GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Preliminary Geotechnical Investigation

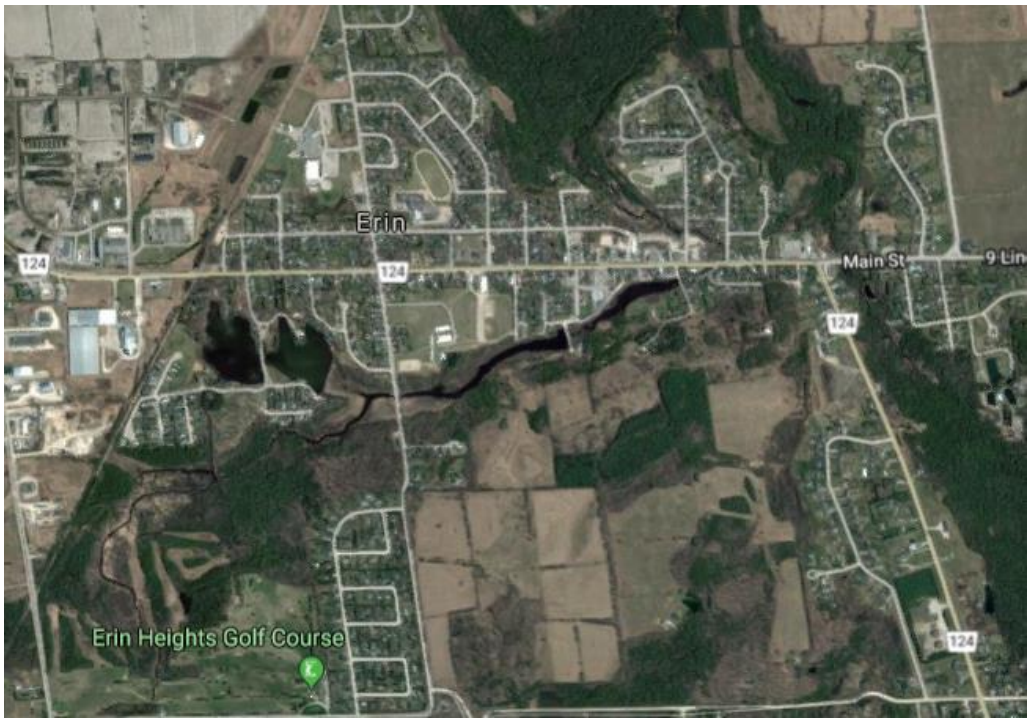
Urban Centre Wastewater Servicing

Class Environmental Assessment Study

Town of Erin, Ontario

Prepared For:

Ainley Group



GeoPro Project No.: 16-1255

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GeoPro CONSULTING LIMITED

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1 INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by Ainley Group (the Client) to conduct a preliminary geotechnical investigation for the Urban Centre Wastewater Servicing Class Environmental Assessment (EA) Study - proposed wastewater treatment plant (WWTP), pumping stations and sanitary sewage collection system in Hillsburgh and Erin Village, Ontario.

The purpose of this geotechnical investigation was to obtain information on the existing subsurface conditions by means of a limited number of boreholes, in-situ tests and laboratory tests of soil samples to provide required geotechnical design information. Based on GeoPro's interpretation of the obtained data, geotechnical comments and recommendations related to the project designs are provided.

This report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Furthermore, the recommendations and opinions in this report are applicable only to the proposed project as described above. On-going liaison and communication with GeoPro during the design stage and construction phase of the project is strongly recommended to confirm that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project shall be directed to GeoPro for further elaboration and/or clarification.

This report is provided on the basis of the terms of reference presented in our approved proposal prepared based on our understanding of the project. 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, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this report can be relied upon.

This report deals with geotechnical issues only. The geo-environmental (chemical) aspects of the subsurface conditions, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources were not investigated and were beyond the scope of this assignment. However, limited chemical testing was carried out on selected soil samples for excess soil disposal purposes.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. Laboratory testing, for most part, follows ASTM or CSA Standards or modifications of these standards that have become standard practice in Ontario.

This report has been prepared for the Client only. Third party use of this report without GeoPro's consent is prohibited. The limitations to the report presented above form an integral part of the report and they must be considered in conjunction with this report.

2 SITE AND PROJECT DESCRIPTION

This preliminary geotechnical investigation is to support the preliminary designs for the urban centre wastewater servicing Class EA study in Hillsburgh and Erin Village, Ontario. It is understood that the proposed study consists of wastewater treatment plants (WWTPs), pumping stations and sanitary sewage collection systems.

3 INVESTIGATION PROCEDURE

Field work for the geotechnical investigation was carried out from October to December, 2017 during which time sixty (60) boreholes (Boreholes BH1 to BH37, BH37A, BH38, BH101 to BH104, BH107, T1 to T9, SPS01BE, SPS02E to SPS04E, SPS06E, SPS08E and SPS01H) were advanced to depths ranging from about 3.1 m to 8.1 m below the existing ground surface. The borehole locations are shown on Drawings 1 to 15.

A proposed borehole location plan prepared by GeoPro was provided to the Client for review prior to the filed investigation work. The approved borehole locations were staked in the field by GeoPro according to the drill rig accessibility and the underground utility conditions. The field work for this investigation was monitored by a member of our engineering staff who logged the boreholes and cared for the recovered samples.

The boreholes were advanced using truck and track mounted continuous flight auger equipment and continues split spoon supplied by drilling specialists subcontracted to GeoPro. Soil samples were recovered at regular intervals of depth using a 50 mm O.D. split-spoon sampler driven into the soil in accordance with the Standard Penetration Test (SPT) procedure described in ASTM D1586 - 11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. In some boreholes, the types and approximate depths of the subgrade soil were obtained using an auger sampling technique.

Groundwater condition observations were made in the boreholes during drilling and upon completion of drilling. The boreholes were backfilled and sealed upon completion of drilling. A monitoring well (51 mm in diameter) was installed in each of Boreholes BH10, BH11, BH15, BH17, BH20, BH23, BH24, BH33 to BH35, BH37, BH37A, BH38, BH101, BH103, BH104, BH107, T2, T3, T5, T9, SPS01BE, SPS02E to SPS04E, SPS06E, SPS08E and SPS01H to measure the long-term groundwater tables.

All soil samples obtained during this investigation were brought to our laboratory for further examination. These soil samples will be stored for a period of three (3) months after the day of issuing draft report, after which time they will be discarded unless we are advised otherwise in writing. Geotechnical classification testing (including water content, grain size distribution and Atterberg Limits, when applicable) was carried out on selected soil samples. The laboratory test results are attached in Figures 1 to 5.

It should be noted the elevations at the as-drilled borehole locations were not available at the time of preparing the report. The borehole locations plotted on the Borehole Location Plan, Drawings 1 to 15 were based on the measurement of the site features and should be considered to be approximate.

4 SUBSURFACE CONDITIONS

4.1 Subsurface Conditions

The borehole locations are shown on Drawings 1 to 15. Notes on sample descriptions are presented in Enclosure 1A. Explanations of terms used in the borehole logs are presented in Enclosure 1B. The subsurface conditions in the boreholes (Boreholes BH1 to BH37, BH37A, BH38, BH101 to BH104, BH107, T1 to T9, SPS01BE, SPS02E to SPS04E, SPS06E, SPS08E and SPS01H) are presented in the individual borehole logs (Enclosures 2 to 61 inclusive). Detailed descriptions of the major soil strata encountered in the boreholes drilled at the site are provided as follows.

4.1.1 Town of Erin (BH1 to BH30)

Pavement Structure

A flexible pavement structure was observed on various roadways in town of Erin. The range and average thicknesses of pavement structure are summarized in the following table:

Location	Pavement Structure (mm)	
	Asphalt Concrete Range (Average)	Granular Base/Subbase Range (Average)
Sideroad 17 (BH1 and BH2)	230 - 300 (265)	230 - 610 (420)
Main Street (BH3, BH8, BH23, BH24 and BH28)	25 - 290 (180)	365 - 465 (415)
May Street (BH4)	55	345
Daniel Street (BH5 and BH16)	60 - 70 (65)	360 - 440 (400)
Dundas Street East (BH7)	110	610
Dundas Street West (BH10 and BH11)	95 - 125 (110)	645 - 695 (670)
Scotch Street (BH9)	90	690
Carberry Street (BH6)	80	680
Erin Heights Drive (BH12 and BH14)	100	360
William Rex Crescent (BH13)	75	315

Church Boulevard (BH15)	95	665
Millwood Road (BH17 and BH19)	85 - 125 (210)	325 - 545 (435)
Waterford Drive (BH18)	120	400
Water Street (BH20)	95	625
Charles Street (BH21)	95	465
William Street (BH22)	45	205
Mountainview Crescent (BH29)	100	400
Leenders Lane (BH30)	115	665

Due to the generally sandy nature of the sand subgrade soils, the exact depth of granular subbase was difficult to distinguish.

Fill Materials

Fill materials consisting of sand, silty sand, sandy silt, sand and silt and gravelly sand to sand and gravel were encountered below the granular base/subbase materials in Boreholes BH1, BH3 to BH5, BH7, BH8, BH12 to BH14, and BH16 to BH29, and extended to depths ranging from about 0.8 m to 3.1 m below the existing ground surface. Borehole BH21 was terminated in these fill materials. SPT N values ranging from 2 to greater than 100 blows per 300 mm penetration indicated a very loose to very dense compactness. The in-situ moisture content measured in the soil samples ranged from approximately 2% to 27%.

Gravelly Sand to Sand and Gravel, and Sandy Gravel

Gravelly sand to sand and gravel, and sandy gravel deposits were encountered below the granular base/subbase materials, fill materials, sand and silt, sandy silt, sand, peat and organic silt deposits in Boreholes BH1 to BH12, BH15 to BH20 and BH22 to BH30, and extended to depths ranging from about 2.1 m to 5.0 m below the existing ground surface. Boreholes BH1 to BH9, BH11, BH12, BH15 to BH19 and BH22 to BH30 were terminated in these deposits. SPT values ranging from 5 to greater than 100 blows per 300mm penetration indicated a loose to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 2% to 19%.

Sand, Sand and Silt, Sandy Silt and Silty Sand

Sand, sand and silt, sandy silt and silty sand deposits were encountered below the granular base/subbase materials, fill materials, gravelly sand, sandy gravel and sand and gravel deposits in Boreholes BH1 to BH3, BH5 to BH7, BH10, BH11, BH23, BH26, BH27 and BH30, and extended to depths ranging from about 2.1 m to 5.0 m below the existing ground surface. Borehole BH10 was terminated in sand deposit. SPT N values ranging from 3 to 40 blows per 300 mm penetration

indicated a very loose to dense compactness. The natural moisture content measured in the soil samples ranged from approximately 4% to 24%.

Organic Silt

Organic silt deposit was encountered below the fill materials in Borehole BH17, and extended to a depth of about 4.0 m below the existing ground surface. An SPT N value of 10 blows per 300 mm penetration indicated a loose to compact compactness. The natural moisture content measured in the soil sample was approximately 29%.

Peat

Peat deposit was encountered below the silty sand deposit in Borehole BH11, and extended to a depth of about 4.0 m below the existing ground surface. SPT N values ranging from 2 to 4 blows per 300 mm penetration indicated a very loose to loose compactness. The natural moisture content measured in the soil samples ranged from approximately 21% to 24%.

Sand and Silt Till and Sandy Silt Till

Sand and silt till and sandy silt till deposits were encountered below the fill materials and gravelly sand to sand and gravel deposits in Boreholes BH13, BH14 and BH20, and extended to depths ranging from about 4.8 m to 5.0 m below the existing ground surface. Boreholes BH13, BH14 and BH20 were terminated in these deposits. SPT N values ranging from 47 to greater than 100 blows per 300 mm penetration indicated a dense to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 6% to 9%.

Probable Bedrock

As best could be practically determined, dolostone presumed to coincide with the bedrock surface was encountered in Borehole BH21 below the fill materials at a depth of about 3.0 m below the existing ground surface. Exploration of the bedrock was not carried out as part of this preliminary assignment, however based on samples recovered from the penetration testing, the bedrock beneath the site appeared to consist of brown dolostone.

4.1.2 Town of Hillsburgh (Boreholes BH31 to BH37, BH37A and BH38)

Pavement Structure

A flexible pavement structure was observed on various roadways in town of Hillsburgh. The range and average thickness of pavement structure are summarized in the following table:

Location	Pavement Structure (mm)	
	Asphalt Concrete Range (Average)	Granular Base/Subbase Range (Average)
Hill Street (BH31)	85	565
Church Street (BH32)	45	525
George Street (BH33)	145	545
Covert Lane (BH34)	45	565
Spruce Street (BH35)	135	565
Douglas Crescent (BH36)	80	520
Trafalgar Road North (BH37 and BH37A and BH38)	115 - 130 (120)	380 - 475 (430)

Due to the generally sandy nature of the sand subgrade soils, the exact depth of granular subbase was difficult to distinguish.

Fill Materials

Fill materials consisting of silt, sand, gravelly sand, (organic) sandy silt, and sand and silt to silty (fine) sand were encountered below the granular base/subbase materials in Boreholes BH31 to BH35, BH37, BH37A and BH38, and extended to depths ranging from about 1.4 m to 2.9 m below the existing ground surface. SPT N values ranging from 3 to 34 blows per 300 mm penetration indicated a very loose to dense compactness. The in-situ moisture content measured in the soil samples ranged from approximately 4% to 25%.

Probable Fill Materials

Probable fill materials consisting of gravelly sand and sand and gravel were encountered below the fill materials in Boreholes BH37 and BH38, and extended to a depth of about 4.0 m below the existing ground surface. SPT N values ranging from 13 to 26 blows per 300 mm penetration indicated a compact compactness. The in-situ moisture content measured in the soil samples ranged from approximately 9% to 17%.

Sand, Sand and Silt and Silty Sand

Sand, sand and silt and silty sand deposits were encountered below the granular base/subbase materials, (probable) fill materials in Boreholes BH31 to BH33, BH36 and BH37, and extended to depths ranging from about 4.0 m to 8.1 m below the existing ground surface. Boreholes BH31, BH33 and BH37 were terminated in these deposits. SPT N values ranging from 4 to 93 blows per 300 mm penetration indicated a loose to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 1% to 24%.

Gravelly Sand to Sand and Gravel

Gravelly sand to sand and gravel deposits were encountered below the fill materials, probable fill materials, sand, silty sand and organic sandy silt deposits in Boreholes BH32, BH34 to BH36, BH37A and BH38, and extended to a depth of about 5.0 m below the existing ground surface. Boreholes BH32, BH34 to BH36, BH37A and BH38 were terminated in these deposits. SPT values ranging from 17 to 81 blows per 300mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 4% to 15%.

Organic Sandy Silt

Organic sandy silt deposit was encountered below the fill materials in Borehole BH37A, and extended to a depth of about 1.7 m below the existing ground surface. An SPT N value of 17 blows per 300 mm penetration indicated a compact compactness. The natural moisture content measured in the soil sample was approximately 28%.

4.1.3 Existing Trail (T1 to T9)

Gravel Surface

Gravel surface with the thicknesses ringing from 20 mm to 170 mm was encountered surficially in Boreholes T1 to T9.

Fill Materials

Fill materials consisting of silty sand, sandy silt, sand and silt, and gravelly sand were encountered below the gravel surface in Boreholes T1 to T9, and extended to depths ranging from about 0.7 m to 3.4 m below the existing ground surface. SPT N values ranging from 2 to 46 blows per 300 mm penetration indicated a very loose to dense compactness. The in-situ moisture content measured in the soil samples ranged from approximately 4% to 23%.

Organic Silt

Organic silt deposit was encountered below the fill materials in Boreholes T6 and T9, and extended to depths ranging from about 2.9 m to 4.0 m below the existing ground surface. SPT N values ranging from 6 to 7 blows per 300 mm penetration indicated a loose compactness. The natural moisture content measured in the soil samples ranged from approximately 28% to 29%.

Peat

Peat deposit was encountered below the fill materials in Borehole T7, and extended to a depth of about 2.4 m below the existing ground surface. SPT N values ranging from 3 to 13 blows per 300 mm penetration indicated a very loose to compact compactness. The natural moisture content measured in the soil samples ranged from approximately 26% to 27%.

Gravelly Sand to Sand and Gravel

Gravelly sand to sand and gravel deposits were encountered below the fill materials, sand, and silt deposits in Boreholes T1, T2 and T4 to T7, and extended to a depth of about 5.0 m below the existing ground surface. Boreholes T1, T2 and T4 to T7 were terminated in these deposits. SPT N values ranging from 24 to 59 blows per 300mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 2% to 15%.

Sand, Silt, Silty (Fine) Sand to (Fine) Sandy Silt and Fine Sand and Silt

Sand, silt, silty (fine) sand to (fine) sandy silt, and fine sand and silt deposits were encountered below the fill materials, peat and organic silt deposits in Boreholes T3 and T5 to T9, and extended to depths ranging from about 4.0 m to 5.6 m below the existing ground surface. Boreholes T3 and T9 were terminated in these deposits. SPT N values ranging from 2 to 27 blows per 300 mm penetration indicated a very loose to compact compactness. The natural moisture content measured in the soil samples ranged from approximately 16% to 29%.

Sandy Silt Till

Sandy silt till deposit was encountered below the silty sand deposit in Borehole T8, and extended to a depth of about 6.6 m below the existing ground surface. Borehole T8 was terminated in this deposit. An SPT N value of 26 blows per 300mm penetration indicated a compact compactness. The natural moisture content measured in the soil sample was approximately 11%.

4.1.4 Potential WWTP (BH101 to BH103)

Topsoil

Topsoil with thicknesses ranging from about 250 mm to 330 mm was encountered surficially in Boreholes BH101 to BH103.

Fill Materials

Fill materials consisting of sandy silt to sand and silt were encountered below the topsoil in Boreholes BH101 to BH103, and extended to depths ranging from about 0.8 m to 2.3 m below the existing ground surface. SPT N values ranging from 2 to 9 blows per 300 mm penetration indicated a very loose to loose compactness. The in-situ moisture content measured in the soil samples ranged from approximately 8% to 23%.

Probable Fill Materials

Probable fill materials consisting of gravelly sand were encountered below the fill materials in Borehole BH101, and extended to a depth of about 2.3 m below the existing ground surface. An

SPT N value of 4 blows per 300 mm penetration indicated a loose compactness. The in-situ moisture content measured in the soil sample was approximately 7%.

Sandy Gravel and Gravelly Sand to Sand and Gravel

Sandy gravel and gravelly sand to sand and gravel deposits were encountered below the fill materials and probable fill materials in Boreholes BH101 to BH103, and extended to depths ranging from about 4.7 m to 5.3 m below the existing ground surface. Boreholes BH101 to BH103 were terminated in these deposits. SPT values ranging from 11 to greater than 100 blows per 300mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 2% to 20%.

4.1.5 Proposed Outfall Area (BH104 and BH107)

Existing Pavement Structure

A flexible pavement structure was observed in Boreholes BH104 and BH107. The thicknesses of asphalt concrete ranged from about 60 mm to 110 mm with an average of 85 mm; and the thicknesses of underlying granular base/subbase materials ranged from about 490 mm to 520 mm with an average of 505 mm.

Fill Materials

Fill materials consisting of silty sand to sand and silt, gravelly sand, and sandy silt were encountered below the granular base/subbase materials in Boreholes BH104 and BH107, and extended to depths ranging from about 2.1 m to 2.9 m below the existing ground surface. SPT N values ranging from 5 to 16 blows per 300 mm penetration indicated a loose to compact compactness. The in-situ moisture content measured in the soil samples ranged from approximately 3% to 22%.

Organic Silt

Organic silt deposit was encountered below fill materials in Borehole BH104, and extended to a depth of about 4.0 m below the existing ground surface. An SPT N value of 7 blows per 300 mm penetration indicated a loose compactness. The natural moisture content measured in the soil sample was approximately 28%.

Sand and Silty Sand

Sand and silty sand deposits were encountered below fill materials and organic silt deposit in Boreholes BH104 and BH107, and extended to depths ranging from about 4.0 m to 5.0 m below the existing ground surface. Borehole BH104 was terminated in the sand deposit. SPT N values ranging from 26 to 31 blows per 300 mm penetration indicated a compact to dense compactness. The natural moisture content measured in these soil samples ranged from approximately 8% to 21%.

Sand and Gravel, and Gravelly Sand

Sand and gravel, and gravelly sand deposits were encountered below silty sand deposit in Borehole BH107, and extended to a depth of about 6.6 m below the existing ground surface. Borehole BH107 was terminated in the gravelly sand deposit. SPT N values ranging from 29 to 33 blows per 300 mm penetration indicated a compact to dense compactness. The natural moisture content measured in these soil samples ranged from approximately 8% to 14%.

4.1.6 Pumping Stations (SPS01BE, SPS02E to SPS04E, SPS06E and SPS08E)

4.1.6.1 Pumping Station SPS 01BE

Topsoil

Topsoil with a thickness of about 240 mm was encountered surficially in Borehole SPS01BE.

Fill Materials

Fill materials consisting of sandy silt was encountered below the topsoil in Borehole SPS01BE, and extended to a depth of about 1.4 m below the existing ground surface. SPT N value ranging from 7 to 34 blows per 300 mm penetration indicated a loose to dense compactness. The in-situ moisture content measured in the soil samples ranged from approximately 7% to 11%.

Gravelly Sand to Sand and Gravel

Gravelly sand to sand and gravel deposits were encountered below the fill materials in Borehole SPS01BE, and extend to a depth of about 4.0 m below the existing ground surface. SPT N values ranging from 24 to 64 blows per 300 mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 9% to 11%.

Sandy Silt Till

Sandy silt till deposit was encountered below the gravelly sand to sand and gravel deposit in Borehole SPS01BE, and extend to a depth of about 7.8 m below the existing ground surface. Borehole SPS01BE was terminated in this deposit. SPT N values ranging from 38 to greater than 100 blows per 300 mm penetration indicated a dense to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 10% to 11%.

4.1.6.2 Pumping Station SPS 02E

Topsoil

Topsoil with a thickness of about 75 mm was encountered surficially in Borehole SPS02E.

Fill Materials

Fill materials consisting of sandy silt was encountered below the topsoil in Borehole SPS02E, and extended to a depth of about 2.1 m below the existing ground surface. SPT N values ranging from 2 to 6 blows per 300 mm penetration indicated a very loose to loose compactness. The in-situ moisture content measured in the soil samples ranged from approximately 8% to 15%.

Upper Gravelly Sand to Sand and Gravel

Upper gravelly sand to sand and gravel deposits were encountered below the fill materials in Borehole SPS02E, and extend to a depth of about 4.0 m below the existing ground surface. SPT N values ranging from 14 to 29 blows per 300 mm penetration indicated a compact compactness. The natural moisture content measured in the soil samples ranged from approximately 4% to 5%.

Sand

Sand deposit was encountered below the upper gravelly sand to sand and gravel deposits in Borehole SPS02E, and extend to a depth of about 6.4 m below the existing ground surface. SPT N values ranging from 14 to greater than 100 blows per 300 mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 13% to 15%.

Lower Gravelly Sand to Sand and Gravel

Lower gravelly sand to sand and gravel deposits were encountered below the sand deposit in Borehole SPS02E, and extend to a depth of about 7.7 m below the existing ground surface. Borehole SPS02E was terminated in these deposits. SPT N values of greater than 100 blows per 300 mm penetration indicated a very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 9% to 11%.

4.1.6.3 Pumping Station SPS 03E

Existing Pavement Structure

A flexible pavement structure was observed in Borehole SPS03E. The thickness of asphalt concrete encountered in the borehole was about 70 mm; and the thickness of underlying granular base/subbase was about 430 mm.

Fill Materials

Fill materials consisting of silty sand was encountered below the granular base/subbase in Borehole SPS03E, and extended to a depth of about 1.4 m below the existing ground surface. An SPT N value of 17 blows per 300 mm penetration indicated a compact compactness. The in-situ moisture content measured in the soil samples was approximately 5%.

Gravelly Sand to Sand and Gravel

Gravelly sand to sand and gravel deposits were encountered below the fill materials in Borehole SPS03E, and extend to a depth of about 4.9 m below the existing ground surface. SPT N values ranging from 11 to 62 blows per 300 mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 3% to 10%.

Sand and Silt Till

Sand and silt till deposit was encountered below the gravelly sand to sand and gravel deposits in Borehole SPS03E, and extend to a depth of about 7.9 m below the existing ground surface. Borehole SPS03E was terminated in this deposit. SPT N values ranging from 11 to greater than 100 blows per 300 mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 6% to 9%.

4.1.6.4 Pumping Station SPS 04E

Topsoil

Topsoil with a thickness of about 90 mm was encountered surficially in Borehole SPS04E.

Fill Materials

Fill materials consisting of sandy silt were encountered below the topsoil in Borehole SPS04E, and extended to a depth of 0.9 m below the existing ground surface. An SPT N value of 6 blows per 300 mm penetration indicated a loose compactness. The in-situ moisture content measured in the soil samples ranged from approximately 20% to 24%.

Organic Sandy Silt

Organic sandy silt deposit was encountered below the fill materials in Borehole SPS04E, and extended to a depth of about 1.1 m below the existing ground surface. An SPT N value of 6 blows per 300 mm penetration indicated a loose compactness. The natural moisture content measured in the soil sample was approximately 27%.

Sandy Silt, (Fine) Sand, and Silt

Sandy silt, (fine) sand, and silt deposits were encountered below the organic sandy silt and gravelly sand deposits in Borehole SPS04E, and extended to a depth of about 7.2 m below the existing ground surface. SPT N values ranging from 4 to 53 blows per 300 mm penetration indicated a loose to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 17% to 25%.

Upper Gravelly Sand

Upper gravelly sand deposit was encountered below the sandy silt deposit in Borehole SPS04E, and extended to a depth of about 2.1 m below the existing ground surface. An SPT N value of 11 blows per 300 mm penetration indicated a compact compactness. The natural moisture content measured in the soil sample was approximately 9%.

Lower Gravelly Sand to Sand and Gravel

Lower gravelly sand to sand and gravel deposits were encountered below the silt deposit in Borehole SPS04E, and extended to a depth of about 8.1 m below the existing ground surface. Borehole SPS04E was terminated in these deposits. An SPT N value of 71 blows per 300 mm penetration indicated a very dense compactness. The natural moisture content measured in the soil sample was approximately 8%.

4.1.6.5 Pumping Station SPS 06E

Topsoil

Topsoil with a thickness of about 150 mm was encountered surficially in Borehole SPS06E.

Fill Materials

Fill materials consisting of sandy silt was encountered below the topsoil in Borehole SPS06E, and extended to a depth of about 0.7 m below the existing ground surface. An SPT N value of 14 blows per 300 mm penetration indicated a compact compactness. The in-situ moisture content measured in the soil sample was approximately 13%.

Probable Fill Materials

Probable fill materials consisting of gravelly sand was encountered below the fill material in Borehole SPS06E, and extended to a depth of about 2.5 m below the existing ground surface. SPT N values ranging from 20 to 31 blows per 300 mm penetration indicated a compact to dense compactness. The in-situ moisture content measured in the soil samples ranged from approximately 8% to 18%.

Sand

Sand deposit was encountered below the probable fill materials in Borehole SPS06E, and extend to a depth of about 5.6 m below the existing ground surface. SPT N values ranging from 2 to 13 blows per 300 mm penetration indicated a very loose to compact compactness. The natural moisture content measured in the soil samples ranged from approximately 17% to 19%.

Gravelly Sand to Sand and Gravel

Gravelly sand to sand and gravel deposits were encountered below the sand deposit in Borehole SPS06E, and extend to a depth of about 7.7 m below the existing ground surface. Borehole SPS06E was terminated in these deposits. SPT N values of greater than 100 blows per 300 mm penetration indicated a very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 7% to 8%.

4.1.6.6 Pumping Station SPS 08E

Existing Pavement Structure

A flexible pavement structure was observed in Borehole SPS08E. The thickness of asphalt concrete encountered in the borehole was about 110 mm; and the thickness of underlying granular base/subbase was about 510 mm.

Fill Materials

Fill materials consisting of silty sand to sand and silt were encountered below the granular base/subbase in Borehole SPS08E, and extended to a depth of about 4.0 m below the existing ground surface. SPT N values ranging from 5 to 10 blows per 300 mm penetration indicated a loose to compact compactness. The in-situ moisture content measured in the soil samples ranged from approximately 9% to 19%.

Gravelly Sand to Sand and Gravel

Gravelly sand to sand and gravel deposits were encountered below the fill materials in Borehole SPS08E, and extend to a depth of about 8.1 m below the existing ground surface. Borehole SPS08E was terminated in these deposits. SPT N values ranging from 25 to 48 blows per 300 mm penetration indicated a compact to dense compactness. The natural moisture content measured in the soil samples ranged from approximately 9% to 16%.

4.1.6.7 Pumping Station SPS 01H

Topsoil

Topsoil with a thickness of about 125 mm was encountered surficially in Borehole SPS01H.

Organic Sandy Silt

Organic sandy silt deposit was encountered below the topsoil in Borehole SPS01H, and extended to a depth of about 0.7 m below the existing ground surface. An SPT N value of 3 blows per 300 mm penetration indicated a very loose compactness. The natural moisture content measured in the soil sample was approximately 25%.

Gravelly Sand to Sandy Gravel

Gravelly sand to sandy gravel deposits were encountered below the organic sandy silt deposit in Borehole SPS01H, and extend to a depth of about 8.1 m below the existing ground surface. Borehole SPS01H was terminated in these deposits. SPT N values ranging from 6 to greater than 100 blows per 300 mm penetration indicated a loose to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 5% to 13%.

4.2 Groundwater Conditions

Groundwater condition observations made in the boreholes during and immediately upon completion of drilling are shown in the borehole logs and are also summarized in the following table. Boreholes BH2, BH4, BH7, BH13, BH14 and BH31 were open and dry upon completion of drilling.

