

**SCOPED HYDROGEOLOGY REPORT
FOR
JACK KENNY COURT**

Prepared for:

1361605 Ontario Limited
448 Highcliffe Drive
Thornhill, Ontario
L4J 7M7

Prepared by:



December 2013
Reference: 09-193

Civil - Environmental - Water Resources
T (905) 857-7600 W www.caldereng.com E calder@caldereng.com



TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 INTRODUCTION	2
1.1 Report Scope and Qualifications	2
2.0 STUDY AREA	3
2.1 Background Studies and Reports	3
2.2 Physiography	4
2.3 Existing Local Topography and Drainage	4
2.4 Site Geology and Hydrogeology	5
2.5 Water Uses in the Area	5
2.6 Environmental Considerations	6
3.0 IMPACT ASSESSMENT	7
4.0 MONITORING	8
5.0 SUMMARY	9
REFERENCES	11
Appendix A: Supporting Geotechnical Information	

1.0 INTRODUCTION

Calder Engineering Ltd. has been retained by 1361605 Ontario Limited to complete a Scoped Hydrogeology Report for a proposed infill residential development on Jack Kenny Court, in Bolton, in the Town of Caledon. The report is supporting documentation for the respective development Draft Plan approval application.

The location of the subject site is shown on Figure 1.1. The site is bounded by existing residential uses on three sides (south, east and west) and a stormwater management pond to the north. The legal description of the property is Part of the East Half of Lot 8, Concession 5, and Part of Block 307, Registered Plan 43M-1324, Town of Caledon, Regional Municipality of Peel.

The site comprises approximately 0.4 hectares (ha). It is currently zoned A1-Agricultural. It is proposed to re-zone the site to residential use and develop it into 8 single dwelling lots with municipal storm, sanitary and water services. Drainage and stormwater would be managed with the application of Low Impact Development (LID) practices.

The objective of this report is to describe existing hydrogeological conditions on the site, and identify potential impacts of the proposed project on the local groundwater system.

1.1 Report Scope and Qualifications

This report is a Scoped Hydrogeology Report providing a review and consolidation of existing information. Site specific information on groundwater conditions was obtained from a geotechnical investigation. No groundwater monitoring wells were installed and water levels recorded as part of the studies conducted to-date for the project.

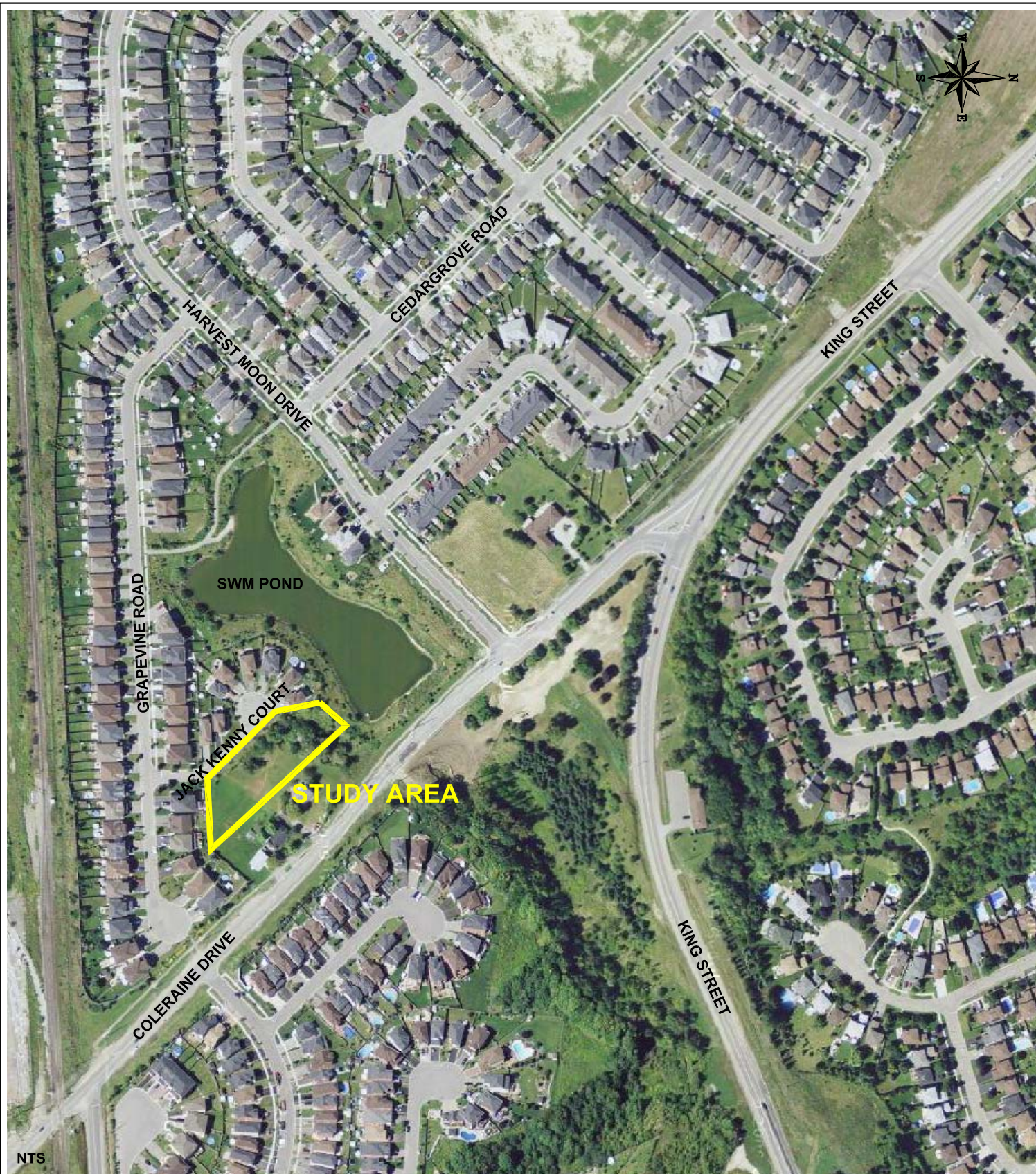


FIGURE 1.1
JACK KENNY STUDY AREA LOCATION
BOLTON, TOWN OF CALEDON

Reference: Aerial Image from Google Earth



Calder Engineering Ltd.

