BARRIE-BRYNE DEVELOPMENTS LTD.
REPORT NUMBER: 211-11672-00

GEOTECHNICAL DESKTOP REVIEW
HIGHWAY 400 & HARVIE ROAD, BARRIE, ON

MARCH 18, 2022 FINAL

GEOTECHNICAL DESKTOP REVIEW

HIGHWAY 400 & HARVIE ROAD, BARRIE, ON

BARRIE-BRYNE DEVELOPMENTS LTD.

TYPE OF DOCUMENT (VERSION 1):
FINAL

PROJECT NO.: 211-11672-00
DATE: MARCH 18, 2022

WSP
2 INTERNATIONAL BLVD. SUITE 201
TORONTO, ON
CANADA M9W 1A2

T: +1 416 798-0065
F: +1 416 798-0518
WSP.COM

REVISION HISTORY

FIRST ISSUE

March 10, 2022	Draft			
Prepared by	Reviewed by	Approved By		
Naomi Tian, Zarankumar Patel M.Eng.	Jordan Black, P.Eng.	Julia Brown, P.Eng. PMP		
REVISION				
March 18, 2022	Final			
Naomi Tian, Zarankumar Patel M.Eng.	Jordan Black, P.Eng.	Julia Brown, P.Eng. PMP		

SIGNATURES

PREPARED BY

March 18, 2022

Naomi Tian
Geotechnical Intern

Date

March 18, 2022

Zarankumar Patel, M.Eng.
Geotechnical EIT

Date

REVIEWED BY

March 18, 2022

Jordan Black, P.Eng.
Project Manager

Date

APPROVED BY

Julia Brown, P.Eng., PMP
Senior Geotechnical Engineer/Team Lead –
Ground Engineering West

Date

TABLE OF CONTENTS

1 INTRODUCTION 1

2 INVESTIGATION METHODOLOGY 2

2.1 DESKTOP STUDIES 2

2.2 FIELD INVESTIGATION AND TESTING 3

3 SUBSURFACE CONDITIONS 5

3.1 Ground Stratigraphy 5

3.1.1 TOPSOIL 5

3.1.2 UPPER SILTY SAND/ SANDY SILT/ SILT AND SAND 5

3.1.3 UPPER SAND 5

3.1.4 LOWER SILTY SAND/ SILT AND SAND 6

3.1.5 CLAYEY SILT/ CLAYEY SANDY SILT/ CLAY AND SILT 6

3.1.6 LOWER SAND 7

3.2 GROUNDWATER CONDITIONS 7

4 PRELIMINARY RECOMMENDATIONS 9

4.1 ROADS 9

4.1.1 STRIPPING, SUB-EXCAVATION AND GRADING 9

4.1.2 CONSTRUCTION 10

4.1.3 DRAINAGE 10

4.2 Foundations 10

4.3 FLOOR SLAB AND PERMANENT DRAINAGE 11

4.4 FROST PROTECTION 11

4.5 EXCAVATION and groundwater control 11

4.5.1 BACKFILLING 11

4.5.2 GROUNDWATER CONTROL 12

4.6 TEMPORARY SHORING 12

4.7 STORMWATER MANAGEMENT 12

4.8 LATERAL EARTH PRESSURE 12

4.9 Seismic Classificaiton 13

5 LIMITATIONS OF THE REPORT 14

6 REFERENCES 15

TABLES

TABLE 2.1 SUMMARY OF BOREHOLE INFORMATION FROM WSP (2021) GEOTECHNICAL INVESTIGATION 3
TABLE 3.1 SUMMARY OF GRAIN SIZE DISTRIBUTION ON UPPER SAND..... 6
TABLE 3.2 SUMMARY OF GRAIN SIZE DISTRIBUTION ON LOWER SILTY SAND/ SILT AND SAND..... 6
TABLE 3.3 SUMMARY OF GRAIN SIZE DISTRIBUTION ON CLAYEY SILT/CLAYEY SANDY SILT/ CLAY AND SILT 7
TABLE 3.4 SUMMARY OF GRAIN SIZE DISTRIBUTION ON LOWER SAND..... 7
TABLE 3.5 SUMMARY OF GROUNDWATER OBSERVATIONS 8
TABLE 4.1 RECOMMENDED PAVEMENT STRUCTURE ON SOIL SUBGRADE 9

FIGURES

FIGURE 1: BOREHOLE LOCATION PLAN
FIGURE 2: CURRENT BOREHOLE INVESTIGATION PLAN
FIGURE 3: BOREHOLE CROSS-SECTION A
FIGURE 4: BOREHOLE CROSS-SECTION B

APPENDICES

A BOREHOLE LOGS
B PARTICLE SIZE DISTRIBUTION REPORT
C SEISMIC REPORT
D PREVIOUS GEOTECHNICAL REPORTS

1 INTRODUCTION

WSP Canada Inc. (WSP) has been retained by Barrie-Bryne Developments Ltd.to provide a geotechnical desktop study for the proposed development site located at Highway 400 and Harvie Road, in the city of Barrie, Ontario.

The site area is situated in a mostly undeveloped land at the southwest corner of Harvie Rd and Highway 400. The investigated site area is around 32.4 ha (80 acres) and the boundaries for the investigation site can be found on the location plan in **Figure 1**. The site is bounded by Harvie Road in the north, Highway 400 on the east, commercial areas in the south, and residential homes on its west. The site has a gently rolling topography with an overall slope towards the northeast sloping towards Lake Simcoe. Ground surface elevations range from about 286 m ASL at the northeast corner of the site and 303 m ASL at the southwest corner of the site.

It is understood that the proposed development of the Site consists of a large mix of semi-detached homes, townhomes, mid-rise residential, 2-storey employment blocks, stormwater management facilities, open spaces, and parkland. It is also our understanding that up to one (1) level of basement is proposed for the semi-detached homes, townhomes, and mid-rise residential buildings.

The purpose of the geotechnical desktop study is to provide an evaluation of anticipated soil and groundwater conditions for the development site. Based on the interpreted existing soil conditions determined by the geotechnical investigations, preliminary geotechnical recommendations for foundations and excavations will be provided for the proposed residential development.

The recommendations provided in this report are considered preliminary and must be verified by WSP once the Client has finalized relevant site development specifications including building layout/locations, final grades, and structural loading parameters.

This report is provided on the basis that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, WSP should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

This report has been prepared for Barrie-Bryne Developments Ltd. Third party use of this report without WSP consent is prohibited.

2 INVESTIGATION METHODOLOGY

2.1 DESKTOP STUDIES

The study area is located within the Whiskey Creek watershed and Lovers Creek watershed. All drainage is directed easterly towards Simcoe Lake. Whiskey Creek is at the northern limit of the investigation area and drains towards Kempenfelt Bay. Lover's creek is located at the southern limit of the site, and also drains towards Kempenfelt Bay.

The Ontario Geological Survey conducted in the eastern half of the Barrie and Elmvale areas (Barnett, P.J. 1997) indicates the study location has areas with deposits of fine to coarse sand and gravel with minor amounts of silt and clay; the site also has silty sand to sand till areas.

The following past geotechnical investigations have been conducted in investigation area:

1. Geotechnical investigation by WSP (2018) for the Bryne Drive Extension (Report No. 181-06461-00 dated 22 November 2021)
2. Geotechnical summary report by AMEC (2006) Earth and Environmental (Report No.TT63002 dated 19 January 2006) which also includes information from:
    a. Geotechnical investigation prepared by Geospec (Report No. 00-629, dated 30 June 2000)
    b. Geotechnical investigation prepared by Peto MacCallum Ltd (Report No. 89 F 751, dated February 1990)
3. Preliminary geotechnical report by DBA Engineering LTD. (Report No. 07-1455-13 dated 29 November 2007)

A geotechnical investigation by WSP (2018) was conducted in the study site area and consisted of thirty-four (34) boreholes (BH18-01 to BH18-06, BH18-20 to BH18-42, BH18-SWM-1, BH18-OF1, and BH18-P1 to BH18-P3) with six (6) installed as monitoring wells (BH18-20, BH18-21, BH18-23, BH18-33, BH18-OF1, and MW1) to determine subsurface conditions. The boreholes were drilled to depths between 5.0 and 12.7 meters below ground surface (mbgs). Borehole MW1 was straight augured until 4.57. The borehole advancement was drilled with solid stem augers and split spoon samples taken at regular intervals.

A geotechnical investigation (2007) in the study area was carried out by DBA Engineering which consisted of forty-five (45) boreholes (BH1-BH38 and BH41-BH47) instrumented with shallow/deep monitoring wells (BH1, BH4, BH17, BH23, BH33, BH36-BH37, BH41-BH43) to determine groundwater conditions. The boreholes were drilled to depths ranging from 2.1 to 12.6 mbgs. Split spoon sampling was taken at regular 0,76 or 1.5m intervals.

A geotechnical investigation (2006) carried out by Amec consisted of seven (7) boreholes (BH1-BH7) that were advanced to between 3.5 to 5.0 mbgs to determine subsurface conditions. The borehole advancement was drilled using solid-stem continuous-flight augers with a track mounted power-auger drilling rig. Soil samples taken at 0.76 or 1.5m intervals using the Standard Penetration Test (SPT).

Geospec carried out a geotechnical investigation (2000) where six (6) boreholes (4-9) were drilled, and no monitoring wells were installed. The boreholes had depths ranging from 3.5 to 6.5 mbgs. The borehole was advanced using a standard auger and soil samples were collected using the SPT.

A geotechnical investigation (1990) was conducted by Peto MacCallum consisted of six (6) boreholes (BH7-BH13) with four (4) installed as monitoring wells (BH7, BH 9-BH10, BH13). The boreholes were advanced to depths of 7.9 to 9.4 mbgs. The borehole advancement was equipped with continuous flight solid stem augers and soil samples were collected using the SPT. It should be recognized that the Peto MacCallum geotechnical investigation was conducted before the installation of a sanitary sewer on the investigation site. It should be noted that BH8 and BH12 are located at where the sanitary sewer is installed, therefore the soil conditions for these boreholes may not be accurate to the present conditions of the site.

The subsurface conditions based on the boreholes from past investigations consisted mainly of surficial topsoil or asphalt pavement structure with occasional boreholes that consisted of earth fill material that directly overlaid native sandy deposits. Boreholes consisted mainly of sandy deposits such as sand, silty sand, sandy silt, and silt and sand with occasional boreholes with layers of clayey deposits such as clayey silt, silty clay, clayey sandy silt, and clay and silt. Occasional boreholes also consisted of till material in the upper layers; clayey till deposits ranged from depths extending from 1.5 to 4 mbgs and sandy till deposits ranged from depths extending to 1.5 to 5 mbgs.

Locations of all boreholes drilled can be found in the borehole location plan in **Figure 1** and the borehole logs are presented in **Appendix A.**

2.2 FIELD INVESTIGATION AND TESTING

The current hydrogeological field investigation (2021) was conducted by WSP from November 23 to 26, 2021. The field investigation consisted of advancing seven (7) boreholes (MW21-01, MW21-02D, MW21-02S, MW21-03, MW21-04, MW21-05D, and MW21-05S) in the study area with monitoring wells installed at all seven (7) boreholes. Split spoon samples were collected for five (5) boreholes (MW21-01, MW21-02D, MW21-03, MW21-04, and MW21-05D) and they ranged from depths of 8.1 to 12.5 mbgs. Two additional boreholes MW21-02S and MW21-05S were drilled around one (1) meter away from MW21-02D and MW21-05D respectively, to the depth of 3.l mbgs.

The locations of these boreholes are depicted in **Figure 2** in the current borehole investigation plan. The as-drilled borehole coordinates and ground geodetic elevations were surveyed by WSP and are presented on the borehole logs in **Appendix A**. A summary of the 2021 borehole information is presented in **Table 2.1** Summary of Borehole Information from WSP (2021) Geotechnical Investigationbelow.

Table 2.1 Summary of Borehole Information from WSP (2021) Geotechnical Investigation

BOREHOLE	APPROXIMATE COORIDATES		APPROXIMATE ELEVATION (m ASL)	DEPTH OF BOREHOLE (MBGS)	WELL INSTALATION
	NORTHING (m)	EASTING (m)			
MW21-01	4910619	604512	301.4	8.1	50mm Monitoring Well
MW21-02D	4911171	604480	292.8	12.5	50mm Monitoring Well
MW21-02S	4911171	604478	292.7	3.1	50mm Monitoring Well
MW21-03	4910742	604042	301.7	9.4	50mm Monitoring Well
MW21-04	4910979	604464	298.4	9.6	50mm Monitoring Well
MW21-05D	4910613	604222	303.3	9.6	50mm Monitoring Well
MW21-05S	4910613	604220	303.0	3.1	50mm Monitoring Well

Prior to drilling operations, underground utilities were cleared at the borehole locations by the representatives of the public and private utilities locate companies

Borehole MW21-1 was drilled using only hollow stems augers, while the other six (6) boreholes (MW21-02 to MW21-05) were drilled using hollow stem augers and mud rotary. All boreholes were completed by a driller subcontracted under the direction and technical supervision of WSP personnel.

Samples were retrieved at regular intervals with a 50 mm outer diameter split-barrel sampler driven using a hammer weighing 624 N and dropping 760 mm in accordance with ASTM D 1586. The SPT 'N' values are presented on the borehole logs in **Appendix A**.

The installed monitoring wells consisted of 50 mm O.D. schedule 40 PVC machine-slotted and threaded screen and riser pipe, unslotted and threaded cone shaped bottom cap, and a protective plastic J-Plug top cap. The well annular spaces were backfilled with filter sand along the screened intervals and with sealing bentonite along the riser pipes. Installation was completed to meet the Provincial Standards O.Reg.903 and the monitoring wells were equipped with rise-up casings. Monitoring well details are further described on the borehole logs in Appendix A. Water level observations were made during drilling and, in open boreholes, upon completion of the drilling operations.

Seismic investigation report is attached in **Appendix C.**

3 SUBSURFACE CONDITIONS

3.1 GROUND STRATIGRAPHY

The locations of the boreholes advanced on site are shown in the current borehole location plan in **Figure 2**. Details of the subsurface conditions encountered in the drilled boreholes are presented on the borehole logs in **Appendix A** and described in the following sections. Geological cross-sections for the Site are presented on **Figures 3** and **4.** It should be noted that subsurface conditions can vary between boreholes and that the details provided below refer to the ground conditions encountered at the borehole locations only.

3.1.1 TOPSOIL

Topsoil was encountered at the ground surface in boreholes MW21-01, MW21-02S, MW21-02D, MW21-03, MW21-04, MW21-05S, MW21-05D and MW1 with thicknesses ranging from 130 to 610mm.

3.1.2 UPPER SILTY SAND/ SANDY SILT/ SILT AND SAND

Deposits of upper silty sand/ sandy silt/ silt and sand was encountered below the surficial topsoil in boreholes MW21-02S, MW21-02D, MW21-05S, MW21-05D and below sand in borehole MW21-01, extending to the depths ranging from 0.6 to 1.8 mbgs (elevations ranging from 302.6 to 292.3 m ASL) with thickness ranging from 0.5 to 1.0 m. The upper silty sand/ sandy silt/ silt and sand was brown in colour with trace to some clay, trace gravel and trace rock fragments.

SPT blow counts "N" values in the upper silty sand/ sandy silt/ silt and sand deposits ranged from 1 to 6 blows per 300mm of penetration, indicating a very loose to loose consistency. Water contents in upper silty sand/ sandy silt/ silt and sand ranged from 7% to 24%.

3.1.3 UPPER SAND

Deposits of upper sand was encountered below the surficial topsoil in boreholes MW21-01, MW21-03 and MW21-04, below the silty sand in boreholes MW21-02S and MW21-02D and underlying the clayey silt in borehole MW21-05D. In borehole MW21-01, the sand layer is interbedded with a unit of silty sand between 0.8 to 1.8 mbgs and in MW21-04, the sand layer is interbedded with a unit of clayey sandy silt between 1.5 to 2.7 mbgs. These deposits were extending to the depths ranging from 3.1 to 9.6 mbgs (elevations ranging from 295.6 to 286.4 m ASL) with thickness ranging from 2.5 to 6.9 m. The upper sand was brown in colour with trace to some silt and trace gravel.

SPT blow counts "N" values in the upper sand deposits ranged from 1 to greater than 100 blows per 300mm of penetration, indicating a very loose to very dense consistency. Water contents in upper sand ranged from 8% to 23%.

Grain size analyses was performed on two (2) samples the upper sand deposits. The test results are presented on the borehole logs in **Appendix A** and are summarized in **Table 3.3** Summary of Grain Size Distribution on Clayey Silt/Clayey Sandy Silt/ Clay and Silt**1**. The test gradation curves are also presented in **Appendix B**.

Table 3.1 Summary of Grain Size Distribution on Upper Sand

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	GRAIN SIZE DISTRIBUTION			
			GRAVEL (%)	SAND (%)	FINES	
					SILT (%)	CLAY (%)
MW21-1	SS8	6.9	0	92	3	5
MW21-2D	SS4	2.3	0	63	31	6

3.1.4 LOWER SILTY SAND/ SILT AND SAND

Deposits of lower silty sand/ silt and sand was encountered below the sand layer in boreholes MW21-02D, MW21-03 and MW21-04 extending to the depths ranging from 7.6 to 9.4 mbgs (elevations ranging from 292.3 to 285.2 m ASL) with thickness ranging from 1.2 to 3.3 m. The lower silty sand/ silt and sand was brown to grey in colour with trace clay.

SPT blow counts "N" values in the lower silty sand/ silt and sand deposits ranged from 72 to greater than 100 blows per 300mm of penetration, indicating very dense consistency. Water contents in lower silty sand/ silt and sand ranged from 18% to 23%.

Grain size analyses was performed on three (3) samples the lower silty sand/silt and sand deposits. The test results are presented on the borehole logs in **Appendix A** and are summarized in **Table 3.3** Summary of Grain Size Distribution on Clayey Silt/Clayey Sandy Silt/ Clay and Silt**2**. The test gradation curves are also presented in **Appendix B**.

Table 3.2 Summary of Grain Size Distribution on Lower Silty Sand/ Silt and Sand

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	GRAIN SIZE DISTRIBUTION			
			GRAVEL (%)	SAND (%)	FINES	
					SILT (%)	CLAY (%)
MW21-3	SS8	7.6	0	41	53	6
MW21-4	SS8	7.6	0	20	68	12
MW21-5D	SS8	7.6	0	89	6	5

3.1.5 CLAYEY SILT/ CLAYEY SANDY SILT/ CLAY AND SILT

Deposits of clayey sandy silt/clayey silt can be found in the upper layers of the boreholes MW21-04 and MW21-05D, just below the sand/sandy silt layers in the boreholes. These deposits were found extending to the depths ranging from 2.7 to 3.1 mbgs (elevations ranging from 300.25 to 295.71 m ASL) with thickness ranging from 1.2 to 2.3m. Deposits of clayey silt/clay and silt can be found in the lower layers of boreholes MW21-02D and MW21-04 extending to depths ranging from 9.6 to 10.7 mbgs (elevations ranging from 282.3 to 300.3 m ASL) with thickness ranging from 0.5 to 3.1m. The clayey silt/clayey sandy silt/clay and silt was grey, or brown to grey in colour with trace gravel and consisted of sand and gravel lenses.

SPT blow counts "N" values in the clayey silt/clayey sandy silt/clay and silt deposits ranged from 16 to over 50 blows per 300mm of penetration, indicating a very stiff to hard consistency. Water contents in clayey silt/ clayey sand silt/ clay and silt ranged from 7% to 31%.

Grain size analyses was performed on one (1) sample from clayey silt/ clayey sand silt/ clay and silt. The test results are presented on the borehole logs in **Appendix A** and are summarized in **Table 3.3** Summary of Grain Size Distribution on Clayey Silt/Clayey Sandy Silt/ Clay and Silt**3**. The test gradation curves are also presented in **Appendix B**.

Table 3.3 Summary of Grain Size Distribution on Clayey Silt/Clayey Sandy Silt/ Clay and Silt

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	GRAIN SIZE DISTRIBUTION			
			GRAVEL (%)	SAND (%)	FINES	
					SILT (%)	CLAY (%)
MW21-5D	SS4	2.3	0	3	17	80

3.1.6 LOWER SAND

Deposits of lower sand was encountered below the clay and silt layer in borehole MW21-02D extending to the depth of 12.5 mbgs (elevations ranging from 280.4 m ASL) with thickness of 1.8 m. The lower sand was grey in colour with trace to some gravel.

SPT blow counts "N" values in the lower sand deposits were greater than 100 blows per 300mm of penetration, indicating a very dense consistency. Water contents in lower sand ranged from 16% to 19%.

Grain size analyses was performed on one (1) sample from the lower sand deposit. The test results are presented on the borehole logs in **Appendix A** and are summarized in **Table 3.4**. The test gradation curves are also presented in **Appendix B**.

Table 3.4 Summary of Grain Size Distribution on Lower Sand

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	GRAIN SIZE DISTRIBUTION			
			GRAVEL (%)	SAND (%)	FINES	
					SILT (%)	CLAY (%)
MW21-2D	SS11	12.2	3	84	7	6

3.2 GROUNDWATER CONDITIONS

Short term (unstabilized) groundwater was found in boreholes MW21-01, MW21-02D and MW21-03 at depths ranging from 2.58 to 9.18 m below the existing ground surface.

The seven (7) boreholes (MW21-01, MW21-02S, MW21-02D, MW21-03 to MW21-04, MW21-05D, MW21-05S) with monitoring wells installed for the current WSP geotechnical investigation (2021) and three (3) boreholes (MW1, BH18-20, and BH18-21) from a past WSP geotechnical investigation (2018) have been measured for groundwater levels.

Groundwater levels measured December 8, 2021 and/or Dec 15/16, 2021 in boreholes MW21-01, MW21-03 to MW21-04, MW21-05D, MW21-05S, MW1, BH18-20, and BH18-21 were at depths ranging from 2.5 to 8.2 m

below the existing ground surface, corresponding to elevations 290.2 to 300.8 m ASL. Boreholes MW21-02S and MW21-02D were dry upon measuring.

Groundwater levels measured January 19, 2022 in all ten (10) boreholes were at depths ranging from 2.7 to 12.1 m below the existing ground surface, corresponding to elevations 300.6 to 280.7 m ASL.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

A summary of groundwater results can be seen below in **Table 3.5.**

Table 3.5 Summary of Groundwater Observations

BOREHOLE	GROUND SURFACE ELEVATION (m ASL)	SCREENED INVERVAL ELEVATION (m ASL)	DATE OF WATER LEVEL MEASUREMENT	DEPTH OF GROUNDWATER LEVEL (MBGS)	GROUND WATER ELEVATION (m ASL)
MW21-1	301.4	295.6 – 294.1	Dec 08/2021	2.6	298.8
			Dec 15/2021	4.0	297.4
			Jan 19/2022	4.1	297.3
MW21-2S	292.7	291.2 – 289.7	Dec 08/2021	Dry	Dry
			Dec 16/2021	Dry	Dry
			Jan 19/2022	2.9	289.8
MW21-2D	292.8	282.2 – 280.6	Dec 08/2021	Dry	Dry
			Dec 16/2021	Dry	dry
			Jan 19/2022	12.1	280.7
MW21-3	301.7	294.1 – 292.5	Dec 08/2021	2.7	299.0
			Dec 15/2021	2.6	299.1
			Jan 19/2022	2.7	299.0
MW21-4	298.4	290.8 – 289.3	Dec 08/2021	8.2	290.2
			Dec 16/2021	8.2	290.2
			Jan 19/2022	8.0	290.4
MW21-5S	303.3	301.5 – 300.0	Dec 08/2021	2.5	300.8
			Jan 19/2022	2.7	300.6
MW21-5D	303.3	295.7 – 294.2	Dec 08/2021	4.1	299.2
			Dec 15/2021	3.4	299.9
			Jan 19/2022	3.7	299.6
MW1 (WSP)	303.0	296.6 – 295.1	Jan 19/2022	6.5	296.5
BH18-20 (WSP)	289.5	282.5 – 279.4	Jan 19/2022	4.5	285.0
BH18-21 (WSP)	299.0	290.4 – 287.4	Jan 19/2022	7.4	291.6

4 PRELIMINARY RECOMMENDATIONS

The following sections provide high level preliminary design recommendations for the proposed development. The recommendations provided by WSP are based on the factual data presented in the reports listed above and should be considered conceptual only. In order to provide geotechnical recommendation to be relied upon for further / detailed design, a supplemental geotechnical investigation is required.

The exact characteristics of the proposed development were not available at the time of this report preparation in terms of the number of floors and basement levels and the Architectural Zero Level. It is envisaged; however, that the proposed development of the Site consists of a large mix of the proposed 2-storey employment blocks, stormwater management facilities, open spaces, and parkland and residential units would likely consist semi-detached homes, townhomes, and mid-rise residential buildings and one (1) basement level.

4.1 ROADS

The anticipated subgrade soil, after stripping the topsoil, loose/soft fill and disturbed native soil and any other organics or unsuitable subsoil, will generally consist of sand and sandy silt.

Based on the above and assuming that traffic usage will be minor local or local, the following minimum pavement thicknesses are recommended for roads to be constructed within the development as outlined in **Table 4.1**. We note that this pavement design should be considered preliminary and must be refined based on traffic data (if provided) and additional geotechnical information.

Table 4.1 Recommended pavement structure on Soil Subgrade

PAVEMENT LAYER	COMPACTION REQUIREMENTS	LIGHT DUTY PAVEMENT (PARKING FOR CARS)	HEAVY DUTY PAVEMENT (DRIVEWAYS + TRUCK ROUTES/ PUBLIC ROADS[SP])
Asphaltic Concrete	Min 92.0% MRD* Min 91.0% MRD (SP19.0)	50 mm OPSS HL 3/SP12.5 50 mm OPSS HL 8/SP19.0	50 mm OPSS HL 3/ SP12.5 70 mm OPSS HL 8/ SP19.0
OPSS Granular A Base (or 20mm Crusher Run Limestone[SP])	100% SPMDD**	150 mm	150 mm
OPSS Granular B Sub-base (or 50mm Crusher Run Limestone[SP])	100% SPMDD**	300 mm	400 mm

Notes:
* MRD - Maximum Relative Density (Min 91.0% for SP19.0; all other Min 92% MRD, OPSS 310 November 2012 pavement compaction requirements)
** SPMDD - Standard Proctor Maximum Dry Density, ASTM-D698
The subgrade must be compacted to 98% SPMDD and 100% for upper 1m.

4.1.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all topsoil and loose/soft fill and any organic or otherwise unsuitable soils to the full depth of the roads both in cut and fill areas. Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof rolled, in the presence of a Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft areas in the subgrade exposed by the proof-roll should be removed and replaced by select fill material, similar to the existing subgrade soil and

approved by a Geotechnical Engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Owing to the relatively impervious nature of the silty or clayey soils at the site, proper cambering and allowing the water drain towards subdrains along the sides of roads is considered to be beneficial for this project. Any water collecting in the granular sub-base materials due to poor drainage could be trapped and will cause problems due to softened subgrade, differential frost heave, etc. Damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may be required.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic material, or other foreign and unsuitable material. It should be noted that some of the excavated native materials, especially the medium to high plasticity silty clays, will be wet and must be aerated and left to dry out before it can be used for non-structural backfill. The fill should be placed in thin layers and compacted to at least 95% of SPMDD. The degree of compaction should be increased to 98% within the top 1m of the subgrade, or as per Region Standards. The compaction of the new fill should be checked by frequent field density tests.

4.1.2 CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.1.3 DRAINAGE

Installation of full-length sub-drains is required on all roads. The sub-drains should be properly filtered to prevent

the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basins. As discussed in Section 3.1.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards sub-drains or other interceptors.

4.2 FOUNDATIONS

The existing information at the site indicates that footings founded on the undisturbed native structures on the site dense to very dense native soil can be designed for anticipated bearing capacities of 300 kPa to 400 kPa at Serviceability Limit States (SLS) and 450 to 600 kPa at Ultimate Limit States (ULS), generally encountered 1.5 to 2.5 m below existing grade. It should be noted that in some boreholes advanced on site, loose to compact soil was encounter within the upper 3 m and reduced bearing capacities and or excavation and replacement of the soil will be required..

Where loose or deleterious material is encountered below the proposed footing elevation the materials should be subexcavated and replaced with engineered fill with a geotechnical bearing capacity of 150 kPa at SLS and 225 kPa at ULS.

Total and differential settlements of spread/strip footings designed to the specified bearing capacity at SLS would not likely exceed the conventional limits of 25 and 18 mm, respectively.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

4.3 FLOOR SLAB AND PERMANENT DRAINAGE

It is anticipated that floor slabs can be directly supported on grade provided surficially softened soils are removed and the base is thoroughly proof rolled. Floor slabs should be structurally separate from the foundation walls and columns. Sawcut control joints should be provided at suitable intervals and along column lines to minimize shrinkage cracking and to allow for differential settlement of the floor slab.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed immediately below floor slabs. An underfloor drainage system and a perimeter drainage for shored excavation systems will also be required.

4.4 FROST PROTECTION

All foundations exposed to seasonal freezing conditions must have at least 1.6 m of soil cover, including floor slabs/rafts, for frost protection.

4.5 EXCAVATION AND GROUNDWATER CONTROL

Excavations for construction of foundations and basement walls are expected to be mainly in native sand and hence can be carried out using conventional hydraulic backhoe.

Excavations in earth fills may encounter obstructions, in the form of brick, glass, coal and cinders fragments and hence provisions must be made in the excavation contract for removal of these obstructions.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA), O.Reg. 213/91, and local regulations. In accordance with OHSA, all subsurface soils can be classified as Type 3 above groundwater table and Type 4 below groundwater table, subject to verification in light of detailed geotechnical study. Accordingly, temporary excavation side-slopes should not exceed 3.0 horizontal to 1.0 vertical. Excavations through multiple soil types should be governed by the soil with the highest number Type designation. Steeper side slopes may be used subject to detailed slope stability analysis by the contractor and review/approval by WSP.

4.5.1 BACKFILLING

Excavated materials from the native sands and silt free from topsoil, organics, and boulders will likely be suitable for use as general construction backfill where it can be suitably compacted, provided its moisture content is kept within 2% of the Standard Proctor Optimum Moisture Content (SPOMC). Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use. Generally, it is not recommended to use excavated materials from the silty clay as construction fill. This may be subject to further evaluation during the detailed geotechnical study for the project.

Stockpiled excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B, in accordance with OPSS.MUNI 1010, should be used.

As a general requirement, all backfill material should be placed in maximum 200 mm thick loose lifts and be uniformly compacted to at least 95% of the Standard Proctor Maximum Dry Density (SPMDD).

4.5.2 GROUNDWATER CONTROL

It is anticipated that the foundation levels of the proposed development will likely be located above the groundwater levels and hence no major dewatering activities would be required for the project. This should be verified in the detailed geotechnical study for the project.

Light and location-specific groundwater control system may be required to handle minor seepage from water bearing layer, which may be encountered within soils of lower permeability, such as the clayey silt and clayey sandy silt and clay and silt.

4.6 TEMPORARY SHORING

It is envisaged that construction of the proposed development would involve ground excavation to a depth of about 3.5 m below the current ground surface. It is not anticipated that a shoring system would be required considering the nature of the proposed development and the geometry of the project area. This should be further evaluated during the detailed design stage. Where considered required, shoring systems must be designed in accordance with the Canadian Foundation Engineering Manual (2006).

4.7 STORMWATER MANAGEMENT

It is understood that a stormwater management (SWM) pond is proposed at Block 73. At this time there is insufficient information to provide geotechnical design recommendations for the SWM pond; however, it is anticipated that a pond liner will be required. Additional geotechnical design recommendations can be provided following an additional geotechnical investigation in the area of the proposed SWM pond and as the SWM pond is further designed

4.8 LATERAL EARTH PRESSURE

Lateral earth pressures acting on underground walls may be calculated using the following expression:

$$p = K (\gamma h + q)$$

where

p	=	Lateral earth pressure in kPa acting at depth h
K	=	Earth pressure coefficient for vertical walls and horizontal backfill.
		K = 0.33 for unrestrained (cantilever) walls with top movements greater than 1% of the wall height
		K = 0.5 for restrained walls, e.g., restrained at the top by structural floor slabs
γ	=	Unit weight of backfill, a value of 19.0 kN/m3 may be assumed
h	=	Depth to point of interest in metres
q	=	Equivalent value of surcharge on the ground surface in kPa

Where applicable, lateral earth pressures from traffic loads and neighboring shallow foundations shall be superimposed on pressures calculated using the above equation.

Where applicable, excavated areas behind retaining walls should be backfilled with non-frost susceptible granular material conforming to the requirements for OPSS.MUNI 1010 Granular “B” Type I material.

4.9 SEISMIC CLASSIFICAITON

Based on the seismic site classification tests and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed buildings can be classified as Class 'D' for seismic site response. The seismic report is attached in **Appendix C.**

It should be noted that the geophysical investigation was limited, and additional investigation should be carried out to confirm the seismic site class.

5 LIMITATIONS OF THE REPORT

This report is intended solely for the Client named. The material in it reflects our best judgement in light of the information available to WSP Canada Inc. at the time of preparation. Unless otherwise agreed in writing by WSP Canada Inc., it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on the information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented, and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

Upon achieving detailed design of the site and development, the Client must provide WSP such design details and allow WSP's Geotechnical team the opportunity to review them as it may be required to advance additional boreholes on the site in order to finalize the recommendation for geotechnical design.

6 REFERENCES

- Barnett, P.J. 1997. Quaternary geology, eastern half of the Barrie and Elmvale areas; Ontario Geological Survey, Map 2645, scale 1:50 000.

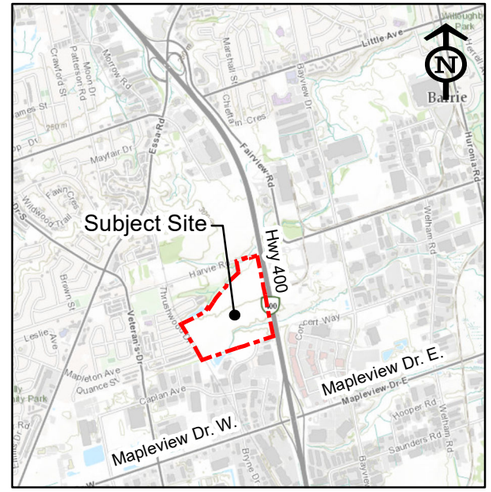
FIGURES

FIGURE 1: BOREHOLE LOCATION PLAN

FIGURE 2: CURRENT BOREHOLE INVESTIGATION PLAN

FIGURE 3: BOREHOLE CROSS-SECTION A

FIGURE 4: BOREHOLE CROSS-SECTION B)



KEY PLAN
N.T.S.

LEGEND

- Subject Site
- Monitoring Well (WSP 2021)
- Borehole Location (WSP 2018)
- Monitoring Well (WSP 2018)
- Borehole Location (DBA Engineering Ltd. 2007)
- Testpit Location (DBA Engineering Ltd. 2007)
- Borehole Location (AMEC 2006)
- Borehole Location (GEOSPEC 2000)
- Borehole Location (Peto MacCallum Ltd. 1990)

0 50 100 200 Meters

N

BOREHOLE LOCATION PLAN

GEOTECHNICAL INVESTIGATION
Highway 400 & Harvie Road,
Barrie, Ontario

DATE: **JANUARY 2022**	SCALE: **1:4000**
PROJECT: **211-11672-00**	FILE NO.:

WSP

FIGURE **1**

Prepared By: Tanya.Peterson

LEGEND:

- SITE BOUNDARY
- CROSS SECTION
- WATERCOURSE
- MONITORING WELL
- MONITORING WELL (PREVIOUSLY DRILLED BY WSP)

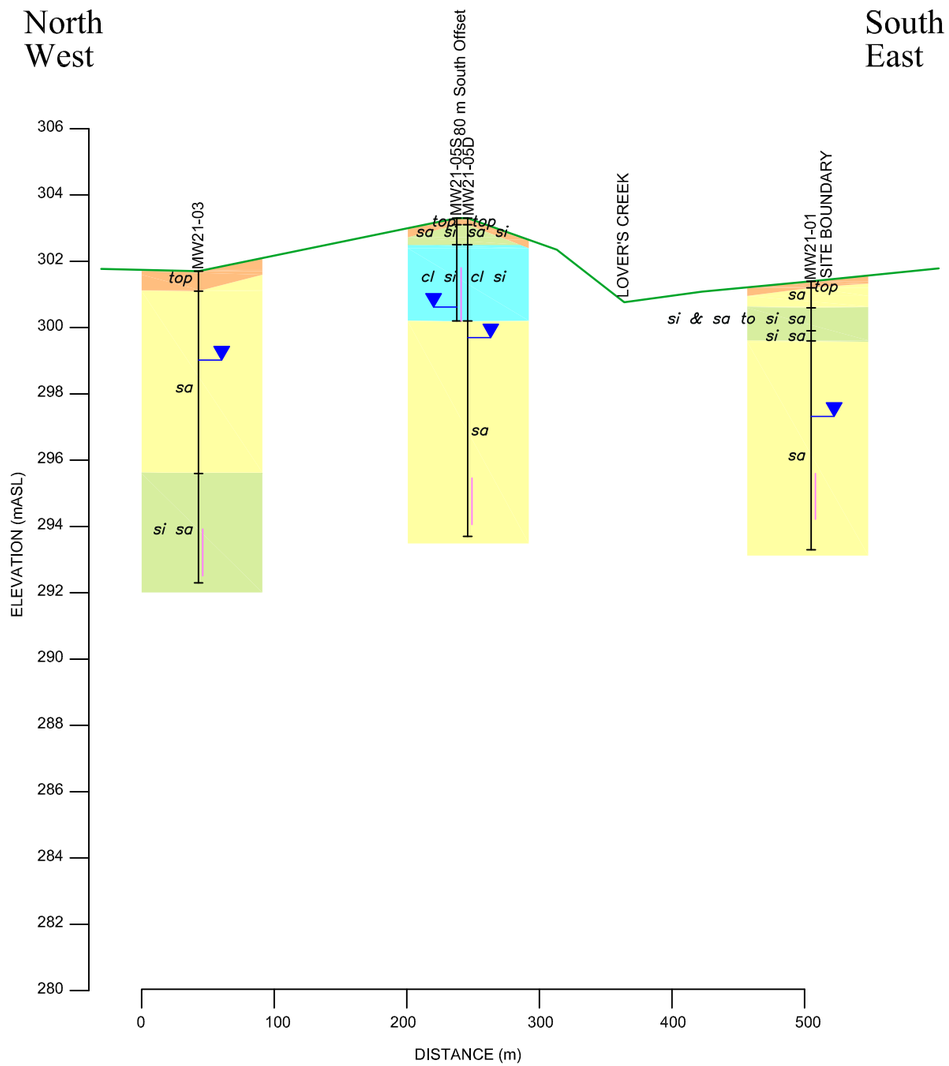
TITLE:
BOREHOLE AND MONITORING WELL LOCATION PLAN

PROJECT:
GEOTECHNICAL INVESTIGATION
HWY 400 & HARVIE ROAD
BARRIE, ONTARIO

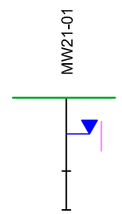
CLIENT:
BARRIE-BRYNE DEVELOPMENTS LIMITED

	PROJECT NO.:	REVIEWED BY:
wsp	211-11672-00	MY
	DATE: MARCH 2022	FIGURE: 2

D:\aProjects\211-11672-00\MXD\Geotechnical\211-11672-00 Figure 2 BH Locations.mxd



LEGEND



WELL ID

GROUND SURFACE

WATER LEVEL (JAN 19, 2022)/ WELL SCREEN

CHANGE IN STRATIGRAPHY

END OF BORING (mBGL)

SOIL DESCRIPTION:

gr - GRAVEL
fi - FILL
si - SILT
sa - SAND
cl - CLAY
ti - TILL

TOPSOIL

SAND

SAND / SILT

CLAYEY SILT

NOTE:
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE WELL LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS. WELL DATA IS PROJECTED ONTO THE SECTION WHICH ALSO MAY CREATE SOME IRREGULARITIES IN CONTACT DEPTHS.

CROSS SECTION A-A'

GEOTECHNICAL INVESTIGATION
HWY 400 & HARVIE ROAD
BARRIE, ONTARIO

DATE: MARCH 2022

PROJECT: 211-11692-00

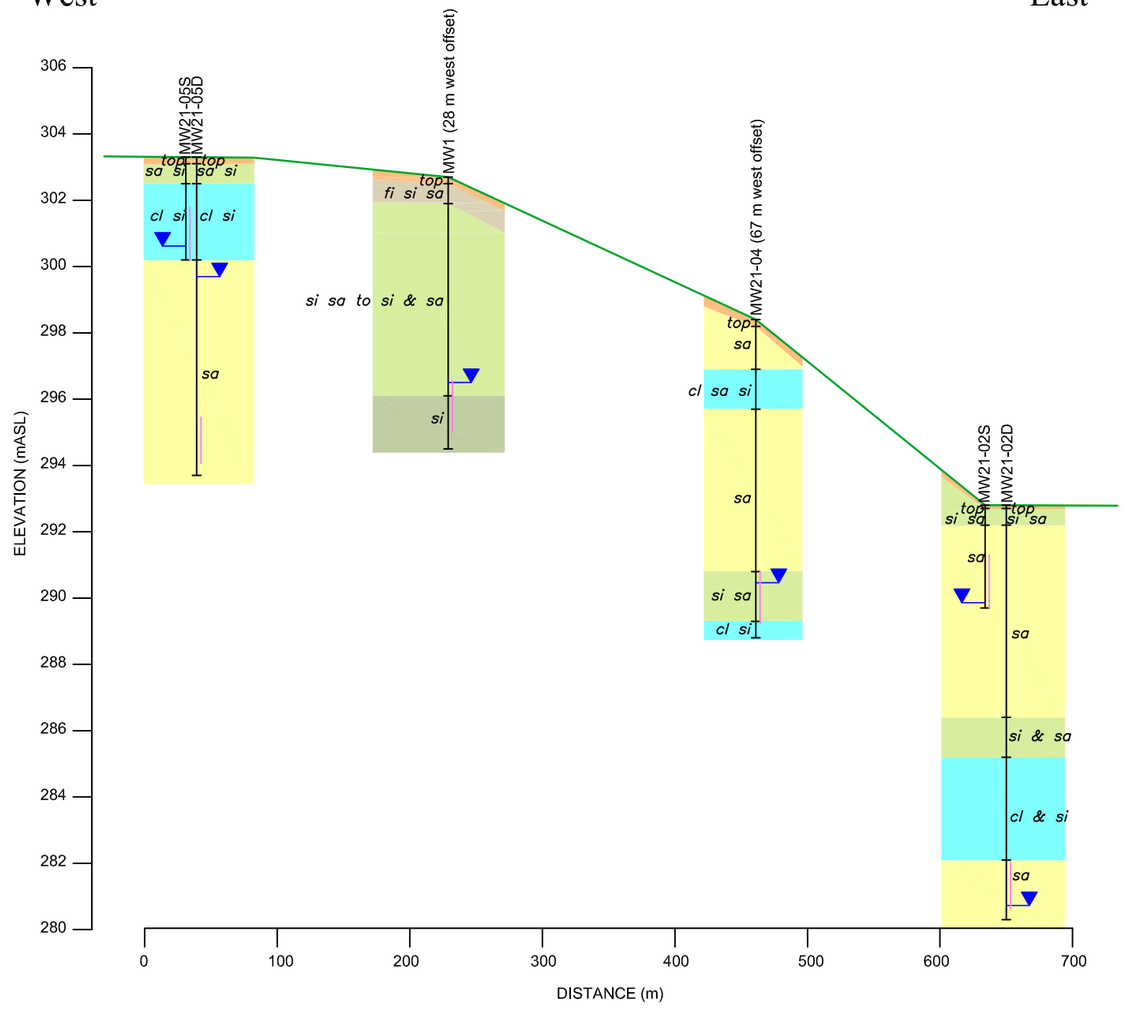
SCALES: AS SHOWN

wsp

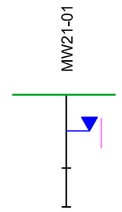
FIGURE 3

South
West

North
East



LEGEND



WELL ID

GROUND SURFACE

WATER LEVEL (JAN 19, 2022)/ WELL SCREEN

CHANGE IN STRATIGRAPHY

END OF BORING (mBGL)

SOIL DESCRIPTION:

gr - GRAVEL
fi - FILL
si - SILT
sa - SAND
cl - CLAY
ti - TILL

TOPSOIL

SILT SAND FILL

SAND / SILT

SAND

SILT

CLAYEY SILT

NOTE:
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE WELL LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS. WELL DATA IS PROJECTED ONTO THE SECTION WHICH ALSO MAY CREATE SOME IRREGULARITIES IN CONTACT DEPTHS.

CROSS SECTION B-B'

GEOTECHNICAL INVESTIGATION
HWY 400 & HARVIE ROAD
BARRIE, ONTARIO

DATE: MARCH 2022

PROJECT: 211-11692-00

SCALES: AS SHOWN

wsp

FIGURE
4

A BOREHOLE LOGS

LOG OF BOREHOLE MW21-01

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Hollow Stem Augers
ENCL NO.: 1
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 200mm
DATUM: Relative
Date: Nov/23/2021
BH LOCATION: N 4910619 E 604512

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
301.4	Ground Surface											
301.0 0.0	**TOPSOIL:** 150 mm					Concrete						
0.2	**SAND:** SAND, trace silt, brown, moist, compact		1	SS	12		301					
300.6												
0.8	**SILT AND SAND TO SILTY SAND:** SILT AND SAND, trace to some clay, brown, moist, very loose		2	SS	1							
299.9							300					
1.5	**SILTY SAND:** SILTY SAND, trace cobble		3	SS	73							
299.5												
1.8	fragments, brown, moist, very dense											
299.1	**SAND:** SAND, trace to some silt, brown,											
2.3	moist, very dense trace gravel		4	SS	50	W. L. 298.8 m Dec 08, 2021	299					
298.3						Bentonite						
3.1	trace silt, no gravel, dense		5	SS	40		298					
296.8						W. L. 297.4 m Dec 15, 2021 Jan 13, 2022	297					
4.6	wet, very dense		6	SS	92							
							296					
			7	SS	95	Sand Screen						
			8	SS	53							0 92 3 5
							294					
293.3			9	SS	28							
8.1	**END OF BOREHOLE** Borehole terminated at 8.1 m below ground surface in SAND. Installed monitoring well upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-02D

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Mud Rotary
ENCL NO.: 2
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 100mm
DATUM: Relative
Date: Nov/26/2021
BH LOCATION: N 4911171 E 604480

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
292.8	Ground Surface				
292.7 / 0.0	**TOPSOIL:** 130 mm				
0.1	**SILTY SAND:** SILTY SAND, trace organics, brown, moist to wet, loose	1	SS	6	
292.3 / 0.6	**SAND:** SAND, trace silt, brown, moist to wet, very loose to loose	2	SS	2	292
		3	SS	4	291
290.4 / 2.4	grey, trace to some silt, moist, dense	4	SS	32	
289.8 / 3.1	wet to saturated, very dense	5	SS	52	290
					289
288.3 / 4.6	some silt to silty	6	SS	88	288
286.4 / 6.4	**SILT AND SAND:** SILT AND SAND, trace clay, grey, moist to wet, very dense	7	SS	72	287
					286
285.2 / 7.6	**CLAY AND SILT:** CLAY AND SILT, grey, moist to wet, hard	8	SS	84	285
					284
283.7 / 9.1	50 mm sand and gravel layer	9	SS	>100	
					283
282.2 / 10.7		10	SS	115	282

Concrete
Bentonite

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
4	0	63	31	6

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-02D

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Mud Rotary
ENCL NO.: 2
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 100mm
DATUM: Relative
Date: Nov/26/2021
BH LOCATION: N 4911171 E 604480

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued							20 40 60 80 100	10 20 30			
	SAND: SAND, trace to some gravel, grey to brown, moist to wet, very dense(Continued)						Sand					
							Screen					
12							281					
280.4			11	SS	>150		W. L. 280.7 m Jan 19, 2022		o			3 84 7 6
12.5	**END OF BOREHOLE** Borehole terminated at 12.5 m below ground surface in SAND. Installed monitoring well upon completion. Monitoring well was dry on December 8, 2021.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-02S

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Hollow Stem Augers
ENCL NO.: 3
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 200mm
DATUM: Relative
Date: Nov/26/2021
BH LOCATION: N 4911171 E 604478

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
292.8	Ground Surface											
292.7	**TOPSOIL:** 130 mm											
0.1	**SILTY SAND:** SILTY SAND, trace organics, brown, moist to wet, loose						Concrete					
292.3												
0.6	**SAND:** SAND, trace silt, brown, moist to wet, very loose to loose						Bentonite					
1							292					
							Sand					
2							291					
							Screen					
290.4												
2.4	grey, trace to some silt, moist, dense											
3							290					
289.8							W. L. 290.0 m Jan 19, 2022					
3.1	**END OF BOREHOLE** Borehole terminated at 3.1 m below ground surface in SAND. Installed monitoring well upon completion. Monitoring well was dry on December 8, 2021.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-03

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Mud Rotary
ENCL NO.: 4
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 100mm
DATUM: Relative
Date: Nov/24/2021
BH LOCATION: N 4910742 E 604042

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
301.7	Ground Surface											
0.0	**TOPSOIL:** 610 mm		1	SS	15		Concrete					
301.1												
300.9	**SAND:**											
0.8	SAND, trace silt, brown, moist, compact		2	SS	9		301					
1	damp to moist, loose											
300.2												
1.5	compact		3	SS	22		300					
2												
299.4												
2.3	wet, dense		4	SS	35		W. L. 299.1 m					
3							W. L. 299.0 m Dec 08, 2021					
298.6												
3.1	trace to some silt		5	SS	48		298					
							Bentonite					
4												
			6	SS	50		297					
5												
							296					
6												
295.6												
6.1	**SILTY SAND:** SILTY SAND, brown, wet, very dense		7	SS	>100		295					
7												
			8	SS	>90		294					0 41 53 6
8							Sand Screen					
							293					
9												
292.5												
9.1	some silt to silty		9	SS	>115							
292.3												
9.4	**END OF BOREHOLE** Borehole terminated at 9.4 m below ground surface in SILTY SAND. Installed monitoring well upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-04

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Mud Rotary
ENCL NO.: 5
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 100mm
DATUM: Relative
Date: Nov/25/2021
BH LOCATION: N 4910979 E 604464

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	WATER CONTENT (%) w_P PLASTIC LIMIT, w NATURAL MOISTURE CONTENT, w_L LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.4	Ground Surface										
298.2 0.2	**TOPSOIL:** 180 mm				Concrete	298					
	SAND: SAND, trace silt, brown, damp, loose to compact	1	SS	11							
1		2	SS	5							
296.9						297					
1.5	**CLAYEY SANDY SILT:** CLAYEY SANDY SILT, trace gravel, brown, moist, very dense	3	SS	50							
2 296.1											
2.3	grey, some sand seams	4	SS	72		296					
295.7											
2.7	**SAND:** SAND, trace silt, brown, wet, very dense										
3 295.4											
3.1	trace to some silt	5	SS	>94		295					
						Bentonite					
4						294					
		6	SS	>100							
5						293					
6											
		7	SS	>100		292					
7 290.8											
7.6	**SILTY SAND:** SILTY SAND, grey, wet, very dense	8	SS	>100		291					0 20 68 12
8						W. L. 290.5 m					
						W. L. 290.2 m Dec 08, 2021					
9 289.3											
9.1 288.9	**CLAYEY SILT:** CLAYEY SILT, some sand to sandy, grey, moist to very moist, hard	9	SS	>98		289					
9.6	**END OF BOREHOLE** Borehole terminated at 9.6 m below ground surface in CLAYEY SILT. Installed monitoring well upon completion.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-05D

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Mud Rotary
ENCL NO.: 6
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 100mm
DATUM: Relative
Date: Nov/24/2021
BH LOCATION: N 4910613 E 604222

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
303.3	Ground Surface											
303.2 0.0	**TOPSOIL:** 180 mm						Concrete					
0.2	**SANDY SILT:** SANDY SILT, trace clay, trace gravel, brown, moist, loose		1	SS	4		303					
302.6												
0.8	**CLAYEY SILT:** CLAYEY SILT, trace sand, trace gravel, brown, moist, compact		2	SS	22		302					
301.8												
1.5	slty sand layers		3	SS	26		301					
			4	SS	16							0 3 17 80
300.3												
3.1	**SAND:** SAND, trace silt, brown, wet, very dense		5	SS	56		300					
						W. L. 300.0 m Dec 15, 2021 W. L. 299.7 m Jan 19, 2022 W. L. 299.3 m Dec 08, 2021						
			6	SS	>94		298					
			7	SS	>100		297					
295.7							296					
7.6	trace to some silt		8	SS	78		Sand Screen					0 89 6 5
			9	SS	63		294					
293.7												
9.6	**END OF BOREHOLE** Borehole terminated at 9.6 m below ground surface in SAND. Installed monitoring well upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-05S

PROJECT: BARRIE SMART CENTRES
REF. NO.: 211-11672-00
CLIENT: BARRIE-BRYNE DEVELOPMENTS LTD.
Method: Hollow Stem Augers
ENCL NO.: 7
PROJECT LOCATION: Bryne Drive/Harvie Road, Barrie, Ontario
Diameter: 200mm
DATUM: Relative
Date: Nov/24/2021
BH LOCATION: N 4910613 E 604220

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
303.3	Ground Surface											
303.2 0.0	**TOPSOIL:** 180 mm					Concrete						
0.2	**SANDY SILT:** SANDY SILT, trace clay, trace gravel, brown, moist, loose						303					
302.6 0.8	**CLAYEY SILT:** CLAYEY SILT, trace sand, trace gravel, brown, moist, compact					Bentonite						
1							302					
301.8 1.5	silty sand layers					Sand						
2												
						Screen						
3						W. L. 300.8 m Dec 08, 2021 W. L. 300.8 m Jan 19, 2022						
300.3 3.1	**END OF BOREHOLE** Borehole terminated at 3.1 m below ground surface in CLAYEY SILT. Installed monitoring well upon completion.											

