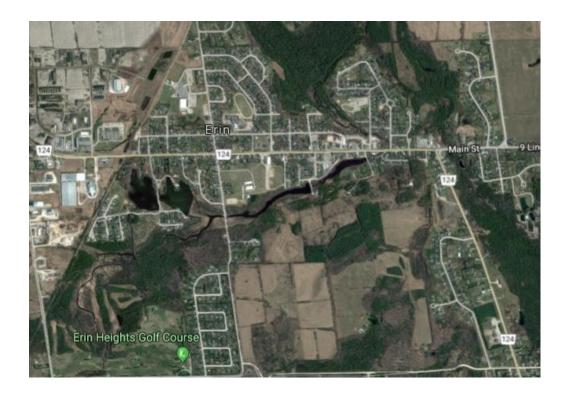


## **Preliminary Geotechnical Investigation**

Urban Centre Wastewater Servicing
Class Environmental Assessment Study
Town of Erin, Ontario

**Prepared For:** 

## **Ainley Group**



**GeoPro Project No.: 16-1255** 

Report Date: January 4, 2018



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## **Limitations to the Report**

#### 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:

	Pavement Structure (mm)		
Location	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	85 - 125	325 - 545
(BH17 and BH19)	(210)	(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:

	Pavement Structure (mm)		
Location	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, 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	-
вн9	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
Т9	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	Screen Interval	Water Level (mBGS) Date of Monitoring					
Well ID	(mBGS)	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	Screen Interval	Water Level (mBGS) Date of Monitoring				
Well ID	(mBGS)	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
Т9	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
DU102	100	150	2.5	Gravelly Sand to Sandy Gravel
BH102	150	225	3.5	Gravelly Sand to Sandy Gravel
BH103	150	225	1.0	Gravelly Sand to Sandy Gravel

<sup>\*</sup>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  $p = lateral earth pressure in kPa acting at depth <math>h_1$ 

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

 $\gamma_1$  = unit weight of overburden soil assuming 22 kN/m<sup>3</sup>

 $h_1$  = 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 4<sup>th</sup> 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	HL 3 Surface Course	40 mm	40 mm
(OPSS 1150)	HL 8 Binder Course	50 mm	100 mm
Granular Material	Granular A Base	150 mm	150 mm
(OPSS.MUNI 1010)	Granular B Type I Subbase	300 mm	450 mm

## Prepared and Approved Subgrade

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

<sup>\*</sup> Denotes Standard Proctor Maximum Dry Density, ASTM-D698

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	

<sup>\*</sup>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  $p = lateral earth pressure in kPa acting at depth <math>h_1$ 

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

 $\gamma_1$  = unit weight of overburden soil assuming 22 kN/m<sup>3</sup>

 $h_1$  = 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 4<sup>th</sup> 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	Granular A Base	150 mm	150 mm		
(OPSS.MUNI 1010)	Granular B Type I Subbase	300 mm	450 mm		
Prepared and Approved Subgrade					

<sup>\*</sup> 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 (proactive) 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 <sub>a</sub> =0.27	K <sub>a</sub> =0.34	K <sub>a</sub> =0.40		
K <sub>b</sub> =0.35	K <sub>b</sub> =0.44	K <sub>b</sub> =0.50		

K <sub>o</sub> =0.43	K₀=0.56	K <sub>o</sub> =0.62
K*=0.45	K*=0.60	K*=0.66

## Compacted Granular 'B' Type I

Angle of Internal Friction  $\phi$ =32° (unfactored)

Unit Weight = 21 kN/m<sup>3</sup>

Coefficient of Lateral Earth Pressure:

Level Backfill	Backfill Sloping at 3H:1V	Backfill Sloping at 2H:1V
K <sub>a</sub> =0.31	K <sub>a</sub> =0.39	K <sub>a</sub> =0.47
K <sub>b</sub> =0.39	K <sub>b</sub> =0.49	K <sub>b</sub> =0.57
K <sub>o</sub> =0.47	K <sub>o</sub> =0.62	K <sub>o</sub> =0.69
K*=0.54	K*=0.68	K*=0.78

Note:

K<sub>a</sub> is the coefficient of active earth pressure

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

Ko 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 freedraining 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	8 – 1.2 Silty Sand to Sand and Silt Fill			
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:

Note:

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	<u>2.4</u>	<u>5</u>	12
BH9 SS2	SAR	2.69	<u>2.4</u>	5	12
BH10 SS2	SAR	5.68	<u>2.4</u>	<u>5</u>	12
BH19 SS2	SAR	10.5	<u>2.4</u>	<u>5</u>	12
BH21 SS2	SAR	18.8	<u>2.4</u>	<u>5</u>	<u>12</u>
BH26 SS2	SAR	27.4	<u>2.4</u>	<u>5</u>	<u>12</u>
BH28 SS2	SAR	60.1	<u>2.4</u>	<u>5</u>	<u>12</u>
BH37 SS3	SAR	11.2	<u>2.4</u>	<u>5</u>	12
BH38 SS2	SAR	14.0	<u>2.4</u>	<u>5</u>	<u>12</u>
BH104 SS2&SS3	SAR	25.4	<u>2.4</u>	<u>5</u>	<u>12</u>
BH107 SS2&SS3	SAR	36.0	<u>2.4</u>	<u>5</u>	<u>12</u>
SPS08E SS2&SS3	SAR	3.41	<u>2.4</u>	5	12

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<sub>4</sub>) 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./			ı	Parameter (So	ore)			
Sample No.	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./			F	Parameter (So	ore)			
Sample No.	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			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 DRAFT

Tim Yu, B.Eng., EIT, Jessica Yao, P.Eng.
Geotechnical Group Senior Geotechnical Engineer

DRAFT

David B. Liu, P.Eng., Principal



## **DRAWINGS**





**Borehole Location** 



Client:	Ainley Group			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		for	
Original Size:	Letter	Rev:	KS		€ GeoPro	Consulting Limite	d





**Borehole Location** 



Client:	Ainl	ey 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		or
Original Size:	Letter	Rev:	KS		€ GeoPro	Consulting Limite	d