2.0 STUDY AREA

2.1 Background Studies and Reports

The following studies and reports have been completed for the site:

- Soil Investigation for Proposed Residential Development, 13576 and 13584 Coleraine Drive, prepared by Soil Engineers Ltd. and dated May 2013
- Phase 1 Environmental Site Assessment, East of Jack Kenny Court, North of Grapevine Road, Town of Caledon, prepared by Soil Engineers Ltd. and dated July 9, 2013
- Functional Servicing and Stormwater Management Report, prepared by Calder Engineering Ltd. and dated October 2013
- Scoped Environmental Impact Study for Jack Kenny Court, Town of Caledon, Ontario, prepared by Savanta and dated July 2013

A summary of the reports and key findings is provided below.

2.1.1 Soil Investigation (Soil Engineers Ltd., 2013)

The geotechnical investigation comprised 4 boreholes each to a depth of 6.6 metres. Generally, the site consists of a 40 to 150 millimetre layer of topsoil, which overlays fill or a silty clay till. The depth of the groundwater table was inferred in the report to be approximately 4.5m below the prevailing ground surface. Groundwater and groundwater seepage were encountered in two of the four boreholes. The permeability of the soils was low, with an estimated coefficient of permeability of 10^{-7} cm/sec.

2.1.2 Phase 1 Environmental Site Assessment (Soil Engineers Ltd., July 9, 2013)

The Phase 1 ESA documented an existing outbuilding (treehouse) and collapsed barn; both would be removed prior to development of the site. Given the historical use of the site for agriculture, a chemical analysis for organochlorine pesticides was completed. The results of the chemical analysis met requirements.

2.1.3 Functional Servicing and Stormwater Management Report (Calder Engineering Ltd., October 2013)

A Functional Servicing Report and Stormwater Management Report was prepared by Calder Engineering Ltd. The site is currently zoned A1-Agricultural. It is proposed to re-zone the site to residential use and develop it into 8 single dwelling lots fronting on Jack Kenny Court with municipal storm, sanitary and water services. Drainage and stormwater would be managed with the application of Low Impact Development (LID) practices. The use of engineered fill is proposed to fill a depression on the site to facilitate development.

2.1.4 Environmental Impact Study (Savanta, July 2013)

A scoped Environmental Impact Study (EIS) was prepared by Savanta. The scoped EIS was based on inventories and analyses carried out in 2013, including an ecological land classification, botanical surveys, calling amphibian surveys and a breeding bird survey. The ecological land classification of the subject site was cultural meadow and cultural woodland. On the property, the EIS identified no wetlands, significant woodlands, significant valley lands, endangered or threatened species or their habitat, areas of natural and scientific interest, fish habitat or significant wetland habitat, as defined in the Natural Heritage Reference Manual for Policy 2.1 of the Provincial Policy Statement.

Regarding groundwater, the site was identified as being in an “upland” setting with no natural heritage features supported by groundwater.

The report concluded that conversion of the subject site to residential use would have minimal impact on the terrestrial functions of the site and that impacts can be partially mitigated through standard design and best management practices.

2.2 Physiography

The town of Bolton is located in the physiographic region known as the South Slope which links the Oak Ridges Moraine to Lake Ontario. The South Slope is characterized by the undulating expanses of land with gentle drumlins found within. Generally, the South Slope displays surficial soils consisting of silt and clay.

2.3 Existing Local Topography and Drainage

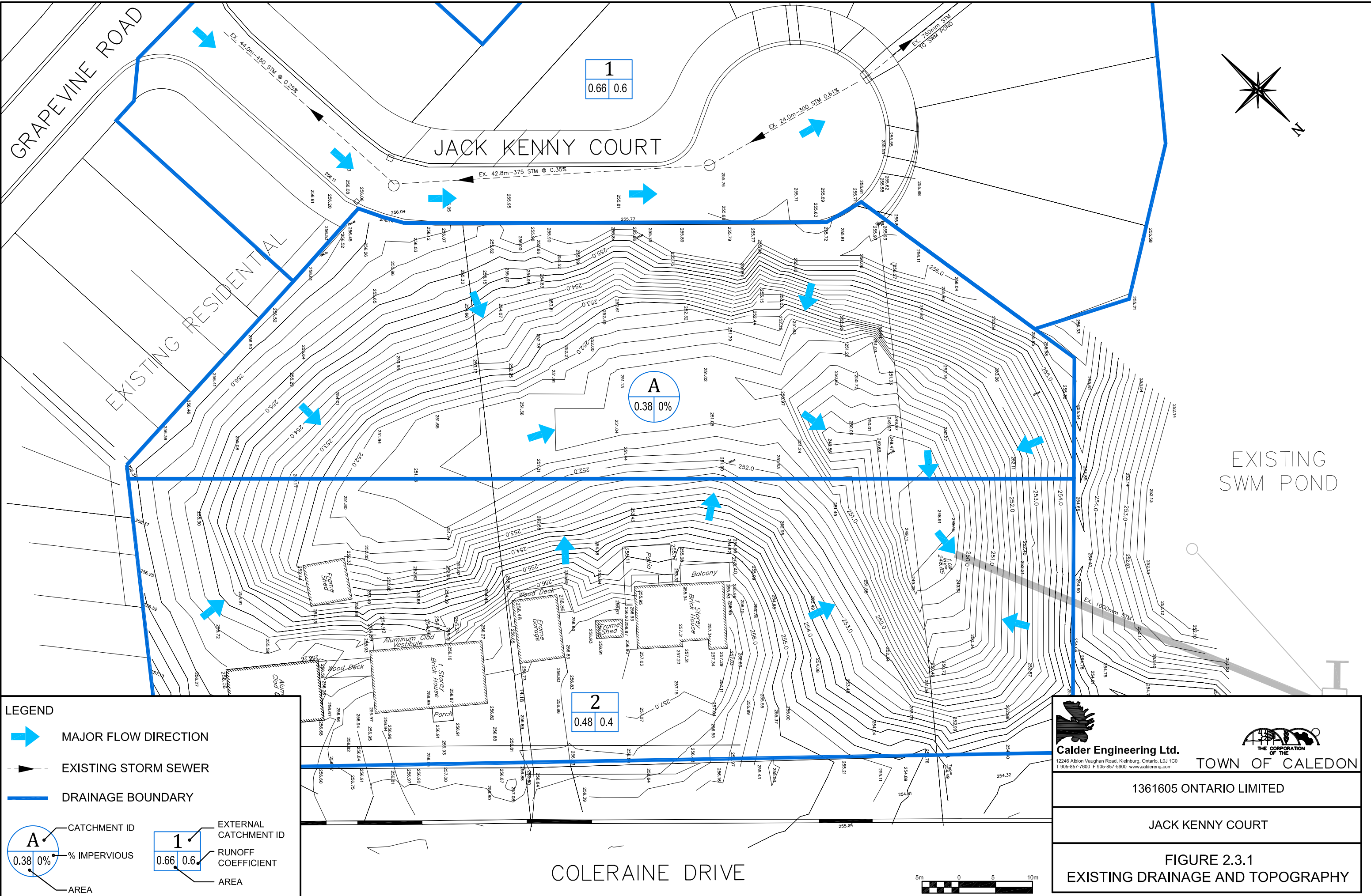
The site is located in the Humber River Watershed. Existing topography and drainage patterns are shown on Figure 2.3.1. The elevations of the site range between approximately 250 and 257 metres above sea level, with existing slopes up to approximately 33%. The site and an adjacent property to the east, generally slope away from all external property boundaries, forming a depression along their common boundary. As reported in the Functional Servicing Report (Calder Engineering Ltd., October 2013), it is proposed to fill this depression to facilitate development. The proposed elevations are approximately 0 to 7 metres above the existing ground surface.