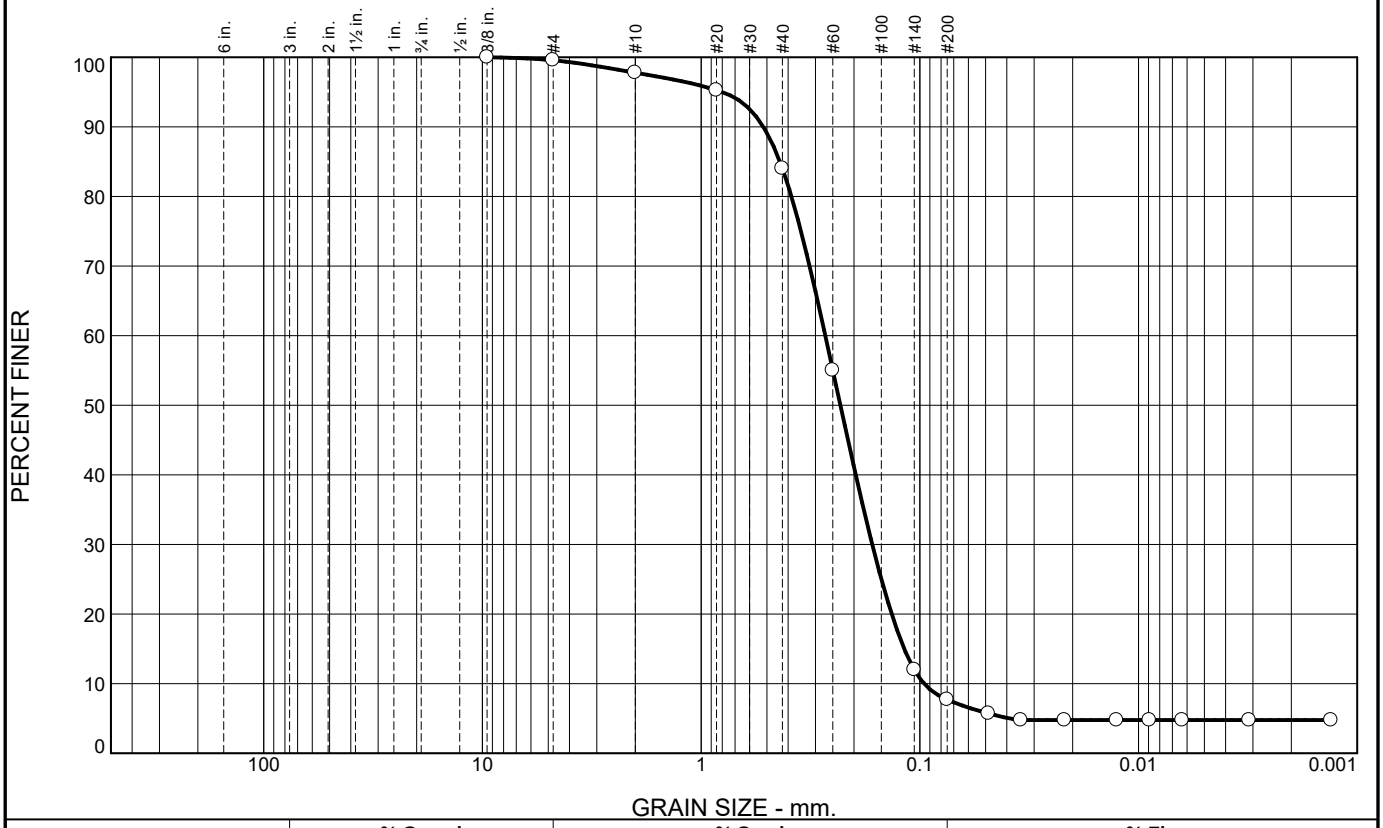
GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

APPENDIX

B PARTICLE SIZE DISTRIBUTION REPORT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	1.8	13.8	76.3	2.9	4.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5mm	100.0		
4.75mm	99.6		
2mm	97.8		
0.850mm	95.3		
0.425mm	84.0		
0.250mm	55.0		
0.106mm	12.0		
0.075mm	7.7		
0.0485 mm.	5.7		
0.0344 mm.	4.8		
0.0218 mm.	4.8		
0.0126 mm.	4.8		
0.0089 mm.	4.8		
0.0063 mm.	4.8		
0.0031 mm.	4.8		
0.0013 mm.	4.8		

* (no specification provided)

Soil Description

Sand, trace clay, trace silt, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5193 D_{85}= 0.4362 D_{60}= 0.2705
D_{50}= 0.2308 D_{30}= 0.1650 D_{15}= 0.1179
D_{10}= 0.0956 C_u= 2.83 C_c= 1.05

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.23, 2021

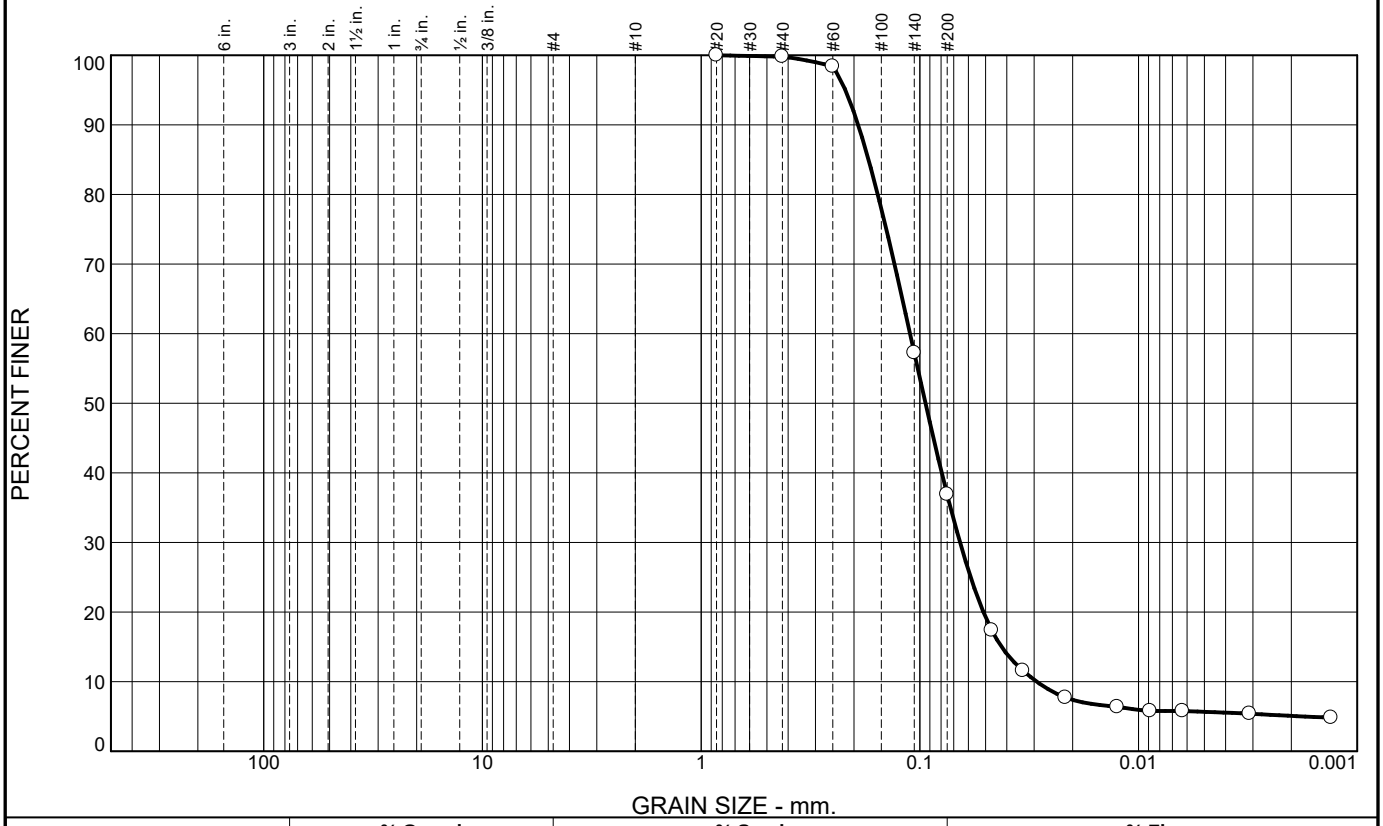
Location: MW21-1 SS8
Sample Number: 21MM-842

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	62.9	31.2	5.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.850mm	100.0		
0.425mm	99.8		
0.250mm	98.4		
0.106mm	57.2		
0.075mm	36.9		
0.0469 mm.	17.4		
0.0337 mm.	11.6		
0.0216 mm.	7.7		
0.0125 mm.	6.4		
0.0089 mm.	5.8		
0.0063 mm.	5.8		
0.0031 mm.	5.4		
0.0013 mm.	4.8		

* (no specification provided)

Soil Description

Silty sand, trace clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1914 D_{85}= 0.1716 D_{60}= 0.1109
D_{50}= 0.0942 D_{30}= 0.0655 D_{15}= 0.0423
D_{10}= 0.0292 C_u= 3.80 C_c= 1.33

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.26, 2021

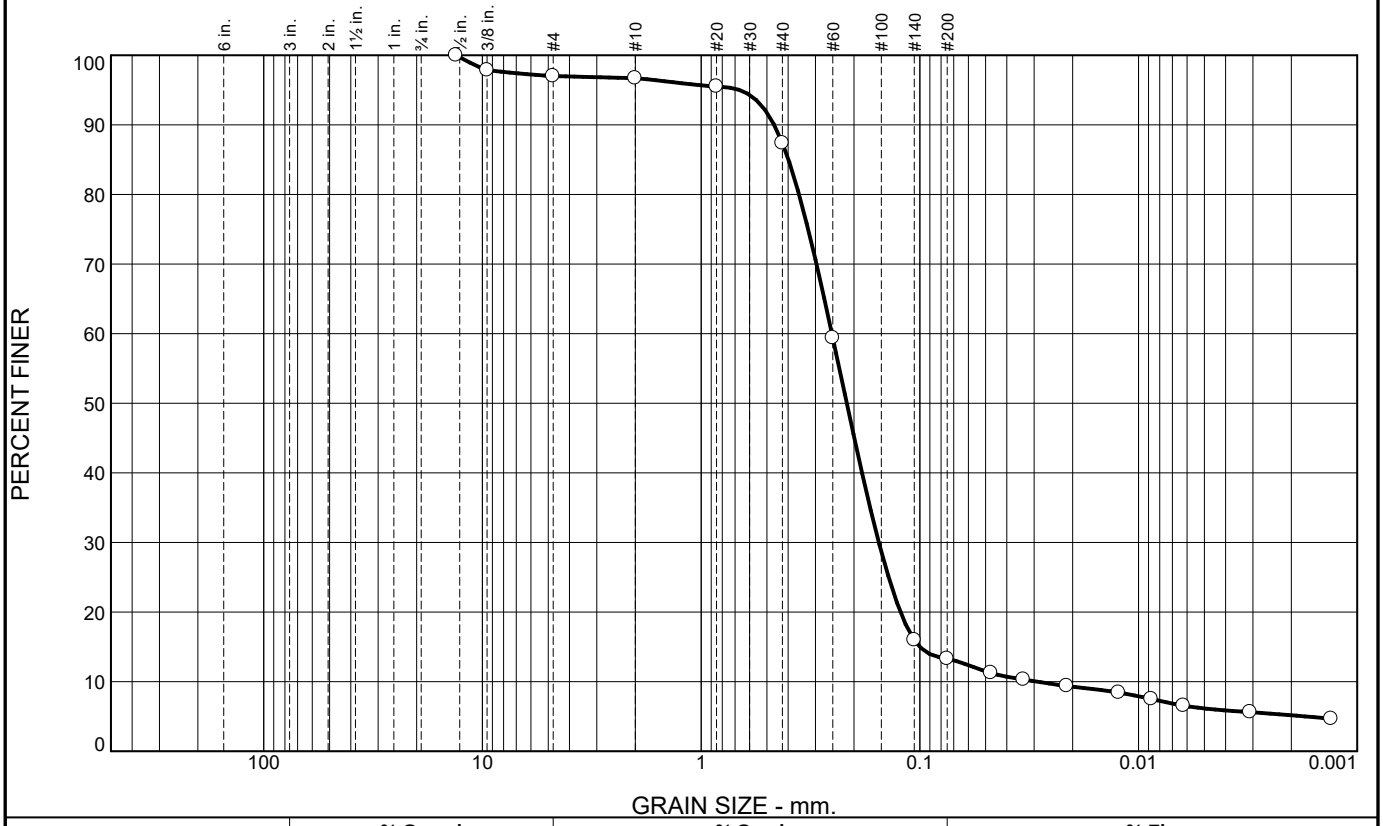
Location: MW21-2 SS4
Sample Number: 21MM-844

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	0.3	9.3	74.1	7.1	6.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
13.2mm	100.0		
9.5mm	97.9		
4.75mm	97.0		
2mm	96.7		
0.850mm	95.5		
0.425mm	87.4		
0.250mm	59.4		
0.106mm	16.0		
0.075mm	13.3		
0.0473 mm.	11.3		
0.0336 mm.	10.3		
0.0213 mm.	9.4		
0.0123 mm.	8.4		
0.0087 mm.	7.5		
0.0062 mm.	6.6		
0.0031 mm.	5.6		
0.0013 mm.	4.7		

* (no specification provided)

Soil Description

Sand, trace silt, trace clay, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4636 D_{85}= 0.3987 D_{60}= 0.2524
D_{50}= 0.2158 D_{30}= 0.1539 D_{15}= 0.1000
D_{10}= 0.0289 C_u= 8.72 C_c= 3.24

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.26, 2021

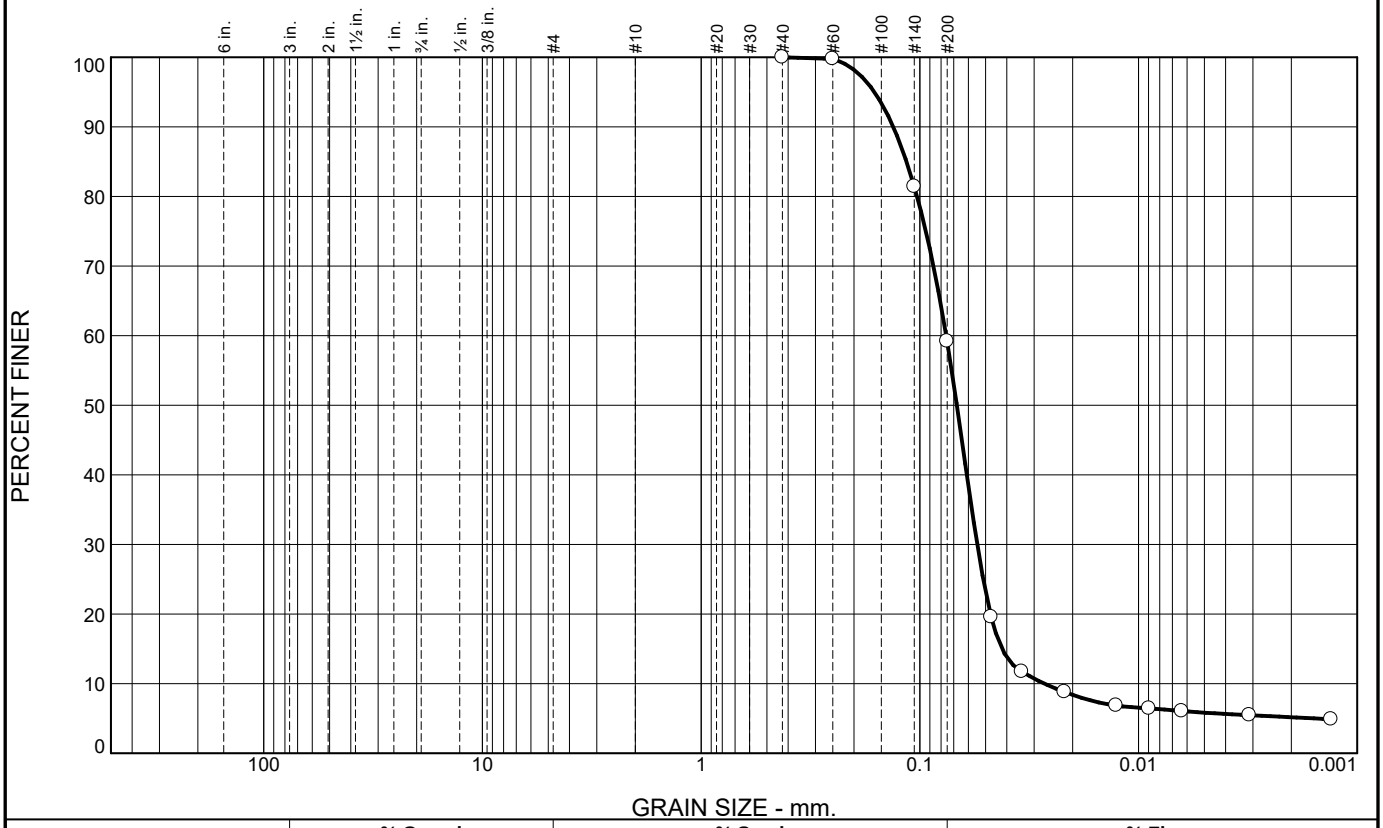
Location: MW21-2 SS11
Sample Number: 21MM-843

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	40.8	53.4	5.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.425mm	100.0		
0.250mm	99.8		
0.106mm	81.4		
0.075mm	59.2		
0.0471 mm.	19.6		
0.0341 mm.	11.7		
0.0218 mm.	8.8		
0.0126 mm.	6.9		
0.0090 mm.	6.5		
0.0063 mm.	6.1		
0.0031 mm.	5.5		
0.0013 mm.	4.9		

* (no specification provided)

Soil Description

Silt and sand, trace clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1322 D_{85}= 0.1150 D_{60}= 0.0757
D_{50}= 0.0678 D_{30}= 0.0546 D_{15}= 0.0421
D_{10}= 0.0269 C_u= 2.82 C_c= 1.46

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.24, 2021

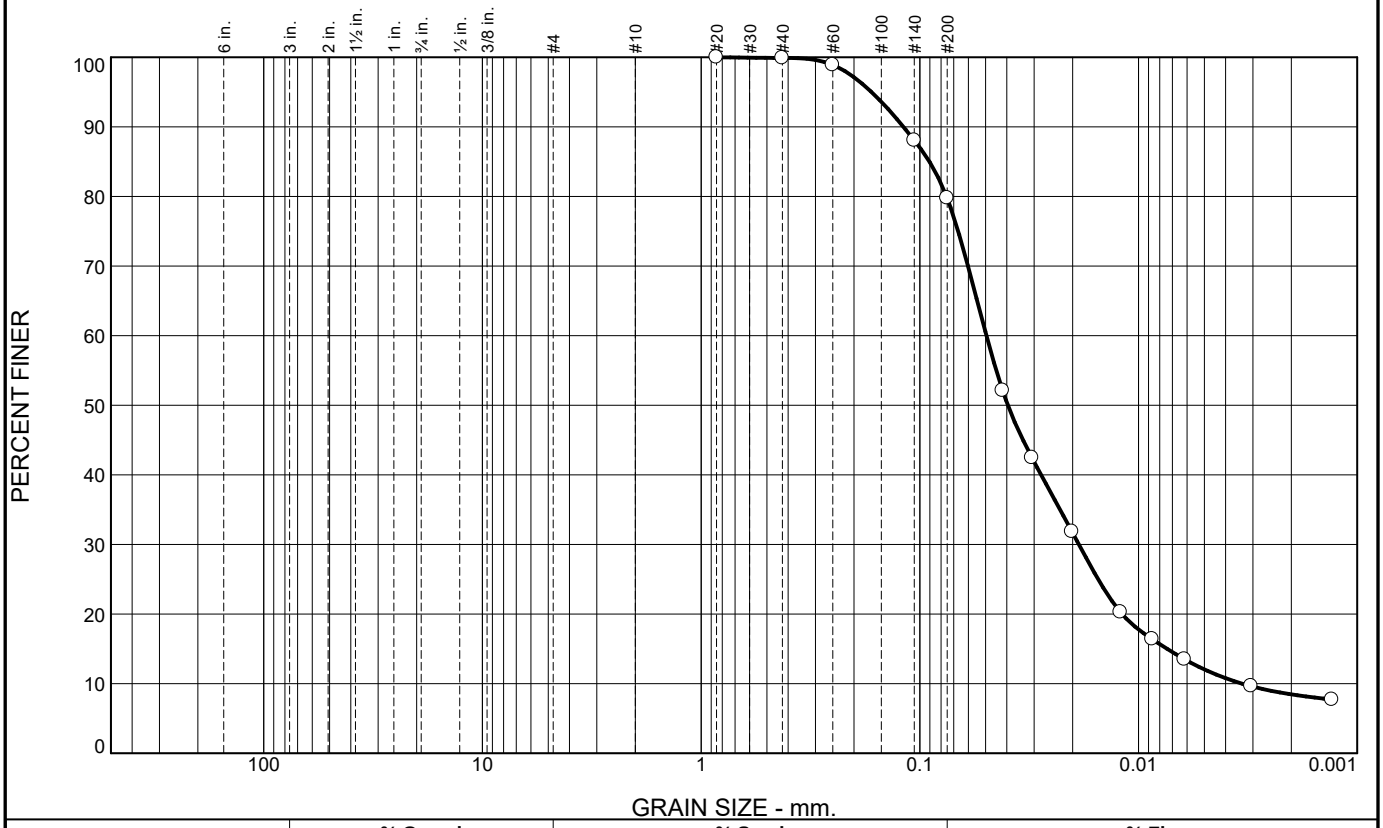
Location: MW21-3 SS8
Sample Number: 21MM-845

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	20.1	67.7	12.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.850mm	100.0		
0.425mm	99.9		
0.250mm	98.9		
0.106mm	88.0		
0.075mm	79.8		
0.0418 mm.	52.1		
0.0307 mm.	42.4		
0.0201 mm.	31.8		
0.0121 mm.	20.3		
0.0086 mm.	16.4		
0.0062 mm.	13.5		
0.0031 mm.	9.6		
0.0013 mm.	7.7		

* (no specification provided)

Soil Description

Sandy silt, some clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1189 D_{85}= 0.0903 D_{60}= 0.0496
D_{50}= 0.0396 D_{30}= 0.0187 D_{15}= 0.0074
D_{10}= 0.0034 C_u= 14.80 C_c= 2.11

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.25, 2021

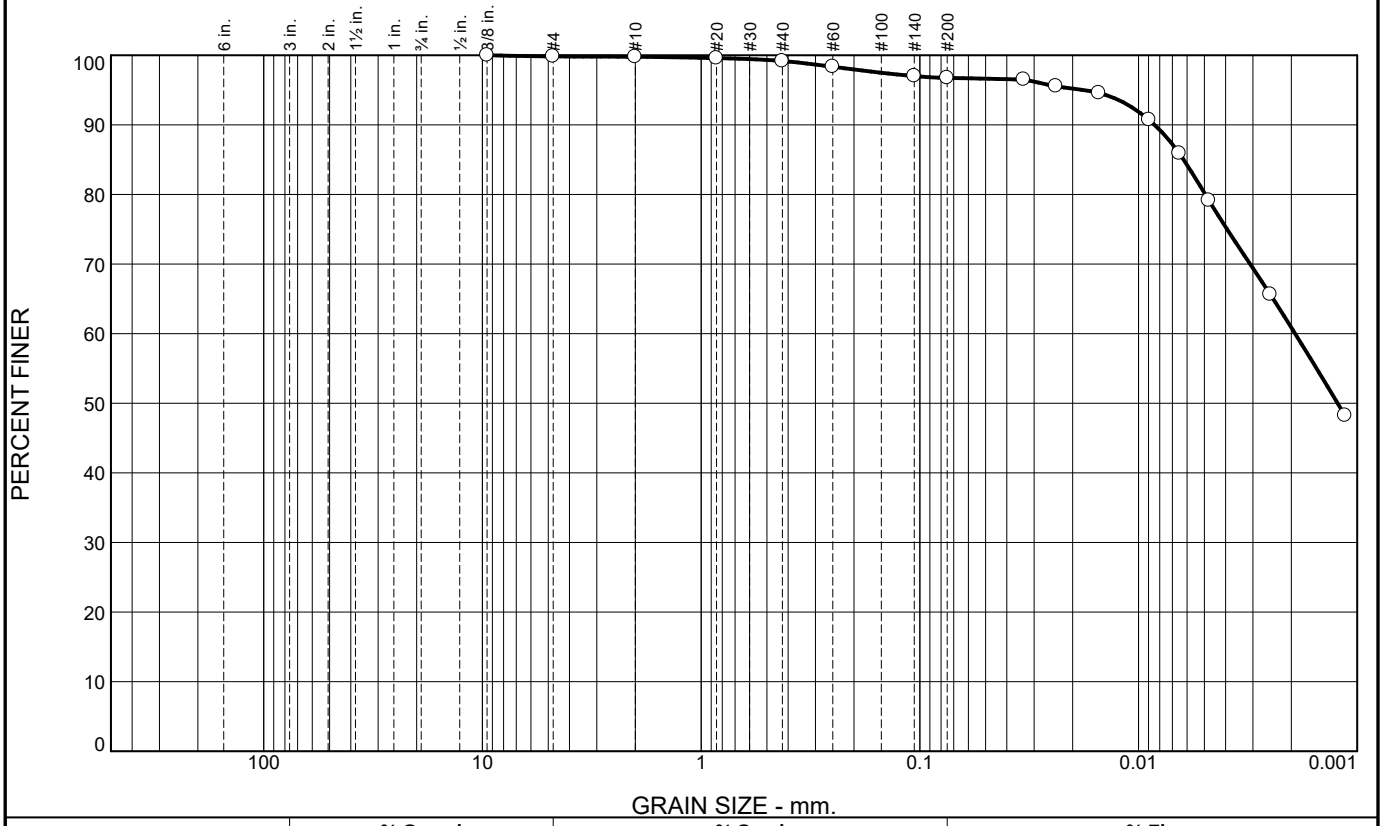
Location: MW21-4 SS8
Sample Number: 21MM-846

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.0	0.6	2.4	16.6	80.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5mm	100.0		
4.75mm	99.8		
2mm	99.8		
0.850mm	99.6		
0.425mm	99.2		
0.250mm	98.3		
0.106mm	97.0		
0.075mm	96.8		
0.0335 mm.	96.5		
0.0238 mm.	95.5		
0.0152 mm.	94.6		
0.0090 mm.	90.7		
0.0065 mm.	85.9		
0.0048 mm.	79.1		
0.0025 mm.	65.6		
0.0011 mm.	48.3		

* (no specification provided)

Soil Description

Clay, some silt, trace sand, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0084 D_{85}= 0.0062 D_{60}= 0.0019
D_{50}= 0.0012 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.24, 2021

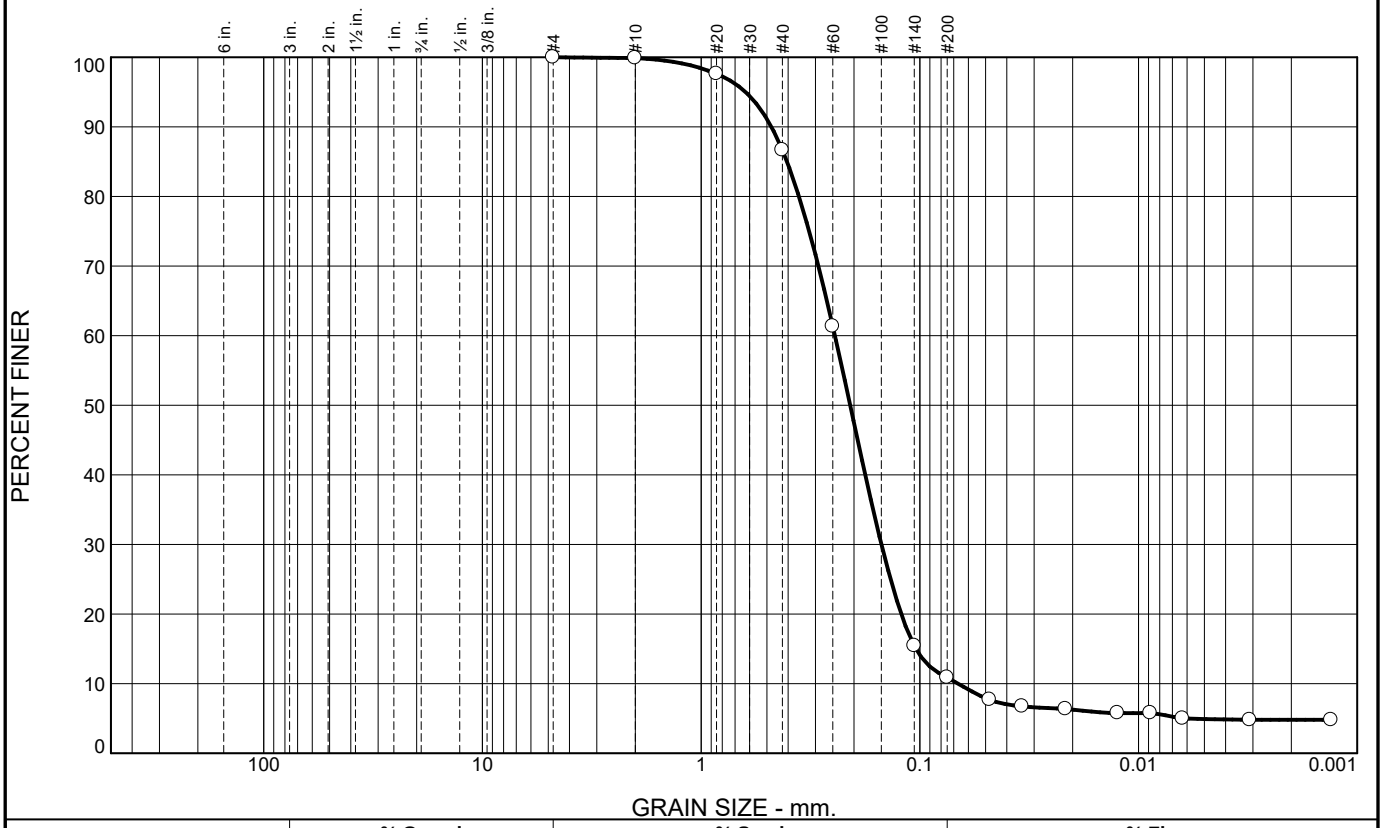
Location: MW21-5 SS4
Sample Number: 21MM-848

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	13.2	75.8	6.0	4.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4.75mm	100.0		
2mm	99.9		
0.850mm	97.6		
0.425mm	86.7		
0.250mm	61.4		
0.106mm	15.4		
0.075mm	10.9		
0.0480 mm.	7.7		
0.0341 mm.	6.7		
0.0216 mm.	6.4		
0.0125 mm.	5.8		
0.0088 mm.	5.8		
0.0063 mm.	5.0		
0.0031 mm.	4.8		
0.0013 mm.	4.8		

* (no specification provided)

Soil Description

Sand, trace silt, trace clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4771 D_{85}= 0.4049 D_{60}= 0.2445
D_{50}= 0.2082 D_{30}= 0.1498 D_{15}= 0.1041
D_{10}= 0.0668 C_u= 3.66 C_c= 1.37

Classification

USCS= AASHTO=

Remarks

Sampled by Nicole C. on Nov.24, 2021

Location: MW21-5 SS8
Sample Number: 21MM-847

Date: 06/12/21

Client: Barrie-Bryne Developments Limited
Project: 211-11672-00 - Barrie SmartCentres Harvie Rd Development

Project No: 211-11672-00 **Figure**

APPENDIX

C SEISMIC REPORT

TECHNICAL MEMORANDUM

TO: Sandi Chieu, B.Sc. Coordinator, Development Engineering, Smartcenters

FROM: Milan Situm, P.Geo.

SUBJECT: Seismic Site classification for mid-rise block 1, Barrie Smartcenter

PROJECT No.: 211-11672-00

DATE: November 29, 2021

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained to provide seismic site classification testing for the proposed structures that are located between Thrustwood Dr. and Highway 400 and south of Harvie Road, Barrie Ontario.

The seismic site classification was achieved using a combination of two (2) geophysical methods known as Multichannel Analysis of Surface Waves (MASW) and Microtremor Analysis Measurements (MAM).

This technical memorandum will include:

- Description of geophysical methods used
- Summary of field study
- One (1) example record from MASW and MAM
- One (1) MASW sounding with seismic site class

2 FIELD STUDY SUMMARY

The testing took place on November 23rd, 2021. Figure 1 shows the area which the testing took place. The equipment used was a Geode Seismograph made by Geometrics. The geode is controlled via laptop using the Seismodule Controller™ application. An array of twenty-four geophones (sensors) operating at a minimum frequency of four and a half hertz (4.5Hz) were used. Two spacings were used; a one (1) meter spacing (blue) and a three (3) meter spacing (red and blue) to highlight the soils characteristics at different depths. An eight (8) pounds sledgehammer was used as an active seismic source. An equipment fact sheet can be found in Appendix A.

Figure 1: Survey area (yellow) with 1-meter MASW spacing marked (blue) and 3-meter spacing marked (red and blue)

3 DATA ANALYSIS

MASW testing is the standard surface method for obtaining seismic site class. This is done by measuring the dispersion of Rayleigh surface waves which propagate within the underlying strata. The frequency vs. phase-velocity of these surface waves are directly correlated to the shear-wave velocity of the material(s) at their corresponding depths. Therefore, a 1D soundings with hard numbers can be created using inversion methods. More details behind the background of MASW can be found in Appendix B.

The data processing sequence involved: removing bad traces, plotting the phase velocity vs. frequency, picking the fundamental mode and applying an inversion. This is done through two modules from the SeisImagerSW™ software package. Theoretically all shots should produce the same shear-wave velocity 1D inversion model. However, this is only true if the geology is uniform along the entire length of the geophone array. In practice there will be lateral variation in the geology and material stiffness. These results are non-unique and the final model must be evaluated to be geologically realistic.

3.1 MASW (ACTIVE) RECORDS

The MASW records are created from measuring the energy response from an active seismic source. A one (1) meter spacing was used to highlight the characteristics of the soil within the upper six (6) meters and a three (3) meter spacing highlighted details between three (3) and twelve (12) meters. The data collected at this site was excellent.

Figure 2 is an example dispersion curve taken from the one (1) meter geophone interval. In this particular example there is a presence of a higher mode. However, the fundamental mode is actually an extremely narrow channel that lies around 200m/s. At a frequency of 25m the curve appears to cut slightly which suggests that there is a stiffer material, such as dry clay.

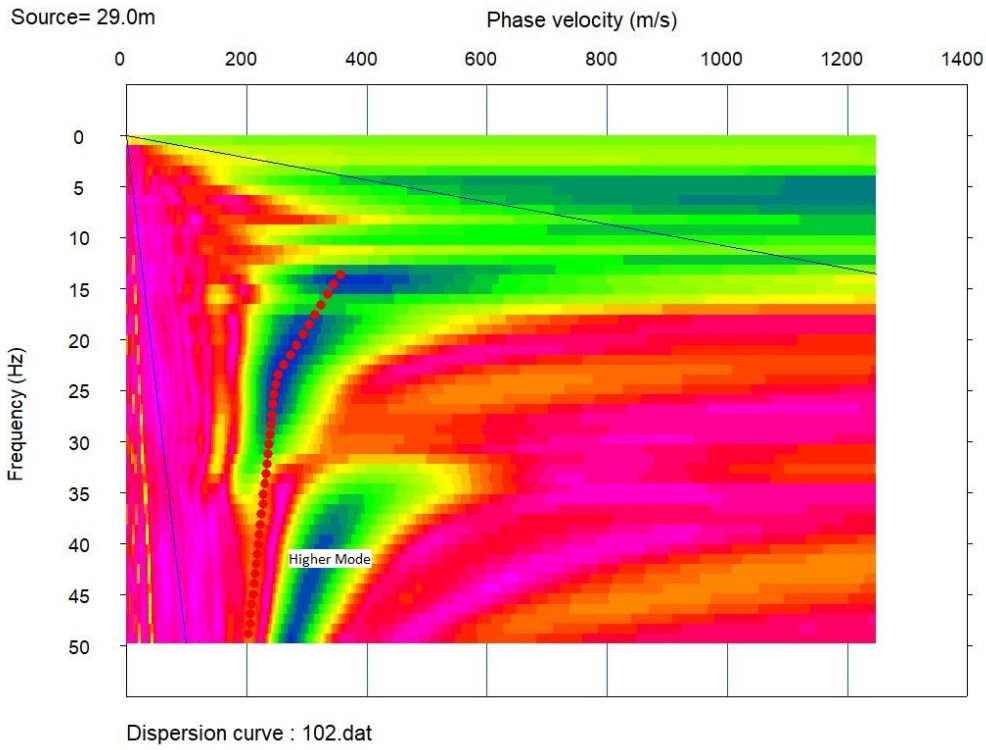


Figure 2: Example of active dispersion curve from a 1m spacing record

3.2 MAM (PASSIVE) RECORDS

The MAM records are created by recording the underlying acoustic noise. Not all noise is used, only the lower frequency portion is applied to modeling shear-wave data which traditionally lies in the fifteen (15) to thirty-five (35) meter range. The quality of the data was excellent.

Figure 3 is the dispersion curve from a 3m spacing. The passive data suggests that there is a very deep geologic layer which has a Vs of 400m/s-450m/s. There is a slight increase in velocity at 8Hz which could indicate 1) a change to a stiffer geologic layer or 2) an increase in geologic density.

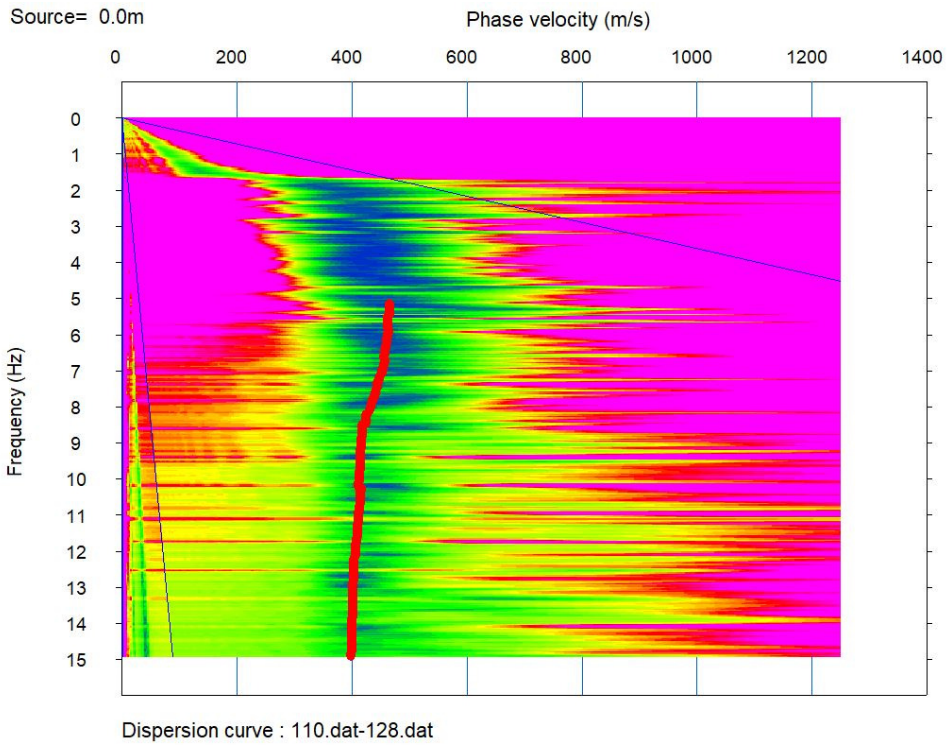


Figure 3: Passive data collected with 3m spacing

3.3 COMBINED RECORDS

The MASW dataset and MAM dataset can be combined to create a more concise model of the subsurface. The dispersion curves are appended together to make a single dispersion curve before the inversion is applied.

Figure 4 is the V_s sounding for mid-rise block **only**. A detailed explanation can be found in Section 4. The average V_s30 from the current surface level is 392m/s. The approximate location of the sounding can be found in the upper right-hand corner of the figure.

The estimated error in the average V_s30 value determined through MASW method is typically +/-10% for surface soundings. A value of 10% is an obligatory error value simply because modelling is involved. The actual error margin is typically better than 10%.

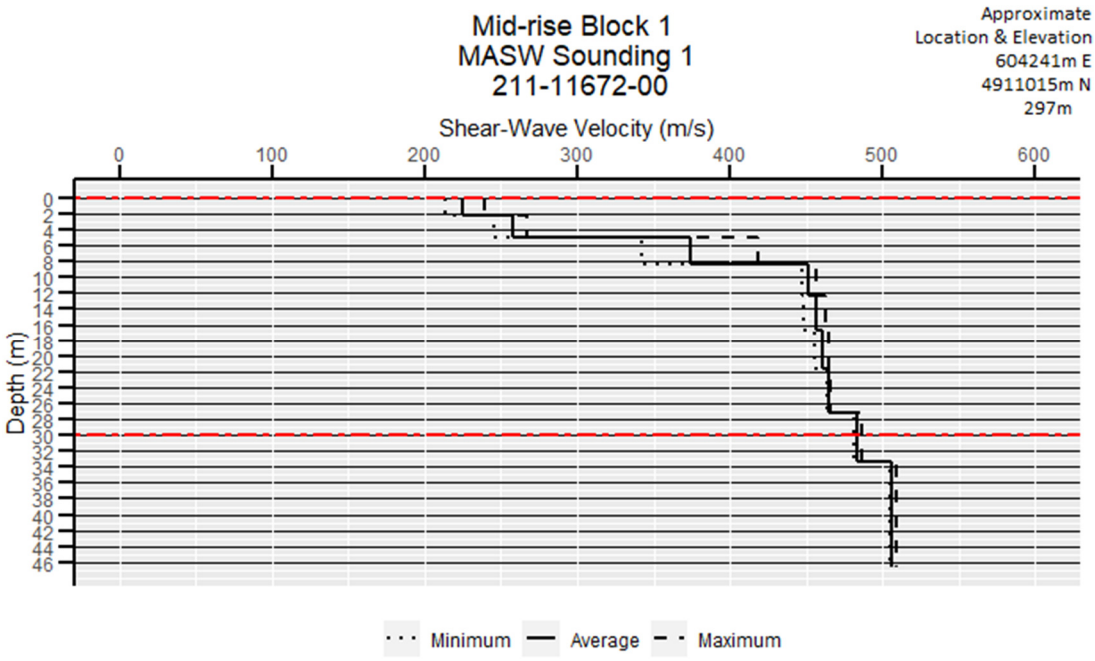


Figure 4: Sounding of Mid-rise Block 1

4 CONCLUSIONS

The approximate location of the survey can be found in Figure 1.

The combined MASW and MAM shear-wave velocity models are presented in Figure 4. The error envelope appears to be very small which suggests that the underlying geology is laterally uniform across the sixty-nine (69) meter geophone array.

The results are summarized in Table 1.

Table 1: Summary of V_s30 values for a slab-on-grade design (0m-30m)

Sounding	Minimum V_s30 (m/s)	Average V_s30 (m/s)	Maximum V_s30 (m/s)	Site Class
1	381	392	405	D

Although the Vs30 value is within site class C (360m/s < V_s30 < 760 m/s), there must be an error margin of 10% which is why it is a site class of D is recommended. Based on surface elevation of 297masl.

Table 2: Summary of V_s30 values for depth range (1m-31m)

Sounding	Minimum V_s30 (m/s)	Average V_s30 (m/s)	Maximum V_s30 (m/s)	Site Class
1	394	405	417	C

If the reference depth for the bottom slab of the building is only one meter deeper then the V_s30 value is over 400 m/s to cover the error margin and thus qualify for a seismic site class C as per table 4.1.8.4.A of the National Building Code of Canada, 2020 edition (also OBC 2012)**.**

The V_s30 values are based on the harmonic mean of the shear wave velocities over the 30m measured range. The surface can be any reference starting depth below the surface. The V_s30 value is calculated (as outlined in Commentary 'J' sentence 4.1.8.4(2) - 101 of the National Building Code) by dividing up the total depth of interest (e.g 30m) by the sum of the time spent in each velocity layer up to that depth. This harmonic mean value reflects the equivalent single layer response.

It must be noted that the site classification provided in this report is based on the V_s30 values as derived from the surface seismic testing method and may be superseded by specific geotechnical information. This geotechnical information includes, but is not limited to, the presence of sensitive and/or liquefiable soils, more than 3m of soft clays, moisture content, etc. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2020 Edition (also OBC 2012) for more information on the requirements for the site classification.

5 RECOMMENDATIONS

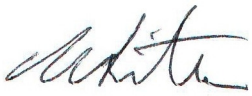
There are two important recommendations for this project:

1) The test can only be applied to any structure within 100 meters of the center of the test location.

2) The test is currently a site class 'D' but it can be improved to a Site Class 'C' if the bottom slab is one (1) meter below the testing grade (297 masl). The grade of the base of the lowest slab must be lower than 296masl.

3) The most important aspect to the test is that it has shown that a site class C is achievable for the general area. Regardless, the site class for larger structures throughout the project area would require a separate test. Not all structures benefit from an improved site class but generally all multistorey structures and single story with a very high ceiling see a savings in structural and mechanical elements.

Prepared by: Milan Situm, P.Geo.



Milan Situm, P.Geo.
Senior Geophysicist

APPENDIX A
EQUIPMENT SHEETS

Geode
Exploration Seismograph

GEOMETRICS
Innovation • Experience • Results

It is no wonder that over 2,700 Geodes have been sold. It is the most versatile and flexible seismograph available. Small and lightweight enough to pack in your suitcase, it expands easily for full-scale 2D and 3D surveys at a cost your bottom line will love. When you are not using the Geode for reflection, refraction, MASW/MAM, or tomography surveys, use it for monitoring earthquakes and other passive sources. The Geode will even do marine profiling or continuous recording. It is the most popular engineering seismograph in the world, and is widely used throughout the academic and research community.

For light-duty applications, you can use your laptop to view, record and even process your data. In harsh conditions, control your Geodes with Geometrics' StrataVisor NZ/C series computers and seismographs. You can connect Geodes together to build systems of over 1,000 channels. Geodes are shock-proof, dust-proof, submersible and able to withstand extreme temperatures.

Fifteen years on, we can say with confidence that the Geode is the most reliable seismograph we have ever produced. Because of this, we can offer a 3-year warranty backed by Geometrics, now in our 48th year of providing prompt, knowledgeable customer support.

FEATURES & BENEFITS

- **Bulletproof** - Not really, but almost. Survives 1.5m drop onto concrete in 14 orientations. The Geode comes standard with a 3-year warranty.
- **Distributed architecture** - Use standard 24-pair geophone cables, no matter how many channels.
- **Ultra-wide bandwidth** - Useful for everything from crosshole surveys to earthquake monitoring.
- **Geophone and line testing** - No need for time-consuming "tap test".
- **Versatile** - Configure systems ranging from 8 to 1000 channels.*
- **Waterproof and dustproof** - No need to pick up the system in a sudden rain or dust storm.
- **High temperature range** - Use in the Sahara, Amazon or at the North Pole.
- **GPS synchronization** - Sub-sample timing accuracy so you know exactly when an event occurs.

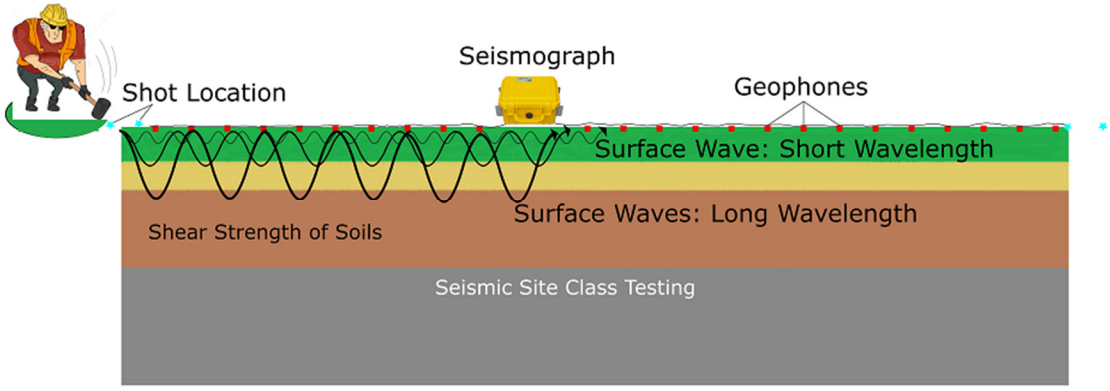
* Systems can be expanded temporarily via Geometrics' rental pool or existing loaner networks.

APPENDIX B
GEOPHYSICAL BACKGROUND

Multichannel Analysis of Surface Waves (MASW) and Micro-tremor Array Measurements (MAM) are geophysical methods that use acoustic waves to measure the shear-wave velocity of the material within the subsurface. To measure this, the dispersion properties of Rayleigh surface waves are measured as a change in phase velocity with frequency. A general property of waves is that their energy decays exponentially with depth, known as the penetration depth, and frequency is inversely proportional to penetration depth. This simply means that lower frequency waves will travel deeper into the underlying strata, and their phase velocities will be influenced by the medium they are travelling in. The range of phase-velocities yields a Rayleigh wave dispersion curve and the inversion of this curve produces a shear-wave velocity (v_s) sounding. The shear wave velocity is useful because it is directly correlated to the stiffness of the underlying strata, known as the shear modulus. The figure below demonstrates the principles of this.

Common Applications of MASW include:

- Seismic Site Classification
- Compaction Evaluation
- Grouting Evaluation
- Anomaly Detection
- Soil-Bedrock Mapping



Site classification involves the principle of wave propagation, as previously described, and amplification of ground motion. The amplification of the ground motion is inversely proportional to the stiffness of the material. The higher stiffness a material has the less ground motion amplification produced. There are six seismic site classifications: A, B, C, D, E and F. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2020 Edition (also OBC 2012) for more information on the requirements for the site classification.

APPENDIX

D PREVIOUS GEOTECHNICAL REPORTS

CITY OF BARRIE
181-06461-00

HYDROGEOLOGICAL ASSESSMENT

BRYNE DRIVE EXTENSION, BARRIE, ONTARIO

NOVEMBER 22, 2021

wsp

HYDROGEOLOGICAL ASSESSMENT

BRYNE DRIVE EXTENSION, BARRIE, ON

CITY OF BARRIE

DRAFT

PROJECT NO.: 181-06461-00
DATE: NOVEMBER 22, 2021

WSP
2 INTERNATIONAL BLVD, SUITE 201
TORONTO, ON
M9W 1A2

T: +1 416-798-0065
WSP.COM

November 22, 2021

City of Barrie
70 Collier Street
PO BOX 400
Barrie, Ontario
L4M 4T5

Attention: **Mr. Alvaro L. Alumina, P.Eng., PMP**

Re: Hydrogeological Assessment – Bryne Drive Extension, Barrie, Ontario

WSP Canada Inc. is pleased to present the Hydrogeological Assessment report, which has been prepared in support of the Bryne Drive Extension from Harvie Road to Caplan Avenue in Barrie, Ontario. This report documents relevant background information, results of our field investigations and analyses, and provides findings and conclusions.

Please do not hesitate to contact the undersigned, should you have any questions or require any further assistance.

Yours sincerely,

WSP Canada Inc.