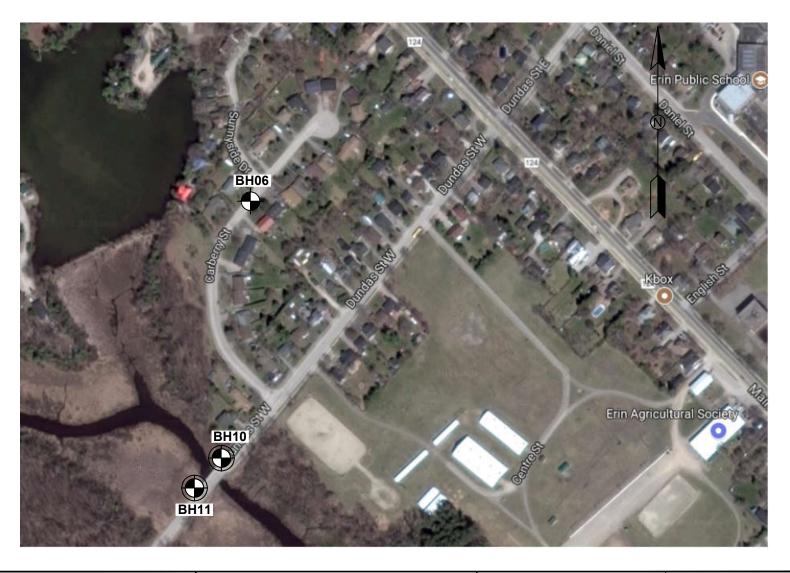




**Borehole Location** 



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 Limite	d

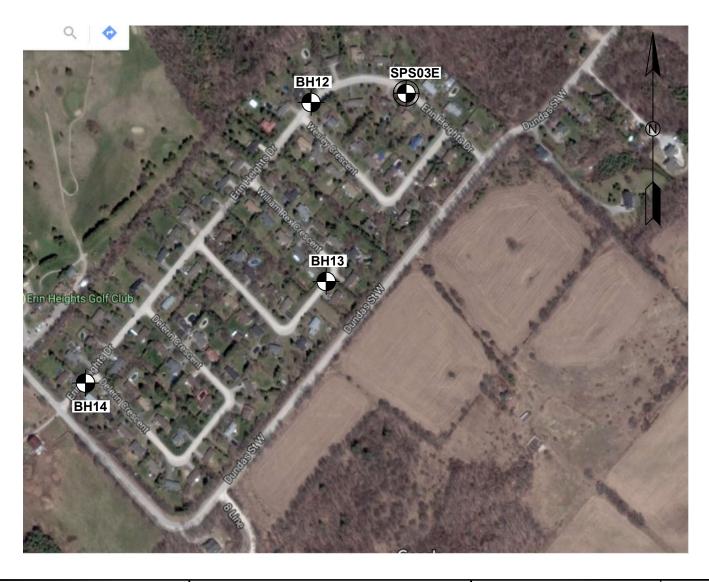




**Borehole Location** 



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			ed

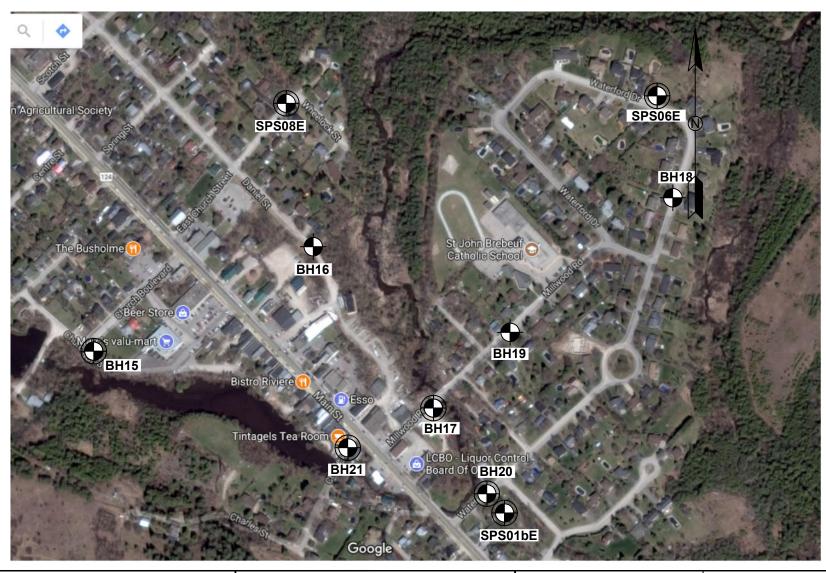




**Borehole Location** 



Client:	nt: Ainley Group			Project No.:	ot No.: <b>16-1255</b> Drawing No.: <b>5</b>			
Drawn:	TY	Approved:	DL	Title: Borehole Location Plan				
Date: <b>No</b>	ovember 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				