Local drainage from the site and adjacent lands to the east is currently to an existing 1000mm culvert at the north end of the adjacent property. The culvert drains to the outlet of the existing stormwater management pond.

There are no surface water features on the site.

2.3.1 Surficial Soils

A geotechnical investigation was performed by Soil Engineers Limited (2013). This investigation comprised 4 boreholes each to a depth of 6.6 metres. Generally, the site consists of a 40 to 150 millimetre layer of topsoil, which overlays fill or a silty clay till.



2.4 Site Geology and Hydrogeology

Peel region lies atop Ordovician bedrock which is generally comprised of shale, limestone, dolostone and siltstone (Ontario Geological Survey, 1991).

As part of the soil investigation report (May 2013), four (4) boreholes were drilled by Soil Engineers Ltd. to investigate subsurface conditions. Boreholes records and locations are provided in Appendix A.

Bedrock was not reached during the drilling process. The soil layers observed in the boreholes were as follows: an approximate 4 to 15 cm thick layer of topsoil comprised of dark brown organic matter; a layer of earth-fill comprised of amorphous silty clay with varying amounts of gravel; followed by a silty-clay till containing predominantly clay till of low to medium plasticity. Boulders were found throughout soil layers (Soil Engineers Ltd., 2013).

The boreholes were checked for the presences of groundwater. As reported in the soil investigation report, groundwater was encountered in two (2) boreholes of the four (4) boreholes. The two boreholes where groundwater was observed are located in the depression. The other two boreholes on higher ground were dry. Seepage was observed at depths of 5.0m and 3.0m and cave-in level on completion was observed at depths of 4.9m and 3.0m, for Boreholes 2 and 3 respectively.

The depth of the groundwater table was inferred in the soils report to be approximately 4.5m below the prevailing ground surface. The report concluded that the relatively shallow groundwater level in Borehole 3 was most likely due to the retention of infiltrated precipitation in the voids of the earth fill; more significant amounts of perched groundwater are likely during wet seasons.

Groundwater yield is expected to be small due to the low permeability of the site soils.

2.5 Water Uses in the Area

The surrounding area has been developed as predominantly single dwelling homes on municipal water and sanitary services. This development occurred in the 1990's. The proposed development would be similarly serviced via the municipal water and sanitary systems.

The site is located outside the 2 to 25-year wellhead protection areas as identified on Schedule 'O' of the Town of Caledon's Official Plan.

Ontario Ministry of Environment (MOE) well records were accessed to identify existing wells within 500m of the site. As of July 2013, seven (7) well records were listed within 500m of the site. These include: 1 test hole, 3 domestic supply wells and 3 abandonment records. Of these seven wells, six (6) wells were identified by Soil Engineers Ltd. as being within 250m of the site in the Phase 1 ESA Report. Results of the well record search are presented in Table 2.5.1 and the approximate locations of identified wells are shown on Figure 2.5.1.