DRAFT

Gord Jarvis
Environmental Consultant, Project Manager

DRAFT

Natalia Codoban, M.Eng., P.Eng.
Senior Hydrogeologist

WSP ref.: 181-06461-00

2 INTERNATIONAL BLVD, SUITE 201
TORONTO, ON
M9W 1A2

T: +1 416-798-0065

wsp.com

SIGNATURES

PREPARED BY

DRAFT

Gord Jarvis
Environmental Consultant, Project Manager

REVIEWED BY

DRAFT

Natalia Codoban, M.Eng., P.Eng.
Senior Hydrogeologist

This report was prepared by WSP Canada Inc. (WSP) for the account of CITY OF BARRIE, in accordance with the Proposal for Additional Hydrogeological Services Agreement (dated June 17, 2021). The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Objectives 1

1.2 Scope and Methodology 1

2 STUDY AREA CONDITIONS 3

2.1 Physiography and Drainage 3

2.2 Bedrock Geology 3

2.3 Surficial Geology 4

2.4 Hydrostratigraphy 4

2.5 Site Stratigraphy 5

3 HYDROGEOLOGICAL ASSESSMENT 7

3.1 Ministry of the Environment, Conservation and Parks Water Well Record Review 7

3.2 Existing Permit To Take Water and Environmental Activity and Sector Registry Search 8

3.3 Source Water Protection – Identification of Vulnerable Areas 8

3.4 Groundwater Conditions 9

3.4.1 Water Level Monitoring 9

3.4.2 Groundwater Flow System Characterization 10

3.5 Hydraulic Conductivity Testing 10

3.6 Groundwater Quality 11

4 DEWATERING ASSESSMENT 13

4.1 Short-Term Dewatering Requirements 14

4.1.1 Construction Dewatering Flow Equations 15

4.1.2 Zone of Influence 16

4.1.3 Results of Construction Dewatering Estimation 16

4.1.4 Storm Water Contribution 17

4.2 Water Taking and Discharge Permitting 18

4.2.1 Environmental Activity and Sector Registry 18

4.2.2 MECP Permit to Take Water 18

4.2.3 Discharge to Natural Environment 18

4.2.4 City of Barrie Discharge Agreement 19

5 POTENTIAL GROUNDWATER IMPACTS....20

5.1 Impacts to Groundwater Users 20

5.2 Impacts to Nearby Structures 20

5.3 Impacts to Natural Heritage Systems.....21

5.4 Contaminant Migration 21

5.5 Well Decommissioning 21

6 MONITORING PLAN.....22

7 CONCLUSIONS AND RECOMMENDATIONS 24

8 STANDARD LIMITATIONS 27

9 REFERENCES.....29

TABLE OF CONTENTS

LIST OF TABLES

TABLE 1: SUMMARY OF SOURCE PROTECTION VULNERABILITY 8
TABLE 2: GROUNDWATER LEVELS IN MONITORING WELLS 9
TABLE 3: SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS 11
TABLE 4: CONSTRUCTION DEWATERING ASSUMPTIONS 14
TABLE 5: CONSTRUCTION DEWATERING FLOW ESTIMATES 17
TABLE 6: GROUNDWATER MONITORING PLAN 22

FIGURES

FIGURE 1 SITE LOCATION PLAN AND MECP WELL RECORDS
FIGURE 2 PHYSIOGRAPHY MAP
FIGURE 3 SURFICIAL GEOLOGY
FIGURE 4 BOREHOLE LOCATION PLAN
FIGURE 5 SHALLOW GROUNDWATER CONTOURS
FIGURE 6 PLAN AND PROFILE DRAWING PP4 (MW1)
FIGURE 7 PLAN AND PROFILE DRAWING PP2 (MW2)
FIGURE 8 PLAN AND PROFILE DRAWING PP1 (MW3)
FIGURE 9 PLAN AND PROFILE DRAWING PP6 (BH18-OF1 & BH18-21))

APPENDICES

APPENDIX A MECP WATER WELL RECORDS
APPENDIX B BOREHOLE AND MONITORING WELL LOGS
APPENDIX C HATCH PLAN AND PROFILE DESIGN DRAWINGS
APPENDIX D HYDRAULIC CONDUCTIVITY TEST ANALYSIS
APPENDIX E LABORATORY CERTIFICATE OF ANALYSIS
APPENDIX F DEWATERING CALCULATIONS

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the City of Barrie to complete a hydrogeological assessment in support of the Bryne Drive Extension. The alignment of the extension is located between Harvie Road and Caplan Avenue (herein referred to as the "Site"), north of Mapleview Drive and west of Highway 400, Ontario. To evaluate regional hydrogeological conditions, a 500-m buffer zone (the "Study Area") was added around the Site (see **Figure 1**).

The Site is located within an agricultural field, bordered by forested area to the north, Highway 400 to the east, commercial buildings to the south and residential development to the west.

It is understood that the design for the Bryne Drive extension from Harvie Road to Caplan Avenue includes:

- Approximately 1 km of roadway to be constructed;
- Road base construction, including widening to five lanes; and,
- Associated municipal services, including storm and sanitary sewers, and watermain.

1.1 OBJECTIVES

The objectives of this study are to characterize the hydrogeological conditions on-site, assess groundwater quality, identify potential construction dewatering needs, and prepare a hydrogeological report in support of an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW), if required.

1.2 SCOPE AND METHODOLOGY

To characterize site conditions, a combination of existing historical information and field data was used. The scope of work for the hydrogeological investigation included:

- A detailed review and interpretation of existing background information on earth sciences and groundwater resources in the Study Area, including previous geotechnical/ hydrogeological reports and Ministry of the Environment, Conservation and Parks Water Well Records (MECP WWRs);
- Field visit to examine the current site conditions;

- Drilling three boreholes and installing three monitoring wells, to supplement the existing two monitoring wells within the area of the alignment. Wells were installed as part of the geotechnical investigation, to understand geological lithology and stratigraphy, current groundwater levels, and groundwater quality;
- Monitoring groundwater levels at all available monitoring wells;
- Conducting in-situ single well response test (rising head) to calculate the hydraulic conductivity at select well locations;
- Collecting three groundwater samples from the newly installed monitoring wells and submission of samples for laboratory analysis of parameters outlined in the City of Barrie Storm/Sanitary Sewer Use By-Law and Provincial Water Quality Objectives;
- Evaluating temporary construction dewatering requirements for construction of the road alignment and assessing the impacts this may have on local groundwater resources; and,
- Preparing a hydrogeological investigation report in accordance with the Ontario Water Resources Act and Ontario Regulation 387/04 for use as a supporting document for a PTTW application or EASR submission, as needed.

2 STUDY AREA CONDITIONS

2.1 PHYSIOGRAPHY AND DRAINAGE

The Site and the Study Area are located entirely within the Peterborough Drumlin Field physiographic region of Southern Ontario (Chapman and Putnam, 1984; MNR, 1984). The region is characterized by drumlins that rise from through the relatively flat lying Newmarket Till Plain. Drumlinized till plains are present within the Study Area, as shown on **Figure 2**.

The Site has a rolling topography and with an overall downward slope towards the northeast. The ground surface elevations at the Site range between approximately 305 in the southern portion of the Site and 286 meters above sea level (masl) in the northern portion of the Site (Google Earth Pro, October 2021).

Based on the watershed mapping provided by the Lake Simcoe Region Conservation Authority (LSRCA, 2012), the Site is present within both the Lovers Creek and Barrie Creeks Subwatersheds of the Lake Simcoe Watershed. Drainage in the southern portion of the Site along the existing Bryne Drive alignment would be managed through municipal storm sewers. In the undeveloped portion of the Site, there is a gully approx. 3 to 4 m deep that drains towards the eastern part of the Site, underneath Highway 400, and discharges to a tributary of Lovers Creek, located approximately 2.5 km east of the Site. The northern portion of the undeveloped area of the Site's drainage is towards the northeast and discharges to Whiskey Creek (see **Figure 1**).

Both Lovers Creek and Whiskey Creek flow generally north to into Kempenfelt Bay (Lake Simcoe), located northeast of the Site. It should be noted that Lovers Creek Wetland Complex, present approximately 2.5 km east of the Site, outside of the Study Area, is a Provincially Significant Wetland (PSW) as identified by the Ministry of Northern Development, Natural Resources and Forestry (NDMNRF). There are no PSW or unevaluated wetlands within the Study Area (MNRF, October 2021).

2.2 BEDROCK GEOLOGY

The bedrock in the Study Area is mapped as shale and limestone of the Middle Ordovician-aged Lindsay Formation of the Simcoe Group (OGS, 1991). The depth to bedrock is over 100 m below ground surface in the area of the Site, as shown in the MECP water well records (see **Appendix A**). Bedrock was not encountered at the Site during this investigation where

boreholes extended to depths of 12.7 m below the ground surface (mbgs), as shown on boreholes logs in **Appendix B**.

2.3 SURFICIAL GEOLOGY

The occurrence and character of the overburden are a result of the repeated glacial advances and retreats that occurred in Southern Ontario. The native surficial soils in the Study Area are comprised predominantly of Ice-Contact Stratified deposits of sand and gravel, with minor inclusions of silt and clay and till. Fine-textured glaciolacustrine massive to well laminated deposits of silt and clay, minor sand and gravel are present at the northern portion of the Study Area. An organic deposit or peat and muck is located in the western portion of the Study Area, outside of the road alignment. Sandy silt to silty sand textured till (Newmarket Till) is also identified as surficial soils within the western and southern portions of the Study Area (OGS, 1990). The surficial geology at the Site and Study Area is shown on **Figure 3.**

2.4 HYDROSTRATIGRAPHY

The hydrostratigraphic units in the Study Area have been well documented in watershed studies for the Lake Simcoe Watershed and Lovers Creek and Barrie Creek's Subwatersheds as well as source water protection reports applicable to the Barrie area. Based on the information in these reports, overburden hydrostratigraphy in the area of the Site is made up of a sequence of regional aquifer and aquitard units. Aquifers have been identified as units A1, A2, A3 and A4, and aquitards as C1, C2, C3 and C4, extending from shallowest to the deepest (LSRCA, 2012).

This report focuses on the aquifer and aquitard units that have the potential to be impacted by the proposed construction at the Site. The following summary describes the characteristics of the A1 aquifer and the C1 aquitard as they are present in the area of the Site from shallowest to deepest:

- **A1 Aquifer** is generally described as an ice-contact stratified drift sequence of coarse grained glacial sediments deposited during the Mackinaw Interstadial Period. The unit is commonly found above elevations of 250 masl. It has been mapped in some locations reaching elevations of up to 350 masl in upland areas and as low as 220 masl in some lowland areas. Though the aquifer may be confined in some local areas, it is typically an unconfined surficial unit; and
- **C1 Aquitard** is identified as a clay to silty clay diamicton matrix (till) that is approximately 20 m thick in the area of the Site.

- **A2 Aquifer** consists of sand deposits with some clast rich portions. The A2 aquifer ranges in thickness from approximately 10 to 30 m in most areas. It is found at elevations of 175 to 230 masl within the lowland areas but the stratigraphic equivalent extends up to approximately 250 masl to the northeast, under the Oro Moraine.

2.5 SITE STRATIGRAPHY

The overburden layers on the Site, identified by WSP during the drilling program for this hydrogeological assessment, are summarized below. The geotechnical investigation completed by WSP in 2018 included drilling 23 boreholes and installing five monitoring wells along the alignment from Harvie Road to Caplan Avenue. The borehole and monitoring well logs are included in **Appendix B**; the locations of boreholes and monitoring wells advanced on the Site are shown on **Figure 4**. Note that groundwater monitoring wells installed at the BH18-20, BH18-23 and BH18-33 locations, as part of the geotechnical investigation, were not accessible and/or destroyed prior to this hydrogeological assessment.

Stratigraphic descriptions have been incorporated onto the Plan and Profile drawings of the road alignment, prepared by Hatch and provided by the City of Barrie to WSP, at the monitoring well locations referenced in this assessment (MW1, MW2, MW3, BH18-21 and BH18-OF1), and are presented as **Figures 6, 7, 8** and **9**. Plan and profiles are included in **Appendix C**.

PAVEMENT AND TOPSOIL

An asphalt pavement structure was encountered at the borehole locations advanced on the existing portions of Bryne Drive. Topsoil was encountered for boreholes advanced either in the existing roadway boulevards or the agricultural fields between the existing ends of Bryne Drive and Harvie Road.

The asphalt / topsoil and granular thicknesses at each of the borehole locations was included in the geotechnical investigation report. The asphalt, where encountered, ranged in thickness from 13 to 19 mm, and topsoil, where encountered ranged in thickness from 20 to 40 mm thick (except for BH18-20 where topsoil thickness was 70 mm) and is described generally as dark brown, moist, sandy silt.

FILL MATERIALS

Fill materials were encountered in the majority of the boreholes underlying either the topsoil or the pavement structure. The fill materials were non-cohesive and ranged from sand and gravel to

sand and silt. The fill materials were brown and moist to wet and extended to depths of 0.5 to 3.5 mbgs. Trace organics were noted in several of the fill samples.

NON-COHESIVE DEPOSITS

Native non-cohesive deposits were encountered in each of the boreholes advanced at the Site. The non-cohesive deposits were brown, moist to saturated, and ranged from sand to silty sand to sand and silt, with trace to some amounts of clay and trace gravel in all boreholes / monitoring wells. The non-cohesive deposits were generally interlayered with the glacial till encountered at the Site. The non-cohesive deposit encountered at the Site has been interpreted to represent the A1 Aquifer in the Study Area.

GLACIAL TILL

A variable glacial till was encountered in several of the boreholes, generally interlayered with the non-cohesive deposits. The till ranged between non-cohesive till (silty sand to sandy silt) to cohesive till (clayey silt) and was brown and moist to wet. Boulders and cobbles are inferred to be present within the till deposit.

COHESIVE DEPOSITS

Native cohesive deposits were encountered in several of the boreholes advanced at the Site. The cohesive deposits were brown to grey, moist to wet, and generally comprised clayey silt to silt and clay containing variable amounts of sand and gravel. The cohesive deposits were generally interlayered with the non-cohesive deposits and glacial till encountered at the Site. The cohesive deposit encountered at the Site has been interpreted to represent the C1 Aquitard in the Study Area.

3 HYDROGEOLOGICAL ASSESSMENT

3.1 MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS WATER WELL RECORD REVIEW

The MECP WWR database was reviewed to determine the number and locations of water wells present within a 500-m radius of the Bryne Drive Extension alignment from Harvie Drive to Caplan Road (i.e., within the Study Area).

The MECP WWR database indicated that there are twenty-nine well records within the Study Area. Locations of identified well records are shown on **Figure 1**. A summary of the WWRs is included in **Appendix A**. A review of the records indicate that a majority of the wells were reported to be monitoring wells, observation wells, test holes or abandoned wells.

Based on the record details, there are nine water supply wells found within the search radius; of these, seven well records indicate groundwater use for domestic water supply, and two well records indicate groundwater use for industrial supply in the Study Area. The domestic supply wells are located within areas of commercial development, with the exception of well #5713455 which is located just south of Harvie Road in an area of residential development. Well #5713455 was completed in 1975, with a screened interval of 43.6 to 44.5 m below ground, corresponding to elevations of 262.6 –263.6 masl, in coarse to fine sand. Industrial well #5708906 was advanced immediately east of Highway 400 and south of Harvie Road in 1972, with a well screened at the depth of 41.1 to 43.6 mbgs (elevations 257.6 – 260.1 masl) in fine to medium sand. Based on the years of the well construction, it is interpreted there are old well records and the wells were decommissioned.

Domestic wells #5701447, #5701450, #5707578, #5708284, #57135655, #5720702 and #5738555 were advanced in the Study Area between 1965 and 2003 (see **Appendix A**). Wells #5701447, #5701578 are 6.1 and 4.6 m deep wells, while the depth for wells #5701450, #5708284, #5713455, #5720702 and #5738555 varies between 16.5 mbgs (elevation of 289.1 masl) and 66.4 mbgs (elevation of 240.1 masl). It is interpreted that most of these wells obtain water from Aquifer A1; well #5738555 is interpreted to be obtaining water from Aquifer #2.

Interpretation of construction impacts to water wells is included in Section 5.1.

3.2 EXISTING PERMIT TO TAKE WATER AND ENVIRONMENTAL ACTIVITY AND SECTOR REGISTRY SEARCH

The MECP maintains a database of all active PTTW and EASR items, related to construction dewatering. A review of the MECP PTTW database indicated that there are no active PTTW registration found within 1 km of the Site (MECP, September 2021a). A review of Access environment records indicates that one water taking EASR was registered for between November 2018 to November 2020 for works on the south side of Harvie Road, west of the Bryne Drive Extension alignment (MECP, September 2021b). This is a record for the expired EASR.

3.3 SOURCE WATER PROTECTION – IDENTIFICATION OF VULNERABLE AREAS

The Study Area lies within the Lovers Creek and Barrie Creeks Subwatersheds of the Lake Simcoe Watershed, and is in the South Georgian Bay Lake Simcoe (SGBLS) Source Protection Region (SPR). The SGBLS SPR is under the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA), Nottawasaga Valley Conservation Authority and Severn Sound Environmental Association. The *Approved Source Protection Plan* (2015, amended 2019) is the reference document, which outlines the relevant policies within the jurisdiction boundaries.

The study boundaries were evaluated to identify any potential drinking water vulnerabilities and threats, including the proximity to any vulnerable areas, including the following:

- Highly Vulnerable Aquifers (HVA)
- Significant Groundwater Recharge Areas (SGRA)
- Intake Protection Zones (IPZ)
- Wellhead Protection Areas (WHPA)
- Wellhead Protection Area-Q (WHPA-Q, Water Quantity)

As indicated in **Table 1**, the Site is not within an HVA or a surface water IPZ. The Bryne Drive extension alignment falls within a SGRA, with vulnerability scores ranging from 2 to 4. The Site does not fall within a WHPA, or WHPA Q1, but is within the WHPA Q2 for the Barrie municipal water supply. The *Approved Source Protection Plan* (2015, amended 2019) indicates that the WHPA-Q2 is "An area delineated through a Tier 3 Water Budget and Water Quantity Risk Assessment as being the area that includes the WHPA-Q1 and any area where a future reduction in recharge would significantly impact that area". Low Impact Development techniques are

recommended to be incorporated into the design of the Bryne Drive extension road alignment to mitigate potential reductions in groundwater recharge as a result of the construction of the Bryne Drive extension.

Table 1: Summary of Source Protection Vulnerability

SOURCE PROTECTION DETAILS FOR LOCATION			
Highly Vulnerable Aquifer (HVA)	NO	**Wellhead Protection Area (WHPA):**	NO
Significant Groundwater Recharge Area (SGRA)	YES	**Wellhead Protection Area Q1 (WHPA-Q1):**	NO
Intake Protection Zone (IPZ)	NO	**Wellhead Protection Area Q2 (WHPA-Q2):**	YES

3.4 GROUNDWATER CONDITIONS

3.4.1 WATER LEVEL MONITORING

The water level monitoring data from the groundwater monitoring wells (MW1, MW2 and MW3) that were installed as part of the hydrogeological assessment, and the existing BH18-21 and BH18-OF1, installed during the geotechnical drilling program, were used to evaluate the depth to the groundwater table at the Site. The water level monitoring results are summarized in **Table 2** below.

The water level monitoring information indicates that the depth to the water table ranged between 2.86 and 7.73 mbgs, or elevations of 301.4 to 289.4 masl in September 2018, November 2018 and September 2021. These water levels appear representative of the depth to the water table in the A1 Aquifer identified in the Study Area.

The water level data at the BH18-OF1 differs from the data for the other monitoring locations. Wells MW1, MW2, MW3 and BH18-21 are screened in silty sand and silt and sand. Well BH18-OF1 is screened in clayey silt with trace sand at the depth of 2.2 to 5.0 mbgs, in proximity to a tributary of Whiskey Creek. It is interpreted that silty sand in this well is representative of the soils of the Whiskey Creek and there is a hydraulic connection between silty sand and voids in clayey silt with trace sand. When there is surface water flow in the Whiskey Creek, the water level in well BH18-OF1 is shallow. When there no water flow in the Creek, well BH18-OF1 is anticipated to be dry.

The water level monitoring data for the project have been recorded during the months of September and November 2018, and September 2021, and are interpreted to be not representative of seasonal high groundwater levels. Further groundwater level monitoring, through the months of March, April and May of 2022, will indicate the expected seasonal high groundwater levels, as groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

Table 2: Groundwater Levels in Monitoring Wells

MONITORING WELL	GROUND SURFACE ELEVATION (masl)	WELL DEPTH (mbgs)	DATE OF WATER LEVEL MEASUREMENT	DEPTH OF GROUNDWATER LEVEL (mbgs)	GROUNDWATER ELEVATION (masl)
NORTHERN PORTION OF THE SITE					
MW1	302.7	7.6	September 7, 2021 September 8, 2021	6.67 6.67	296.0 296.0
MW2	303.8	6.1	September 7, 2021 September 8, 2021	2.89 2.86	300.8 300.9
MW3	305.0	6.1	September 7, 2021 September 8, 2021	3.72 3.62	301.3 301.4
BH18-21	297.1	11.5	September 21, 2018 November 2, 2018 September 8, 2021	7.70 7.30 7.73	289.4 289.8 289.4
BH18-OF1	295.1	4.5	September 21, 2018 November 2, 2018 September 8, 2021	1.50 1.40 DRY	293.6 293.7 < 290.6

3.4.2 GROUNDWATER FLOW SYSTEM CHARACTERIZATION

Based on the local topography, the direction of shallow groundwater flow in the area is generally expected to be north to northeast towards Kempenfelt Bay, with localized influence from the tributaries of Lovers Creek and Whiskey Creek. An interpreted overburden groundwater contour map is included as **Figure 5** and includes the water levels measured in the wells on September 8, 2021.

3.5 HYDRAULIC CONDUCTIVITY TESTING

On September 8, 2021, single well response tests (SWRT) were conducted by WSP at the three monitoring wells (MW1, MW2 and MW3) as part of this assessment, to estimate the saturated hydraulic conductivity (K) of the soil at the well screen depths. The testing was done by

performing an in-situ rising head test using a datalogger placed in the well to accurately measure the change in head versus time.

The hydraulic conductivity values for each of the tested wells were calculated from the SWRT data, using Aquifer Test Software and the Bouwer & Rice computation method. The semi-log plots for normalized drawdown versus time are included in **Appendix D** and the test results are summarized in **Table 3** below.

Table 3: Summary of Hydraulic Conductivity Test Results

MONITORING WELL	WELL DEPTH (mbgs)	DOMINANT LITHOLOGY ACROSS SCREENED INTERVAL	SCREEN DEPTH RANGE (mbgs)	HYDRAULIC CONDUCTIVITY (m/sec)
NORTHERN PORTION OF THE SITE				
MW1	7.6	Silty Sand to Silt	6.1 to 7.6	4.2×10^{-6}
MW2	6.1	Sand	4.6 to 6.1	3.1×10^{-4}
MW3	6.1	Sand	4.6 to 6.1	2.1×10^{-4}

As can be seen from **Table 3**, the results show that hydraulic conductivity values for the overburden wells ranged between 4.2×10^{-6} m/sec and 3.1×10^{-4} m/sec. These values are consistent with what is expected from the tested sand and silty sand to silt formations.

For a conservative dewatering assessment, the overburden will be considered to be one continuous unit, with the hydraulic conductivity value of 3.1×10^{-4} m/sec used in the calculations.

3.6 GROUNDWATER QUALITY

To assess the suitability for discharge of pumped groundwater during construction activities, three groundwater samples were collected; one from each of wells MW1, MW2 and BH18-21 on September 8, 2021. Prior to collection of the samples, approximately three (3) standing well volumes of groundwater were purged from the wells.

The samples were field-filtered and collected and placed into laboratory-supplied vials and/or bottles containing analytical test group specific preservatives, as required. The metals samples were field filtered. Dedicated nitrile gloves were used by WSP staff during sample handling. The groundwater samples were submitted to an independent laboratory, Caduceon Environmental Laboratories, in Barrie, Ontario, for analysis of parameters listed in the City of Barrie Sewer Use By-Law. Caduceon is a laboratory certified by the Canadian Association for Laboratory Accreditation Inc.

For the assessment purposes, the analytical results were compared to Table 1 – Limits for Sanitary Sewer Discharge and Table 2 – Limits for Storm Sewer Discharge (The Corporation of the City of Barrie By-Law Number 2021-002), and key parameters of Provincial Water Quality Objectives (PWQO). A summary of the analytical results and the laboratory Certificate of Analysis (CofA) are enclosed in **Appendix E**.

The analysis indicates that all City of Barrie Sanitary Sewer Discharge By-Law criteria were met. Parameters that exceeded the City of Barrie Storm Sewer Discharge By-Law included only total suspended Solids (TSS) at all three sampling locations.

The analysis indicates that concentration of cobalt of 23 µg/L in the sample collected at MW2 exceeded the PWQO criteria of 0.9 µg/L; concentration of cobalt was below the Reporting Detection Limit (R.D.L.) of 5 µg/L at two other sampling locations but the R.D.L. exceeded the cobalt's PWQO of 0.9 µg/L. Concentrations of zinc in two samples (23 and 33 µg/L) exceeded the PWQO of 5 µg/L; concentration of zinc in the third sample was below its R.D.L. and PWQO. Concentration of phosphorus of 300 µg/L in the sample from well MW1 exceeded the PWQO criteria, while concentration of phosphorus in two other samples was below the R.D.L. of 10 µg/L and below the PWQO. Concentrations of several parameters, including hexachlorobenzene, lead, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(a,h)anthracene, chrysene, fluoranthene, phenanthrene, phenolics and silver below their R.D.L. but R.D.L. were above the PWQO.

Based on these results groundwater is suitable to be pumped from the Site to the City of Barrie Sanitary sewers. Pre-treatment will be required before any groundwater can be pumped from the Site to the City of Barrie Storm sewers. Treatment options typically include the use of weir tanks for discharge water detention and settlement of suspended solids, or filtration.

It should be noted that a discharge permit from the City of Barrie is required to be obtained prior to any construction dewatering discharge activity to the City of Barrie sewers.

Alternatively, groundwater collected during construction can be discharged to the natural environment, utilizing proper erosion and sediment control methods. Groundwater treatment will also be required to be implemented to ensure the discharge meets the PWQO criteria.

4 DEWATERING ASSESSMENT

It is understood that the design for the Bryne Drive extension from Harvie Road to Caplan includes:

- Approximately 1 km of roadway to be constructed;
- Road base construction, including widening to five lanes; and,
- Associated municipal services, including storm and sanitary sewers, and watermain.

Based on detailed review of the Plan and Profile drawings, we understand that:

- The start of the Bryne Drive extension project starts at Caplan Avenue at chainage 3+262.5, and ends south of Harvie Road at chainage 4+230, resulting in a total length of approximately 970 m;
- An existing sanitary sewer extends under the current alignment of Bryne Drive from Caplan Avenue to the dead-end adjacent to commercial buildings;
- The installation of the storm sewer and watermain at elevations illustrated on the Plan and Profile drawings (see **Appendix C**) will not extend below the water table, based on the current groundwater level monitoring data. The exception is a connection of the storm sewer section at chainage 4+218 to 4+225;
- Construction of the proposed sanitary sewer will require the deepest excavations during the project which will extend below the water table; and,
- The proposed sanitary sewer starts at chainage 3+610; the manhole location of PMH1 with a base elevation of approximately 299.8 masl, PMH2 at chainage 3+720 has a proposed base elevation of 298.7 masl, PMH3 at chainage 3+820 has a proposed base elevation of 298.4 masl, PMH4 at chainage 3+930 has a proposed base elevation of 297.5 masl, and PMH5 at chainage 4+040 has a proposed base elevation of 293.7 masl.

Based on the interpreted groundwater contour elevations (September 8, 2021 data), as illustrated on **Figure 5**, dewatering will be required from chainage 3+610 (groundwater elevation was ~ 300.9 masl), where the proposed sanitary sewer starts to approximate chainage 3+770 of the alignment, where the water table was at approximate elevation of 297.8 masl. The proposed works north of 3+770 are expected to be above the water table, based on the September 2021 water level data.

The method of installing the proposed sanitary sewer is not known at the time of preparing this report. As such, the dewatering calculations have been completed for the most conservative scenario of open trench along the full alignment, including for the installation of the manholes, assuming that the length of the alignment requiring dewatering to be open at any time is a maximum length of 30 m.

4.1 SHORT-TERM DEWATERING REQUIREMENTS

The interpreted static groundwater levels at the Site are higher than the maximum excavation depth and, therefore, construction dewatering will be required during excavation. To maintain a stable and relatively dry excavation, water levels should be lowered to at least 1.0 m below the lowest excavation depth. It should be noted that groundwater levels can vary and are subject to seasonal fluctuations and may respond to major weather events.

A complete list of assumptions used in the construction dewatering calculations is included in **Table 4**.

Table 4: Construction Dewatering Assumptions – Sanitary Sewer in Southern Portion of Alignment

INPUT	ASSUMPTION	NOTES
SANITARY SEWER IN SOUTHERN PORTION OF ALIGNMENT		
Ground Surface Elevation	303.8 masl (MW2 location)	Representative ground surface elevation (MW2)
Groundwater Level in Overburden *	300.9 masl (MW2 location)	Shallowest depth to groundwater, 2.86 mbgs, in current water level monitoring data
Hydraulic Conductivity	3.1 x 10^{-4} m/s (MW2 location)	Calculated based on testing resuts at the MW2 location
Approximate Excavation Depth Requiring Dewatering	298.7 masl	Approximately 3.6 mbgs at the PMH2 location
Target Pumping Level	297.7 masl	Assumed 1.0 m below excavation depth
Dimensions of Excavation	30 m x 2 m	Assumed length of alignment requiring dewatering to be open at a time for installation of proposed sanitary sewer, and assumed 2 m wide excavation, based on soil conditions
STORM SEWER IN NORTHERN PORTION OF ALIGNMENT		
Ground Surface Elevation	295.1 masl (BH18-OF1 location)	Representative ground surface elevation (BH18-OF1)
Groundwater Level in Overburden *	293.7 masl (BH18-OF1 location)	Shallowest depth to groundwater, 1.40 mbgs, at the BH18-OF1 location in current water level monitoring data

INPUT	ASSUMPTION	NOTES
Hydraulic Conductivity	4.2 x 10^{-6} m/s (MW1 location)	Calculated based on testing resuts at the MW1 location, interpreted to be representative of the silt formation
Approximate Excavation Depth Requiring Dewatering	293.2 masl	Approximately 1.9 mbgs based on field data at BH18-OF1
Target Pumping Level	292.2 masl	Assumed 1.0 m below excavation depth
Dimensions of Excavation	10 m x 2 m	length of alignment requiring dewatering for installation of proposed storm sewer, and assumed 2 m wide excavation, based on soil conditions

*all available water level data is from the months of September and November and likely does not represent seasonally high water levels across the Site and, therefore, may be underestimating the potential water handling and groundwater zone of influence in dewatering calculations.

4.1.1 CONSTRUCTION DEWATERING FLOW EQUATIONS

It is assumed that the construction area will be an open excavation within the extent of the property boundaries. The dewatering flow estimate was calculated using the Dupuit approximation for linear trenches, which is expressed as follows:

$$Q = \frac{2\,x\,(L+W)\,x\,K\,x(H^2-h^2)}{R_o}$$

Where:

Q = Rate of pumping (m^3/day)

H = Initial depth of water (water bearing zone/aquifer total head) prior to dewatering (m)

h = Depth of water under the deepest excavation elevation (m)

K = Hydraulic Conductivity (m/day)

R_0 = Radius of influence

It is expected that the initial dewatering rate will be higher in order to remove groundwater from within the subsurface formations. The dewatering rates are expected to decrease once the target

water level is achieved in the excavation footprint, as groundwater will have been removed from 'storage' within the soils, resulting in lower seepage rates into the excavation.

4.1.2 ZONE OF INFLUENCE

The zone of influence (ZOI) for construction dewatering is based on the empirical Sichardt's Equation and represents the theoretical distance from the centre of dewatering to where the lowering of groundwater becomes insignificant. The equation is empirical and was developed to provide representative flow rates, using the steady state flow dewatering equations, as discussed above.

It is noted that in steady state conditions, the radius (or zone) of influence of pumping will extend until boundary flow conditions are reached, and sufficient water inputs are equal to the discharge rate due to pumping. As a result, the distance of influence calculated using the Sichardt's equation is used to provide a representative flow rate calculation, but it is not accurate in determining the actual radius influenced by pumping. The ZOI from dewatering for linear flow is calculated based on the following empirical relationship:

$$R_0 = C(H - h)\sqrt{K}$$

Where:

K = Hydraulic conductivity (m/sec)

H = Static Saturated Head (m)

h = Dynamic Saturated Head (m)

C = Coefficient based on geometry and source of dewatering (3000 assumed)

Based on the Sichardt's equation and the representative K-value, the ZOI for the portion of the alignment requiring dewatering for the installation of the sanitary sewer in the southern portion of the Site is **115 m** from the edge of the excavation; and, 8 m from the edge of the excavation required for the installation of the storm sewer in the northern portion of the Site (see **Table 7** below).

4.1.3 RESULTS OF CONSTRUCTION DEWATERING ESTIMATION

Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Table 5: Construction Dewatering Flow Estimates

	ZONE OF INFLUENCE (ZOI) FROM THE EDGE OF THE EXCAVATION	TOTAL FLOW	WITH FACTOR OF SAFETY (2)
SANITARY SEWER IN SOUTHERN PORTION OF ALIGNMENT	115 m	220,000 L/day	440,000 L/day
STORM SEWER IN NORTHERN PORTION OF ALIGNMENT	8 m	7,200 L/day	14,400 L/day

The complete dewatering flow rate estimates are provided in **Appendix F, Table F-1.**

The construction dewatering flow rate includes a factor of safety of 2, to account for expected seasonal fluctuations in the groundwater table and variation in hydrogeological properties beyond those encountered during the course of this study. This peak dewatering flow rate also provides additional capacity for the dewatering contractors.

Please note that it is the responsibility of the contractor to ensure dry conditions are maintained within the excavation at all times. Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Additionally, the presence of near-surface fill material could hold significant groundwater.

The maximum flow calculations are intended to provide a conservative estimate to account for unforeseeable conditions that may arise during construction. It should be noted that the dewatering estimates provided in this report are based on assumptions to provide a general idea of dewatering needs. The dewatering estimates must be reviewed/revised if the design of the proposed construction is changed.

4.1.4 STORM WATER CONTRIBUTION

Rain and snow that accumulates in the excavation will need to be handled during construction. The dewatering flow rate calculations do not include contributions from precipitation events. In order to predict the effects of storm water, a simple estimate was calculated based on the geometry of the planned excavation and a 10-mm rain event. For this magnitude of precipitation event, it is estimated that about **600 L** of water would require handling for a 30 m section of the alignment requiring dewatering. The results are included in **Appendix F, Table F-1.** It is recommended that additional capacity be included for the handling of large precipitation events in order to keep the excavation area relatively dry and stable.

4.2 WATER TAKING AND DISCHARGE PERMITTING

4.2.1 ENVIRONMENTAL ACTIVITY AND SECTOR REGISTRY

Water takings greater than 50,000 L/day but less than 400,000 L/day at any one time for a project will require registration as an EASR. Based on the calculated construction dewatering rates, the Bryne Drive extension project is not applicable for a registration under the MECP Environmental Activity and Sector Registry system (EASR).

4.2.2 MECP PERMIT TO TAKE WATER

Short-term construction water takings greater than 400,000 L/day at any one time for the project will require a Category 3 PTTW. Based on the calculated construction dewatering rates, construction dewatering flow rate estimate for the portion of the Bryne Drive extension alignment, including possible storm water contribution, that requires dewatering indicates that the maximum expected daily groundwater taking will be approximately **440,000 L/day**. Therefore, a Category 3 PTTW from the MECP is required for construction dewatering. A PTTW application requires a minimum of 90 days for the MECP to process; in this regard, appropriate lead time should be factored into the overall project schedule to accommodate the PTTW process.

4.2.3 DISCHARGE TO NATURAL ENVIRONMENT

If temporary construction water is to be discharged to local surface water, approvals will be required from the LSRCA and an Environmental Compliance Approval (ECA) may be required from the MECP. As such, the quality of groundwater will have to conform to the applicable standards. These include the Provincial Water Quality Objectives and the Canadian Water Quality Guideline for the Protection of Aquatic Life, particularly with regards to sodium and chloride. As discussed in **Section 3.6**, groundwater treatment to reduce concentrations of total metals (including phosphorus, cobalt and zinc) needs to be implemented.

Erosion and sediment control measures and acceptable/target TSS concentrations for the regional watershed must also be implemented.

Please note that the list of analyzed PWQO parameters in this report is not complete and should be updated to ensure the analysis includes all parameters required by the LSRCA or MECP approvals. It should also be noted that the approval process for an ECA submission can take between 12 and 18 months to process.

4.2.4 CITY OF BARRIE DISCHARGE AGREEMENT

If temporary construction water is to be discharged to local sewer systems, then a discharge permit will need to be obtained by a dewatering contractor prior to any discharge to the sewer system. WSP recommends that groundwater is tested for parameters listed in the City of Barrie's Storm/Sanitary By-Law prior and during construction, as outlined in the recommended monitoring program.

Based on the groundwater sampling results, pre-treatment of groundwater is required prior to discharge to the City of Barrie Storm Sewer. Treatment for TSS is required to satisfy the Limits for Discharge to the City of Barrie Storm Sewer. The analysis indicates that all City of Barrie Sanitary Sewer Discharge By-Law criteria were met.

5 POTENTIAL GROUNDWATER IMPACTS

5.1 IMPACTS TO GROUNDWATER USERS

As described in **Section 3.1**, the MECP water well records indicate that nine out of the 29 identified wells within the Study Area were identified as domestic and irrigation supply wells. The domestic supply wells are located within areas of commercial development, with the exception of WWR #5713455 which is located just south of Harvie Road in an area of residential development. Well #5713455 was completed in 1975, with a screened interval of 43.6 to 44.5 m below ground, corresponding to elevations of 262.6 –263.6 masl, in coarse to fine sand. Industrial well #5708906 was advanced immediately east of Highway 400 and south of Harvie Road in 1972, with a well screened at the depth of 41.1 to 43.6 mbgs (elevations 257.6 – 260.1 masl) in fine to medium sand. Both of these wells are outside of the estimated ZOI, of 115 m, of the anticipated dewatering requirements. Also, based on the years of the well construction, it is interpreted that there are old well records and the wells were decommissioned.

5.2 IMPACTS TO NEARBY STRUCTURES

During the course of dewatering activities and some time after, settlement may occur in saturated unconsolidated soils within a ZOI. As a result, neighbouring buildings, utilities and underground structures/infrastructure may be at risk when lowering water levels or depressurizing an aquifer.

Based on the dewatering assessment, the ZOI is anticipated to be up to approximately 115 m from the excavation boundary. A geotechnical engineer should be consulted to determine potential settlement impacts to structures from dewatering activities prior to construction.

It is additionally considered a best practice to develop a pro-active settlement monitoring program in order to signal any potential areas of concern during construction, and the need for additional mitigation measures. As part of a dewatering plan prepared by the dewatering contractor, a settlement monitoring program may be required and should be approved by the consultant supervising the construction (contract administrator) and the City of Barrie, prior to the start of construction. Utilities owners may also have stringent monitoring requirements and may be consulted by the City prior to approval.

5.3 IMPACTS TO NATURAL HERITAGE SYSTEMS

The proposed re-development of the Site will result in changes to the size of impervious areas and potential changes to groundwater quality and quantity flowing to Lovers Creek and Whiskey Creek and surrounding natural areas.

Based on a review of the background information and published maps, there are no PSW or unevaluated wetlands in the Study Area. The closest Lovers Creek PSW is located approximately 2.5 km of the Site, outside of the Study Area (see Section 2.1). Since this PSW is located outside the ZOI for short-term dewatering, impacts to the natural heritage systems are anticipated to be negligible, if any in this area.

Best management practices that promote groundwater infiltration and recharge could contribute to mitigating the effects of urbanization.

5.4 CONTAMINANT MIGRATION

Changes to hydraulic gradient as a result of temporary construction dewatering activities could also potentially influence the migration of contaminants from off-site properties. The construction dewatering calculations result in a reasonably high daily flow rate with a ZOI of 115 m. Given the portion of the project requiring construction dewatering, and the proximity to commercial buildings in the southern portion of the Site, a Phase One ESA is recommended to be completed to identify any potential sources of contaminants in the Study Area.

5.5 WELL DECOMMISSIONING

Following the completion of construction activities, all remaining monitoring wells, well points and eductors (if any) installed at various stages of this project must be decommissioned. The installation and eventual decommissioning of the wells and the dewatering system must be carried out by a licenced water well contractor in accordance with Regulation 903 of the Ontario Water Resources Act.

6 MONITORING PLAN

To monitor the dewatering system and document both on-site and off-site impacts, water levels, discharge rates, and discharge quality should be monitored during dewatering activities.

During the period of active dewatering, water levels should be monitored within the excavation and on-site around the perimeter of the excavation to confirm the zone of influence. In addition, discharge quality must be monitored to demonstrate that water quality meets the applicable Sewer Use By-Law or PWQO criteria. A recommended groundwater monitoring plan is described in **Table 6** below. Note that the monitoring frequency should be evaluated at a later date once additional details about the site design and construction staging efforts are available.

Table 6: Groundwater Monitoring Plan

PERIOD	WATER LEVEL MONITORING LOCATION	METHODS	TRIGGERS FOR MITIGATION	MITIGATION/COMMENTS
WATER LEVELS				
Pre-Construction	On-Site monitoring wells along the proposed excavation area	Dataloggers or Manual	None	Completed to develop baseline water level hydrograph for the water-bearing zone
During Construction or active dewatering	On-site monitoring wells and outside excavation monitoring wells and private wells Discharge rate or volume at each point of discharge	Datalogger or Manual Manual	Water level at excavation location too high – increase pumping, or adjust dewatering system Water level in monitoring wells significantly lower (actual trigger level to be determined based on start-up testing)	Completed to demonstrate water levels in the water bearing zone during construction period are at the expected elevation. If an impact attributable to the dewatering is noted, more frequent monitoring will be considered. Mitigation will be developed to address specific issues detected.
Post-Construction	On-site monitoring wells	Manual	Water levels do not recover to within 75% of expected post-construction static levels.	If an impact attributable to dewatering is detected post-construction, a modified monitoring program will continue until impacts no longer affect water levels and appropriate recommendations for mitigation measures will be provided.

PERIOD	WATER LEVEL MONITORING LOCATION	WATER LEVEL MONITORING FREQUENCY	METHODS	TRIGGERS FOR MITIGATION	MITIGATION/COMMENTS
WATER QUALITY					
During Construction	Discharge from dewatering at each discharge point and/or treatment system	Once at start of dewatering at point of discharge Weekly at each discharge location for the first 2 weeks of dewatering If water quality is suitable and stable, monthly for the remainder of the dewatering at that location	Discharge anaysed for relevant parameters by an accredited laboratory. The analytical results to be compared to the Region of Peel Sanitary / Storm Sewer Use By-Law or PWQO standards	Discharge quality exceeds the Region of Peel Sanitary / Storm Sewer Use By-Law or PWQO criteria	In the event that discharge water exceeds the relevant criteria, confirmatory monitoring will be done. Additional treatment will be considered and evaluated depending on the water quality testing results.

7 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the hydrogeological investigation completed for the Site.

CONCLUSIONS

- It is understood that the design for the Bryne Drive extension from Harvie Road to Caplan Avenue includes: approximately 1 km of roadway to be constructed; road base construction, including widening to five lanes; and associated municipal services, including storm and sanitary sewers, and watermain.
- The monitoring program has shown that overburden groundwater levels at the Site ranges between 2.86 and 7.73 mbgs, corresponding to elevations of 301.4 to 289.4 masl. These water levels appear representative of the depth to the water table in the A1 Aquifer identified in the Study Area. The water level monitoring data for the project have been recorded during the months of September and November 2018, and September 2021, and are interpreted to be not representative of seasonal high groundwater levels.
- The installation of the storm sewer and watermain at elevations illustrated on the Plan and Profile drawings will not extend below the water table, based on the current groundwater level monitoring data, except for the storm sewer connection in the northern portion of the alignment (chainage 4+218 to 4+225).
- Construction of the proposed sanitary sewer will require the deepest excavations during the project which will extend below the water table. Based on the interpreted groundwater contour elevations, dewatering will be required in the southern portion of the alignment from where the proposed sanitary sewer starts (chainage 3+610) to approximate chainage 3+770 of the alignment, where the water table was at an elevation of 297.8 masl in September 2021.
- Hydraulic conductivity values for the overburden wells ranged between 4.2×10^{-6} m/sec and 3.1×10^{-4} m/sec. The overburden has been treated as a single continuous unit for the purposes of the dewatering assessment, with the hydraulic conductivity value of 3.1×10^{-4} m/sec used in the calculations.

- The dewatering assessment indicates that the required short-term water taking volume for the proposed construction, including a factor of safety of 2, is approximately **440,000** L/day. As such, the Site will require a Category 3 PTTW from the MECP is required for construction dewatering.
- The groundwater quality analysis indicates that all City of Barrie Sanitary Sewer Discharge By-Law criteria were met. Parameters that exceeded the City of Barrie Storm Sewer Discharge By-Law included only total suspended Solids (TSS). The analysis indicates that phosphorus, cobalt and zinc had reported results above the PWQO criteria, even though the samples were field filtered. Concentrations of several parameters, including hexachlorobenzene, lead, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(a,h)anthracene, chrysene, fluoranthene, phenanthrene, phenolics and silver below their R.D.L. but R.D.L. were above the PWQO.

RECOMMENDATIONS

- A Category 3 PTTW from the MECP is required for construction dewatering.
- A discharge permit from the City of Barrie will be required to be obtained prior to any construction dewatering if discharge is to be directed to the storm or sanitary sewers. If discharge will be directed to the natural environment, a permit will need to be obtained from the LSRCA and an ECA may be required from the MECP prior to any dewatering activities. The LSRCA and MECP may also require additional PWQO parameters to be analyzed since only select parameters were included in this hydrogeological report.
- A geotechnical engineer should be consulted to determine potential settlement impacts to structures from dewatering activities prior to construction.
- It is recommended that further groundwater level monitoring, through the months of March, April and May of 2022, will indicate the expected seasonal high groundwater levels, as groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.
- It is recommended to collect another groundwater sample for parameters of interest once the discharge location(s) during construction is confirmed.
- A Phase One ESA is recommended to be completed to identify any potential sources of contaminants in the Study Area that could potential migrate towards the Site during dewatering activities.

- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells should be carried out by a licensed contractor, under the supervision of a licensed water well technician.

8 STANDARD LIMITATIONS

WSP Canada Inc. prepared this report solely for the use of the intended recipient, City of Barrie, in accordance with the Proposal for Additional Hydrogeological Services Agreement (dated June 17, 2021). In the event a contract has not been executed, the parties agree that the WSP General Terms for Consultant shall govern their business relationship which was provided to you prior to the preparation of this report.

The report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

The intended recipient is solely responsible for the disclosure of any information contained in this report. Except for the City of Toronto, if a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report.

WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and

understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

WSP disclaims any responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions /or costs.

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

Overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

The original of this digital file will be kept by WSP for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP, its integrity cannot be assured. As such, WSP does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.

This limitations statement is considered an integral part of this report.

9 REFERENCES

- Cashman, P. M. (2013). Groundwater Lowering in Construction: A Practical Guide to Dewatering (Second Ed.).
- Chapman, L.J., and D. F. Putnam. (1984). The Physiography of Southern Ontario, Third Edition, Ontario. Geological Survey Special Volume 2.
- Google Earth Pro V7.3.2.5491. Barrie, Ontario, http://www.earth.google.com, Date accessed: October 30, 2021.
- Lake Simcoe Region Conservation Authority (2015, amended 2019). Approved South Georgian Bay Lake Simcoe Source Protection Plan.
- Lake Simcoe Region Conservation Authority (2012). Barrie Creeks, Lovers Creek, and Hewitt's Creek Subwatershed Plan, https://www.lsrca.on.ca/Pages/Subwatershed-Plans.aspx, Date accessed: September 12, 2021.
- Ministry of Natural Resources (1984). Map P.2715. Physiography of Southern Ontario, Scale 1: 600,000.
- Ministry of Environment, Conservation and Parks. Maps: Permits to Take Water, http://www.ontario.ca/environment-and-energy/map-permits-take-water, Date accessed: September 12, 2021a.
- Ministry of Environment, Conservation and Parks, Access Environment Web Portal, http://www.accessenvironment.ene.gov.on.ca , Date accessed: September 12, 2021b.
- Ontario Geological Survey (1990). Quaternary Geology: Toronto and Surrounding Area. Ontario Geological Survey Map P. 2204, Scale 1: 100,000.
- Ministry of Natural Resources and Forestry, 2019. Make a Map: Naturqal Heritage Areas, https://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US, Date accessed: October 30, 2021
- Ontario Geological Survey (1991). Bedrock Geology of Ontario: Southern Sheet. Ministry of Northern Development and Mines Map 2544, Scale 1: 1,000,000.
- WSP Canada Inc. (2019). Geotechnical Investigation for Bryne Drive Extension, Barrie, Ontario.

