gradually slope towards Lake Ontario, following the topography of the underlying Halton Till.

The Quaternary Geology of Ontario, Southern Sheet, Map 2556, issued by the Ontario Geological Survey (OGS 1991a), indicates that the overburden soils in the region of study area consist of Halton Till deposits. The Halton Till is formed by the last major advance of the Lake Ontario basin ice lobe (Sharpe and Russell 2013). These deposits are primarily comprised of a dense, sandy to silty clay Till that is clast poor and reddish brown in colour, which is often interbedded with silt, clay, sand, and gravel (**Error! Reference source not found.**). The Halton Till is typically 3 metres (m) to 6 m thick, but locally can range from 15 m to 30 m in thickness.

Isolated glaciolacustrine deposits are also identified in the vicinity of Etobicoke Creek located within the study area. These deposits consist of massive to laminated silt and clay; may contain poorly sorted diamicton (unsorted to poorly sorted and contains particles ranging in size from clay to boulders) layers, (OGS 2005, Map 2223).

The Bedrock Geology of Ontario, Southern Sheet, Map 2544, issued by the OGS (1991b), indicates that the bedrock underlying the region is identified as Queenston Formation. However, according to the historical boreholes logs, both Georgian Bay formation and Queenston Formation rock were uncounted.

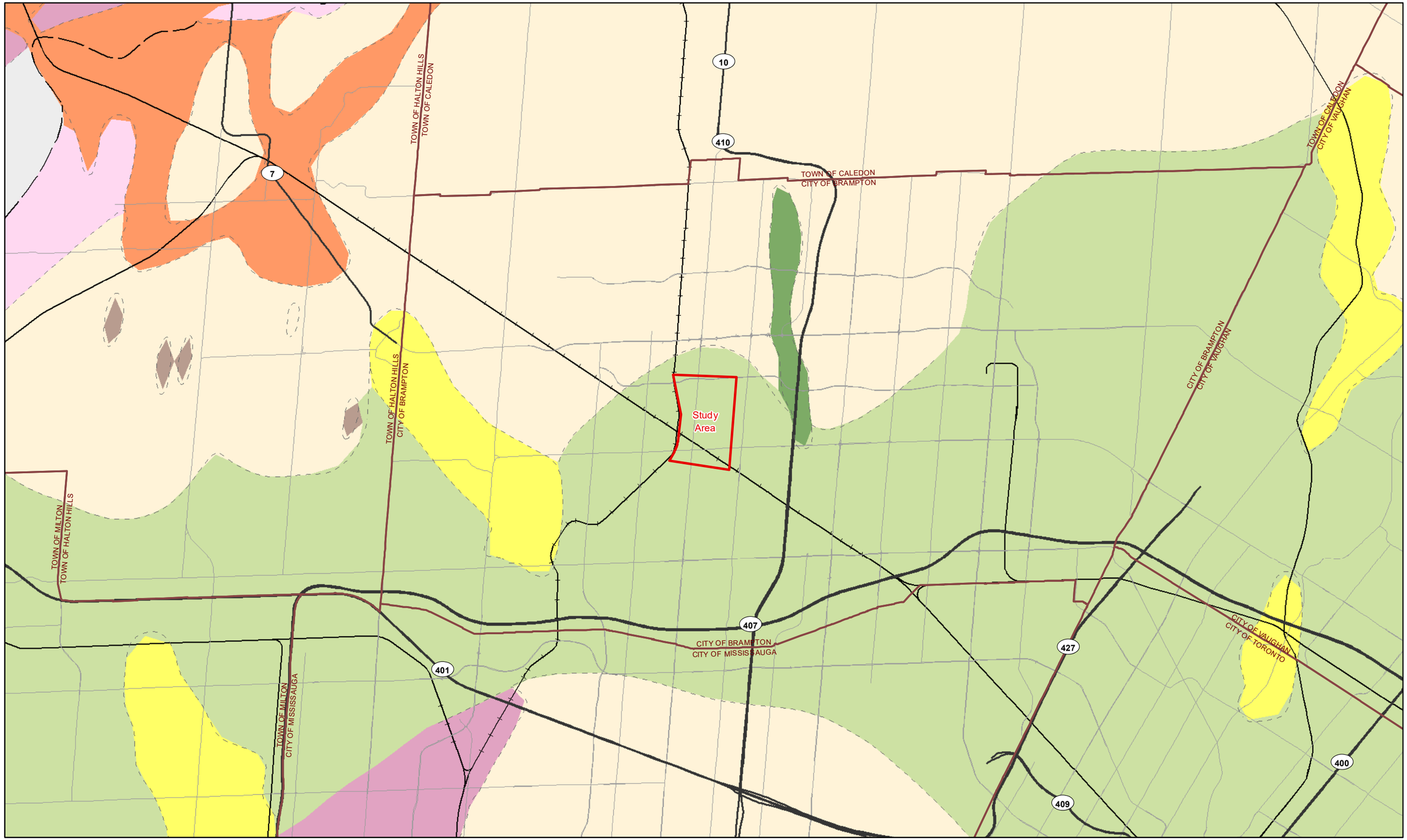
6. Geotechnical Condition

6.1 Overburden

The study area location is within the physiographic region identified as the Peel Plain; from the northern side, it is near the boundary with the physiographic region known as the South Slope, as identified by Chapman and Putnam (1984). The Peel Plain generally consists of glacial Till deposits: it is characterized as a level to undulating