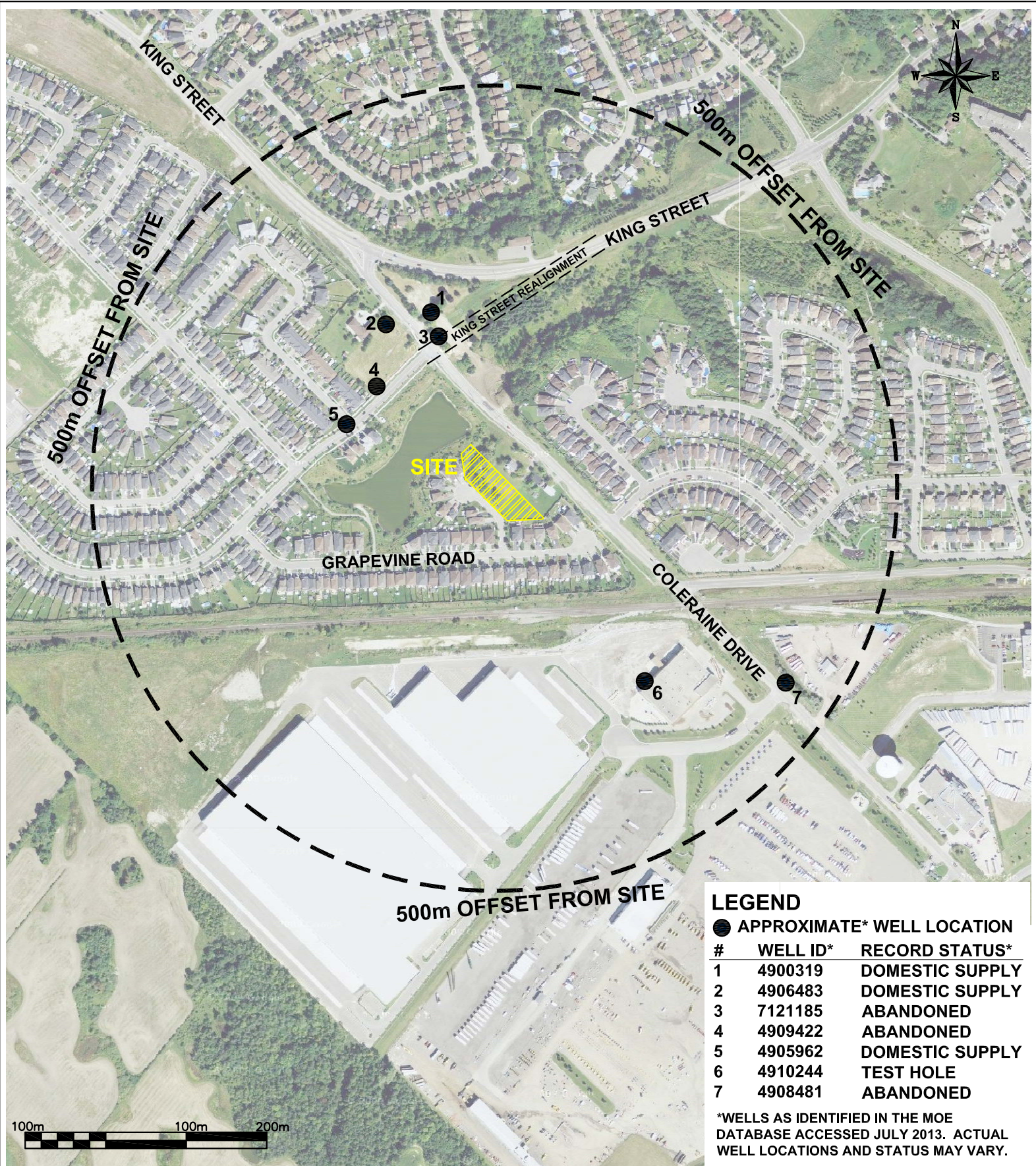


FIGURE 2.5.1
MOE Well Records Within 500m of Site (as of July 2013)



TABLE 2.5.1: MOE WELL RECORDS (AS OF JULY 2013)

No	Well ID	Year	Easting	Northing	Elevation	Well Depth	Water Found Depth	Listed Status	Listed Well Use
1	4900319	1957	600319.6	4858462	257.28	50 ft	50 ft	Water Supply	Domestic
2	4906483	1986	600263.6	4858447	258.07	249 ft	249 ft	Water Supply	Domestic
3	7121185	2009	600329	4858432	257.11	16 m	7 m	Abandoned, Other	NL
4	4909422	2004	600252	4858370	256.34	NL	NL	Abandoned, Other	Not Used
5	4905962	1983	600214.6	4858323	256.38	237 ft	238 ft	Water Supply	Domestic
6	4910244	2006	600585	4858004	259.93	3.1 m	NL	Test Hole	Not Used
7	4908481	1999	600760	4858002	260.12	NL	NL	Abandoned, Supply	NL

Notes:

1. Table information as reported in MOE Well Records database for the Region of Peel. Database accessed July 2013.

A field survey was not completed at this time. Based on the approximate well locations shown in Figure 2.5.1 and the extent of development of the surrounding area, it is believed that additional wells of the seven identified may be no longer in use.

2.6 Environmental Considerations

On the property, the EIS (Savanta, July 2013) identified no wetlands, significant woodlands, significant valley lands, endangered or threatened species or their habitat, areas of natural and scientific interest, fish habitat or significant wetland habitat, as defined in the Natural Heritage Reference Manual for Policy 2.1 of the Provincial Policy Statement. Regarding groundwater, the site was identified as being in an “upland” setting with no natural heritage features supported by groundwater.

The report concluded that conversion of the subject site to residential use would have minimal impact on the terrestrial functions of the site and that impacts can be partially mitigated through standard design and best management practices.

3.0 IMPACT ASSESSMENT

The proposed project consists of 8 single dwelling lots connecting to an existing subdivision. The lots would be provided with municipal water and sanitary services with driveway access from Jack Kenny Court.

The following factors mitigating the impact of the development on local groundwater conditions are noted:

1. The 0.4 ha development site is an infill residential development. The proposed development is similar to the surrounding land use.
2. To the best of our knowledge, there are no active private wells within 500m of the proposed development.
3. The development site is outside of the 2 to 25-year wellhead protection areas identified on Schedule 'O' of the Town of Caledon's Official Plan.
4. Groundwater was encountered in the two boreholes located in the depression. The two boreholes at higher elevations were dry. As reported in Soil Engineers Ltd. (May 2013), the permanent groundwater table was inferred to be 4.5m below the existing ground surface.
5. The use of engineered fill is proposed to fill a depression on the site to facilitate development of lots fronting on Jack Kenny Court. The proposed final ground surface is 0 to 7m above the existing ground surface.
6. Savanta (2013) identified no natural heritage features that are supported by groundwater.
7. Due to the groundwater table depth, inherent low soil permeability and proposed fill placement for the development, it is not anticipated that there will be any material surface and ground water interaction.

Based on the above, the proposed development is not expected to have a measurable impact on groundwater levels, well yield (if applicable) or water quality.

4.0 MONITORING

To the best of our knowledge there are no active wells within 500m of the proposed development.

Based on this information and the other factors listed in Section 3.0, a groundwater monitoring program is not proposed for this project.