BH No.	BH Depth (m)	Depth of Water Encountered during Drilling (mBGS)	Cave-in Depth upon Completion of Drilling (mBGS)	Water Level upon Completion of Drilling (mBGS)
BH1	5.0	-	4.3	-
BH3	5.0	4.6	4.1	-
BH5	5.0	-	2.7	-
BH6	5.0	3.0	2.1	2.1
BH8	5.0	-	2.1	-
BH9	5.0	-	3.2	-
BH10	5.0	0.8	3.4	3.4
BH11	5.0	0.8	3.0	1.8
BH12	5.0	-	3.7	-
BH15	5.0	3.0	4.4	4.4
BH16	5.0	-	2.9	-
BH17	5.0	2.3	-	-
BH18	4.7	-	3.8	-
BH19	5.0	-	4.0	-
BH20	5.0	1.5	3.7	3.7
BH21	3.1	1.5	1.5	1.5
BH22	4.6	1.5	2.1	1.5
BH23	5.0	2.3	-	-
BH24	5.0	1.5	4.3	4.3
BH25	5.0	4.6	4.0	-
BH26	5.0	-	4.4	-
BH27	5.0	-	2.7	-
BH28	5.0	3.0	2.0	-
BH29	5.0	3.0	3.7	2.9
BH30	5.0	2.3	2.3	2.3

BH32	5.0	-	2.4	-
BH33	8.1	1.5	-	-
BH34	5.0	1.5	4.4	-
BH35	5.0	4.6	3.0	2.7
BH36	5.0	-	2.4	-
BH37	5.0	3.0	-	-
BH37A	5.0	2.3	-	-
BH38	5.0	1.5	-	-
BH101	4.8	-	3.7	-
BH102	5.3	-	2.8	-
BH103	4.7	-	4.3	-
BH104	5.0	3.0	-	-
BH107	6.6	4.6	-	-
SPS01BE	7.8	1.5	6.7	-
SPS01H	8.1	3.0	2.7	2.7
SPS02E	7.7	4.6	3.4	3.4
SPS03E	7.9	2.7	-	-
SPS04E	8.1	1.5	4.9	4.9
SPS06E	7.7	0.8	-	-
SPS08E	8.1	3.5	-	-
T1	5.0	4.6	3.5	3.5
T2	5.0	2.3	-	-
T3	5.0	2.3	-	-
T4	5.0	2.3	1.4	-
T5	5.0	2.3	-	-
T6	5.0	2.3	3.4	2.7
T7	5.0	0.8	1.2	1.2
T8	6.6	2.3	5.2	4.6
T9	5.0	3.1	4.1	4.1

Note: mBGS = meters below ground surface

Twenty-eight (28) monitoring wells (51 mm in dia.) were installed to monitor groundwater levels. The monitoring well construction details and measured groundwater levels are shown in the following table.

Monitoring Well ID	**Screen Interval (mBGS)**	**Water Level (mBGS) Date of Monitoring**				
		December 5, 2017	**December 11, 2017**	**December 15, 2017**	**December 17, 2017**	**December 21, 2017**
BH10	2.3 – 3.8	1.22	-	-	-	-
BH11	1.5 – 3.0	1.08	-	-	-	-
BH15	3.1 – 4.6	-	-	dry	-	-
BH17	3.1 – 4.6	-	2.69	-	-	-
BH20	3.1 – 4.6	-	-	-	1.19	-

Monitoring Well ID	Screen Interval (mBGS)	Water Level (mBGS) Date of Monitoring				
		December 5, 2017	December 11, 2017	December 15, 2017	December 17, 2017	December 21, 2017
BH23	3.1 – 4.6	-	-	-	1.15	-
BH24	3.1 – 4.6	-	-	-	1.14	-
BH33	6.1 -7.6	-	-	-	1.93	-
BH34	3.1 -4.6	4.52	-	-	-	-
BH35	3.2 – 4.7	4.38	-	-	-	-
BH37	3.1 – 4.6	-	-	-	2.27	-
BH37A	3.1 – 4.6	-	-	-	3.11	-
BH38	3.1 – 4.6	-	-	-	2.75	-
BH101	2.1 – 3.6	dry	-	-	-	-
BH103	2.7 – 4.2	dry	-	-	-	-
BH104	3.5 – 5.0	-	-	-	-	2.73
BH107	4.6 – 6.1	-	-	-	-	5.07
SPS01BE	3.1 – 4.6	1.02	-	-	-	-
SPS01H	6.1 – 7.6	3.19	-	-	-	-
SPS02E	4.9 – 6.4	3.69	-	-	-	-
SPS03E	3.7 – 5.2	-	2.25	-	-	-
SPS04E	4.1 – 5.6	1.85	-	-	-	-
SPS06E	4.0 – 5.5	-	-	-	-	0.35
SPS08E	6.1 – 7.6	-	-	-	-	2.11
T2	3.1 – 4.6	1.18	-	-	-	-
T3	3.1 – 4.6	-	-	-	-	2.15
T5	3.1 – 4.6	-	-	-	-	2.64
T9	3.1 – 4.6	3.79	-	-	-	-

Note: mBGS = meters below ground surface

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

4.3 Laboratory Testing Results

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the Project Engineer. Moisture content determinations were carried out on all granular base/subbase and subgrade soil samples.

Grain size analyses of eleven (11) subgrade samples confirmed the visual descriptions of the subgrade soils. The summarized results are provided in the following table, and the grain size distribution curves of these samples are presented in Figures 1 to 5.

Soil Sample ID	Soil Depth (m)	Description
BH1 SS3	1.5 – 2.0	Sand and Silt
BH23 SS3	1.5 – 2.0	Sand to Silty Sand Fill
BH25 SS2	0.8 – 1.2	Gravelly Sand
BH28 SS5	3.1– 3.5	Gravelly Sand to Sandy Gravel
BH31 SS5	3.1 – 3.5	Silt Sand
BH36 SS2	0.8 – 1.2	Sand and Silt
BH101 SS4	2.3 – 3.1	Gravelly Sand to Sandy Gravel
BH104 SS3	1.5 – 2.0	Gravelly Sand Fill
SPS03E SS3	1.5 – 2.0	Sand and Gravel
T3 SS4	2.3 – 2.8	Silty Fine Sand to Fine Sand and Silt
T5 SS4	2.3 – 2.8	Silt

5 PRELIMINARY DISCUSSION AND RECOMMENDATIONS

This report contains the preliminary geotechnical engineering recommendations and comments. These preliminary recommendations and comments are based on factual information and are intended only for use by the design engineers. The number of boreholes may not be sufficient for detailed designs and to determine all the factors that may affect construction methods and costs. Subsurface conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express GeoPro's opinion only and are not intended to direct the contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this preliminary geotechnical report should not be sufficient to assess all the factors that may have an effect on the construction.

The preliminary design drawings of the project were not available when this report was prepared. Once the preliminary design drawings and site plan are available, this preliminary geotechnical report should be reviewed by GeoPro, and further recommendations may be provided as needed.

5.1 Conventional (Open Cut) Installation of the Proposed Sanitary Sewage

The invert depths of the proposed sanitary sewage are not available at the time of preparing the report. We have assumed that the majority of the sanitary sewage installations would require excavations between about 3 m and 4 m below the existing ground surface. According to the results of this investigation, the soils at the proposed founding depths are generally anticipated

to be in the probable fill materials, peat, organic silt, silt, silty sand, gravelly sand to sandy gravel, sand and gravel, sand, sand and silt till, sandy silt till deposits and potentially probable bedrock. The native soils are considered to be suitable for supporting the pipes, provided the integrity of the base of the trench can be maintained during construction. The suitability of the existing fill materials to support the pipes, if encountered at the base of the trenches, should be further assessed during construction. This assessment will require inspection during construction by qualified geotechnical personnel from GeoPro to determine the suitability of the fill materials for supporting the pipes. Should any peat and organic silt deposits be encountered at the base of the trench, these peat and organic deposits should be completely removed and replaced with granular engineered fill.

It should be noted that some difficulties should be encountered in excavating the gravelly soils and glacial till at some locations. In addition, gravelly soils and glacial till are inferred to contain cobbles and boulders. Once the actual service invert depths are finalized, the following comments and recommendations should be reviewed and revised as necessary.

5.1.1 Trenching Excavation and Temporary Groundwater Control

Based on the results of this investigation, excavations (assumed up to 3 m to 4 m below the existing ground surface) for the site servicing are anticipated to be carried out through fills, peat, organic (sandy) silt, glacial till, silty/sandy/gravelly deposits and potentially probable bedrock. The site servicing pipes are anticipated to be generally above, at or below the groundwater tables measured at the borehole locations.

Groundwater control during excavations within the glacial tills can be handled, as required, by pumping from properly constructed and filtered sumps located within the excavations. Perched groundwater may be expected in the fill materials, native peat, organic (sandy) silt and cohesionless silty/sandy/gravelly soils above the groundwater tables at various depths which can be handled, as required, by pumping from properly constructed and filtered sumps located within the excavations. However, more significant groundwater seepage should be expected from fill materials and wet cohesionless silty/sandy/gravelly deposits below the prevailing groundwater tables and wet cohesionless silty/sandy/gravelly layers/zones within the glacial tills. Due to the predominant cohesionless silty/sandy/gravelly soils and the anticipated groundwater tables, some form of positive (pro-active) groundwater control or depressurization should be required to maintain the stability of the base and side slopes of the trench excavations, in addition to pumping from sumps. The groundwater level should be lowered to at least 1 m below the excavation base prior to excavating for the site services.

It should be noted that any construction dewatering or water taking in Ontario is governed by Ontario Regulation 387/04 - Water Taking and Transfer, made under the Ontario Water Resources Act (OWRA), and/or Ontario Regulation 63/16 – Registrations under Part II.2 of the Act – Water Taking, made under Environmental Protection Act. Based on these regulations, water taking of more than 400,000 L/day is subject to a Permit to Take Water (PTTW), while water taking of

50,000 L/day to 400,000 L/day is to be registered through the Environmental Activity and Sector Registry (EASR).

Where excavations are conducted by conventional temporary open cuts, side slopes should not be steeper than 1.5 horizontal to 1 vertical (1.5H:1V). However, depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of the slopes may be required, especially in looser/softer zones (i.e. in fills or wet sandy/silty deposits) or where localized seepage is encountered. Care should be taken to direct surface runoff away from the open excavations and all excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. According to OHSA, the compact to dense and stiff to hard glacial tills would be classified as Type 2 soils above groundwater table and Type 3 below groundwater table; the fill materials, native peat, organic (sandy) silt and silty/sandy/gravelly soils would be classified as Type 3 soils above groundwater table and Type 4 below groundwater table and unless supported by shoring or other approved retaining method, the excavations will require minimum side slopes of 3H:1V. In addition, care must be taken during excavation to ensure that adequate support is provided for any existing structures and underground services located adjacent to the excavations.

The excavated material should be placed well back from the edge of the excavation and stockpiling of materials adjacent to the excavation should be prohibited, to minimize surcharge loading near the excavation crest.

5.1.2 Temporary Shoring and Trench Boxes

It is understood that for the majority of the service installations, the extent of the excavations will have to be minimized to allow for traffic to continue using a reduced portion of the existing roadway. Where side slopes of excavations are steepened to limit the extent of the excavation, some form of trench support system such as a trench box system will be required. The trench support system shall be designed by a professional engineer. The earth pressure on the multiple braced shoring system may be evaluated by using the pressure distribution diagram shown on Drawing 16. It must be emphasized that a trench liner box provides protection for construction personnel but does not provide any lateral support for the adjacent excavation walls, underground services or existing structures. In the case of trench box excavation work, the tolerance for disturbance of any structure founded above a 1 horizontal to 1 vertical line projected up from the base of the excavation should be assessed prior to construction. If adjacent structures and/or utilities or existing pavement structure open for traffic are susceptible to damage from construction induced settlement, then excavation support using sheet piles or a strutted soldier pile and lagging wall must be considered. It is therefore, imperative that any underground services or existing structures adjacent to the excavations be accurately located prior to construction and adequate support provided where required. Steepened excavations should be left open for as short a duration as possible and completely backfilled at the end of each working

day. Care must be taken during excavation near any underground structures located within or adjacent to the excavation. The owner of the structures/utilities should also be contacted prior to excavating near their easement to confirm that the proposed excavation meets their requirements.

While the use of trench boxes is an effective and economical trench-support method, its use can cause increased loss of ground relative to properly braced shoring, especially when working close to granular base courses below existing pavements or along existing utility trenches backfilled with granular materials. Trench boxes also reduce the contractor's ability to compact backfill materials placed between the trench wall and the outer trench box shell, thereby increasing the likelihood of post-construction settlements along the trench walls. When trench boxes are used along existing roadways, settlements frequently occur along the trench wall, which may manifest months after completion of backfilling. In such cases, following backfilling of the trench, road reconstruction should include a provision for saw-cutting the asphalt at least 1 m back from the trench walls, recompacting the upper trench backfill, and then repaving. Where permissible under the OHSA and where its use is considered to be a safe alternative for shoring and bracing, contractors may elect to utilize trench boxes for temporary trench wall support for trenches less than 6 m deep in Type 2 and 3 soils. Where trench depths exceed 6 m (or at any trench depth in Type 4 soil), engineered support systems designed by a qualified professional engineer are required under the OHSA.

Further to the above and in consideration of the cohesionless fill materials and native silty/sandy/gravelly soils, some loss of ground should be expected for the sections of nearly vertical excavation where a trench box will be used. It is anticipated that in the cohesionless soils, the unsupported soils on the trench sides will relax, filling the void between the trench walls and trench box. This may lead to loss of ground below the pavement and potentially undermine and reduce the stability of the pavement structure adjacent to the open traffic lanes. In order to minimize this effect, the gap between the trench walls and trench box should be minimized during the excavation and trench box installation.

5.1.3 Pipe Support and Bedding

The bedding for the service pipes should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions and should be designed in accordance with the standards of the local municipality or Ontario Provincial Standard Specifications (OPSS). Where granular bedding is deemed to be acceptable, it should consist of at least 150 mm of TS 1010 Granular A or 19 mm crusher run limestone material. The thickness of the bedding may, however, have to be increased (i.e. 300 mm to 450 mm) depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soils at the trench base level consists of wet sandy/silty deposits. From springline to 300 mm above obvert of the pipe, sand cover could be used. All bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 100 percent of the material's Standard Proctor Maximum Dry Density (SPMDD).

To avoid the loss of soil fines from the subgrade, clear stone bedding material should not be used in any case for pipe bedding or to stabilize the bases.

5.1.4 Trench Backfill

Based on visual and tactile examination and the measured natural water contents of the soil samples, the majority of the existing fill materials and silty/sandy/gravelly soils above groundwater tables and the glacial tills are anticipated to be generally at or near their estimated optimum water contents for compaction. However, the fill materials and native silty/sandy/gravelly soils below the prevailing groundwater tables are anticipated to be generally wet of their estimated optimum water contents for compaction, which should require some aeration prior to reuse as backfill materials.

A great amount of cobbles and boulders were encountered in some of the boreholes. The cobbles and boulders are not suitable for backfill and maybe wasted.

Portion of the existing fill materials containing organic matters, peat, and organic (sandy) silt should be wasted or disposed off-site.

The excavated materials at suitable water contents may be reused as trench backfill provided they are free of significant amounts of topsoil, organics or other deleterious material, and are placed and compacted as outlined below. It should also be noted that due to the predominantly fine-grained, silty nature of the majority of the existing fill materials and native soils at some locations, some difficulty would be expected in achieving adequate compaction, especially during wet weather.

The backfill should be placed in maximum 300 mm loose lifts at or near (±2%) their optimum moisture content and each lift should be compacted to at least 95% SPMDD. From 1 m below subgrade to subgrade elevation, the materials should be placed in maximum 300 mm loose lifts and uniformly compacted to at least 98 % SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling. In pavement areas, the upper zone of the trench backfill within the depth of 1.4 m below the pavement surface should be non-frost susceptible materials without excessive fines and compacted to at least 98% SPMDD. The fine grained silty soils encountered at the site is potentially of high frost susceptibility, which should not be used in the upper zone of the trench backfill within the depth of 1.4 m below the pavement surface.

It should be noted that if the soils for trench backfilling were placed and compacted at wet of their optimum water content (>2%), pumping and rolling conditions may be encountered, which would require mitigative measures in order to construct roads and utilities. This might include significant extra thicknesses of granular base, base reinforcement using geogrids or importing of better quality common fill.

Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in-situ material, then an approved imported sandy material which meets the requirements for OPSS Select Subgrade Material ("SSM") could be used. It should be placed in loose lift thicknesses as indicated above and uniformly compacted to at least 95% SPMDD.

Normal post-construction settlement of the compacted trench backfill should be anticipated, with the majority of such settlement taking place within about 6 months following the completion of trench backfilling operations. This settlement may be compensated for, where necessary, by placing additional granular material prior to asphalt paving. Alternatively, if the asphalt binder course is placed shortly following the completion of trench backfilling operations in these areas, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding.

5.1.5 Pavement Restoration Designs

This section of the report provides recommendations for the restoration of the pavement within the project limits. Disturbed/damaged pavement, resulting from the underground service construction operations, should be restored in kind to match the existing pavement structure. For Town of Erin, refer to Section 4.1.1 Pavement Structure. For Town of Hillsburgh, refer to Section 4.1.2 Pavement Structure.

The granular subbase and base materials should be uniformly compacted to at least 100 percent of their standard Proctor maximum dry densities (SPMDD). The asphalt material should be compacted between 92 to 96.5 percent of its maximum relative density, as measured in the field using a nuclear density gauge.

Since the reinstated pavement section will abut existing pavement, proper longitudinal lap joints should be constructed to key the new asphalt into the existing surface. The existing asphalt edges should be provided with a proper saw cut edge prior to keying in the new asphalt. Any pavement sections that are undermined due to construction activities should be removed by the saw cut and reconstructed. The subbase thickness should match the existing subbase depth of the adjacent pavement structure.

5.2 Proposed Wastewater Treatment Plant (WWTP) (Boreholes BH101 to BH103)

Based on the results of this preliminary geotechnical investigation, the native soils encountered at the potential WWTP location are generally considered to be suitable for supporting the proposed development.

The following preliminary geotechnical information is provided for the planning and preliminary design of the potential WWTP, underground services and paved roads at the site.

- The existing surficial topsoil/organics and other near surface very loose/soft soils including those containing significant amounts of organic matter, are not considered to be suitable for supporting building foundations, pavement structures and/or engineered fills.

- Fill materials were encountered below the topsoil in Boreholes BH101 to BH103 and extended to depths ranging from 0.8 to 2.3 m below the existing ground surface. The existing fill materials are considered to be unsuitable for supporting the proposed development and any other settlement sensitive structures. The existing fill materials are also considered to be unsuitable for supporting engineered fills.

- Depending upon the final site grading scheme and proposed final grade elevations, the areas may need to be brought up to the underside of the footings, if required, using engineered fill. The materials proposed for use as engineered fill should be approved by qualified geotechnical personnel from GeoPro at the source, prior to hauling to the site. Some of the native soils at the site would be unsuitable for reuse as engineered fill due to the anticipated difficulties in compaction. Imported materials approved by the geotechnical engineer may be considered for use as engineered fill. Details regarding placement and compaction requirements for engineered fill, if utilized at the site, can be provided once the actual development plans are available, as part of the detailed geotechnical recommendations for the project.

- A preliminary bearing resistance for conventional shallow spread and/or strip footings are provided in the following table.

BH No.	Bearing Resistance at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Anticipated Bearing Soil
BH101	150	225	2.5	Gravelly Sand to Sandy Gravel
BH102	100	150	2.5	Gravelly Sand to Sandy Gravel
	150	225	3.5	Gravelly Sand to Sandy Gravel
BH103	150	225	1.0	Gravelly Sand to Sandy Gravel

*the bearing resistances are preliminary and not sufficient for detailed designs.

- All exterior footings and footings in unheated areas should be protected with a minimum of 1.4 m of earth cover for frost protection.

- Based on the results of this preliminary geotechnical investigation, groundwater control during excavations within the fill materials and native silty/sandy/gravelly soils above the prevailing groundwater tables can be handled, as required, by pumping from properly constructed filtered sumps located within the excavations. However, more significant groundwater seepage may be expected from the cohesionless silty/sandy/gravelly

deposits below the prevailing groundwater tables; positive dewatering consisting of well points or eductors should be required to drawn down the groundwater table to at least 1 m below the excavation base elevation prior to excavation. Should groundwater be encountered during excavations. Due to the presence of the coarse-grained soils at the sites, groundwater table fluctuating may respond quickly to weather conditions. A long-term ground water monitoring program is to be carried out concurrently to evaluate the long-term groundwater table fluctuation.

- The cohesionless silty/sandy/ gravelly deposits at the site are extremely easy to be disturbed by construction activities and foot traffic. A 75 mm thick of concrete skim coat on the founding subgrade immediately after its approval may be required, to prevent its disturbance by construction activities.

- The majority of the subsoils above the local water table are generally near their estimated optimum water contents for compaction and should be suitable for reuse as trench backfill, provided they are free of significant amounts of topsoil, organics and other deleterious materials. Excavated silty/sandy/gravelly subsoils from below the local water table (i.e. for deeper excavations, if required) would likely require some drying prior to placement.

- A great amount of cobbles and boulders were encountered in some of the boreholes. The cobbles and boulders are not suitable for backfill and maybe wasted.

- It is anticipated that trench excavations for underground servicing would consist of conventional temporary open cuts with side slopes not steeper than 1.5 horizontal to 1 vertical. However, some local flattening of side slopes may be required in some area in loose soil zones or where significant water seepage is encountered. Conventional bedding thicknesses are anticipated for underground services founded within the native competent subsoils at the site. Additional bedding thickness may be required for services founded in wet sandy soils, depending upon the excavation depths and success of the contractor's groundwater control measures. It should be noted that cobbles and boulders should be encountered at the site. Excavation below the groundwater table in the sandy/silty/gravelly deposits, construction dewatering would be required. Active dewatering such as well points or eductors may be required prior to excavations in the cohesionless soils below the groundwater tables. Otherwise, it will result in an unstable base and flowing sides. The groundwater table must be lowered to at least 1.0 m below the lowest elevation of the excavation base.

- The lateral earth pressure acting at any depth on underground walls can be calculated as follows:

$$p = K_1 (\gamma_1 h_1 + q)$$

Where p = lateral earth pressure in kPa acting at depth h_1

K_1 = earth pressure coefficient K_1=0.5 for basement wall design

γ_1 = unit weight of overburden soil assuming 22 kN/m^3

h_1 = depth in overburden soil

q = value of surcharge in kPa

The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall.

The flood elevation may be considered in the design due to the predominant coarse grained cohessionless soils encountered at the site.

- Should the structure footprint be extending to the property lines, it is anticipated that the proposed excavations will be supported by a temporary shoring system consisting of timber lagging and soldier piles and tie back anchors. Unsupported open cut excavation may be utilized at the areas where the sufficient space is available. The shoring system must be designed in accordance with the 4th Edition of the Canadian Foundation Engineering Manual.

- The recommended pavement structures provided in the following table are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. The values may need to be adjusted based on the city /regional standards. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of eight to ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Recommended Pavement Structure Thickness

Material		Light Duty Parking (Cars)	Heavy Duty Parking (Delivery Trucks)
Hot-Mix Asphalt (OPSS 1150)	HL 3 Surface Course	40 mm	40 mm
	HL 8 Binder Course	50 mm	100 mm
Granular Material (OPSS.MUNI 1010)	Granular A Base	150 mm	150 mm
	Granular B Type I Subbase	300 mm	450 mm

Prepared and Approved Subgrade

* Denotes Standard Proctor Maximum Dry Density, ASTM-D698
The subgrade must be compacted to 98% SPMDD for at least the upper 300 mm unless accepted by GeoPro.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum grade of 2 %) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening. This is particularly important in heavy-duty pavement areas.

5.3 Proposed Pumping Stations (Boreholes SPS01BE, SPS02E to SPS04E, SPS06E, SPS08E and SPS01H)

Based on the results of this preliminary geotechnical investigation, the native soils encountered at each of the proposed pumping station locations are generally considered to be suitable for supporting the proposed development.

The following preliminary geotechnical information is provided for the planning and preliminary design of the proposed pumping stations.

- The existing surficial topsoil/organics and other near surface very loose / soft soils including those containing significant amounts of organic matter, are not considered to be suitable for supporting building foundations, pavement structures and/or engineered fills.

- Fill materials were encountered below the topsoil and granular base/subbase materials in Boreholes SPS01BE, SPS02E, SPS03E, SPS04E, SPS06E and SPS08E and extended to depths ranging from 0.9 m to 4.0 m below the existing ground surface. The existing fill materials are considered to be unsuitable for supporting the proposed development and any other settlement sensitive structures. The existing fill materials are also considered to be unsuitable for supporting engineered fills.

- Depending upon the final site grading scheme and proposed final grade elevations, the areas may need to be brought up to the underside of the footings, if required, using engineered fill. The materials proposed for use as engineered fill should be approved by qualified geotechnical personnel from GeoPro at the source, prior to hauling to the site. Some of the native soils at the site would be unsuitable for reuse as engineered fill due to the anticipated difficulties in compaction. Imported materials approved by the geotechnical engineer may be considered for use as engineered fill. Details regarding placement and compaction requirements for engineered fill, if utilized at the site, can be

provided once the actual development plans are available, as part of the detailed geotechnical recommendations for the project.

- A preliminary bearing resistance for conventional shallow spread and/or strip footings are provided in the following table.

BH No.	Bearing Resistance at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Anticipated Bearing Soil
SPS01BE	400	600	6.0	Sandy Silt Till
SPS01H	300	450	6.0	Gravelly Sand to Sand and Gravel
SPS02E	200	300	6.5	Gravelly Sand to Sand and Gravel
SPS03E	400	600	6.0	Sand and Silt Till
SPS04E	300	450	6.5	Silt
SPS06E	300	450	6.0	Gravelly Sand to Sand and Gravel
SPS08E	300	450	5.0	Gravelly Sand to Sand and Gravel

*the bearing resistances are preliminary and not sufficient for detailed designs.

- All exterior footings and footings in unheated areas should be protected with a minimum of 1.4 m of earth cover for frost protection.

- Based on the results of this preliminary geotechnical investigation, groundwater control during excavations within the fill materials, organic (sandy) silt and silty/sandy/gravelly deposits above the prevailing groundwater tables can be handled, as required, by pumping from properly constructed filtered sumps located within the excavations. However, significant groundwater seepage will be expected from the water bearing cohesionless sandy/silty/gravelly deposits below the prevailing groundwater tables; positive dewatering consisting of well points or eductors should be required to drawn down the groundwater table to at least 1 m below the excavation base elevation prior to excavation. It should be noted that any construction dewatering or water taking in Ontario is governed by Ontario Regulation 387/04 - Water Taking and Transfer, made under the Ontario Water Resources Act (OWRA), and/or Ontario Regulation 63/16 – Registrations under Part II.2 of the Act – Water Taking, made under Environmental Protection Act. Based on these regulations, water taking of more than 400,000 L/day is subject to a Permit to Take Water (PTTW), while water taking of 50,000 L/day to 400,000 L/day is to be registered through the Environmental Activity and Sector Registry (EASR). The need for and the type of groundwater control measures can be reviewed by the engineer as part of the detailed geotechnical and hydrogeological investigations, which would be required to support the detailed designs of the proposed development.

- In consideration of the relatively high groundwater tables encountered at the sites, for any permanent underground structure, such as a basement, a permanent under-slab and perimeter drainage system will be required; subject to the volume of the water extracted from the drainage system, a permanent Permit To Take Water (PTTW) may be required, which should be consulted with local municipality and conservation authorities.

- Based on the groundwater level measured at each of the sites, the wet well and chamber structures of the proposed pump station are anticipated to extend below the measured groundwater tables and will, therefore, be subjected to hydrostatic uplifting pressures. In consideration of the coarse grained soils at the site, the groundwater table fluctuation may respond to the weather conditions quickly, as such, it is recommended that the groundwater tables for uplifting design may be considered as the existing ground surface or designed flood elevations, which ever is higher. Additional uplifting resistances such as enlarged base slabs and anchor systems may be considered for the sites.

- Water bearing cohesionless silty/sandy/ gravelly deposits at the site are extremely easy to be disturbed by construction activities and foot traffic. A 100 mm thick of concrete skim coat on the founding subgrade immediately after its approval may be required, to prevent its disturbance by construction activities.

- The majority of the subsoils above the local water table are generally near their estimated optimum water contents for compaction and should be suitable for reuse as trench backfill, provided they are free of significant amounts of topsoil, organics and other deleterious materials. Excavated silty/sandy/gravelly subsoils from below the local water table (i.e. for deeper excavations, if required) would likely require some drying prior to placement.

- It is anticipated that trench excavations for underground servicing would consist of conventional temporary open cuts with side slopes not steeper than 1.5 horizontal to 1 vertical. However, some local flattening of side slopes may be required in some area in loose soil zones or where significant water seepage is encountered. Conventional bedding thicknesses are anticipated for underground services founded within the native competent subsoils at the site. Additional bedding thickness may be required for services founded in wet sandy soils, depending upon the excavation depths and success of the contractor's groundwater control measures. It should be noted that cobbles and boulders should be encountered at the site. Excavation below the groundwater table in the silty/sandy/gravelly deposits, construction dewatering would be required. Active dewatering such as well points or eductors may be required prior to excavations in the cohesionless soils below the groundwater tables. Otherwise, it will result in an unstable base and flowing sides. The groundwater table must be lowered to at least 1.0 m below the lowest elevation of the excavation base.

- The lateral earth pressure acting at any depth on underground walls can be calculated as follows:

$$p = K_1 (\gamma_1 h_1 + q)$$

Where p = lateral earth pressure in kPa acting at depth h_1

K_1 = earth pressure coefficient K_1=0.5 for basement wall design

γ_1 = unit weight of overburden soil assuming 22 kN/m^3

h_1 = depth in overburden soil

q = value of surcharge in kPa

The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall.

The flood elevation may be considered in the design due to the predominant coarse grained cohessionless soils encountered at the site.

- Should the structure footprint be extending to the property lines, it is anticipated that the proposed excavations will be supported by a temporary shoring system consisting of timber lagging and soldier piles and tie back anchors. Unsupported open cut excavation may be utilized at the areas where the sufficient space is available. The shoring system must be designed in accordance with the 4th Edition of the Canadian Foundation Engineering Manual.

- The recommended pavement structures provided in the following table are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. The values may need to be adjusted based on the city /regional standards. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of eight to ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Recommended Pavement Structure Thickness

Material		Light Duty Parking (Cars)	Heavy Duty Parking (Delivery Trucks)
Hot-Mix Asphalt (OPSS 1150)	HL 3 Surface Course	40 mm	40 mm
	HL 8 Binder Course	50 mm	100 mm

Granular Material (OPSS.MUNI 1010)	Granular A Base	150 mm	150 mm
	Granular B Type I Subbase	300 mm	450 mm
Prepared and Approved Subgrade			

* Denotes Standard Proctor Maximum Dry Density, ASTM-D698
The subgrade must be compacted to 98% SPMDD for at least the upper 300 mm unless accepted by GeoPro.

The long term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum grade of 2 %) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening. This is particularly important in heavy-duty pavement areas.

5.4 Sanitary Sewage Outfall (Boreholes BH104 and BH107)

The potential sanitary sewage outfall will be constructed in the vicinity of Boreholes BH104 and BH107. However, the preliminary founding elevations, size and types of the sanitary sewage outfall were not available at the time of preparing this report. Once the preliminary design is available, it should be further reviewed by the geotechnical engineer from GeoPro, following which additional recommendations can be provided, as required.

5.4.1 Foundation Design Considerations and Wingwalls

Based on the results of this investigation, the fill materials are considered unsuitable to support the proposed sanitary sewage outfall/wingwall structures and should be completely removed from the foundation footprint. The potential sanitary sewage outfall may be founded in the native, undisturbed, competent native deposits. The soil bearing resistance at the Serviceability Limit State (SLS) and a factored bearing resistance at the Ultimate Limit State (ULS), together with the corresponding founding depths at the borehole location and anticipated soil, are provided in the following table.

Borehole No.	Bearing Resistance at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Anticipated Bearing Soil
BH104	200	300	4.5	Dense Sand
BH107	200	300	3.0	Compact Silty Sand

All foundation bases must be inspected by GeoPro to confirm the design bearing values prior to pouring concrete.