tract of clayey soils covering approximately 800 square kilometres across central portions of the Regional Municipalities of York, Peel, and Halton. The Peel Plain has a gradual and relatively uniform slope towards Lake Ontario. The South Slope generally consists of sandy silt to silty sand textured soils that is described as the southern slope of the Oak Ridges Moraine, extending for approximately 200 kilometres from the Niagara Escarpment to the Trent River (**Error! Reference source not found.**).

The Quaternary Geology of Southern Ontario Map 2556 (OGS 1991a) indicates that the overburden in the region consists predominantly of Halton Till deposits primarily comprised of silt and silty clay soils. The Quaternary Geology of Toronto and Surrounding Area, Southern Ontario Map 2204 (Sharpe 1980) similarly identifies the overburden in the area to consist of Halton Till having a silty clay texture. Isolated glaciomarine deposits consisting of silt and clay, minor sand, and quiet water deposits are also identified immediately south of the study area.

The Ontario Geology Survey (OGS) boreholes record database within study area mainly along Highway 410, Queen Street East, and Bovaird Drive East. These records describe the predominant soils encountered in the boreholes as consisting of silty clay, sand, and gravel (Till).



Study Area
Municipal Boundary
Highway
Road
Railway

Physiography (Chapman & Putnam)

13: Eskers
11: Sand Plains
9: Limestone Plains
8: Bevelled Till Plains
7: Drumlins
6: Till Plains (Drumlinized)
3: Spillways
2: Till Moraines
1: Escarpments
contact
escarpment

0 1 2
Kilometers

Notes:
1. Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1

Figure 5.1
Regional and Project Area Physiography
Downtown Brampton New 750 mm Feedermain
Region of Peel
Brampton, Ontario