5.0 SUMMARY

1. Calder Engineering Ltd. was retained by 1361605 Ontario Limited to complete a Scoped Hydrogeology Report for a proposed residential infill development on Jack Kenny Court in Bolton in the Town of Caledon. The report is supporting documentation for the respective subdivision Draft Plan application. The report is Scoped in that it reviews and consolidates existing information.
2. The overall site comprises approximately 0.4 ha. It is proposed to rezone the property from A1-Agricultural and develop the site with 8 single dwelling lots fronting on Jack Kenny Court with municipal water, sanitary and storm services. Lot level controls and Low Impact Development (LID) practices are recommended for implementation, wherever feasible, to reduce the volume of runoff and provide, as far as practical, a natural hydrologic response. The proposed development is similar to the surrounding land use.
3. The site is located in the Humber River Watershed. The elevations of the site range between approximately 250 and 257 metres above sea level, with existing slopes up to approximately 33%. As reported in the Functional Servicing Report (Calder Engineering Ltd., October 2013), it is proposed to fill a depression to facilitate development. The proposed elevations are approximately 0 to 7 metres above the existing ground surface.
4. Local drainage from the site and adjacent lands to the east is currently to an existing 1000mm culvert at the north end of the adjacent property. The culvert drains to the outlet of the existing stormwater management pond.
5. Four (4) boreholes were drilled by Soil Engineers Ltd. as part of the soil investigation report (May 2013). Bedrock was not reached during the drilling process. Generally, the site consists of a 40 to 150 millimetre layer of topsoil, which overlays fill or a silty clay till. Groundwater was encountered in the two low-lying borehole locations; the two higher elevation boreholes were dry. The depth of the groundwater table was inferred in the soils report to be approximately 4.5m below the prevailing ground surface. Groundwater yield is expected to be small due to the low permeability of the site soils.
6. To the best of our knowledge, there are no active private wells within 500m of the proposed development. The development site is outside of the 2 to 25-year wellhead protection areas identified on Schedule 'O' of the Town of Caledon's Official Plan.
7. Savanta (2013) identified no natural heritage features that are supported by groundwater.
8. Due to the groundwater table depth, inherent low soil permeability and proposed fill placement for the development, it is not anticipated that there will be any material surface and ground water interaction.

9. The proposed development is not expected to have a measurable impact on groundwater levels, well yield (if applicable) or water quality.
10. A groundwater monitoring program is not proposed for this project.

REFERENCES

Calder Engineering Ltd. (October 2013). Functional Servicing and Stormwater Management Report.

Ontario Geological Survey, (1991). Bedrock geology of Ontario, Southern sheet; Map 2544, scale 1:1 000 000.

Savanta Inc. (July 2013). Scoped Environmental Impact Study for Jack Kenny Court, Town of Caledon, Ontario.

Soil Engineers Ltd. (May 2013). Soil Investigation for Proposed Residential Development, 13576 and 13584 Coleraine Drive.

Soil Engineers Ltd. (July 9, 2013). Phase 1 Environmental Site Assessment, East of Jack Kenny Court, North of Grapevine Road, Town of Caledon.

Town of Caledon. (December 31, 2008 Consolidation). Town of Caledon Official Plan

APPENDIX A
SUPPORTING GEOTECHNICAL INFORMATION
(Soil Engineers Ltd, May 2013)

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report are as follows:

1. SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core with size and percentage of recovery
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash Sample

2. PENETRATION RESISTANCE/'N'

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter 90° point cone driven by a 140-pound hammer falling 30 inches.
Plotted as _____

Standard Penetration Resistance or 'N' value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.
Plotted as 'O'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

3. SOIL DESCRIPTION

a) Cohesionless Soils:

<u>'N' (Blows/ft)</u>	<u>Relative Density</u>
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) Cohesive Soils:

Undrained Shear

<u>Strength (ksf)</u>	<u>'N' (Blows/ft)</u>	<u>Consistency</u>
Less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

c) Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 - Field vane test in borehole
The number denotes the sensitivity to remoulding.

△ - Laboratory vane test

□ - Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength.

METRIC CONVERSION FACTORS

1 ft. = 0.3048 metres
1 lb. = 0.453 kg

1 inch = 25.4 mm
1 ksf = 47.88 kN/m²



Soil Engineers Ltd.