The anticipated founding soils are extremely easy to disturb, a mud slab consisting of at lest 100 mm lean concrete (i.e. 15 MPa) shall be placed immediately upon completion of inspection by a geotechnical engineering from GeoPro.

Foundations designed to the specified bearing resistance values at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

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

It should be noted that the recommended foundation type, founding depths, and bearing resistances were based on the borehole information only. The geotechnical recommendations and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to the subsurface conditions between and beyond the boreholes when foundation construction is underway. The interpretation between and beyond the boreholes and the recommendations of this report **must** therefore be checked through field inspections provided by a qualified geotechnical engineer from GeoPro to validate the information for use during the construction stage. Due to the anticipated variation of the subsurface conditions at this specific site, the geotechnical engineer who carried out the geotechnical investigation shall be retained during the construction stage to avoid the potential misinterpretation of the soil information presented in the report.

5.4.2 Subgrade Protection, Frost Protection and Scour Protection

It should be noted that the proposed founding level should be at least 1.4 m below the proposed final grade to provide sufficient earth cover for frost protection, unless the sanitary sewage outfall is designed to withstand the frost pressures. It should be noted that scour protection, such as rip rap and rock blocks, should not be considered as earth cover for frost protection purposes.

The requirements for design of erosion protection measures for the sanitary sewage outfall should be considered by design engineers. As a minimum requirement, rip rap protection for the sanitary sewage outfall should be considered in accordance with the applicable OPSS/OPSD standards.

5.4.3 Sliding Resistance

Resistance to lateral forces /sliding resistance between the sanitary sewage outfall footing base concrete and the subgrade should be calculated in accordance with Section 6.7.5 of the CHBDC. The coefficient of friction may be considered as follows:

- Coefficient of friction between pour-in-place concrete footings and native sand/silty sand soils = 0.4 (unfactored)

- Coefficient of friction between precast concrete footings and native sand/silty sand soils = 0.3 (unfactored)

It should be noted that these values are unfactored; in accordance with Section 6.7.5 of the CHBDC, a factor of 0.8 should be applied when calculating the horizontal resistance.

5.4.4 Temporary Excavations and Groundwater Control

It is anticipated that the foundation excavations at the site will consist of temporary open cuts with side slopes not steeper than 1.5 horizontal to 1 vertical (1.5H:1V). However, depending on the construction procedures adopted by the contractor and the weather conditions at the time of construction, some local flattening of the slopes will be required, especially in looser/softer zones (i.e. in fills) or where localized seepage is encountered. All excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. According to the Act, the existing fills, organic silt and silty/ sandy/ gravelly deposits would be classified as Type 3 soils above groundwater table and Type 4 below the groundwater table.

The excavations for the sanitary sewage outfall may extend to a maximum depth of about 4 m to 5 m below the existing ground surface through the granular base/subbase, fill materials, native organic silt and silty/sandy/gravelly soils. If space permits, open-cut excavations to the proposed depths may be carried out in accordance with the guidelines outlined in the OHSA for Construction Activities. In addition, care must be taken during excavation to ensure that adequate support is provided for any existing structures and underground services located adjacent to the excavations.

Should adjacent structures and/or utilities be susceptible to damage from construction induced settlement, a more positive excavation support system, such as a shoring system designed by a professional engineer may be considered.

Groundwater control at the site should be required to allow for construction of foundation elements in a dry condition. Perched groundwater should be expected in the fill materials and native organic silt and cohesionless silty/sandy/gravelly soils above the groundwater tables at various depths which can be handled, as required, by pumping from properly constructed and filtered sumps located within the excavations. However, more significant groundwater seepage should be expected from wet organic silt and cohesionless silty/sandy/gravelly deposits below the prevailing groundwater tables at the time of construction. Due to the predominant cohesionless silty/sandy/gravelly soils and the anticipated groundwater tables, some form of positive (pro-active) groundwater control or depressurization should be required to maintain the stability of the base and side slopes of the excavations, in addition to pumping from sumps. The groundwater

level should be lowered to at least 1 m below the excavation base prior to excavating for the site services.

It should be noted that any construction dewatering or water taking in Ontario is governed by Ontario Regulation 387/04 - Water Taking and Transfer, made under the Ontario Water Resources Act (OWRA), and/or Ontario Regulation 63/16 – Registrations under Part II.2 of the Act – Water Taking, made under Environmental Protection Act. Based on these regulations, water taking of more than 400,000 L/day is subject to a Permit to Take Water (PTTW), while water taking of 50,000 L/day to 400,000 L/day is to be registered through the Environmental Activity and Sector Registry (EASR).

Depending on the construction procedures and groundwater control measures adopted by the contractor and weather conditions at the time of construction, cut off measures, such as a sheet pile wall, may be required to improve the effectiveness of the groundwater control measures in addition to pumping from sumps.

Surface water should be directed away from the excavation area to prevent ponding of water that could result in disturbance and weakening of the foundation subgrade.

5.4.5 Lateral Earth Pressures for Design

The following recommendations are made concerning the design of the walls, assuming that the backfill to the sanitary sewage outfall structures, and wing walls consists of free-draining granular fill meeting the requirements of OPSS 1010 Granular A or Granular B. This fill should be compacted in loose lifts not greater than 200 mm in thickness to 98 percent of the material's Standard Proctor Maximum Dry Density (SPMDD) in accordance with OPSS 501. The fill materials should be benched into the existing roadway embankment side slopes if required. Longitudinal drains and weep holes should be installed to provide positive drainage of the granular backfill. Other aspects of the granular backfill requirements with respect to sub-drains and frost taper should be in accordance with applicable Ontario Provincial Standard Drawings.

Computation of earth pressures acting against any wing walls should be in accordance with applicable design codes. For design purposes, the following properties can be assumed for backfill.

Compacted Granular 'A' or Granular 'B' Type II

Angle of Internal Friction =35 (unfactored)

Unit Weight = 22 kN/m3

Coefficient of Lateral Earth Pressure:

Level Backfill	Backfill Sloping at 3H:1V	Backfill Sloping at 2H:1V
K_a=0.27	K_a=0.34	K_a=0.40
K_b=0.35	K_b=0.44	K_b=0.50

K_o=0.43	K_o=0.56	K_o=0.62
K*=0.45	K*=0.60	K*=0.66

Compacted Granular 'B' Type I

Angle of Internal Friction ϕ=32° (unfactored)

Unit Weight = 21 kN/m^3

Coefficient of Lateral Earth Pressure:

Level Backfill	Backfill Sloping at 3H:1V	Backfill Sloping at 2H:1V
K_a=0.31	K_a=0.39	K_a=0.47
K_b=0.39	K_b=0.49	K_b=0.57
K_o=0.47	K_o=0.62	K_o=0.69
K*=0.54	K*=0.68	K*=0.78

Note: K_a is the coefficient of active earth pressure

K_b is the backfill earth pressure coefficient for an unrestrained structure including compaction efforts

K_o is the coefficient of earth pressure at rest

K* is the earth pressure coefficient for a soil loading a fully restrained structure and includes compaction effects

These values are based on the assumption that the backfill behind the retaining structures is free-draining granular material and adequate drainage is provided.

The earth pressure coefficient to be adopted will depend on whether the retaining structure is restrained or some movement can occur such that the active state of earth pressure can develop. The effect of compaction should also be taken into account in the selection of the appropriate earth pressure coefficients. The use of vibratory compaction equipment behind the abutments and the walls should be restricted in size.

A minimum compaction surcharge of 12 kPa should be included in the lateral earth pressures for the structural design of the walls, according to CHBDC Section 6.12.3 and Figure 6.6. Other surcharge loadings should be accounted for in the design as required.

The above calculation yields lateral pressures due to soil loading only. If the sanitary sewage outfall is intended to become partially submerged during the design flood event, then appropriate hydrostatic pressures below the water table should be added to the earth pressures calculated as above in order to obtain the total lateral pressure acting on the sanitary sewage outfall structure.

The fill depth during placement should be maintained equal on both sides of the outfall structure, with one side not exceeding the other by more than 500 mm.

The use of heavy vibratory equipment behind the sanitary sewage outfall structure and any other below-grade structures should be limited within a lateral distance equal to the height of the

backfill (at the time of compaction) above the base of the structure. If required, GeoPro can provide additional assistance with the refinement of design earth pressure parameters based on the type of sanitary sewage outfall structure selected, dimensions, etc.

5.5 Seismic Site Class

The 2012 Ontario Building Code (OBC 2012) came into effect on January 1, 2014 and contains updated seismic analysis and design methodology. The seismic site classification methodology outlined in the code is based on subsurface conditions within the upper 30 m below grade. Two methods of defining the site class for the proposed development are presented in the following sections: a conservative approach based on shallow boreholes (i.e. boreholes less than 30 m in depth) using local geological/physiographical experience; and a method based on geophysical testing in accordance with Section 4.1.8.4A of the OBC 2012.

The conservative site classification is based on physical borehole information obtained at depths of less than 30 m and on general knowledge of the local geology and physiography. Based on this borehole information and our local experience, a Site Class D designation may be considered for the site.

6 ENVIRONMENTAL SOIL ANALYTICAL RESULTS

6.1 Soil Sample Submission

In order to provide information on the chemical quality of the subsurface soils, selected soil samples were submitted to AGAT Laboratories in Mississauga, Ontario ("AGAT") for chemical analyses. Descriptions of the selected soil samples and analytical parameters are presented in the following table:

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
BH1 SS3	1.5 – 2.0	Sand and Silt	SAR
BH5 SS3	1.5 – 2.0	Sand	SAR
BH9 SS2	0.8 – 1.2	Gravelly Sand to Sand and Gravel	SAR
BH10 SS2	0.8 – 1.2	Gravelly Sand	SAR
BH14 SS2	0.8 – 1.2	Gravelly Sand Fill	SAR
BH15 SS2	0.8 – 1.2	Gravelly Sand to Sand and Gravel	SAR
BH19 SS2	0.8 – 1.2	Gravelly Sand Fill	SAR
BH21 SS2	0.8 – 1.2	Gravelly Sand to Sand and Gravel Fill	SAR
BH26 SS2	0.8 – 1.2	Silty Sand Fill	SAR
BH28 SS2	0.8 – 1.2	Sandy Silt to Silty Sand Fill	SAR
BH30 SS3	1.5 – 2.0	Gravelly Sand to Sand and Gravel	SAR
BH31 SS2	0.8 – 1.2	Gravelly Sand Fill	SAR
BH32 SS3	1.5 – 2.0	Sand	SAR

BH37 SS3	1.5 – 2.0	Silty Sand to Sand and Silt Fill	SAR
BH38 SS2	0.8 – 1.2	Silty Sand to Sand and Silt Fill	SAR
BH101 SS2	0.8 – 1.2	Silty Sand to Sand and Silt Fill	SAR
BH103 SS2	0.8 – 1.5	Gravelly Sand to Sand and Gravel	SAR
BH104 SS2&SS3	0.8 – 2.0	Silty Sand to Sand and Silt Fill; Gravelly Sand Fill	SAR
BH107 SS2&SS3	0.8 – 2.0	Silty Sand Fill	SAR
SPS01bE SS3	1.5 – 2.0	Gravelly Sand to Sand and Gravel	SAR
SPS01H SS2	0.8 – 1.2	Gravelly Sand to Sandy Gravel	SAR
SPS02E SS2	0.8 – 1.2	Sandy Silt Fill	SAR
SPS03E SS2	0.8 – 1.2	Silty Sand Fill	SAR
SPS04E SS3	1.5 – 2.0	Gravelly Sand	SAR
SPS06E SS2	0.8 – 1.2	Gravelly Sand Probable Fill	SAR
SPS08E SS2&SS3	0.8-2.0	Silty Sand to Sand and Silt Fill	SAR
T1 SS3A	1.5 – 2.0	Sand and Silt to Silty Sand Fill	SAR
T3 SS2	0.8 – 1.2	Sand and Silt to Silty Sand Fill	SAR
T6 SS2	0.8 – 1.2	Sandy Silt Fill	SAR
T8 SS2	0.8 – 1.2	Silty Sand to Sand and Silt Fill	SAR

Note: SAR = Sodium Adsorption Ratio

It should be noted that at the time of the sampling, no obvious visual or olfactory evidence of environmental impact (i.e. staining or odours) was observed at the sampling locations.

6.2 Soil Analysis Results

A total of twenty-nine (29) soil samples were analysed for parameter of SAR under Ontario Regulation 153/04 ("O. Reg. 153/04") as amended. A copy of the soil analytical results is provided in the Laboratory Certificates of Analysis, attached in Appendix A.

The soil analytical results were compared with the Ontario Ministry of the Environment and Climate Change (MOECC) "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", April 2011, Table 1: Full Depth Background Site Condition Standards for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Uses (2011 MOECC Table 1 Standards); Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition (2011 MOECC Table 2 Standards), and Table 3: Full Depth Generic Site Condition Standards in a non-potable Ground Water Condition (2011 MOECC Table 3 Standards).

Based on the comparison, exceedances of the MOECC Table 1, Table 2 or Table 3 standards were noted for SAR in the tested soil samples taken from Boreholes BH1, BH9, BH10, BH19, BH21, BH26, BH28, BH37, BH38, BH104 and BH107. The exceedance values detected in the soil samples are summarized in the following table:

Soil Sample ID	Parameter	Detected Value / Unit	MOECC Table 1 Standards Guideline Value	MOECC Table 2 and 3 Standards (R/P/I) Guideline Value	MOECC Table 2 and 3 Standards (I/C/C) Guideline Value
BH1 SS3	SAR	6.18	**2.4**	**5**	12
BH9 SS2	SAR	2.69	**2.4**	5	12
BH10 SS2	SAR	5.68	**2.4**	**5**	12
BH19 SS2	SAR	10.5	**2.4**	**5**	12
BH21 SS2	SAR	18.8	**2.4**	**5**	**12**
BH26 SS2	SAR	27.4	**2.4**	**5**	**12**
BH28 SS2	SAR	60.1	**2.4**	**5**	**12**
BH37 SS3	SAR	11.2	**2.4**	**5**	12
BH38 SS2	SAR	14.0	**2.4**	**5**	**12**
BH104 SS2&SS3	SAR	25.4	**2.4**	**5**	**12**
BH107 SS2&SS3	SAR	36.0	**2.4**	**5**	**12**
SPS08E SS2&SS3	SAR	3.41	**2.4**	5	12

Note: R/P/I = Residential, Parkland and Institutional Property Use
I/C/C = Industrial, Commercial and Community Property Use
2.4 = standard value exceeded by the analytical result

6.3 Discussion of Analytical Results

Based on the analytical results, exceedances of MOECC Table 1, Table 2 or Table 3 Standards were noted for SAR in the tested soil samples. It should be noted that the samples with exceedances of SAR values were taken from the boreholes located on the roadways. The elevated SAR values in the tested soil samples may likely be attributed to the application of de-icing salt on the road.

Based on the results of soil sample analysis, GeoPro would recommend the following disposal option:

1) The soils generated at the Site at the same tested sample depths from Boreholes BH5, BH14, BH15, BH30 to BH32, BH101, BH103, SPS01BE, SPS01H, SPS02E, SPS03E, SPS04E, SPS06E, T1, T3, T6 and T8 with no identified exceedances can be re-used on Site or re-used at a receiving site which is not used for agricultural purposes and would accept the soils as per the test results;

2) The soils generated at the Site at the same tested sample depth from Boreholes BH9 and SPS08E can be re-used for the on-site development, provided that the soils will not be in contact with groundwater, or re-used at a receiving site which is not considered as an environmentally sensitive site and would accept the soil as per the test results; and

3) The soils generated at the Site at the same tested sample depths from Boreholes BH1, BH10, BH19, BH21, BH26, BH28, BH37, BH38, BH104 and BH107, may be disposed at facilities, which are suitable to accept salt-impacted excess soil (i.e., certain former aggregate sites, mines, etc.) or at a licensed landfill site. However, additional chemical testing may be required by these facilities.

It should be noted that the results of the chemical analysis refer only to the soil samples analyzed, which were obtained from specific sampling locations and sampling depths, and that the soil chemistry may vary between and beyond the location and depth of the samples taken. Therefore, soil materials to be used on site or transported to other sites must be inspected during excavation for indication of variance in composition or any chemical/environmental constraints. If conditions indicate significant variations, further chemical analyses should be carried out.

Please note that the level of testing outlined herein is meant to provide a broad indication of soil quality based on the limited soil samples tested. The analytical results contained in this report should not be considered a warranty with respect to the soil quality or the use of the soil for any specific purpose. Furthermore, it must be noted that our scope of work was only limited to the review of the analytical results of the limited number of samples. The scope of work did not include any environmental evaluation or assessment of the subject site (such as a Phase One or Phase Two Environmental Site Assessment).

Sites accepting fill may have requirements relating to its aesthetic or engineering properties in addition to its chemical quality. Some receiving sites may have specific chemical testing protocols, which may require additional tests to meet the requirements. The requirements for accepting the fill at an off-site location must be confirmed in advance. GeoPro would be pleased to assist once the receiving sites are determined and the requirements of the receiving sites are available.

7 CORROSIVITY POTENTIAL

The sulphate (SO_4) resistance requirements for concrete in contact with the site soils were evaluated by performing water-soluble sulphate tests on four (4) soil samples taken from Boreholes BH1, BH5, BH9, BH10, BH14, BH15, BH19, BH26, BH28, BH30 to BH32, BH37, BH38, BH101, BH103, BH104, BH107, SPS01BE, SPS01H, SPS02E, SPS03E, SPS04E, SPS06E, SPS08E, T1, T3, T6 and T8, with depths shown in the following table. The analytical data are attached to Appendix B.

The test revealed that the sulphate concentrations in the tested soil samples from tested samples ranged from less than 2 to 59 ug/g (or <0.0002% to 0.0059%). The category of severity of attack is “negligible” based on CSA Standard A23.1, Concrete Materials and Methods of Concrete Construction. The final selection of the type of concrete should be made by the Engineer taking into account all aspects of design considerations.

The corrosivity of soils towards ferrous metal was evaluated by performing corrosivity tests on same soil samples. The corrosivity of soils was evaluated using the 10 points method which is based on five soil properties: sulphides, resistivity, pH, Redox potential and moisture content. The following table summarizes the ANSI/AWWA rating for the tested soil sample for the potential for corrosion towards buried grey or ductile cast iron pipe. A score of ten (10) points or more indicates potential for corrosion.

BH No./ Sample No.	Parameter (Score)							
	Depth (m)	Soil Type	PH	Resistivity (ohm.cm)	Sulfide (%)	Redox potential (mV)	Moisture Content (%)	Total Points
BH1 SS5	3.05 – 3.51	Gravelly Sand to Sand and Gravel	8.33 (0)	2090 (5)	< 0.05 (2)	161 (0)	7 (1)	8
BH5 SS5	3.05 – 3.51	Gravelly Sand to Sand and Gravel	8.83 (3)	4330 (0)	< 0.05 (2)	172 (0)	4 (1)	6
BH9 SS4	2.29 – 2.75	Gravelly Sand to Sand and Gravel	8.99 (3)	5150 (0)	< 0.05 (2)	153 (0)	3 (1)	6
BH10 SS5	3.05 – 3.51	Sand	8.64 (3)	4180 (0)	< 0.05 (2)	158 (0)	18 (2)	7
BH14 SS5	3.05 – 3.51	Sand and Silt Till	8.87 (3)	8850 (0)	< 0.05 (2)	172 (0)	8 (1)	6
BH15 SS5	3.05 – 3.51	Gravelly Sand to Sand and Gravel	9.07 (3)	4220 (0)	< 0.05 (2)	139 (0)	3 (1)	6
BH19 SS4	2.29 – 2.75	Gravelly Sand to Sand and Gravel	8.77 (3)	2410 (2)	< 0.05 (2)	145 (0)	4 (1)	8
BH26 SS5	3.05 – 3.51	Sand	9.30 (3)	2230 (2)	< 0.05 (2)	124 (0)	5 (1)	8
BH28 SS4	2.29 – 2.75	Gravelly Sand to Sandy Gravel	8.38 (0)	833 (10)	0.06 (3.5)	155 (0)	3 (1)	14.5
BH30 SS5	3.05 – 3.51	Gravelly Sand	8.87 (3)	8930 (0)	0.05 (3.5)	150 (0)	11 (2)	8.5
BH31 SS5	3.05 – 3.51	Silty Sand	8.89 (3)	8260 (0)	< 0.05 (2)	176 (0)	9 (1)	6
BH32 SS5	3.05 – 3.51	Sand	9.39 (3)	12000 (0)	< 0.05 (2)	157 (0)	5 (1)	6
BH37 SS4	2.29 – 2.75	Sand and Gravel Probable Fill	8.65 (3)	1080 (10)	0.05 (3.5)	181 (0)	9 (1)	17.5
BH38 SS4 &SS5	2.29 – 3.51	Sand and Silt Fill; Gravelly Sand Probable Fill	8.26 (0)	1160 (10)	0.06 (3.5)	188 (0)	19 (2)	15.5
BH101 SS5	3.05 – 3.81	Gravelly Sand to Sandy Gravel	8.27 (0)	11200 (0)	< 0.05 (2)	169 (0)	3 (1)	3
BH103 SS4	2.29 – 3.05	Gravelly Sand to Sand and Gravel	8.23 (0)	11900 (0)	< 0.05 (2)	163 (0)	6 (1)	3

BH No./ Sample No.	Parameter (Score)							
	Depth (m)	Soil Type	PH	Resistivity (ohm.cm)	Sulfide (%)	Redox potential (mV)	Moisture Content (%)	Total Points
BH104 SS4	2.29 – 2.75	Sandy Silt Fill	7.93 (0)	448 (10)	0.08 (3.5)	184 (0)	22 (2)	15.5
BH107 AS4	2.29 – 2.75	Silty Sand	9.05 (3)	526 (10)	0.08 (3.5)	153 (0)	6 (1)	17.5
SPS01BE SS4	2.29 – 2.75	Gravelly Sand to Sand and Gravel	8.75 (3)	7190 (0)	< 0.05 (2)	155 (0)	12 (2)	7
SPS01H SS5	3.05 – 3.51	Gravelly Sand to Sandy Gravel	8.44 (0)	5240 (0)	< 0.05 (2)	170 (0)	13 (2)	4
SPS02E SS5	3.05 – 3.51	Gravelly Sand to Sand and Gravel	8.70 (3)	9170 (0)	< 0.05 (2)	163 (0)	3 (1)	6
SPS03E SS5	3.05 – 3.51	Gravelly Sand to Sand and Gravel	8.89 (3)	8260 (0)	< 0.05 (2)	201 (0)	11 (2)	7
SPS04E SS5	3.05 – 3.51	Fine Sand	8.99 (3)	12500 (0)	< 0.05 (2)	156 (0)	22 (2)	7
SPS06E SS6	4.57 – 5.03	Sand	8.79 (3)	10000 (0)	0.07 (3.5)	169 (0)	18 (2)	8.5
SPS08E SS6	4.57 – 5.03	Gravelly sand to Sand and Gravel	8.4 (0)	6060 (0)	< 0.05 (2)	157 (0)	12 (2)	4
T1 SS5A&B	3.05 – 3.51	Silty Sand Fill; Gravelly Sand to Sand and Gravel	8.43 (0)	5680 (0)	< 0.05 (2)	171 (0)	11 (2)	4
T3 SS4	2.29 – 2.75	Silty Fine Sand to Fine Sand and Silt	8.61 (3)	12500 (0)	< 0.05 (2)	173 (0)	24 (2)	7
T6 SS5A	3.05 – 3.36	Sandy Silt Fill	7.99 (0)	7350 (0)	< 0.05 (2)	180 (0)	15 (2)	4
T8 SS5A&B	3.05 – 3.51	Silty Sand to Sand and Silt Fill; Silty Sand	8.21 (0)	5880 (0)	0.1 (3.5)	177 (0)	18 (2)	5.5

According to the ANSI/AWWA rating system, the tested results of samples BH1 SS5, BH5 SS5, BH9 SS4, BH10 SS5, BH14 SS5, BH15 SS5, BH19 SS4, BH26 SS5, BH30 SS5, BH31 SS5, BH32 SS5, BH101 SS5, BH103 SS4, SPS01bE SS4, SPS01H SS5, SPS02E SS5, SPS03E SS5, SPS04E SS5, SPS06E SS6, SPS08E SS6, T1 SS5A&B, T3 SS4, T6 SS5A, T8 SS5A&B indicate moderate potential for corrosion of grey ductile iron pipe. However, the tested results of samples BH28 SS4, BH37 SS4, BH38 SS4&SS5, BH104 SS4 and BH107 AS4 indicate that soils are corrosive to ductile-iron pipes, the anti-corrosion

protection is needed. Further provision of recommendations for corrosion protection is outside of the scope of GeoPro's terms of reference.

Note that there may be other overriding factors in the assessment of corrosion potential, such as the application of de-icing salts on the roadway and subsequent leaching into the subsoils, stray currents, etc.

8 MONITORING AND TESTING

The geotechnical aspects of the final design drawings and specifications should be reviewed by GeoPro prior to tendering and construction, to confirm that the intent of this report has been met. During construction, full-time engineered fill monitoring and sufficient foundation inspections, subgrade inspections, in-situ density tests and materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes, and to monitor conformance to the pertinent project specifications.

9 CLOSURE

The preliminary geotechnical recommendations provided in this report are not sufficient for final design or construction purposes. Once the actual development plans are available, the information in this report should be reviewed by the geotechnical engineer and an additional detailed geotechnical and hydrogeological investigation carried out, compatible with the actual proposed development plans for the site. In this regard, GeoPro would be pleased to provide further geotechnical and hydrogeological services if site development plans proceed forward.

We appreciate the opportunity to be of service to you and trust that this report provides sufficient preliminary geotechnical engineering information to facilitate the planning and preliminary concept design of this project. We look forward to providing you with continuing service during the detailed design stage. Please do not hesitate to contact our office should you wish to discuss, in further detail, any aspects of this project.

Yours very truly,

GEOPRO CONSULTING LIMITED

DRAFT

Tim Yu, B.Eng., EIT,
Geotechnical Group

DRAFT

Jessica Yao, P.Eng.
Senior Geotechnical Engineer

DRAFT

David B. Liu, P.Eng., Principal

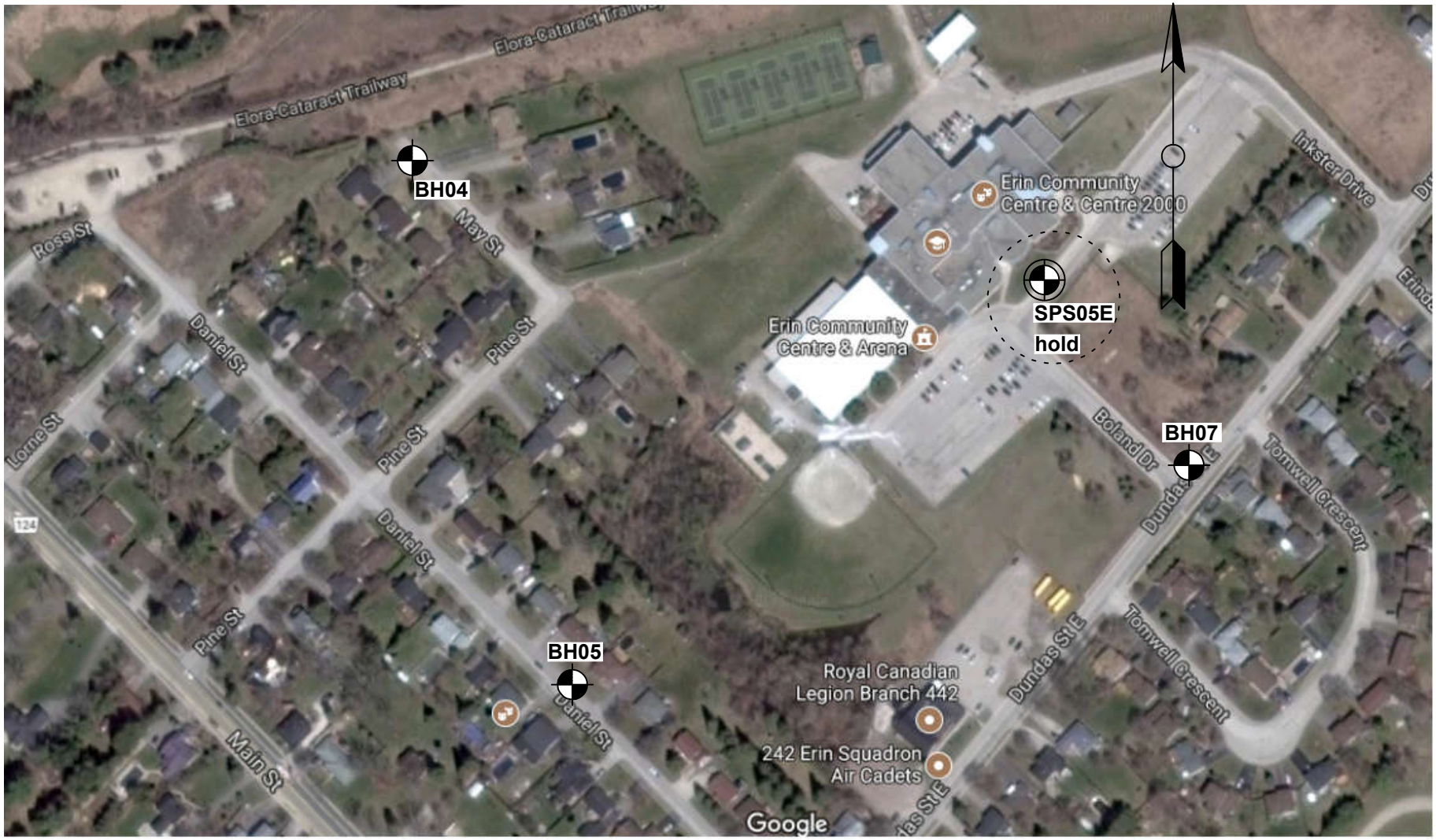
DRAWINGS

Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	Ainley Group			Project No.: 16-1255	Drawing No.: 1
Drawn:	TY	Approved:	DL	Title:	Borehole Location Plan
Date:	November 2017	Scale:	N.T.S.	Project:	Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario
Original Size:	Letter	Rev:	KS		GeoPro Consulting Limited