Jacobs

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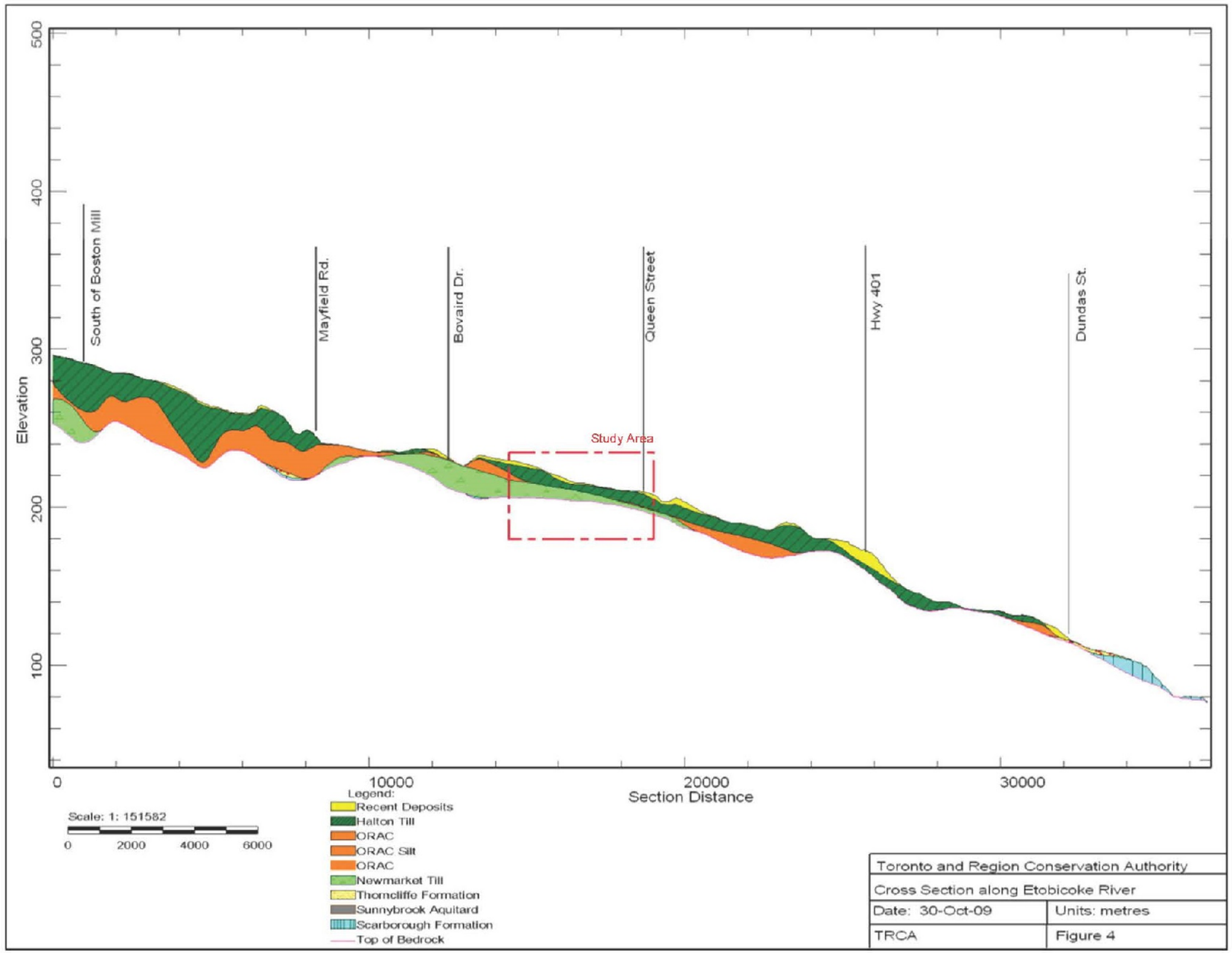

Notes:
1. Cross-Section is from Etobicoke and Mimico Creeks Watersheds Technical update Report, Toronto Region conservation, 2010.

Figure 5.2
Cross-section Along Etobicoke River
Downtown Brampton New 750 mm Feedermain
Region of Peel
Brampton, Ontario