CONSULTING SOIL, FOUNDATION & ENVIRONMENTAL ENGINEERS

100 NUGGET AVENUE, SCARBOROUGH, ONTARIO M1S 3A7

TEL: (416) 754-8515

FAX: (416) 754-8516

JOB NO: 1006-S045

LOG OF BOREHOLE NO: 1

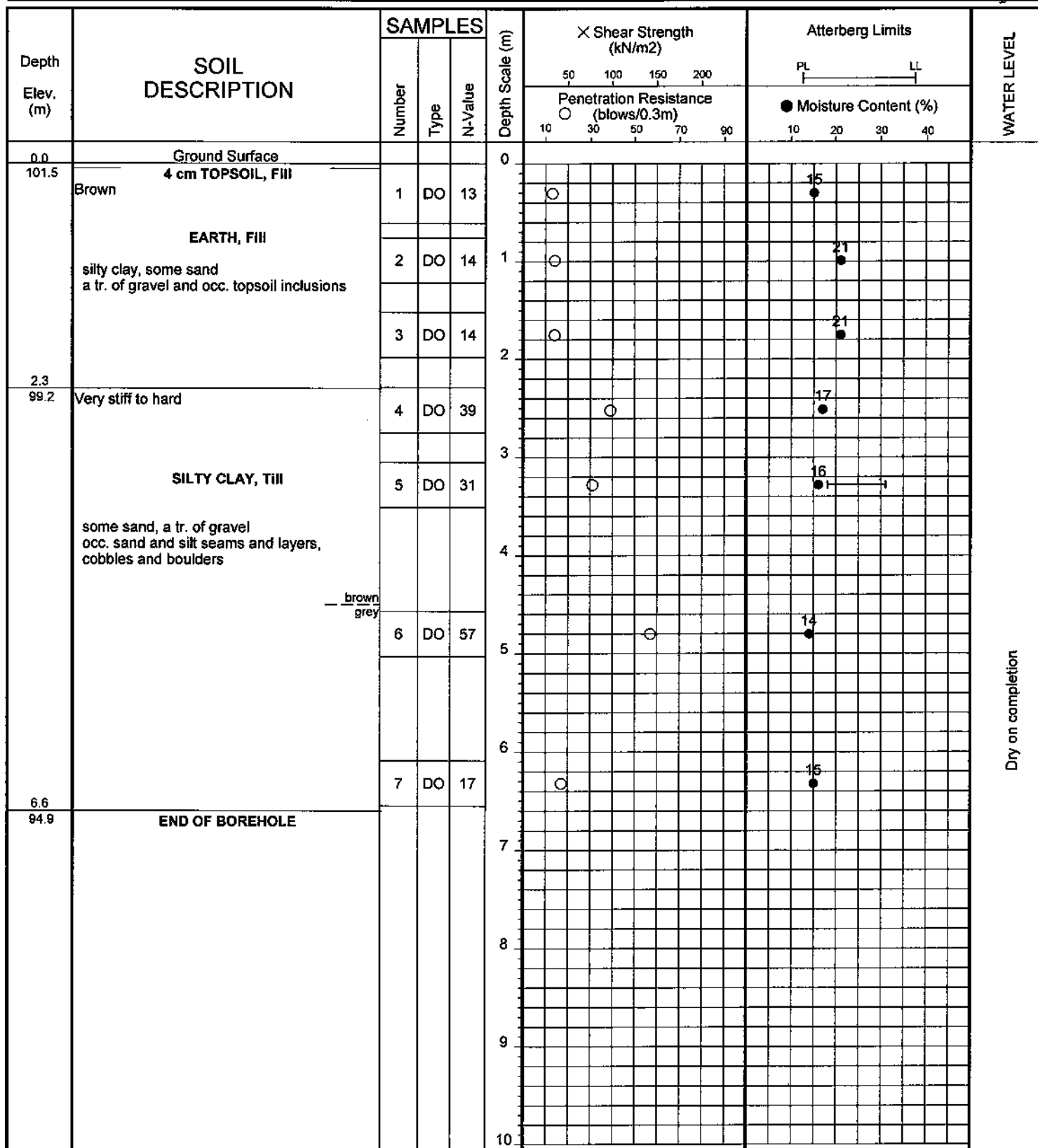
FIGURE NO: 1

JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 13576 and 13584 Coleraine Drive
Town of Bolton

METHOD OF BORING: Flight-Auger

DATE: June 22, 2010



Soil Engineers Ltd.