FIGURES

Key Map (nts)

Source: (c) 2010 Microsoft Corporation and its data suppliers

WSP
2 INTERNATIONAL BLVD.
TORONTO, ONTARIO, CANADA M9W 1A2
TEL: 416-798-0065 I FAX: 416-798-05-18
WWW.WSP.COM

LEGEND

- Proposed Alignment
- 500m Study Area
- MECP Water Wells

CLIENT: City of Barrie

CLIENT REF. #

PROJECT: HYDROGEOLOGICAL INVESTIGATION
BRYNE DRIVE EXTENSION
CITY OF BARRIE, ONTARIO

PROJECT NO: 181-06461-00

DATE: October 2021

DESIGNED BY:

DRAWN BY: NS

CHECKED BY: MY

FIGURE NO: 1

SCALE: As shown

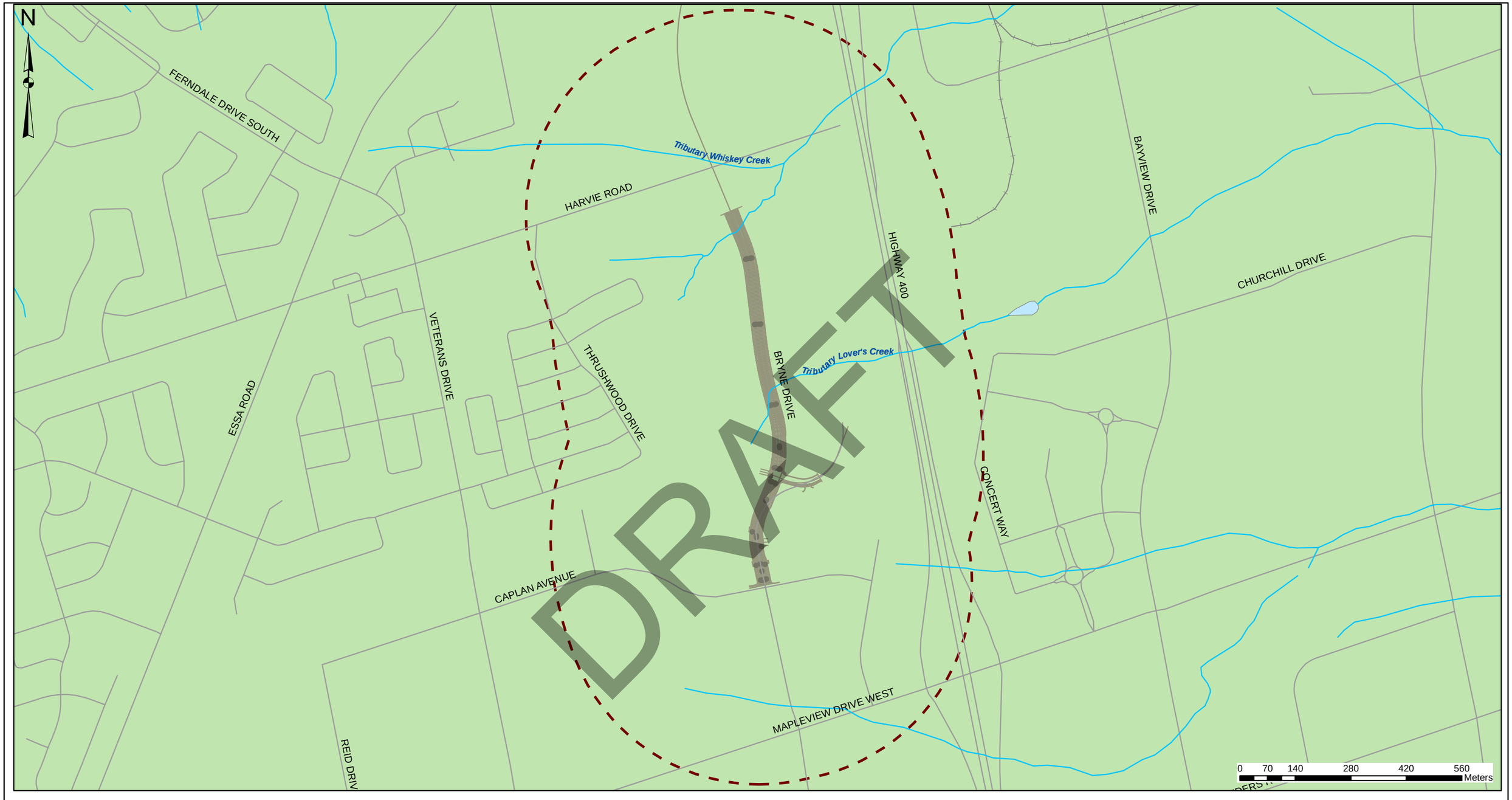
TITLE: SITE LOCATION PLAN AND MECP WATER WELL RECORDS

DISCIPLINE: ENVIRONMENT

ISSUE:

RV.#: 0

DATE OF:



WSP
2 INTERNATIONAL BLVD.
TORONTO, ONTARIO, CANADA M9W 1A2
TEL: 416-798-0065 I FAX: 416-798-05-18
WWW.WSP.COM

LEGEND

500m Study Area

LEGEND PHYSIOGRAPHIC LANDFORM

Till Plains (Drumlinized)

CLIENT: **City of Barrie**

CLIENT REF. #

PROJECT: **HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION CITY OF BARRIE, ONTARIO**

PROJECT NO: 181-06461-00	DATE: October 2021
DESIGNED BY:	
DRAWN BY: NS	
CHECKED BY: GJ	
FIGURE NO: 2	SCALE: As shown

TITLE: **PHYSIOGRAPHY MAP**

DISCIPLINE: **ENVIRONMENT**

ISSUE:

DATE OF:

RV.#: 0

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

WSP
2 INTERNATIONAL BLVD.
TORONTO, ONTARIO, CANADA M9W 1A2
TEL: 416-798-0065 I FAX: 416-798-05-18
WWW.WSP.COM

LEGEND

- 500m Study Area
- 20 - Organic Deposits: peat, muck, marl
- 6 - Ice-contact stratified deposits: sand and gravel, minor silt, clay and till
- 8a - Fine-textured glaciolacustrine massive to well-laminated deposits: silt and clay, minor sand and gravel
- 5b - Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain
- 9c - Course-textured glaciolacustrine foreshore & basinal deposits: sand, gravel, minor silt and clay

CLIENT: **City of Barrie**

CLIENT REF. #

PROJECT: **HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION CITY OF BARRIE, ONTARIO**

PROJECT NO: 181-06461-00

DATE: October 2021

DESIGNED BY:

DRAWN BY: NS

CHECKED BY: GJ

FIGURE NO: 3

SCALE: As shown

TITLE: **SURFICIAL GEOLOGY**

DISCIPLINE: **ENVIRONMENT**

ISSUE:

RV.#: 0

DATE OF:

Source: (c) 2010 Microsoft Corporation and its data suppliers

WSP
2 INTERNATIONAL BLVD.
TORONTO, ONTARIO, CANADA M9W 1A2
TEL: 416-798-0065 I FAX: 416-798-05-18
WWW.WSP.COM

LEGEND

- 500m Study Area
- Monitoring Well by WSP (2018)
- Borehole by WSP (2018)
- Monitoring Well by WSP (2021)

CLIENT: **City of Barrie**

CLIENT REF. #

PROJECT: **HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION CITY OF BARRIE, ONTARIO**

PROJECT NO: 181-06461-00

DATE: October 2021

DESIGNED BY:

DRAWN BY: NS

CHECKED BY: GJ

FIGURE NO: 4

SCALE: As shown

TITLE: **BOREHOLE LOCATION PLAN**

DISCIPLINE: **ENVIRONMENT**

ISSUE:

RV.#: 0

DATE OF:

Source: (c) 2010 Microsoft Corporation and its data suppliers

WSP
2 INTERNATIONAL BLVD.
TORONTO, ONTARIO, CANADA M9W 1A2
TEL: 416-798-0065 I FAX: 416-798-05-18
WWW.WSP.COM

LEGEND

- 500m Study Area
- Monitoring Well by WSP (2018)
- Borehole by WSP (2018)
- Monitoring Well by WSP (2021)
- 0.5m Groundwater Contour
- Inferred Groundwater Flow Direction
- (301.4) Groundwater elevation, masl (Sept.08, 2021)

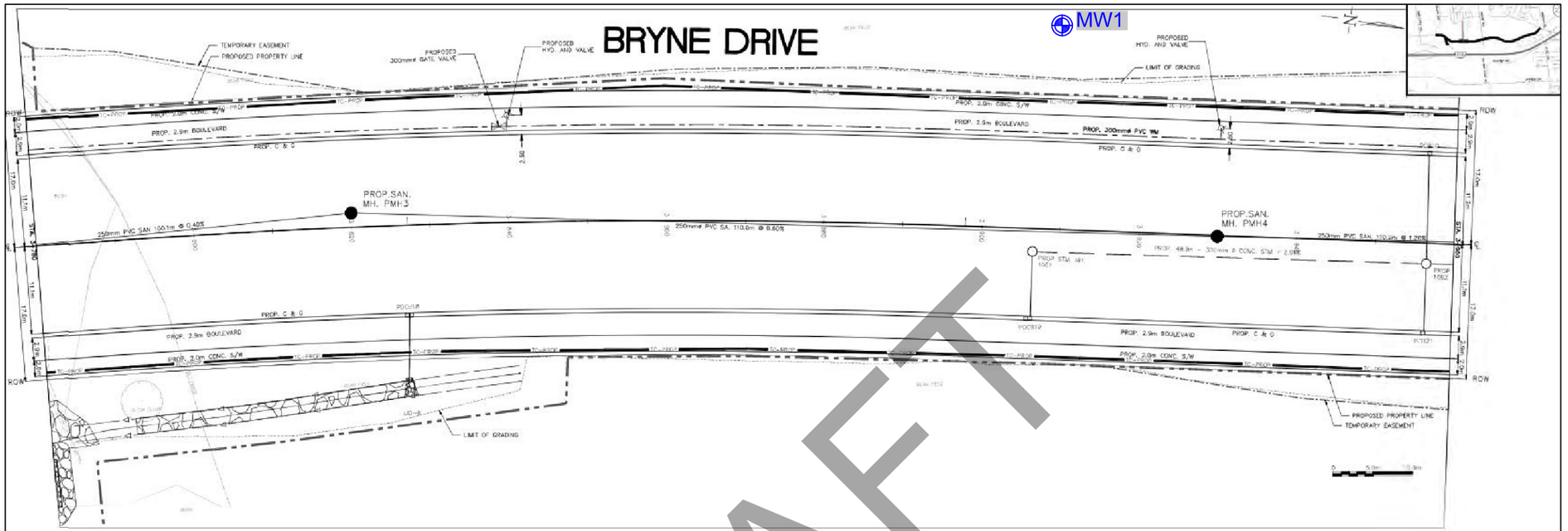
CLIENT: City of Barrie	PROJECT NO: 181-06461-00
CLIENT REF. #	DATE: October 2021
PROJECT: HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION CITY OF BARRIE, ONTARIO	DESIGNED BY:
	DRAWN BY: NS
	CHECKED BY: GJ
	FIGURE NO: 5
	SCALE: As shown

TITLE: **SHALLOW GROUNDWATER CONTOURS**

DISCIPLINE: **ENVIRONMENT**

ISSUE: | RV.#: 0

DATE OF:



wsp
2 INTERNATIONAL BLVD., SUITE 201
TORONTO, ONTARIO CANADA M9W 1A2
TEL.: 416-798-0065 | FAX: 416-798-0518 | WWW.WSP.COM

LEGEND:

Reference: Plan & Profile drawings prepared by Hatch, dated September 23, 2020

MW3 — Monitoring Well No:

Monitoring Well by WSP (Sept.8, 2021)

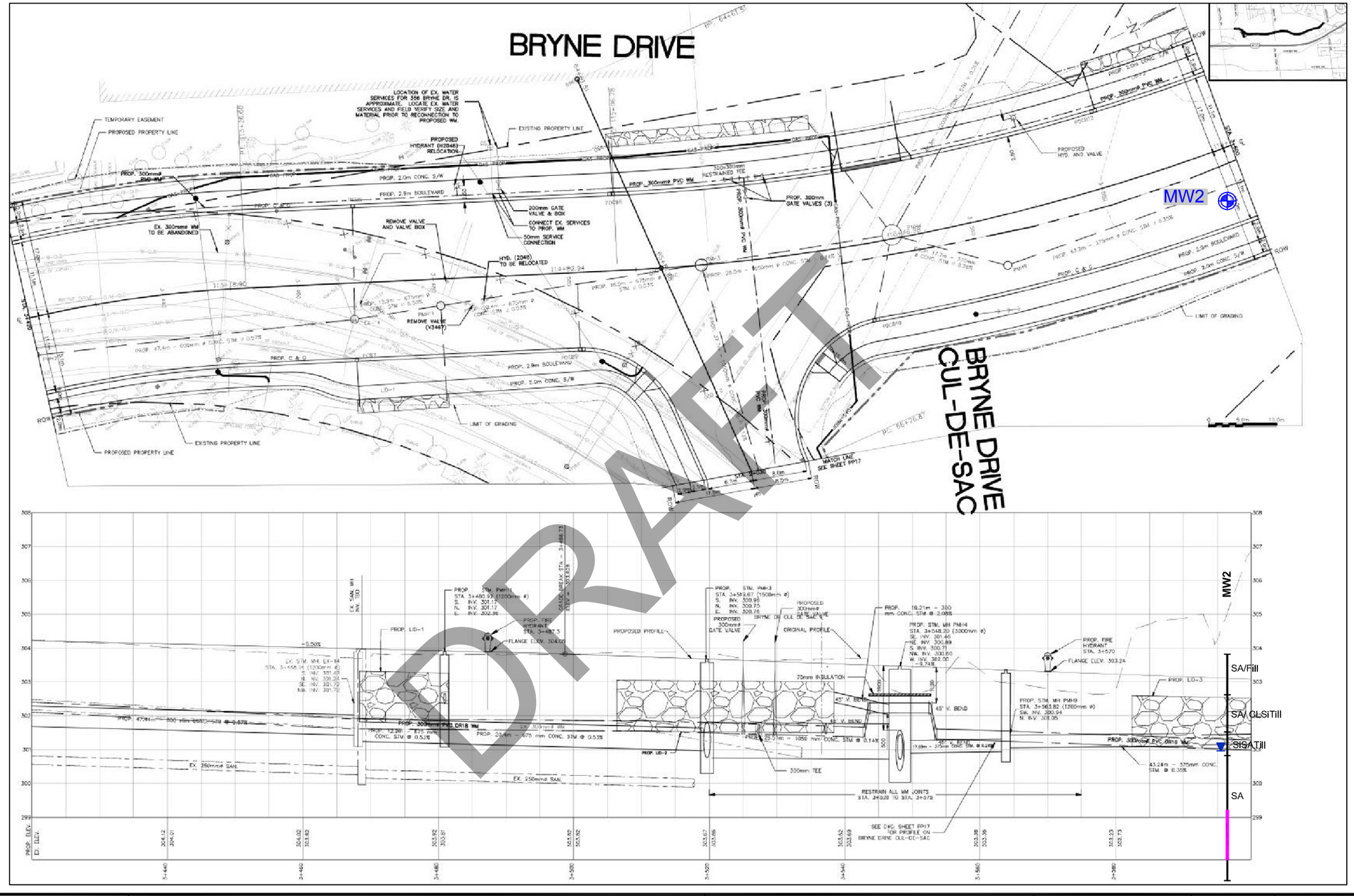
Water Level (Sept. 8, 2021)

Well

Screen

CLIENT: City of Barrie	PROJECT NO: 181-06461-00
CLIENT REF. #:	DATE: October 2021
PROJECT: HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION, CITY OF BARRIE, ONTARIO	DESIGNED BY:
	DRAWN BY: NS
	CHECKED BY: GJ
	FIGURE NO: 6
	SCALE: As Shown
TITLE: PLAN AND PROFILE - MW1	
DISCIPLINE: ENVIRONMENT	
ISSUE:	RV. # 0
DATE OF:	

D:\Nina's GIS Files\AutoCAD Drawings 2021\181-06461-00 Bryne Dr Expansion, Barrie\Data\CAD\Bryne Dr - Updated Borehole Locations (2018-05-07)\Bryne Dr - new Monit Wells & PROFILES.dwg



D:\Nina's GIS Files\AutoCAD Drawings 2021\181-06461-00 Bryne Dr Expansion, Barrie\Data\CAD\Bryne Dr - Updated Borehole Locations (2018-05-07)\Bryne Dr - new Monit Wells & PROFILES.dwg

2 INTERNATIONAL BLVD., SUITE 201
TORONTO, ONTARIO CANADA M9W 1A2
TEL.: 416-798-0065 | FAX: 416-798-0518 | WWW.WSP.COM

LEGEND:

MW3 — Monitoring Well No:

Water Level (Sept. 8, 2021)

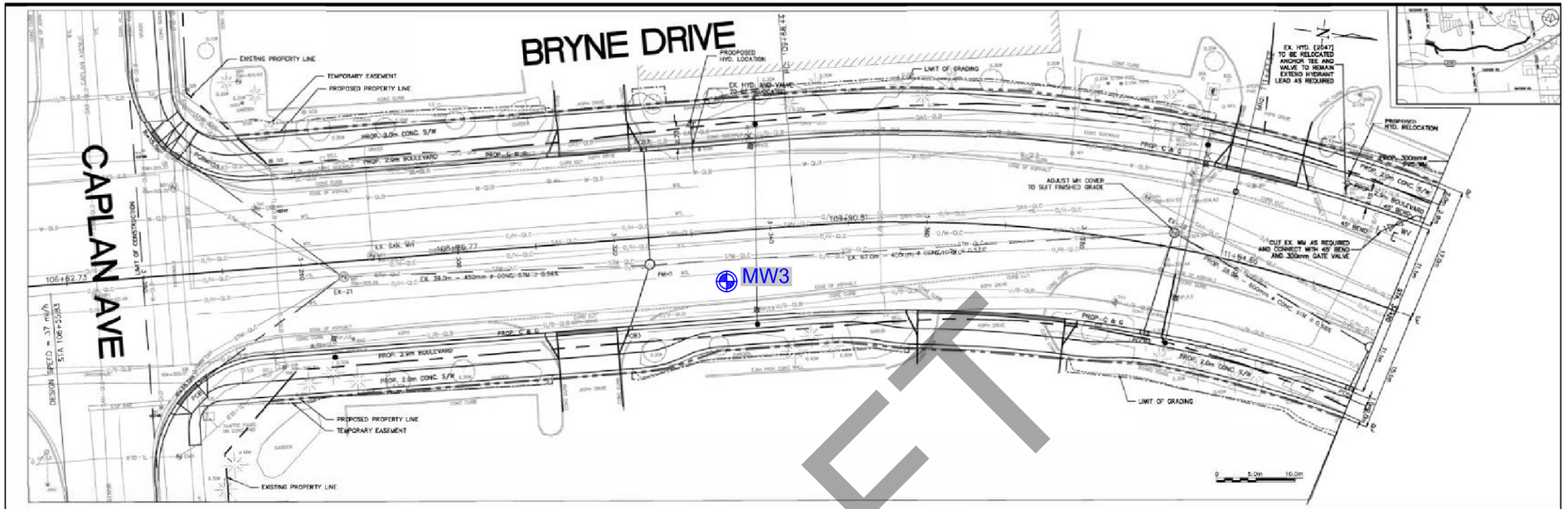
Well

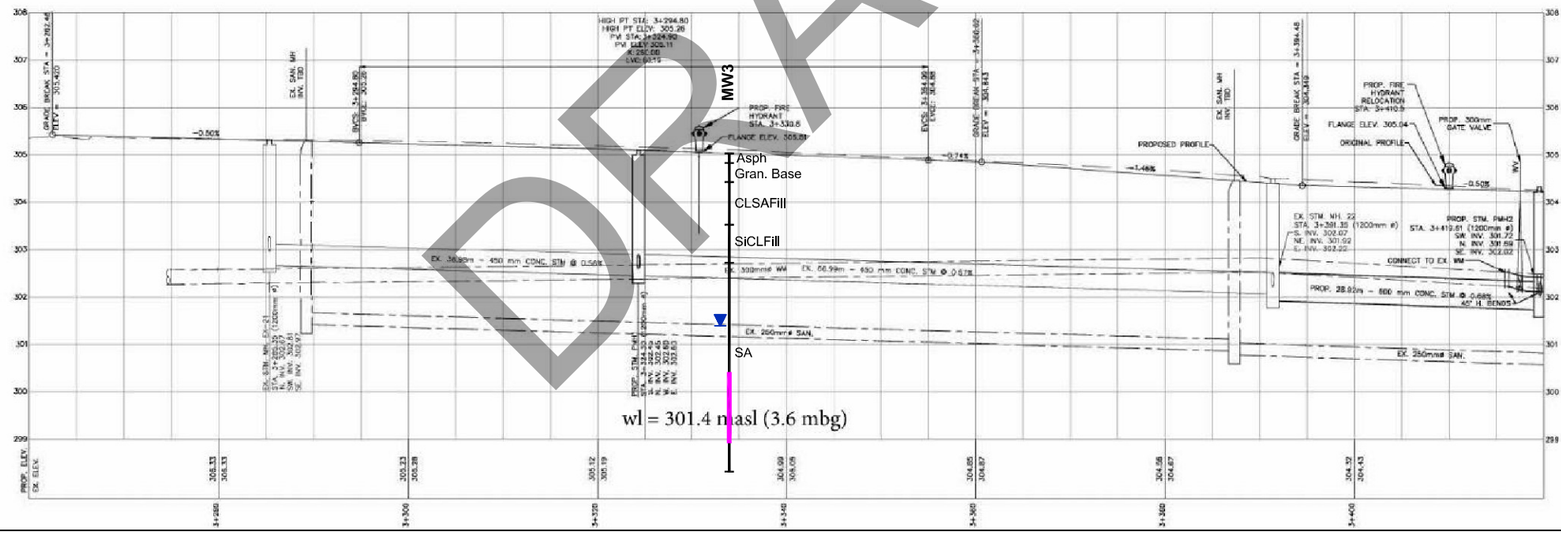
Screen

Monitoring Well by WSP (Sept.8, 2021)

Reference: Plan & Profile drawings prepared by Hatch, dated September 23, 2020

CLIENT: City of Barrie	PROJECT NO: 181-06461-00
CLIENT REF. #:	DATE: October 2021
PROJECT: HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION, CITY OF BARRIE, ONTARIO	DESIGNED BY:
	DRAWN BY: NS
	CHECKED BY: GJ
	FIGURE NO: 7
	SCALE: As Shown
	TITLE: PLAN AND PROFILE - MW2
	DISCIPLINE: ENVIRONMENT
	ISSUE:
	DATE OF:
	RV. # 0





wsp
2 INTERNATIONAL BLVD., SUITE 201
TORONTO, ONTARIO CANADA M9W 1A2
TEL.: 416-798-0065 | FAX: 416-798-0518 | WWW.WSP.COM

LEGEND:

Reference: Plan & Profile drawings prepared by Hatch, dated September 23, 2020

MW3 — Monitoring Well No:

Water Level (Sept. 8, 2021)

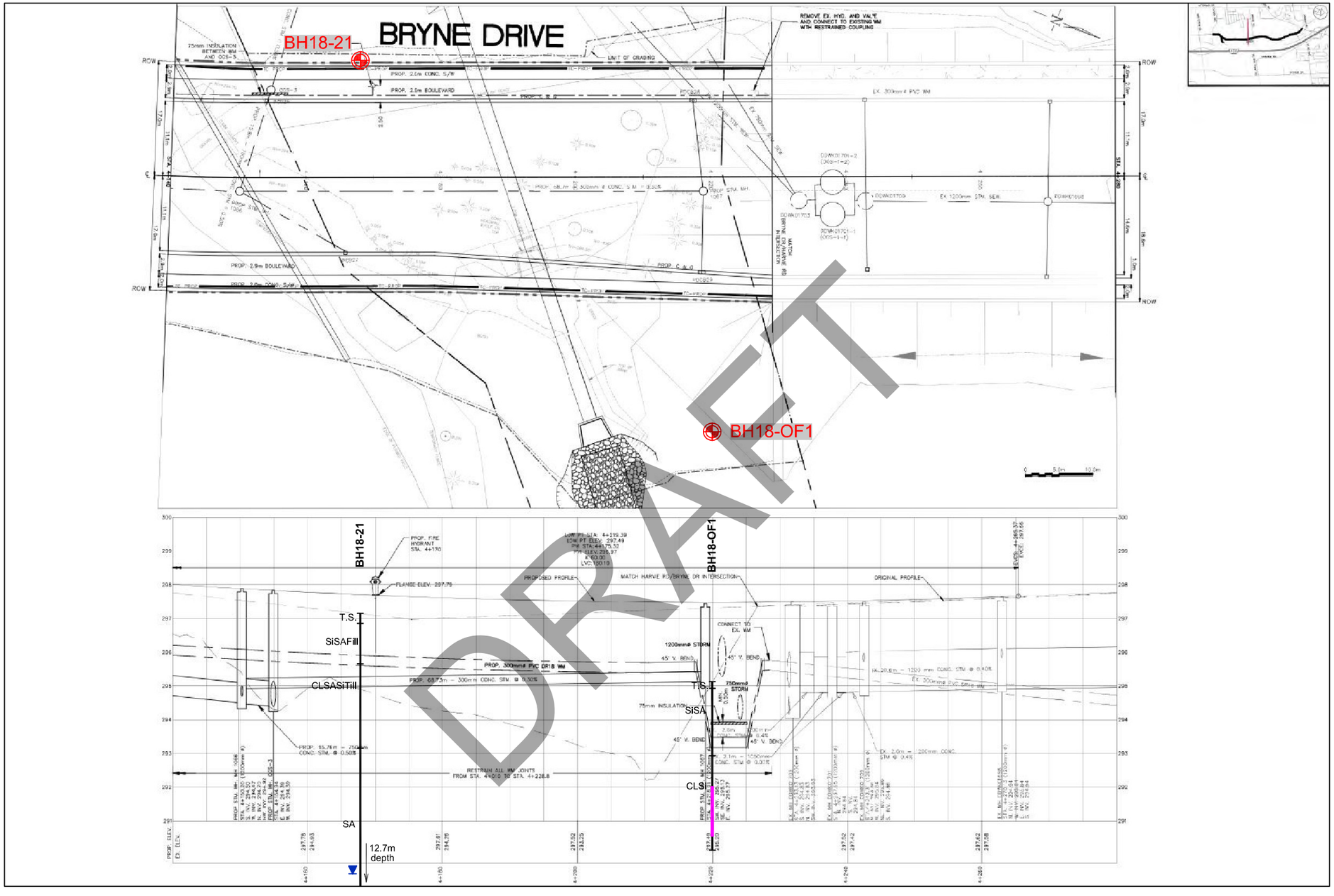
Well

Screen

Monitoring Well by WSP (Sept.8, 2021)

CLIENT: City of Barrie	PROJECT NO: 181-06461-00
CLIENT REF. #:	DATE: October 2021
PROJECT: HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION, CITY OF BARRIE, ONTARIO	DESIGNED BY:
	DRAWN BY: NS
	CHECKED BY: GJ
	FIGURE NO: 8
	SCALE: As Shown
TITLE: PLAN AND PROFILE - MW3	
DISCIPLINE: ENVIRONMENT	
ISSUE:	RV. # 0
DATE OF:	

D:\Nina's GIS Files\AutoCAD Drawings 2021\181-06461-00 Bryne Dr Expansion, Barrie\Data\CAD\Bryne Dr - Updated Borehole Locations (2018-05-07)\Bryne Dr - new Monit Wells & PROFILES.dwg



2 INTERNATIONAL BLVD., SUITE 201
TORONTO, ONTARIO CANADA M9W 1A2
TEL.: 416-798-0065 | FAX: 416-798-0518 | WWW.WSP.COM

LEGEND:

Reference: Plan & Profile drawings prepared by Hatch, dated September 23, 2020

MW3 — Monitoring Well No:

Monitoring Well by WSP (June 2018)

Water Level (Sept. 8, 2021)

Well

Screen

CLIENT: City of Barrie	PROJECT NO: 181-06461-00
CLIENT REF. #:	DATE: October 2021
PROJECT: HYDROGEOLOGICAL INVESTIGATION BRYNE DRIVE EXTENSION, CITY OF BARRIE, ONTARIO	DESIGNED BY:
	DRAWN BY: NS
	CHECKED BY: GJ
	FIGURE NO: 9
	SCALE: As Shown

TITLE: **PLAN AND PROFILE - BH18-OF1 & BH18-21**

DISCIPLINE: **ENVIRONMENT**

ISSUE:

DATE OF:

RV. # **0**

APPENDIX

A MECP WATER WELL RECORDS

MECP Water Well Records

Well Record #

5701447 **Lot** 007 **Conc** 12 INNISFIL TOWNSHIP / SIMCOE

Date 1966-10-03 **DD/MM/YYYY**

Elev 305.2 (masl) **Easting** 604634 **Northing** 4910111

Domestic / Livestock Water Supply **UTM RC** 5 **margin of error : 100 m - 300 m**

Water Found 1.8 (mbgs) 303.3 (masl) FRESH

Casing Diameter 30 inch **Casing Material:** CONCRETE

Top of Screen (mbgs) **Bottom of Screen** (mbgs)

Screen Interval (m)

Flowing? N

SWL 1.8 (mbgs) 303.3 (masl)

Pumping WL (mbgs) (masl)

Pump Rate 9.1 (LPM) /

Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	305.2		
5.5	299.7		MEDIUM SAND / /
6.1	299.1		CLAY / /

5701450 **Lot** 008 **Conc** 12 BARRIE CITY (INNISFIL) / SIMCOE

Date 1965-07-06 **DD/MM/YYYY**

Elev 303.1 (masl) **Easting** 604858 **Northing** 4910313

Domestic / Livestock Water Supply **UTM RC** 5 **margin of error : 100 m - 300 m**

Water Found 39.6 (mbgs) 263.4 (masl) FRESH

Casing Diameter 6 inch **Casing Material:** STEEL

Top of Screen 42.4 (mbgs) **Bottom of Screen** 44.2 (mbgs)

Screen Interval 1.8 (m)

Flowing? N

SWL 30.5 (mbgs) 272.6 (masl)

Pumping WL 43.6 (mbgs) 259.5 (masl)

Pump Rate 9.1 (LPM) 4 / 0

Spec. Cap. 0.69 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	303.1		
16.8	286.3		FILL / /
39.6	263.4		COARSE SAND / /
44.2	258.9		FINE SAND / /

5707578 **Lot** 006 **Conc** 12 INNISFIL TOWNSHIP / SIMCOE

Date 1970-10-10 **DD/MM/YYYY**

Elev 306.9 (masl) **Easting** 604164 **Northing** 4909803

/ Domestic Water Supply **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found 2.4 (mbgs) 304.5 (masl) FRESH

Casing Diameter 30 inch **Casing Material:** CONCRETE

Top of Screen (mbgs) **Bottom of Screen** (mbgs)

Screen Interval (m)

Flowing? N

SWL 1.5 (mbgs) 305.4 (masl)

Pumping WL 4.0 (mbgs) 302.9 (masl)

Pump Rate 22.7 (LPM) 1 / 0

Spec. Cap. 9.32 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	306.9		
2.4	304.5	BROWN	CLAY / /
4.6	302.3	GREY	GRAVEL / /

5708284 **Lot** 006 **Conc** 12 INNISFIL TOWNSHIP / SIMCOE

Date 1971-09-04 **DD/MM/YYYY**

Elev 307.4 (masl) **Easting** 604114 **Northing** 4909773

/ Domestic Water Supply **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found 42.7 (mbgs) 264.7 (masl) FRESH

Casing Diameter 6 inch **Casing Material:** STEEL

Top of Screen 43.0 (mbgs) **Bottom of Screen** 43.9 (mbgs)

Screen Interval 0.9 (m)

Flowing? N

SWL 35.4 (mbgs) 272.0 (masl)

Pumping WL 39.9 (mbgs) 267.5 (masl)

Pump Rate 63.6 (LPM) 1 / 0

Spec. Cap. 13.92 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	307.4		
0.3	307.1		TOPSOIL / /
8.8	298.6	BROWN	CLAY / MEDIUM SAND / GRAVEL
13.1	294.3	BROWN	MEDIUM SAND / /
18.3	289.1	BLUE	CLAY / /
36.6	270.8	YELLOW	COARSE SAND / /
43.9	263.5	YELLOW	MEDIUM SAND / /

Well Record #

5708594 **Lot** 007 **Conc** 12 BARRIE CITY (INNISFIL) / SIMCOE

Date 1971-11-17 **DD/MM/YYYY**

Elev 294.7 (masl) / **Easting** 604644 **Northing** 4911233 Test Hole **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found (mbgs) (masl)

Casing Diameter 1 inch **Casing Material:** STEEL

Top of Screen 112.8 (mbgs) **Bottom of Screen** 113.7 (mbgs)

Screen Interval 0.9 (m)

Flowing? N

SWL 64.0 (mbgs) 230.7 (masl)

Pumping WL (mbgs) (masl)

Pump Rate (LPM) /

Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	294.7		
25.0	269.7	BROWN	SAND / GRAVEL /
27.1	267.5	BROWN	CLAY / SAND /
28.7	266.0	BROWN	CLAY / SAND / GRAVEL
44.2	250.5	BROWN	FINE SAND / CLAY /
66.4	228.2	GREY	FINE SAND / CLAY /
82.6	212.1	GREY	CLAY / /
85.0	209.6	GREY	CLAY / SILT /
93.3	201.4	GREY	FINE SAND / CLAY /
122.5	172.1	GREY	CLAY / SILT /
123.7	170.9	GREY	CLAY / SILT / GRAVEL
127.1	167.6	GREY	CLAY / SILT /
139.0	155.7	GREY	CLAY / SILT / GRAVEL
146.6	148.1	GREY	CLAY / /
154.8	139.8	BROWN	CLAY / SAND / STONES
170.7	124.0	GREY	CLAY / SILT /
174.7	120.0	GREY	LIMESTONE / /

5708595 **Lot** 007 **Conc** 12 BARRIE CITY (INNISFIL) / SIMCOE

Date 1971-12-08 **DD/MM/YYYY**

Elev 295.1 (masl) / **Easting** 604614 **Northing** 4911263 Test Hole **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found (mbgs) (masl)

Casing Diameter 2 inch **Casing Material:** STEEL

Top of Screen 46.9 (mbgs) **Bottom of Screen** 49.1 (mbgs)

Screen Interval 2.1 (m)

Flowing? N

SWL 23.5 (mbgs) 271.7 (masl)

Pumping WL (mbgs) (masl)

Pump Rate (LPM) /

Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	295.1		
12.2	282.9	BROWN	SAND / GRAVEL /
17.4	277.8	BROWN	SAND / GRAVEL / CLAY
18.6	276.5	BROWN	CLAY / SILT /
22.9	272.3		SAND / CLAY / SILT
23.5	271.7	BROWN	CLAY / /
24.7	270.4	GREY	SAND / CLAY / SILT
28.3	266.8	BROWN	CLAY / SILT / FINE SAND
35.1	260.1		FINE SAND / CLAY /
36.6	258.6	BROWN	CLAY / SAND /
39.6	255.5	GREY	SAND / CLAY /
42.7	252.5	BROWN	CLAY / SILT /
49.4	245.7	GREY	FINE SAND / CLAY / SAND
53.9	241.2	GREY	CLAY / SILT /
65.5	229.6	GREY	FINE SAND / CLAY / SAND
84.4	210.7	GREY	CLAY / /
95.1	200.0	GREY	FINE SAND / /
102.4	192.7	GREY	CLAY / SILT /
108.8	186.3	GREY	CLAY / /
121.0	174.1	GREY	FINE SAND / /

Well Record #

5708596 **Lot** 007 **Conc** 12 BARRIE CITY (INNISFIL) / SIMCOE

Date 1972-01-11 **DD/MM/YYYY**

Elev 295.1 (masl) / Not Used **Easting** 604614 Test Hole **Northing** 4911263 **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found 109.7 (mbgs) 185.4 (masl) FRESH

Casing Diameter 1 inch **Casing Material:** STEEL

Top of Screen 119.8 (mbgs) **Bottom of Screen** 120.7 (mbgs)

Screen Interval 0.9 (m)

Flowing? N

SWL	62.5	(mbgs)	232.6	(masl)
Pumping WL	73.5	(mbgs)	221.7	(masl)
Pump Rate	377.3	(LPM)	26	/ 0
Spec. Cap.	34.39	(LPM/m)	Hour / Minute	

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	295.1		
12.2	282.9	BROWN	SAND / GRAVEL /
18.6	276.5	BROWN	SAND / GRAVEL / CLAY
22.9	272.3	GREY	SAND / CLAY / SILT
23.5	271.7	BROWN	CLAY / /
24.7	270.4	GREY	SAND / CLAY / SILT
28.3	266.8	BROWN	CLAY / SILT / FINE SAND
35.1	260.1	BROWN	FINE SAND / CLAY /
36.6	258.6	BROWN	CLAY / SAND /
39.6	255.5	GREY	SAND / CLAY /
42.7	252.5	BROWN	CLAY / SILT /
49.4	245.7	GREY	FINE SAND / CLAY /
53.9	241.2	GREY	CLAY / SILT /
65.5	229.6	GREY	FINE SAND / CLAY /
84.4	210.7	GREY	CLAY / /
95.4	199.7	GREY	FINE SAND / CLAY /
99.4	195.8	GREY	CLAY / SILT /
107.6	187.5	GREY	CLAY / /
121.9	173.2	GREY	FINE SAND / /
123.7	171.4	GREY	CLAY / SAND /

5708906 **Lot** 008 **Conc** 12 BARRIE CITY (INNISFIL) / SIMCOE

Date 1972-03-28 **DD/MM/YYYY**

Elev 301.2 (masl) / Industrial **Easting** 604844 Water Supply **Northing** 4910703 **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found 33.5 (mbgs) 267.7 (masl) FRESH

Casing Diameter 6 inch **Casing Material:** STEEL

Top of Screen 41.1 (mbgs) **Bottom of Screen** 43.6 (mbgs)

Screen Interval 2.4 (m)

Flowing? N

SWL	28.3	(mbgs)	272.9	(masl)
Pumping WL	41.8	(mbgs)	259.5	(masl)
Pump Rate	181.8	(LPM)	13	/ 0
Spec. Cap.	13.56	(LPM/m)	Hour / Minute	

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	301.2		
3.4	297.9	BROWN	SAND / /
		BROWN	SAND / /
6.1	295.1	BROWN	CLAY / /
		BROWN	CLAY / /
7.6	293.6	BROWN	GRAVEL / /
		BROWN	GRAVEL / /
39.9	261.3	YELLOW	COARSE SAND / FINE SAND /
		YELLOW	COARSE SAND / FINE SAND /
43.6	257.6	GREY	FINE SAND / MEDIUM SAND /
		GREY	FINE SAND / MEDIUM SAND /
45.7	255.5	GREY	SAND / CLAY /
		GREY	SAND / CLAY /

Well Record #

5710048 — **Lot** 007 **Conc** 12 — BARRIE CITY (INNISFIL) / SIMCOE

Date 1972-05-05 **DD/MM/YYYY**

Elev 293.3 (masl) **Easting** 604604 **Northing** 4911323
/ Industrial Water Supply **UTM RC** 4 **margin of error : 30 m - 100 m**
Water Found 109.7 (mbgs) 183.6 (masl) FRESH
Casing Diameter 20 inch **Casing Material:** STEEL
Top of Screen 110.9 (mbgs) **Bottom of Screen** 120.4 (mbgs)
Screen Interval 9.4 (m)

Flowing? N
SWL 63.1 (mbgs) 230.2 (masl)
Pumping WL 92.7 (mbgs) 200.7 (masl)
Pump Rate 909.2 (LPM) 24 / 0
Spec. Cap. 30.75 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	293.3		
10.1	283.3	BROWN	SAND / GRAVEL /
17.7	275.6	BROWN	GRAVEL / SAND /
22.6	270.8	BROWN	SAND / GRAVEL / CLAY
28.0	265.3	GREY	CLAY / GRAVEL /
40.5	252.8	BROWN	SAND / GRAVEL / CLAY
83.2	210.1	GREY	CLAY / SAND / SILT
92.4	201.0	BROWN	SAND / /
109.7	183.6	GREY	CLAY / SILT /
122.5	170.8	BROWN	SAND / CLAY /
122.8	170.5	BROWN	SAND / CLAY /

5713455 — **Lot** 006 **Conc** 12 — INNISFIL TOWNSHIP / SIMCOE

Date 1975-06-17 **DD/MM/YYYY**

Elev 307.1 (masl) **Easting** 603754 **Northing** 4911073
/ Domestic Water Supply **UTM RC** 5 **margin of error : 100 m - 300 m**
Water Found 32.0 (mbgs) 275.1 (masl) FRESH
Casing Diameter 5 inch **Casing Material:** STEEL
Top of Screen 43.6 (mbgs) **Bottom of Screen** 44.5 (mbgs)
Screen Interval 0.9 (m)

Flowing? N
SWL 32.0 (mbgs) 275.1 (masl)
Pumping WL 39.6 (mbgs) 267.5 (masl)
Pump Rate 22.7 (LPM) 2 / 0
Spec. Cap. 2.98 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	307.1		
2.4	304.7	BROWN	CLAY / SAND /
11.0	296.1	BROWN	SAND / /
11.3	295.8	BROWN	CLAY / /
23.8	283.3	GREY	CLAY / /
44.5	262.6	BROWN	SAND / /

5715532 — **Lot** 008 **Conc** 12 — INNISFIL TOWNSHIP / SIMCOE

Date 1978-07-13 **DD/MM/YYYY**

Elev 292.7 (masl) **Easting** 604764 **Northing** 4911123
/ Test Hole **UTM RC** 5 **margin of error : 100 m - 300 m**
Water Found (mbgs) (masl)
Casing Diameter **Casing Material:**
Top of Screen (mbgs) **Bottom of Screen** (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	292.7		
3.0	289.7		SAND / CLAY / DIRTY
6.7	286.0	BROWN	SILT / CLAY /
27.7	265.0		SAND / GRAVEL /
31.7	261.0		SAND / CLAY / LAYERED
51.8	240.9		SAND / CLAY / PACKED
69.8	222.9	GREY	SAND / CLAY / SILT
73.2	219.6	GREY	CLAY / SAND / SILTY
91.4	201.3	GREY	CLAY / SILTY /
109.7	183.0	GREY	CLAY / SILTY / SOFT
115.8	176.9	GREY	CLAY / SAND / SILTY
144.2	148.5	GREY	CLAY / SILTY /
152.4	140.3	GREY	CLAY / HARD /

Well Record #

5720702 — **Lot** 007 **Conc** 12 — INNISFIL TOWNSHIP / SIMCOE

Date 1985-12-10 (DD/MM/YYYY)
Elev 305.6 (masl) **Easting** 604466 **Northing** 4910589
/ Domestic Water Supply **UTM RC** 9 **unknown UTM**
Water Found 10.4 (mbgs) 295.3 (masl) Not stated
Casing Diameter 30 inch **Casing Material:** CONCRETE
Top of Screen (mbgs) **Bottom of Screen** (mbgs)
Screen Interval (m)

Flowing? N
SWL 10.4 (mbgs) 295.3 (masl)
Pumping WL 14.6 (mbgs) 291.0 (masl)
Pump Rate (LPM) 0 / 30
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	305.6		
0.3	305.3	BROWN	TOPSOIL / HARD /
16.5	289.2	BROWN	SAND / PACKED /

5735778 — **Lot** 008 **Conc** 12 — INNISFIL TOWNSHIP / SIMCOE

Date 2000-12-08 (DD/MM/YYYY)
Elev 299.5 (masl) **Easting** 604858 **Northing** 4910230
/ Abandoned-Other **UTM RC** 3 **margin of error : 10 - 30 m**
Water Found (mbgs) (masl)
Casing Diameter **Casing Material:**
Top of Screen (mbgs) **Bottom of Screen** (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	299.5		
			/ /

5738555 — **Lot** 006 **Conc** 12 — INNISFIL TOWNSHIP / SIMCOE

Date 2003-11-18 (DD/MM/YYYY)
Elev 306.5 (masl) **Easting** 603885 **Northing** 4910395
/ Domestic Water Supply **UTM RC** 9 **unknown UTM**
Water Found 59.4 (mbgs) 247.0 (masl) FRESH
Casing Diameter 6 inch **Casing Material:** STEEL
Top of Screen 65.5 (mbgs) **Bottom of Screen** 66.4 (mbgs)
Screen Interval 0.9 (m)

Flowing? N
SWL 1.5 (mbgs) 304.9 (masl)
Pumping WL 66.4 (mbgs) 240.0 (masl)
Pump Rate 22.7 (LPM) 12 / 0
Spec. Cap. 0.35 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	306.5		
4.6	301.9	BROWN	CLAY / /
18.3	288.2	GREY	SAND / SILT /
59.4	247.0	GREY	CLAY / /
66.4	240.0	GREY	SAND / /

5738704 — **Lot** **Conc** — BARRIE CITY / SIMCOE

Date 2003-12-23 (DD/MM/YYYY)
Elev 302.4 (masl) **Easting** 604610 **Northing** 4909950
/ Not Used Observation Wells **UTM RC** 5 **margin of error : 100 m - 300 m**
Water Found 3.3 (mbgs) 299.1 (masl) FRESH
Casing Diameter 5 cm **Casing Material:** PLASTIC
Top of Screen 2.3 (mbgs) **Bottom of Screen** 5.5 (mbgs)
Screen Interval 3.1 (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	302.4		
0.2	302.2		UNKNOWN TYPE / /
1.0	301.4		SAND / GRAVEL / FILL
5.5	297.0	BROWN	SAND / COARSE SAND /

Well Record #

7111727 — **Lot** 006 **Conc** 12 — INNISFIL TOWNSHIP / SIMCOE

Date 2008-07-14 (DD/MM/YYYY)
Elev 307.8 (masl) / **Easting** 604138 **Northing** 4909762 **UTM RC** 3 **margin of error : 10 - 30 m**
Water Found (mbgs) (masl)
Casing Diameter **Casing Material:**
Top of Screen (mbgs) **Bottom of Screen** (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	307.8		PREV. DRILLED / /

7139177 — **Lot** **Conc** — BARRIE CITY / SIMCOE

Date 2009-11-24 (DD/MM/YYYY)
Elev 295.9 (masl) / Not Used / **Easting** 604300 Abandoned-Other **Northing** 4911332 **UTM RC** 4 **margin of error : 30 m - 100 m**
Water Found (mbgs) (masl)
Casing Diameter 36 inch **Casing Material:** CONCRETE
Top of Screen (mbgs) **Bottom of Screen** (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	295.9		
7.0	288.9		/ /

7141933 — **Lot** 008 **Conc** 12 — BARRIE CITY (INNISFIL) / SIMCOE

Date 2010-02-05 (DD/MM/YYYY)
Elev 294.3 (masl) / Industrial / **Easting** 604659 Abandoned-Other **Northing** 4911259 **UTM RC** 4 **margin of error : 30 m - 100 m**
Water Found (mbgs) (masl)
Casing Diameter 20 inch **Casing Material:** STEEL
Top of Screen 109.7 (mbgs) **Bottom of Screen** 121.9 (mbgs)
Screen Interval 12.2 (m)

Flowing?
SWL 63.1 (mbgs) 231.3 (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	294.3		/ /

7141934 — **Lot** 008 **Conc** 12 — BARRIE CITY (INNISFIL) / SIMCOE

Date 2010-02-05 (DD/MM/YYYY)
Elev 291.7 (masl) / Monitoring / **Easting** 604692 **Northing** 4911366 **UTM RC** 4 **margin of error : 30 m - 100 m**
Water Found (mbgs) (masl)
Casing Diameter 6 inch **Casing Material:** STEEL
Top of Screen 121.9 (mbgs) **Bottom of Screen** 125.0 (mbgs)
Screen Interval 3.0 (m)

Flowing?
SWL 63.1 (mbgs) 228.6 (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	291.7		/ /

7145163 — **Lot** **Conc** — BARRIE CITY / SIMCOE

Date 2009-12-01 (DD/MM/YYYY)
Elev 302.7 (masl) / Monitoring / **Easting** 604620 Observation Wells **Northing** 4909969 **UTM RC** 4 **margin of error : 30 m - 100 m**
Water Found (mbgs) (masl)
Casing Diameter 2 inch **Casing Material:** PLASTIC
Top of Screen 1.5 (mbgs) **Bottom of Screen** 6.1 (mbgs)
Screen Interval 4.6 (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	302.7		
3.7	299.0	BROWN	SAND / / PACKED
6.1	296.6	BROWN	SILT / SAND / PACKED

Well Record #

7153784 **Lot** **Conc** INNISFIL TOWNSHIP / SIMCOE

Date 2010-08-27 **DD/MM/YYYY**

Elev 303.2 (masl) **Easting** 604618 **Northing** 4909992

/ Monitoring and Te Abandoned-Other **UTM RC** 3 **margin of error : 10 - 30 m**

Water Found 20.0 (mbgs) 283.2 (masl) FRESH

Casing Diameter cm **Casing Material:** PLASTIC

Top of Screen 6.0 (mbgs) **Bottom of Screen** 4.5 (mbgs)

Screen Interval -1.5 (m)

Flowing?

SWL 5.4 (mbgs) 297.8 (masl)

Pumping WL (mbgs) (masl)

Pump Rate (LPM) /

Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0	303.2				
10.0	293.2	BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL

10.0	293.2	BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL
		BROWN	SAND /	GRAVEL	/ FILL

Well Record #						
	10.0	293.2	BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
			BROWN	SAND /	GRAVEL	/ FILL
	15.0	288.2	BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/
			BROWN	GRAVEL /	SAND	/

15.0	288.2	BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/

15.0	288.2	BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
		BROWN	GRAVEL /	SAND	/
20.0	283.2	GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/

Well Record #

20.0	283.2	GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/

20.0	283.2	GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/
		GREY	CLAY /	TILL	/

Well Record #

7207031 **Lot** **Conc** INNISFIL TOWNSHIP / SIMCOE

Date 2013-07-22 **DD/MM/YYYY** | **Elev** 292.3 (masl) **Easting** 604534 **Northing** 4911534 | / Monitoring Observation Wells **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found (mbgs) (masl)

Casing Diameter cm **Casing Material:**

Top of Screen (mbgs) **Bottom of Screen** (mbgs)

Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	292.3		

/ /

7207770 **Lot** **Conc** BARRIE CITY (INNISFIL) / SIMCOE

Date 2013-07-04 **DD/MM/YYYY** | **Elev** 301.4 (masl) **Easting** 604805 **Northing** 4910680 | / Monitoring and Te Monitoring and Test Hole **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found 2.3 (mbgs) 299.1 (masl) Untested

Casing Diameter 2 inch **Casing Material:** PLASTIC

Top of Screen 3.0 (mbgs) **Bottom of Screen** 6.1 (mbgs)

Screen Interval 3.0 (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	301.4		
3.0	298.3	BROWN	SAND / SILT / LOOSE
5.2	296.2	BROWN	SAND / / SILTY
6.1	295.3	GREY	SILT / SAND /

7239314 **Lot** **Conc** INNISFIL TOWNSHIP / SIMCOE

Date 2014-03-26 **DD/MM/YYYY** | **Elev** 303.8 (masl) **Easting** 604495 **Northing** 4909947 | / **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found (mbgs) (masl)

Casing Diameter **Casing Material:**

Top of Screen (mbgs) **Bottom of Screen** (mbgs)

Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0	303.8		

/ /

7325388 **Lot** 006 **Conc** 12 INNISFIL TOWNSHIP / SIMCOE

Date 2018-11-01 **DD/MM/YYYY** | **Elev** (masl) **Easting** 604151 **Northing** 4909775 | / Monitoring and Te **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found (mbgs) (masl)

Casing Diameter 2 inch **Casing Material:** PLASTIC

Top of Screen 6.1 (mbgs) **Bottom of Screen** 9.1 (mbgs)

Screen Interval 3.0 (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
5.5		BROWN	CLAY / /
7.3		BROWN	SAND / GRAVEL /
9.1		BROWN	FINE SAND / WATER-BEARING /

7325389 **Lot** 006 **Conc** 12 INNISFIL TOWNSHIP / SIMCOE

Date 2018-11-09 **DD/MM/YYYY** | **Elev** (masl) **Easting** 603920 **Northing** 4909961 | / Monitoring and Te **UTM RC** 4 **margin of error : 30 m - 100 m**

Water Found (mbgs) (masl)

Casing Diameter 2 inch **Casing Material:** PLASTIC

Top of Screen 4.6 (mbgs) **Bottom of Screen** 7.6 (mbgs)

Screen Interval 3.0 (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
5.5		BROWN	SAND / GRAVEL /

Well Record #

									7.6		BROWN	FINE SAND /	WATER-BEARING	/
7338087	**Lot** 008	**Conc** 12			BARRIE CITY (INNISFIL) / SIMCOE							**Flowing?**		
Date 2019-06-17	**Elev**	(masl)	**Easting** 604774		**Northing** 4911224							**SWL**	(mbgs)	(masl)
DD/MM/YYYY	/ Monitoring		Observation Wells		**UTM RC** 4	**margin of error : 30 m - 100 m**						**Pumping WL**	(mbgs)	(masl)
	Water Found 2.4	(mbgs)	(masl)		Untested							**Pump Rate**	(LPM)	/
	Casing Diameter 2	Inch	**Casing Material:**	PLASTIC			**Depth (m)**	**Elev (masl)**				**Spec. Cap.**	(LPM/m)	Hour / Minute
	Top of Screen 0.9	(mbgs)	**Bottom of Screen** 3.4	(mbgs)			0.0		**Color**			**Soil Descriptions**		
	Screen Interval 2.4	(m)												
							1.5		BROWN	FILL /		FILL	/ SAND	
									BROWN	FILL /		FILL	/ SAND	
							3.0		GREY	CLAY /			/	
									GREY	CLAY /			/	
7351984	**Lot** 008	**Conc** 12			BARRIE CITY (INNISFIL) / SIMCOE							**Flowing?**		
Date 2020-01-10	**Elev**	(masl)	**Easting** 604835		**Northing** 4910705							**SWL**	(mbgs)	(masl)
DD/MM/YYYY	/				**UTM RC** 4	**margin of error : 30 m - 100 m**						**Pumping WL**	(mbgs)	(masl)
	Water Found 1.9	(mbgs)	(masl)		Untested							**Pump Rate**	(LPM)	/
	Casing Diameter 5	cm	**Casing Material:**	PLASTIC			**Depth (m)**	**Elev (masl)**				**Spec. Cap.**	(LPM/m)	Hour / Minute
	Top of Screen 1.5	(mbgs)	**Bottom of Screen** 4.5	(mbgs)			0.0		**Color**			**Soil Descriptions**		
	Screen Interval 3.0	(m)												
											/		/	
7367047	**Lot**	**Conc**			/							**Flowing?**		
Date	**Elev**	(masl)	**Easting**		**Northing**							**SWL**	(mbgs)	(masl)
DD/MM/YYYY	/				**UTM RC**							**Pumping WL**	(mbgs)	(masl)
	Water Found	(mbgs)	(masl)									**Pump Rate**	(LPM)	/
	Casing Diameter		**Casing Material:**				**Depth (m)**	**Elev (masl)**				**Spec. Cap.**	(LPM/m)	Hour / Minute
	Top of Screen	(mbgs)	**Bottom of Screen**	(mbgs)			0.0		**Color**			**Soil Descriptions**		
	Screen Interval	(m)												
											/		/	

APPENDIX

B

BOREHOLE AND MONITORING WELL LOGS

LOG OF BOREHOLE MW 1

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Hollow Stem Auger
ENCL NO.: 1
PROJECT LOCATION: Barrie
Diameter: 203mm
DATUM: Relative
Date: Sep/07/2021
BH LOCATION: See Figure 1

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
302.7	Ground Surface						
0.0 / 302.5	Straight augered to 4.57m, data from previously drilled BH18-28.						
0.2 / 301.9	**TOPSOIL** dark brown, moist	1	SS	6		302	
0.8	**SILTY SAND FILL** some gravel, cobbles, orangy brown, moist, loose	2	SS	4			
	SILTY SAND to SILT and SAND brown to grey, moist to saturated, loose to dense	3	SS	33		301	
		4	SS	48			0 75 (25)
		5	SS	44		Bentonite Holeplug	
		6	SS	19		299	
		7	SS	50		298	
		8	SS	33		Sand	
296.1						297	
6.6	**SILT** some fine sand, brown, saturated, compact	9	SS	28		W. L. 296.0 m Sep 08, 2021	
		10	SS	50		295	
294.5							
8.2	**End of Borehole** 51mm diameter monitoring well installed upon completed, screened 6.1mbgs to 7.62mbgs.						

Date WL(mbg)
07/09/2021 6.67
08/09/2021 6.67

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

LOG OF BOREHOLE MW2

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Hollow Stem Auger
ENCL NO.: 2
PROJECT LOCATION: Barrie
Diameter: 203mm
DATUM: Relative
Date: Sep/07/2021
BH LOCATION: See Figure 1

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m	ELEVATION
303.8	Ground Surface				
0.0	Straight augered to 4.57m, data from previously drilled BH18-33.	1	SS	4	
	SAND FILL some silt to silty, trace gravel, trace clay, trace organics, brown to orangy brown, moist, loose	2	SS	7	303
302.6					
1.2	**SANDY, CLAYEY SILT TILL** trace gravel, brown, wet, stiff	3	SS	9	302
301.5					
2.3	**SILTY SAND TILL** trace gravel, trace clay, occasional sand layers, occasional silt layers, grey, moist to wet, dense	4	SS	38	
300.8					301
3.0	**SAND** some silt to silty, brown to grey, saturated, compact to very dense	5	SS	29	
		6	SS	46	300
		7	SS	22	299
		8	SS	97	298
297.1					
6.7	**End of Borehole** 51mm diameter monitoring well installed upon completed, screened 4.57mbgs to 6.1mbgs.				

Date WL(mbg)
07/09/2021 2.89
08/09/2021 2.86

Bentonite Holeplug
W. L. 300.9 m
Sep 08, 2021
Sand
Screen

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW3

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Hollow Stem Auger
ENCL NO.: 3
PROJECT LOCATION: Barrie
Diameter: 203mm
DATUM: Relative
Date: Sep/07/2021
BH LOCATION: See Figure 1

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
305.0	Ground Surface				
304.8 0.2	Straight augered to 4.57m, data from previously drilled BH18-40.		CORE		
304.4	**ASPHALT**	1	SS	23	
0.6	**GRAVELLY SAND FILL** trace silt, brown, moist to dry, compact				
1	**SILTY SAND FILL** trace gravel, brown, moist, loose	2	SS	8	304
303.5					
1.5	**SILTY CLAY FILL** some sand layers, brown, wet, firm	3	SS	5	
2					Bentonite Holeplug
302.7					
2.3	**SAND** trace to some silt, trace gravel, brown, wet to saturated, compact to very dense	4	SS	28	
3		5	SS	58	302
4					W. L. 301.4 m Sep 08, 2021 Sep 07, 2021
					Sand
5		6	SS	30	300
					Screen
		7	SS	41	
6					299
		8	SS	43	
298.3					
6.7	**End of Borehole** 51mm diameter monitoring well installed upon completed, screened 4.57mbgs to 6.1mbgs.				

Date WL(mbg)
07/09/2021 3.72
08/09/2021 3.62

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	37	45		(18)
	0	91		(9)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ $^{\varepsilon}$=3% Strain at Failure

LOG OF BOREHOLE BH18-21

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Hollow Stem Auger
ENCL NO.: 4
PROJECT LOCATION: Barrie
Diameter: 200mm
DATUM: Relative
Date: Jun/12/2018
BH LOCATION: See Figure 1

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
297.1	Ground Surface										
297.0	**TOPSOIL**										
0.3	dark brown, moist	1	SS	8		297					
	SILTY SAND FILL mixed with topsoil, brown and dark brown, moist, loose	2	SS	10		296					
295.7											
1.5	**CLAYEY SANDY SILT TILL** trace sand, trace gravel, brown, moist, stiff to very stiff	3	SS	13		295					3 31 49 17
		4	SS	10							
		5	SS	17		294					5 27 42 26
293.1											
4.0	**SAND** trace gravel, some silt, brown, dry to wet, very dense	6	SS	59		293					
		7	SS	61		292					
		8	SS	56		291					
		9	SS	74		290					0 85 (15)
		10	SS	57		288					
		11	SS	78		287					
284.5						286					
12.7	End of Borehole					285					

W. L. 289.8 m Feb 11. 2018
W. L. 289.4 m Sep 21, 2018

NOTES:

Groundwater measured at a depth of 6.7 m below site grades on completion of drilling operations.