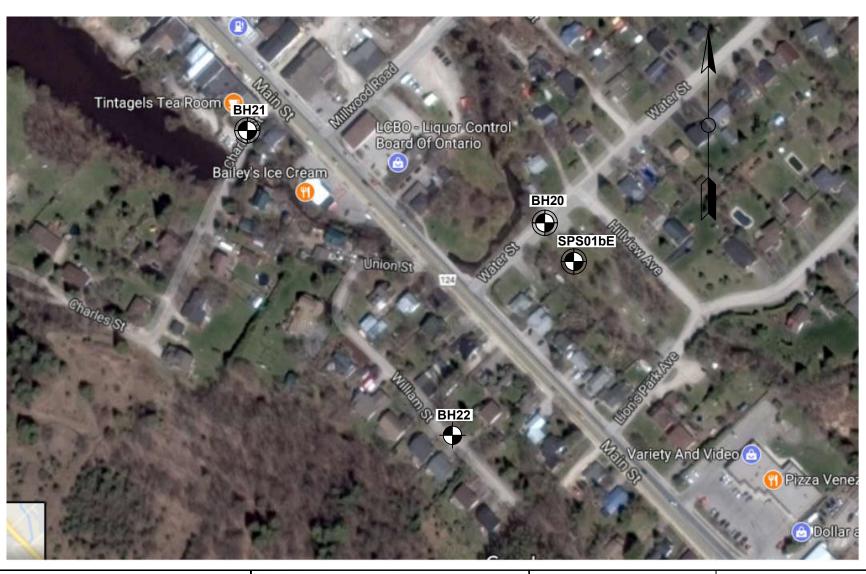




**Borehole Location** 



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

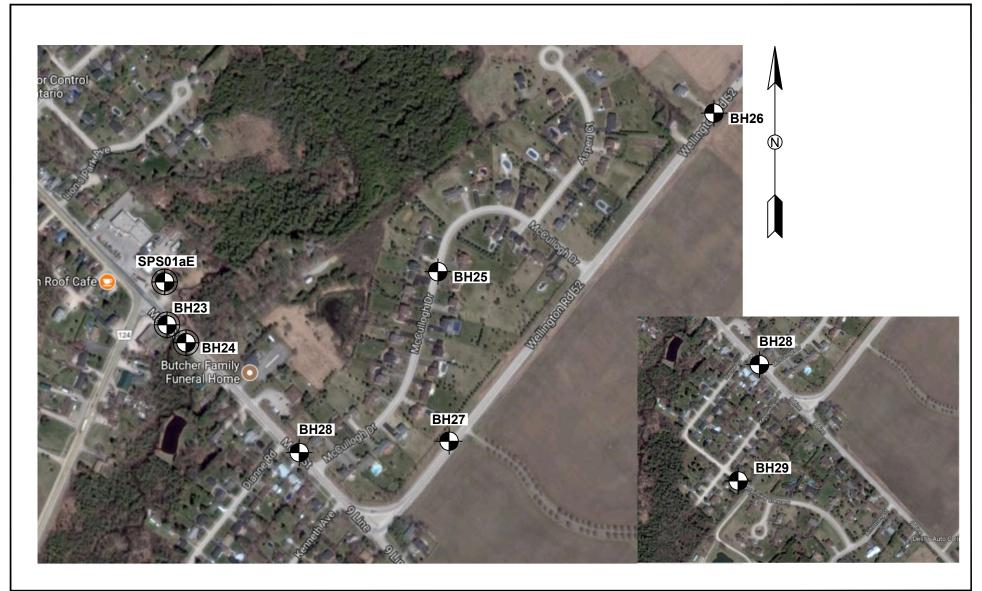




**Borehole Location** 



Client:	Ainl	ey 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			for
Original Size:	Letter	Rev:	KS		€ GeoPro	Consulting Limite	ed





**Borehole Location** 



Client:	Ainl	ey Group		Project No.:	16-1255	Drawing No.:	8
Drawn:	TY	Approved:	DL	Title: Borehole Location Plan			
Date:	November 2017	Scale:	N.T.S.	Project:	Urban Centro	technical Investigation f Wastewater Servicing of Erin, Ontario	or
Original Size:	Letter	Rev:	KS	GeoPro Consulting Limited			d





**Borehole Location** 



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





**Borehole Location** 



Client: Ainley Group				Project No.: <b>16-1255</b> Drawing No.: <b>10</b>			
Drawn:	TY	Approved:	DL	Title:			
Date:	November 2017	Scale:	N.T.S.	Project:	for		
Original Size:	Letter	Rev:	KS		€ GeoPro	Consulting Limite	d





**Borehole Location** 



Client:	Ainle	ey Group		Project No.:	Project No.: <b>16-1255</b> Drawing No.: <b>11</b>			
Drawn:	TY	Approved:	DL	Title:				
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				





**Borehole Location** 



Client:	Ainl	ey Group		Project No.:	Project No.: <b>16-1255</b> Drawing No.: <b>12</b>			
Drawn:	TY	Approved:	DL	Title: Borehole Location Plan				
Date:	November 2017	Scale:	N.T.S.	Project:	for			
Original Size:	Letter	Rev:	KS		€ GeoPro	Consulting Limite	ed	

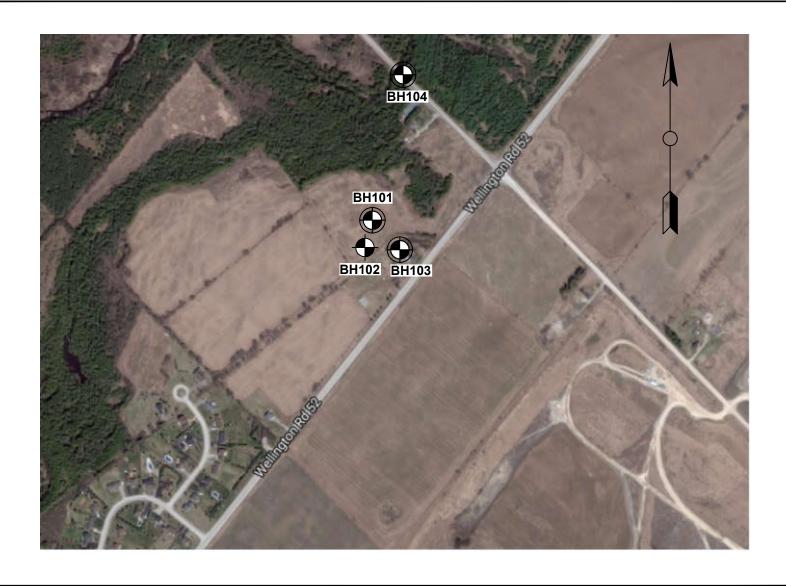




**Borehole Location** 



C	Client: Ainley Group				Project No.:	Project No.: <b>16-1255</b> Drawing No.: <b>13</b>			
	Orawn:	TY	Approved:	DL	Title: Borehole Location Plan				
	)ate:	November 2017 Scale: N.T.S.			Project:	Urban Centr	otechnical Investigation e Wastewater Servicing n of Erin, Ontario		
	Original Size:	Letter	Rev:	KS		€ GeoPre	o Consulting Limite	ed	