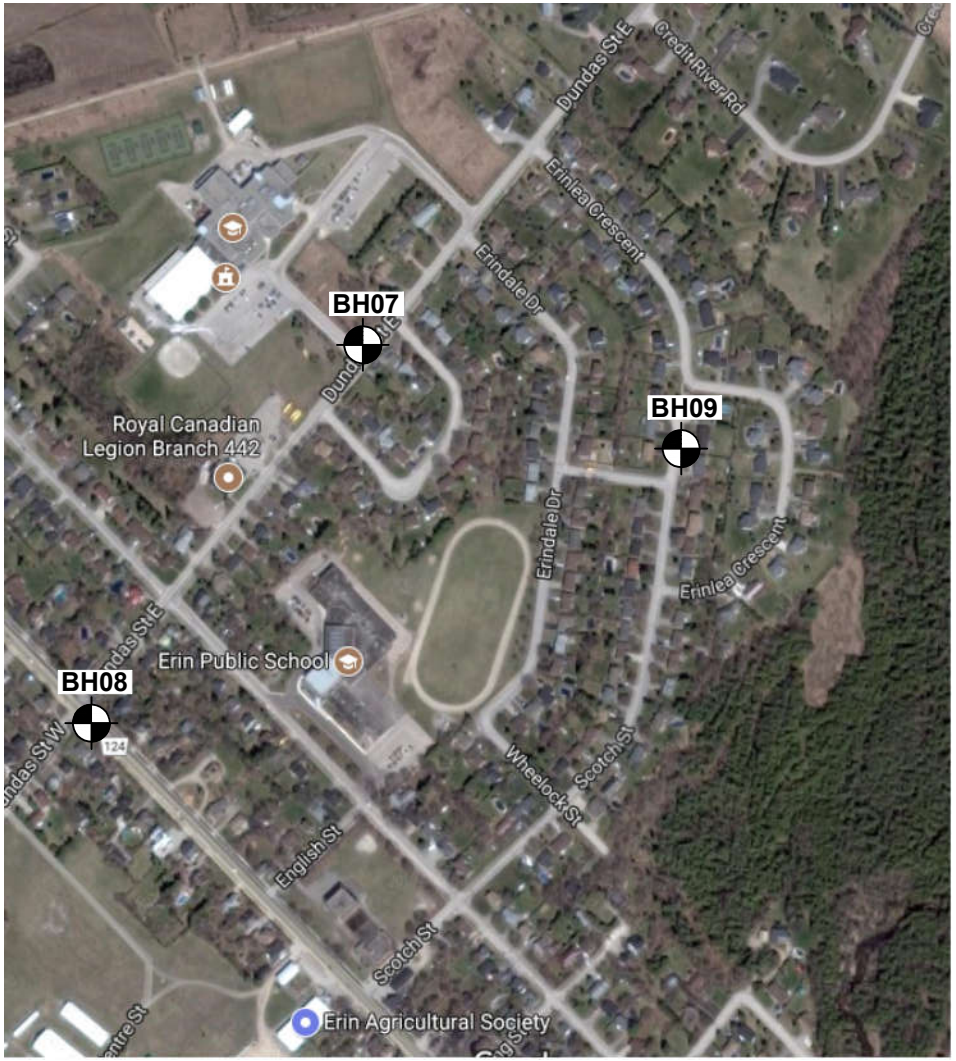


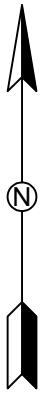
Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **2**
Drawn:	**TY**	Approved:	**DL**	Title:	**Borehole Location Plan**
Date:	**November 2017**	Scale:	**N.T.S.**	Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size:	**Letter**	Rev:	**KS**		*GeoPro* Consulting Limited



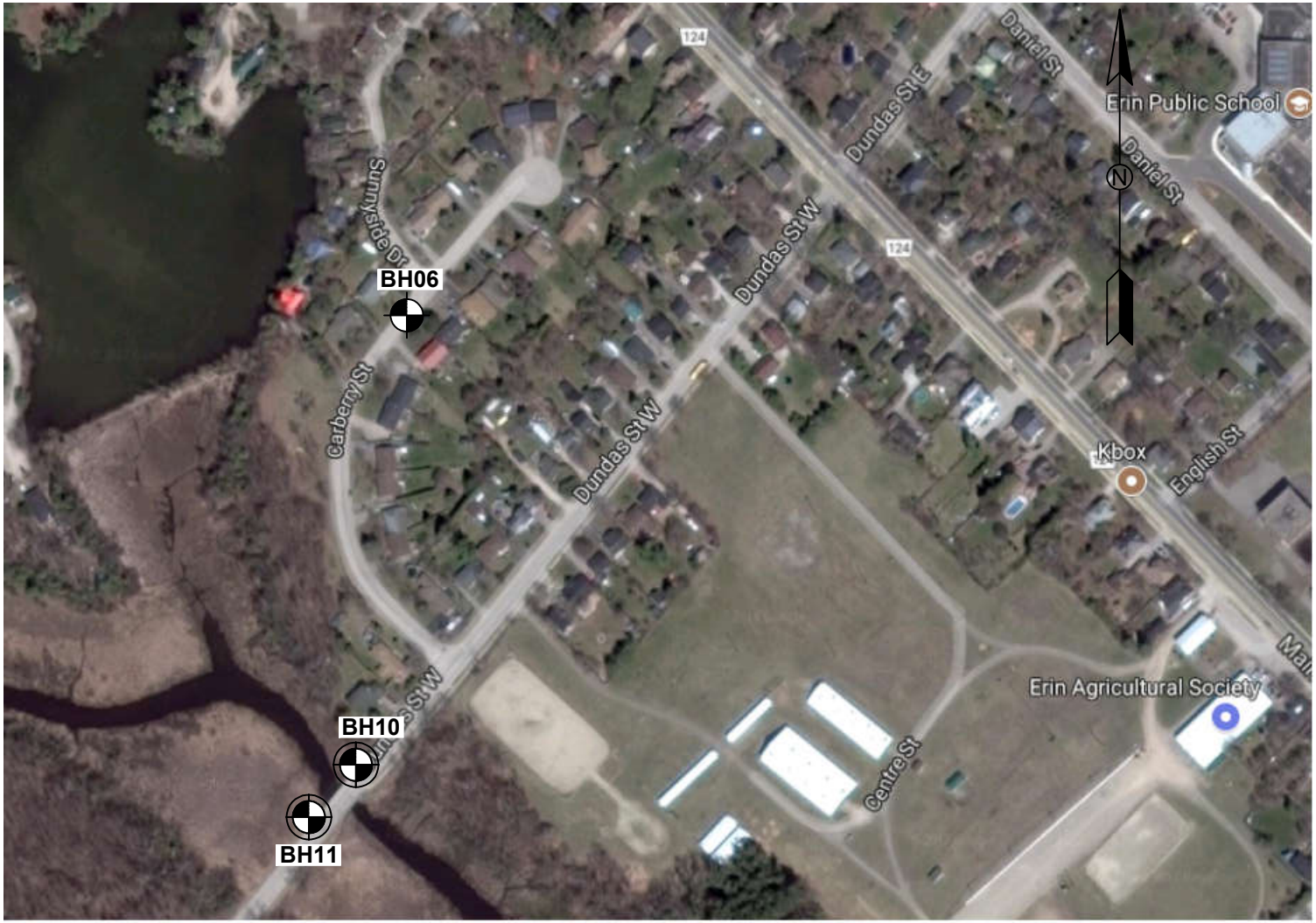


Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **3**
Drawn: **TY**		Approved: **DL**		Title: **Borehole Location Plan**	
Date: **November 2017**		Scale: **N.T.S.**		Project: **Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**	
Original Size: **Letter**		Rev: **KS**		**GeoPro Consulting Limited**	

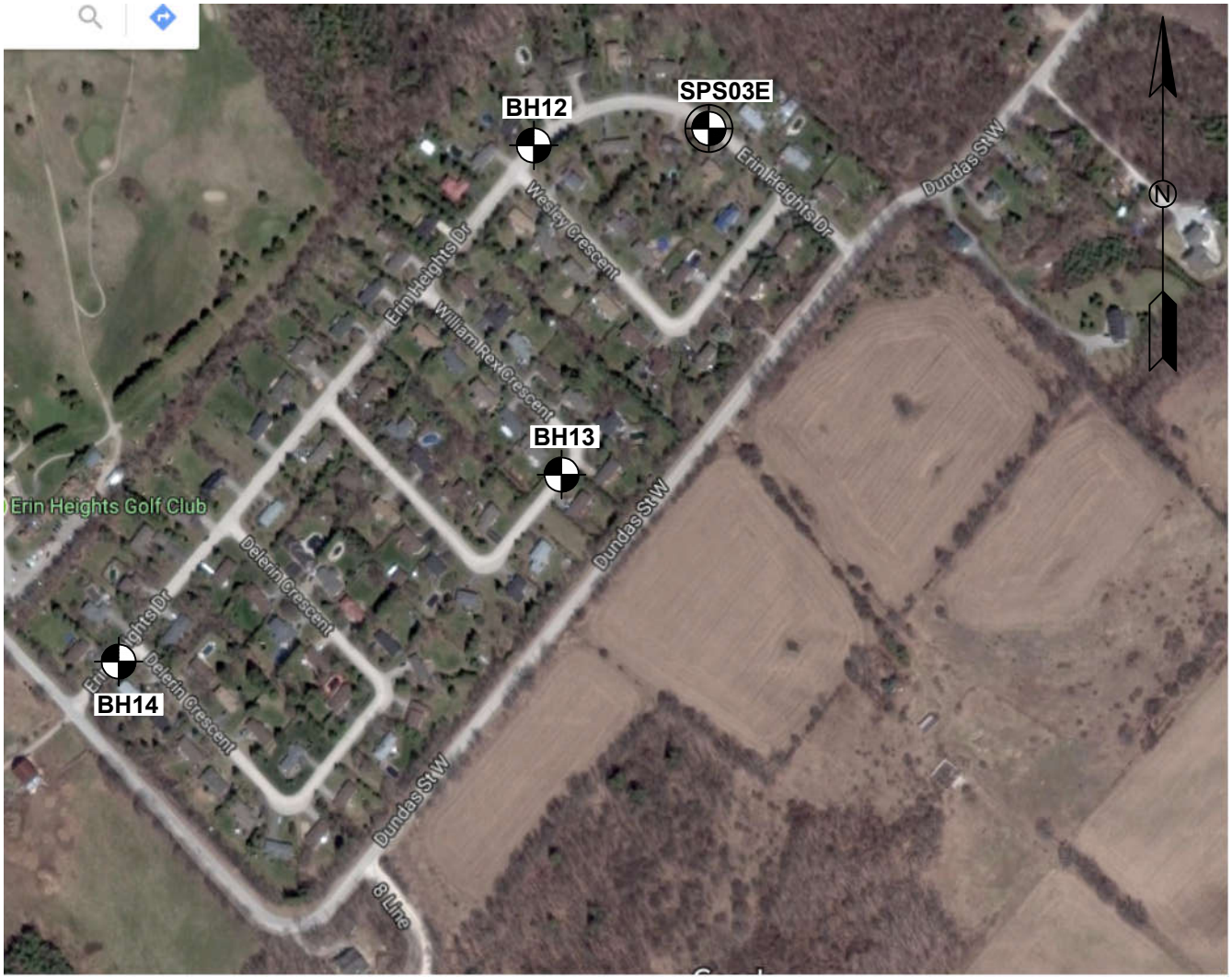


Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **4**
Drawn: **TY**		Approved: **DL**		Title:	**Borehole Location Plan**
Date: **November 2017**		Scale: **N.T.S.**		Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size: **Letter**		Rev: **KS**			*GeoPro* Consulting Limited

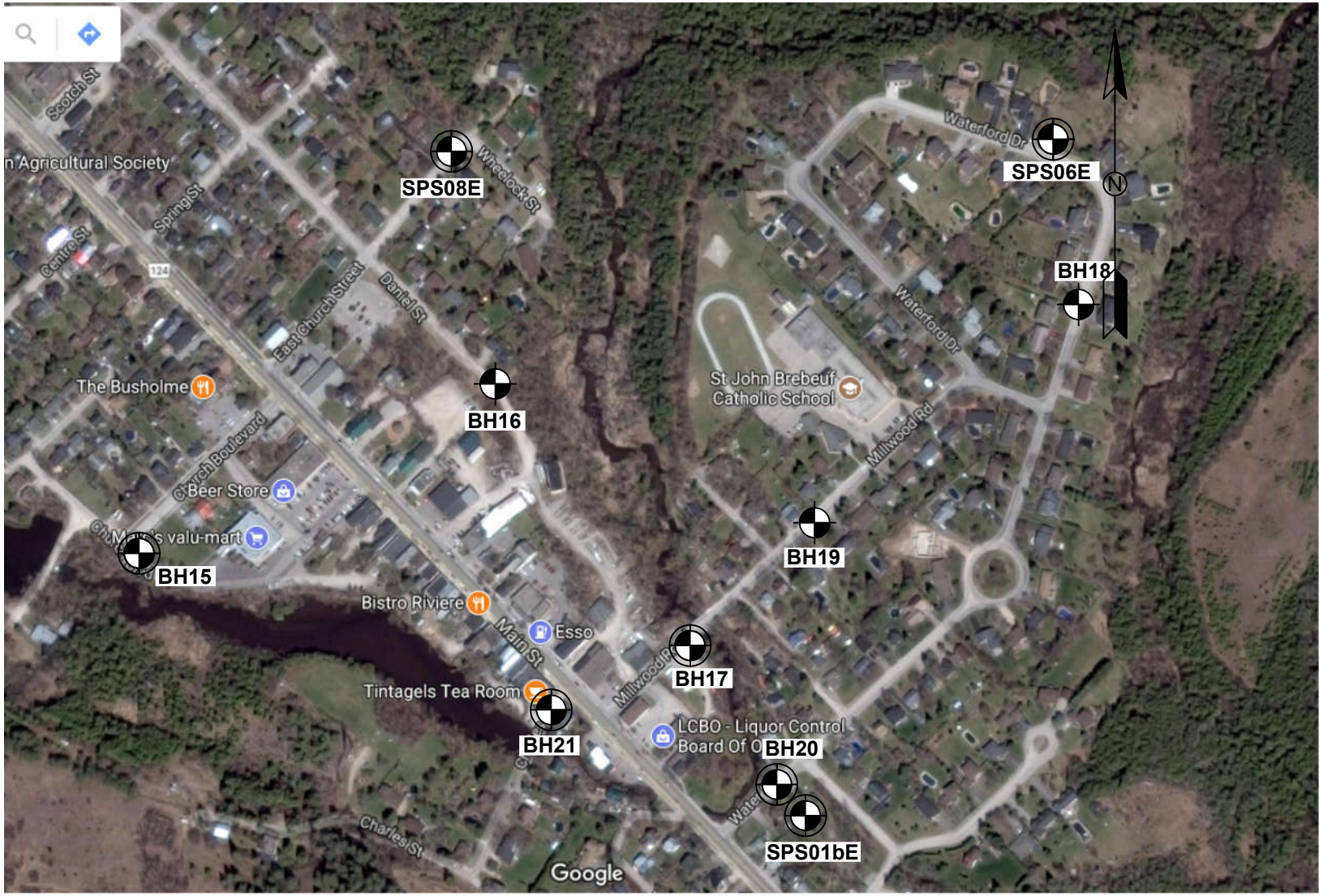


Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	Ainley Group			Project No.: 16-1255	Drawing No.: 5
Drawn:	TY	Approved:	DL	Title:	Borehole Location Plan
Date:	November 2017	Scale:	N.T.S.	Project:	Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario
Original Size:	Letter	Rev:	KS		GeoPro Consulting Limited

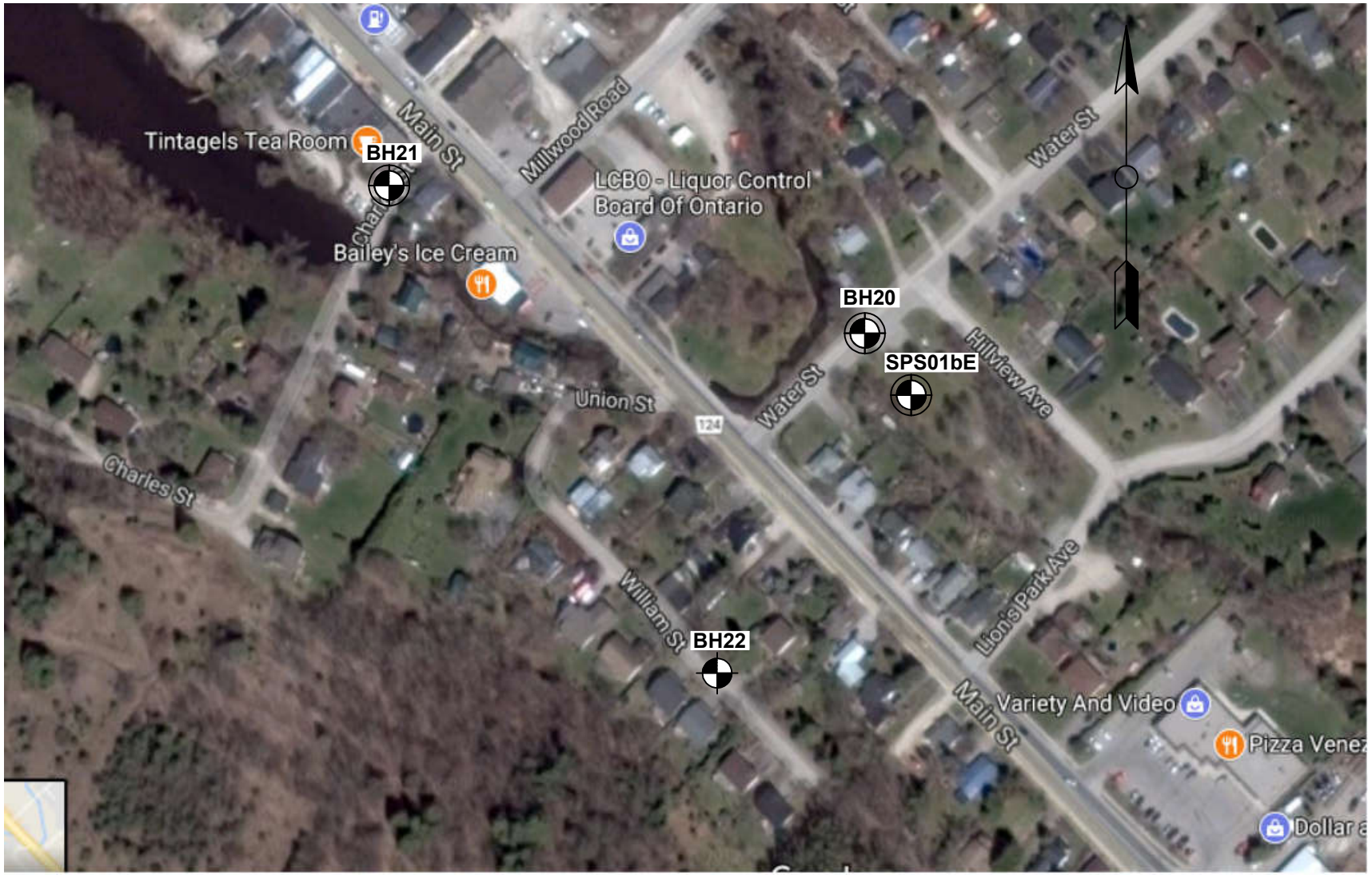


Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	Ainley Group			Project No.: 16-1255	Drawing No.: 6
Drawn:	TY	Approved:	DL	Title:	Borehole Location Plan
Date:	November 2017	Scale:	N.T.S.	Project:	Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario
Original Size:	Letter	Rev:	KS		GeoPro Consulting Limited



Legend:

Borehole Location

Borehole/Monitoring Well Location

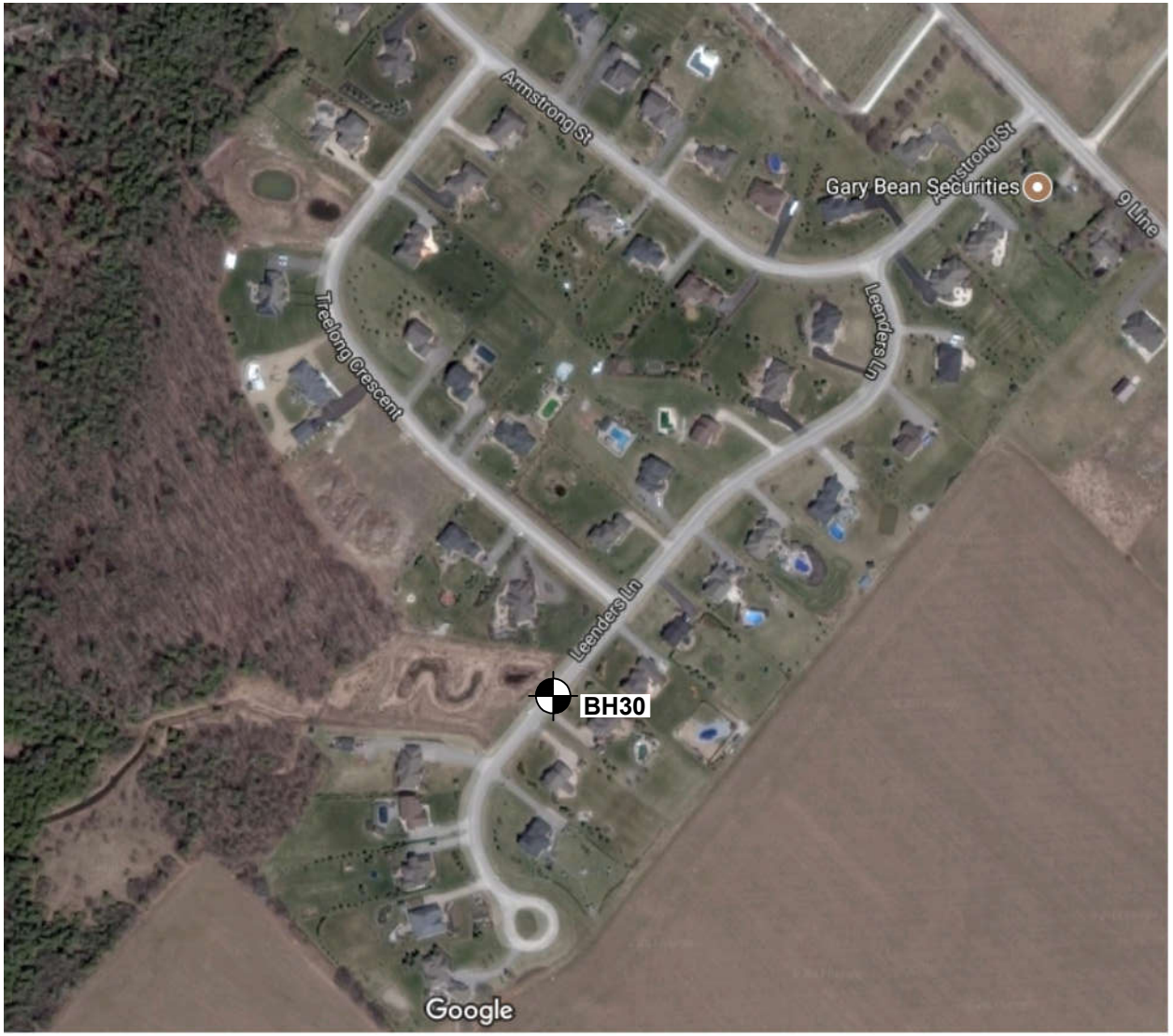
Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **7**
Drawn: **TY**		Approved: **DL**		Title:	**Borehole Location Plan**
Date: **November 2017**		Scale: **N.T.S.**		Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size: **Letter**		Rev: **KS**			*GeoPro* Consulting Limited

Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **8**
Drawn: **TY**		Approved: **DL**		Title:	**Borehole Location Plan**
Date: **November 2017**		Scale: **N.T.S.**		Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size: **Letter**		Rev: **KS**			**GeoPro Consulting Limited**



Legend:

Borehole Location

Borehole/Monitoring Well Location

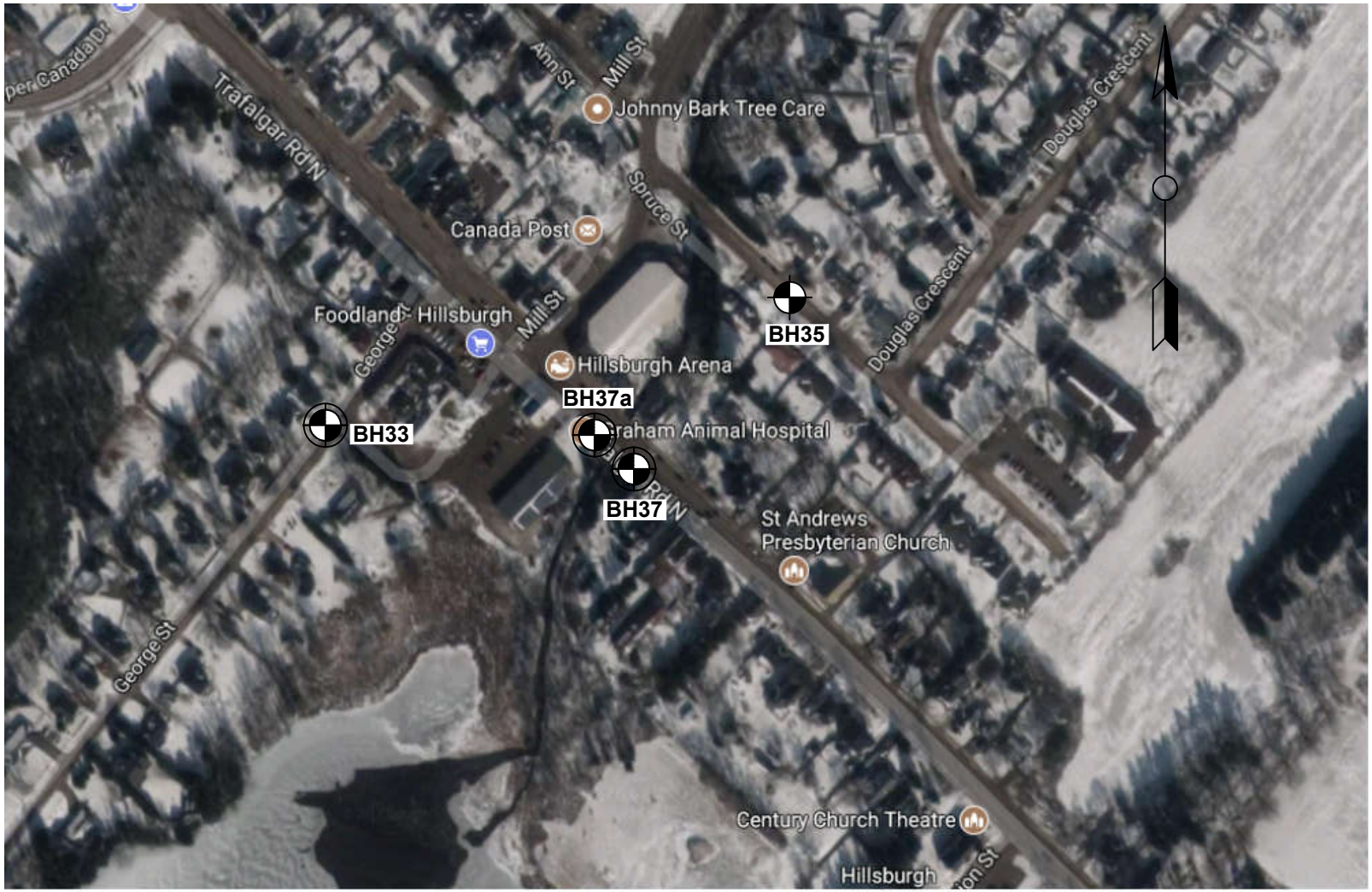
Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **9**
Drawn: **TY**		Approved: **DL**		Title: **Borehole Location Plan**	
Date: **November 2017**		Scale: **N.T.S.**		Project: **Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**	
Original Size: **Letter**		Rev: **KS**		**GeoPro Consulting Limited**	

Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **10**
Drawn:	**TY**	Approved:	**DL**	Title:	**Borehole Location Plan**
Date:	**November 2017**	Scale:	**N.T.S.**	Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size:	**Letter**	Rev:	**KS**		*GeoPro* Consulting Limited

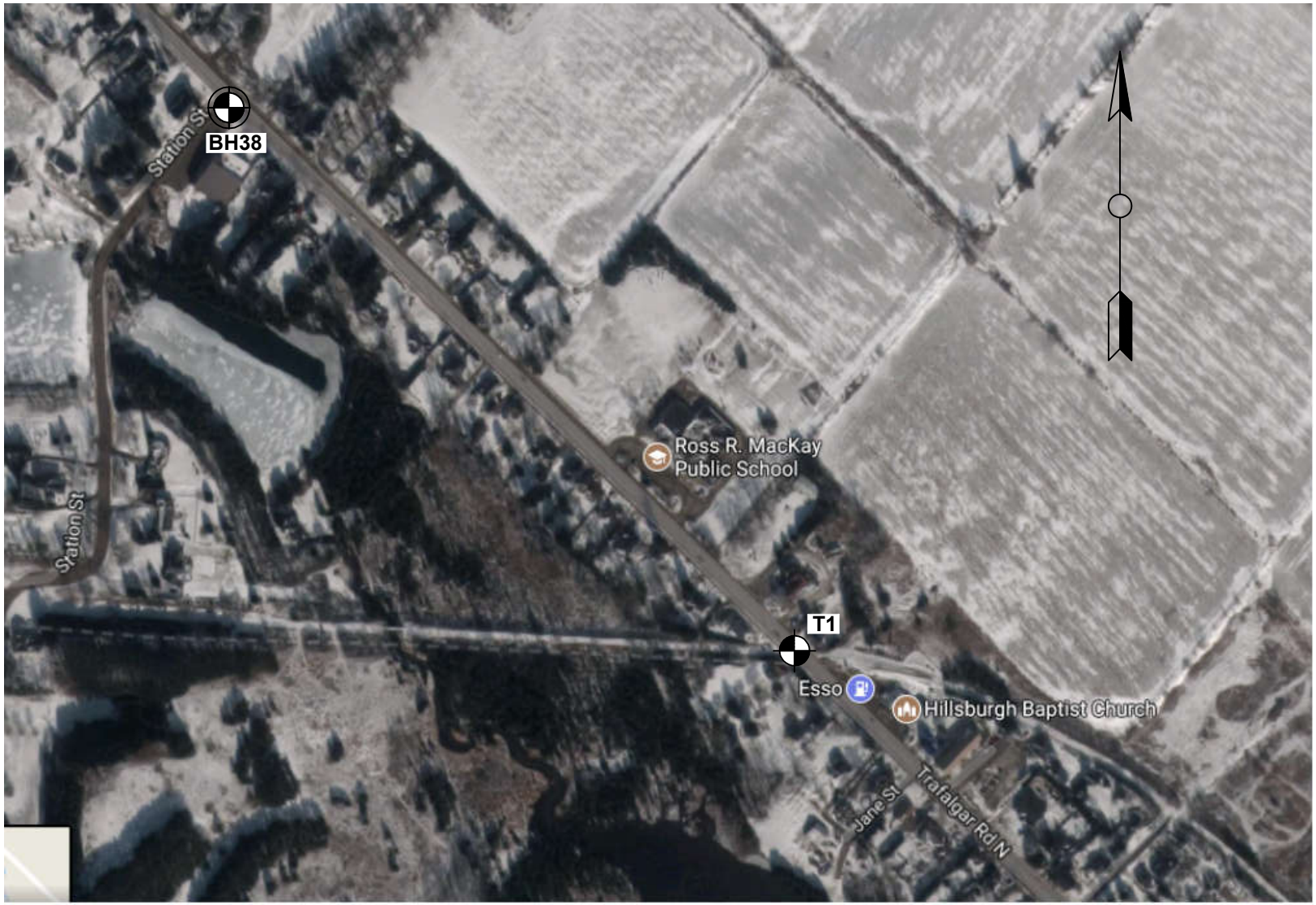


Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **11**
Drawn: **TY**		Approved: **DL**		Title:	**Borehole Location Plan**
Date: **November 2017**		Scale: **N.T.S.**		Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size: **Letter**		Rev: **KS**			*GeoPro* Consulting Limited



Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **12**
Drawn: **TY**		Approved: **DL**		Title:	**Borehole Location Plan**
Date: **November 2017**		Scale: **N.T.S.**		Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size: **Letter**		Rev: **KS**			*GeoPro* Consulting Limited

Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	Ainley Group			Project No.: 16-1255	Drawing No.: 13
Drawn:	TY	Approved:	DL	Title:	Borehole Location Plan
Date:	November 2017	Scale:	N.T.S.	Project:	Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario
Original Size:	Letter	Rev:	KS		GeoPro Consulting Limited

Legend:

Borehole Location

Borehole/Monitoring Well Location

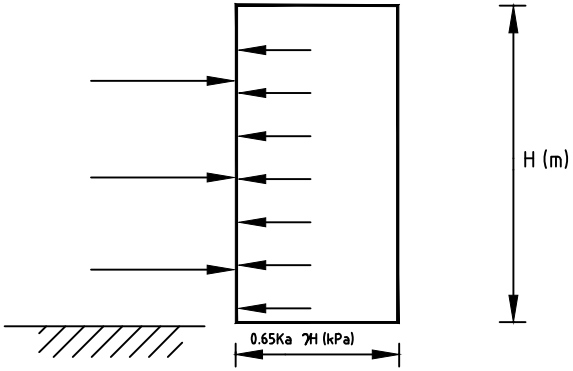
Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **14**
Drawn: **TY**		Approved: **DL**		Title:	**Borehole Location Plan**
Date: **November 2017**		Scale: **N.T.S.**		Project:	**Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**
Original Size: **Letter**		Rev: **KS**			*GeoPro* Consulting Limited

Legend:

Borehole Location

Borehole/Monitoring Well Location

Client:	**Ainley Group**			Project No.: **16-1255**	Drawing No.: **15**
Drawn: **TY**		Approved: **DL**		Title: **Borehole Location Plan**	
Date: **November 2017**		Scale: **N.T.S.**		Project: **Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing Town of Erin, Ontario**	
Original Size: **Letter**		Rev: **KS**		**GeoPro Consulting Limited**	

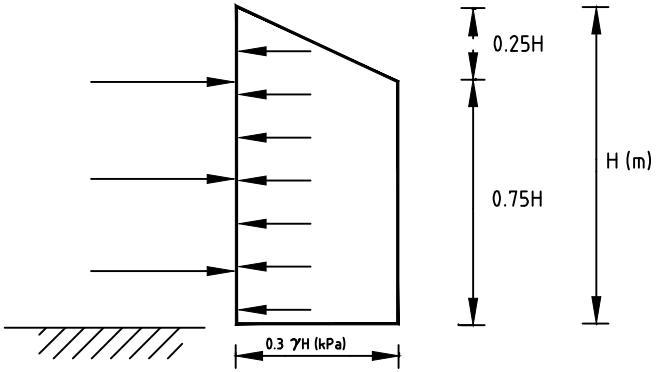


γ = unit weight of soil = 21.0 kN/m ^{3}

γ' = submerged unit weight of soil (i.e. below ground water level)= 11.2 kN/m ^{3}

Ka = 0.3

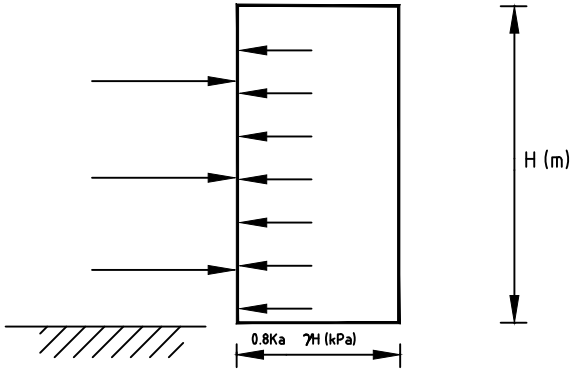
IN COMPACT TO VERY DENSE NON-COHESIVE SOILS (SANDS AND SILTS)



γ = unit weight of soil = 21.5 kN/m ^{3}

γ' = submerged unit weight of soil (i.e. below ground water level)= 11.7 kN/m ^{3}

IN COHESIVE CLAYS OR CLAYEY SOILS

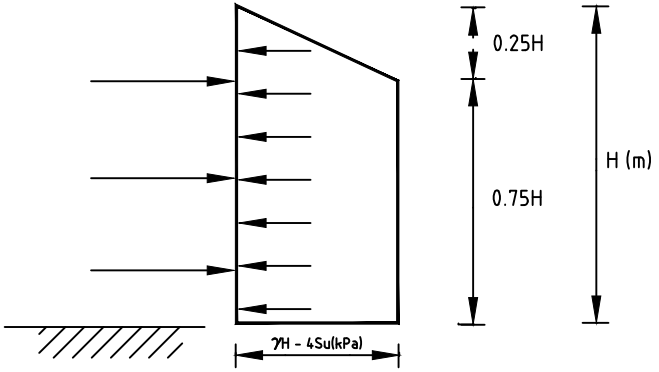


γ = unit weight of soil = 19.0 kN/m ^{3}

γ' = submerged unit weight of soil (i.e. below ground water level)= 9.2 kN/m ^{3}

Ka = 0.36

IN LOOSE OR DISTURBED NON-COHESIVE SOILS (SANDS AND SILTS)



γ = unit weight of soil = 19.0 kN/m^3

γ' = submerged unit weight of soil (i.e. below ground water level)= 9.2 kN/m^3

Su = 10 KPa

IN VERY SOFT TO FIRM COHESIVE CLAYS OR CLAYEY SOILS

Notes:
1. Check system for partial excavation condition.
2. If the free water level is above the base of the excavation, the hydrostatic pressure must be added to the above pressure distribution.
3. If surcharge loadings are present near the excavation, these must be included in the lateral pressure calculation.

Client:	The Municipal Infrastructure Group Ltd.			Project No.: **16-1255**	Drawing No.: **16**
Drawn:	**GH**	Approved:	**JY**	Title: **Earth Pressure Distribution on Temporary Multiple Braced Excavations**	
Date:	**December, 2017**	Scale:	**N.T.S**	Project: Preliminary Geotechnical Investigation Urban Centre Wastewater Servicing, Town of Erin, Ontario	
Original Size:	**Letter**	Rev:	**JY**	GeoPro Consulting Limited	

S:\Projects_Standard Report Drawings\EARTH PRESSURE DISTRIBUTION ON BRACED EXCAVATIONS-Aug-2012.dwg

ENCLOSURES

Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil stratums is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Enclosure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

PM – Samples advanced by manual pressure
WR – Samples advanced by weight of sampler and rod
WH – Samples advanced by static weight of hammer

Dynamic Cone Penetration Resistance, N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Piezo-Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60 degree conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurement of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

Textural Classification of Soils (ASTM D2487)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction

1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Compactness Condition (Formerly Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE BH1

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-14

REF. NO.: 16-1255

ENCL. NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (300 mm)									
0.3	**GRANULAR BASE/SUBBASE:** (230 mm)		1A	AS						
0.5	**FILL:** sandy silt to silty sand, trace clay, trace gravel, brown, moist, compact		1B	AS						
1			2A	SS	24					
1.1	**SANDY GRAVEL:** trace silt, containing cobbles and boulders, brown, moist, compact		2B	SS						
1.4	**SAND AND SILT:** some gravel, trace clay, containing cobbles and boulders, brown, moist, loose		3	SS	7					13 43 37 7
2			4	SS	9					
2.9	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt till, layers/zones of sandy silt till, containing cobbles and boulders, brown, moist, dense		5	SS	46					
4			6	SS	41					
5.0	**END OF BOREHOLE:**									

Note:
1) Borehole caved at a depth of 4.3 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

WATER CONTENT (%): Plastic Limit w_P — Natural Moisture Content w — Liquid Limit w_L; 10 20 30 40

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH2

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: CS | DATE: 2017-11-08

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (SPT / Cone, blows/0.3m) & SHEAR STRENGTH (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (230 mm)									
0.2	**GRANULAR BASE/SUBBASE:** (610 mm)		1	AS						
0.8	**SANDY SILT:** some sand, trace to some clay, trace gravel, dark brown to brown, moist to wet, loose to compact		2A	SS						
			2B	SS	23					
			3	SS	8					
			4	SS	8					
2.9	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace to some clay, brown, moist, compact to dense		5	SS	19					
			6	SS	50					
5.0	**END OF BOREHOLE** Note: 1) Borehole was open and dry upon completion of drilling.									

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH3

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-23

REF. NO.: 16-1255

ENCL. NO.: 4

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**ASPHALT CONCRETE:** (25 mm) **GRANULAR BASE/SUBBASE:** (465 mm)		1A	AS		
0.5	**NO RECOVERY:** likely sandy silt, trace organics		1B	AS		
1			2	AS	7	
1.4	**FILL:** sandy silt to sand and silt, trace clay, trace gravel, brown, moist, loose		3	SS	7	
2						
2.1	**FILL:** sand, some silt, trace gravel, brown, moist, loose		4	SS	4	
3						
2.9	**SAND:** some silt, brown, moist, loose		5	SS	5	
4						
4.0	**GRAVELLY SAND:** some silt, trace clay, containing rock fragments, containging cobbles and boulders, brown, saturated, compact		6	SS	18	
5						
5.0	**END OF BOREHOLE:**					

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 4.1 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit / Natural Moisture Content / Liquid Limit
w_P w w_L
WATER CONTENT (%)
10 20 30 40

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 BH4

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-01

REF. NO.: 16-1255

ENCL. NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (55 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (345 mm)	1A	AS	
0.4	**FILL:** sand, some gravel, trace to some silt, trace clay, brown, moist	1B	AS	
0.8	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist, loose to dense	2	SS	27
		3	SS	18
		4	AS	
		5	SS	5
		6	SS	49
5.0	**END OF BOREHOLE** Note: 1) Borehole was open and dry upon completion of drilling.			

GROUND WATER ELEVATION

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%)
10 20 30 40

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 BH5

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-01

REF. NO.: 16-1255

ENCL. NO.: 6

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**ASPHALT CONCRETE:** (70 mm)					
0.1	**GRANULAR BASE/SUBBASE:** (360 mm)		1A	AS		
0.4	**FILL:** gravelly sand, trace silt, brown, moist, loose		1B	AS		
1			2	SS	7	
1.4	**SAND:** some gravel, trace silt, brown, moist, compact		3	SS	13	
2			4	AS		
2.9	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, containing cobbles and boulders, brown, moist, dense to very dense		5	SS	31	
4						
			6	SS	68	
5						
5.0	**END OF BOREHOLE**					

Note:
1) Borehole caved at a depth of 2.7 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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

01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:03

LOG OF BOREHOLE BH6

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-09

REF. NO.: 16-1255

ENCL. NO.: 7

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (○ SPT, ≳ Cone, blows/0.3m) / SHEAR STRENGTH (kPa) (● Unconfined, ▲ Quick Triaxial, ✕ Field Vane & Sensitivity, ⊠ Penetrometer, + Lab Vane)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (80 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (680 mm)		1	AS						
0.8	**GRAVELLY SAND:** some silt, trace clay, containing cobbles and boudlers, brown, moist, dense		2	SS	44					
1.4	**SAND:** some gravel to gravelly, some silt, trace clay, brown, moist, compact		3	SS	26					
2.1	**SAND AND GRAVEL TO GRAVELLY SAND:** some silt, trace clay, containing cobbles and boulders, brown to grey, moist to wet, compact to dense		4	SS	42					
	--- wet		5	SS	35					
	--- grey, layers/zones of sand		6	SS	14					
5.0	**END OF BOREHOLE**									

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.1 mBGS upon completion of drilling.
3) Borehole caved at a depth of 2.1 below ground surface upon completion of drilling.

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

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

LOG OF BOREHOLE BH7

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: CS

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-08

REF. NO.: 16-1255

ENCL. NO.: 8

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**ASPHALT CONCRETE:** (110 mm)					
0.1	**GRANULAR SUBBASE/BASE:** (610 mm)		1A	AS		
0.7	**FILL:** sandy silt, trace clay, trace gravel, layers of silty sand, brown, moist, compact		1B	AS		
1			2	SS	16	
1.4	**SANDY SILT:** trace to some clay, trace gravel, some organics, dark brown, moist, loose		3	SS	6	
2						
2.1	**SAND AND GRAVEL:** trace to some silt, containing cobbles and boulders, brown, moist, dense		4	SS	32	
3						
2.9	**SAND:** trace to some silt, trace to some gravel, brown, moist, compact		5	SS	13	
4						
4.0	**SAND AND GRAVEL:** trace to some silt, containing cobbles and boulders, brown, moist, dense		6	SS	50	
5						
5.0	**END OF BOREHOLE**					

Note:
1) Borehole was open and dry upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 BH8

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-21

REF. NO.: 16-1255

ENCL. NO.: 9

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**ASPHALT CONCRETE:** (150 mm)					
0.2	**GRANULAR BASE/SUBBASE:** (430mm)		1A	AS		
0.6	**FILL:** silty sand, some gravel, containing cobbles, brown, moist, compact		1B	AS		
			2	SS	19	
			3	SS	13	
2.1	**GRAVELLY SAND TO SAND AND GRAVEL:** trace silt, containing rock fragments, containing cobbles and boulders, brown, moist, compact to very dense		4	SS	41	
			5	SS	54	
			6	SS	17	
5.0	**END OF BOREHOLE:** Note: 1) Borehole caved at a depth of 2.1 m below ground surface (mBGS) upon completion of drilling.					

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 BH9

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-09

REF. NO.: 16-1255

ENCL. NO.: 10

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	"N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (○ SPT, ≈ Cone, blows/0.3m) / SHEAR STRENGTH (kPa) (● Unconfined, ▲ Quick Triaxial, ✕ Field Vane & Sensitivity, ⊠ Penetrometer, + Lab Vane)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (90 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (690 mm)		1	AS						
0.8	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace clay, containing cobbles and boulders, brown, moist, compact to very dense		2A / 2B	SS	18		○ at 18	○ at 18		
1			3	SS	50 / 130 mm		> >100	○ ○		
2			4	SS	36		○ at 36	○ at 36		
3			5	SS	49		○ at 49	○ at 49		
4	--- auger grinding		6	SS	96 / 255 mm		> >100	○ ○		
5.0	**END OF BOREHOLE** Note: 1) Borehole caved at a depth of 3.2 m below ground surface (mBGS) upon completion of drilling.									

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH10

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-08

REF. NO.: 16-1255

ENCL. NO.: 11

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
0.0	**ASPHALT CONCRETE:** (95 mm)				Concrete	
0.1	**GRANULAR BASE/SUBBASE:** (695 mm)	1	AS			
0.8	**GRAVELLY SAND:** some silt, trace clay, containging cobbles and boulders, brown, moist to wet, loose to compact	2	SS	13	Bentonite; 1.2mBGS Dec 05	
		3	SS	6	Sand	
2.1	**SAND:** some silt, trace gravel, brown, saturated, very loose to compact	4	SS	3		
		5	SS	12	Screen	
		6	SS	9	Natural pack	
5.0	**END OF BOREHOLE**					

Notes:
1) Water encountered at a depth of 0.8 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.4 mBGS upon completion of driling.
3) Borehole caved at a depth of 3.4 mBGS upon completion of driling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	1.22

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

WATER CONTENT (%): Plastic Limit (w_P) — Natural Moisture Content (w) — Liquid Limit (w_L); 10 20 30 40

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 BH11

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-08

REF. NO.: 16-1255

ENCL. NO.: 12

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (125 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (645 mm)	1	AS		
0.8	**SANDY SILT:** some sand, some organics, dark brown, moist, compact	2A	SS	11	
1.1	**SILTY SAND:** trace clay, some organics, some rootlets, brown, moist, loose to compact	2B	SS		
		3	SS	7	
2.1	**PEAT:** black, moist, very loose to loose	4	SS	2	
		5	SS	4	
4.0	**SAND AND GRAVEL:** trace to some silt, trace clay, grey, wet, compact	6	SS	11	
5.0	**END OF BOREHOLE**				

Concrete

Bentonite

1.1mBGS Dec 05

Sand

Screen

Natural pack

Notes:
1) Water encountered at a depth of 0.8 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 1.8 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.0 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	1.08

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit, Natural Moisture Content, Liquid Limit; w_P, w, w_L

WATER CONTENT (%): 10, 20, 30, 40

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 BH12

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-10-31

REF. NO.: 16-1255

ENCL. NO.: 13

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**ASPHALT CONCRETE:** (100 mm)					
0.1	**GRANULAR BASE/SUBBASE:** (360 mm)		1A	AS		
0.5	**FILL:** gravelly sand, some silt to silty, trace clay, brown, moist, loose		1B	AS		
1			2	SS	9	
1.4	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, brown, moist, compact		3	SS	15	
2			4	AS		
3			5	SS	24	
4						
5			6	SS	15	
5.0	**END OF BOREHOLE**					

Note:
1) Borehole caved at a depth of 3.7 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m^3)

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 BH13

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: GH | DATE: 2017-10-31

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 14

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (○ SPT, ≳ Cone, blows/0.3m) / SHEAR STRENGTH (kPa) (● Unconfined, ▲ Quick Triaxial, ✕ Field Vane & Sensitivity, ⊠ Penetrometer, + Lab Vane)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (75 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (315 mm)		1A	AS						
0.4	**FILL:** sandy silt, trace to some clay, trace gravel, containing rock fragments, containing cobbles, compact		1B	AS						
1			2	SS	14					
1.4	**FILL:** silty sand, trace to some gravel, trace clay, pockets of clayey silt, brown, moist, loose		3	SS	8					
2			4	AS						
2.9	**SAND AND SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, dense to very dense		5	SS	48					
4										
5			6	SS	74					
5.0	**END OF BOREHOLE** Note: 1) Borehole was open and dry upon completion of drilling.									

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH14

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-10-31

REF. NO.: 16-1255

ENCL. NO.: 15

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (100 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (360 mm)		1A	AS						
0.5	**FILL:** silty sand, some gravel, trace clay, brown, moist		1B	AS						
0.8	**FILL:** gravelly sand, some silt to silty, containing rock fragments, brown, moist, dense		2	SS	42					
1.4	**FILL:** silty sand, trace clay, trace gravel, brown, moist, very loose		3	SS	2					
			4	AS						
2.9	**SAND AND SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense		5	SS	65					
			6	SS	50 / 75 (mm)		> >100			
4.8	**END OF BOREHOLE**									

Note:
1) Borehole was open and dry upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH15

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-17

REF. NO.: 16-1255

ENCL. NO.: 16

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
0.0	**ASPHALT CONCRETE:** (95 mm)				Concrete	
0.1	**GRANULAR BASE/SUBBASE:** (665 mm)	1	AS			
0.8	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, containing cobbles and boulders, moist to wet, compact to very dense	2	SS	19	Bentonite	
	--- auger grinding	3	SS	63		
		4	SS	36	Sand	
	--- wet	5	SS	39		
	--- auger grinding				Screen	
		6	SS	61	Natural pack	
5.0	**END OF BOREHOLE**					

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 4.4 mBGS upon completion of driling.
3) Borehole caved at a depth of 4.4 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 15, 2017	dry

DYNAMIC PENETRATION TEST: SPT / Cone, blows/0.3m; SHEAR STRENGTH (kPa): Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane

Plastic Limit, Natural Moisture Content, Liquid Limit; WATER CONTENT (%)

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS

Measurement: 1st, 2nd, 3rd, 4th

GRAPH NOTES: Numbers refer to Sensitivity; Strain at Failure

LOG OF BOREHOLE BH16

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-23

REF. NO.: 16-1255

ENCL. NO.: 17

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0 / 0.1	**ASPHALT CONCRETE:** (60 mm) **GRANULAR BASE/SUBBASE:** (440 mm)		1A	AS						
0.5	**FILL:** gravelly sand, trace clay, trace silt, brown, moist, loose to compact		1B	AS						
1			2	SS	10					
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, containing rock fragments, containing cobbles and boulders, brown, moist, dense		3	SS	31					
2	---auger grinding									
3			4	SS	47					
4										
5			5	SS	42					
5.0	**END OF BOREHOLE**									

Note:
1) Borehole caved at a depth of 2.9 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20 40 60 80

WATER CONTENT (%): Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L); 10 20 30 40

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH17

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-23

REF. NO.: 16-1255

ENCL. NO.: 18

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (125 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (325 mm)	1A	AS		
		1B	AS		
0.5	**FILL:** sand and silt to silty sand, trace to some clay, trace gravel, brown, moist to wet, loose to compact	2	SS	29	
		3	SS	13	
	--- wet	4	SS	6	
2.9	**ORGANIC SILT:** some sand, trace clay, containing cobbles and boulders, black, moist, loose to compact	5	SS	10	
4.0	**GRAVELLY SAND:** trace clay, trace silt, containing rock fragments, brown, saturated, compact	6	SS	27	
5.0	**END OF BOREHOLE**				

Concrete

Bentonite

2.7mBGS Dec 11
Sand

Screen

Natural pack

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 11, 2017	2.69

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P — Natural Moisture Content w — Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 BH18

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER:

SAMPLE REVIEW:

CHECKED:

DIAMETER: 205 mm

DATE: 2017-11-23

REF. NO.: 16-1255

ENCL. NO.: 19

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST: SPT / Cone blows/0.3m; SHEAR STRENGTH (kPa): Unconfined, Quick Triaxial, Field Vane & Sensitivity, Penetrometer, Lab Vane	Plastic Limit / Natural Moisture Content / Liquid Limit; WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (120 mm)										
0.1	**GRANULAR BASE/SUBBASE:** (400 mm)		1A	AS							
0.5	**FILL:** gravelly sand, some silt, trace clay, brown, moist, compact		1B	AS							
1			2	SS	21						
1.4	**FILL:** sandy silt to sand and silt, trace clay, trace gravel, containing cobbles, brown, moist to wet, loose to very dense		3	SS	6						
2			4	SS	50 / 145 mm			> >100			
2.9	**NO RECOVERY:** likely sand and gravel, very dense --- auger grinding		5	SS	50 / 75 mm			> >100			
4											
4.0	**GRAVELLY SAND:** some silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, moist, very dense		6	SS	50 / 100 mm			> >100			
4.7	**END OF BOREHOLE**										

Note:
1) Borehole caved at a depth of 3.8 m below ground surface (mBGS) upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH19

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-13

REF. NO.: 16-1255

ENCL. NO.: 20

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (○ SPT, ≳ Cone, blows/0.3m) / SHEAR STRENGTH (kPa) (● Unconfined, ▲ Quick Triaxial, ✕ Field Vane & Sensitivity, ⊠ Penetrometer, + Lab Vane)	WATER CONTENT (%) (Plastic Limit w_P, Natural Moisture Content w, Liquid Limit w_L)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (85 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (545 mm)		1A	AS						
0.6	**FILL:** gravelly sand, trace to some silt, brown, moist, compact		1B	AS						
1			2	SS	24		○	○		
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, containing rock fragments, containing cobbles and boulders, dense to very dense									
2			3	SS	46		○	○		
			4	SS	53		○	○		
2.9	**NO RECOVERY DUE TO COBBLES:** likely sand and gravel, very dense --- auger grinding		5	SS	50 / 100 mm		> >100 ○	○		
3.9	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, containing rock fragments, containing cobbles and boulders, dense									
5			6	SS	32		○	○		
5.0	**END OF BOREHOLE:** Note: 1) Borehole caved at a depth of 4.0 m below ground surface (mBGS) upon completion of drilling.									

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH20

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-13

REF. NO.: 16-1255

ENCL. NO.: 21

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (95 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (625 mm)	1A	AS	
0.7	**FILL:** silty sand, some gravel, trace clay, trace organics, dark brown, moist, compact	1B	AS	
		2	SS	20
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, layers/zones of sand, containing rock fragments, containing cobbles and boulders, brown, wet, dense to very dense	3	SS	41
		4	SS	46
	--- layers of sand	5	SS	61
4.0	**SANDY SILT TILL:** trace to some clay, trace gravel, containing cobbles and boulders, grey, moist, dense	6	SS	47
5.0	**END OF BOREHOLE**			

Concrete

1.2mBGS Dec 17

Bentonite

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST: ○ SPT, ≈ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20 40 60 80

Plastic Limit, Natural Moisture Content, Liquid Limit (w_P, w, w_L)

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.7 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	1.19

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH21

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-14

REF. NO.: 16-1255

ENCL. NO.: 22

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (95 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (465 mm)		1A	AS						
0.6	**FILL:** gravelly sand to sand and gravel, some silt, trace clay, dark brown, moist to wet, compact to very dense		1B	AS						
1			2	SS	19					
	--- wet		3	SS	13					
2										
	--- auger grinding		4	SS	50 / 130 mm					
3										
3.0	~~**PROBABLE BEDROCK:**~~		5	SS	50 / 25 mm					
3.1	dolostone, brown									
	END OF BOREHOLE DUE TO AUGER REFUSAL ON PROBABLE BEDROCK									

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 1.5 mBGS upon completion of drilling.
3) Borehole caved at a depth of 1.5 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

WATER CONTENT (%): Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L); 10, 20, 30, 40

GROUNDWATER ELEVATIONS

Measurement: 1st, 2nd, 3rd, 4th

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

LOG OF BOREHOLE BH22

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-01

REF. NO.: 16-1255

ENCL. NO.: 23

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (45 mm)	1A	AS	
0.1	**GRANULAR BASE/SUBBASE:** (205 mm)			
0.3	**FILL:** gravelly sand, trace to some silt, trace clay, brown, moist, compact	1B	AS	
		2	SS	17
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, containing cobbles and boulders, brown, wet, compact to very dense	3	SS	22
		4	AS	
	--- auger grinding	5	SS	93 / 230 mm
4.6	**END OF BOREHOLE**	6	SS	50 / 25 mm

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 1.5 mBGS upon completion of drilling.
3) Borehole caved at a depth of 2.1 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit, Natural Moisture Content, Liquid Limit; w_P, w, w_L

WATER CONTENT (%): 10, 20, 30, 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

> >100

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH23

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155m

DATE: 2017-11-23

REF. NO.: 16-1255

ENCL. NO.: 24

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (170 mm)				Concrete
0.2	**GRANULAR BASE/SUBBASE:** (400 mm)	1A	AS		
0.6	**FILL:** sand to silty sand, trace gravel, trace organics, trace roolets, pockets of sandy silt, brown to grey, moist, loose to compact	1B	AS		
		2	SS	7	1.2mBGS Dec 17
					Bentonite
	--- grey	3	SS	8	
		4	SS	14	
2.9	**SAND:** trace to some silt, trace to some gravel, containing rock fragments, grey, wet, dense	5	SS	40	Sand
					Screen
		6A	SS		
4.7	**SANDY GRAVEL:** some silt, containing cobbles and boulders, brown, saturated, dense	6B	SS	38	Natural Pack
5.0	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	1.15

DYNAMIC PENETRATION TEST: SPT / Cone, blows/0.3m; SHEAR STRENGTH (kPa): Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane

WATER CONTENT (%): Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L)

UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
7	79	14	

GROUNDWATER ELEVATIONS

Measurement: 1st, 2nd, 3rd, 4th

GRAPH NOTES: Numbers refer to Sensitivity; Strain at Failure

LOG OF BOREHOLE BH24

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-15

REF. NO.: 16-1255

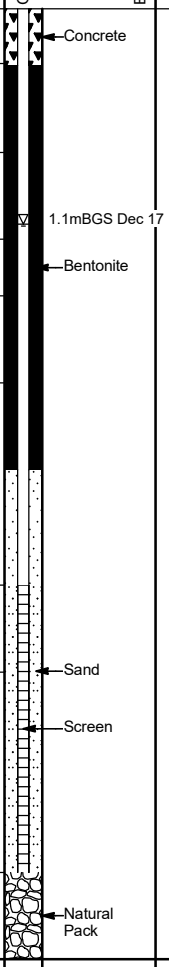
ENCL. NO.: 25

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (290 mm)			
0.3	**GRANULAR BASE/SUBBASE:** (400 mm)	1A	AS	
0.7	**FILL:** sandy silt to silty sand, trace clay, trace gravel, trace organics, dark brown, moist, very dense	1B	AS	
		2	SS	54
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace clay, grey, wet, very dense	3	SS	54
		5	SS	62
		6	SS	51
5.0	**END OF BOREHOLE**			

Note:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 4.3 mBGS upon completion of drilling.
3) Borehole caved at a depth of 4.3 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	1.14



DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 BH25

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-01

REF. NO.: 16-1255

ENCL. NO.: 26

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (80 mm)					
0.1	**GRANULAR BASE/SUBBASE:** (340 mm)	1A	AS			
0.4	**FILL:** silty sand, some gravel, trace clay, brown, moist	1B	AS			
0.8	**GRAVELLY SAND:** trace to some silt, trace clay, containing cobbles and boulders, brown, moist, compact to dense	2	SS	25		38 48 12 2
		3	SS	21		
		4	AS			
		5	SS	39		
4.0	**SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, wet, compact	6	SS	26		
5.0	**END OF BOREHOLE**					

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 4.0 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≈ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20 40 60 80

Plastic Limit (w_P) — Natural Moisture Content (w) — Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

GROUNDWATER ELEVATIONS

Measurement: 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH26

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-15

REF. NO.: 16-1255

ENCL. NO.: 27

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST (SPT / Cone, blows/0.3m) & SHEAR STRENGTH (kPa)	WATER CONTENT (%) (Plastic Limit, Natural Moisture Content, Liquid Limit)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (160 mm)										
0.2	**GRANULAR BASE/SUBBASE:** (500 mm)		1A	AS							
0.7	**FILL:** silty sand, trace to some gravel, brown, moist, dense		1B	AS							
1			2	SS	35						
1.4	**SAND:** trace silt, trace gravel, brown, moist, compact		3	SS	16						
2			4	SS	12						
3			5	SS	12						
4											
4.0	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, brown, moist, dense		6	SS	38						
5											
5.0	**END OF BOREHOLE** Note: 1) Borehole caved at a depth of 4.4 m below ground surface (mBGS) upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH27

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-15

REF. NO.: 16-1255

ENCL. NO.: 28

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**ASPHALT CONCRETE:** (195 mm)					
0.2	**GRANULAR BASE/SUBBASE:** (485 mm)		1A	AS		
0.7	**FILL:** gravelly sand, some silt, containing cobbles and boulders, brown, moist, compact to dense		1B	AS		
1			2	SS	30	
			3	SS	19	
2						
2.1	**SAND:** trace to some gravel, trace silt, containing cobbles and boulders, brown, moist, compact		4	SS	14	
3						
			5	SS	12	
4						
4.0	**GRAVELLY SAND:** trace silt, containing rock fragments, containing cobbles and boulders, brown, moist, compact to dense					
			6	SS	30	
5						
5.0	**END OF BOREHOLE**					

Note:
1) Borehole caved at a depth of 2.7 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 BH28

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-15

REF. NO.: 16-1255

ENCL. NO.: 29

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (255 mm)									
0.3	**GRANULAR BASE/SUBBASE:** (365 mm)		1A	AS						
0.6	**FILL:** sandy silt to silty sand, trace clay, trace gravel, trace organics, dark brown to brown, moist, very loose to loose		1B	AS						
1			2	SS	5					
2	---brown		3	SS	3					
2.1	**GRAVELLY SAND TO SANDY GRAVEL:** trace silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to dense		4	SS	47					
3	--- auger grinding, wet		5	SS	15					57 34 9
4										
5			6	SS	41					
5.0	**END OF BOREHOLE**									

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 2.0 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≈ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit, Natural Moisture Content, Liquid Limit; w_P, w, w_L

WATER CONTENT (%): 10, 20, 30, 40

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 BH29

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-10-31

REF. NO.: 16-1255

ENCL. NO.: 30

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (100 mm)									
0.1	**GRANULAR BASE/SUBBASE:** (400 mm)		1A	AS						
0.5	**FILL:** sandy silt, some clay, trace gravel, brown, moist		1B	AS						
0.8	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some clay, trace to some silt, containing cobbles and boulders, brown, moist to wet, compact to dense		2	SS	24					
			3	SS	38					
	--- wet		4	SS	19					
			5	SS	35					
			6	SS	23					
5.0	**END OF BOREHOLE**									

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.9 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.7 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≈ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

WATER CONTENT (%): Plastic Limit w_P, Natural Moisture Content w, Liquid Limit w_L; 10, 20, 30, 40

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 BH30

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: KL | DATE: 2017-11-13

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 31

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (115 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (665 mm)	1	AS	
0.8	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, containing cobbles and boulders, brown, moist, dense to very dense	2A	SS	
		2B	SS	48
		3	SS	65
2.1	**SAND:** trace silt, trace gravel, brown, wet, compact	4A	SS	26
2.6	**GRAVELLY SAND:** trace to some silt, containing rock fragments, containing cobbles and boulders, brown, wet, compact	4B	SS	
		5	SS	19
4.0	**SAND:** trace silt, trace gravel, brown, wet, compact	6A	SS	28
4.9	**SAND AND GRAVEL:** trace silt, containing cobbles and boulders, brown, wet, compact	6B	SS	
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.3 mBGS upon completion of drilling.
3) Borehole caved at a depth of 2.3 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%) (10, 20, 30, 40)

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 BH31

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-02

REF. NO.: 16-1255

ENCL. NO.: 32

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (85 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (565 mm)	1A	AS	
0.7	**FILL:** gravelly sand, trace clay, trace silt, brown, moist, compact	1B	AS	
1		2	SS	24
1.4	**FILL:** silty sand, trace to some gravel, trace clay, containing cobbles, brown, moist, dense	3A	SS	34
1.8	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, dark brown, moist to wet, dense	3B	SS	
2				
2.7	**SILTY SAND:** trace clay, trace gravel, layers of silty sand, pockets of sand, brown, moist, compact	5	SS	22
3				
4				
4.0	**SAND:** trace silt, trace gravel, brown, moist, very dense	6	SS	71
5				
5.0	**END OF BOREHOLE** Note: 1) Borehole was open and dry upon completion of drilling.			