Water level at 7.7 mbgs measured on September 21, 2018.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3%: Strain at Failure

LOG OF BOREHOLE BH18-OF1

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 5
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/12/2018
BH LOCATION: See Figure 1

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
295.1	Ground Surface											
0.0 / 294.9	**TOPSOIL** dark brown, moist						295					
0.2	**SILTY SAND** brown, moist to saturated, very loose to compact		1	SS	3							
1			2	SS	11		294					
			3	SS	10	W. L. 293.7 m W. L. 293.6 m Sep 21, 2018						
2 / 292.9							293					
2.2	**CLAYEY SILT** trace sand, brown to grey, moist, tiff to hard		4	SS	8							
3			5	SS	45		292					
4							291					
			6	SS	58							
290.1 / 5.0	End of Borehole Groundwater measured at a depth of 1.2 m below site grades on completion of drilling operations.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-20

PROJECT: Bryne Drive Extension
CLIENT: City of Barrie
PROJECT LOCATION: Barrie
DATUM: Relative
BH LOCATION: See Figure 3

Method: Hollow Stem Auger
Diameter: 200mm
Date: Jun/13/2018

REF. NO.: 181-06461-00
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GR	SA	SI	CL
	Ground Surface							
0.0	**TOPSOIL** dark brown, moist	1	SS	2				
0.7	**SAND** trace silt, brown, wet, compact	2	SS	10				
1.5	**SILTY CLAY** grey to brown, moist, firm to hard	3	SS	8	0	8	48	44
		4	SS	26				
		5	SS	85				
4.0	**SAND** trace gravel, trace silt, brown, dry to moist, very dense	6	SS	93				
		7	SS	95	1	91		(8)
		8	SS	89				
		9	SS	83				
		10	SS	95				
		11	SS	88				
12.5	End of Borehole NOTES: Water level was measured as dry on September 21, 2018							

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ε=3% Strain at Failure

LOG OF BOREHOLE 18-22

PROJECT: Bryne Drive Extension
CLIENT: City of Barrie
PROJECT LOCATION: Barrie
DATUM: Relative
BH LOCATION: See Figure 1/2

REF. NO.: 181-06461-00
ENCL NO.: 10

Method: Solid Stem Auger
Diameter: 150mm
Date: Jun/07/2018

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface							20 40 60 80 100	10 20 30			
0.0	**TOPSOIL** dark brown, moist											
0.2	**SAND** brown, trace to some silt, moist, very loose to very dense		1	SS	4			4				
			2	SS	4			4				0 96 (4)
			3	SS	16			16				
			4	SS	80			80				
			5	SS	66			66				
			6	SS	43			43				
5.0	End of Borehole Borehole open and dry on completion of drilling operations.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-23

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 11
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/07/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface										
0.0	**TOPSOIL** dark brown, moist										
0.2	**SILTY SAND** brown, moist, loose to very dense		1	SS	8			8			
			2	SS	5			5			
			3	SS	30			30			
			4	SS	39			39			
			5	SS	65			65			
			6	SS	32			32			
							W. L. 3.6 mBGL Jun 07, 2018				
5.0	End of Borehole Groundwater measured at a depth of 3.7 m below site grades on completion of drilling operations.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-24

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 12
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/07/2018
BH LOCATION: See Figure 1/2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	"N"
	Ground Surface				
0.0	**TOPSOIL** dark brown, moist				
0.2	**SILTY SAND** some gravel, brown, moist, compact	1	SS	11	11
0.8	**CLAYEY SILT TILL** sandy, brown, moist, firm	2	SS	5	5
1.5	**SILTY SAND** trace clay, brown, moist, very loose to dense	3	SS	2	2
		4	SS	31	31
		5	SS	36	36
		6	SS	40	40
5.0	End of Borehole Borehole open and dry on completion of drilling operations.				

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	2	34	32	32

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3% Strain at Failure

LOG OF BOREHOLE 18-25

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 13
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/07/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface				
0.0	**TOPSOIL** dark brown, moist				
0.2	**SILTY SAND** brown, moist, loose	1	SS	4	
		2	SS	4	
1.5	**CLAYEY SILT TILL** sandy, trace gravel, brown, moist, very stiff	3	SS	19	2 30 36 32
2.3	**SILTY SAND TILL** some clay, trace gravel, brown, moist, dense	4	SS	46	
3.0	**SILTY SAND** brown, moist, compact to very dense	5	SS	29	
		6	SS	74	
5.0	End of Borehole Borehole open and dry on completion of drilling operations.				

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
GROUND WATER CONDITIONS
ELEVATION
STRATA PLOT

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3% Strain at Failure

LOG OF BOREHOLE 18-26

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 14
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/07/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	Ground Surface						
0.0	**TOPSOIL** dark brown, moist						
0.2	**SILTY SAND** trace to some gravel, brown, moist, very loose to compact		1	SS	2		
			2	SS	4		
			3	SS	18		
2.3	**SILTY SAND TILL** some gravel, trace clay, brown, moist, compact		4	SS	22		
			5	SS	78		
			6	SS	44		
5.0	End of Borehole Borehole open and dry on completion of drilling operations.						

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-27

PROJECT: Bryne Drive Extension
CLIENT: City of Barrie
PROJECT LOCATION: Barrie
DATUM: Relative
BH LOCATION: See Figure 1/2

Method: Solid Stem Auger
Diameter: 150mm
Date: Jun/06/2018

REF. NO.: 181-06461-00
ENCL NO.: 15

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	Ground Surface						
0.0	**TOPSOIL** dark brown, moist						
0.2	**SAND and GRAVEL FILL** trace silt, brown, moist, loose to compact		1	SS	6		
0.9	**SILTY SAND** brown, moist, compact		2	SS	19		
1.1	**SILT and SAND TILL** some gravel, trace clay, brown, moist, compact						
1.8	**SILTY SAND to SILT and SAND** brown to gray, moist to dry, dense to very dense		3	SS	33		
			4	SS	52		
			5	SS	73		
			6	SS	81		
5.0	End of Borehole Borehole open and dry on completion of drilling operations.						

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3% Strain at Failure

LOG OF BOREHOLE 18-28

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 16
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/06/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface										
0.0	**TOPSOIL** dark brown, moist										
0.2	**SILTY SAND FILL** some gravel, cobbles, orangy brown, moist, loose		1	SS	6			6	○		
0.8	**SILTY SAND to SILT and SAND** brown to grey, moist to saturated, loose to dense		2	SS	4			4	○		
			3	SS	33			33	○		
			4	SS	48			48	○		0 75 (25)
			5	SS	44			44	○		
4.7	**SILT** trace to some sand, brown, saturated, compact		6	SS	19			19	○		
5.0	End of Borehole Borehole open and dry on completion of drilling operations.										

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 3=3% Strain at Failure

LOG OF BOREHOLE 18-29

PROJECT: Bryne Drive Extension
CLIENT: City of Barrie
PROJECT LOCATION: Barrie
DATUM: Relative
BH LOCATION: See Figure 1/2

REF. NO.: 181-06461-00
ENCL NO.: 17

Method: Solid Stem Auger
Diameter: 150mm
Date: Jun/06/2018

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
	Ground Surface						
0.0	**TOPSOIL** dark brown, moist						
0.2	**SILTY SAND FILL** trace gravel, trace organics, orangy brown, moist, loose		1	SS	4		
			2	SS	4		
1.2	**SILT and SAND to SILTY SAND** brown, moist to saturated, loose to very dense		3	SS	10		
			4	SS	55		
			5	SS	36		
			6	SS	43		
5.0	End of Borehole Groundwater measured at a depth of 3.8 m below site grades on completion of drilling operations.						

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-30

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 18
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/06/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	Ground Surface						
0.0	**TOPSOIL** dark brown, moist		1	SS	3		
0.3	**SAND FILL** some silty, trace organics, brown, moist to saturated, very loose		2	SS	3		
1.5	**SAND** some silt to silty, brown, saturated, compact to very dense		3	SS	31		
			4	SS	51		
			5	SS	71		
			6	SS	15		
			7	SS	30		
6.5	End of Borehole Groundwater measured at a depth of 0.9 m below site grades on completion of drilling operations.						

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-31

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 19
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/06/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface										
0.0	**TOPSOIL** dark brown, moist										
0.2	**SILTY SAND FILL** some gravel, cobbles, boulder, orangy brown, moist, loose		1	SS	5			5	○		
0.8	**SILTY SAND TILL** some gravel, trace clay, brown, wet, loose		2	SS	6			6	○		
1.5	**SAND** some silt to silty, trace gravel, brown, wet to saturated, compact to very dense		3	SS	30			30	○		
			4	SS	39			39	○		
			5	SS	52			52	○		
			6	SS	73			73	○		
5.0	End of Borehole Groundwater measured at a depth of 2.0 m below site grades on completion of drilling operations.										

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-32

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 20
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/06/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface							
0.0	**TOPSOIL** dark brown, moist							
0.2	**SAND FILL** some silt to silty, orangy brown to brown, moist, loose		1	SS	5			
0.9	**SANDY CLAYEY SILT TILL** trace gravel, brown, moist, firm to stiff		2	SS	8			
1.5	**SILTY SAND TILL** trace gravel, some clay, brown, wet, compact to dense		3	SS	21			4 52 28 16
2.4	**SAND** some silt to silty, trace gravel, brown, wet to saturated, compact to very dense		4	SS	37			
			5	SS	26			
			6	SS	65			
5.0	End of Borehole Groundwater measured at a depth of 2.4 m below site grades on completion of drilling operations.							

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3% Strain at Failure

LOG OF BOREHOLE 18-33

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 21
PROJECT LOCATION: Barrie
Diameter: 190mm
DATUM: Relative
Date: Jun/06/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT; SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface						20 40 60 80 100	10 20 30			
0.0	**SAND FILL** some silt to silty, trace gravel, trace clay, trace organics, brown to orangy brown, moist, loose	1	SS	4			4				
		2	SS	7			7				
1.2	**SANDY, CLAYEY SILT TILL** trace gravel, brown, wet, stiff	3	SS	9			9				
2.3	**SILTY SAND TILL** trace gravel, trace clay, occasional sand layers, occasional silt layers, grey, moist to wet, dense	4	SS	38	W. L. 2.3 mBGL Jun 06, 2018		38				
3.0	**SAND** some silt to silty, brown to grey, saturated, compact to very dense	5	SS	29			29				
		6	SS	68/ 0.28m			68/0.28m				
5.0	End of Borehole Groundwater measured at a depth of 2.3 m below site grades on completion of drilling operations.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-34

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
ENCL NO.: 22
PROJECT LOCATION: Barrie
Method: Solid Stem Auger
DATUM: Relative
Diameter: 150mm
Date: Jun/01/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GR	SA	SI	CL
	Ground Surface							
0.0	**TOPSOIL** dark brown, moist							
0.3	**SAND and SILT FILL** trace organics, brown, moist, compact	1	SS	10				
		2	SS	19				
1.5	**SILTY SAND TILL** some clay, trace gravel, brown, moist, compact	3	SS	25	3	53	28	16
2.3	**SILTY SAND** trace gravel, brown, wet to saturated, compact to very dense	4	SS	27				
		5	SS	20				
		6	SS	66				
5.0	End of Borehole Groundwater measured at a depth of 2.9 m below site grades on completion of drilling operations.							

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3% Strain at Failure

LOG OF BOREHOLE 18-35

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
ENCL NO.: 23
PROJECT LOCATION: Barrie
Method: Solid Stem Auger
DATUM: Relative
Diameter: 150mm
Date: May/31/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
	Ground Surface						
0.0	**ASPHALT**			CORE			
0.1	**GRAVELLY SAND FILL** trace silt, brown, moist to dry, dense		1	SS	37		
0.6	**SILTY SAND FILL** trace gravel, brown, moist to saturated, dense to very loose		2	SS	40		
			3	SS	24		
			4	SS	6		
			5	SS	1		
3.4	**SANDY SILT** brown, saturated, very dense		6	SS	68		
5.0	End of Borehole Groundwater measured at a depth of 3.0 m below site grades on completion of drilling operations.						

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3% Strain at Failure

LOG OF BOREHOLE 18-36

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 24
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/01/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface											
0.0	**TOPSOIL** dark brown, moist											
0.2	**SILT and SAND to SILTY SAND FILL** trace to some gravel, trace clay, trace organics, brown, moist to wet, compact to loose		1	SS	20			20				
			2	SS	6			6				
1.5	**SILTY SAND** trace gravel, brown, moist to saturated, dense to very dense		3	SS	32			32				1 72 (27)
			4	SS	45			45				
			5	SS	40			40				
			6	SS	88/ 0.28m			88/0.28m				
5.0	End of Borehole Groundwater measured at a depth of 3.1 m below site grades on completion of drilling operations.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ε=3% Strain at Failure

LOG OF BOREHOLE 18-37

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 25
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: May/31/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface											
0.0	**ASPHALT**			CORE								
0.1	**GRAVEL and SAND to GRAVELLY SAND FILL** trace silt, brown, moist to dry, compact		1	SS	22							
0.6	**SILTY SAND FILL** trace gravel, brown, moist, compact		2	SS	22							
1.5	**SAND** some silt to silty, trace gravel, brown, moist to saturated, compact to very dense		3	SS	15							
			4	SS	34							
			5	SS	36							
			6	SS	62							
5.0	End of Borehole Groundwater measured at a depth of 2.4 m below site grades on completion of drilling operations.											

SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE
WATER CONTENT (%): PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-38

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 26
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/01/2018
BH LOCATION: See Figure 1/2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface				
0.0	**ASPHALT**		CORE		
0.1	**GRAVELLY SAND FILL** trace silt, brown, moist to dry, compact	1	SS	23	
0.3	**SAND FILL** some gravel to gravelly, trace silt, brown, moist to dry, compact				
0.5	**SILT and SAND FILL** trace gravel, trace clay, brown, moist to wet, compact to loose	2	SS	29	
		3	SS	21	
		4	SS	10	4 60 (36)
3.0	**SAND** some silt to silty, brown, saturated, dense to very dense	5	SS	44	
		6	SS	82/ 0.25m	
5.0	End of Borehole Groundwater measured at a depth of 2.9 m below site grades on completion of drilling operations.				

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3%: Strain at Failure

LOG OF BOREHOLE 18-39

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 27
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: May/31/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface										
0.0	**TOPSOIL** dark brown, moist										
0.2	**SANDY CLAYEY SILT FILL**										
0.3	brown, moist, firm		1	SS	6			6			
	SAND FILL some silt, trace clay, orangy brown, moist, loose										
0.8	**SILTY SAND TILL** some gravel, trace clay, brown, moist, compact		2	SS	23			23			
1.5	**SAND** some silt to silty, brown, moist to saturated, dense to very dense		3	SS	37			37			
			4	SS	44			44			
			5	SS	34			34			
			6	SS	60			60			
5.0	End of Borehole Groundwater measured at a depth of 2.8 m below site grades on completion of drilling operations.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 3=3% Strain at Failure

LOG OF BOREHOLE 18-40

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 28
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: May/31/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface							20 40 60 80 100	10 20 30			
0.0	**ASPHALT**			CORE								
0.2	**GRAVELLY SAND FILL** trace silt, brown, moist to dry, compact		1	SS	23			23				37 45 (18)
0.6	**SILTY SAND FILL** trace gravel, brown, moist, loose		2	SS	8			8				
1.5	**SILTY CLAY FILL** some sand layers, brown, wet, firm		3	SS	5			5				
2.3	**SAND** trace to some silt, trace gravel, brown, wet to saturated, compact to very dense		4	SS	28			28				0 91 (9)
			5	SS	58			58				
			6	SS	30			30				
5.0	End of Borehole Groundwater measured at a depth of 3.1 m below site grades on completion of drilling operations.											

SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3%: Strain at Failure

LOG OF BOREHOLE 18-41

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
Method: Solid Stem Auger
ENCL NO.: 29
PROJECT LOCATION: Barrie
Diameter: 150mm
DATUM: Relative
Date: Jun/01/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
	Ground Surface						
0.0	**ASPHALT**			CORE			
0.2	**GRAVELLY SAND FILL** trace silt, brown, moist, compact		1	SS	26		
0.5	**SILTY CLAY TILL** some sand, trace gravel, brown, moist, stiff to very stiff		2	SS	12		
			3	SS	24		
2.3	**SILTY CLAY** trace sand, brown, moist, hard		4	SS	51		
2.6	**SILTY SAND** brown, moist to saturated, very dense		5	SS	71		
			6	SS	73		
5.0	End of Borehole Groundwater measured at a depth of 3.3 m below site grades on completion of drilling operations.						

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 18-42

PROJECT: Bryne Drive Extension
REF. NO.: 181-06461-00
CLIENT: City of Barrie
ENCL NO.: 30
PROJECT LOCATION: Barrie
Method: Solid Stem Auger
DATUM: Relative
Diameter: 150mm
Date: May/31/2018
BH LOCATION: See Figure 1/2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GR	SA	SI	CL
	Ground Surface							
0.0	**ASPHALT**		CORE					
0.1	**GRAVEL and SAND FILL** trace silt, brown, moist, compact	1	SS	30	33	55		(12)
0.5	**SAND FILL** some gravel, trace silt, brown, moist, compact							
0.9	**SILTY SAND TILL** some gravel, trace clay, brown, moist, compact	2	SS	24				
1.5	**SILT and CLAY**							
1.6	trace gravel, trace sand, brown, moist, stiff	3A	SS	14				
	SAND some silt to silty, brown, moist to saturated, compact to very dense	4	SS	39				
		5	SS	70				
		6	SS	82/ 0.28m				
5.0	End of Borehole Groundwater measured at a depth of 3.3 m below site grades on completion of drilling operations.							

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)

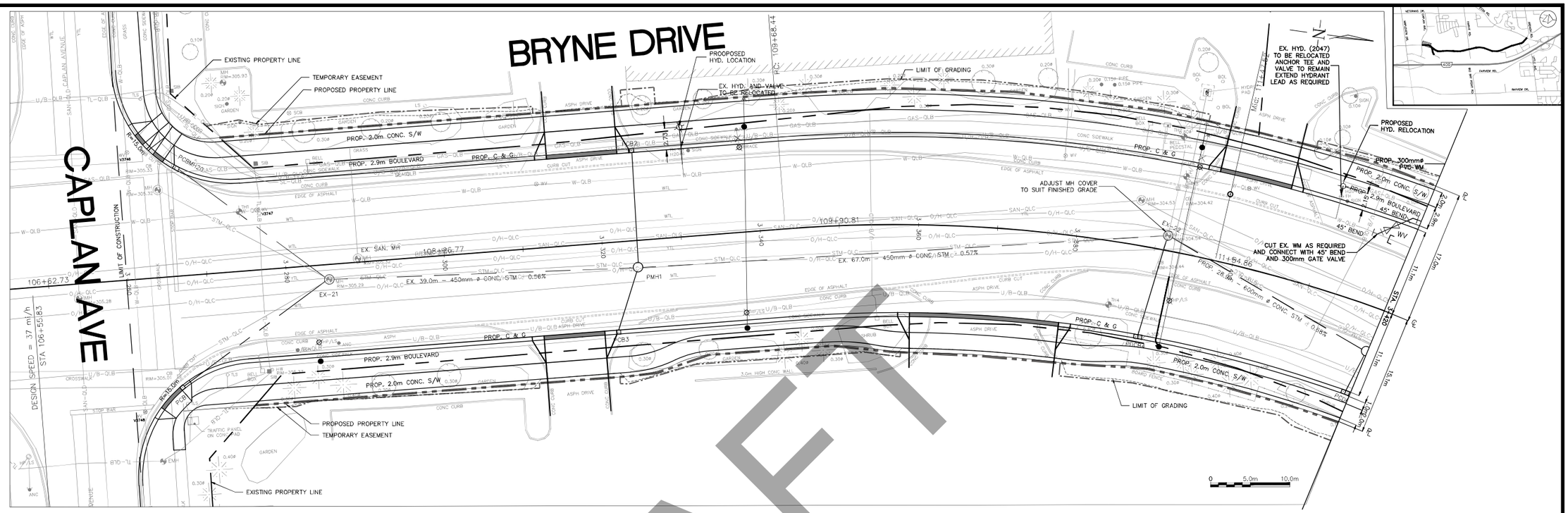
GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

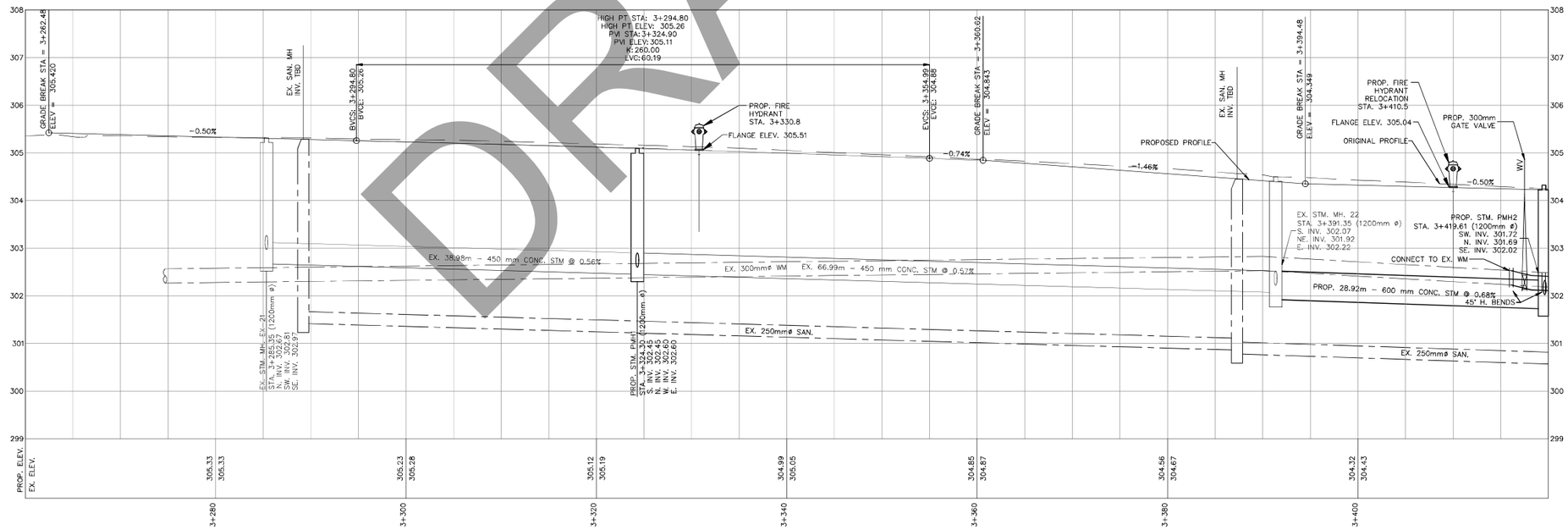
GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3%: Strain at Failure

APPENDIX

C

HATCH PLAN AND PROFILE DESIGN DRAWINGS





GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 031910009 (N=4914801.348, E=601584.468)AND 010860410 (N=4913103.464, E=606668.620), AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

269.751 – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.6KM NORTH OF EDGEHILL DRIVE, TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44CM SOUTH OF NORTHWEST END AND 37CM BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

PLAN AND PROFILE
BRYNE DRIVE
STA. 3+240 TO STA. 3+420

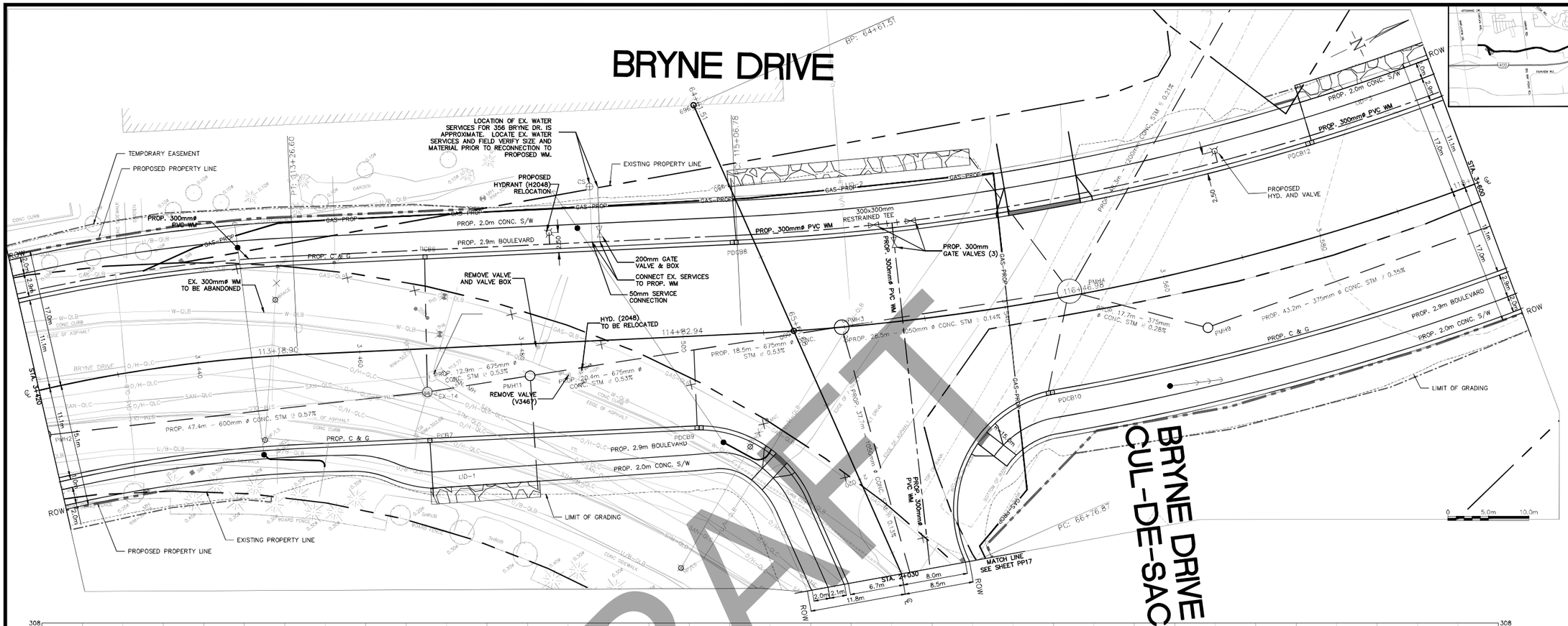
Barrie
ENGINEERING DEPARTMENT

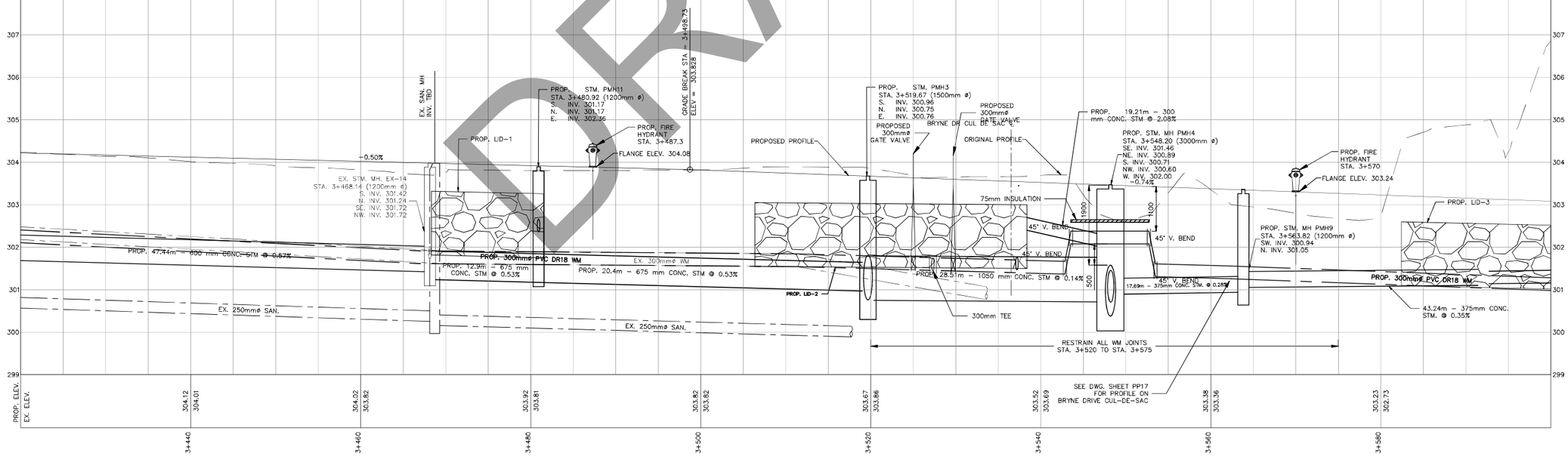
SCALE HOR. 1:250	VERT. 1:50	CONTRACT NO.	
DESIGN V.V	DRAWN V.V	SHEET NO.	PP1
REVIEWED	DATE 2020.09.23		

-001

9/24/2020 10:58 AM VALDERRAMA, VICTOR H:\5347~25~2KO-PP.DWG

BRYNE DRIVE





GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 031910009 (N=4914801.348, E=601584.468)AND 010860410 (N=4913103.464, E=606668.620). AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

269.75± – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.0KM NORTH OF EDGEHILL DRIVE. TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44.0m SOUTH OF NORTHWEST END AND 370m BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

PLAN AND PROFILE
BRYNE DRIVE
STA. 3+420 TO STA. 3+600

Barrie
ENGINEERING DEPARTMENT

SCALE HOR.	1:250	VERT.	1:50
DESIGN	V.V	DRAWN	V.V
REVIEWED		DATE	2020.09.23

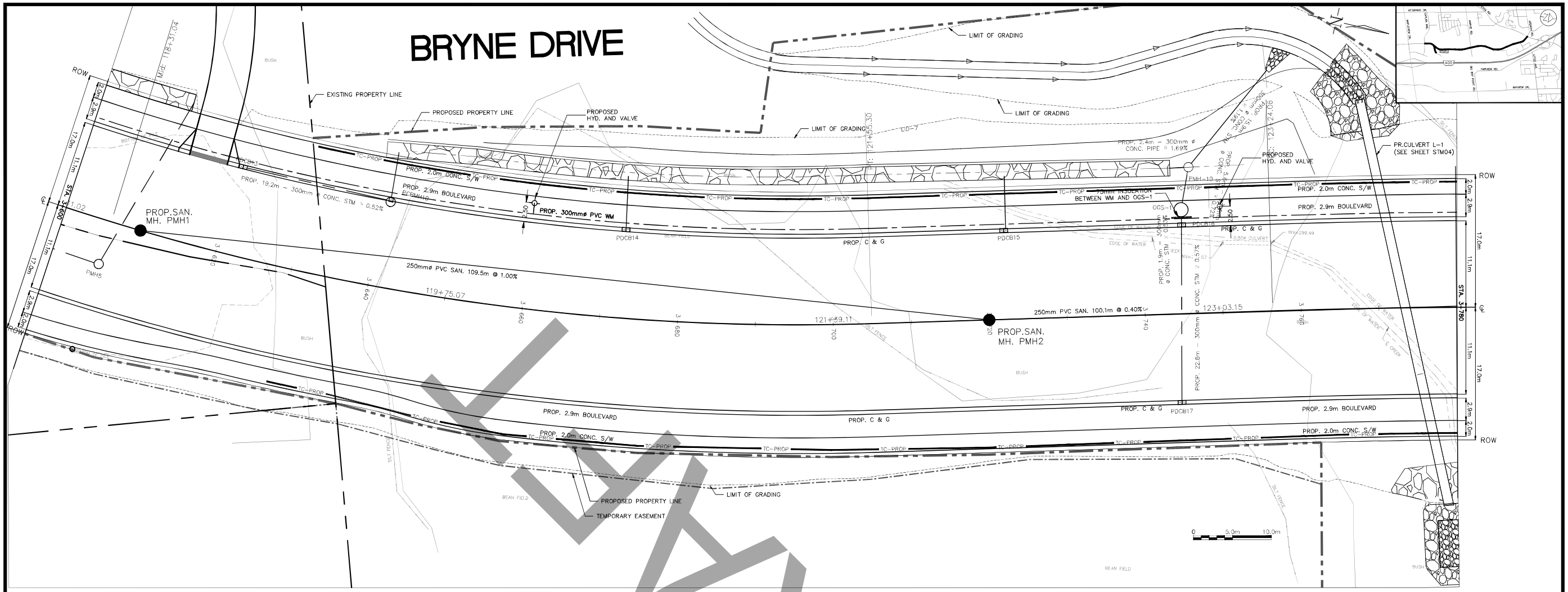
CONTRACT NO.

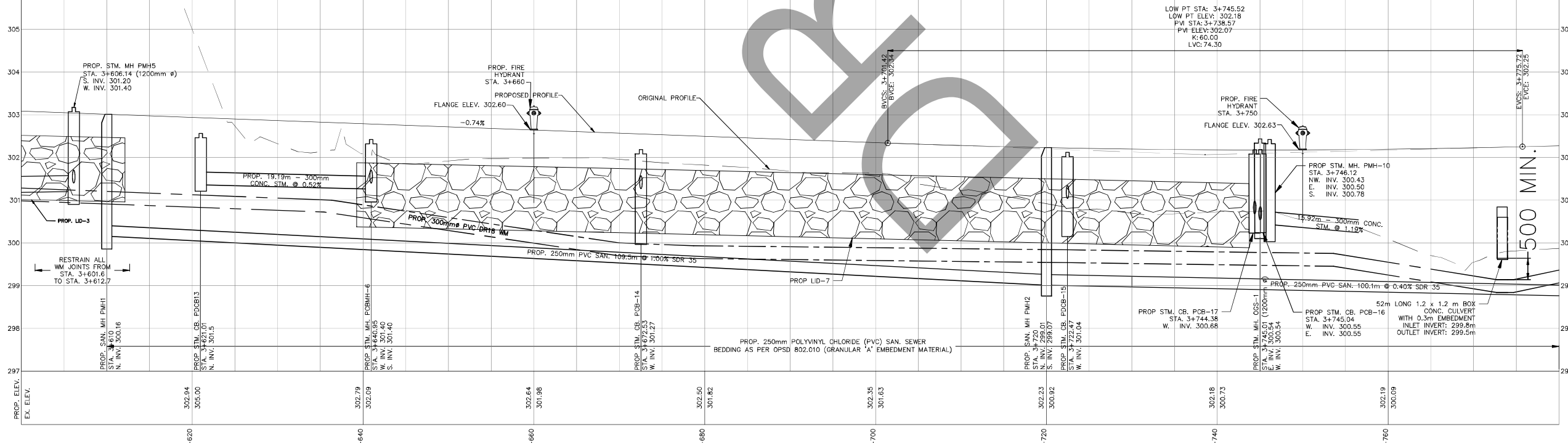
SHEET NO. PP2

-002

9/28/2020 4:03:1 PM VALDERRAMA, VICTOR — 353437-25-260-PP.DWG

BRYNE DRIVE





GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 031910009 (N=4914801.348, E=601584.468)AND 010860410 (N=4913103.464, E=609668.620) AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

309.751 – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.0KM NORTH OF EDGEHILL DRIVE. TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44CM SOUTH OF NORTHWEST END AND 37CM BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

PLAN AND PROFILE
BRYNE DRIVE
STA. 3+600 TO STA. 3+780

Barrie
ENGINEERING DEPARTMENT

SCALE HOR.	1:250	VERT.	1:50
DESIGN	V.V	DRAWN	V.V
REVIEWED		DATE	2020.09.23

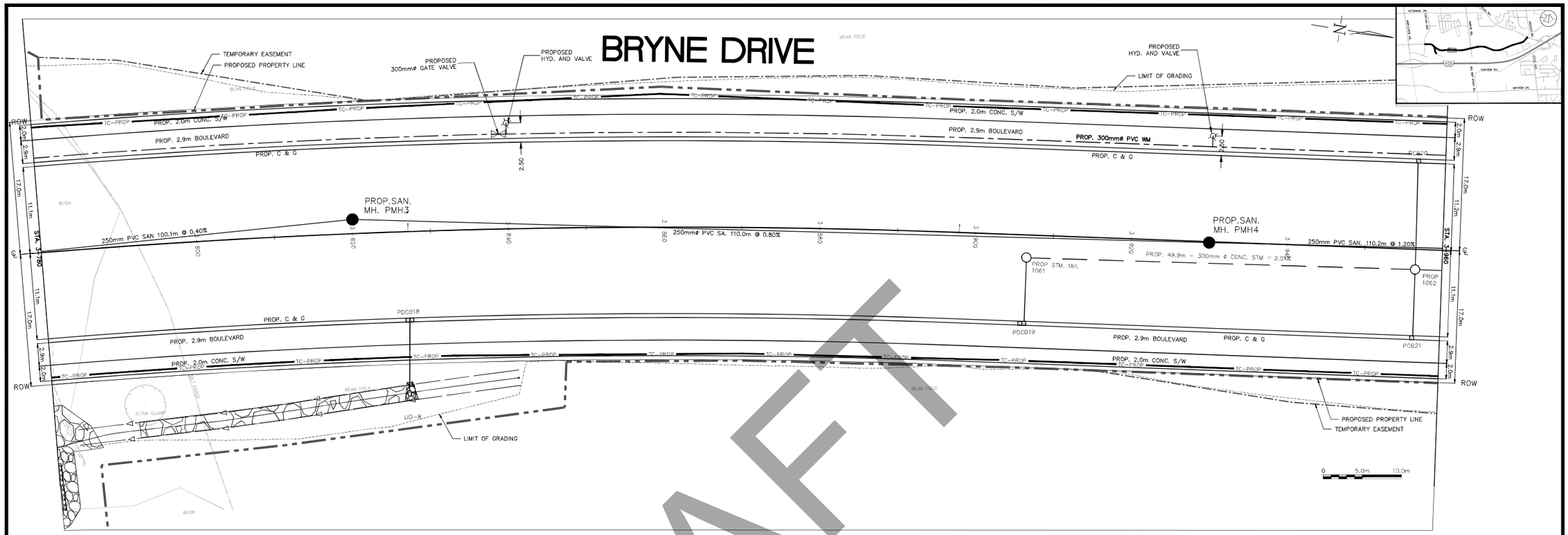
CONTRACT NO.

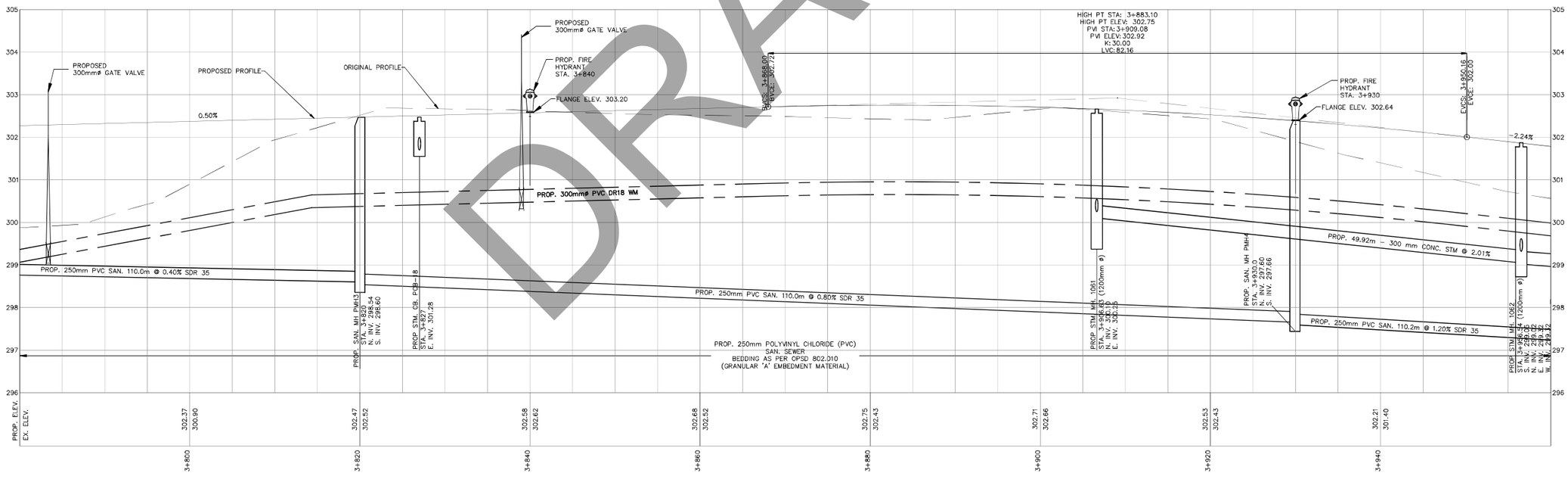
SHEET NO. PP3

-003

9/28/2020 4:04 PM VALDESPRADA, VICTOR H:\35347-25-200-PP.DWG

BRYNE DRIVE





GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 031910009 (N=4914801.348, E=601384.468)AND 010860410 (N=4913103.464, E=606668.620), AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

269.751 – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.0KM NORTH OF EDGEHILL DRIVE. TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44.0M SOUTH OF NORTHWEST END AND 370M BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

PLAN AND PROFILE
BRYNE DRIVE
STA. 3+780 TO STA. 3+960

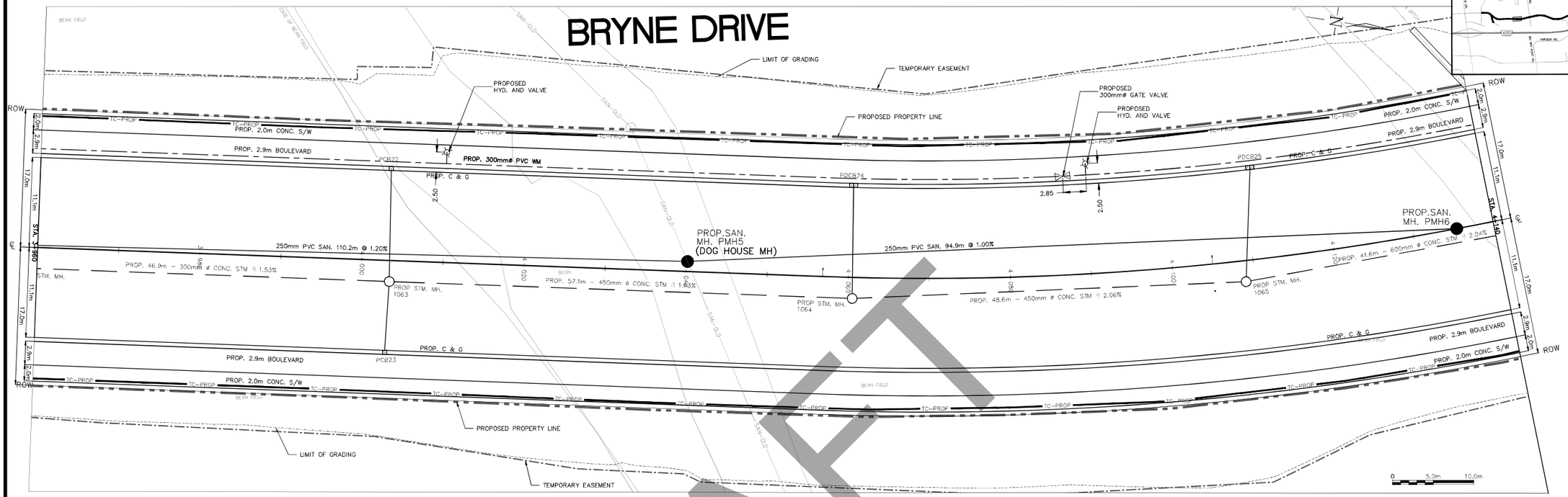
Barrie
ENGINEERING DEPARTMENT

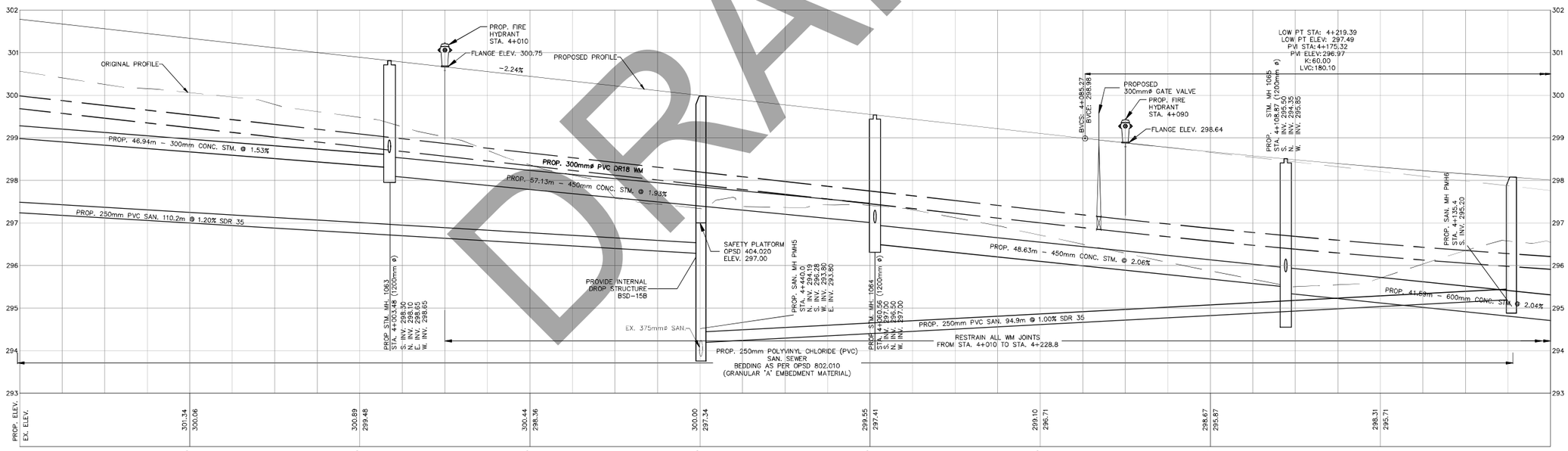
SCALE HOR. 1:250	VERT. 1:50	CONTRACT NO.	
DESIGN V.V	DRAWN V.V	SHEET NO.	PP4
REVIEWED	DATE 2020.09.23		

-004

9/28/2020 4:05 PM VALISHAMMA, VICTOR H:\353437-25-260-PP.DWG

BRYNE DRIVE





GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 03190009 (N=4914801.348, E=601584.468)AND 01086040 (N=4913103.464, E=606668.820). AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

309.751 – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.0KM NORTH OF EDGEHILL DRIVE, TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 13.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44CM SOUTH OF NORTHWEST END AND 370M BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

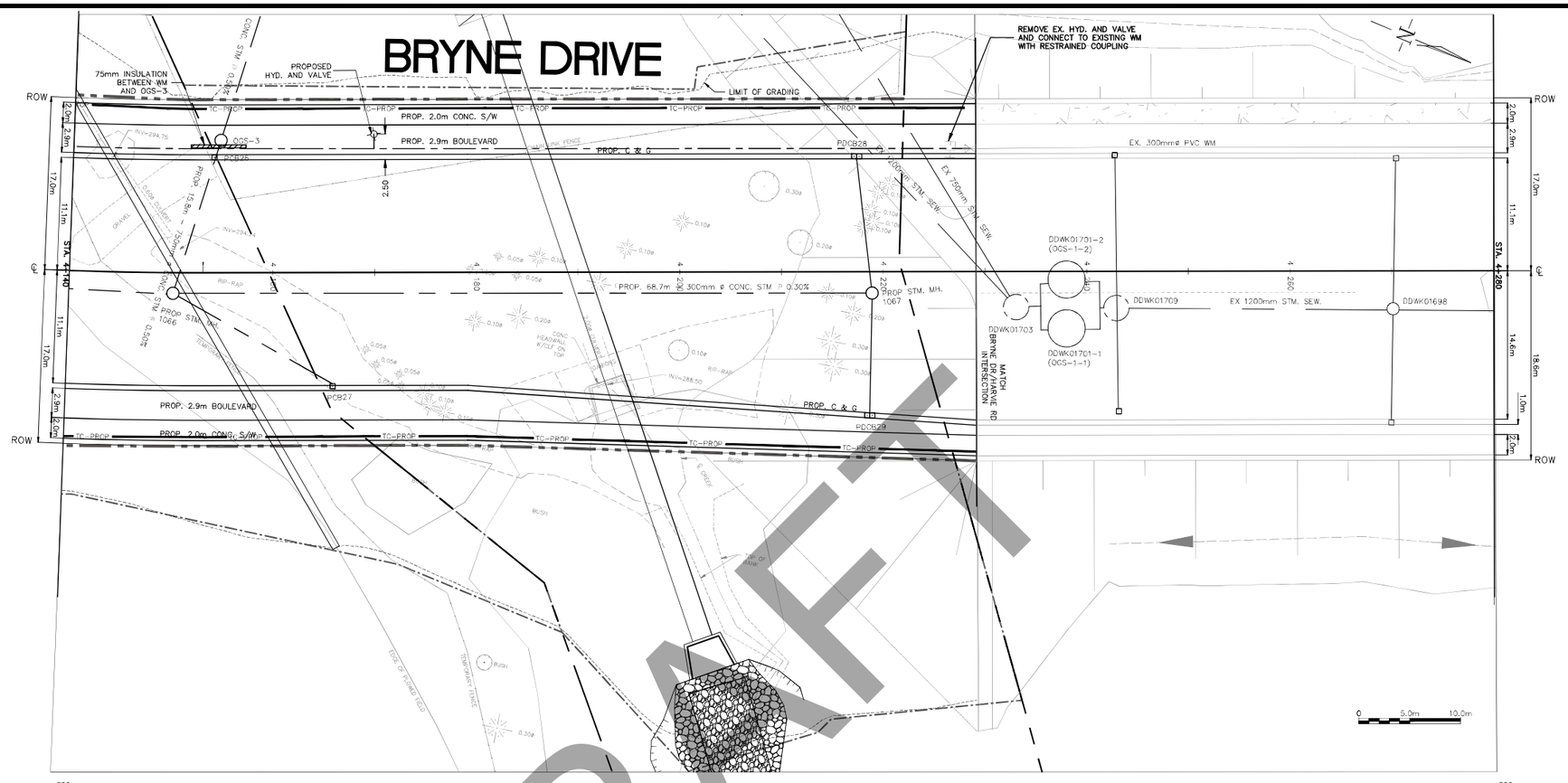
PLAN AND PROFILE
BRYNE DRIVE
STA. 3+960 TO STA. 4+140

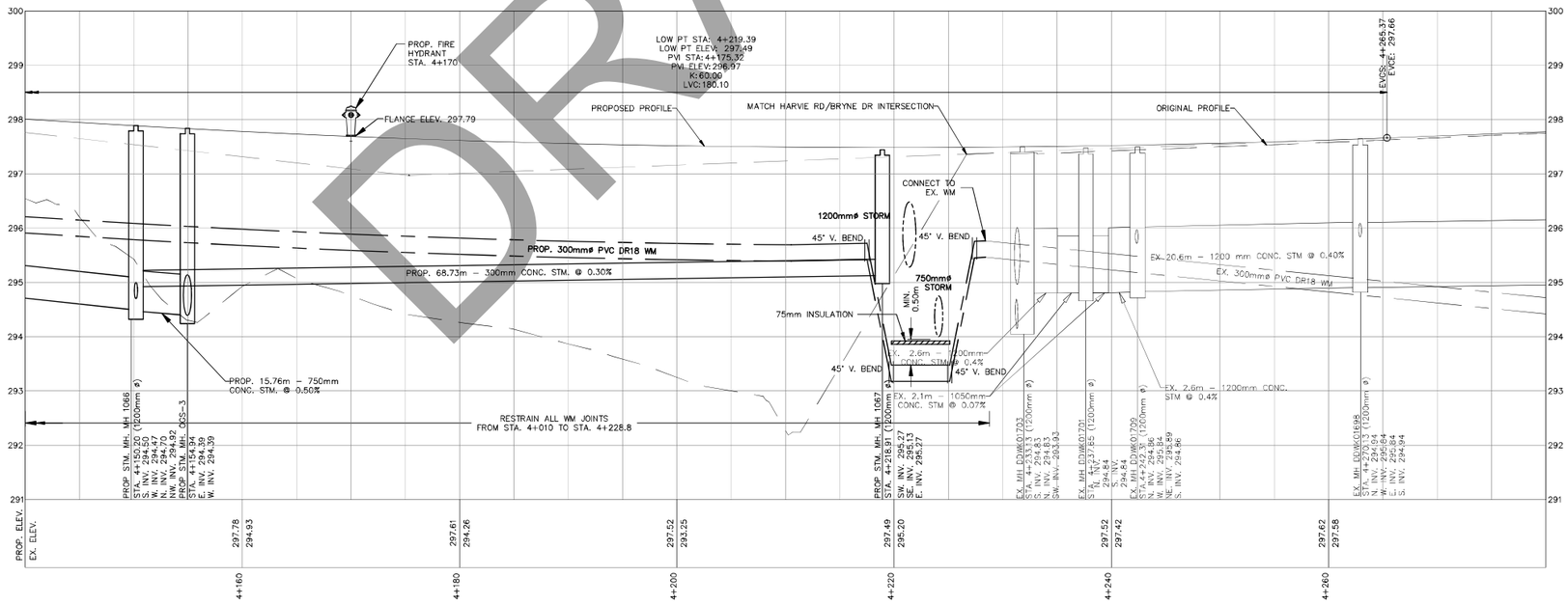
Barrie
ENGINEERING DEPARTMENT

SCALE HOR. 1:250	VERT. 1:50	CONTRACT NO.	
DESIGN V.V	DRAWN V.V	SHEET NO.	PP5
REVIEWED	DATE 2020.09.23		

9/28/2020 4:58 PM VALDERRAMA, VICTOR H:\35347-25-200-PP.DWG

BRYNE DRIVE





GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID. BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 03190009 (N=4914801.348, E=601584.468)AND 01080410 (N=4913103.464, E=606668.620), AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE, 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

209.751 – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.0KM NORTH OF EDGEHILL DRIVE, TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44CM SOUTH OF NORTHWEST END AND 37CM BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

PLAN AND PROFILE
BRYNE DRIVE
STA. 4+140 TO STA. 4+280

Barrie
ENGINEERING DEPARTMENT

SCALE HOR.	1:250	VERT.	1:50
DESIGN	V.V	DRAWN	V.V
REVIEWED		DATE	2020.09.23

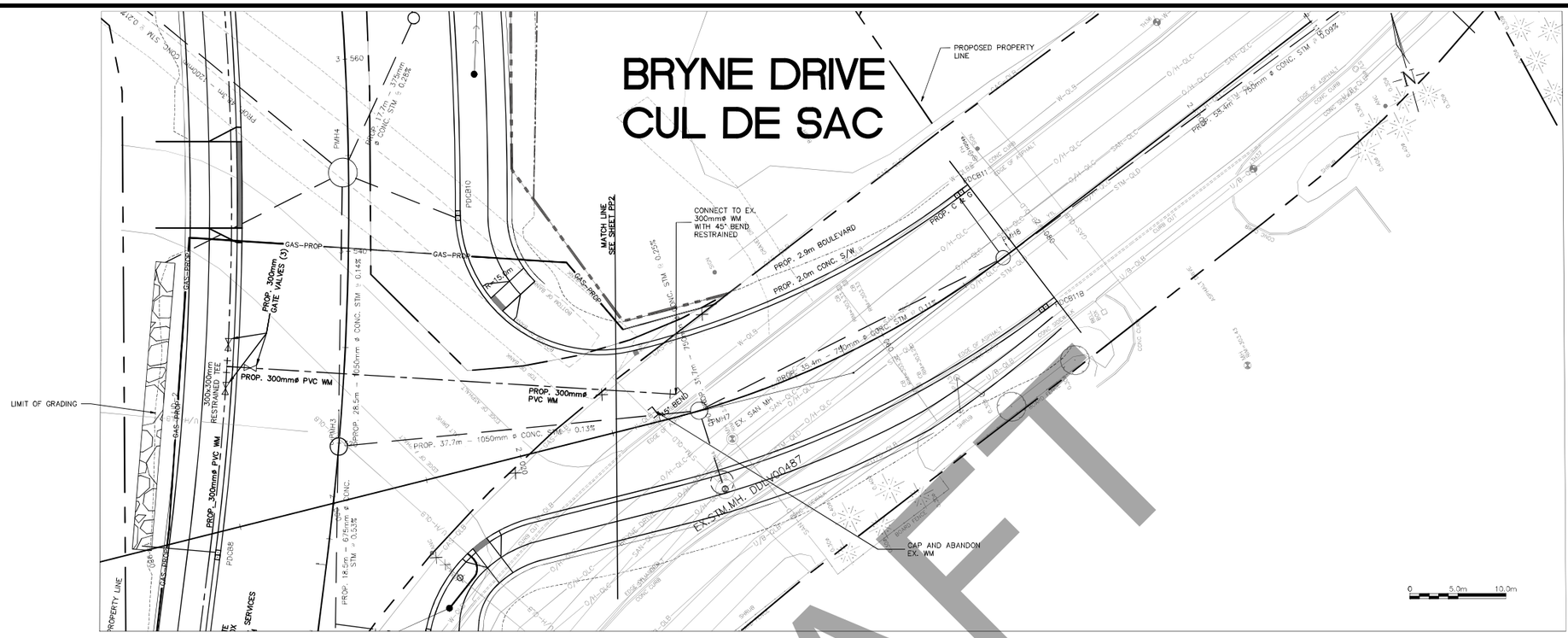
CONTRACT NO.