**Borehole Location** 



Client:	Ainl	ey Group		Project No.:	16-1255	Drawing No.:	14
Drawn:	TY	Approved:	DL	Title: Borehole Location Plan			
Date:	November 2017	Scale:	N.T.S.	Project:	for		
Original Size:	Letter	Rev:	KS	GeoPro Consulting Limited			





**Borehole Location** 



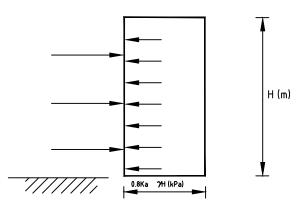
Client: Ainley Group				Project No.:	Project No.: <b>16-1255</b> Drawing No.: <b>15</b>			
Drawn:	TY	Approved:	DL	Title: Borehole Location Plan				
Date:	November 2017	Scale:	N.T.S.	Project:	for			
Original Size:	Letter	Rev:	KS		€ GeoPro	Consulting Limite	ed	

 $\gamma$  = unit weight of soil = 21.0 kN/m<sup>3</sup>

 $\gamma$ ' = 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)

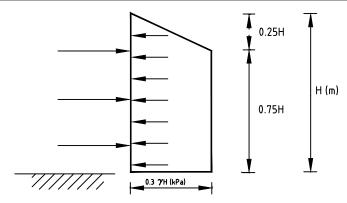


7 = unit weight of soil = 19.0 kN/m <sup>3</sup>

 $\gamma'$  = submerged unit weight of soil (i.e. below ground water level)= 9.2 kN/m <sup>3</sup>

Ka = 0.36

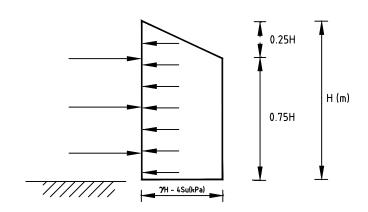
## IN LOOSE OR DISTURBED NON-COHESIVE SOILS (SANDS AND SILTS)



 $\gamma$  = unit weight of soil = 21.5 kN/m  $^3$ 

 $\gamma'$  = submerged unit weight of soil (i.e. below ground water level)= 11.7 kN/m<sup>3</sup>

#### IN COHESIVE CLAYS OR CLAYEY SOILS



 $\gamma$  = unit weight of soil = 19.0 kN/m<sup>3</sup>

7' = submerged unit weight of soil (i.e. below ground water level)= 9.2 kN/m³

Su = 10 KPa

#### IN VERY SOFT TO FIRM COHESIVE CLAYS OR CLAYEY SOILS

#### Notes.

- 1. Check system for partial excavation condition.
- 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 I	nfrastructure C	Froup Ltd.	Project No.: <b>16-1255</b> Drawing No.: <b>16</b>					
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					



# **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, 4<sup>th</sup> 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.
- 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

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

Auger 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<sub>d</sub>:

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,  $60^{\circ}$  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 Engine	eering 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)

Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

SPT "N" Value

#### Soil Tests

Soil rests											
W	Water content										
$\mathbf{W}_{p}$	Plastic limit										
Wı	Liquid limit										
С	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										



(3)																								
PROJ	ECT: Preliminary Geotechnical Invest	igatior	n for	Urba	n Ce	entre V												DA						
CLIENT: Ainley Group										METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm														
PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario									) EN													: 201		
DATUM: N/A									PLE			/: TY	1									NO.: 1		55
BH LOCATION: See Borehole Location Plan								_	CKE			ENIE	TD/	\TIO	NI T	EST	$\overline{}$					. NO.:	: 2 T	
SOIL PROFILE SAMPLES				H H		l '	0 5	SPT	~	z C	one	1	blows	s/0.3m		lastic	N	Natura Noistur	l e L	iquid Limit	,m	REMARKS AND		
		LOT			"N" BLOWS/0.3m	GROUND WATER	z			20		0	60		80		- 1	imit <sub>VP</sub>	C	Conten w	t	Limit W <sub>L</sub>	(kN/m³)	GRAIN SIZE
ELEV DEPTH	DESCRIPTION	STRATA PLOT	띪		ŏ	ND ND	ELEVATION	•						TH (			Ι,	⊢— Λ/ΑΤΕ	=R (	—o— CONT	FNT	— (%)	UNIT WT	DISTRIBUTION (%)
(m)		TRA	NUMBER	TYPE	N" B	ROL	I.E.V.	<b>A</b>	Quick		xial 🛭			neter		ab Var	ie	10	20			10	<u> </u>	GR SA SI CL
0.0	ASPHALT CONCRETE: (300 mm)	0)		-	-	ĬΠ	ш	t	T	Ť			Ť	T			+	Ť	Ť				_	OK OA OI OL
-																								
_ 0.3	GRANULAR BASE/SUBBASE: (230 mm)	$\otimes$	1A	AS													0							
- 0.5	FILL: sandy silt to silty sand, trace		1B	AS													0							
-	clay, trace gravel, brown, moist, compact	$\otimes$	_			1																		
_1			2A	SS	24					0								0						
1.1	SANDY GRAVEL: trace silt, containing cobbles and boulders,	0.0	2B	SS													0							
- 1.4	brown, moist, compact	41111																						
- '. <del>-</del>	SAND AND SILT: some gravel, trace clay, containing cobbles and		<u> </u>			1																		
-	boulders, brown, moist, loose		3	ss	7													0						13 43 37 7
- 2						]																		
-																								
-						1																		
-			4	ss	9													0						
-																								
-																								
<u>3</u> 2.9	2.9 GRAVELLY SAND TO SAND AND GRAVEL: trace to some silt	6 ()				1																		
-	till, layers/zones of sandy silt till, containing cobbles and boulders,	0 0	5	SS	46							0					Ι.	5						
-	brown, moist, dense	, ()	ľ		40																			
-		Pot				1																		
-		0																						
- <u>4</u>		0.0																						
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-		• O.	ı																					
-		0																						
-		6 () 6 ()			١.,												١.							
- - 5		0.0	6	SS	41						'	b					l°							
5.0	END OF BOREHOLE:	u. ·. ·	$\vdash$			H		T		$\vdash$				$\dashv$	$\dashv$	+	十	+						
	Note:																							
	1) Borehole caved at a depth of 4.3 m below ground surface (mBGS)																							
	upon completion of drilling.																							
			l					1									1						1	