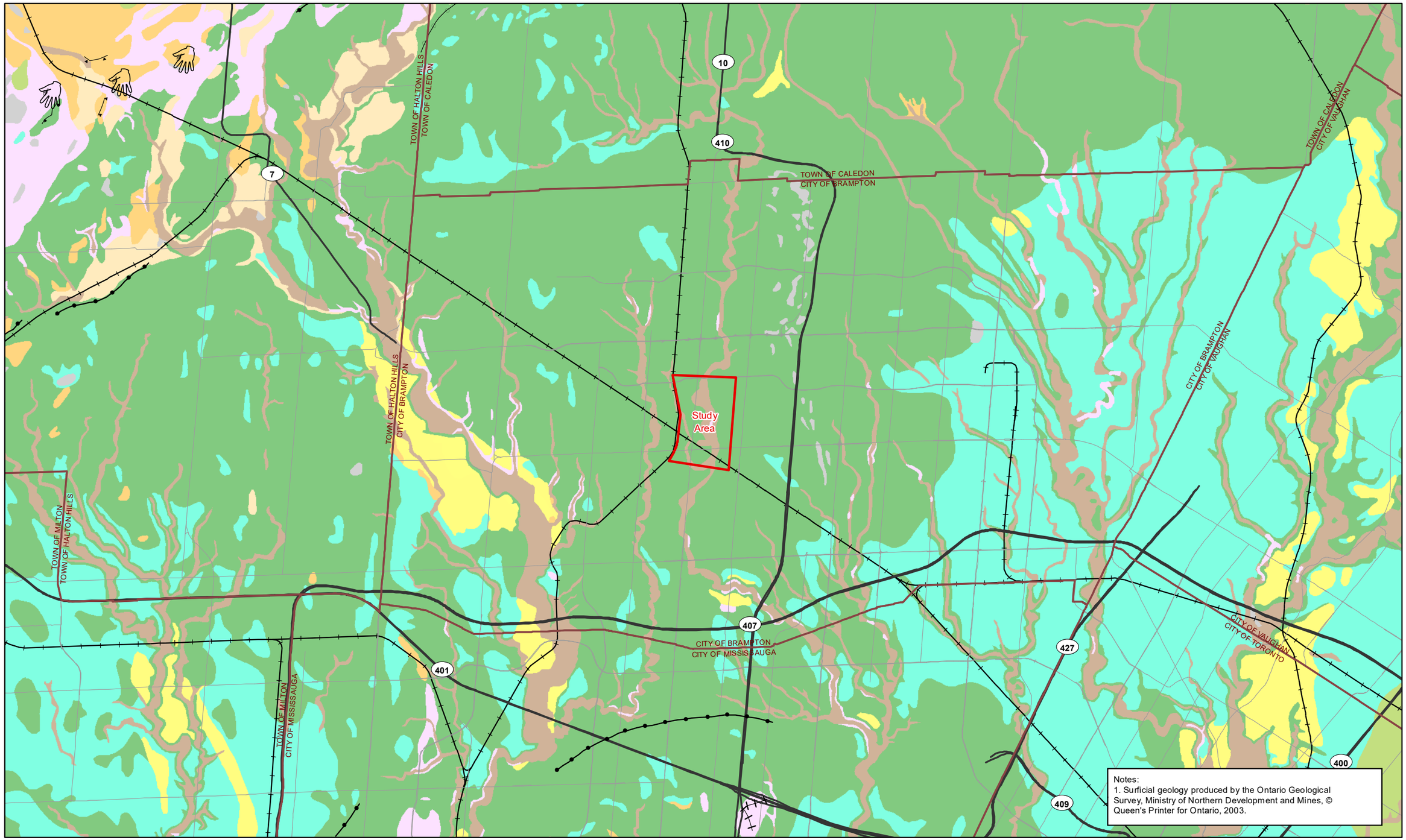

Figure 6.1
Regional and Project Area Surficial Geology
Downtown Brampton New 750 mm Feedermain
Region of Peel
Brampton, Ontario

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6.1.1 Fill

Fill was encountered below the topsoil in the most of referenced historical boreholes in the study area. The thickness or the fill ranged from about 1.0 m to 7.0 m.

Both cohesive and cohesionless fill soils were encountered in the referenced historical boreholes. The cohesive portion of the fill consists of clayey silt with sand to some sand, containing trace gravel; and silty clay to gravelly sandy silty clay, as well as organic matter and rootlets. The cohesionless portion of the fill consists of silty sand containing some gravel and trace clay and gravelly silty sand; to gravelly sand; to sand and gravel, as well as organic material and rootlets in some boreholes.