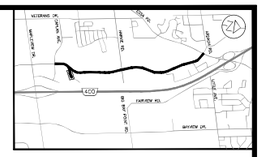
SHEET NO. PP6

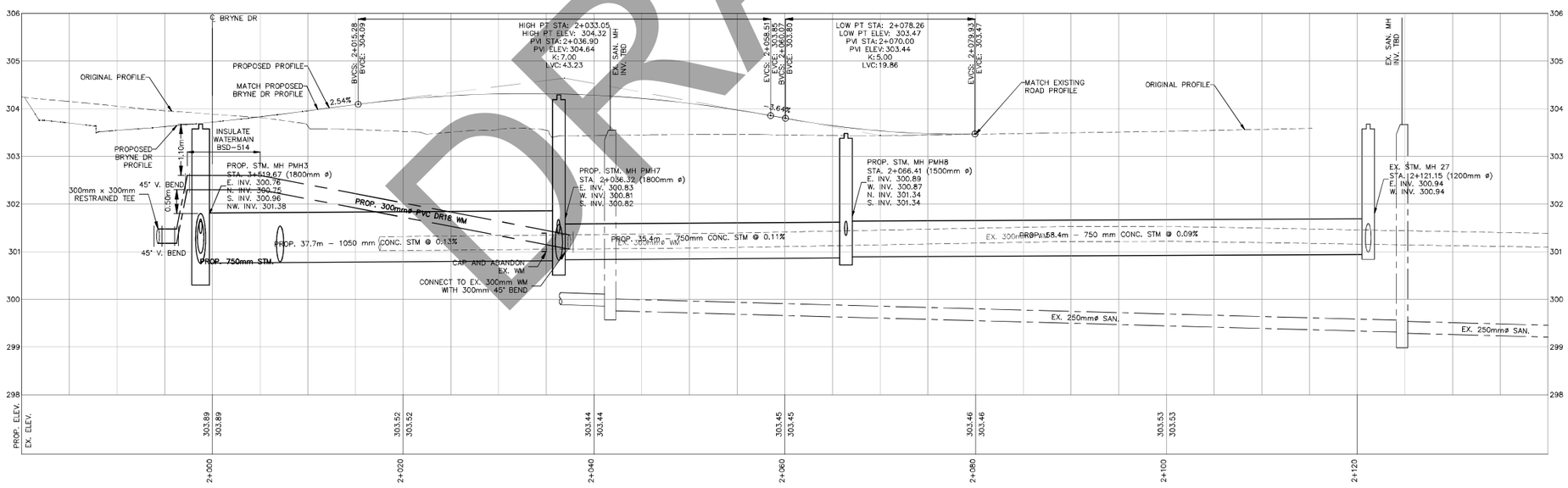
-006

9/28/2020 4:08 PM VALDESPRINA, VICTOR H:\35347-25-2100-PP.DWG

BRYNE DRIVE CUL DE SAC







GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE

BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 03190009 (N=4914801.348, E=601584.468)AND 01080410 (N=4915103.464, E=600668.620), AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470

369.75m – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.06M NORTH OF EDGEHILL DRIVE. TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44CM SOUTH OF NORTHWEST END AND 37CM BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	30% SUBMISSION	2017.11.22	T.K
B	30% SUBMISSION (REVISED)	2018.02.14	T.K
C	60% SUBMISSION	2018.05.16	T.K
D	90% SUBMISSION	2018.11.20	T.K
E	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

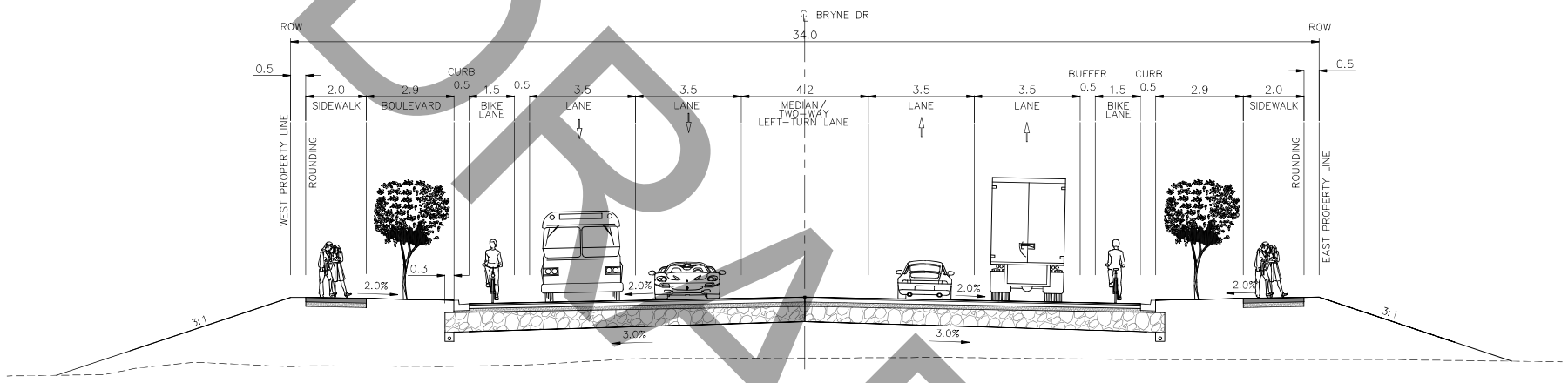
BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

PLAN AND PROFILE
BRYNE DRIVE CUL-DE-SAC

Barrie
ENGINEERING DEPARTMENT

SCALE HOR. 1:250	VERT. 1:50	CONTRACT NO.	
DESIGN V.V	DRAWN V.V	SHEET NO.	PP17
REVIEWED	DATE 2020.09.23		

9/28/2020 4:02 PM VALDERRAMA, VICTOR H:\35343\25-2100\PP.DWG



BRYNE DR
STA 3+260 TO STA 4+230

GENERAL NOTES

REFER TO CURRENT CITY OF BARRIE STANDARDS FOR APPLICABLE GENERAL NOTES.

HATCH

BENCH MARKS
DISTANCE NOTE
DISTANCES SHOWN HEREON ARE GRID DISTANCES AND CAN BE CONVERTED TO GROUND DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 1.0003.

BEARING NOTE
BEARINGS HEREIN ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 031910009 (N=4914801.348, E=601584.468)AND 010860410 (N=4913103.464, E=604668.620), AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE, 17 AND ARE BASED ON NAD27 (76 ADJUSTMENT).

BENCH MARK V010865470
209.751 – BRASS TABLET SET IN CONCRETE HEADWALL OF UNDERGROUND STORM SEWER ENTRANCE ON WEST SIDE OF FERNDALE DRIVE NORTH, 1.0KM NORTH OF EDGEHILL DRIVE. TABLET IS SET HORIZONTALLY IN EAST FACE OF WESTERLY WALL, 15.0m WEST OF CENTRELINE OF FERNDALE DRIVE NORTH, 44CM SOUTH OF NORTHWEST END AND 37CM BELOW TOP OF CONCRETE WALL.

BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED
A	90% SUBMISSION	2018.11.20	T.K.
B	100% SUBMISSION	2020.09.23	T.K

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

BRYNE DRIVE IMPROVEMENTS
CAPLAN AVENUE TO HARVIE ROAD

TYPICAL CROSS SECTION
BRYNE DRIVE

Barrie
ENGINEERING DEPARTMENT

SCALE HOR.		VERT.		CONTRACT NO.
DESIGN	V.V.	DRAWN	K.M	
REVIEWED	T.K	DATE	2020.09.23	SHEET NO. TP01

-001

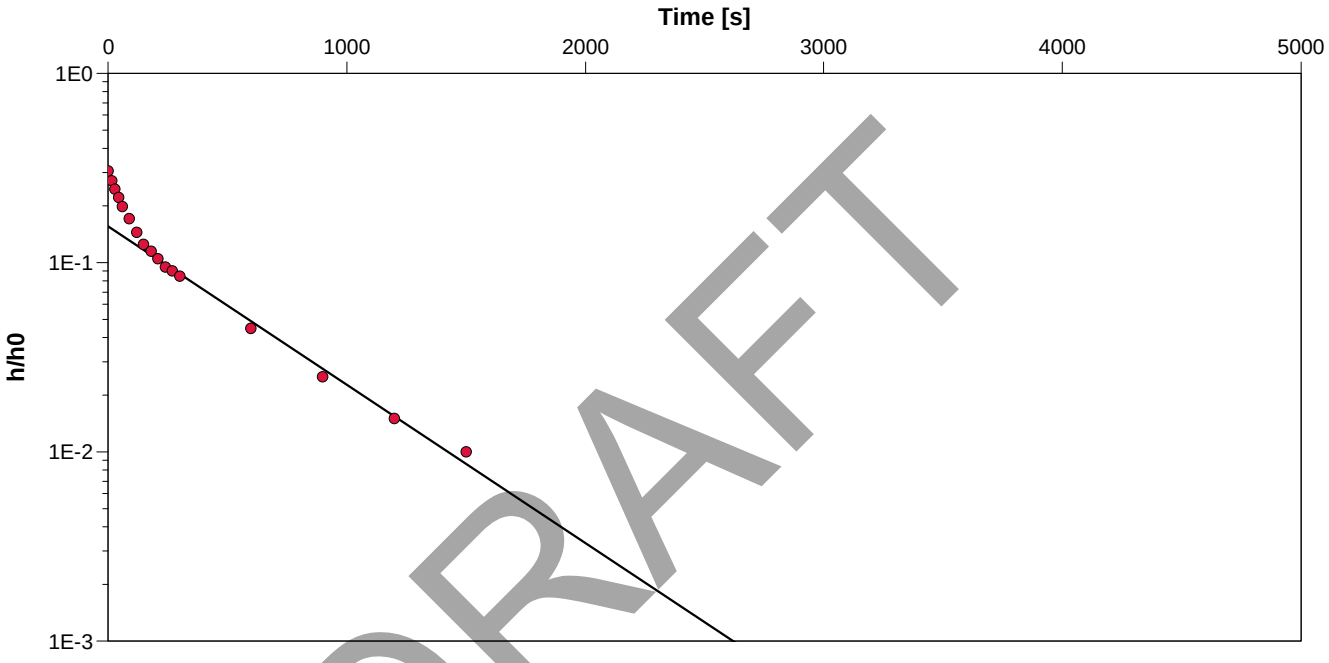
9/22/2020 10:55 PM MIGUEL.PEYA H:\353437-25-260-TPS.DWG

APPENDIX

D HYDRAULIC CONDUCTIVITY TEST ANALYSIS

	Slug Test Analysis Report
	Project: Bryne Drive Extension
	Number: 181-06461-00
	Client: City of Barrie

Location: Bryne Drive, City of Barrie	Slug Test: MW1	Test Well: MW1
Test Conducted by: K Allen		Test Date: 08-Sep-21
Analysis Performed by: G Jarvis	MW1	Analysis Date: 13-Sep-21
Aquifer Thickness: 6.90 m		

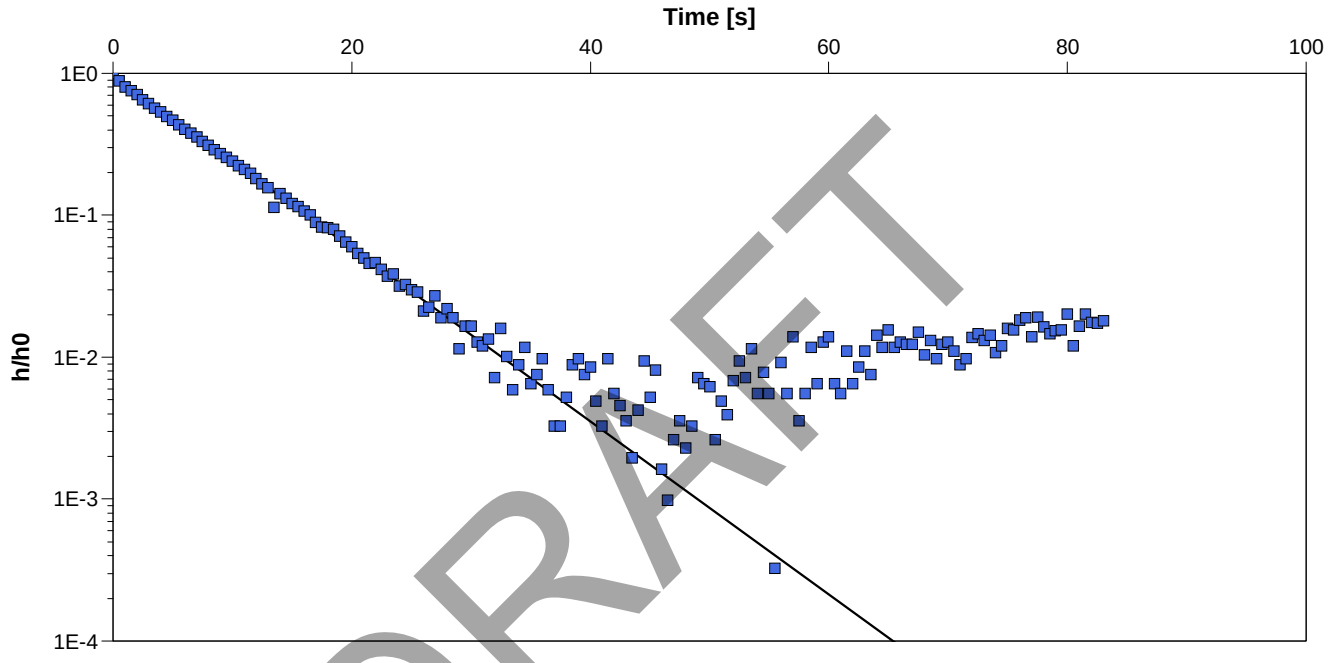


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW1	4.24×10^{-6}	

	Slug Test Analysis Report
	Project: Bryne Drive Extension
	Number: 181-06461-00
	Client: City of Barrie

Location: Bryne Drive, City of Barrie	Slug Test: MW2	Test Well: MW2
Test Conducted by: K Allen		Test Date: 08-Sep-21
Analysis Performed by: G Jarvis	MW2	Analysis Date: 13-Sep-21
Aquifer Thickness: 3.10 m		

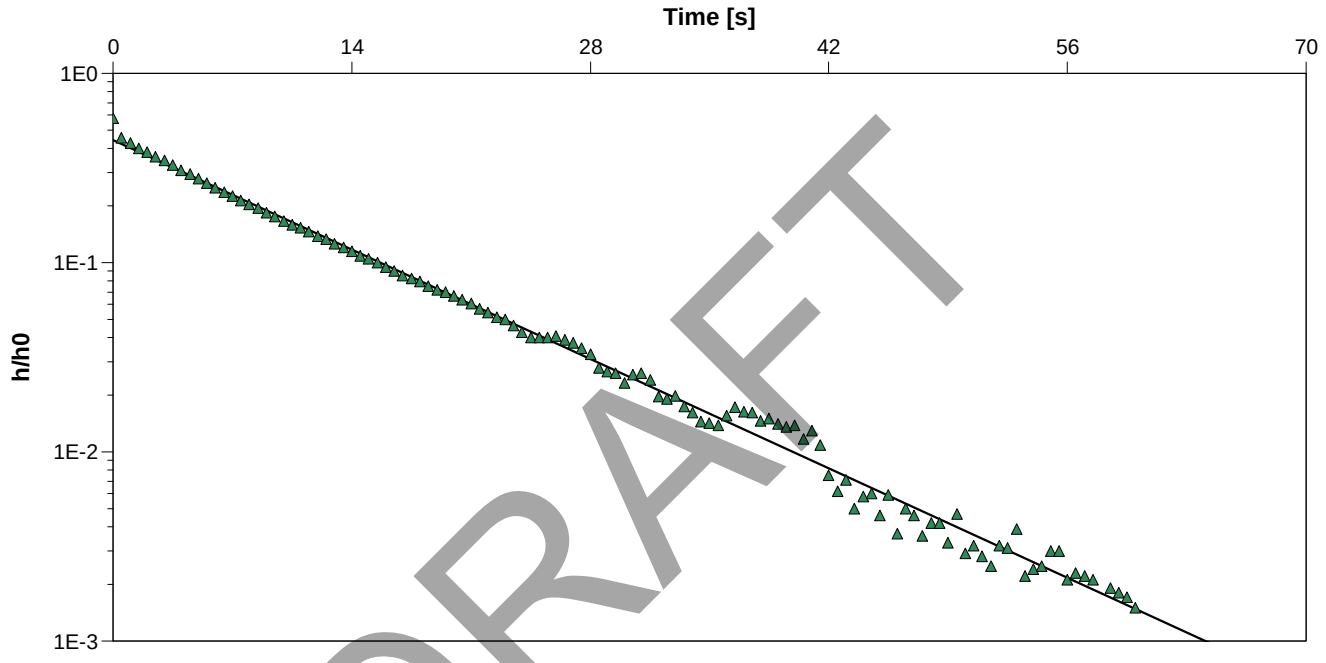


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW2	3.09×10^{-4}	

	Slug Test Analysis Report
	Project: Bryne Drive Extension
	Number: 181-06461-00
	Client: City of Barrie

Location: Bryne Drive, City of Barrie	Slug Test: MW3	Test Well: MW3
Test Conducted by: K Allen		Test Date: 08-Sep-21
Analysis Performed by: G Jarvis	MW3	Analysis Date: 13-Sep-21
Aquifer Thickness: 3.80 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW3	2.09×10^{-4}	

APPENDIX

E LABORATORY CERTIFICATE OF ANALYSIS

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 23-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:

P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	3	Kingston	US	14-Sep-21	A-CN-001 (k)	SM 4500CN
A - Wet Chem	3	Kingston	kwe	15-Sep-21	A-COD K	SM5220C
Anions	3	Holly Lane	pcu	14-Sep-21	A-IC-01 (o)	SM4110C
pH	3	Holly Lane	SYL	13-Sep-21	A-PH-01 (o)	SM 4500H
Sulphide	3	Kingston	kwe	15-Sep-21	A-S2	SM4500-S2
A - Wet Chem	3	Kingston	aro	15-Sep-21	A-TPTKN-001 (N)(k)	E3199A.1
A - Wet Chem	3	Kingston	aro	15-Sep-21	A-TPTKN-001 (P)(k)	E3199A.1
Total Suspended Solids	3	Kingston	bbr	14-Sep-21	A-TSS-001 (k)	SM2540D
BOD	3	Kingston	JWF	11-Sep-21	C-BOD-001 (k)	SM 5210B
SVOC	3	Kingston	sge	16-Sep-21	C-NAB-W-001 (k)	EPA 8270
Oil & Grease	3	Kingston	MTY	14-Sep-21	C-O&G-001 (k)	SM 5520
Phenolics (4-aap)	3	Kingston	kwe	13-Sep-21	C-PHEN-01 (k)	MOEE 3179
VOC's	3	Richmond Hill	JE	14-Sep-21	C-VOC-02 (rh)	EPA 8260
Mercury	3	Holly Lane	PBK	14-Sep-21	D-HG-02 (o)	SM 3112 B
Metals - ICP-OES	3	Holly Lane	hmc	14-Sep-21	D-ICP-01 (o)	SM 3120
Metals-ICP-MS	3	Holly Lane	TPR	22-Sep-21	D-ICPMS Dissolved 7800	EPA 200.8
Metals - ICP-MS	3	Holly Lane	TPR	15-Sep-21	D-ICPMS-01 (o)	EPA 200.8

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 23-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

	Client I.D.		MW1	MW2	BH18-21		Barrie Sanitary	
	Sample I.D.		B21-29018-1	B21-29018-2	B21-29018-3		Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Date Collected		08-Sep-21	08-Sep-21	09-Sep-21			
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.80	7.29	8.01		9.5	9.5
BOD(5 day)	mg/L	3	3	3	< 3		300	15
COD	mg/L	5	12	31	< 5		600	
Total Kjeldahl Nitrogen	mg/L	0.1	0.4	< 0.1	0.2		100	
Total Suspended Solids	mg/L	3	197	52	17		350	15
Oil and Grease-Mineral	mg/L	1.0	< 1.0	< 1.0	< 1.0		15	
Oil and Grease-Anim/Veg.	mg/L	1.0	< 1.0	3.3	1.8		150	
Phosphorus-Total	mg/L	0.01	0.30	< 0.01	< 0.01		10	
Cyanide (Total)	mg/L	0.005	< 0.005	< 0.005	< 0.005		1.2	
Chloride	mg/L	0.5	16.0	369	2.8		1500	
Fluoride	mg/L	0.1	< 0.1	< 0.1	< 0.1		10	
Sulphate	mg/L	1	10	21	2		1500	
Aluminum (total)	mg/L	0.01	0.04	0.09	0.07		50	
Antimony	mg/L	0.0001	0.0002	0.0002	0.0002		5.0	
Arsenic	mg/L	0.0001	0.0002	0.0001	< 0.0001		1.0	
Barium	mg/L	0.001	0.018	0.086	0.016		5.0	
Benzene	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.01	
Bismuth	mg/L	0.02	< 0.02	< 0.02	< 0.02		5.0	
Cadmium	mg/L	0.000015	< 0.000015	0.000035	< 0.000015		0.7	0.001
Chromium	mg/L	0.002	< 0.002	< 0.002	< 0.002		2.0	0.08
Cobalt	mg/L	0.005	< 0.005	0.023	< 0.005		5.0	
Copper	mg/L	0.002	0.004	0.003	< 0.002		2.0	0.01
Dichlorobenzene,1,2-	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.05	
Dichlorobenzene,1,4-	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.08	

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 23-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

	Client I.D.		MW1	MW2	BH18-21		Barrie Sanitary	
	Sample I.D.		B21-29018-1	B21-29018-2	B21-29018-3		Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Date Collected		08-Sep-21	08-Sep-21	09-Sep-21			
Parameter	**Units**	**R.L.**						
Ethylbenzene	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.06	
Gold	mg/L	0.0007	< 0.0007	< 0.0007	< 0.0007		5.0	
Hexachlorobenzene	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001		0.0001	
Iron	mg/L	0.005	0.007	0.243	0.066		50	
Lead	mg/L	0.02	< 0.02	< 0.02	< 0.02		0.7	0.05
Manganese (Total)	mg/L	0.001	0.004	3.48	0.005		5.0	
Mercury	mg/L	0.00002	< 0.00002	< 0.00002	< 0.00002		0.01	
Dichloromethane (Methylene Chloride)	mg/L	0.005	< 0.005	< 0.005	< 0.005		0.09	
Molybdenum	mg/L	0.01	< 0.01	< 0.01	< 0.01		5.0	
Nickel	mg/L	0.01	< 0.01	< 0.01	< 0.01		2.0	0.05
Total PAH	mg/L	0.0001	< 0.0001	0.00014	< 0.0001		0.005	
Acenaphthene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Acenaphthylene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Anthracene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Benzo(a)anthracene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Benzo(a)pyrene	µg/L	0.01	< 0.01	< 0.01	< 0.01			
Benzo(b+k)fluoranthene	µg/L	0.1	< 0.1	< 0.1	< 0.1			
Benzo(g,h,i)perylene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Dibenzo(a,h)anthracene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Chrysene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Fluoranthene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Fluorene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Indeno(1,2,3,-cd)pyrene	µg/L	0.05	< 0.05	< 0.05	< 0.05			

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 23-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

	Client I.D.		MW1	MW2	BH18-21		Barrie Sanitary	
	Sample I.D.		B21-29018-1	B21-29018-2	B21-29018-3		Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Date Collected		08-Sep-21	08-Sep-21	09-Sep-21			
Parameter	**Units**	**R.L.**						
Methylnaphthalene,1-	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Methylnaphthalene,2-	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Naphthalene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Phenanthrene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Pyrene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Phenolics	mg/L	0.002	< 0.002	< 0.002	< 0.002		0.1	
Platinum	mg/L	0.00004	< 0.00004	< 0.00004	< 0.00004		5.0	
Rhodium	mg/L	0.00002	< 0.00002	< 0.00002	< 0.00002		5.0	
Selenium	mg/L	0.001	< 0.001	< 0.001	< 0.001		1.0	
Silver	mg/L	0.005	< 0.005	< 0.005	< 0.005		0.4	
Sulphide	mg/L	0.01	< 0.1	0.05	< 0.01		1.0	
Tetrachloroethane,1,1,2,2-	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.06	
Tetrachloroethylene	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.06	
Toluene	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.02	
Trichloroethylene	mg/L	0.0005	< 0.0005	< 0.0005	< 0.0005		0.05	
Xylene, m,p,o-	mg/L	0.0011	< 0.0011	< 0.0011	< 0.0011		0.3	
Tin	mg/L	0.05	< 0.05	< 0.05	< 0.05		5.0	
Vanadium	mg/L	0.005	< 0.005	< 0.005	< 0.005		5.0	
Zinc	mg/L	0.005	< 0.005	0.023	0.033		2.0	0.04

1 . Elevated RL due to sample matrix interference

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: --- **REPORT No. B21-29018**

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 23-Sep-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

Summary of Exceedances

Storm Sewer Guidelines		
MW1	Found Value	Limit
Total Suspended Solids (mg/L)	197	15
MW2	Found Value	Limit
Total Suspended Solids (mg/L)	52	15
BH18-21	Found Value	Limit
Total Suspended Solids (mg/L)	17	15

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Rev. 1

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 07-Oct-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:

P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	3	Kingston	US	14-Sep-21	A-CN-001 (k)	SM 4500CN
A - Wet Chem	3	Kingston	kwe	15-Sep-21	A-COD K	SM5220C
Anions	3	Holly Lane	pcu	14-Sep-21	A-IC-01 (o)	SM4110C
pH	3	Holly Lane	SYL	13-Sep-21	A-PH-01 (o)	SM 4500H
Sulphide	3	Kingston	kwe	15-Sep-21	A-S2	SM4500-S2
A - Wet Chem	3	Kingston	aro	15-Sep-21	A-TPTKN-001 (N)(k)	E3199A.1
A - Wet Chem	3	Kingston	aro	15-Sep-21	A-TPTKN-001 (P)(k)	E3199A.1
Total Suspended Solids	3	Kingston	bbr	14-Sep-21	A-TSS-001 (k)	SM2540D
BOD	3	Kingston	JWF	11-Sep-21	C-BOD-001 (k)	SM 5210B
SVOC	3	Kingston	sge	16-Sep-21	C-NAB-W-001 (k)	EPA 8270
Oil & Grease	3	Kingston	MTY	14-Sep-21	C-O&G-001 (k)	SM 5520
Phenolics (4-aap)	3	Kingston	kwe	13-Sep-21	C-PHEN-01 (k)	MOEE 3179
VOC's	3	Richmond Hill	JE	14-Sep-21	C-VOC-02 (rh)	EPA 8260
Mercury	3	Holly Lane	PBK	14-Sep-21	D-HG-02 (o)	SM 3112 B
Metals - ICP-OES	3	Holly Lane	hmc	14-Sep-21	D-ICP-01 (o)	SM 3120
Metals-ICP-MS	3	Holly Lane	TPR	22-Sep-21	D-ICPMS Dissolved 7800	EPA 200.8
Metals - ICP-MS	3	Holly Lane	TPR	15-Sep-21	D-ICPMS-01 (o)	EPA 200.8

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Rev. 1

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 07-Oct-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

	Client I.D.		MW1	MW2	BH18-21		PWQO	
	Sample I.D.		B21-29018-1	B21-29018-2	B21-29018-3		Interim PWQO	PWQO
	Date Collected		08-Sep-21	08-Sep-21	09-Sep-21			
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.80	7.29	8.01			8.5
BOD(5 day)	mg/L	3	3	3	< 3			
COD	mg/L	5	12	31	< 5			
Total Kjeldahl Nitrogen	µg/L	100	400	< 100	200			
Total Suspended Solids	mg/L	3	197	52	17			
Oil and Grease-Mineral	µg/L	1000	< 1000	< 1000	< 1000			
Oil and Grease-Anim/Veg.	µg/L	1000	< 1000	3300	1800			
Phosphorus-Total	µg/L	10	300	< 10	< 10		10	
Cyanide (Total)	µg/L	5	< 5	< 5	< 5			
Chloride	µg/L	500	16000	369000	2800			
Fluoride	µg/L	100	< 100	< 100	< 100			
Sulphate	µg/L	1000	10000	21000	2000			
Aluminum (total)	µg/L	10	40	90	70			
Antimony	µg/L	0.1	0.2	0.2	0.2		20	
Arsenic	µg/L	0.1	0.2	0.1	< 0.1		5	5
Barium	µg/L	1	18	86	16			
Benzene	µg/L	0.5	< 0.5	< 0.5	< 0.5		100	
Bismuth	µg/L	20	< 20	< 20	< 20			
Cadmium	µg/L	0.015	< 0.015	0.035	< 0.015		0.1	0.2
Chromium	µg/L	2	< 2	< 2	< 2			
Cobalt	µg/L	5	< 5	23	< 5		0.9	
Copper	µg/L	2	4	3	< 2		5	
Dichlorobenzene,1,2-	µg/L	0.5	< 0.5	< 0.5	< 0.5			2.5
Dichlorobenzene,1,4-	µg/L	0.5	< 0.5	< 0.5	< 0.5			4

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Rev. 1

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 07-Oct-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

	Client I.D.		MW1	MW2	BH18-21		PWQO	
	Sample I.D.		B21-29018-1	B21-29018-2	B21-29018-3		Interim PWQO	PWQO
	Date Collected		08-Sep-21	08-Sep-21	09-Sep-21			
Parameter	**Units**	**R.L.**						
Ethylbenzene	µg/L	0.5	< 0.5	< 0.5	< 0.5		8	
Gold	µg/L	0.7	< 0.7	< 0.7	< 0.7			
Hexachlorobenzene	µg/L	0.1	**< 0.1**	**< 0.1**	**< 0.1**			0.0065
Iron	µg/L	5	7	243	66			300
Lead	µg/L	20	**< 20**	**< 20**	**< 20**		1	5
Manganese (Total)	µg/L	1	4	3480	5			
Mercury	µg/L	0.02	< 0.02	< 0.02	< 0.02			0.2
Dichloromethane (Methylene Chloride)	µg/L	5	< 5	< 5	< 5		100	
Molybdenum	µg/L	10	< 10	< 10	< 10		40	
Nickel	µg/L	10	< 10	< 10	< 10			25
Total PAH	µg/L	0.1	< 0.1	0.14	< 0.1			
Acenaphthene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Acenaphthylene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Anthracene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**			0.0008
Benzo(a)anthracene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**		0.0004	
Benzo(a)pyrene	µg/L	0.01	< 0.01	< 0.01	< 0.01			
Benzo(b+k)fluoranthene	µg/L	0.1	< 0.1	< 0.1	< 0.1			
Benzo(g,h,i)perylene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**		0.00002	
Dibenzo(a,h)anthracene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**		0.002	
Chrysene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**		0.0001	
Fluoranthene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**		0.0008	
Fluorene	µg/L	0.05	< 0.05	< 0.05	< 0.05		0.2	
Indeno(1,2,3,-cd)pyrene	µg/L	0.05	< 0.05	< 0.05	< 0.05			

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Rev. 1

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 07-Oct-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

	Client I.D.		MW1	MW2	BH18-21		PWQO	
	Sample I.D.		B21-29018-1	B21-29018-2	B21-29018-3		Interim PWQO	PWQO
	Date Collected		08-Sep-21	08-Sep-21	09-Sep-21			
Parameter	**Units**	**R.L.**						
Methylnaphthalene,1-	µg/L	0.05	< 0.05	< 0.05	< 0.05		2	
Methylnaphthalene,2-	µg/L	0.05	< 0.05	< 0.05	< 0.05		2	
Naphthalene	µg/L	0.05	< 0.05	< 0.05	< 0.05		7	
Phenanthrene	µg/L	0.05	**< 0.05**	**< 0.05**	**< 0.05**		0.03	
Pyrene	µg/L	0.05	< 0.05	< 0.05	< 0.05			
Phenolics	µg/L	2	**< 2**	**< 2**	**< 2**			1
Platinum	µg/L	0.04	< 0.04	< 0.04	< 0.04			
Rhodium	µg/L	0.02	< 0.02	< 0.02	< 0.02			
Selenium	µg/L	1	< 1	< 1	< 1			100
Silver	µg/L	5	**< 5**	**< 5**	**< 5**			0.1
Sulphide	µg/L	10	< 100	50	< 10			
Tetrachloroethane,1,1,2,2-	µg/L	0.5	< 0.5	< 0.5	< 0.5		70	
Tetrachloroethylene	µg/L	0.5	< 0.5	< 0.5	< 0.5		50	
Toluene	µg/L	0.5	< 0.5	< 0.5	< 0.5		0.8	0.8
Trichloroethylene	µg/L	0.5	< 0.5	< 0.5	< 0.5		20	
Xylene, m,p,o-	µg/L	1.1	< 1.1	< 1.1	< 1.1			
Tin	µg/L	50	< 50	< 50	< 50			
Vanadium	µg/L	5	< 5	< 5	< 5		6	
Zinc	µg/L	5	< 5	**23**	**33**		20	30

1 . Elevated RL due to sample matrix interference
2 . Revised report to change guidelines as per client request.

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Rev. 1

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 07-Oct-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

Summary of Exceedances

Interim PWQO

MW1	Found Value	Limit
Dibenzo(a,h)anthracene (µg/L)	< 0.05	0.002
Phosphorus-Total (µg/L)	300	10
Benzo(g,h,i)perylene (µg/L)	< 0.05	0.00002
Phenanthrene (µg/L)	< 0.05	0.03
Chrysene (µg/L)	< 0.05	0.0001
Lead (µg/L)	< 20	1
Cobalt (µg/L)	< 5	0.9
Fluoranthene (µg/L)	< 0.05	0.0008
Benzo(a)anthracene (µg/L)	< 0.05	0.0004

MW2	Found Value	Limit
Benzo(a)anthracene (µg/L)	< 0.05	0.0004
Benzo(g,h,i)perylene (µg/L)	< 0.05	0.00002
Chrysene (µg/L)	< 0.05	0.0001
Cobalt (µg/L)	23	0.9
Dibenzo(a,h)anthracene (µg/L)	< 0.05	0.002
Fluoranthene (µg/L)	< 0.05	0.0008
Lead (µg/L)	< 20	1
Phenanthrene (µg/L)	< 0.05	0.03
Zinc (µg/L)	23	20

BH18-21	Found Value	Limit
Zinc (µg/L)	33	20

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Provincial Water Quality Objectives

MW1	Found Value	Limit
Hexachlorobenzene (µg/L)	< 0.1	0.0065
Anthracene (µg/L)	< 0.05	0.0008
Phenolics (µg/L)	< 2	1
Silver (µg/L)	< 5	0.1
Lead (µg/L)	< 20	5

MW2	Found Value	Limit
Silver (µg/L)	< 5	0.1
Anthracene (µg/L)	< 0.05	0.0008
Hexachlorobenzene (µg/L)	< 0.1	0.0065
Lead (µg/L)	< 20	5
Phenolics (µg/L)	< 2	1

BH18-21	Found Value	Limit
Zinc (µg/L)	33	30
Anthracene (µg/L)	< 0.05	0.0008
Lead (µg/L)	< 20	5
Silver (µg/L)	< 5	0.1
Phenolics (µg/L)	< 2	1
Hexachlorobenzene (µg/L)	< 0.1	0.0065

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B21-29018

Rev. 1

Report To:

WSP Canada Inc.
561 Bryne Drive, Units C&D
Barrie ON L4N 9Y3
Attention: Gord Jarvis

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 09-Sep-21
DATE REPORTED: 07-Oct-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 181-06461-00-200
WATERWORKS NO.

Interim PWQO

BH18-21	Found Value	Limit
Cobalt (µg/L)	< 5	0.9
Fluoranthene (µg/L)	< 0.05	0.0008
Chrysene (µg/L)	< 0.05	0.0001
Lead (µg/L)	< 20	1
Benzo(g,h,i)perylene (µg/L)	< 0.05	0.00002
Phenanthrene (µg/L)	< 0.05	0.03
Benzo(a)anthracene (µg/L)	< 0.05	0.0004
Dibenzo(a,h)anthracene (µg/L)	< 0.05	0.002

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

APPENDIX

F

DEWATERING CALCULATIONS

Table F1: Dewatering Calculations for Open-Cut Sections in the Study Area
Bryne Drive Extension, Barrie, Ontario

SICHARDT FORMULA

$$Q = \frac{2\,x\,(L+W)\,x\,K\,x(H^2-h^2)}{R_o}\ (m^3/day)$$

$$R_{sich} = C(H-h)\sqrt{K}\ (m)$$

No.	Limits	Type / Chainage	Monitoring Well	Hydraulic Conductivity (m/sec)	Hydraulic Conductivity (m/day)	Overburden / Bedrock Well	Groundwater Elevation (masl)	Lowest excavation depth (masl)	Base of Aquifer (masl)	Length (m)	Width (m)	Static Water Level (masl)	Target Pumping Groundwater (masl)	H (m)	h (m)	R_{sich} (m)	R_0 (m)	Q (m^3/day)	S.F.	Qmax (m^3/day)	Estimated Construction Dewatering Flow Rate (L/day)	Estimated Maximum Construction Flow Rate with Safety Factor (L/day)
1	3+610 to 3+770	Sanitary Sewer	MW2	3.10E-04	2.68E+01	Overburden	300.90	298.70	297.0	30	2	300.90	297.70	3.90	0.70	112.68	114.68	220.02	2.00	440.0	220,000	440,000
2	4+220 to 4+230	Storm Sewer	BH18-OF1	4.20E-06	3.63E-01	Overburden	293.70	293.20	290.7	10	2	293.70	292.20	3.00	1.50	6.15	8.15	7.21	2.00	14.4	7,200	14,400
																					227,200	454,400

Stormwater estimate

Location	Assumed Precip Event (mm)	Area (m^2)	Total (L)
Excavation	10	60	600

29 November 2007

Ref. No. 07-1455-13

Via e-mail

Barrie_Bryne Development Limited
c/o, Smart Centres
700 Applewood Crescent, Suite 100
Vaughan, Ontario L4K 5X3

Attention: **Mr. Kevin Rachman**

Re: **Percolation Test Results**
Proposed Commercial Development
Hwy 400 and Harvie road, Barrie, Ontario

INTRODUCTION

DBA Engineering Ltd (DBA) was retained by Smart Center (the 'client') to assess the percolation time of the in-situ soils for a site located on the southwest corner of the intersection of Hwy 400 and Harvie Road, in Barrie, Ontario (the 'site') as shown on attached Figure No. 1. It is our understanding that the results of the percolation tests are required to evaluate the feasibility for infiltration of the storm water.

A geotechnical investigation was conducted for the site by DBA Engineering Ltd and consisted of advancing forty five (45) boreholes (BH1 to BH38 and BH41 to BH47) at locations shown in the attached Figure No.2, 2A, and 2B.

Based on the conditions encountered in the boreholes, the soil profile generally consisted of surficial topsoil underlain by native soil. The native soil was predominantly sand deposit; however frequent silty sand/sandy silt layers and occasional silty clay layers were also encountered in the boreholes. A copy of the Record of Boreholes is attached to this report. The results of this geotechnical investigation is used by DBA to establish effective locations for percolation tests in order to represent various soil conditions at the site.

Groundwater was encountered in open boreholes at the depths of 6.0 m, 3.8 m, 2.0 m, and 6.1 m in boreholes BH1, BH2, BH35 and BH41, respectively, upon completion of drilling. No noticeable groundwater was encountered in the remaining boreholes upon completion of drilling. It should also be noted that there was not sufficient time available for the groundwater to stabilize inside the open boreholes. Thirteen (13) standpipe piezometers were installed, one in each of boreholes BH1, BH4, BH14, BH17, BH23, BH33 and BH37, and two in each of BH41, BH42 and BH43. The groundwater level in the piezometers was measured on 26 October 2007 and 14 November 2007. The groundwater level measured in the standpipe piezometers are summarized in the following table.

Borehole	Groundwater Depth below the existing ground surface (m)		
	Upon completion	26 October 2007	14 November 2007
BH 01	6.0	5.9	5.8
BH 04	3.8	dry	dry
BH14	dry	dry	dry
BH 17	dry	dry	dry
BH 23	dry	5.5	5.5
BH 33	dry	dry	dry
BH 37	dry	2.1	2.0
BH41 (shallow)	dry	dry	dry
BH41 (deep)	6.1	9.9	9.9
BH42 (shallow}	dry	dry	dry
BH42 (deep)	dry	dry	dry
BH43 (shallow}	dry	dry	dry
BH43 (deep)	dry	dry	dry

IN-SITU PERCOLATION TEST

A total of eight test holes (P1 to P8) were drilled to depths ranging from 0.7 m to 1.5 m below the existing ground surface at locations shown in attached Figures No.2, 2A and 2B.

Percolation tests were conducted in P1 to P8, started in morning of 28 October, 2007 and ended on 29 October, 2007. The following table summarise the results of the percolation tests.

Locations	Depth of Test Hole (m)	Measured Percolation Rate (minute/cm)	Estimated Permeability Based on Percolation Rate (cm/sec)
P1	1.5	<1	$\geq 10^{-1}$
P2	0.7	<1	$\geq 10^{-1}$
P3	1.5	<1	$\geq 10^{-1}$
P4	1.4	<1	$\geq 10^{-1}$
P5	1.3	<1	$\geq 10^{-1}$
P6	1.5	<1	$\geq 10^{-1}$
P7	1.2	<1	$\geq 10^{-1}$
P8	1.5	<1	$\geq 10^{-1}$

The estimated soil permeability in the above table is obtained based on the measured percolation rate using Ontario Building Code Supplementary Guideline – SG6.

In order to assess soil permeability by depth, several grain size analyses were conducted on samples from various depths and locations collected during geotechnical investigation. The results of the grain size analyses are attached and summarized below. Empirical correlations were used to estimate the soil permeability based on grain size analyses.

Sample	Depth (m)	Particle Size Distribution			Estimated Permeability (cm/sec)
		Gravel	Sand	Silt & Clay	
BH – 24 SS2	1.0	5%	53%	42%	10^{-3} to 10^{-4}
BH – 41 SS2	1.0	3%	35%	62%	10^{-4} to 10^{-5}
BH – 41 SS3	1.8	5%	69%	26%	10^{-2} to 10^{-3}
BH – 01 SS4	2.5	0%	81%	19%	10^{-2} to 10^{-3}
BH – 43 SS6	4.7	33%	53%	14%	10^{-2} to 10^{-3}
BH – 42 SS7	6.4	16%	76%	8%	10^{-1} to 10^{-2}

CONCLUSIONS

The in-site percolation tests resulted the values of the percolation time to be less than 1 min/cm. The estimated permeability of the upper portion of the soil based on measured percolation rates is assessed to be more than 10^{-1} cm/sec. The permeability of the soil was also assessed through grain size analyses which resulted lower estimated permeability when compared with result of actual percolation test.

Overall, these soils are considered suitable for infiltration of storm water at this site; however this should be verified by project designer.

Should you have any questions, please don't hesitate to contact the undersigned.