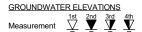


01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:02





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: CS DATE: 2017-11-08 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 3 SOIL PROFILE SAMPLES DYNAMIC PENETRATION TEST REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (230 mm) GRANULAR BASE/SUBBASE: 0.2 (610 mm) AS 2A SS SANDY SILT: some sand, trace to 23 0 some clay, trace gravel, dark brown 2B SS to brown, moist to wet, loose to compact ss 8 3 0 0 4 SS 8 3 2.9 GRAVELLY SAND TO SAND AND GRAVEL: some silt, trace to some clay, brown, moist, compact to dense 5 SS 19 d . Ģ. Ö. Ō. . O ٥٠٥ SS 50 6 0 5.0 END OF BOREHOLE 1) Borehole was open and dry upon completion of drilling.



2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



18"																								
PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servi												er Servicing DRILLING DATA												
CLIENT: Ainley Group										METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm													mm	
PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario									FIELD ENGINEER: KL DATE: 2017-11-23												23			
DATU	DATUM: N/A								PLE I	REV	ΊΕW	/: TY	,							F	REF.	NO.: 1	16-12	55
BH LC	BH LOCATION: See Borehole Location Plan									D: DI	_									E	ENCL	NO.:	4	
	SOIL PROFILE		SA	MPL	ES			Π	DYN	AMI	C PE	ENE	TRA	ATIO	N T	EST	-			Natura				REMARKS
		Τ.				띮			0 8	PT 20	4	. Co	one 60		blow: 80	s/0.3i	m	Plas Limi	tic I	Moistur Conten	e L ıt	iquid Limit	(kN/m³)	AND
		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	z	H		_			_		_		$\dashv$	W <sub>P</sub>	-	w	-	W <sub>L</sub>	ξ.	GRAIN SIZE
ELEV DEPTH	DESCRIPTION	TA F	Ä		No.	ΔN	ELEVATION		ح Uncor			TRE						\//	TER	—o— CON1	FENT	—I (%)	UNIT WT	DISTRIBUTION (%)
(m)		IRA	NUMBER	TYPE	B	R N	, E	•	Quick	Triax	ial 🗵	Pen	etron	neter	+ L	ab Va							늘	
8.6	ASPHALT CONCRETE: (25 mm)	.s	Ž	É	-	ڻ ق	i ii	╁	T 2	20	4	U	60	) 	80	, 	$\dashv$	- 1	0 2	20 3	10 4	10	$\Box$	GR SA SI CL
- 0:0	GRANULAR BASE/SUBBASE:	$\bowtie$	١,,															_						
-	(465 mm)	$\otimes$	1A	AS														0						
0.5	NO RECOVERY: likely sandy silt,	XX	-		-																			
- 0.0	trace organics		1B	AS														0						
-						1																		
_1			2	AS	7															þ				
-																								
-						1																		
1.4	FILL: sandy silt to sand and silt,	$\bowtie$																						
-	trace clay, trace gravel, brown, moist, loose	$\bowtie$																						
-		$\otimes$	3	SS	7														0					
2		$\bowtie$				1																		
		$\bigotimes$																						
- 2.1	FILL: sand, some silt, trace gravel, brown, moist, loose	$\bowtie$	_			1																		
-		$\bowtie$	١.		١.																			
-		$\bowtie$	4	SS	4			0										0						
-		$\otimes$	<u> </u>			ł																		
<u>3</u> 2.9	SAND: some silt, brown, moist,	XX																						
<u> </u>	loose		-			1																		
-			5	ss	5			0										0						
-			١	33	3			ľ										Ŭ						
-						1																		
-			1																					
-																								
<u>4</u> - 4.0	GRAVELLY SAND: some silt.																							
- 7.0	trace clay, containing rock	ه ٥٠																						
-	fragments, containing cobbles and boulders, brown, saturated,	0 0																						
-	compact	0																						
-		J. O.	1																					
-		0.0	6	SS	18				C	1									0					
- 5	END OF BOREHOLE:	<u> </u>	$\vdash$			<u> </u>		+	-				_	_	4	_	4						Н	
5.0																								
	Notes: 1) Water encountered at a depth of																ļ							
	4.6 m below ground surface																							
	(mBGS) during drilling.																							
	2) Borehole caved at a depth of 4.1 mBGS upon completion of drilling.																							
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01 - GEOPRO SOIL LOG GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ 2018-01-04 11:03



PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** METHOD: Continuous Flight Auger - Auto Hammer CLIENT: Ainley Group DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-11-01 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 5 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (55 mm) GRANULAR BASE/SUBBASE: 1A AS 0 (345 mm) FILL: sand, some gravel, trace to some silt, trace clay, brown, moist 1B AS GRAVELLY SAND TO SAND AND GRAVEL: trace clay, trace 0.8 ٥ ٥ 2 SS 27 0 silt, containing cobbles and boulders, brown, moist, loose to 1.0 dense ه ن , , O ٥. () SS 18 d 0 .Q ن ہ . Q. 4 AS 0 ن ه Ó ه ٥ Ö. 0 5 SS 5 0 ٥ ٥ Ó O. Ö. ٥. () Ι΄. .Ο. SS 49 0 6 **END OF BOREHOLE** 1) Borehole was open and dry upon completion of drilling.