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit, Natural Moisture Content, Liquid Limit; w_P, w, w_L

WATER CONTENT (%): 10, 20, 30, 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
4	61	30	5

GROUNDWATER ELEVATIONS

Measurement: 1st, 2nd, 3rd, 4th

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

LOG OF BOREHOLE BH32

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-02

REF. NO.: 16-1255

ENCL. NO.: 33

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0 / 0.1	**ASPHALT CONCRETE:** (45 mm) **GRANULAR BASE/SUBBASE:** (525 mm)		1A	AS		
0.6	**FILL:** gravelly sand, trace clay, trace silt, brown, moist, dense		1B	AS		
			2	SS	32	
1.4	**SAND:** trace to some gravel, trace silt, brown, moist, compact to very dense		3	SS	20	
			4	SS	23	
			5	SS	93	
4.7	**SAND AND GRAVEL:** trace silt, brown, moist, very dense		6A	SS	52	
			6B	SS		
5.0	**END OF BOREHOLE** Note: 1) Borehole caved at a depth of 2.4 m below ground surface (mBGS) upon completion of drilling.					

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m^3)

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 BH33

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-22

REF. NO.: 16-1255

ENCL. NO.: 34

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (145 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (545 mm)	1A	AS		
		1B	AS		
0.7	**FILL:** sand and silt to silty sand, trace clay, trace gravel, trace organics, brown, moist to wet, very loose to loose	2	SS	6	
	--- wet	3	SS	3	
2.1	**SAND:** trace to some silt, trace gravel, brown, wet, loose	4	SS	6	
		5	SS	7	
		6	SS	7	
		7	SS	4	
		8	SS	7	
8.1	**END OF BOREHOLE**				

Concrete

1.9mBGS Dec 17

Bentonite

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit — Natural Moisture Content — Liquid Limit
w_P — w — w_L
WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

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

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	1.93

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH34

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-02

REF. NO.: 16-1255

ENCL. NO.: 35

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (45 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (565 mm)	1A	AS	
		1B	AS	
0.6	**FILL:** silty fine sand to sand and silt, trace clay, trace gravel, layers of organic silt, brown, moist to wet, loose	2	SS	7
	--- wet	3	SS	7
2.1	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist to wet, compact to very dense	4	SS	23
		5	SS	60
	--- wet	6	SS	64
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 4.4 mBGS upon completion of drilling.
3) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	4.52

Concrete

Bentonite

Sand

Screen

4.5mBGS Dec 05

Natural Pack

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit, Natural Moisture Content, Liquid Limit; w_P, w, w_L

WATER CONTENT (%): 10, 20, 30, 40

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 BH35

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-02

REF. NO.: 16-1255

ENCL. NO.: 36

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (135 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (565 mm)	1A	AS		
0.7	**FILL:** silty sand, trace to some clay, trace gravel, containing cobbles, brown, moist, loose to compact	1B	AS		
		2	SS	6	
		3	SS	22	
2.5	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist to wet, very dense				
		5	SS	60	
	--- wet	6	SS	81	
5.0	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.0 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	4.38

Concrete

Benonite

Sand

Screen

4.4mBGS Dec 05

Natural Pack

DYNAMIC PENETRATION TEST: ○ SPT, ≈ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit, Natural Moisture Content, Liquid Limit (w_P, w, w_L)

WATER CONTENT (%): 10, 20, 30, 40

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 BH36

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-02

REF. NO.: 16-1255

ENCL. NO.: 37

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (80 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (520 mm)	1A	AS	
		1B	AS	
0.6	**SAND AND SILT:** some gravel, trace clay, brown, moist, compact	2	SS	18
		3A	SS	24
1.8	**SILTY SAND:** some gravel, trace clay, containing cobbles and boulder, brown, moist, compact to very dense	3B	SS	
		4	SS	29
		5	SS	65
4.0	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, brown, moist, dense	6	SS	33
5.0	**END OF BOREHOLE**			

Note:
1) Borehole caved at a depth of 2.4 m below ground surface (mBGS) upon completion of drilling.

GROUND WATER ELEVATION

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)
WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
GR	SA	SI	CL	
15	40	38	7	

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH37

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-22

REF. NO.: 16-1255

ENCL. NO.: 38

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (130 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (440 mm)	1A	AS	
		1B	AS	
0.6	**FILL:** silty sand to sand and silt, trace clay, trace gravel, pockets of organic silt, brown, moist, loose to compact	2	SS	22
		3	SS	7
2.1	**PROBABLE FILL:** sand and gravel, trace to some silt, brown, moist, compact	4	SS	13
		5	SS	26
4.0	**SAND:** trace to some silt, trace gravel, brown, saturated, loose to compact	6	SS	10
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	2.27

Concrete

Bentonite

2.3mBGS Dec 17

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST: SPT, Cone, blows/0.3m; SHEAR STRENGTH (kPa): Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane

Plastic Limit, Natural Moisture Content, Liquid Limit; WATER CONTENT (%)

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS

Measurement: 1st, 2nd, 3rd, 4th

GRAPH NOTES: Numbers refer to Sensitivity; Strain at Failure

LOG OF BOREHOLE BH37A

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-22

REF. NO.: 16-1255

ENCL. NO.: 39

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (115 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (475 mm)	1A	AS		
0.6	**FILL:** silt, trace clay, trace sand, trace gravel, layers of silty sand, brown, wet, compact	1B	AS		
		2A	SS		
0.9	**FILL:** sand, trace to some silt, trace gravel, brown, moist, compact	2B	SS	14	
1.4	**ORGANIC SANDY SILT:** trace gravel, dark grey, moist, compact	3A	SS		
1.7	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to dense --- wet	3B	SS	17	
		4	SS	19	
		5	SS	18	
		6	SS	32	
5.0	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	3.11

Concrete
Bentonite
3.1mBGS Dec 17
Sand
Screen
Natural Pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 BH38

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-22

REF. NO.: 16-1255

ENCL. NO.: 40

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**ASPHALT CONCRETE:** (120 mm)			
0.1	**GRANULAR BASE/SUBBASE:** (380 mm)	1A	AS	
		1B	AS	
0.5	**FILL:** silty sand to sand and silt, trace clay, trace gravel, trace organics, trace rootlets, layers of sandy silt, brown, moist, compact	2	SS	11
1.8	**FILL:**organic sandy silt, dark grey, moist, compact	3A	SS	11
		3B	SS	
2.1	**FILL:** sand and silt, some gravel, trace to some clay, brown, wet, loose	4	SS	8
2.9	**PROBABLE FILL:** gravelly sand, some silt, trace clay, brown, wet, compact	5	SS	20
4.0	**SAND AND GRAVEL:** some silt, trace clay, containing cobbles and boulders, brown, wet, dense	6	SS	33
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 17, 2017	2.75

Concrete

Bentonite

2.8mBGS Dec 17

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST: SPT, Cone, blows/0.3m; SHEAR STRENGTH (kPa): Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane

Plastic Limit, Natural Moisture Content, Liquid Limit; WATER CONTENT (%)

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS

Measurement: 1st 2nd 3rd 4th

GRAPH NOTES: Numbers refer to Sensitivity; Strain at Failure

01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:03

LOG OF BOREHOLE BH101

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Split Spoon

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-28

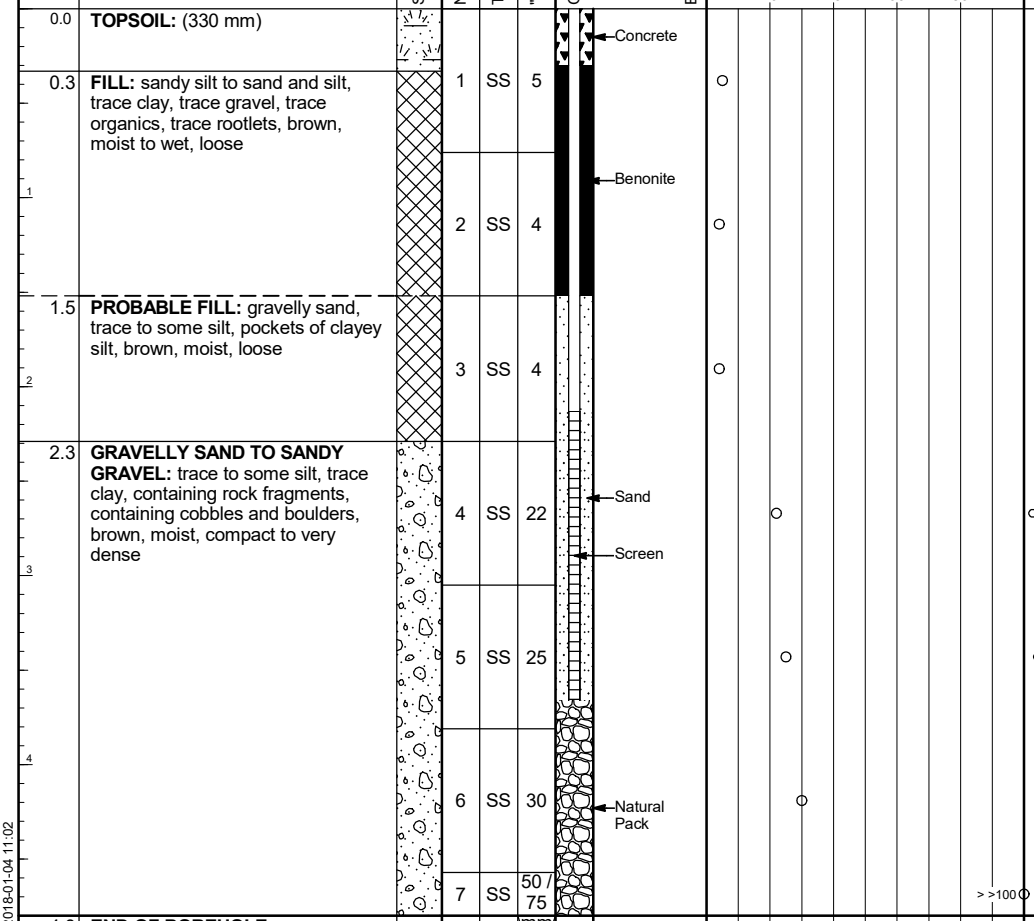
REF. NO.: 16-1255

ENCL. NO.: 41

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** (330 mm)					
0.3	**FILL:** sandy silt to sand and silt, trace clay, trace gravel, trace organics, trace rootlets, brown, moist to wet, loose	1	SS	5		
		2	SS	4		
1.5	**PROBABLE FILL:** gravelly sand, trace to some silt, pockets of clayey silt, brown, moist, loose	3	SS	4		
2.3	**GRAVELLY SAND TO SANDY GRAVEL:** trace to some silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, moist, compact to very dense	4	SS	22		77 17 6
		5	SS	25		
		6	SS	30		
		7	SS	50 / 75 (mm)		
4.8	**END OF BOREHOLE**					

Notes:
1) Borehole caved at a depth of 3.7 m below ground surface (mBGS) upon completion of drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)
Date W.L. Depth
Dec. 5, 2017 dry



DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit | Natural Moisture Content | Liquid Limit
w_P w w_L
WATER CONTENT (%)
10 20 30 40

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 BH102

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Split Spoon

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-04-12

REF. NO.: 16-1255

ENCL. NO.: 42

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (○ SPT, ≳ Cone, blows/0.3m) / SHEAR STRENGTH (kPa) (● Unconfined, ▲ Quick Triaxial, ✕ Field Vane & Sensitivity, ⊠ Penetrometer, + Lab Vane)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** (250 mm)									
0.3	**FILL:** sandy silt, trace clay, trace gravel, zones of sand and silt, brown, moist to wet, very loose to loose		1	SS	3		○ 3	○ 18		
1			2	SS	2		○ 2	○ 20		
2			3	SS	4		○ 3	○ 19		
2.3	**GRAVELLY SAND TO SAND AND GRAVEL:** trace silt, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to dense		4	SS	11		○ 11	○ 11		
3			5	SS	21		○ 21	○ 11		
4			6	SS	29		○ 29	○ 20		
5			7	SS	38		○ 38	○ 11		
5.3	**END OF BOREHOLE** Note: 1) Borehole caved at a depth of 2.8 m below ground surface (mBGS) upon completion of drilling.									

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH103

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Split Spoon

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-28

REF. NO.: 16-1255

ENCL. NO.: 43

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**TOPSOIL:** (300 mm)					Concrete
0.3	**FILL:** sandy silt, trace gravel, trace organics, trace rootlets, dark brown, moist, loose		1	SS	9	
0.8	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, layers of sand, containing rock fragments, containing cobbles and boulders, brown, moist, compact to very dense		2	SS	28	Bentonite
			3	SS	19	
			4	SS	20	
			5	SS	35	Sand / Screen
			6	SS	35	
			7	SS	50 / 115 mm	Natural pack
4.7	**END OF BOREHOLE**					

Notes:
1) Borehole caved at a depth of 4.3 m below ground surface (mBGS) upon completion of drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)
Date W.L. Depth
Dec. 5, 2017 dry

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

> >100

Plastic Limit / Natural Moisture Content / Liquid Limit
w_P w w_L
WATER CONTENT (%)
10 20 30 40

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 BH104

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-20

REF. NO.: 16-1255

ENCL. NO.: 44

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (60 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (490 mm)	1A	AS		
0.6	**FILL:** silty sand to sand and silt, trace clay, trace gravel, brown, moist, compact	1B	AS		
1		2	SS	16	
1.4	**FILL:** gravelly sand, some silt, trace clay, brown, moist, loose	3	SS	7	
2					
2.1	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, layers of organic silt, brown, wet, loose	4	SS	5	
3	2.9 **ORGANIC SILT:** some sand, trace clay, trace gravel, seams of silty sand, black, moist, loose	5	SS	7	
4					
4.0	**SAND:** trace silt, trace gravel, brown, wet, dense	6	SS	31	
5					
5.0	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 21, 2017	2.73

Concrete
Bentonite
2.7mBGS Dec 21
Sand
Screen
Natural Pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
31	42	22	5

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

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

LOG OF BOREHOLE BH107

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-20

REF. NO.: 16-1255

ENCL. NO.: 45

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (110 mm)				Concrete
0.1	**GRANULAR BASE/SUBBASE:** (520 mm)	1A	AS		
0.6	**FILL:** silty sand, trace clay, trace gravel, layers/zones of sand, containing cobbles, brown, moist, loose	1B	AS		
		2	SS	9	
		3	SS	7	
2.1	**NO RECOVERY:** likely silty sand				Bentonite
		4	AS		
2.9	**SILTY SAND:** some gravel, trace clay, containing cobbles and boulders, brown, moist, compact	5	SS	26	
4.0	**SAND AND GRAVEL:** containing rock fragments, containing cobbles and boulders, brown, moist, compact --- auger grinding	6	SS	29	5.1mBGS Dec 21 Screen
5.6	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, grey, saturated, dense	7	SS	33	Natural Pack
6.6	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 21, 2017	5.07

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%)
10 20 30 40

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

01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:02

LOG OF BOREHOLE SPS01BE

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-08

REF. NO.: 16-1255

ENCL. NO.: 46

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**TOPSOIL:** (240 mm)			
0.2	**FILL:** sandy silt, some gravel, trace to some clay, trace organics, trace rootlets, containing cobbles, brown, moist, loose to dense	1	SS	7
		2	SS	34
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace clay, containing cobbles and boulders, brown, wet, compact to very dense	3	SS	43
		4	SS	64
		5	SS	24
4.0	**SANDY SILT TILL:** trace to some clay, trace gravel, containing cobbles and boulders, grey, moist, dense to very dense	6	SS	38
		7	SS	50 / 100 mm
		8	SS	50 / 125 mm
7.8	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 6.7 mBGS upon completion of drilling.
3) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	1.02

GROUND WATER: 1.0mBGS Dec 05

Concrete; Bentonite; Sand; Screen; Natural pack

DYNAMIC PENETRATION TEST: ○ SPT ≳ Cone blows/0.3m (20 40 60 80)

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane (20 40 60 80)

Plastic Limit w_P — Natural Moisture Content w — Liquid Limit w_L

WATER CONTENT (%) (10 20 30 40)

> >100

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

01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:03

LOG OF BOREHOLE SPS01H

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-03

REF. NO.: 16-1255

ENCL. NO.: 47

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**TOPSOIL:** (125 mm)			
0.1	**ORGANIC SANDY SILT:** trace clay, trace garvel, trace rootlets, dark brown, moist, very loose	1	SS	3
0.7	**GRAVELLY SAND TO SANDY GRAVEL:** trace to some clay, trace to some silt, containing cobbles and boulders, brown, moist to wet, loose to very dense	2	SS	17
		3	SS	12
		4	SS	6
	--- wet	5	SS	23
	--- auger grinding	6	SS	51
	--- auger grinding	7	SS	50 / 125 mm
	--- auger grinding	8	SS	76
8.1	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 2.7 below ground surface upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	3.19

Concrete

Bentonite

3.2mBGS Dec 05

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 SPS02E

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-03

REF. NO.: 16-1255

ENCL. NO.: 48

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**TOPSOIL:** (75 mm)			
0.1	**FILL:** sandy silt, trace clay, trace gravel, trace organics, trace rootlets, dark brown, moist, loose	1	SS	6
0.7	**FILL:** sandy silt, trace clay, trace gravel, containing red bricks, brown, moist, very loose	2	SS	2
		3	SS	3
2.1	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, containing cobbles and boulders, brown, moist, compact	4	SS	14
		5	SS	29
4.0	**SAND:** trace to some gravel, trace silt, containing cobbles and boulders, dark brown, wet, compact to very dense	6	SS	14
		7A	SS	72 / 205 mm
6.4	**GRAVELLY SAND TO SAND AND GRAVEL:** trace silt, brown, wet, very dense	7B	SS	
7.7	**END OF BOREHOLE**	8	SS	50 / 50 mm

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.4 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.4 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	3.69

Concrete

Bentonite

3.7mBGS Dec 05

Sand

Screen

Natural pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

> >100

> >100

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 SPS03E

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: GH

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-10-30

REF. NO.: 16-1255

ENCL. NO.: 49

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (70 mm)	1A	AS		Concrete
0.1	**GRANULAR BASE/SUBBASE:** (430 mm)	1B	AS		
0.5	**FILL:** silty sand, some gravel, trace clay, containing cobbles, brown, moist, compact --- auger grinding	2	SS	17	
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist to wet, compact to very dense	3	SS	62	Bentonite
		4	SS	50	2.3mBGS Dec 11
	--- wet	5	SS	44	
		6A	SS	11	Sand
		6B	SS		Screen
4.9	**SAND AND SILT TILL:** some gravel, trace clay, containing cobbles and boulders, brown, moist, compact to very dense	7	SS	50 / 75 mm	Natural pack
		8	SS	50 / 75 mm	
7.9	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 2.7 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 11, 2017	2.25

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

> >100

Natural Moisture Content; Plastic Limit (w_P), (w), Liquid Limit (w_L)

WATER CONTENT (%): 10, 20, 30, 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
46	46	8	

GROUNDWATER ELEVATIONS

Measurement: 1st ▽, 2nd ▼, 3rd ▼, 4th ▼

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

LOG OF BOREHOLE SPS04E

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing
CLIENT: Ainley Group
PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario
DATUM: N/A
BH LOCATION: See Borehole Location Plan

DRILLING DATA
METHOD: Continuous Flight Auger - Auto Hammer
FIELD ENGINEER: KL
SAMPLE REVIEW: TY
CHECKED: DL
DIAMETER: 155 mm
DATE: 2017-11-03
REF. NO.: 16-1255
ENCL. NO.: 50

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**TOPSOIL:** (90 mm)			
0.1	**FILL:** sandy silt, trace to some clay, trace gravel, some organics, brown, moist, loose	1	SS	6
		2A	SS	
0.9	**ORGANIC SANDY SILT:** trace	2B	SS	6
1.1	clay, dark brown, moist, loose	2C	SS	
	SANDY SILT: trace to some clay,			
1.4	some organics, brown, moist, loose			
	GRAVELLY SAND: some silt, brown, wet, compact	3	SS	11
2.1	**FINE SAND:** trace silt, trace gravel, brown, saturated, loose	4	SS	4
		5	SS	5
4.0	**SAND:** trace to some silt, trace gravel, brown, saturated, compact	6	SS	21
5.6	**SILT:** trace clay, layers of clay silt, containing cobbles and boulders, brown, moist, very dense	7	SS	53
7.2	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist, very dense	8	SS	71
8.1	**END OF BOREHOLE:**			

Notes:
1) Water encountered at a depth of 1.5 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 4.9 mBGS upon completion of drilling.
3) Borehole caved at a depth of 4.9 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)
Date W.L. Depth
Dec. 5, 2017 1.85

Concrete
1.9mBGS Dec 05
Bentonite
Sand
Screen
Natural Pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80
SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit | Natural Moisture Content | Liquid Limit
w_P w w_L
WATER CONTENT (%)
10 20 30 40

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

01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:03

LOG OF BOREHOLE SPS06E

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-21

REF. NO.: 16-1255

ENCL. NO.: 51

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
0.0	**TOPSOIL:** (150 mm)				Concrete	
0.2	**FILL:** sandy silt, trace clay, trace gravel, trace organics, trace rootlets, containing rock fragments, brown, moist, compact	1	SS	14	0.4mBGS Dec 21	
0.7	**PROBABLE FILL:** gravelly sand, some silt, trace gravel, brown, wet to saturated, compact to dense	2	SS	20		
	--- saturated	3	SS	31	Bentonite	
2.5	**SAND:** trace to some gravel, trace silt, brown, wet, very loose to compact	5	SS	13		
		6	SS	2	Sand / Screen	
5.6	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, wet, very dense	7	SS	50 / 90 mm	Natural Pack	
7.7	**END OF BOREHOLE**	8	SS	50 / 100 mm		

Notes:
1) Water encountered at a depth of 0.8 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L.	Depth
Dec. 21, 2017	0.35	

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

WATER CONTENT (%): Plastic Limit w_P — Natural Moisture Content w — Liquid Limit w_L; 10 20 30 40

> >100

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 SPS08E

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-12-15

REF. NO.: 16-1255

ENCL. NO.: 52

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**ASPHALT CONCRETE:** (110 mm)				
0.1	**GRANULAR BASE/SUBBASE:** (510 mm)	1A	AS		
0.5	**FILL:** silty sand to sand and silt, some gravel, trace clay, trace rootlets, pockets of silt, containing cobbles, brown, moist to wet, loose to compact	1B	AS		
		2	SS	10	
		3	SS	6	
		4	SS	7	
	--- wet	5	SS	5	
4.0	**GRAVELLY SAND TO SAND AND GRAVEL:** trace to some silt, containing rock fragments, containing cobbles and boulders, brown, wet, compact to dense	6	SS	25	
	--- auger grinding	7	SS	48	
		8	SS	43	
8.1	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 3.5 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 21, 2017	2.10

Concrete

2.1mBGS Dec 21

Bentonite

Sand

Screen

Natural pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 T1

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-07

REF. NO.: 16-1255

ENCL. NO.: 53

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**GRAVEL SURFACE:** (90 mm)					
0.1	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, layers of clayey silt, brown, moist to wet, very loose to compact		1	SS	10	
			2	SS	4	
1.4	**FILL:** sand and silt to silty sand, trace clay, trace gravel, pockets of clayey silt, brown, moist, very loose to compact		3	SS	5	
			4	SS	3	
			5A	SS	26	
3.2	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist to wet, compact to dense		5B	SS		
	--- wet		6	SS	46	
5.0	**END OF THE BOREHOLE**					

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.5 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.5 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 T2

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-17

REF. NO.: 16-1255

ENCL. NO.: 54

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**GRAVEL SURFACE:** (170 mm)			
0.2	**FILL:** silty sand, some gravel, trace to some clay, containing rock fragments, containing cobbles, brown, moist to wet, loose to compact	1	SS	11
		2	SS	9
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to dense --- wet	3	SS	24
		4	SS	27
		5	SS	34
		6	SS	31
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 5, 2017	1.18

Concrete

1.2mBGS Dec 05

Bentonite

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

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 T3

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: KL | DATE: 2017-11-17

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 55

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
0.0	**GRAVEL SURFACE:** (20 mm)									
	FILL: sand and silt to silty sand, trace clay, trace gravel, trace organics, trace rootlets, brown, moist to wet, very loose to loose	1	SS	5						
	--- cobbles									
		2	SS	2						
	--- wet	3	SS	5						
2.1	**SILTY FINE SAND TO FINE SAND AND SILT:** trace clay, trace gravel, brown, saturated, loose to compact	4	SS	9			0	29	68	3
		5	SS	8						
		6	SS	11						
5.0	**END OF BOREHOLE:**									

Concrete

Bentonite

2.2mBGS Dec 21

Sand

Screen

Natural Pack

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L.	Depth
Dec. 21, 2017	2.15	

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

GROUNDWATER ELEVATIONS

Measurement: 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE T4

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-16

REF. NO.: 16-1255

ENCL. NO.: 56

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**GRAVEL SURFACE:** (65 mm)					
0.1	**FILL:** silty sand, trace gravel, brown, moist, loose		1A	SS	7	
0.3	**FILL:** gravelly sand, some silt, trace organics, dark brown, moist, loose		1B	SS		
0.7	**GRAVELLY SAND TO SAND AND GRAVEL:** trace silt, layers/zones of sand, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to very dense		2	SS	39	
			3	SS	27	
			4	SS	27	
			5	SS	24	
			6	SS	59	
5.0	**END OF BOREHOLE**					

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 1.4 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit / Natural Moisture Content / Liquid Limit
w_P w w_L
WATER CONTENT (%)
10 20 30 40

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 T5

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-16

REF. NO.: 16-1255

ENCL. NO.: 57

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST: SPT / Cone, blows/0.3m (20 40 60 80)	SHEAR STRENGTH (kPa): Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane (20 40 60 80)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%) (10 20 30 40)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**GRAVEL SURFACE:** (70 mm)											
0.1	**FILL:** silty sand, some gravel, trace clay, brown, moist, loose		1	SS	8		Concrete					
0.7	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, trace rootlets, pockets of clayey silt, dark brown to brown, moist, very loose to loose		2	SS	3		Bentonite					
	--- brown		3	SS	7							
2.1	**SILT:** trace clay, layers/zones of sand and silt, brown, wet, compact		4	SS	16		2.6mBGS Dec 21					0 9 88 3
			5	SS	19		Sand / Screen					
4.0	**GRAVELLY SAND:** some silt, trace clay, containing cobbles and boulders, brown, wet, dense		6	SS	31		Natural Pack					
5.0	**END OF BOREHOLE**											

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)

Date	W.L. Depth
Dec. 21, 2017	2.64

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE T6

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: KL | DATE: 2017-11-07

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 58

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION
0.0	**GRAVEL SURFACE:** (75 mm)					
0.1	**FILL:** silty sand, trace to some gravel, trace clay, grey to brown, moist, loose --- brown		1	SS	6	
0.7	**FILL:** sandy silt, trace clay, trace gravel, brown, moist, loose		2	SS	7	
1.4	**FILL:** silty sand, trace to some gravel, trace clay, brown, moist, loose		3	SS	9	
2.1	**FILL:** sandy silt, trace to some clay, trace to some gravel, some organics, dark brown, moist to wet, very loose to loose		4	SS	2	
	--- wet		5A	SS	7	
3.4	**ORGANIC SILT:** trace clay, trace rootlets, black, moist, loose		5B	SS		
4.0	**SAND:** trace silt, brown, wet, compact		6A	SS	27	
4.7	**GRAVELLY SAND:** trace clay, trace silt, containing cobbles and boulders, brown, wet, compact		6B	SS		
5.0	**END OF BOREHOLE**					

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

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

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.4 mBGS upon completion of drilling.