Yours truly,

DBA Engineering Ltd.,

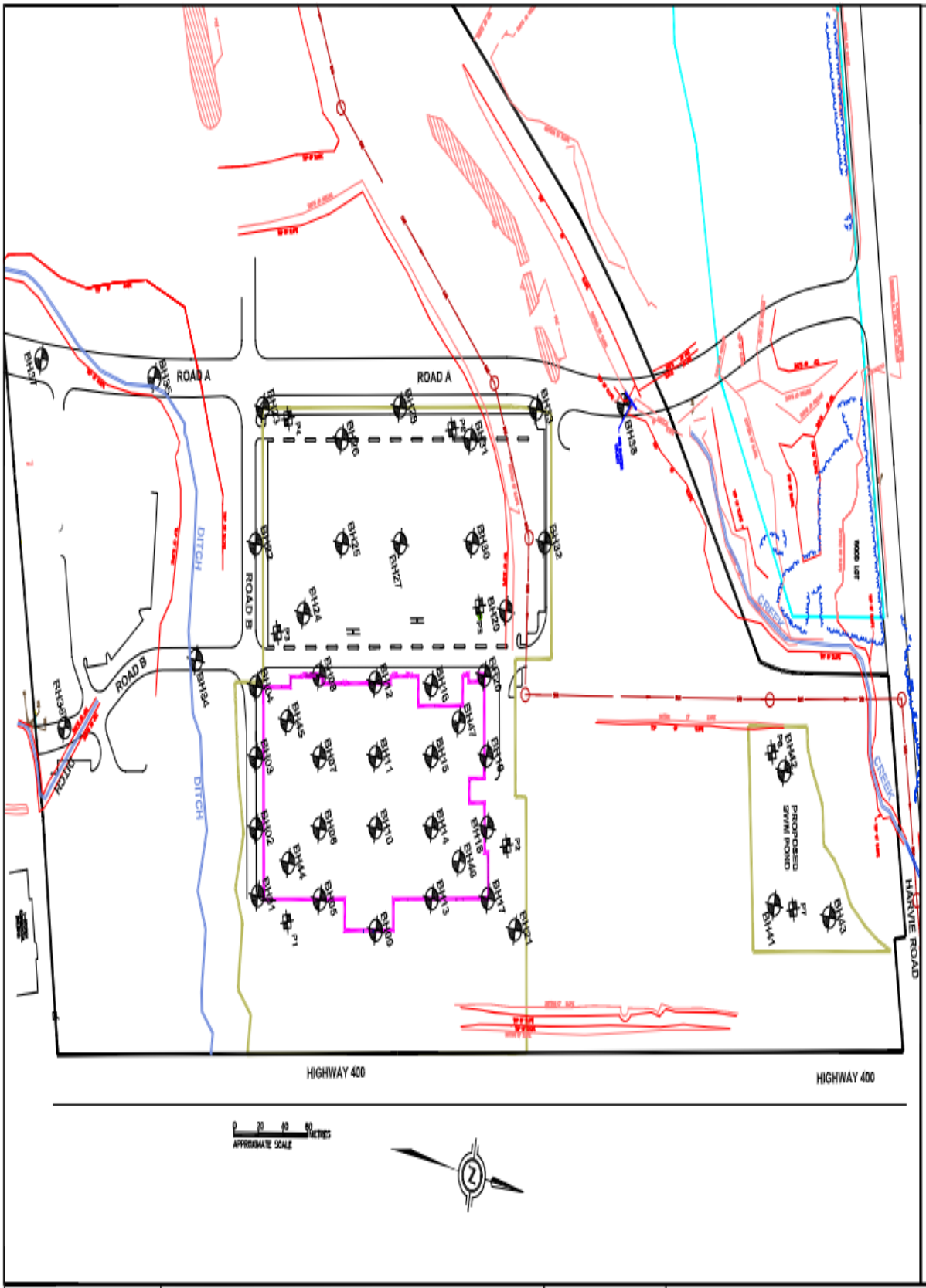
for

Adeel Shaikh, B.Eng.
Assistant Project Manager

Masoud Manzari, M.Sc. Eng., P. Eng.
Manager, Geotechnical Engineering

Enclosure:
Site Location Plan
Bore Hole Location Plan
Grain Size Analysis
Record of Boreholes

	CLIENT: **SMART CENTRES**	DWN BY:	TITLE: SITE LOCATION PLAN	REV. NO.:
		CHK'D BY: MM		DATE: NOV 2007
DBA ENGINEERING LTD. 370 Steelcase Road East Markham, Ontario L3R 1G2		DATUM: -	PROJECT: GEOTECHNICAL INVESTIGATION PROPOSED COMMERCIAL DEVELOPMENT HARVIE ROAD AND HIGHWAY 400, BARRIE, ONTARIO	PROJECT NO: 07-1455-13
		PROJECTION:		FIGURE No. 1
		SCALE: AS SHOWN		



LEGEND

- PROPOSED BUILDING
- SITE BOUNDARY
- LAND PARCEL BOUNDARY
- BOREHOLE LOCATION
- PERCOLATION TEST LOCATION
- PROPOSED CURB
- EXISTING SANITARY SEWER
- EXISTING MANHOLE
- CREEK/DITCH
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. ALL BOREHOLE LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
2. DRAWING NOT TO SCALE. DO NOT SCALE DRAWING.
3. DRAWING SHOULD BE READ IN CONJUNCTION WITH DBA REPORT No.: 07-1455-13

CLIENT: **SMART CENTRES**

DWN BY:

CHK'D BY: MM

DATUM: -

PROJECTION:

SCALE: AS SHOWN

TITLE: **BOREHOLE LOCATION PLAN**

REV. NO.:

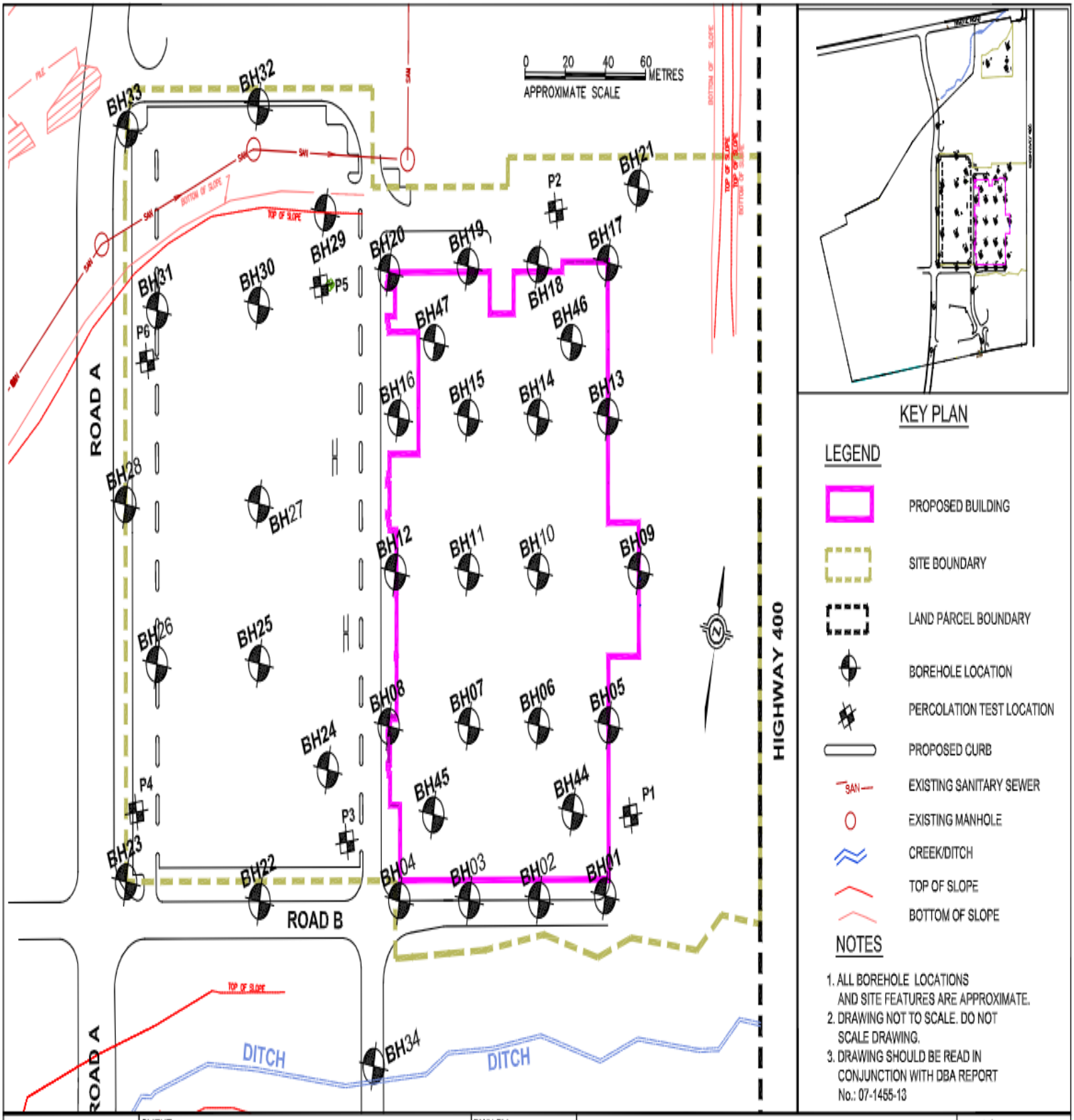
DATE: NOV 2007

PROJECT: GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
HARVIE ROAD AND HIGHWAY 400, BARRIE, ONTARIO

PROJECT NO: 07-1455-13

FIGURE No. 2

DBA ENGINEERING LTD.
370 Steelcase Road East
Markham, Ontario L3R 1G2



KEY PLAN

LEGEND

- PROPOSED BUILDING
- SITE BOUNDARY
- LAND PARCEL BOUNDARY
- BOREHOLE LOCATION
- PERCOLATION TEST LOCATION
- PROPOSED CURB
- EXISTING SANITARY SEWER
- EXISTING MANHOLE
- CREEK/DITCH
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. ALL BOREHOLE LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
2. DRAWING NOT TO SCALE. DO NOT SCALE DRAWING.
3. DRAWING SHOULD BE READ IN CONJUNCTION WITH DBA REPORT No.: 07-1455-13

CLIENT: SMART CENTRES

TITLE: BOREHOLE LOCATION PLAN (SITE-1)

DWN BY:

CHK'D BY: MM

DATUM: -

PROJECTION:

SCALE: AS SHOWN

REV. NO.:

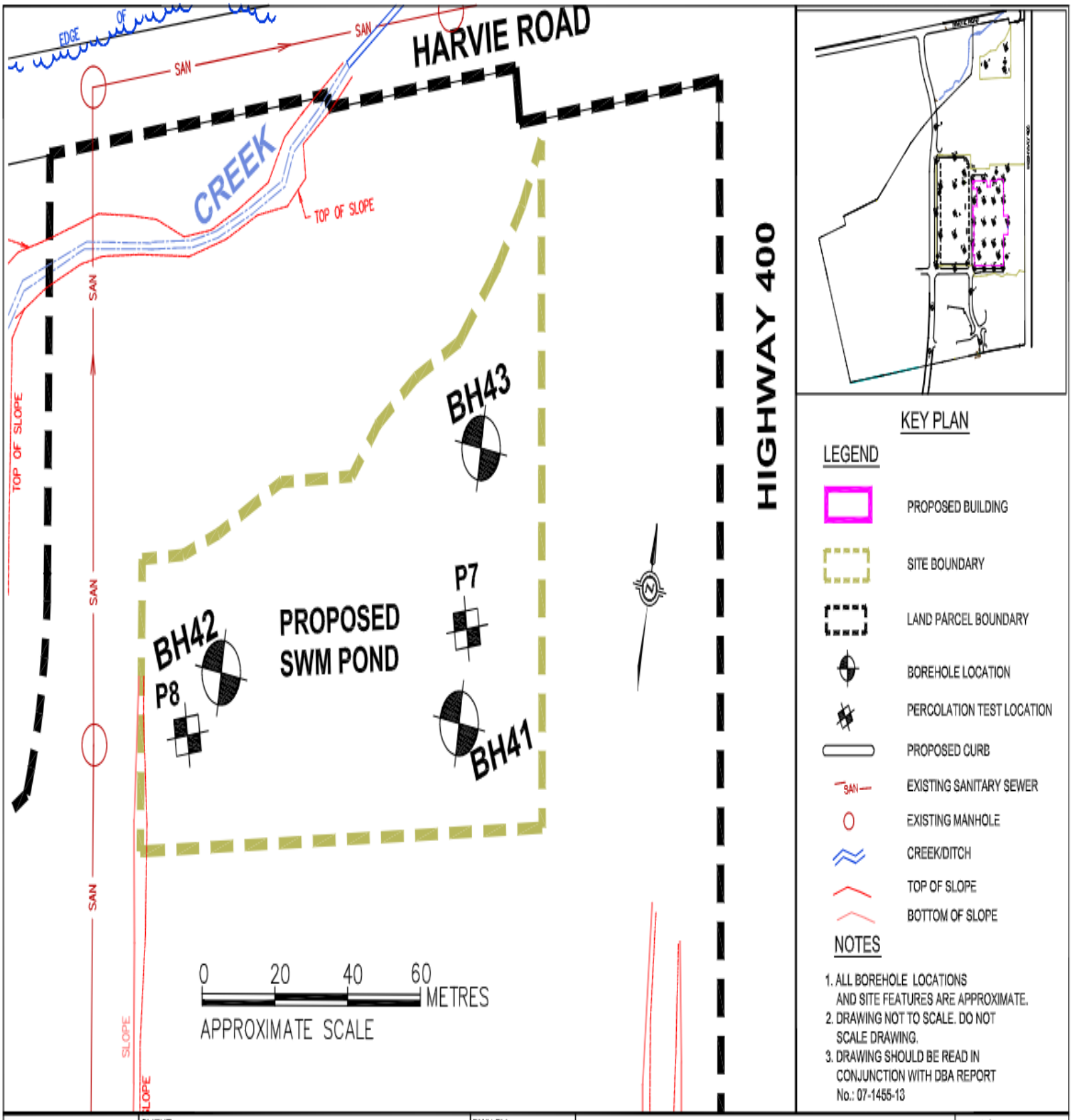
DATE: NOV 2007

PROJECT: GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
HARVIE ROAD AND HIGHWAY 400, BARRIE, ONTARIO

PROJECT NO: 07-1455-13

FIGURE No. 2A

DBA ENGINEERING LTD.
370 Steelcase Road East
Markham, Ontario L3R 1G2



KEY PLAN

LEGEND

- PROPOSED BUILDING
- SITE BOUNDARY
- LAND PARCEL BOUNDARY
- BOREHOLE LOCATION
- PERCOLATION TEST LOCATION
- PROPOSED CURB
- SAN — EXISTING SANITARY SEWER
- EXISTING MANHOLE
- CREEK/DITCH
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. ALL BOREHOLE LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
2. DRAWING NOT TO SCALE. DO NOT SCALE DRAWING.
3. DRAWING SHOULD BE READ IN CONJUNCTION WITH DBA REPORT No.: 07-1455-13

CLIENT: SMART CENTRES

DWN BY:

CHK'D BY: MM

DATUM: -

PROJECTION:

SCALE: AS SHOWN

TITLE: BOREHOLE LOCATION PLAN (SITE-2)

REV. NO.:

DATE: NOV 2007

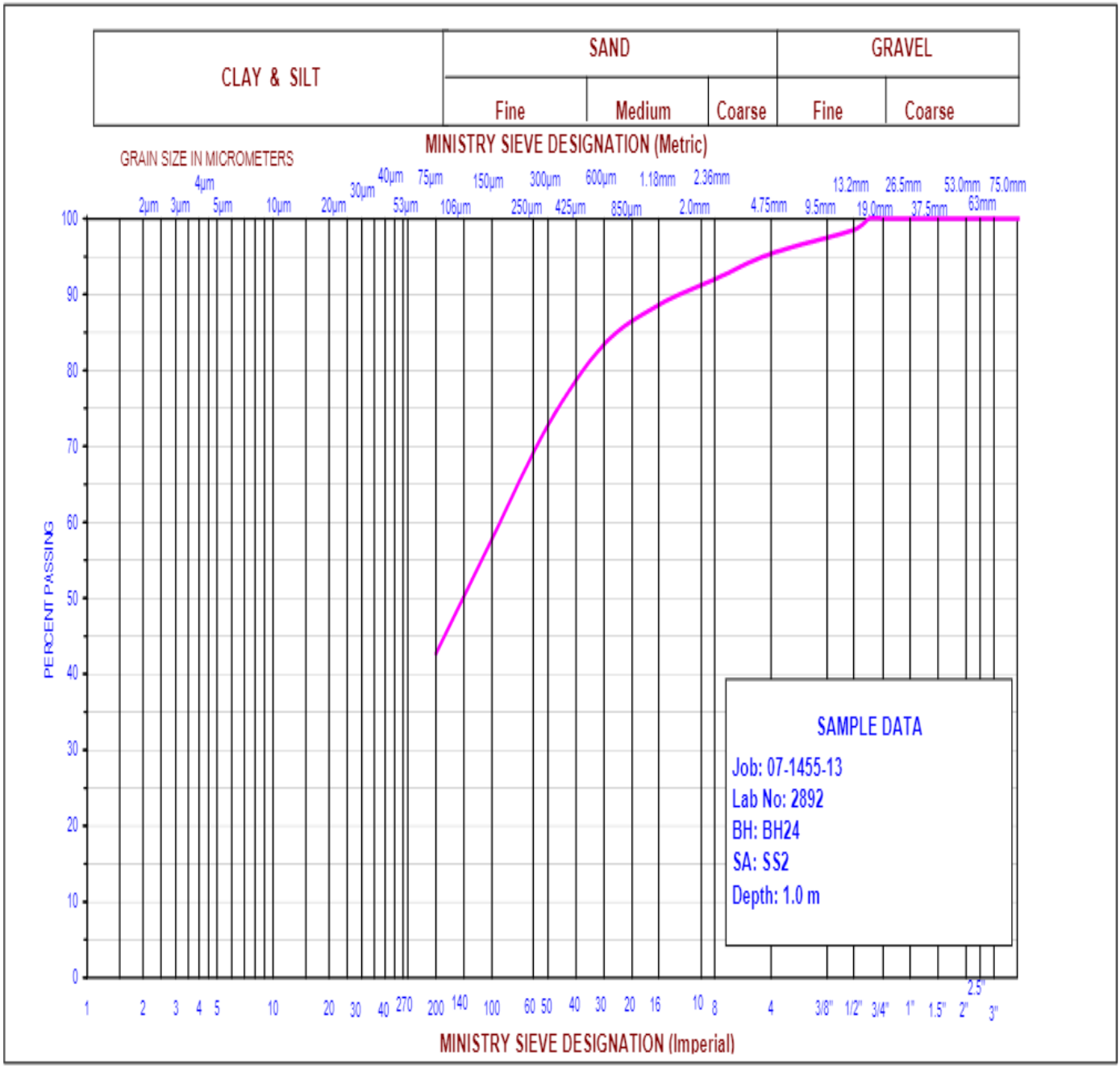
PROJECT: GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
HARVIE ROAD AND HIGHWAY 400, BARRIE, ONTARIO

PROJECT NO: 07-1455-13

FIGURE No. 2B

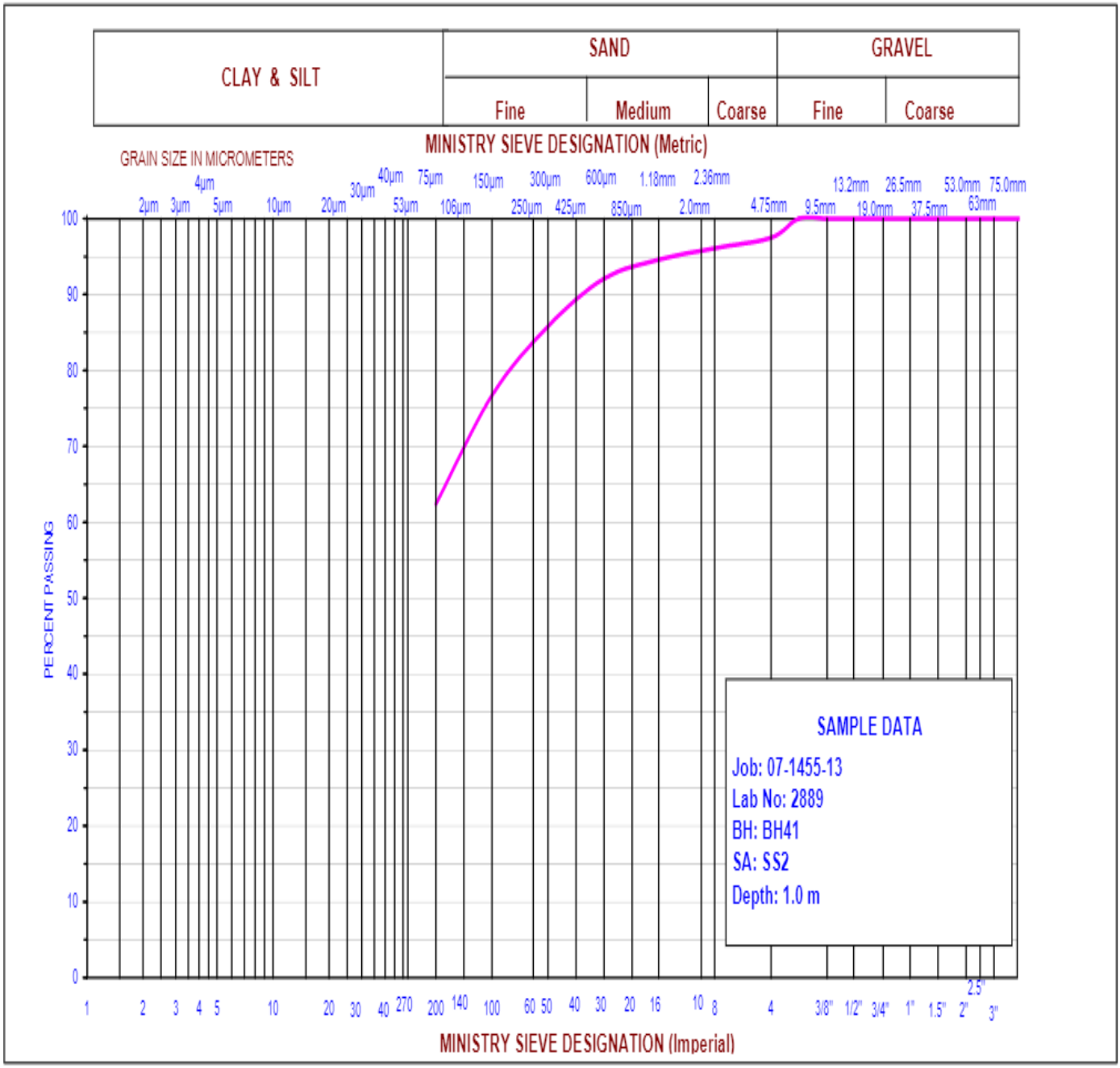
DBA ENGINEERING LTD.
370 Steelcase Road East
Markham, Ontario L3R 1G2

UNIFIED SOIL CLASSIFICATION SYSTEM



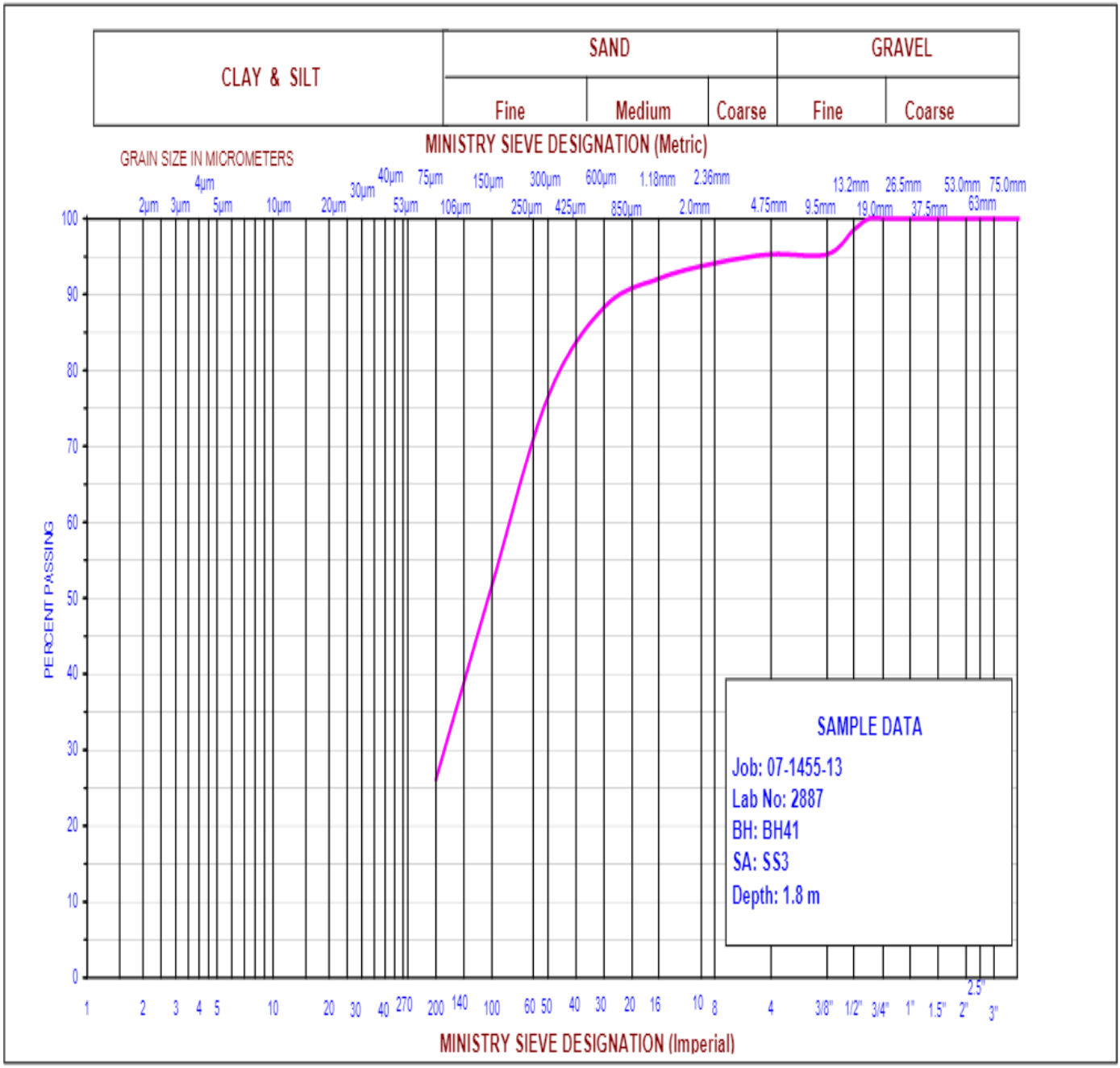
	GRAIN SIZE DISTRIBUTION	Client: Smart Centres	
		Project: Geotechnical Investigation	
	SILTY SAND trace gravel	Location: Highway 400 & Harvie Road, Barrie, ON	
		Lab No.: 2892	Date: October 30, 2007

UNIFIED SOIL CLASSIFICATION SYSTEM



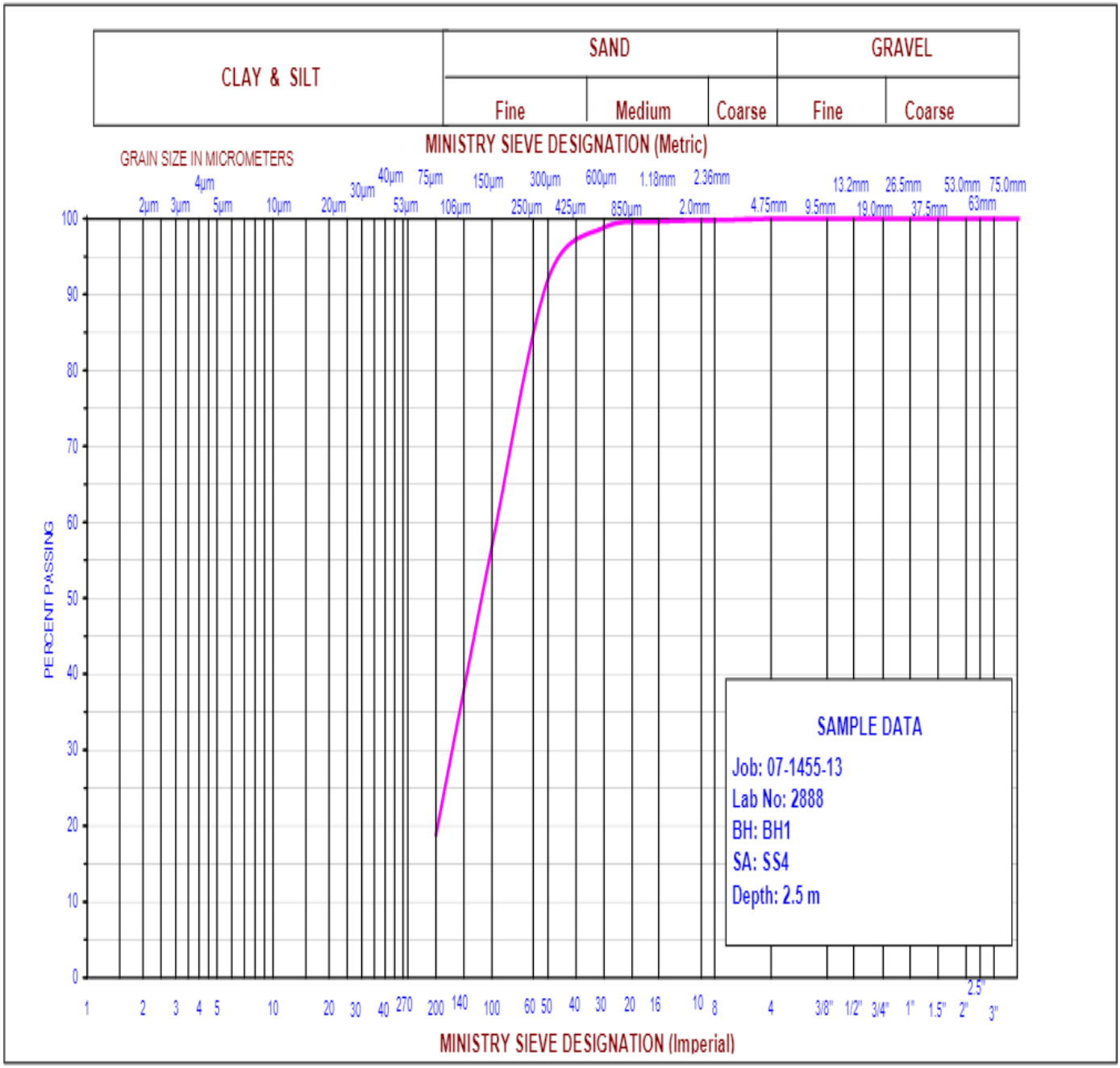
	GRAIN SIZE DISTRIBUTION	Client: Smart Centres	
		Project: Geotechnical Investigation	
	SANDY SILT	Location: Highway 400 & Harvie Road, Barrie, ON	
	trace gravel	Lab No.: 2889	Date: October 30, 2007

UNIFIED SOIL CLASSIFICATION SYSTEM



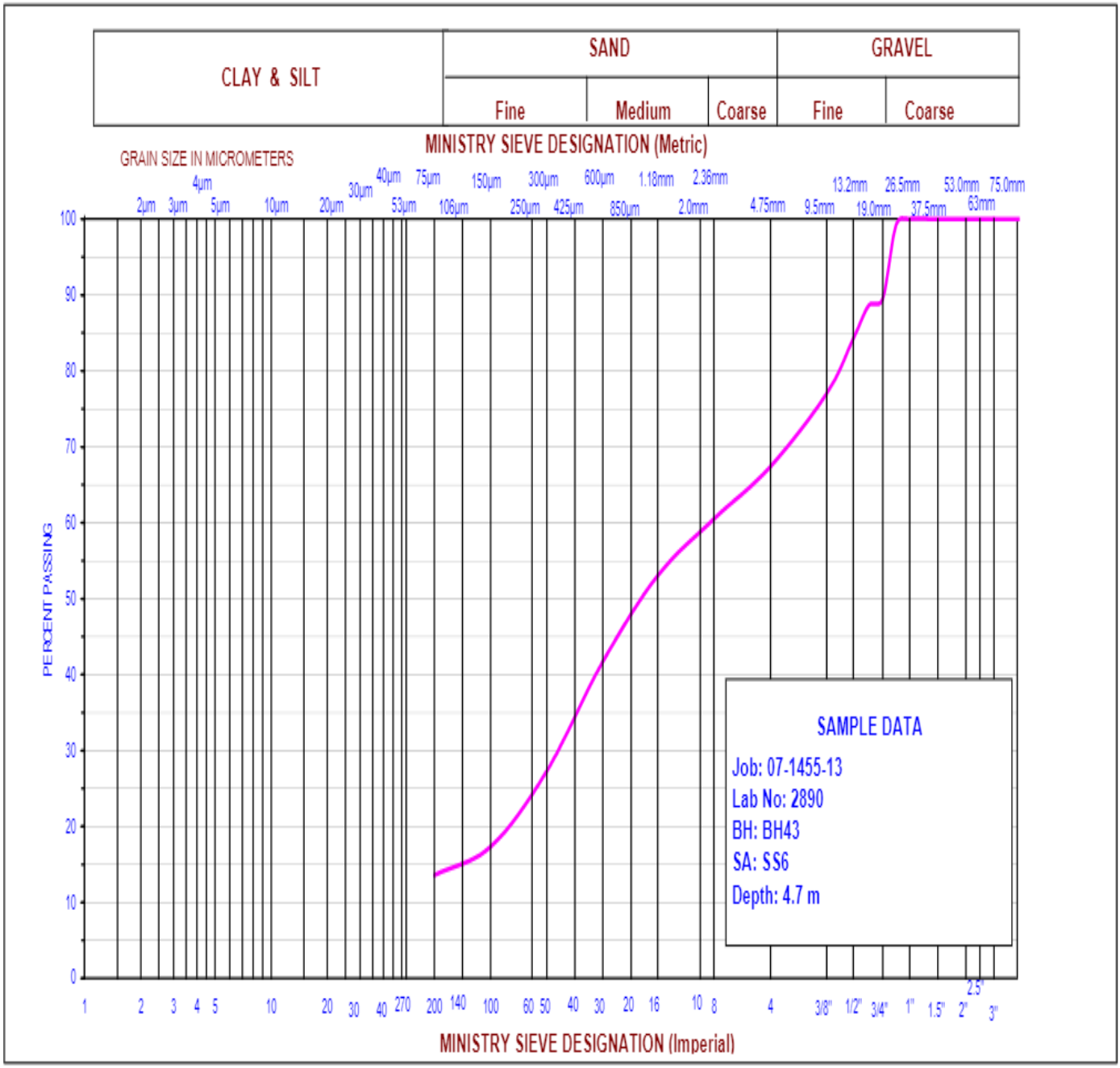
	GRAIN SIZE DISTRIBUTION	Client: Smart Centres	
		Project: Geotechnical Investigation	
	SAND	Location: Highway 400 & Harvie Road, Barrie, ON	
	some silt, trace gravel	Lab No.: 2887	Date: October 30, 2007

UNIFIED SOIL CLASSIFICATION SYSTEM



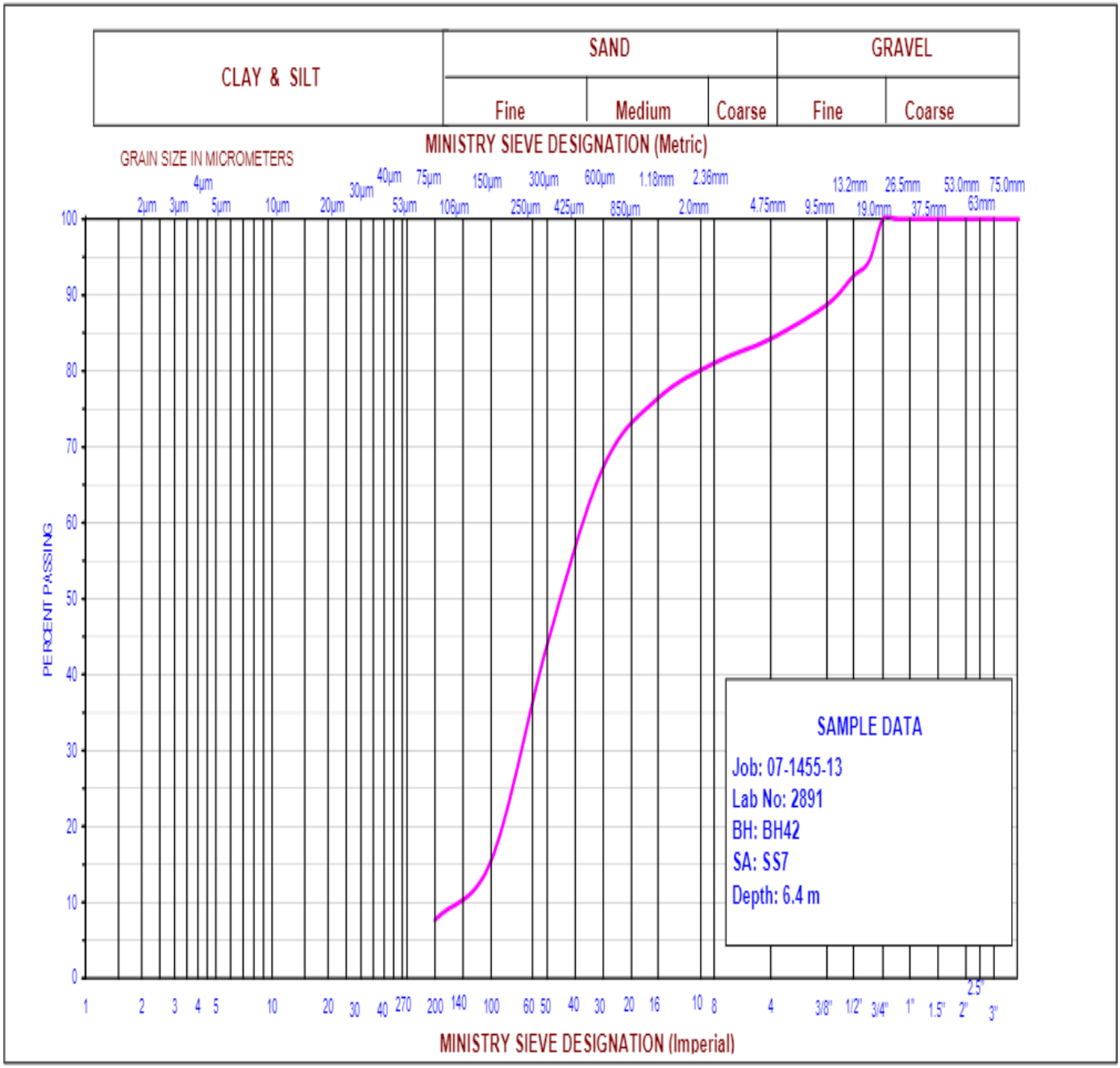
	GRAIN SIZE DISTRIBUTION	Client: Smart Centres	
		Project: Geotechnical Investigation	
	SAND	Location: Highway 400 & Harvie Road, Barrie, ON	
	some silt	Lab No.: 2888	Date: October 30, 2007

UNIFIED SOIL CLASSIFICATION SYSTEM



	GRAIN SIZE DISTRIBUTION	Client: Smart Centres	
		Project: Geotechnical Investigation	
	SAND	Location: Highway 400 & Harvie Road, Barrie, ON	
	with gravel, some silt	Lab No.: 2890	Date: October 30, 2007

UNIFIED SOIL CLASSIFICATION SYSTEM



	GRAIN SIZE DISTRIBUTION	Client: Smart Centres	
		Project: Geotechnical Investigation	
	SAND	Location: Highway 400 & Harvie Road, Barrie, ON	
	some gravel, trace silt	Lab No.: 2891	Date: October 30, 2007

RECORD OF BOREHOLE No. BH 01

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07 Date Completed: Oct 9, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	Geodetic Ground Surface Elevation: 300.9 m							PenetrationTesting ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
	about 50 mm Topsoil 300.8 / 0.1										
	yellowish brown/grey SAND trace to some silt trace organics and rootlets in SS1 loose to compact moist	SS	1	70	4			○	9		
		SS	2	89	6	1	300	○	2		
		SS	3	83	8			○	6		
						2	299				
		SS	4	72	18			○	5		
						3	298				
	..... dense to very dense	SS	5	78	35			○	7		
						4	297				
		SS	6	100	60			○	6		
						5	296				
						6	295				Groundwater in piezometer on 26/10/2007: 5.9 m
		SS	7	0	33			○	12		Groundwater in piezometer on 14/11/2007: 5.8 m
	294.3 End of Borehole 6.6										
	Piezometer was installed to depth of 6.1 m										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ Groundwater depth on completion of drilling: 6.0 m.

▼ Groundwater depth observed on 14/11/2007 at a depth of: 5.8 m.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 02

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07	Date Completed: Oct 9, 07	Revision No.: 0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 299.9 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 300 mm Topsoil										
	299.6										
	brown/grey SAND trace to some silt loose to compact moist to wet 0.3	SS	1	84	6			○	11		
		SS	2	89	6	1	299	○	3		
		SS	3	89	7			○	3		
						2	298				
		SS	4	78	10			○	5		
		SS	5	11	11	3	297	○	8		
						▽ 4 ■	296				
	------ grey, very dense wet	SS	6	100	50/15			50 ○ 15	20		
						5	295				
						6	294				
		SS	7	72	84/31			84 ○ 31	19		
	293.3 End of Borehole 6.6										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ Groundwater depth on completion of drilling: 3.8 m.

■ Cave in depth recorded on completion of drilling: 4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 03

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.8 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 300 mm Topsoil										
	300.5										
	brown SAND trace to some silt trace organics in SS1 loose moist to wet 0.3	SS	1	62	7			○	11		
						1	300				
		SS	2	72	6			○	3		
	..... dense to very dense	SS	3	89	34	2	299	○	3		
		SS	4	78	45		298	○	3		
		SS	5	83	46	3		○	2		
						4	297				
		SS	6	83	69		296	○	11		
						5					
	----- wet	SS	7	100	92/23	6	295	○ 92/23			
	294.3 End of Borehole 6.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 04

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.7 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading: △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 330 mm Topsoil										
	301.4	SS	1	59	5			○	8		
	dark brown to grey SAND trace to some silt trace organics and rootlets in SS1 loose to compact moist to wet 0.3						301				
		SS	2	83	11	1		○	1		
	..... dense to very dense	SS	3	89	41		300	○	3		
		SS	4	100	47	2		○	6		
		SS	5	89	61	3	299	○	3		
		SS	6	78	81	4	298	○	4		
	----- wet	SS	7	100	83/25	5	297	○	17		Groundwater in piezometer on 26/10/2007: dry
	295.2							83/25			
	End of Borehole 6.5					6	296				Groundwater in piezometer on 14/11/2007: dry
	Piezometer was installed to depth of 6.3 m										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 14/11/2007 at a depth of: dry m.

RECORD OF BOREHOLE No. BH 05

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07 Date Completed: Oct 9, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 100 mm Topsoil	301.3						
	brown/dark brown SAND trace to some silt trace rootlets in SS1 very loose to loose moist	0.1	SS	1	79	4		301
							1	
			SS	2	78	5		
								300
	..... dense to very dense		SS	3	89	33	2	
								299
			SS	4	72	43		
							3	
			SS	5	72	68		298
							4	
								297
			SS	6	93	94		
							5	
								296
							6	
			SS	7	100	96/23		295
		294.9						
	End of Borehole	6.5						

FIELD TESTING: Penetration Testing — ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 06

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07 Date Completed: Oct 10, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.6 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 250 mm Topsoil						
	301.4						
	yellowish brown/grey SAND trace to some silt trace rootlets in SS1 loose to compact moist 0.3	SS	1	70	7		
							301
		SS	2	89	6	1	
							300
		SS	3	89	15	2	
	..... dense						
		SS	4	61	49		299
						3	
		SS	5	78	40		
							298
						4	
		SS	6	100	41		297
						5	
							296
						6	
	295.4 6.2						
	grey SANDY SILT compact wet	SS	7	78	25		
	295.0 6.6 End of Borehole						

FIELD TESTING

PenetrationTesting
○ SPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING

★ Rinse pH Values
2 4 6 8 10 12
Soil Vapour Reading
△ parts per million (ppm)
100 200 300 400
▲ Lower Explosive Limit (LEL)
W_P W W_L
Plastic Liquid
20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 07

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07 Date Completed: Oct 10, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.8 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 250 mm Topsoil						
	301.6						
	brown 0.3 SAND trace to some silt trace organics, trace rootlets in SS1 loose moist	SS	1	95	7		
							301
		SS	2	72	7	1	
	.....						
	dense to very dense	SS	3	61	44		300
						2	
		SS	4	89	37		
							299
						3	
		SS	5	100	48		
							298
						4	
		SS	6	100	80/30		297
						5	
							296
						6	
		SS	7	100	53		
	295.2						
	End of Borehole 6.6						

FIELD TESTING

PenetrationTesting: ○ SPT ● DCPT

MTO Vane*: △ Intact ▲ Remould

Nilcon Vane*: ◇ Intact ◆ Remould

* Undrained Shear Strength (kPa): 20 40 60 80

LAB TESTING

★ Rinse pH Values: 2 4 6 8 10 12

Soil Vapour Reading: △ parts per million (ppm): 100 200 300 400

▲ Lower Explosive Limit (LEL)

W_P W W_L

Plastic Liquid: 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

80
30

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 08

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07	Date Completed: Oct 11, 07	Revision No.: 0, 11/28/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.2 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 360 mm Topsoil	301.8										
	brown/grey SAND with to silty trace gravel loose to very dense moist	0.4	SS	1	70	8		302	○			
							1					
			SS	2	61	6		301	○			
			SS	3	93	42			○			
							2					
			SS	4	89	50		300	○			
		299.3										
	grey SILTY SAND dense to very dense moist	2.9					3					
			SS	5	100	48		299	○			
							4					
								298				
			SS	6	100	78/28			78 28			
							5					
								297				
							6					
								296				
			SS	7	77	95/28			95 28			
		295.7										
	End of Borehole	6.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 09

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07	Date Completed: Oct 9, 07	Revision No.: 0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING PenetrationTesting: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 200 mm Topsoil	301.3										
	yellowish brown/ grey SAND some silt loose moist	0.2	SS	1	84	4		301	○			
			SS	2	89	4	1		○			
	..... dense to very dense		SS	3	100	58		300	○			
			SS	4	61	55	2	299	○			
	- trace gravel		SS	5	84	87/28	3		○ 87/28			
			SS	6	83	95/31	4	298	○ 95/31			
			SS	7	80	83/30	5	297	○ 83/30			
		295.0					6	296				
	End of Borehole	6.6						295				

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 10

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07	Date Completed: Oct 10, 07	Revision No.: 0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.6 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 165 mm Topsoil	301.4										
	dark brown/grey SAND trace to some silt trace rootlets in SS1 very loose to compact moist	0.2	SS	1	67	3			○	10		
			SS	2	83	23	1	301	○	2		
	..... dense to very dense		SS	3	83	33		300	○	2		
			SS	4	54	47	2		○	3		
	- silty sand		SS	5	89	50	3	299	○	12		
			SS	6	89	71	4	298	○	3		
			SS	7	98	81/26	5	297	○ 81/26	3		
		295.1					6	296				
	End of Borehole	6.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 11

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07 Date Completed: Oct 10, 07	Revision No.:	0, 11/28/07

Geodetic Ground Surface Elevation: 301.5 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	about 200 mm Topsoil										
	301.3										
	dark brown/grey SAND trace silt to some silt very loose to loose moist 0.2	SS	1	75	2		301				
						1					
		SS	2	61	6		300				
	..... very dense	SS	3	83	53	2					
		SS	4	78	68		299				
		SS	5	89	55	3	298				
	296.9					4	297				
	grey SILTY SAND very dense moist 4.6	SS	6	100	89/30	5	296	89/30			
		SS	7	100	87/25	6	295	87/25			
	294.9 End of Borehole 6.5										

FIELD TESTING: Penetration Testing — ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 12

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07	Date Completed: Oct 11, 07	Revision No.: 0, 11/28/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.4 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 280 mm Topsoil										
	301.1										
	yellowish brown/ brown SAND some silt trace organics and rootlets in SS1 loose to dense moist 0.3	SS	1	62	6		301	○	8		
		SS	2	89	4	1	300	○	6		
		SS	3	78	6	2		○	3		
		SS	4	78	41		299	○	2		
	298.4					3					
	grey SILTY SAND very dense moist 3.1	SS	5	78	51		298	○	5		
	------ some silt	SS	6	100	91/25	4	297	91/25 ○	7		
	295.3					5	296				
	grey SAND trace silt very dense moist 6.1	SS	7	100	50/9	6	295.1	50/9 ○	3		
	End of Borehole 6.3										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 13

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07	Date Completed: Oct 9, 07	Revision No.: 0, 11/28/07

Geodetic Ground Surface Elevation: 300.7 m

DESCRIPTION	Elevation	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
about 300 mm Topsoil	300.4	0.3				
brown SAND trace silt and gravel trace rootlet very loose moist	300.0	0.7	SS	1	84	4
grey SANDY SILT TILL trace to some gravel dense to very dense moist			SS	2	67	47
			SS	3	89	96/31
			SS	4	100	82/28
brown SILTY SAND very dense moist	297.9	2.8	SS	5	89	63
			SS	6	100	64
			SS	7	100	84/25
End of Borehole	294.2	6.5				

FIELD TESTING: Penetration Testing (○ SPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); W_P W W_L; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 14

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07	Date Completed: Oct 9, 07	Revision No.: 0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 280 mm Topsoil											
		300.2										
	yellowish brown/brown SAND some silt trace gravel compact to very dense damp to moist	0.3	SS	1	62	8			○			
								300				
			SS	2	78	14	1		○			
								299				
			SS	3	83	52			○			
		298.7					2					
	grey/brown SANDY SILT TILL very dense moist	1.8										
			SS	4	83	61		298	○			
							3					
		297.3										
	brown SAND very dense moist	3.2	SS	5	77	90/28			90/28			
								297				
							4					
								296				
			SS	6	98	80/26			80/26			
							5	295				
							6					
			SS	7	100	92/26			92/26			
		294.0						294				
	End of Borehole	6.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 15

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07 Date Completed: Oct 10, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	about 240 mm Topsoil	300.2										
	dark brown/brown SAND some gravel, some silt trace rootlets and trace organics in SS1 very loose to compact moist	0.2	SS	1	30	2						
			SS	2	93	24	1	300				
		298.7	SS	3	72	22		299				
	grey SANDY SILT TILL trace gravel compact to very dense moist	1.7					2					
		297.9	SS	4	100	50/15		298	50/15			
	grey SAND some silt very dense moist	2.6					3					
			SS	5	98	90/26		297	90/26			
							4					
			SS	6	100	50/15		296	50/15			
							5					
								295				
							6					
			SS	7	100	79/31		294	79/31			
		293.9										
	End of Borehole	6.6										

FIELD TESTING: Penetration Testing — ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic 20 40 60 80 Liquid

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 16

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 300 mm Topsoil	300.1										
	dark brown/brown SAND trace to some silt loose to compact moist	0.3	SS	1	62	4		300	○			
			SS	2	89	26	1	299	○			
			SS	3	78	29			○			
		298.1					2	298				
	grey SANDY SILT TILL trace gravel very dense moist	2.3	SS	4	100	56			○			
		297.2	SS	5	100	50/10	3	297	50 ○ 10			
	grey SAND trace silt very dense moist	3.3										
			SS	6	100	92/25	4	296	92 ○ 25			
							5	295				
			SS	7	100	92/23	6	294	92 ○ 23			
		293.9										
	End of Borehole	6.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 17

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 9, 07	Date Completed: Oct 9, 07	Revision No.: 0, 11/28/07

Geodetic Ground Surface Elevation: 299.0 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Field Testing: Undrained Shear Strength (kPa) 20 40 60 80	Lab Testing: Lower Explosive Limit (LEL) 20 40 60 80
	298.9	about 80 mm Topsoil						
	298.9	yellowish brown/brown SAND with silt some rootlets in SS1 to SS3 loose damp	SS	1	75	4		8
1	298		SS	2	89	5		3
		- sandy silt	SS	3	93	7		6
2	297	------- very dense						
			SS	4	83	52		3
3	296		SS	5	54	81/31	81 31	3
4	295		SS	6	75	91/31	91 31	3
5	294							
6	293		SS	7	100	50/15	50 15	8
	292.6	End of Borehole 6.4						

Piezometer was installed to depth of 5.9 m

Groundwater in piezometer on 26/10/2007: dry

Groundwater in piezometer on 14/11/2007: dry

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

No freestanding groundwater measured in open borehole on completion of drilling.

Groundwater depth observed on 14/11/2007 at a depth of: dry m.

RECORD OF BOREHOLE No. BH 18

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07	Date Completed: Oct 10, 07	Revision No.: 0, 11/28/07

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 299.0 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	about 190 mm Topsoil	298.8											
	yellowish brown SAND trace silt to some silt trace organics in SS1 loose to compact moist		0.2	SS	1	93	8						
				SS	2	67	6	1	298				
				SS	3	72	21						
	grey SANDY SILT/SAND TILL trace gravel very dense moist	297.2	1.8					2	297				
				SS	4	89	61						
								3	296				
	grey SAND trace to some silt very dense moist	295.8	3.2	SS	5	89	65						
								4	295				
				SS	6	77	83/28						
								5	294				
								6	293				
				SS	7	89	81/31						
	End of Borehole	292.4	6.6										

FIELD TESTING: Penetration Testing — ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); W_P W W_L; Plastic Liquid; 20 40 60 80

SS 1: 10 | SS 2: 18 | SS 3: 8 | SS 4: 6 | SS 5: 3 | SS 6: 83/28, 3 | SS 7: 81/31, 6

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 19

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	SKS
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 10, 07 Date Completed: Oct 10, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 298.9 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil										
	298.6										
	brown SAND trace to some silt very loose to compact moist 0.2	SS	1	87	3			○	6		
						1	298				
		SS	2	61	4			○	6		
	- trace clay	SS	3	78	13	2	297	○	14		
	- trace gravel	SS	4	83	12			○	13		
	.....					3	296				
	dense to very dense	SS	5	93	36			○	3		
						4	295				
		SS	6	93	92/31			92 ○ 31	6		
						5	294				
						6	293				
		SS	7	0	63			○	8		
	292.3										
	End of Borehole 6.6										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 20

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 299.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 250 mm Topsoil	298.8										
	yellowish brown SAND trace organics and rootlets in SS1 loose moist	0.3	SS	1	75	10			○	7		
			SS	2	78	4	1	298	○	6		
		297.3	SS	3	78	23			○	19		
	grey SILTY CLAY very stiff to hard moist	1.7					2	297				
			SS	4	100	51			○	18		
		296.0					3	296				
	grey SILTY SAND trace gravel in SS5 very dense moist	3.1	SS	5	89	78			○	3		
			SS	6	100	50/13	4	295	50 13	3		
							5	294				
							6	293				
			SS	7	84	88/28			88 28	13		
		292.5										
	End of Borehole	6.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 21

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 298.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
	about 250 mm Topsoil 297.8										
	dark brown SAND trace clay, some silt some organics in SS1 loose to compact damp to moist 0.3	SS	1	75	8			○			
		SS	2	89	4	1	297	○			
		SS	3	75	13	2	296	○			
	295.9 End of Borehole 2.1										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 22

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil	302.2										
	dark brown SAND trace to some silt loose to dense moist	0.2	SS	1	75	6		302	○			
			SS	2	78	15	1		○			
	------ grey		SS	3	67	48		301	○			
			SS	4	78	38	2	300	○			
			SS	5	67	40	3	299	○			
		298.7										
	End of Borehole	3.7										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 23

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 12, 07 Date Completed: Oct 12, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.4 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
	about 230 mm Topsoil										
	302.2										
	yellowish brown to brown SAND trace to some silt trace rootlets in SS1 loose to very dense moist 0.2	SS	1	62	6		302	○	6		
		SS	2	83	7	1	301	○	6		
		SS	3	89	10	2		○	2		
	..... grey	SS	4	100	40		300	○	3		
		SS	5	89	26	3	299	○	12		
		SS	6	78	20	4 5	298	○	14		Groundwater in piezometer on 26/10/2007: 5.5 m
							297				
		SS	7	84	61/28	6	296	61 ○ 28	18		Groundwater in piezometer on 14/11/2007: 5.5 m
	295.9 End of Borehole 6.5 Piezometer was installed to depth of 6.2 m										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 14/11/2007 at a depth of: 5.5 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 24

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	about 250 mm Topsoil	302.2										
	dark brown Sand Fill some silt and gravel damp	0.3	SS	1	67	10		302		4		
		301.7										
	grey SILTY SAND trace gravel dense damp	0.7	SS	2	93	33	1			6		
		301.0										
	grey SANDY SILT trace gravel very dense damp	1.4	SS	3	89	53		301		8		
							2					
	- sand		SS	4	89	64		300		2		
							3					
			SS	5	59	80/28		299	80 28	4		
		298.7										
	End of Borehole	3.7										

FIELD TESTING: Penetration Testing — ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 25

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING PenetrationTesting: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil	302.2										
	yellowish brown/ brown SAND trace silt to some silt trace rootlets in SS1 loose to dense moist	0.2	SS	1	67	4						
								302				
			SS	2	89	4	1					
								301				
			SS	3	75	38	2					
		300.3										
	End of Borehole	2.1										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 26

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 350 mm Topsoil	302.5										
	dark brown SAND trace gravel in SS1 loose moist	0.4	SS	1	75	9			○			
			SS	2	89	7	1	302	○			
	grey SILTY SAND TILL very dense moist	301.4 1.4	SS	3	89	55		301	○			
	grey SAND dense to very dense moist	300.7 2.1	SS	4	89	35	2		○			
			SS	5		92/25	3	300	○ 92/25			
	End of Borehole	299.3 3.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 27

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.6 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
	about 230 mm Topsoil 300.3										
	yellowish brown/grey SAND trace to some silt, trace gravel loose to very dense moist to damp 0.2	SS	1	75	5			○			
							300				
		SS	2	89	5	1		○			
							299				
		SS	3	100	50/5			50 ○ 5			
	298.8 End of Borehole 1.7										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 28

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 280 mm Topsoil	300.5										
	yellowish brown SAND some silt loose damp	0.3	SS	1	67	8			○	8		
								300				
			SS	2	78	5	1		○	7		
			SS	3	83	10		299	○	8		
		298.7					2					
	brown SILTY SAND dense to very dense moist	2.1										
			SS	4	83	36			○	11		
								298				
							3					
			SS	5	78	45			○	3		
								297				
							4					
			SS	6	100	80		296	○	16		
		295.8					5					
	End of Borehole	5.0										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 29

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 297.9 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 280 mm Topsoil	297.6										
	yellowish brown SAND some silt, trace organics compact moist	0.3	SS	1	70	18			○			
	brown SANDY SILT trace gravel, trace clay loose moist	297.2 0.7	SS	2	67	8	1	297	○			
	brown SAND trace silt compact moist	296.7 1.2	SS	3	62	13	2	296	○			
	End of Borehole	295.8 2.1										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 30

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 298.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 280 mm Topsoil	298.6										
	dark brown/grey SAND trace silt, trace organics loose to compact moist	0.3	SS	1	67	6			○			
							1	298				
			SS	2	100	6			○			
	------ some gravel		SS	3	33	15		297	○			
		296.7					2					
	End of Borehole	2.1										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 31

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 12, 07 Date Completed: Oct 12, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 298.7 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 330 mm Topsoil 298.4										
	yellowish brown/brown SAND trace to some silt loose moist 0.3	SS	1	75	8			○			
							298				
		SS	2	89	10	1		○			
							297				
		SS	3	67	4	2		○			
	296.6 End of Borehole 2.1										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 32

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 297.2 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 280 mm Topsoil	297.0										
	yellowish SAND trace to some silt trace organics loose moist	0.3	SS	1	62	9		297	○			
			SS	2	89	6	1	296	○			
		295.7										
	grey SILTY SAND trace gravel loose moist	1.5	SS	3	59	6	2		○			
		295.1										
	End of Borehole	2.1										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 33

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 11, 07 Date Completed: Oct 11, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 297.3 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING PenetrationTesting: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 200 mm Topsoil	297.1										
	yellowish brown SAND some silt, trace gravel, trace organics compact moist	0.2	SS	1	59	13		297	○	○ 9		
		296.5										
	grey SANDY SILT trace gravel compact to very dense moist	0.8	SS	2	89	12	1	296	○	○ 10		
			SS	3	100	82/23			○ 82/23	○ 7		
		295.3										
	grey SAND some silt very dense moist	2.0	SS	4	100	64/25	2	295	○ 64/25	○ 4		
			SS	5	100	75/31	3	294	○ 75/31	○ 9		Groundwater in piezometer on 26/10/2007: dry
			SS	6		72/31	4	293	○ 72/31	○ 5		Groundwater in piezometer on 14/11/2007: dry
		292.3					5					
	End of Borehole	5.0										
	Piezometer was installed to depth of 4.6 m											

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 14/11/2007 at a depth of: dry m.