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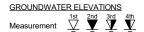
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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-11-01 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 6 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (70 mm) GRANULAR BASE/SUBBASE: 1A AS 0 (360 mm) FILL: gravelly sand, trace silt, brown, moist, loose 1B AS 0 2 SS 7 0 0 SAND: some gravel, trace silt, brown, moist, compact ss 13 lo 0 4 AS 0 3 2.9 GRAVELLY SAND TO SAND AND GRAVEL: trace to some silt, ٥٠ () trace clay, containing cobbles and boulders, brown, moist, dense to 5 SS 31 0 , O. very dense ٥ () Ö. Ō. Ö. ٥٠٥ SS 68 0 6 0 **END OF BOREHOLE** 1) Borehole caved at a depth of 2.7 m below ground surface (mBGS) upon completion of drilling.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-09 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 7 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (80 mm) GRANULAR BASE/SUBBASE: (680 mm) 1 AS 0 GRAVELLY SAND: some silt. 0.8 trace clay, containing cobbles and ٥ () 2 SS 44 0 boudlers, brown, moist, dense اء .0. 0.1 SAND: some gravel to gravelly, some silt, trace clay, brown, moist, compact SS | 26 0 0 SAND AND GRAVEL TO GRAVELLY SAND: some silt, trace clay, containing cobbles and boulders, brown to grey, moist to 4 ss 42 0 wet, compact to dense --- wet SS 35 0 --- grey, layers/zones of sand SS 14 0 6 0 5.0 END OF BOREHOLE 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.

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: CS DATE: 2017-11-08 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 8 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION Unconfined ★ Field Vane & Sensitivity
 Quick Triaxial ☑ Penetrometer + Lab Vane (%) WATER CONTENT (%) (m) 10 20 30 40 40 60 80 GR SA SI CL 0.0 ASPHALT CONCRETE: (110 mm) GRANULAR SUBBASE/BASE: (610 mm) 1A AS 0 FILL: sandy silt, trace clay, trace gravel, layers of silty sand, brown, 0 1B AS 2 SS 16 0 moist, compact SANDY SILT: trace to some clay, trace gravel, some organics, dark brown, moist, loose ss 3 6 0 0 SAND AND GRAVEL: trace to some silt, containing cobbles and boulders, brown, moist, dense 4 SS 32 0 SAND: trace to some silt, trace to some gravel, brown, moist, compact SS 13 О 0 SAND AND GRAVEL: trace to some silt, containing cobbles and boulders, brown, moist, dense SS 50 6 **END OF BOREHOLE** 1) Borehole was open and dry upon completion of drilling.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Service																								
PROJ	IECT: Preliminary Geotechnical Invest	igation	for	Urba	n Ce	ntre	Wastewater	Ser	vicin	g					I	DRII	LLII	NG D	ATA					
CLIEN	NT: Ainley Group						N	ΛEΤ	HOD	): Co	ntin	uous	s Fliç	ght A	Auge	er - <i>P</i>	Auto	Ham	mer	[	DIAM	ETER	: 155	mm
PROJ	IECT LOCATION: Town of Erin and H	illsburg	gh, C	Ontari	io		F	IEL	D EN	<b>IGIN</b>	IEEF	R: K	L							[	DATE	E: 201	7-11-	21
DATU	JM: N/A						5	SAM	PLE	RE۱	/IEV	V: T	Y							F	REF.	NO.: 1	16-12	55
BH LC	OCATION: See Borehole Location Plan	n					(	CHE	CKE	D: D	L									E	ENCL	NO.	: 9	
	SOIL PROFILE		SA	MPL	.ES				DYN	NAM				ATIO	T NC	ES	Γ			Natura	ıl			REMARKS
					33	띪				SPT 20		≥ C 10		0	blow 8	/s/0.3 ∩	m	Plas Limi	tic N	Moistur Conter	re l nt	Liquid Limit	(kN/m³)	AND
EL EV		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	7	<u>₹</u> ⊢		_		_	ENC	_				W <sub>P</sub>		w		$\mathbf{W}_{L}$	[돌	GRAIN SIZE DISTRIBUTION
ELEV DEPTH	DESCRIPTION	TAF	3ER		δ	DN.	F	•	Unco								,	W	ATER	—o—	ΓΕΝΤ	(%)	UNIT WT	(%)
(m)		TRA	NUMBER	TYPE	E E	ROL		<u> </u>	Quic	k Tria 20		⊠ Pe ∮0		mete 80	r + L 8		ane					40	<u>\</u>	GR SA SI CL
0.0	ASPHALT CONCRETE: (150 mm)	S	z	-	-	Θ	<u> </u>	+	<u> </u>	1	Т		Т						0 2			40	-	GR SA SI CL
0.2	, ,	$\times\!\!\times\!\!\times$				ł																		
-	(430mm)	$\bowtie$	1A	AS														0						
-		$\bowtie$																						
0.6	<b>FILL:</b> silty sand, some gravel, containing cobbles, brown, moist,	$\bowtie$	1B	AS														0						
_	compact	$\bowtie$																						
1			2	SS	19					þ								0						
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-		$\bowtie$																						
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-			3	SS	13				0									0						
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- - 2.1	GRAVELLY SAND TO SAND	-KXX																						
	AND GRAVEL: trace silt,	60.																						
-	containing rock fragments, containing cobbles and boulders,	0.0	4	ss	41													0						
-	brown, moist, compact to very	600																						
-	dense	و . و				1																		
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- <u>5</u>		0.0																						
5.0	END OF BOREHOLE:																							
	Note:																							
	1) Borehole caved at a depth of 2.1																							
	m below ground surface (mBGS) upon completion of drilling.																							
	· · · · ·																							
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PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-09 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 10 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH × DESCRIPTION ● Unconfined ★ Field Vane & Sensitivity

▲ Quick Triaxial ⊠ Penetrometer + Lab Vane (%) WATER CONTENT (%) (m) 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (90 mm) GRANULAR BASE/SUBBASE: (690 mm) 1 AS 0 **GRAVELLY SAND TO SAND** AND GRAVEL: some silt, trace ٥٠٥ 2B SS 18 d 0 clay, containing cobbles and boulders, brown, moist, compact to .Q very dense ٥. () SS 130 Ö. 3 > > 100 0 0 ن ه Ö. ٥ () Ö. SS 36 0 4 ٥ () ر. 0. ٥ () .O SS 49 0 ە 🗘 . O ن ن Ó ٥ () O. ه () --- auger grinding 96 .0 6 SS 255 >>10000 .Q 5.0 END OF BOREHOLE 1) Borehole caved at a depth of 3.2 m below ground surface (mBGS) upon completion of drilling.