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

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

LOG OF BOREHOLE T7

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: KL | DATE: 2017-11-08

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 59

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST (SPT / Cone blows/0.3m) & SHEAR STRENGTH (kPa) (Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane)	Plastic Limit / Natural Moisture Content / Liquid Limit — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**GRAVEL SURFACE:** (150 mm)									
0.2	**FILL:** silty sand, trace to some gravel, trace clay, brown, moist, loose to dense		1	SS	9					
			2A	SS	46					
1.1	**FILL:** sandy silt, trace to some gravel, trace clay, trace organics, trace rootlets, containing cobbles, brown, moist, very loose to dense		2B	SS						
			3A	SS	3					
1.7	**PEAT:** black, moist, very loose to compact		3B	SS						
			4A	SS	13					
2.4	**SAND:** trace silt, trace gravel, brown, wet, loose to compact		4B	SS						
			5	SS	10					
4.0	**GRAVELLY SAND:** some clay, some silt, layers/zones of clayey silt, grey, wet, dense		6	SS	34					
5.0	**END OF BOREHOLE** Notes: 1) Water encountered at a depth of 0.8 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 1.2 mBGS upon completion of drilling. 3) Borehole caved at a depth of 1.2 mBGS upon completion of drilling.									

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE T8

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 205 mm

FIELD ENGINEER: KL | DATE: 2017-11-17

SAMPLE REVIEW: TY | REF. NO.: 16-1255

CHECKED: DL | ENCL. NO.: 60

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0 / 0.1	**GRAVEL SURFACE:** (50 mm)			
	FILL: silty sand to sand and silt, trace clay, trace gravel, layers/zones of sand, brown, moist to wet, loose	1	SS	6
		2	SS	2
		3	SS	3
		4	SS	3
		5A	SS	5
		5B	SS	
3.2	**SILTY SAND:** trace to some clay, trace gravel, containing cobbles and boulders, brown, wet to saturated, very loose to loose			
	--- saturated	6	SS	2
5.6	**SANDY SILT TILL:** some clay, trace gravel, layer s of clayey silt, containing cobbles and boulders, brown, moist, compact	7	SS	26
6.6	**END OF BOREHOLE:**			

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 4.6 mBGS upon completion of drilling.
3) Borehole caved at a depth of 5.2 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10, 20, 30, 40

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 T9

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing
CLIENT: Ainley Group
PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario
DATUM: N/A
BH LOCATION: See Borehole Location Plan

DRILLING DATA
METHOD: Continuous Flight Auger - Auto Hammer
FIELD ENGINEER: KL
SAMPLE REVIEW: TY
CHECKED: DL

DIAMETER: 155 mm
DATE: 2017-11-07
REF. NO.: 16-1255
ENCL. NO.: 61

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**GRAVEL SURFACE:** (100 mm)			
0.1	**FILL:** silty sand, trace to some clay, trace to some gravel, trace organics, dark brown, moist to wet, very loose to compact	1	SS	11
		2	SS	7
		3	SS	3
2.1	**ORGANIC SILT:** trace clay, trace gravel, trace rootlets, black, moist, loose	4	SS	6
2.9	**FINE SAND AND SILT:** trace clay, brown, moist to wet, loose	5	SS	7
4.0	**SAND:** trace silt, brown, wet, compact	6	SS	19
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 3.1 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 4.1 mBGS upon completion of drilling.
3) Borehole caved at a depth of 4.1 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS)
Date — W.L. Depth
Dec. 5, 2017 — 3.79

GROUND WATER: Concrete; Bentonite; Sand; 3.8mBGS Dec 05; Screen; Natural Pack

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)
SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit (w_P) — Natural Moisture Content (w) — Liquid Limit (w_L)
WATER CONTENT (%) (10, 20, 30, 40)

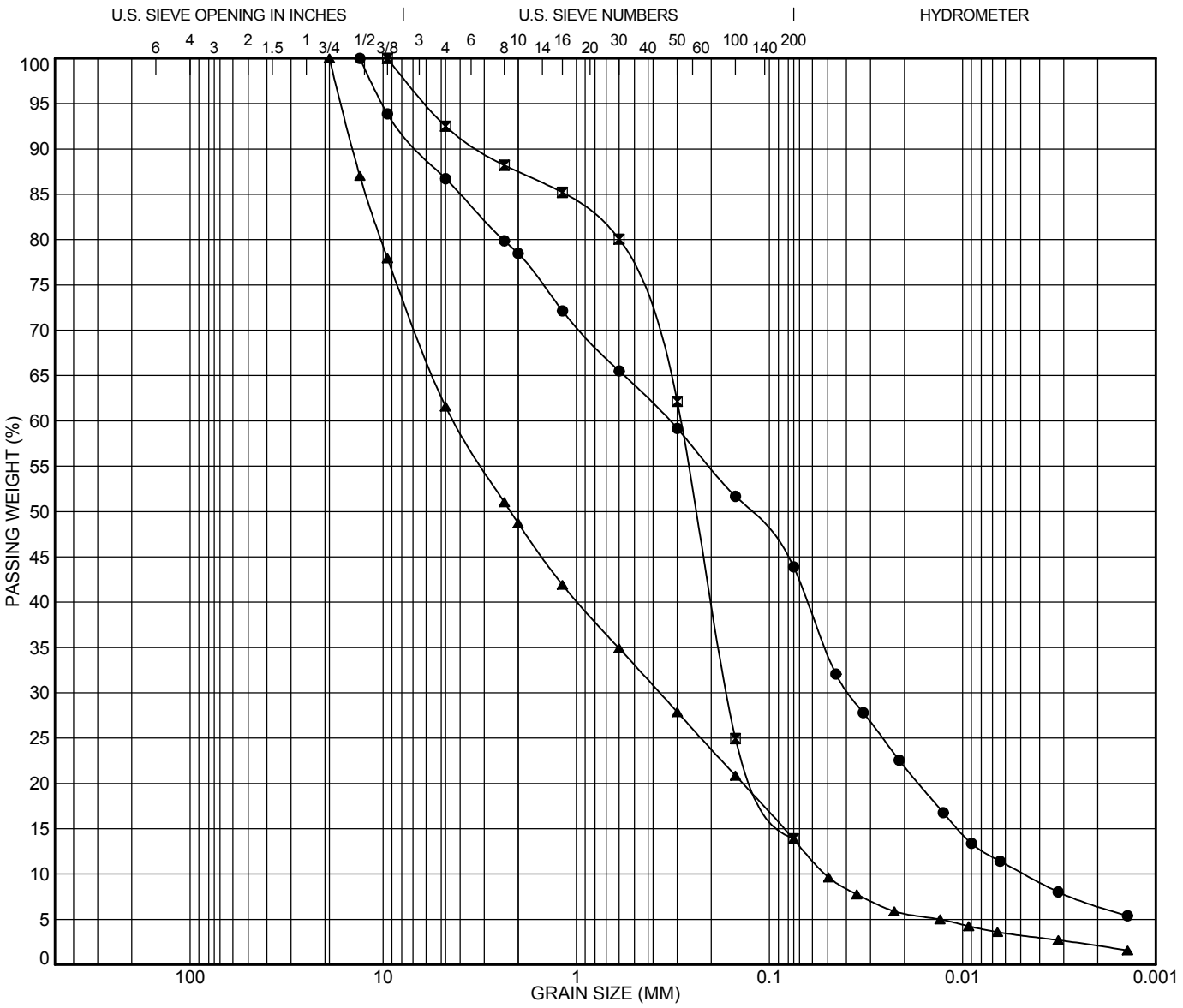
UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

FIGURES



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
● BH1	SS3	1.52					0.95	68.48
⊠ BH23	SS3	1.52						
▲ BH25	SS2	0.76					0.62	83.40

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BH1	SS3	1.52	13.2	0.329	0.039	0.005	13.3	42.8	37.4	6.5
⊠ BH23	SS3	1.52	9.5	0.288	0.165		7.5	78.6	13.9	
▲ BH25	SS2	0.76	19	4.277	0.37	0.051	38.4	47.8	11.8	2.1

GeoPro CONSULTING LIMITED
Unit 57, 40 Vogell Road, Richmond Hill, Ontario L4B 3N6
Tel: 905-237-8336 Fax: 905-248-3699
office@geoproconsulting.ca www.geoproconsulting.ca

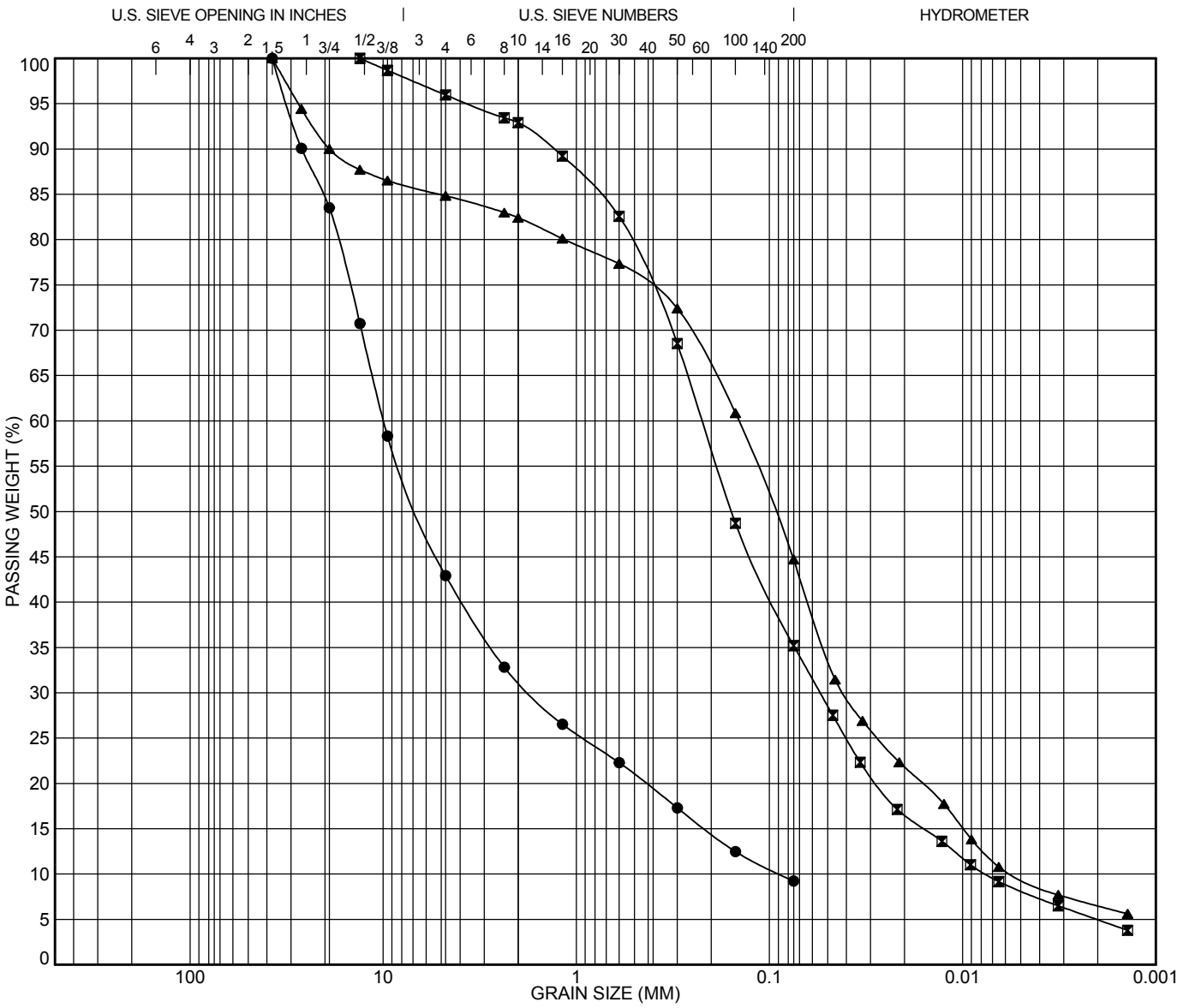
GRAIN SIZE DISTRIBUTION

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

LOCATION: Town of Erin, Ontario

PROJECT NO.: 16-1255 | SAMPLED ON: 2017-11-01

FIGURE NO.: 1 | TESTED ON: 2017-11-30



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BH28	SS5	3.05					3.41	112.30
⊠	BH31	SS5	3.05					1.77	29.43
▲	BH36	SS2	0.76					2.16	26.62

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH28	SS5	3.05	37.5	9.93	1.73	0.088	57.1	33.7	9.2	
⊠	BH31	SS5	3.05	13.2	0.223	0.055	0.008	4.0	60.8	30.2	5.0
▲	BH36	SS2	0.76	37.5	0.145	0.041	0.005	15.2	40.1	38.2	6.5

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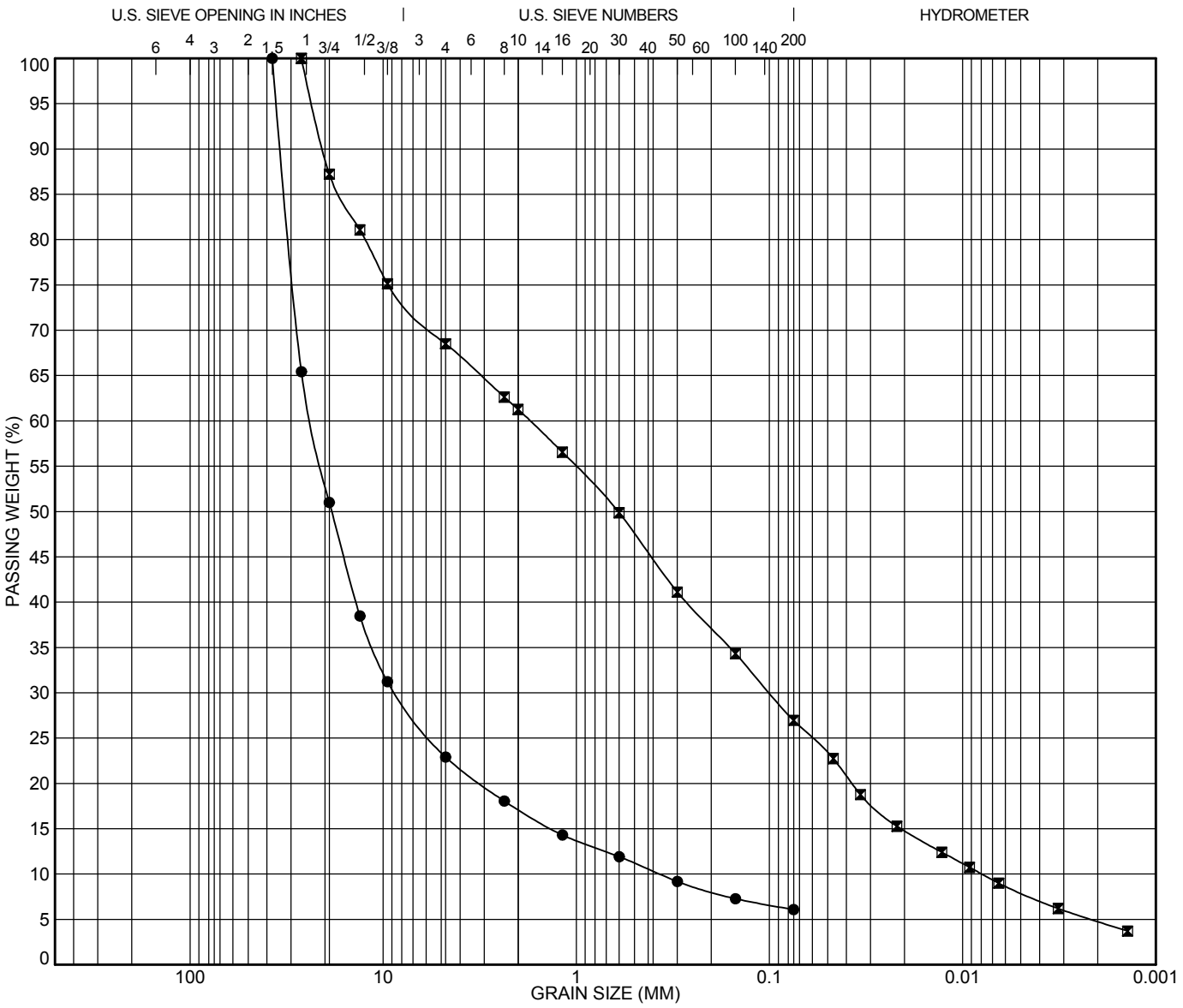
GRAIN SIZE DISTRIBUTION

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

LOCATION: Town of Erin, Ontario

PROJECT NO.: 16-1255 | SAMPLED ON: 2017-11-02

FIGURE NO.: 2 | TESTED ON: 2017-11-30



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**BH101**	**SS4**	**2.29**					**8.52**	**63.31**
⊠	**BH104**	**SS3**	**1.52**					**0.72**	**218.55**

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH101**	**SS4**	**2.29**	**37.5**	**23.383**	**8.578**	**0.369**	**77.1**	**16.8**	**6.1**	
⊠	**BH104**	**SS3**	**1.52**	**26.5**	**1.737**	**0.1**	**0.008**	**31.5**	**41.5**	**22.2**	**4.8**

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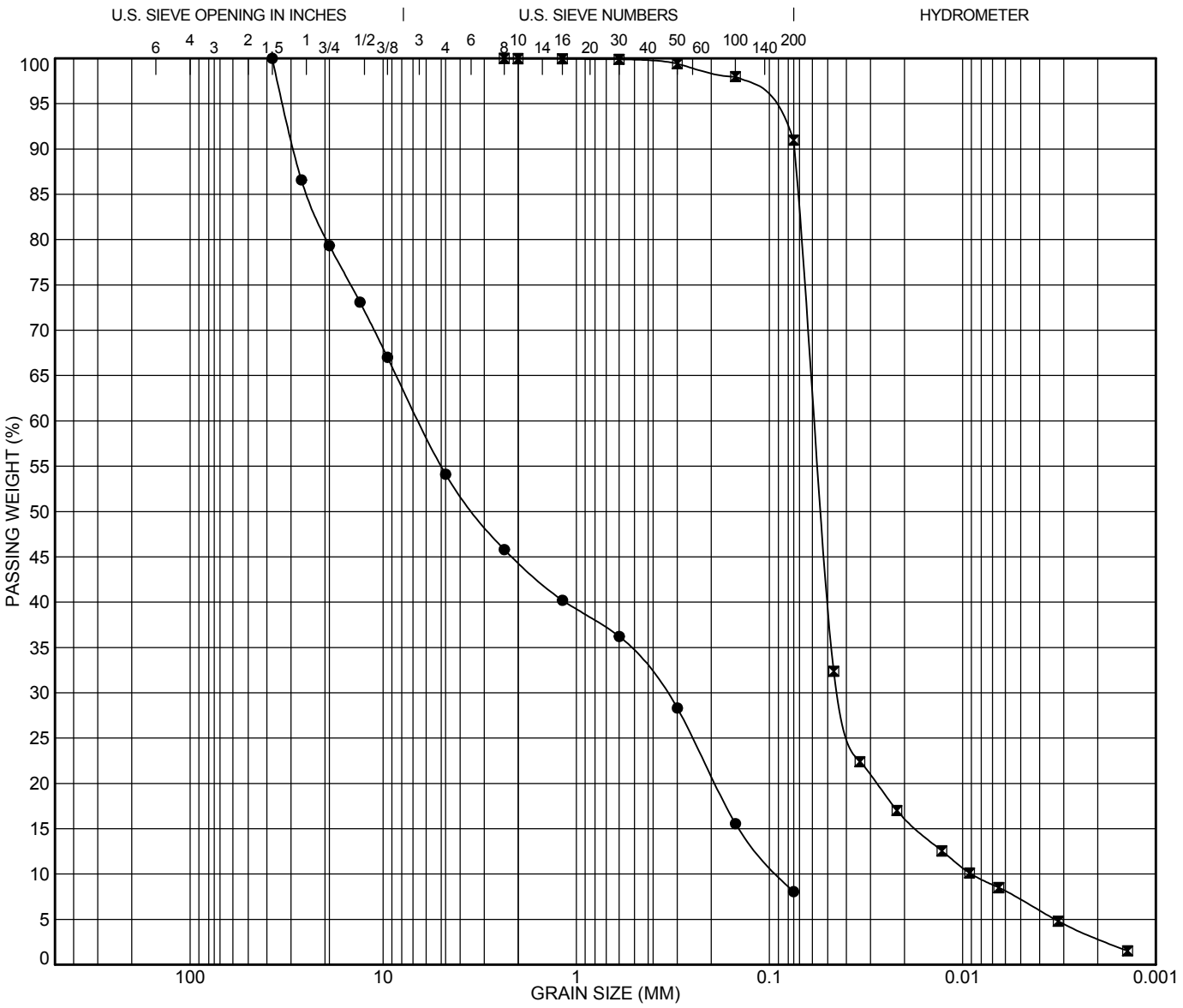
GRAIN SIZE DISTRIBUTION

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

LOCATION: Town of Erin, Ontario

PROJECT NO.: 16-1255 | SAMPLED ON: 2017-11-20

FIGURE NO.: 3 | TESTED ON: 2017-11-30



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**SPS03E**	**SS3**	**1.52**					**0.21**	**72.65**
⊠	**T5**	**SS4**	**2.29**					**3.56**	**6.48**

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SPS03E**	**SS3**	**1.52**	**37.5**	**6.518**	**0.348**	**0.09**	**45.9**	**46.0**	**8.1**	
⊠	**T5**	**SS4**	**2.29**	**2.36**	**0.058**	**0.043**	**0.009**	**0.0**	**9.0**	**88.0**	**2.9**

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Tel: 905-237-8336 Fax: 905-248-3699
office@geoproconsulting.ca www.geoproconsulting.ca

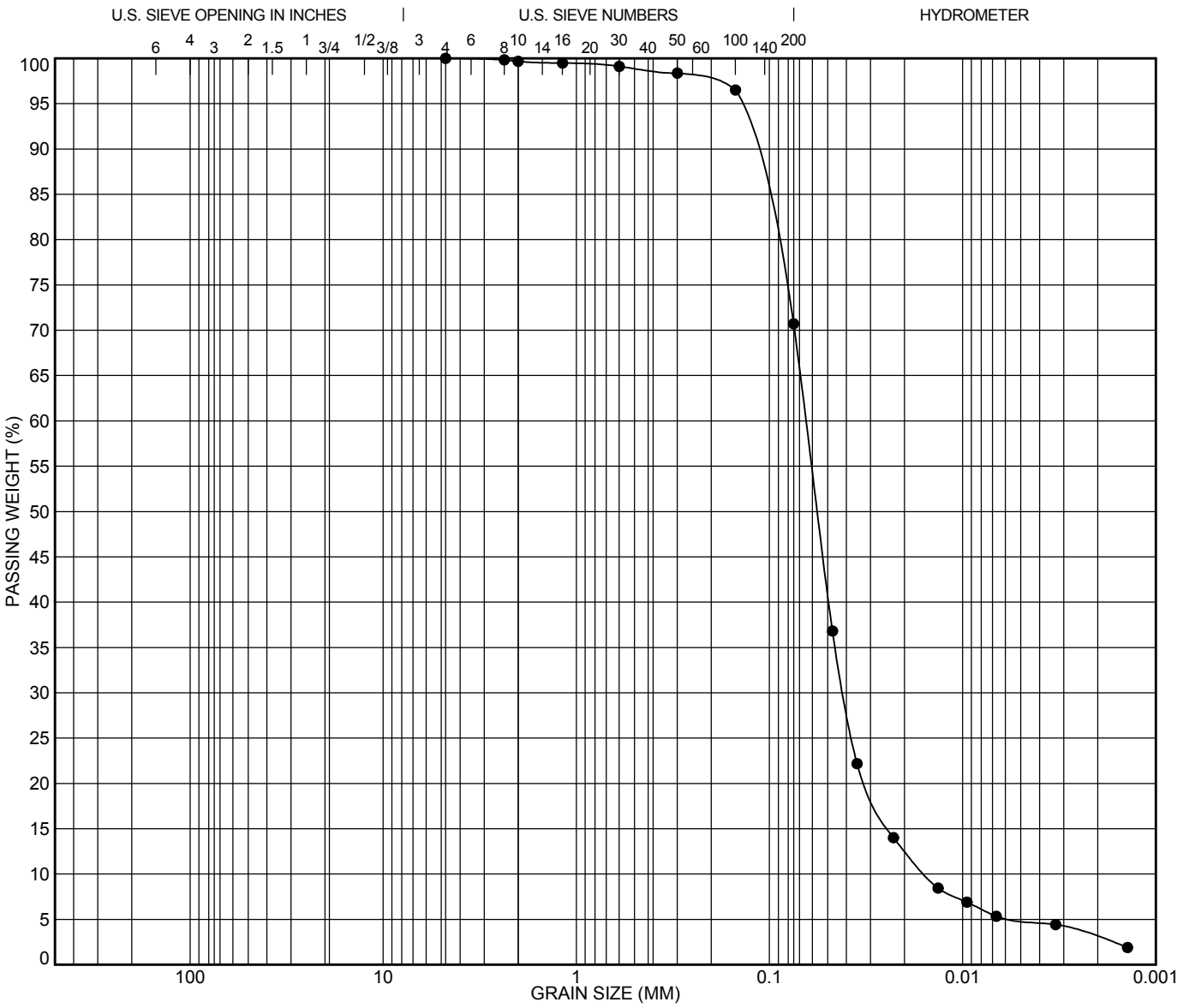
GRAIN SIZE DISTRIBUTION

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

LOCATION: Town of Erin, Ontario

PROJECT NO.: 16-1255 | SAMPLED ON: 2017-11-16

FIGURE NO.: 4 | TESTED ON: 2017-11-30



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**T3**	**SS4**	**2.29**					**1.68**	**4.17**

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T3**	**SS4**	**2.29**	**4.75**	**0.065**	**0.041**	**0.016**	**0.0**	**29.3**	**67.8**	**2.9**

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GRAIN SIZE DISTRIBUTION

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

LOCATION: Town of Erin, Ontario

PROJECT NO.: 16-1255 | SAMPLED ON: 2017-11-17

FIGURE NO.: 5 | TESTED ON: 2017-12-15

APPENDIX A

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T282046

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 15, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T282046

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:Erin

SAMPLED BY:Kirby

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-11-07

DATE REPORTED: 2017-11-15

				SAMPLE DESCRIPTION:	SPS03E SS2	BH 5 SS3	BH 14 SS2	BH 31 SS2	BH 32 SS3
				SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:	2017-10-31	2017-10-31	2017-10-31	2017-11-02	2017-11-02
Parameter	Unit	G / S	RDL		8892198	8892214	8892216	8892218	8892220
Sodium Adsorption Ratio	NA	2.4	NA		1.01	0.764	1.66	1.27	1.42

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8892198-8892220 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T282046

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:Erin

SAMPLED BY:Kirby

Soil Analysis

RPT Date: Nov 15, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8892198	8892198	1.01	1.04	2.9%	NA	NA			NA			NA		

Comments: NA signifies Not Applicable.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T282046

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:Erin

SAMPLED BY:Kirby

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

SR6

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T282046

Cooler Quantity:

Arrival Temperatures: 3.0 | 2.9 | 2.7 / 2.9 | 2.6 | 2.7

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☑ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides))	O. Reg 153: ORPs (☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☑ SAR)	O. Reg 153: Full Metals Scan	O. Reg 153: Regulation/Custom Metals	O. Reg 153: Nutrients (☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2)	O. Reg 153: Volatiles (☐ VOC ☐ BTEX ☐ THM)	O. Reg 153: PHCs F1 - F4	O. Reg 153: ABNs	O. Reg 153: PAHs	O. Reg 153: PCBs (☐ Total ☐ Aroclors)	O. Reg 153: Organochlorine Pesticides	O. Reg 153: TCLP (☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs)	O. Reg 153: Sewer Use
SPS03E SS2	Oct 30, 2017	PM	1	Soil	—			✓										
BH 5 SS3	Oct 31, 2017	PM	1	↑	—			✓										
BH 14 SS2	Oct 31, 2017	PM	1		—			✓										
BH 31 SS2	Nov. 2, 2017	PM	1	↓	—			✓										
BH 32 SS3	Nov. 2, 2017	PM	1	Soil	—			✓										

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Tim Yu	Nov. 6, 2017				
				11/07/17	11:45
Craig	11/07/17	3:40			

Page 1 of 1

N°: T 059109

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T283347

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 20, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T283347

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-11-10

DATE REPORTED: 2017-11-20

				SAMPLE DESCRIPTION:	SPS01H SS2	SPS02E SS2	SPS04E SS3	T1 SS3A	T6 SS2
				SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:	2017-11-03	2017-11-03	2017-11-03	2017-11-07	2017-11-07
Parameter	Unit	G / S	RDL		8903812	8903819	8903820	8903821	8903822
Sodium Adsorption Ratio	NA	2.4	NA		0.213	0.939	0.354	1.60	0.094

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8903812-8903822 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T283347

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Nov 20, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8902126		0.078	0.094	18.6%	NA	NA			NA			NA		

Comments: NA signifies Not Applicable.

Certified By: Amanjot Bhela

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T283347

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

SRZ 1 Bag

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 17T283347
Cooler Quantity:
Arrival Temperatures: 32 | 30 | 29 / 30 | 34 | 26
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Report Information:
Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)
☑ Regulation 153/04 — Table (Indicate One): ☐ Ind/Com ☑ Res/Park ☐ Agriculture; Soil Texture (Check One): ☑ Coarse ☐ Fine
☐ Sewer Use — ☐ Sanitary ☐ Storm; Region (Indicate One): ☐ MISA
☐ Regulation 558 ☐ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: 16-1255
Site Location: Erin
Sampled By: Kirby
AGAT Quote #: PO:
Please note: if quotation number is not provided, client will be billed full price for analysis.

Invoice Information: Bill To Same: Yes ☑ No ☐
Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification		Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI Y/N	O. Reg 153: Metals and Inorganics	Metals: ☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☑ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
SPS01 If	SS2	Nov 3, 2017	PM	1	Soil	—				✓										
SPS02E	SS2	Nov 3, 2017	PM	1	Soil	—				✓										
SPS04E	SS3	Nov 3, 2017	PM	1	Soil	—				✓										
T1	SS3A	Nov 7, 2017	AM	1	Soil	—				✓										
T6	SS2	Nov 7, 2017	PM	1	Soil	—				✓										

Samples Relinquished By (Print Name and Sign): Tim Yu Tim Yu	Date: Nov 10, 2017	Time:	Samples Received By (Print Name and Sign):	Date: 11/10/17	Time: 110
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:
Samples Relinquished By (Print Name and Sign):	Date: 11/10/17	Time: 1750	Samples Received By (Print Name and Sign):	Date:	Time:

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Nº: T 059121

Document ID: DIV 78 1511 014

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Date Issued: February 22, 2017

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T284728

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 27, 2017

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T284728

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-11-15

DATE REPORTED: 2017-11-27

SAMPLE DESCRIPTION:				BH9 SS2	BH10 SS2	BH15 SS2	SPS01bE SS3
SAMPLE TYPE:				Soil	Soil	Soil	Soil
DATE SAMPLED:				2017-11-09	2017-11-08	2017-11-09	2017-11-08
Parameter	Unit	G / S	RDL	8911566	8911567	8911568	8911569
Sodium Adsorption Ratio	NA	2.4	NA	2.69	5.68	2.20	0.827

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8911566-8911569 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract obtained from 2:1 leaching procedure (2 parts extraction fluid:1 part wet soil).