JOB NO: 1006-S045

LOG OF BOREHOLE NO: 2

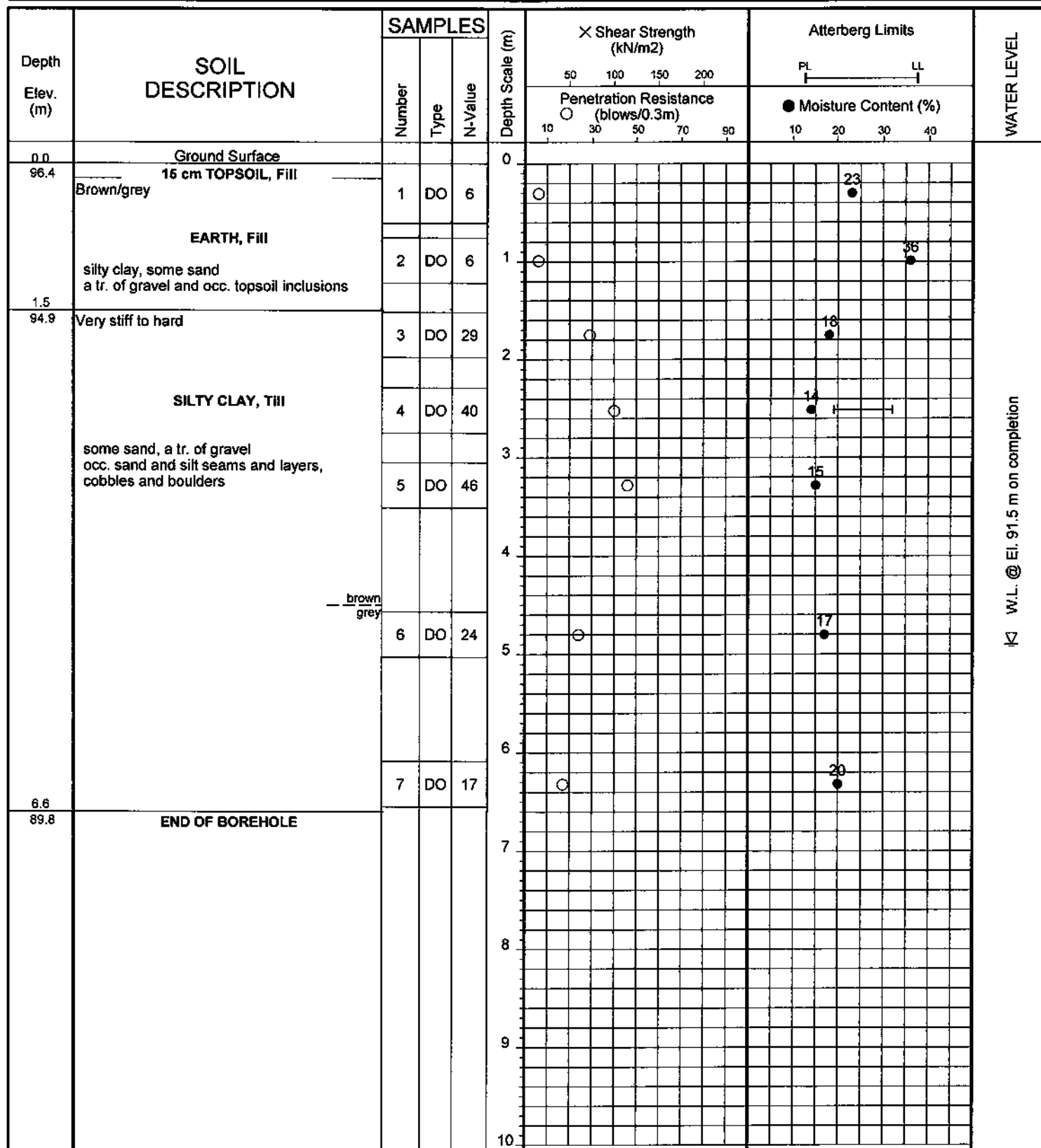
FIGURE NO: 2

JOB DESCRIPTION: Proposed Residential Development

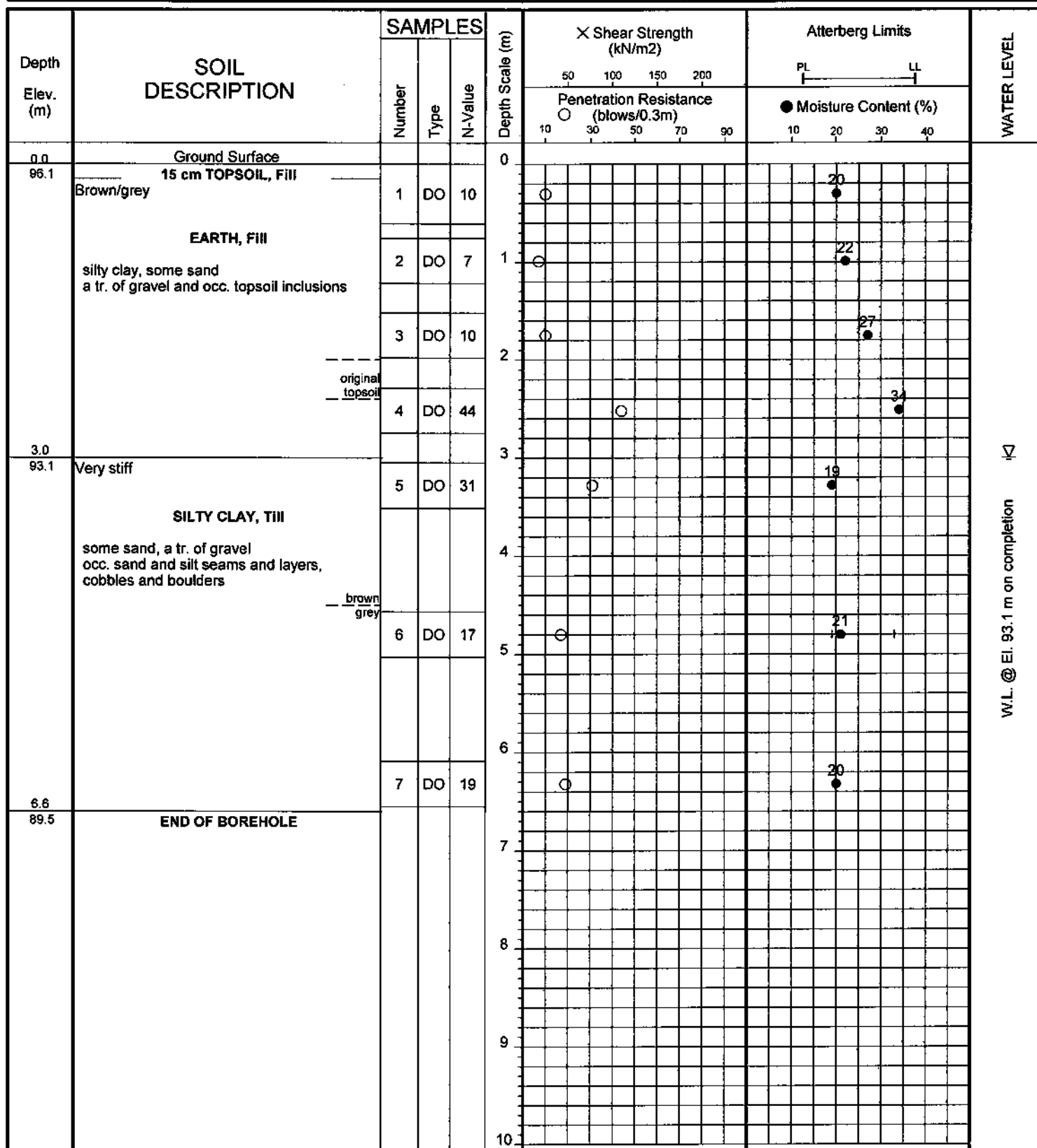
JOB LOCATION: 13576 and 13584 Coleraine Drive
Town of Bolton

METHOD OF BORING: Flight-Auger

DATE: June 23, 2010

**Soil Engineers Ltd.**

JOB NO: 1006-S045

LOG OF BOREHOLE NO: 3**FIGURE NO: 3****JOB DESCRIPTION:** Proposed Residential Development**JOB LOCATION:** 13576 and 13584 Coleraine Drive
Town of Bolton**METHOD OF BORING:** Flight-Auger**DATE:** June 23, 2010**Soil Engineers Ltd.**