2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-08 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 11 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (95 mm) -Concrete GRANULAR BASE/SUBBASE: (695 mm) 1 AS 0 **GRAVELLY SAND:** some silt, trace clay, containing cobbles and boulders, brown, moist to wet, loose 00 2 SS 13 0 -Rentonite to compact 1.2mBGS Dec 05 .O ٥٠0 . O ss 6 3 ن ن 0 0 Ó SAND: some silt, trace gravel, brown, saturated, very loose to compact SS 3 0 Screen 5 SS 12 0 -Natural pack SS 9 6 **END OF BOREHOLE** 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) W.L. Depth Dec. 5, 2017 1.22



2018-01-04 11:02

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-08 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 12 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (125 mm) -Concrete GRANULAR BASE/SUBBASE: 0.1 (645 mm) 1 AS O Bentonite SANDY SILT: some sand, some SS 2A organics, dark brown, moist, 11 1.1mBGS Dec 05 2B SS SILTY SAND: trace clay, some -Sand organics, some rootlets, brown, moist, loose to compact 7 3 SS 0 PEAT: black, moist, very loose to loose SS 2 <u>/ //</u> 4 11, <u>\ \ /,</u> 5 SS 4 0 0 -Natural  $\frac{\nabla}{\nabla}$ SAND AND GRAVEL: trace to pack some silt, trace clay, grey, wet, compact SS 11 o 6 **END OF BOREHOLE** 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) W.L. Depth Dec. 5, 2017 1.08



2018-01-04 11:02

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





		PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Serv																						
PROJ	IECT: Preliminary Geotechnical Invest	igation	for	Urba	n Ce	entre	Wastewater \$	Servi	cing						I	DRII	LLII	NG D	ATA					
	NT: Ainley Group													ght A	luge	er - <i>F</i>	∖uto	Ham	mer			IETER		
	JECT LOCATION: Town of Erin and Hi	illsburg	gh, C	)ntari	0			ELD												[	DATE	Ξ: 201	7-10-	31
DATU	JM: N/A						S	AMP	LE F	REV	′IEW	/: T\	′							F	REF.	NO.:	16-12	55
BH LC	OCATION: See Borehole Location Plan	n					С	HEC	KED	D: DI	L									-	ENCL	L. NO.	: 13	
	SOIL PROFILE		SA	MPL		_ س			OYN. os			ENE z C	TRA	ATIC		ΓES <sup>*</sup> /s/0.3		Plas	tic N	Natura	al Co	Liquid	رور (	REMARKS
					"N" BLOWS/0.3m	GROUND WATER				0		0	6	0	8		,,,,,	Limi	t (	/loistur Conter	nt	Liquid Limit	(kN/m³)	AND GRAIN SIZE
ELEV	DESCRIPTION	STRATA PLOT	~		/S/	Ŋ O	ELEVATION		S	HEA	AR S	TRI	ENG	тн	(kP	a)		W <sub>P</sub> ⊢				W <sub>L</sub>	1)	DISTRIBUTION
DEPTH (m)	BESSIAL FISH	SAT/	NUMBER	٦	BLC	N N		● L					ld Va netror					WA	ATER	CON	TENT	(%)	UNIT WT	(%)
		STF	N	TYPE	ż	GR				0	4		6		8			1	0 2	0 3	30	40	<u>S</u>	GR SA SI CL
<u>0.0</u> _ 0.1	ASPHALT CONCRETE: (100 mm) GRANULAR BASE/SUBBASE:	XX				ł																		
- 0	(360 mm)	$\bowtie$	1A	AS														0						
- - 0.5	FILL: gravelly sand, some silt to	$\bowtie$			-																			
- 0.5	silty, trace clay, brown, moist, loose	$\otimes$	1B	AS														0						
-		$\bowtie$				ł																		
- <u>1</u>		$\bowtie$	2	SS	9				}									0						
-		$\otimes$																						
-																								
1.4	<b>GRAVELLY SAND:</b> trace silt, containing cobbles and boulders,	° O.				1																		
-	brown, moist, compact	0.0			4-																			
-		, O	3	SS	15				0									0						
2		6.0.				1																		
- -		0.0																						
-		٥ ٥																						
-		0	4	AS														0						
-		0.0																						
-		0.00																						
3		0				4																		
-		6.0.	_	00	0.4																			
-		0 0	5	SS	24					0								0						
-		6.00				1																		
-		0																						
-		0.0																						
<u>-</u>		0.00																						
-		0																						
-		60.																						
-		0.0				┨																		
-		. 0.	6	SS	15				0									0						
- - <u>5</u>		0 0	ľ																					
5.0	END OF BOREHOLE																							
	Note:																							
	1) Borehole caved at a depth of 3.7 m below ground surface (mBGS)																							
	upon completion of drilling.																							
						1																		
								1																
								1																
						1																		
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						1		1															1	





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-10-31 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 14 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (75 mm) GRANULAR BASE/SUBBASE: 1A AS 0 (315 mm) FILL: sandy silt, trace to some clay, trace gravel, containing rock 1B AS fragments, containing cobbles, compact 2 SS 14 0 1.4 FILL: silty sand, trace to some gravel, trace clay, pockets of clayey silt, brown, moist, loose ss 8 0 0 4 AS 3 2.9 SAND AND SILT TILL: trace clay, trace gravel, containing cobbles and boulders, brown, moist, dense to very dense SS 48 o SS 74 0 6 **END OF BOREHOLE** 1) Borehole was open and dry upon completion of drilling.