Certified By: Amanjot Bhela

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17T284728

PROJECT: 16-1255

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8911566	BH9 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	2.69
8911567	BH10 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	5.68

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T284728

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Nov 27, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8911559		6.72	6.65	1.0%	NA	NA			NA			NA		

Comments: NA signifies Not Applicable.

Certified By: Amanjot Bhela

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T284728

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

1 / 6

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 17T284728
Cooler Quantity:
Arrival Temperatures: 3.0 | 2.7 / 3.0 | 2.5 | 2.6
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Report Information:
Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd.
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)
☑ Regulation 153/04 — Table 1 (Indicate One) — ☐ Ind/Com ☑ Res/Park ☐ Agriculture
Soil Texture (Check One): ☑ Coarse ☐ Fine
☐ Sewer Use — ☐ Sanitary ☐ Storm — Region (Indicate One) — ☐ MISA
☐ Regulation 558 ☐ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: 16-1255
Site Location: Erin
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information: Bill To Same: Yes ☑ No ☐
Company: As above
Contact:
Address:
Email:

Sample Matrix Legend
B Biota
GW Ground Water
O Oil
P Paint
S Soil
SD Sediment
SW Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN	☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg	☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH 9 SS2	Nov9,2017	AM	1	Soil	—					✓												
BH 10 SS2	Nov8,2017	AM	1	Soil	—					✓												
BH 15 SS2	Nov8,2017	AM	1	Soil	—					✓												
SPSOIBE SS3	Nov8,2017	AM	1	Soil	—					✓												

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Tim Yu	Nov 15, 2017				
			Craig Lincoln	11/15/17	11:05
Craig Lincoln	11/15/17	4:35			

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N°: T 059396

Document ID: DIV 78-151-1014
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AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT:

AGAT WORK ORDER: 17T286765

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 30, 2017

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T286765

PROJECT:

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-11-21

DATE REPORTED: 2017-11-30

SAMPLE DESCRIPTION:				BH 1 SS3	BH 19 SS2	BH 21 SS2	BH 26 SS2	BH 28 SS2	BH 30 SS3
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2017-11-14	2017-11-13	2017-11-14	2017-11-15	2017-11-15	2017-11-13
Parameter	Unit	G / S	RDL	8925311	8925312	8925313	8925314	8925315	8925317
Sodium Adsorption Ratio	NA	2.4	NA	6.18	10.5	18.8	27.4	60.1	1.09

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8925311-8925317 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

Certified By: Amanjot Bhela

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17T286765

PROJECT:

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8925311	BH 1 SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	6.18
8925312	BH 19 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	10.5
8925313	BH 21 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	18.8
8925314	BH 26 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	27.4
8925315	BH 28 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	60.1

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T286765

PROJECT:

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Soil Analysis

RPT Date: Nov 30, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8925311	8925311	6.18	6.23	0.8%	NA	NA			NA			NA		

Comments: NA signifies Not Applicable.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T286765

PROJECT:

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

SR 12

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 1772867 65

Cooler Quantity: BAG

Arrival Temperatures: 4.6 4.3 4.1 3.8 3.3 3.1

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan. Timy Yu
Address: Unit 57. 40 Vogell Rd.
Richmond Hill. ON
Phone: 905-237-8336 Fax:

Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☑ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region _____ (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
_____ (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin. ON
Sampled By: Kirby
AGAT Quote #: _____ PO: _____
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI Y/N	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☑ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH 1 SS3	Nov 14, 2017	PM	1	Soil	—					✓										
BH 19 SS2	Nov 13, 2017	PM	1	Soil	—					✓										
BH 21 SS2	Nov 14, 2017	PM	1	Soil	—					✓										
BH 26 SS2	Nov 15, 2017	PM	1	Soil	—					✓										
BH 28 SS2	Nov 15, 2017	PM	1	Soil	—					✓										
BH 30 SS3	Nov 13, 2017	PM	1	Soil	—					✓										

	Date	Time		Date	Time
Samples Relinquished By (Print Name and Sign): Tim Yu	Nov 20, 2017		Samples Received By (Print Name and Sign):	2017/11/21	12:22
Samples Relinquished By (Print Name and Sign):	2017/11/21	4:16	Samples Received By (Print Name and Sign):		
Samples Relinquished By (Print Name and Sign):			Samples Received By (Print Name and Sign):		

Page 1 of 1

N°: T 059383

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T289318

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Dec 05, 2017

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T289318

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-11-28

DATE REPORTED: 2017-12-05

SAMPLE DESCRIPTION:				BH37 SS3	BH 38 SS2	BH104 SS2&SS3	BH107 SS2&SS3	T3 SS2	T8 SS2	SPSO6E SS2
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2017-11-22	2017-11-22	2017-11-22	2017-11-22	2017-11-22	2017-11-22	2017-11-22
Parameter	Unit	G / S	RDL	8941978	8941981	8941982	8941983	8941984	8941985	8941986
Sodium Adsorption Ratio	NA	2.4	NA	11.2	14.0	25.4	36.0	0.198	0.167	0.913

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8941978-8941986 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

Certified By: Amanjot Bhela

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17T289318

PROJECT: 16-1255

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8941978	BH37 SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	11.2
8941981	BH 38 SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	14.0
8941982	BH104 SS2&SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	25.4
8941983	BH107 SS2&SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	36.0

AGAT Laboratories

5835 COOPERS AVENUE
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FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T289318

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Dec 05, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8941978	8941978	11.2	11.4	1.8%	NA	NA			NA			NA		

Comments: NA signifies Not Applicable.

Certified By: Amanjot Bhela

5835 COOPERS AVENUE
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TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T289318

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 17T289318
Cooler Quantity: Bags In Cooler
Arrival Temperatures: 4.8 | 4.5 | 4.3 | 3.7 | 3.9
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: 17T289318

Report Information:
Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☑ Regulation 153/04
Table (Indicate One): ☐ Ind/Com ☑ Res/Park ☐ Agriculture
Soil Texture (Check One): ☑ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One): ☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: 16-1255
Site Location: Erin ON
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:
Bill To Same: Yes ☐ No ☐
Company: As above
Contact:
Address:
Email:

Sample Matrix Legend
B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification		Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH37	SS3	Nov 22, 2017	PM	1	Soil	—			✓											
BH38	SS2	Nov 22, 2017	PM	1	Soil	—			✓											
BH104	SS2 & SS3	Nov 20, 2017	PM	1	Soil	—			✓											
BH107	SS2 & SS3	Nov 20, 2017	PM	1	Soil	—			✓											
T3	SS2	Nov 17, 2017	PM	1	Soil	—			✓											
T8	SS2	Nov 17, 2017	PM	1	Soil	—			✓											
SPSOBE	SS2	Nov 21, 2017	PM	1	Soil	—			✓											

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Tim Yu	Nov 27, 2017			2017/11/28	11:03
		4:17			

Page 1 of 1

Nº: T 059316

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T291834

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Dec 11, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T291834

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-12-05

DATE REPORTED: 2017-12-11

				SAMPLE DESCRIPTION:	BH103 SS2	BH101 SS2
				SAMPLE TYPE:	Soil	Soil
				DATE SAMPLED:	2017-11-28	2017-11-28
Parameter	Unit	G / S	RDL		8956173	8956176
Sodium Adsorption Ratio	NA	2.4	NA		0.183	0.066

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8956173-8956176 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T291834

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Dec 11, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8956173	8956173	0.183	0.173	5.6%	NA	NA			NA			NA		

Comments: NA signifies Not Applicable.

Certified By: Amanjot Bhela

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T291834

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T291834

Cooler Quantity: 3

Arrival Temperatures: 4.7 4.5 4.3 / 2.6 2.3 3.1

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☑ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region _____ (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
_____ (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin, ON
Sampled By: Kirby
AGAT Quote #: _____ PO: _____
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH103 SS2	Nov28,2017	PM	1	Soil	—			✓											
BH101 SS2	Nov28,2017	PM	1	Soil	—			✓											

Samples Relinquished By (Print Name and Sign): Tim Yu	Date: Dec 4, 2017	Time:	Samples Received By (Print Name and Sign):	Date: 2017/12/5 Time: 1:57
Samples Relinquished By (Print Name and Sign):	Date: 2017/12/5	Time: 4:21	Samples Received By (Print Name and Sign):	Date: Time:
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date: Time:

Page 1 of 1

Nº: T 059390

Document ID: DIV 78-1511-014

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: February 22, 2017

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T297671

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: Dec 29, 2017

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T297671

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

O. Reg. 153(511) - ORPs (Soil)

DATE RECEIVED: 2017-12-21

DATE REPORTED: 2017-12-29

				SP 508E SS2 +
SAMPLE DESCRIPTION:				SS3
SAMPLE TYPE:				Soil
DATE SAMPLED:				2017-12-15
Parameter	Unit	G / S	RDL	8992116
Sodium Adsorption Ratio	NA	2.4	NA	3.41

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8992116 SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

Certified By: Vivine Basily

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17T297671

PROJECT: 16-1255

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8992116	SP 508E SS2 + SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - ORPs (Soil)	Sodium Adsorption Ratio	NA	2.4	3.41

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T297671

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Soil Analysis

RPT Date: Dec 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - ORPs (Soil)															
Sodium Adsorption Ratio	8994392		0.673	0.688	2.2%	NA									

Comments: NA signifies Not Applicable.

Certified By: Divine Basily

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T297671

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T297671

Cooler Quantity: Med

Arrival Temperatures: 4.5 4.2 4.8 / 3.8 3.7 3.5

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd.
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☑ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region ____ (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
____ (Indicate One)

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin, ON
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
SPS08E SS2+SS3	Dec 15 2017	PM	1	Soil	—			✓											

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Tim Yu	Dec 20, 2017				
	2017/12/21	4:12		2017/12/21	9:33

Page 1 of 1

Nº: T 059252

APPENDIX B

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T282050

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 15, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T282050

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-11-07

DATE REPORTED: 2017-11-15

		SAMPLE DESCRIPTION:		SPS 03E SS5	BH 5 SS5	BH 14 SS5	BH 31 SS5	BH 32 SS5
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-10-30	2017-10-31	2017-10-31	2017-11-02	2017-11-02
Parameter	Unit	G / S	RDL	8891318	8891398	8891399	8891400	8891401
Sulfide (S2-)	%		0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride (2:1)	µg/g		2	31	98	19	32	12
Sulphate (2:1)	µg/g		2	8	7	4	<2	2
pH (2:1)	pH Units		NA	8.89	8.83	8.87	8.89	9.39
Electrical Conductivity (2:1)	mS/cm		0.005	0.121	0.231	0.113	0.121	0.083
Resistivity (2:1)	ohm.cm		1	8260	4330	8850	8260	12000
Redox Potential (2:1)	mV		5	201	172	172	176	157

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8891318-8891401 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T282050

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Nov 15, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8891318	8891318	< 0.05	< 0.05	NA	< 0.05	98%	80%	120%						
Chloride (2:1)	8891401	8891401	12	12	0.0%	< 2	104%	80%	120%	101%	80%	120%	99%	70%	130%
Sulphate (2:1)	8891401	8891401	2	2	NA	< 2	96%	80%	120%	101%	80%	120%	102%	70%	130%
pH (2:1)	8891401	8891401	9.39	9.40	0.1%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8891401	8891401	0.083	0.083	0.0%	< 0.005	97%	90%	110%	NA			NA		
Redox Potential (2:1)	8891401	8891401	157	158	0.6%	< 5	103%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T282050

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

SR6

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T282050

Cooler Quantity:

Arrival Temperatures: 2.6 | 2.7 | 2.6
2.9 | 2.6 | 2.9

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting.
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vajell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Project Information:

Project: 16-1255
Site Location: Erin
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☑ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity
SPS 03 E SS5	Oct 30, 2017	PM	1	Soil	—															✓
BH 5 SS5	Oct 31, 2017	PM	1	↑	—															✓
BH 14 SS5	Oct 31, 2017	PM	1		—															✓
BH 31 SS5	Nov 2, 2017	PM	1		—															✓
BH 32 SS5	Nov 2, 2017	PM	1	Soil	—															✓

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Tim Yu, Tim Yu	Nov. 6, 2017		Craig Cuttle	11/07/17	11:45
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Craig Cuttle	11/07/17	2:40			

Page 1 of 1

N°: T 059122

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T283345

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 20, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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MISSISSAUGA, ONTARIO
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T283345

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-11-10

DATE REPORTED: 2017-11-20

		SAMPLE DESCRIPTION:		SPS01H SS5	SPS02E SS5	SPS04E SS5	T1 SS5A & B	T6 SS5A
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-11-03	2017-11-03	2017-11-03	2017-11-07	2017-11-07
Parameter	Unit	G / S	RDL	8903887	8903891	8903892	8903893	8903894
Sulfide (S2-)	%		0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride (2:1)	µg/g		2	66	19	20	62	9
Sulphate (2:1)	µg/g		2	12	5	4	6	3
pH (2:1)	pH Units		NA	8.44	8.70	8.99	8.43	7.99
Electrical Conductivity (2:1)	mS/cm		0.005	0.191	0.109	0.080	0.176	0.136
Resistivity (2:1)	ohm.cm		1	5240	9170	12500	5680	7350
Redox Potential (2:1)	mV		5	170	163	156	171	180

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8903887-8903894 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T283345

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Nov 20, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8903894	8903894	< 0.05	< 0.05	NA	< 0.05	98%	80%	120%						
Chloride (2:1)	8902966		67	62	7.8%	< 2	101%	80%	120%	101%	80%	120%	98%	70%	130%
Sulphate (2:1)	8902966		103	99	4.0%	< 2	96%	80%	120%	104%	80%	120%	100%	70%	130%
pH (2:1)	8902966		7.97	7.99	0.3%	NA	100%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8898808		0.206	0.209	1.4%	< 0.005	96%	90%	110%	NA			NA		
Redox Potential (2:1)	8902966		182	181	0.6%	< 5	101%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T283345

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

SR7 ~~BB~~ 1 Bag

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 1TT283345

Cooler Quantity:

Arrival Temperatures: 3.2 | 3.0 | 2.9
3.0 | 3.4 | 3.0

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Beijing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd
Richmond Hill ON
Phone: 905-237-8336 Fax:

Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use ☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558 ☐ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☑ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification		Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y / N	Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics ☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity					
SP S01H	SS5	Nov 3, 2017	PM	1	Soil	—																				✓						
SP S02E	SS5	Nov 3, 2017	PM	1	Soil	—																				✓						
SP S04E	SS5	Nov 3, 2017	PM	1	Soil	—																				✓						
T1	SS5A&B	Nov 7 2017	AM	1	Soil	—																				✓						
T6	SS5A	Nov 7, 2017	PM	1	Soil	—																				✓						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Tim Yu	NOV 12, 2017				
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
				11/10/17	110
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
	11/10/17	430			

Page ____ of ____

N°: T 059120

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T284718

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 27, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T284718

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-11-15

DATE REPORTED: 2017-11-27

		SAMPLE DESCRIPTION:		BH9 SS4	BH10 SS5	BH15 SS5	SPS 01bE SS4
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-11-09	2017-11-08	2017-11-09	2017-11-08
Parameter	Unit	G / S	RDL	8911561	8911562	8911563	8911564
Sulfide (S2-)	%		0.05	<0.05	<0.05	<0.05	<0.05
Chloride (2:1)	µg/g		2	73	91	73	43
Sulphate (2:1)	µg/g		2	13	15	8	8
pH (2:1)	pH Units		NA	8.99	8.64	9.07	8.75
Electrical Conductivity (2:1)	mS/cm		0.005	0.194	0.239	0.237	0.139
Resistivity (2:1)	ohm.cm		1	5150	4180	4220	7190
Redox Potential (2:1)	mV		5	153	158	139	155

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8911561-8911564 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T284718

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Nov 27, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8911561	8911561	< 0.05	< 0.05	NA	< 0.05	98%	80%	120%						
Chloride (2:1)	8905875		2	2	NA	< 2	101%	80%	120%	99%	80%	120%	100%	70%	130%
Sulphate (2:1)	8905875		3	3	NA	< 2	94%	80%	120%	99%	80%	120%	99%	70%	130%
pH (2:1)	8905875		8.16	8.13	0.4%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8911559		0.495	0.514	3.8%	< 0.005	97%	90%	110%	NA			NA		
Redox Potential (2:1)	8905875		155	155	0.0%	< 5	101%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T284718

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

1/6

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T284718

Cooler Quantity:

Arrival Temperatures: 3.0 | 3.0 | 2.7
3.0 | 2.5 | 2.6

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: unit 57, 40 Vogell Rd.
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: tim@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐Ind/Com ☐Res/Park ☐Agriculture
Soil Texture (Check One) ☐Coarse ☐Fine

☐ Sewer Use
☐Sanitary ☐Storm
Region (Indicate One) ☐MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐All Metals ☐153 Metals (excl. Hydrides) ☐Hydride Metals ☐153 Metals (incl. Hydrides))	O. Reg 153: ORPs (☐B-HWS ☐Cl ☐CN ☐Cr^{6+} ☐EC ☐FOC ☐Hg ☐pH ☐SAR)	O. Reg 153: Full Metals Scan	O. Reg 153: Regulation/Custom Metals	Nutrients: ☐TP ☐NH_3 ☐TKN ☐NO_3 ☐NO_2 ☐NO_3+NO_2	Volatiles: ☐VOC ☐BTEX ☐THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐Total ☐Aroclors	Organochlorine Pesticides	TCLP: ☐M&I ☐VOCs ☐ABNs ☐B(a)P ☐PCBs	Sewer Use	Corrosivity
BH 9 SS4	Nov 9, 2017	AM	1	Soil	—														✓
BH 10 SS5	Nov 8. 2017	AM	1	Soil	—														✓
BH 15 SS5	Nov 9, 2017	AM	1	Soil	—														✓
SPS 01bE SS4	Nov 8, 2017	AM	1	Soil	—														✓

	Date	Time		Date	Time
Samples Relinquished By (Print Name and Sign): Tim Yu Tim Yu	Nov 15, 2017		Samples Received By (Print Name and Sign):	11/15/17	1105
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page ____ of ____

Nº: T 059397

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T286763

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 30, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T286763

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Corrosivity Package

DATE RECEIVED: 2017-11-21

DATE REPORTED: 2017-11-30

		SAMPLE DESCRIPTION:		BH 1 SS5	BH 19 SS4	BH 26 SS5		BH 28 SS4		BH 30 SS5
		SAMPLE TYPE:		Soil	Soil	Soil		Soil		Soil
		DATE SAMPLED:		2017-11-14	2017-11-13	2017-11-15		2017-11-15		2017-11-13
Parameter	Unit	G / S	RDL	8925357	8925361	8925370	RDL	8925373	RDL	8925378
Sulfide (S2-)	%		0.05	<0.05	<0.05	<0.05	0.05	0.06	0.05	0.05
Chloride (2:1)	µg/g		2	252	193	227	4	818	2	25
Sulphate (2:1)	µg/g		2	17	15	7	4	31	2	6
pH (2:1)	pH Units		NA	8.33	8.77	9.30	NA	8.38	NA	8.87
Electrical Conductivity (2:1)	mS/cm		0.005	0.478	0.415	0.448	0.005	1.20	0.005	0.112
Resistivity (2:1)	ohm.cm		1	2090	2410	2230	1	833	1	8930
Redox Potential (2:1)	mV		5	161	145	124	5	155	5	150

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8925357-8925370 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

8925373 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Elevated RDL indicates the degree of sample dilution prior to the analysis for Anions in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.

8925378 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
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FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T286763

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Soil Analysis

RPT Date: Nov 30, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8925357	8925357	< 0.05	< 0.05	NA	< 0.05	99%	80%	120%						
Chloride (2:1)	8925370	8925370	227	236	3.9%	< 2	108%	80%	120%	106%	80%	120%	104%	70%	130%
Sulphate (2:1)	8925370	8925370	7	7	NA	< 2	95%	80%	120%	99%	80%	120%	103%	70%	130%
pH (2:1)	8925370	8925370	9.30	9.23	0.8%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8925370	8925370	0.448	0.477	6.3%	< 0.005	98%	90%	110%	NA			NA		
Redox Potential (2:1)	8925370	8925370	124	124	0.0%	< 5	104%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T286763

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

SR 12

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
PH: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T286763

Cooler Quantity: BAN

Arrival Temperatures: 4.6 4.8 4.1 / 3.6 3.3 3.1

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd.
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin, ON
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification		Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides))	O. Reg 153: ORPs (☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR)	Full Metals Scan	Regulation/Custom Metals	Nutrients: (☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2)	Volatiles: (☐ VOC ☐ BTEX ☐ THM)	PHCs F1 - F4	ABNs	PAHs	PCBs: (☐ Total ☐ Aroclors)	Organochlorine Pesticides	TCLP: (☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs)	Sewer Use	Corrosivity
BH 1	SS 5	Nov 14, 2017	PM	1	Soil	—														✓
BH 19	SS 4	Nov 13, 2017	PM	1	Soil	—														✓
BH 26	SS 5	Nov 15, 2017	PM	1	Soil	—														✓
BH 28	SS 4	Nov 15, 2017	PM	1	Soil	—														✓
BH 30	SS 5	Nov 13, 2017	PM	1	Soil	—														✓

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Tim Yu	Nov 20, 2017				
	2017/11/21	4:10		2017/11/21	12:21
	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
			Samples Received By (Print Name and Sign):	Date	Time

Page 1 of 1

N°: T 059399

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T289231

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Dec 05, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T289231

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Corrosivity Package

DATE RECEIVED: 2017-11-28

DATE REPORTED: 2017-12-05

SAMPLE DESCRIPTION:				BH37 SS4	BH38 SS4 & SS5		BH104 SS4		BH107 SS4		T3 SS4
SAMPLE TYPE:				Soil	Soil		Soil		Soil		Soil
DATE SAMPLED:				2017-11-22	2017-11-22		2017-11-20		2017-11-20		2017-11-17
Parameter	Unit	G / S	RDL	8942020	8942027	RDL	8942028	RDL	8942029	RDL	8942030
Sulfide (S2-)	%		0.05	0.05	0.06	0.05	0.08	0.05	0.08	0.05	<0.05
Chloride (2:1)	µg/g		2	513	515	8	1490	4	1260	2	8
Sulphate (2:1)	µg/g		2	22	21	8	59	4	22	2	3
pH (2:1)	pH Units		NA	8.65	8.26	NA	7.93	NA	9.05	NA	8.61
Electrical Conductivity (2:1)	mS/cm		0.005	0.929	0.865	0.005	2.23	0.005	1.90	0.005	0.080
Resistivity (2:1)	ohm.cm		1	1080	1160	1	448	1	526	1	12500
Redox Potential (2:1)	mV		5	181	188	5	184	5	153	5	173

SAMPLE DESCRIPTION:				T8 SS5A&B	SPS06E SS6
SAMPLE TYPE:				Soil	Soil
DATE SAMPLED:				2017-11-17	2017-11-21
Parameter	Unit	G / S	RDL	8942031	8942042
Sulfide (S2-)	%		0.05	0.10	0.07
Chloride (2:1)	µg/g		2	48	18
Sulphate (2:1)	µg/g		2	4	11
pH (2:1)	pH Units		NA	8.21	8.79
Electrical Conductivity (2:1)	mS/cm		0.005	0.170	0.100
Resistivity (2:1)	ohm.cm		1	5880	10000
Redox Potential (2:1)	mV		5	177	169

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8942020-8942027 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

8942028-8942029 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).
Elevated RDL indicates the degree of sample dilution prior to the analysis for Anions in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.

*Sulphide analyzed at AGAT 5623 McAdam

8942030-8942042 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T289231

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Soil Analysis

RPT Date: Dec 05, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8942020	8942020	0.05	0.05	NA	< 0.05	98%	80%	120%						
Chloride (2:1)	8941914		22	21	4.7%	< 2	100%	80%	120%	105%	80%	120%	104%	70%	130%
Sulphate (2:1)	8941914		198	195	1.5%	< 2	92%	80%	120%	103%	80%	120%	106%	70%	130%
pH (2:1)	8941914		8.27	8.25	0.2%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8941978		0.985	0.977	0.8%	< 0.005	97%	90%	110%	NA			NA		
Redox Potential (2:1)	8941914		193	194	0.5%	< 5	101%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T289231

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

BALL Env Ltd Copy

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T2 89231

Cooler Quantity: ~~2~~

Arrival Temperatures: 4.8 | 4.5 | 4.3
4 | 3.7 | 3.4

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan. Tim Yu
Address: Unit 57 40 Vogell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use ☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin. ON
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification		Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI Y/N	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN	Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg	pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN	NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity
BH37	SS4	Nov 22, 2017	PM	1	Soil	—																				✓
BH38	SS4 & SS5	Nov 22, 2017	PM	1		—																				✓
BH104	SS4	Nov 20, 2017		1		—																				✓
BH107	SS4	Nov 20, 2017		1		—																				✓
T3	SS4	Nov 17, 2017		1		—																				✓
T8	SS5A&B	Nov 17, 2017		1		—																				✓
SPSOBE	SS6	Nov 21 2017	PM	1	Soil	—																				✓

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Tim Yu					
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
	2017/11/20	4:17		2017/11/20	11:03
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

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Nº: T 059317

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T291830

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Dec 13, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T291830

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-12-05

DATE REPORTED: 2017-12-13

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: BH103 SS4 SAMPLE TYPE: Soil DATE SAMPLED: 2017-11-28 8956047	SAMPLE DESCRIPTION: BH101 SS5 SAMPLE TYPE: Soil DATE SAMPLED: 2017-11-28 8956048
Sulfide (S2-)	%		0.05	<0.05	<0.05
Chloride (2:1)	µg/g		2	5	6
Sulphate (2:1)	µg/g		2	3	3
pH (2:1)	pH Units		NA	8.23	8.27
Electrical Conductivity (2:1)	mS/cm		0.005	0.084	0.089
Resistivity (2:1)	ohm.cm		1	11900	11200
Redox Potential (2:1)	mV		5	163	169

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8956047-8956048 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T291830

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Dec 13, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8956048	8956048	< 0.05	< 0.05	NA	< 0.05	101%	80%	120%						
Chloride (2:1)	8954296		39	38	2.6%	< 2	106%	80%	120%	107%	80%	120%	107%	70%	130%
Sulphate (2:1)	8954296		24	24	0.0%	< 2	95%	80%	120%	97%	80%	120%	106%	70%	130%
pH (2:1)	8956060		9.20	9.27	0.8%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8956173		0.127	0.125	1.6%	< 0.005	92%	90%	110%	NA			NA		
Redox Potential (2:1)	8955613		188	189	0.5%	< 5	104%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

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Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T291830

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T291830

Cooler Quantity: 1 of 2

Arrival Temperatures: 4.4 4.5 4.3 3.0 3.3 3.1

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin, ON
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: As above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity
BH 103 SS4	Nov 28, 2017	PM	1	Soil	—															✓
BH 101 SS5	Nov 28, 2017	PM	1	Soil	—															

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Tim Yu	Dec 4, 2017			2017/12/5	1:51
	2017/12	4:21			

Page 1 of 1

Nº: T 059318

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
UNIT 57, 40 VOGELL ROAD
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1255

AGAT WORK ORDER: 17T297643

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Dec 29, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T297643

PROJECT: 16-1255

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Corrosivity Package

DATE RECEIVED: 2017-12-21

DATE REPORTED: 2017-12-29

		SAMPLE DESCRIPTION:		SPS08E SS6
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-12-15
Parameter	Unit	G / S	RDL	8991976
Sulfide (S2-)	%		0.05	<0.05
Chloride (2:1)	µg/g	NA	2	32
Sulphate (2:1)	µg/g		2	12
pH (2:1)	pH Units		NA	8.40
Electrical Conductivity (2:1)	mS/cm	0.57	0.005	0.165
Resistivity (2:1)	ohm.cm		1	6060
Redox Potential (2:1)	mV		5	157

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8991976 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T297643

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

Soil Analysis

RPT Date: Dec 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8991976	8991976	< 0.05	< 0.05	NA	< 0.05	99%	80%	120%						
Chloride (2:1)	8993018		35	38	8.2%	< 2	98%	80%	120%	100%	80%	120%	122%	70%	130%
Sulphate (2:1)	8993018		66	70	5.9%	< 2	101%	80%	120%	102%	80%	120%	105%	70%	130%
pH (2:1)	8990650		8.14	8.15	0.1%	NA	100%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8992997		1.32	1.42	7.3%	< 0.005	98%	90%	110%	NA			NA		
Redox Potential (2:1)	8993018		142	139	2.1%	< 5	104%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 17T297643

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Kirby

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17T297643

Cooler Quantity: Bag Med

Arrival Temperatures: 4.5 4.2 4 | 3.8 3.7 3.5

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GeoPro Consulting
Contact: Bujing Guan, Tim Yu
Address: Unit 57, 40 Vogell Rd.
Richmond Hill, ON
Phone: 905-237-8336 Fax:
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: timy@geoproconsulting.ca

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☑ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region ____ (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
____ (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16-1255
Site Location: Erin, ON
Sampled By: Kirby
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: as above
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	O. Reg 153: All Metals / 153 Metals (excl. Hydrides) / Hydride Metals / 153 Metals (incl. Hydrides)	O. Reg 153: ORPs: B-HWS, Cl, CN, Cr*, EC, FOC, Hg, pH, SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: TP, NH_3, TKN, NO_3, NO_2, NO_3+NO_2	Volatiles: VOC, BTEX, THM	PHCs F1 - F4	ABNs	PAHs	PCBs: Total, Aroclors	Organochlorine Pesticides	TCLP: M&I, VOCs, ABNs, B(a)P, PCBs	Sewer Use	Corrosivity
SPS08E 556	Dec 15, 2017	PM	1	Soil	—																✓

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Tim Yu	Dec 20, 2017			Dec 19/17	9:33
	2017/12/21	4:12			

Page 1 of 1

N°: T 059253

LIMITATIONS TO THE REPORT

This report is intended solely for the Client named. The report is prepared based on the work has been undertaken in accordance with normally accepted geotechnical engineering practices in Ontario.

The comments and recommendations given in this report are based on information determined at the limited number of the test hole and test pit locations. The boundaries between the various strata as shown on the borehole logs are based on non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation rather than a precise plane of geological change. Subsurface and groundwater conditions between and beyond the test holes and test pits may differ significantly from those encountered at the test hole and test pit locations. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole and test pit locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The report reflects our best judgment based on the information available to GeoPro Consulting Limited at the time of preparation. Unless otherwise agreed in writing by GeoPro Consulting Limited, it shall not be used to express or imply warranty as to any other purposes. No portion of this report shall be used as a separate entity, it is written to be read in its entirety. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated.

The design recommendations given in this report are applicable only to the project designed and constructed completely in accordance with the details stated in this report. Otherwise, our responsibility is limited to interpreting the subsurface information at the borehole or test pit locations.

Should any comments and recommendations provided in this report be made on any construction related issues, they are intended only for the guidance of the designers. The number of test holes and test pits may not be sufficient to determine all the factors that may affect construction activities, methods and costs. Such as, the thickness of surficial topsoil or fill layers may vary significantly and unpredictably; the amount of the cobbles and boulders may vary significantly than what described in the report; unexpected water bearing zones/layers with various thickness and extent may be encountered in the fill and native soils. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and make their own conclusions as to how the subsurface conditions may affect their work and determine the proper construction methods.

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. GeoPro Consulting Limited 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.