RECORD OF BOREHOLE No. BH 34

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07	Date Completed: Oct 15, 07	Revision No.: 0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 300.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 250 mm Topsoil 299.8										
	dark brown SAND trace to some silt very loose moist 0.3	SS	1	67	2			○	19		
						1	299				
		SS	2	100	4			○	4		
	------ grey	SS	3	89	3			○	5		
						2	298				
	------ compact to dense	SS	4	89	24			○	5		
						3	297				
		SS	5		42			○	8		
	296.3 End of Borehole 3.7										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 35

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 299.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 360 mm Topsoil	299.1										
	yellowish brown Sand Fill some organics, trace rootlets moist	0.4	SS	1	75	5		299	○	14		
		298.7										
	brown SAND trace to some silt, trace organics in SS2 compact to dense wet	0.8	SS	2	0	8	1		○			
								298				
			SS	3	100	23			○	24		
							2 ▽ ■					
			SS	4	89	48		297	○	19		
							3					
			SS	5	75	38		296	○	20		
		295.8										
	End of Borehole	3.7										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ Groundwater depth on completion of drilling: 2 m.

■ Cave in depth recorded on completion of drilling: 2.1 m.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 36

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07	Date Completed: Oct 15, 07	Revision No.: 0, 11/28/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 302.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 250 mm Topsoil	302.5										
	dark brown Sand Fill some silt, trace organics moist	0.3	SS	1	67	8			○			
		302.0						302				
	grey SAND trace to some silt compact to very dense moist	0.8	SS	2	100	15	1		○			
			SS	3	100	55		301	○			
							2					
			SS	4	89	61			○			
								300				
							3					Groundwater in piezometer on 26/10/2007: dry
			SS	5	53	82/28			○ 82/28			
		299.3										
	End of Borehole	3.5										
	Piezometer was installed to depth of 3.4 m											Groundwater in piezometer on 14/11/2007: dry

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 14/11/2007 at a depth of: dry m.

RECORD OF BOREHOLE No. BH 37

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil	301.1										
	dark brown Sand Fill some organics, trace rootlets moist	0.2	SS	1	75	5		301		20		
		300.6										
	brown/grey SAND trace to some silt loose to very dense moist to wet	0.8	SS	2	89	8	1			13		
								300				
			SS	3	100	23				16		
							2					Groundwater in piezometer on 26/10/2007: 2.1 m
								299				
			SS	4	89	18				23		
							3					Groundwater in piezometer on 14/11/2007: 1.9 m
			SS	5	0	62		298				
							4					
								297				
			SS	6	100	72/28			72 28	20		
		296.4					5					
	End of Borehole	5.0										
	Piezometer was installed to depth of 3.9 m											

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling. ■ Cave in depth recorded on completion of drilling: 1.8 m.

▼ Groundwater depth observed on 14/11/2007 at a depth of: 1.9 m.

RECORD OF BOREHOLE No. BH 38

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 12, 07	Date Completed: Oct 12, 07	Revision No.: 0, 11/28/07

Geodetic Ground Surface Elevation: 296.5 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Field Testing	Lab Testing	Instrumentation Installation	Comments
		about 200 mm Topsoil								
	296.3									
		dark brown Sand and Gravel Fill moist								
	296.1									
		yellowish brown to light grey SAND trace to some silt loose to compact moist	SS	1	67	19		9		
1	296		SS	2	78	7		4		
	295		SS	3	78	17		7		
2		..... very dense								
	294		SS	4	100	92/25	92 25	3		
3		- with gravel	SS	5	100	50/13	50 13	6		
	293									
4	292		SS	6	83	78/31	78 31	4		
5		291.5 End of Borehole 5.0								

Penetration Testing: ○ SPT ● DCPT

MTO Vane*: △ Intact ▲ Remould

Nilcon Vane*: ◇ Intact ◆ Remould

* Undrained Shear Strength (kPa) 20 40 60 80

★ Rinse pH Values 2 4 6 8 10 12

Soil Vapour Reading △ parts per million (ppm) 100 200 300 400

▲ Lower Explosive Limit (LEL)

W_P W W_L

Plastic Liquid 20 40 60 80

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 41

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 291.6 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 230 mm Topsoil						
	brown/grey SAND some silt, trace gravel loose to very dense moist	291.4	0.2	SS	1	67	8
	- sandy silt			SS	2	78	12
				SS	3	89	40
				SS	4	83	50
	- some gravel	288.4	3.2				
	grey SANDY SILT TILL trace gravel very dense moist			SS	5	78	74
	grey SILTY CLAY trace sand hard moist	287.5	4.1	SS	6	100	37
	grey SAND with gravel, trace silt very dense moist	285.2	6.4	SS	7	100	50/10

FIELD TESTING: Penetration Testing (○ SPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS

Groundwater in shallow piezometer on 26/10/2007: dry

Groundwater in shallow piezometer on 14/11/2007: dry

Groundwater in deep piezometer on 26/10/2007: 9.9 m

Groundwater in deep piezometer on 14/11/2007: 9.9 m

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ Groundwater depth on completion of drilling: 6.1 m.

▼ Groundwater depth observed on 14/11/2007 at a depth of: 9.9 m.

■ Cave in depth recorded on completion of drilling: 10.7 m.

Scale: 1 : 37

Continued on Next Page

RECORD OF BOREHOLE No. BH 41

Project Number: **07-1455-13** Drilling Location: **See site plan.** Logged by: **GRA**

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	grey SAND with gravel, trace silt very dense moist							Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
		SS	8	77	50/13	8	284	50/13	2		
		SS	9	81	50/15	9	283	50/15	2		
		SS	10	82	50/13	10	282	50/13	6		
	279.3	SS	11	77	50/13	11	281	50/13			
	End of Borehole 12.3					12	280				
	Piezometers were installed to depth of 10.1 m and 3.0 m										

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 42

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 15, 07 Date Completed: Oct 15, 07	Revision No.:	0, 11/28/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 290.3 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
	about 250 mm Topsoil	290.1										
	yellowish brown to brown Sand to Silty Sand Fill trace organics in SS1 moist	0.3	SS	1	67	9		290	○	11		
			SS	2	89	8	1	289	○	14		
		288.8										
	brown SANDY SILT compact to very dense moist	1.5	SS	3	100	13			○	22		
							2	288				
			SS	4	89	51			○	12		
							3	287				Groundwater in shallow piezometer on 26/10/2007: dry
			SS	5	100	70			○	15		
		286.8										Groundwater in shallow piezometer on 14/11/2007: dry
	grey SAND trace to some silt very dense moist	3.5					4	286				
			SS	6	100	50/15			50 ○ 15	3		
							5	285				
							6					Groundwater in deep piezometer on 26/10/2007: dry
			SS	7	100	92/25		284	92 ○ 25	7		
							7					Groundwater in deep piezometer on 14/11/2007: dry

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 14/11/2007 at a depth of: dry m.

Scale: 1 : 37

Continued on Next Page

RECORD OF BOREHOLE No. BH 42

Project Number: **07-1455-13** Drilling Location: **See site plan.** Logged by: **GRA**

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	grey SAND trace to some silt very dense moist						283				
	- trace gravel	SS	8	74	50/15	8	282	50/15	4		
		SS	9	87	50/15	9	281	50/15	3		
		SS	10	81	50/15	10	280	50/15	5		
		SS	11		50/13	11	279	50/13	4		
	277.8					12	278				
	End of Borehole 12.5										
	Piezometers were installed to depth of 12.2 m and 3.0 m										

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 43

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 16, 07 Date Completed: Oct 16, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 290.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 250 mm Topsoil	290.2										
	dark brown Silty Sand/Sandy Silt Fill trace gravel, trace rootlets moist	0.3	SS	1	67	7		290	○	9		
		289.6										
	yellowish brown to brown SAND compact moist	0.8	SS	2	78	17	1	289	○	3		
			SS	3	89	21			○	3		
		288.1					2	288				
	grey SANDY SILT trace clay compact moist	2.3	SS	4	89	23			○	22		
			SS	5	78	27	3		○	25		Groundwater in shallow piezometer on 26/10/2007: dry
		286.9						287				
	grey SAND with gravel, some silt very dense moist	3.5					4					Groundwater in shallow piezometer on 14/11/2007: dry
			SS	6	71	50/13		286	50 ○ 13	2		
							5	285				
			SS	7	78	86/31	6	284	86 ○ 31	3		Groundwater in deep piezometer on 26/10/2007: dry
							7					Groundwater in deep piezometer on 14/11/2007: dry

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 14/11/2007 at a depth of: dry m.

Scale: 1 : 37

Continued on Next Page

RECORD OF BOREHOLE No. BH 43

Project Number: **07-1455-13** Drilling Location: **See site plan.** Logged by: **GRA**

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	grey SAND with gravel, some silt very dense moist							Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		
		SS	8	78	79/31	8	283	79 31	3		
		SS	9	81	50/15	9	282	50 15	2		
		SS	10	67	58/31	10	281	58 31	2		
		SS	11	88	86/25	11	280	86 25	4		
	277.8					12	279				
	End of Borehole 12.6						278				
	Piezometers were installed to depth of 11.6 m and 3.1 m										

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 44

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 16, 07 Date Completed: Oct 16, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING PenetrationTesting: ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil	301.3										
	brown/grey SAND trace to some silt trace organics loose to compact moist	0.2	SS	1	75	6		301	○			
			SS	2	100	10	1		○			
	..... dense to very dense		SS	3	100	35		300	○			
							2					
			SS	4	89	67		299	○			
							3					
			SS	5	88	86/25			○ 86/25			
	End of Borehole	298.0 3.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 45

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 16, 07 Date Completed: Oct 16, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 301.7 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil	301.5										
	yellowish brown/grey SAND trace to some silt trace rootlet in SS1 loose to compact damp	0.2	SS	1	75	5			○			
								301				
			SS	2	89	6	1		○			
			SS	3	100	25		300	○			
	..... dense to very dense						2					
			SS	4	89	50			○			
								299				
							3					
			SS	5	84	78/28			○ 78/28			
		298.2										
	End of Borehole	3.5										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 37

RECORD OF BOREHOLE No. BH 46

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 16, 07 Date Completed: Oct 16, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 299.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 250 mm Topsoil	299.6										
	dark brown SAND trace to some silt loose moist	0.3	SS	1	75	6			○			
								299				
			SS	2	100	6	1		○			
		298.5										
	grey SILTY SAND TILL trace gravel, some sand compact to very dense moist	1.4	SS	3	89	24		298	○			
							2					
			SS	4	95	75/23			75/23			
		296.9						297				
	grey SAND trace silt very dense damp	2.9	SS	5	81	50/15	3		50/15			
		296.5										
	End of Borehole	3.4										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH 47

Project Number:	07-1455-13	Drilling Location:	See site plan.	Logged by:	GRA
Project Client:	Smart Centres	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	GRA
Project Name:	Geotechnical Investigation, Wal-Mart	Drilling Machine:	Track Mounted Drill	Reviewed by:	MM
Project Location:	Highway 400 and Harvie Road, Barrie, ON	Date Started:	Oct 16, 07 Date Completed: Oct 16, 07	Revision No.:	0, 11/28/07

Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 299.7 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT MTO Vane*: △ Intact ▲ Remould Nilcon Vane*: ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	about 230 mm Topsoil 299.5										
	yellowish brown/brown SAND trace to some silt loose moist 0.3	SS	1	75	6			○			
							299				
		SS	2	89	8	1		○			
		SS	3	89	8		298	○			
						2					
	297.4										
	grey SANDY SILT TILL trace clay, trace gravel, some sand compact to very dense moist 2.3	SS	4	100	15		297	○			
						3					
	296.3	SS	5	75	84/31			84 ○ 31			
	grey SAND trace silt very dense moist 3.4 296.0 3.7										
	End of Borehole										

DBA Engineering Limited
370 Steelcase Road East
Markham, Ontario L3R 1G2
Tel: 1-800-819-8833
Fax: 905-940-8508

▽ No freestanding groundwater measured in open borehole on completion of drilling.

19 Janaury 2006
Ref. No. TT63002

Via E-mail Only

Diamora Developments Limited
700 Applewood Crescent, Suite 100
Vaughan, Ontario
L4K 5X3

Attention: **Ms. Allison Clark**
Assistant Project Manager, Land Development

Re: **Summary of the Results of Preliminary Geotechnical Investigation**
Proposed Commercial and Industrial Development
Highway 400 and Harvie Road
Barrie, Ontario

AMEC Earth and Environmental, a division of AMEC Americas Limited, was retained by Diamora Development Limited (Diamora) to conduct a preliminary geotechnical investigation for a proposed commercial/industrial development to be located on the southwest corner of the intersection of Highway 400 and Harvie Road in Barrie, Ontario (Figure No. 1). As requested, this summary letter report is prepared to provide you with or preliminary information. The information provided here in will be further revised and finalized in our final report.

The purpose of this preliminary geotechnical investigation was to obtain information on the subsurface conditions at the site by means of a limited number of boreholes, in-situ tests and laboratory tests on selected soil samples. Based on our interpretation of the data obtained, preliminary recommendations are provided on the geotechnical aspects of the development.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The subject site with a total area of about 70 acres was bounded by Highway 400 to the east, commercial development and undeveloped lands to the south, residential development to the west, City of Barrie Storm Water Management Pond (SWM) to the north, and Harvie Road to the northeast, as shown in Figure No. 2.

The site was generally undeveloped and only some sewers were observed to have been installed at the site, which were identified by existing manholes at site. The approximate alignment is shown in Figure No. 2.

Several piles of wood chips and fill material in various sizes exist at the site. A small portion of the site (0.8 acres) on the northeast corner was designated as environmentally protected zones (EP). A tributary of the Laures Creek was located on the southeast portion of the site, which was also designated as EP.

AMEC Earth & Environmental
A division of AMEC Americas Limited
www.amec.com

104 Crockford Blvd.
Scarborough, Ontario
Canada, M1R 3C3
Tel +1(416) 751-6565
Fax +1(416) 751-7592

12 Ontario Street, Unit 6A
Orillia, Ontario
Canada, L3V 6H1
Tel +1(705) 329-1542
Fax +1(705) 329-1429

The topography of the site was generally undulating with overall sloped down toward northeast. Based on the ground surface elevation at borehole locations, a grade difference in order of 10 m was noted from northeast to southwest portion of the site. Several low-lying areas were located on the southern portion of the site which performed as drainage swales for the surface water runoff toward the tributary of the Laures Creek. The ground surface was covered by snow at the time of the investigation; however, signs of overgrown vegetation were evidences on the ground surface. Scattered trees were located across the site.

The Site is proposed for commercial and industrial development, which typically consists of one storey buildings without basement. The details of the proposed development were not available at the time of the preparation of this summary report. However, it is our understanding that the proposed commercial/industrial buildings will be generally located along the boundaries of the site with associated parking areas/driveways on the central portion.

BACKGROUND INFORMATION

A geotechnical investigation was conducted by PetoMacCallum Ltd (report number 89 F 751, dated February 1990) for a parcel of the land located on the southwest corner of the intersection of Highway 400 and Harvie Road. Based on the information provided to us, six boreholes (out of thirteen) of PetoMacCallum's investigation were located in vicinity or within the boundaries of the site under our investigation. These boreholes were advanced to depths ranging from 7.8 m to 9.4 m. The soil profile was generally consisted of 0.5 m topsoil underlain by native soils (sand/silt/sand and silt). The native silty/sandy soils were generally loose in the upper portion (depths of 1.5 m to 1.5 m), becoming compact to very dense by increased depth. In boreholes PM-BH9 and PM-BH12, a layer of firm to very stiff clayey soil was also encountered underlying the topsoil which in turn was underlain by native sandy/silty soils. Groundwater was encountered in the installed piezometers in depths ranging from 2.3 m to 5.7 m.

Another geotechnical investigation was conducted for the subject site by GeoSpec (report number 00-629, dated 30 June 2000). Based on the information provided to us, six boreholes (out of nine) were located within the boundaries of the subject site. These boreholes were advanced to depths ranging from 3.5 m to 6.5 m. According to the report prepared by GeoSpec, two boreholes (GS-BH4 and GS-BH5) were located in the area of the installed sewers, which encountered thick layers of fill soils (2.7 m and more than 3 m, respectively). In the remaining boreholes, the soil profile generally consisted of 0.2 m to 0.4 m topsoil underlain by native soils (sand/sand and silt). The native silty/sandy soils were generally loose in the upper portion (to depths of 0.5 m to 1.5 m), becoming compact to very dense by increased depth. However, in one borehole (GS-BH9), loose sand was extended to depth of 3 m below grade.

The logs of borehole prepared by PetoMacCallum Ltd and GeoSpec for the above investigations have been included as attachments to this letter. The logs of boreholes have been provided for reference only and AMEC is not responsible for the accuracy/correctness of these borehole information.

INVESTIGATION PROCEDURES

For the present investigation, the fieldwork was performed on 11 January 2006, and consisted of advancing and sampling 7 boreholes (BH 1 to BH 7) to depths ranging from 3.5 m to 5.0 m below the existing ground surface. The approximate borehole locations established in the field by AMEC's field personnel are presented on Figure No. 2.

The boreholes were advanced using solid-stem continuous-flight augers, with a track-mounted power-auger drilling rig, under the full-time supervision of experienced geotechnical personnel from AMEC Earth & Environmental. Soil samples were generally taken at 0.76 m or 1.5 m intervals while performing the Standard Penetration Test (SPT).

The ground surface elevations at the borehole locations were surveyed using the top of the fire hydrant located at the southeast portion of the site (north end of Bryne Drive) as a temporary benchmark, with an assigned elevation of 100.00 m. It should be noted that the borehole elevations are approximate and should not be used for construction purposes. In addition, it should be noted that the ground surface elevation shown at the logs of boreholes advanced by PetoMacCallum Ltd and GeoSpec (in 1990 and 2000) have been surveyed using a different bench mark.

SUB-SURFACE CONDITIONS

Based on the subsurface conditions encountered in the boreholes, the soil profile consisted predominantly of topsoil (0.2 m to 0.6 m thick) overlying native sand soil. However, the native sand was underlain by silty clay/clayey silt in Borehole BH1, at a depth of 4 m below existing grade. Furthermore, fill and possible fill was encountered immediately under the topsoil in Boreholes BH5 and BH 6, extending to 1.0 m and 1.4 m below existing grade, respectively. The fill materials contained trace organic matter and rootlets.

With the exception of Boreholes BH 1 and BH 2, the native sand was generally loose in the upper portion, becoming compact to very dense by increased depth. No loose sand was encountered in Boreholes BH 1 and BH2. The loose sand was generally encountered to the depths of 1 m to 2 m below existing grades; however, in Borehole BH7 (advanced in a low-lying area) loose sand extended to the depths of more than 3.5 m.

In Borehole BH1, sand deposit was underlain by a layer of silty clay/clayey silt soil. The silty clay/clayey silt was very stiff and extended to termination depth of the borehole.

Open borehole groundwater was encountered only in Borehole BH 1 at depth of 4.3 m upon completion. No noticeable groundwater was encountered in the remaining open boreholes upon completion.

PRELIMINARY RECOMMENDATIONS

Final design grades were not available for review at the time of this investigation; therefore, the

following recommendations are preliminary in nature and are based on the assumption that the final grades would generally be similar to the existing grades.

The piles of wood chips and all fill materials should be removed from the area of the proposed development. Topsoil (0.2 m to 0.5 m) and any exposed soils which contain excessive organics and other compressible, weak and deleterious materials should be sub-excavated and removed from all settlement sensitive areas of the site.

Excluding Boreholes GS-BH4 and GS-BH5 (advanced between the installed sewer), fill material and possible fill was only encountered in Boreholes BH 5 and BH6. However, it should be noted that the boreholes advanced by GeoSpec and PetoMacCallum Ltd have been drilled 5 and 15 years ago, respectively; in particular, is the boreholes advanced by Peto (in 1990) which was prior to construction of the sewers. Detailed delineation of the fills will should be carried out by additional borehole/test pits in the next phase of the investigation.

In the area of the proposed pavement:

Subsequent to stripping/removal of the surfacial materials (as noted above), the exposed inorganic subgrade should be proof rolled with heavy compactors. During proof rolling, spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with approved engineered fill, compatible with subgrade conditions.

In the area of the proposed buildings:

For slab on grade construction; after removal of all the surfacial materials (as noted above), the grade should be cut to competent subgrade and raised using engineered fill to the proposed grades.

Full removal of the existing fill should be carried; however, partial removal may well be considered. The quality and thickness of the existing fill material should be confirmed by excavating some test pits.

The condition of the loose surfacial sand should be evaluated at the time of construction. Based on the condition encountered in the boreholes, with the exception of the area of Boreholes BH7 and GS-BH9, the depth of the additional sub-excavation for loose sand should be in order of 0.5 m to 1.0 m. However, detailed determination of the thickness of the loose sand will need to be carried out by additional boreholes in the next phase of the investigation. At the location of Boreholes BH7 and GS-BH9, deep sub-excavation is expected. Methods such as Dynamic Compaction may be considered. However, considering that some cut and engineered fill would be carried on at the site, we expect the sub-excavation method to be more cost effective than Dynamic Compaction. Furthermore, with the Dynamic Compaction method vibration analysis for the nearby structures, such as Highway 400, will need to be carried.

The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying topsoil and any organic inclusions are removed. However, reconditioning of the soil (i.e. drying) may be required.

Based on the results of the investigation, spread/strip footings founded within the compact to very dense native deposits and/or engineered fill can be used to support the proposed buildings. The allowable soil bearing pressure is generally 150 kPa to 300 kPa, depending on exact founding elevations. AMEC should be consulted during the final design phase.

Given the groundwater levels encountered in the advanced boreholes (1990, 2000, and 2006), depend on the design depth of the proposed services, some dewatering of the excavations may be required. Therefore, the use of a series of temporary sumps and pumps, and/or well points (depend on the depths) may be required. Test pits should be excavated to evaluate the appropriate method of dewatering prior to construction. The adverse effect of the dewatering system to any y water wells in the neighbouring properties, should be considered during the construction.

CLOSURE

This letter is prepared to summarized some of the result of the preliminary geotechnical investigation. A complete report of this investigation will be provided to you in later time.

The sub-soil information and recommendations contained in this letter should be used solely for the purpose of preliminary geotechnical investigation of this development.

Additional investigation may be required to provide geotechnical information for the final design.

Sincerely,

AMEC Earth & Environmental

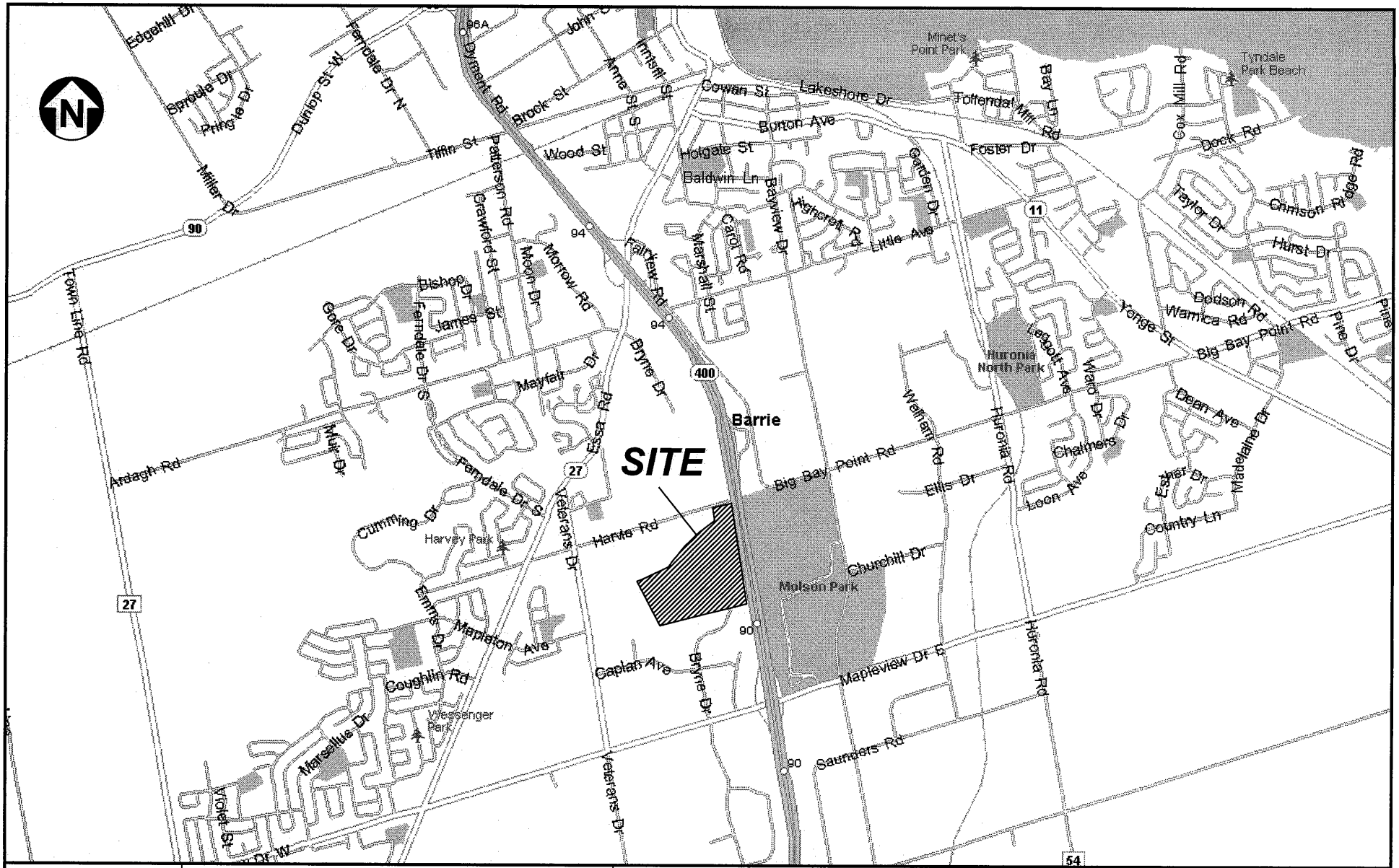
Masoud Manzari, M.Sc.Eng.
Project Manager

Houshang Shad, Ph.D., P. Eng.
Technical Manager

AMEC Earth & Environmental
A division of AMEC Americas Limited
www.amec.com

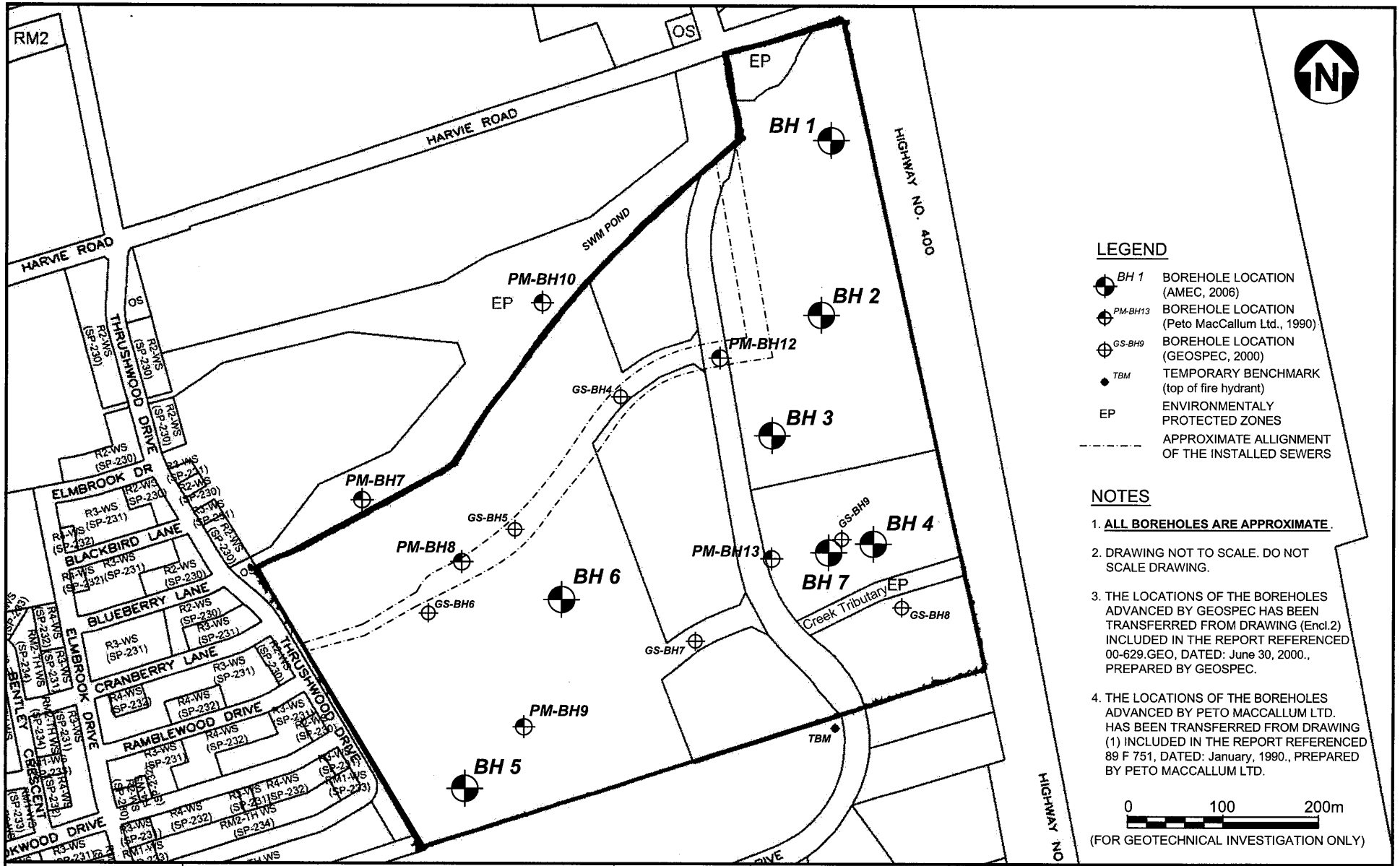
104 Crockford Blvd.
Scarborough, Ontario
Canada, M1R 3C3
Tel +1(416) 751-6565
Fax +1(416) 751-7592

12 Ontario Street, Unit 6A
Orillia, Ontario
Canada, L3V 6H1
Tel +1(705) 329-1542
Fax +1(705) 329-1429



CLIENT LOGO	CLIENT: DIAMORA DEVELOPMENTS LIMITED	DWN BY: KW	TITLE: SITE LOCATION PLAN	REV. NO.: A
		CHK'D BY: MM		DATE: JANUARY 2006
AMEC Earth & Environmental 104 Crockford Blvd, Scarborough, ON, M1R 3C3		DATUM:	PROJECT: PRELIMINARY GEOTECHNICAL INVESTIGATION PROPOSED COMMERCIAL DEVELOPMENT HIGHWAY 400 AND HARVIE ROAD BARRIE, ONTARIO	PROJECT NO: TT63002
		PROJECTION: N/A		FIGURE No. 1
		SCALE: N.T.S.		

Z:\Projects\2006\TT63002 - First Pro - Hwy400 - Barrie\Drawings\TT63002 - Site Location Plan.dwg - Site Location Plan1 - Jan. 18, 2006 3:32pm - kent.wong



CLIENT LOGO	CLIENT: DIAMORA DEVELOPMENTS LIMITED	DWN BY: KW	TITLE: BOREHOLE LOCATION PLAN	REV. NO.: A
		CHK'D BY: MM		DATE: JANUARY 2006
AMEC Earth & Environmental 104 Crockford Blvd, Scarborough, ON, M1R 3C3	amec	DATUM:	PROJECT: PRELIMINARY GEOTECHNICAL INVESTIGATION PROPOSED COMMERCIAL DEVELOPMENT HIGHWAY 400 AND HARVIE ROAD BARRIE, ONTARIO	PROJECT NO: TT63002
		PROJECTION: N/A		FIGURE No. 2
		SCALE: AS SHOWN		

P:\Projects\2006\TT63002 - First Pro - Hwy400 - Barrie\Drawings\TT63002 - Borehole Location Plan.dwg - Site Location Plan1 - Jan. 19, 2006 11:36am - masoud.manzari

RECORD OF BOREHOLE No BH 1 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
90.7												
0.0	**about 460 mm TOPSOIL**		1	SS	5							
90.2												
0.5	brown **SAND** trace gravel dense moist		2	SS	39		1	90				
			3	SS	43		2	89				
			4	SS	54			88				
	wet		5	SS	49		3					
86.7								87				
4.0	brown **SILTY CLAY / CLAYEY SILT** very stiff moist					▽	4					
			6	SS	29			86				
85.6							5					
5.0	**End of Borehole** Groundwater in open borehole on completion: 4.3 m Depth of cave-in on completion: 4.3 m											

+3 ×3 Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH 2 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
94.0												
0.0	**about 410 mm TOPSOIL**		1	SS	5					○		
93.6												
0.4	brown **SAND** trace gravel, trace silt to 1 m depth loose to very dense moist		2	SS	17		1	93		○		
			3	SS	51		2	92		○		
			4	SS	31					○		
	damp		5	SS	56		3	91		○		
							4	90				
			6	SS	98					○		
88.9							5	89				
5.0	**End of Borehole** No noticeable groundwater in open borehole on completion											

+3 ×3 Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH 3 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		m					
98.6 0.0	**about 560 mm TOPSOIL**		1	SS	4							
98.1 0.6	brown **SAND** trace gravel loose to very dense moist		2	SS	6		1	98				
			3	SS	6		2	97				
			4	SS	45		3	96				
			5	SS	79		4	95				
			6	SS	85		5	94				
93.6 5.0	**End of Borehole** No noticeable groundwater in open borehole on completion											

+3 x3 Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH 4 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
98.6 / 0.0	**about 480 mm TOPSOIL**		1	SS	3							
98.1 / 0.5	brown **SAND** trace rootlets to 1 m depth loose to very dense moist to damp		2	SS	5		1	98				
			3	SS	31		2	97				
	trace gravel		4	SS	44		3	96				
			5	SS	64		4	95				
93.9 / 4.7	**End of Borehole** No noticeable groundwater in open borehole on completion		6	SS	55/15			94				

+3 ×3 Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 5 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
100.3												
0.0	**about 480 mm TOPSOIL**											
99.8			1	AU				100				
0.5	brown to dark brown **Silty Sand / Clayey Silt FILL** trace organics and rootlets wet		2	SS	7		1					
98.9								99				
1.4	brown **SAND** trace silt compact to very dense damp to moist		3	SS	25		2					
			4	SS	40			98				
							3					
			5	SS	76			97				
96.8												
3.5	**End of Borehole** No noticeable groundwater in open borehole on completion											

$+^3$ $\times^3$ Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 6 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: o UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
100.0												
0.0	**about 480 mm TOPSOIL**		1	SS	3					o		
99.5												
0.5	brown **Sand (possible FILL)** occasional organics and rootlets moist											
99.0			2	SS	5		1	99		o		
1.0	brown **SAND** compact to very dense moist to damp											
			3	SS	27					o		
							2	98				
			4	SS	34					o		
	trace gravel						3	97				
			5	SS	79					o		
96.5												
3.5	**End of Borehole**											
	No noticeable groundwater in open borehole on completion											

+3 ×3 Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 7 1 OF 1

CLIENT Diamora Developments Limited LOCATION Hwy 400 and Harvei Rd, Barrie, Ontario ORIGINATED BY JF

REF. TT63002 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM NA DATE 11 January 2006 CHECKED BY PB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		m		20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	w_P w w_L WATER CONTENT (%) 10 20 30	γ kN/m³	GR SA SI CL
96.7 0.0	**about 300 mm TOPSOIL**											
96.4 0.3	brown **SAND** loose moist		1	AU			1	96				
			2	SS	4		2	95				
								94				
			3	SS	8		3					
93.2 3.5	**End of Borehole** No noticeable groundwater in open borehole on completion											

+³ ×³ Numbers refer to Sensitivity

GEOSPEC ENGINEERING LTD.
287 Tiffin Street, Unit 10, Barrie, Ontario L4N 7R8 TEL: (705) 722-4638 FAX: (705) 722-4958

BOREHOLE LOG

CLIENT:	R.G. Robinson & Associates Ltd.	**BORE HOLE N° (s):**	4
PROJECT NAME:	Harvie Road Industrial Subdivision	**BORING DATE:**	May 8, 2000
PROJECT N°:	00-629-GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	297.46 m	**BORING METHOD:**	Standard Auger

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
297.46						
	Brown, moist, loose to compact **SAND FILL** with occasional organic inclusions		1	14		
	Gradation @3.5 95% Sand 4% Gravel < 1% Silt		2	3		
294.8				14		
	Brown, moist, compact to dense layered **SAND** with trace gravel and silt		3			
294.0				56		
	END OF BOREHOLE NB: Dry & open to 3.5 m on completion.		4			
			5			
			6			

GEOSPEC ENGINEERING LTD.
287 Tiffin Street, Unit 10, Barrie, Ontario L4N 7R8 TEL: (705) 722-4638 FAX: (705) 722-4958

BOREHOLE LOG

CLIENT:	R.G. Robinson & Associates Ltd	**BORE HOLE N° (s):**	5
PROJECT NAME:	Harvie Road Industrial Subdivision	**BORING DATE:**	May 8, 2000
PROJECT N°:	00-629-GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	300.50 m	**BORING METHOD:**	Standard Auger

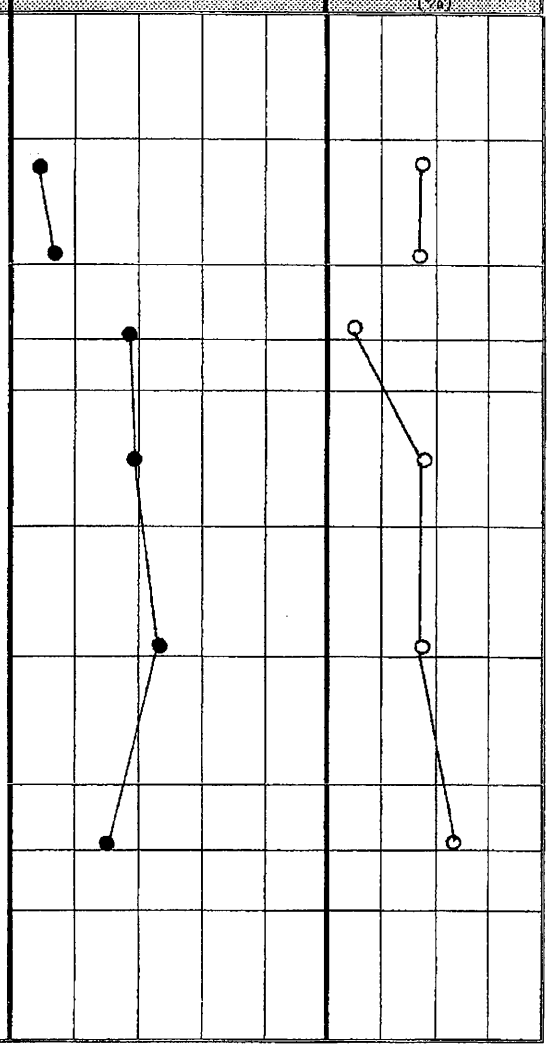
ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
300.50						
	10 cm **TOPSOIL** over		1	15		
	Brown, moist to damp, compact **SILTY SAND FILL**		2	15		
			3	14		
297.0				11		
	END OF BOREHOLE NB: Dry & open to 3.5 m on completion.		4			
			5			
			6			

GEOSPEC ENGINEERING LTD.
287 Tiffin Street, Unit 10, Barrie, Ontario L4N 7R8 TEL: (705) 722-4638 FAX: (705) 722-4958

BOREHOLE LOG

CLIENT:	R.G. Robinson & Associates Ltd.	**BORE HOLE N° (s):**	6
PROJECT NAME:	Harvie Road Industrial Subdivision	**BORING DATE:**	May 8, 2000
PROJECT N°:	00-629 GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	302.33 m	**BORING METHOD:**	Standard Auger

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	N VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
302.33						
	25 cm **TOPSOIL** over					
	brown, moist, loose to compact **SAND & SILT**		1	8		
			2	16		
299.6		2.7 ▼		39		
	brown, moist to wet, dense layered **SAND** with trace gravel and silt		3			
				40		
			4			
	Gradation @5.0m 94% Sand 5% Gravel <1% Silt		5	46		
			6			
295.8				31		
	END OF BOREHOLE NB: Wet cave at 2.7 m on completion.					



GEOSPEC ENGINEERING LTD.
287 Tiffin Street, Unit 10, Barrie, Ontario L4N 7R8 TEL: (705) 722-4638 FAX: (705) 722-4958

BOREHOLE LOG

CLIENT:	R.G. Robinson & Associates Ltd.	**BORE HOLE N° (s):**	7
PROJECT NAME:	Harvie Road Industrial Subdivision	**BORING DATE:**	May 8, 2000
PROJECT N°:	00-629 GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	300.37 m	**BORING METHOD:**	Standard Auger

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	N VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION ● DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
300.37	30 cm **TOPSOIL** over					
	brown, moist to wet loose to very dense layered **SAND** with trace gravel and silt	3.5 ▼	1	5		
			2	20		
			3	74		
			4	22		
			5	10		
			6	43		
293.9	**END OF BOREHOLE** NB: Wet cave at 3.5 m on completion.					

GEOSPEC ENGINEERING LTD.
287 Tiffin Street, Unit 10, Barrie, Ontario L4N 7R8 TEL: (705) 722-4638 FAX: (705) 722-4958

BOREHOLE LOG

CLIENT:	R.G. Robinson & Associates Ltd.	**BORE HOLE N° (s):**	8
PROJECT NAME:	Harvie Road Industrial Subdivision	**BORING DATE:**	May 8, 2000
PROJECT N°:	00-629 GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	301.12 m	**BORING METHOD:**	Standard Auger

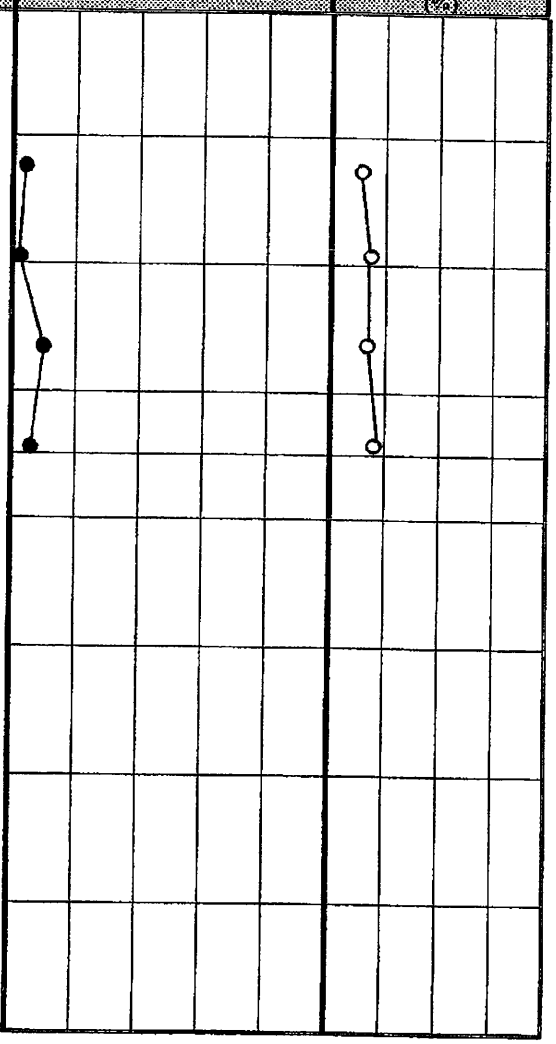
ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION ● DYNAMIC CONE ◆ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
301.12	38cm **TOPSOIL** over					
	Gradation @2.0m 96% Sand 3% Gravel <1% Silt		1	25		
	Brown, moist, compact to dense layered **SAND** with trace gravel and silt.		2	27		
			3	40		
297.6				38		
	END OF BOREHOLE NB: Dry & open to 3.5 m on completion.		4			
			5			
			6			

GEOSPEC ENGINEERING LTD.
287 Tiffin Street, Unit 10, Barrie, Ontario L4N 7R8 TEL: (705) 722-4638 FAX: (705) 722-4958

BOREHOLE LOG

CLIENT:	R.G. Robinson & Associates Ltd.	**BORE HOLE N° (s):**	9
PROJECT NAME:	Harvie Road Industrial Subdivision	**BORING DATE:**	May 8, 2000
PROJECT N°:	00-629 GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	298.47 m	**BORING METHOD:**	Standard Auger

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION ● DYNAMIC CONE ○ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
298.47	15 cm **TOPSOIL** over					
	brown, moist, very loose to loose layered **SAND** with trace gravel and silt		1	4		
			2	1		
			3	10		
295.0				6		
	END OF BOREHOLE NB: Dry & open to 3.5 m on completion.		4			
			5			
			6			



PetoMacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 7

PROJECT Barrie-400 Industrial Subdivision — OUR PROJECT NO. 89 F 751
LOCATION Harvie Road and Veterans Drive, Barrie, Ont. — BORING DATE Jan. 10/90 — ENGINEER TS
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN TS

DEPTH in METRES	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES
	GROUND ELEVATION 297.80				
0.50	TOPSOIL: Dark brown silty fine sand, organic, moist, becoming rusty brown, loose	297	1	SS	8
	SAND: Loose light brown fine sand, some silt, moist		2	SS	8
1.5		296	3	SS	8
	becoming compact, saturated with silt laminae, dilatant	295	4	SS	23
2.90					
3.0	LAYERED SAND AND SILT: Very dense brown to grey silty fine sand, and fine sandy silt, dilatant, saturated		5	SS	51
		294			
4.5		293	6	SS	62
5.40					
	SILT: Hard grey silt, some clay, occasional silty clay laminae, D.T.P.L.	292			
6.0			7	SS	69
		291			
7.5 7.50					
	SAND: Very dense brown fine to medium sand, some silt, moist	290			
8.50					
	BOREHOLE TERMINATED AT 8.50 m	289	8	SS	50/125 mm
9.0					
10.5					
12.0					
13.5					
15.0					
16.5					

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT % 10 20 30

PROPOSED INVERT EL.290.80

GROUND WATER OBSERVATIONS AND REMARKS

Native Backfill

Bentonite Seal

SS 4 wet

Cave

Upon completion of augering wet cave at 4.1 m

WATER LEVEL READING
Jan.30/90 2.60 m

NOTES:

CHECKED BY: JS.

PetoMacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 8

PROJECT: Barrie-400 Industrial Subdivision — OUR PROJECT NO. 89 F 751
LOCATION: Harvie Road and Veterans Drive, Barrie, Ont. — BORING DATE: Jan. 8/90 — ENGINEER: TS
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: TS

GROUND ELEVATION 301.22

DEPTH in METRES	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES
0.50	TOPSOIL: Dark brown silty fine sand, organic, moist, becoming silty brown, loose	301	1	SS	5
		300	2	SS	8
1.5	SAND: Loose to compact light brown fine sand, some silt, silt laminae, moist		3	SS	12
2.40		299			
	LAYERED SAND AND SILT: Dense to very dense grey silty fine sand and fine sandy silt, dilatant, saturated		4	SS	33
3.0		298	5	SS	53
		297			
4.5			6	SS	38
		296			
6.0		295	7	SS	60
		294			
7.5					
8.20		293	8	SS	55
	BOREHOLE TERMINATED AT 8.20 m				
9.0					
10.5					
12.0					
13.5					
15.0					
16.5					

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M: 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT %: 10 20 30

PROPOSED INVERT EL. 295.50

GROUND WATER OBSERVATIONS AND REMARKS:
SS 6 wet
Upon completion of augering wet cave at 3.9 m

NOTES:

CHECKED BY: JS.

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 9

PROJECT: Barrie-400 Industrial Subdivision — OUR PROJECT NO. 89 F 751
LOCATION: Harvie Road and Veterans Drive, Barrie, Ont. — BORING DATE: Jan. 10/90 — ENGINEER: TS
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: TS

DEPTH in METRES	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES
	GROUND ELEVATION 302.91				
0.50	TOPSOIL: Dark brown fine sandy silt, organic, moist becoming loose rusty brown silty fine sand	302	1	SS	5
			2	SS	6
1.5	CLAY: Firm to very soft brown silty clay, with horizons of clayey silt, A.P.L. to W.T.P.L.	301	3	SS	16
2.10					
	SAND: Dense grey fine sand, some silt, saturated	300	4	SS	40
3.0			5	SS	41
		299			
4.5	occasional laminae of silt and fine to medium sand	298	6	SS	51
		297			
6.0			7	SS	44
		296			
7.5					
7.90		295	8	SS	54
	BOREHOLE TERMINATED AT 7.90 m				
9.0					
10.5					
12.0					
13.5					
16.0					
16.5					

SHEAR STRENGTH C_u kPa (25 50 75 100)
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST •
BLOWS/0.3M (20 40 60 80)

PROPOSED INVERT EL.297.50

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % (10 20 30)

GROUND WATER OBSERVATIONS AND REMARKS

Native Backfill
Bentonite Seal
SS 4 wet
Cave

Upon completion of augering wet cave at 1.3 m

WATER LEVEL READING
Jan. 30/90 2.30 m

NOTES: ■ Undrained shear strength based on insitu pocket penetrometer measurement

CHECKED BY: T.S.

PML/504A

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 10

PROJECT: Barrie-400 Industrial Subdivision — OUR PROJECT NO. 89 F 751
LOCATION: Harvie Road and Veterans Drive, Barrie, Ont. — BORING DATE: Jan. 10/90 — ENGINEER: TS
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: TS

DEPTH in METRES	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES
	GROUND ELEVATION 288.65				
0.10	TOPSOIL: Dark brown fine sandy silt, organic, moist	288	1	SS	5
1.5	LAYERED SAND AND SILT: Compact grey silty fine sand and fine sandy silt, dilatant, saturated	287	2	SS	19
			3	SS	30
2.60		286	4	SS	31
3.0	SILT: Hard grey silt, some clay, occasional silty clay laminae, D.T.P.L.		5	SS	60
4.20		285			
4.5	SAND: Very dense light brown fine to medium sand, some silt, moist	284	6	SS	50/140 mm
		283			
6.0	occasional medium to coarse sand and gravel layers		7	SS	50/150 mm
		282			
7.5		281			
		280			
9.0			8	SS	78/250 mm
9.40	BOREHOLE TERMINATED AT 9.40 m	279			
10.5					
12.0					
13.5					
15.0					
16.5					

PROPOSED INVERT EL. 281.65

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3M: 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT %: 10 20 30

GROUND WATER OBSERVATIONS AND REMARKS

Bentonite Seal
Native Backfill
SS 2 wet
Cave

Upon completion of augering cave at 0.9 m, free water at 0.5 m

WATER LEVEL READING
Jan. 30/90 DRY

NOTES:

CHECKED BY: JJ

PML/504A

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 12

PROJECT: Barrie-400 Industrial Subdivision — OUR PROJECT NO. 89 F 751
LOCATION: Harvie Road and Veterans Drive, Barrie, Ont. — BORING DATE: Jan. 8/90 — ENGINEER: TS
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: TS

DEPTH in METRES	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES
	GROUND ELEVATION 297.68				
0.50	TOPSOIL: Dark brown silty fine sand, organic, moist, becoming rusty brown, loose	297	1	SS	7
1.00			2	SS	5
1.5	CLAY: Firm to very stiff grey silty clay, trace sand and gravel, D.T.P.L. (till like)	296	3	SS	28
2.10	SAND TILL: Very dense grey silty fine sand, trace gravel, moist	295	4	SS	55
3.0 3.10			5	SS	28
	SAND: Compact to very dense light brown fine sand, some silt, moist	294			
4.5		293	6	SS	80
	becoming grey, very moist with occasional saturated silt seams, dilatant	292			
6.0			7	SS	75/275 mm
6.90		291			
7.5	LAYERED SAND AND SILT: Very dense grey silty fine sand and fine sandy silt, dilatant, saturated	290	8	SS	69
8.08	BOREHOLE TERMINATED AT 8.08 m	289			
9.0					
10.5					
12.0					
13.5					
15.0					
16.5					

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION x
STANDARD PENETRATION TEST ●
BLOWS/0.3M: 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT %: 10 20 30

PROPOSED INVERT EL. 292.50

GROUND WATER OBSERVATIONS AND REMARKS:
Upon completion of augering hole open to 7.5 m, no free water

NOTES:

CHECKED BY: TS

PML/504A

PetoMacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 13

PROJECT: Barrie-400 Industrial Subdivision — OUR PROJECT NO. 89 F 751
LOCATION: Harvie Road and Veterans Drive, Barrie, Ont. — BORING DATE: Jan. 10/90 — ENGINEER: TS
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: TS

DEPTH in METRES	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES
	GROUND ELEVATION 301.54				
0.50	TOPSOIL: Dark brown silty fine sand, organic, moist, becoming rusty brown, loose	301	1	SS	5
1.5	SAND: Loose to compact light brown fine/fine to medium sand, some silt, moist	300	2	SS	4
			3	SS	22
3.0	becoming dense to very dense occasional silt laminae	299	4	SS	39
		298	5	SS	51
4.5	becoming grey, saturated dilatant	297			
		296			
6.0		295	6	SS	37
7.5		294	7	SS	52
8.40	BOREHOLE TERMINATED AT 8.40 m	293			
9.0					
10.5					
12.0					
13.5					
15.0					
16.5					

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT % 10 20 30

PROPOSED INVERT EL. 295.50

GROUND WATER OBSERVATIONS AND REMARKS

Native Backfill
Bentonite Seal
SS 6 wet
Cave

Upon completion of augering wet cave at 5.5 m

WATER LEVEL READING
Jan.30/90 5.70 m

NOTES:

CHECKED BY: TS.

PML/504A