JOB NO: 1006-S045

LOG OF BOREHOLE NO: 4

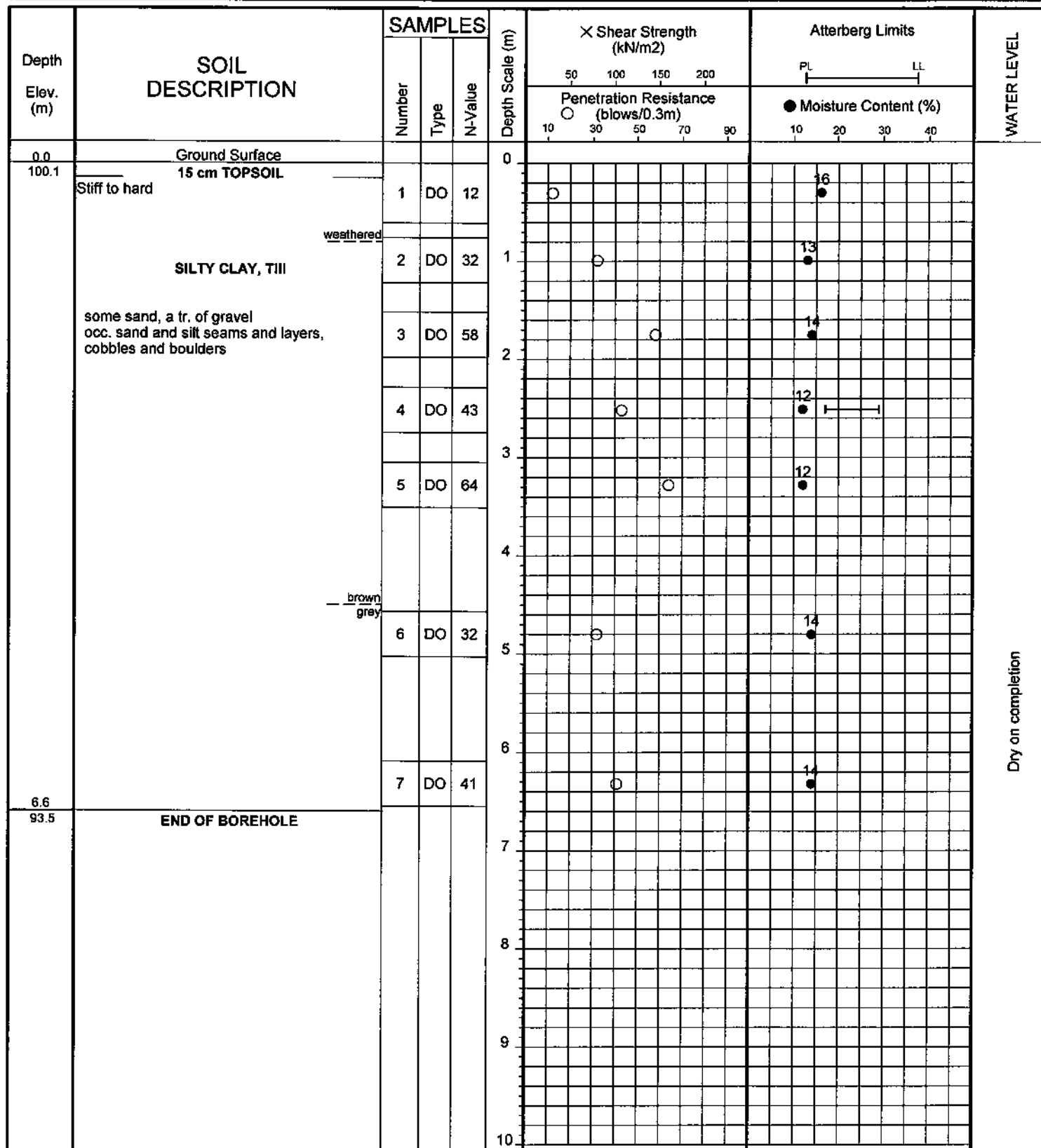
FIGURE NO: 4

JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 13576 and 13584 Coleraine Drive
Town of Bolton

METHOD OF BORING: Flight-Auger

DATE: June 22, 2010

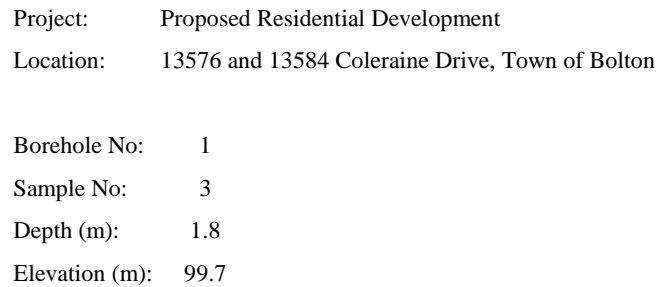
**Soil Engineers Ltd.**



Reference No: 1006-S045

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Liquid Limit (%) = -

Plastic Limit (%) = -

$$\text{Plasticity Index (\%)} = \quad -$$

Moisture Content (%) = 21

Estimated Permeability

$$(\text{cm./sec.}) = 10^{-7}$$

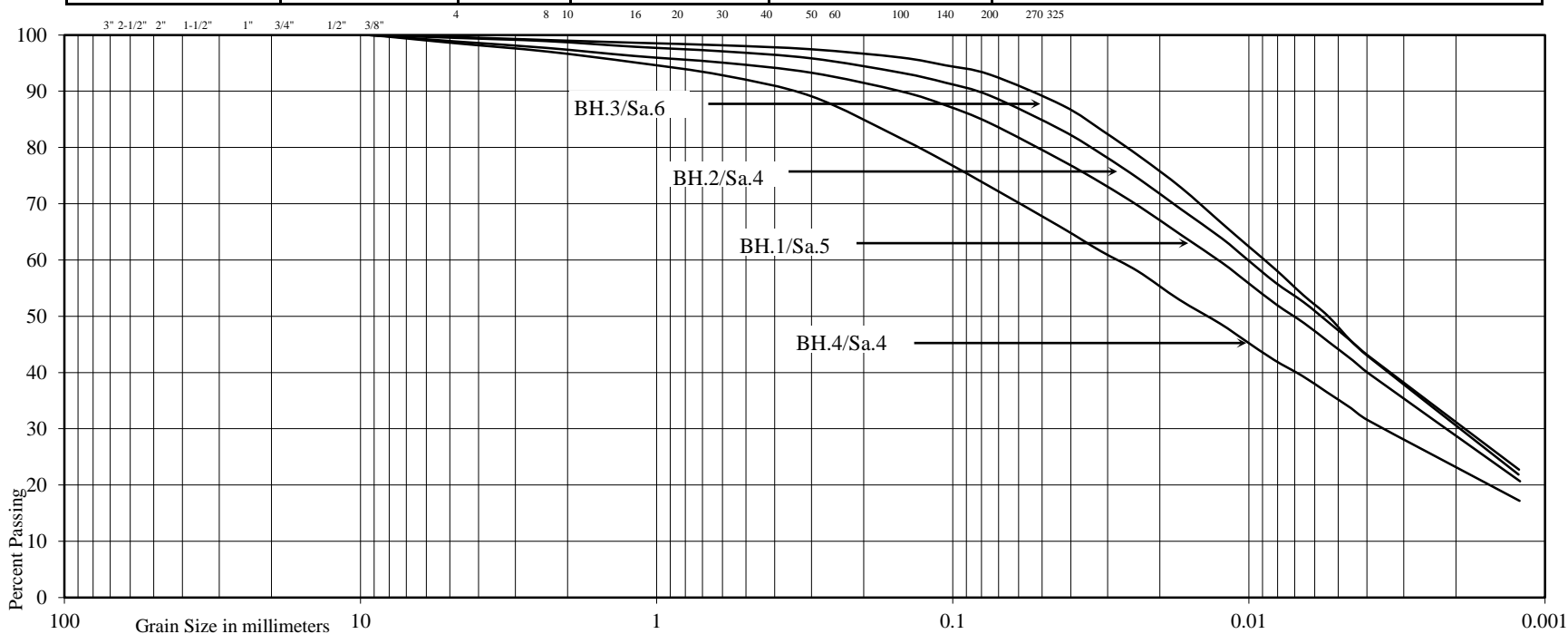
Figure: 5

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE		FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development
Location: 13576 and 13584 Coleraine Drive, Town of Bolton

Borehole No:	1	2	3	4
Sample No:	5	4	6	4
Depth (m):	3.3	2.5	4.8	2.5
Elevation (m):	98.2	93.9	91.3	97.6

BH./Sa.	1/5	2/4	3/6	4/4
Liquid Limit (%) =	31	32	33	29
Plastic Limit (%) =	18	19	19	17
Plasticity Index (%) =	13	13	14	12
Moisture Content (%) =	16	14	21	12
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY, Till
a trace of sand to sandy, a trace of gravel