6.1.2 Surficial Deposits

The surficial deposits were founded mainly below the fill material along the Etobicoke creeks and its flood plains lines in the referenced historical boreholes. These deposits consist of clayey silt to silty clay containing some sand; silty sand with some gravel; and sand and gravel.

Alluvial deposit consists of silty sand with gravel to gravel with silty sand. Some areas contained of fragments of shale in the lower portion of the stratum.

6.1.3 Cohesive Glacial Till

The cohesive clayey silt to silty clay Till deposit is the predominant stratum that was encountered mostly below the surficial soils through referenced historical investigation in the vicinity of the study area. The Glacial Till deposit consists of clayey silt – silty clay, to silty clay with sand, to clayey sand, containing traces of to some gravel.

The presence of cobbles and boulders within the Till deposits were inferred, as noted on the borehole records, based on observation of cobbles, auger grinding, and difficult drilling conditions.

6.1.4 Non-cohesive Glacial Till

Underlaying the cohesive Glacial Till in some boreholes was a grey non-cohesive Till described as a very dense silty sand. However, if this non-cohesive material is subjected to an unbalanced hydrostatic head, “boiling” may result.

6.2 Bedrock

OGS Map 2544 indicates that the region is located on the Queenston Formation (OGS 1991b). The Queenston Formation consists of reddish shale with limestone interbedding.

The limited number of OGS boreholes referenced above were advanced to the bedrock surface and encountered grey shale bedrock (Georgian Bay Formation). However, other boreholes recorded Queenston Shale in the vicinity of the study area.

7. Hydrogeology

As a revised hydrostratigraphic framework model of Halton Till in the Greater Toronto Area under the interpretation stated (Sharpe and Russell 2013),” the extent of Halton Till is much reduced from previous regional maps (Sharpe 1980,1988) were it was drawn as a continuous unit from Lake Ontario to Oak Ridges Moraine (OGS 1991b; Boyce and Eyles 2000).”

It also presents “a new stratigraphic model that provides and updated setting for revised Halton Till sediment model.” The new model presents that “Halton Till strata comfortably rest on, and are intercalated with, Oak Ridges Moraine sediment rather than being explicitly associated with a glacial Lake Ontario basin ice advance (OGS 1991b).”

“In the low-relief Halton Till plain setting (in Peel Region west of the Humber River) is the thickest, most fine-grained, and most homogeneous Halton Till. Sediment may be up to 30 m thick; however, it can thin to less than 5 m where the Till plain meets the Oak Ridges Moraine (Russell et al., 2005). Halton Till has a gradational basal contact and laminated interbeds; it becomes more massive and richer in gravel upward. Massive diamicton has horizontal hydraulic conductivity (K) of 1 x 10^{-5} cm/s to 1 x 10^{-3} centimetres per second (cm/s) and vertical K of 1 x 10^{-6} cm/s to 1 x 10^{-7} cm/s (Golder and Associates 1994). Interbedded sand and gravel sediment has K values of I x 10^{-4} cm/s, whereas interbedded sand-gravel and diamicton has K values of I x 10^{-3} cm/s (Golder and Associates 1994). In general, low gradients on thick, muddy Halton Till sediment promote direct run-off to streams rather than infiltration to groundwater” (Sharpe, D.R. and H.A.J. Russell. 2013).

8. References

Chapman, L.J., and D.F. Putnam (Chapman and Putnam), 1984. *The Physiography of Southern Ontario*. Ontario Geological Survey, Special Volume 2,270p, Accompanied by Map P.2715 (Coloured), scale 1;600,00.

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Sharpe, D.R. 1980. Quaternary Geology of Toronto and Surrounding Area. Ontario Geological Survey Preliminary Map P.2204, Geological Series. Scale 1:100,000. Compiled 1980.

Sharpe, D.R. and H.A.J. Russell. 2013. *A revised hydrostratigraphic framework model of Halton Till in the Greater Toronto Area, Ontario*. Geological Survey of Canada. Current Research 2013-9, 27 p. doi:10.4095/292098.

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