2018-01-04 11:02

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





12	PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Service																							
PROJ	JECT: Preliminary Geotechnical Investi	Wastewater	Sen	ricing	ı						DRII	LLII	NG D	ATA										
CLIEN	NT: Ainley Group						N	IETH	HOD	Cor	ntinu	ious	Flig	ht A	uge	r - <i>P</i>	Auto	Ham	mer		DIAM	ETER	: 155	mm
PROJ	JECT LOCATION: Town of Erin and Hi	llsburg	gh, C	)ntari	io		F	IEL	EN	GIN	EER	R: GH	1								DATE	: 201	7-10-	31
DATU	JM: N/A						5	AMI	PLE	REV	ΊΕW	: TY	,							F	REF.	NO.: 1	16-12	55
BH LO	OCATION: See Borehole Location Plan	า					C	HE	CKE	D: DI	L									Е	NCL	NO.:	: 15	
	SOIL PROFILE		SA	MPL	.ES				DYN	AMI	C PI	ENE	TRA	ATIC	N T	ES	Γ			Natura	ı			REMARKS
		Ι.				띮			0.5	PT 20		e Co			blow		m	Plast Limit	tic N	Noisture Conten	e l t	Liquid Limit	(kN/m³)	AND
		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	2	ŀ			4		60		80			W <sub>P</sub>		W		W <sub>L</sub>	S S	GRAIN SIZE
ELEV DEPTH	DESCRIPTION	Ι¥	ER		Š	Q.	Ę		S Uncoi			TRE					,	10/0	TED	O	FENIT		W	DISTRIBUTION (%)
(m)		RA.	NUMBER	TYPE	" BL	S S	NO E AVE	Ĭ	Quick	Triax	dal ⊠	Pen	etron	neter	+ L	ab V				CONT			UNIT WT	
0.0	ASPHALT CONCRETE: (100 mm)	တ	ž	F	Z	9	ū I	4		20	4	0	60	)	80	)		1	0 2	0 3	0 4	40	5	GR SA SI CL
0.1	GRANULAR BASE/SUBBASE:	$\times$																						
-	(360 mm)	$\bowtie$	1A	AS														0						
- 0.5	FILL: silty sand, some gravel, trace	$\bigotimes$			-																			
- 0.5	clay, brown, moist	$\otimes$	1B	AS														0						
- - 0.8	FILL: gravelly sand, some silt to	$\overset{\sim}{\otimes}$																						
- _1	silty, containing rock fragments,		2	SS	42							。						0						
-	brown, moist, dense		_		72																			
-		$\bowtie$																						
1.4	FILL: silty sand, trace clay, trace	$\bowtie$																						
-	gravel, brown, moist, very loose	$\bowtie$																						
-		$\bowtie$	3	SS	2			b										0						
-		$\otimes$																						
		$\bowtie$				1																		
-																								
-																								
-			4	AS														0						
-		$\bowtie$																						
-		$\bowtie$																						
<u>3</u> 2.9		φ																						
-	trace gravel, containing cobbles and boulders, brown, moist, very																							
-	dense		5	SS	65									0				0						
-																								
-																								
-																								
- 4																								
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-																								
-		$    \phi    $																						
-					50 /																			
-			6	SS	75											> > 	100 (	) 0						
4.8	END OF BOREHOLE				mm																			
	Note:																							
	Borehole was open and dry upon completion of drilling.																							
	completion of drilling.																							
								1																
								1																
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**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-17 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 16 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 20 40 60 80 GR SA SI CL ASPHALT CONCRETE: (95 mm) -Concrete GRANULAR BASE/SUBBASE: (665 mm) 1 AS 0 GRAVELLY SAND TO SAND AND GRAVEL: trace to some silt, ٥ () 2 SS 19 trace clay, containing cobbles and boulders, moist to wet, compact to ). .o. very dense ن ه Bentonite --- auger grinding Ö. ن ه SS | 63 3 0 0 Ó ن ه .O SS 36 0 0 4 ن ن Ó ن ه --- wet .O SS 39 0 ٥ ٥ --- auger grinding Ø. ن ه Screen Q Ö. ٥ ٥ ر. آ.*ه* . ن SS 61 -Natural 6 0 pack **END OF BOREHOLE** 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) W.L. Depth Dec. 15, 2017



2018-01-04 11:02

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL







**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing METHOD: Continuous Flight Auger - Auto Hammer CLIENT: Ainley Group DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-23 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 17 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (60 mm) GRANULAR BASE/SUBBASE: 1A AS 0 (440 mm) FILL: gravelly sand, trace clay, trace silt, brown, moist, loose to 1B AS 0 compact 2 SS 10 **GRAVELLY SAND TO SAND** AND GRAVEL: trace to some silt, ٥٠ () containing rock fragments, 3 SS 31 containing cobbles and boulders, 0 Ö. brown, moist, dense Ō. ---auger grinding ن ه O. ن ن Ō. ٥ () β. .0. SS 47 С 0 ٥ () ٥ () Q. ی ه Ö. ٥ () SS 42 5 **END OF BOREHOLE** 1) Borehole caved at a depth of 2.9 m below ground surface (mBGS) upon completion of drilling.



2018-01-04 11:02

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-23 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 18 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (125 mm) -Concrete 0.1 GRANULAR BASE/SUBBASE: 1A AS (325 mm) FILL: sand and silt to silty sand, 0.5 1B AS trace to some clay, trace gravel, brown, moist to wet, loose to 2 SS 29 Bentonite SS 13 0 0 --- wet 4 SS 6 0 2.7mBGS Dec 11 —Sand ORGANIC SILT: some sand, trace clay, containing cobbles and boulders, black, moist, loose to compact 5 SS 10 Screen GRAVELLY SAND: trace clay, ٥ ٥ trace silt, containing rock fragments, brown, saturated, compact Ó ن ہ ). . O. SS 27 -Natural 0 6 pack 5.0 END OF BOREHOLE 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



2018-01-04 11:02

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing																								
PROJ	IECT: Preliminary Geotechnical Investi	igation	for	Urba	n Ce	ntre \	Wastewater	Ser	vicin	g						RIL	LII	NG D	ATA					
CLIEN	NT: Ainley Group						N	1ET	HOD	: Co	ntinu	ious	Flig	jht A	uge	r - A	uto	Ham	mer	I	DIAM	1ETER	205	mm
PROJ	IECT LOCATION: Town of Erin and Hi	llsburg	gh, C	ntari	io		F	IEL	D EN	IGIN	EEF	₹:								I	DATE	Ξ: 201	7-11-	-23
DATU	JM: N/A						5	AM	PLE	RΕV	/IEV	<b>/</b> :								ı	REF.	NO.: 1	16-12	:55
BH LO	OCATION: See Borehole Location Plan	ı					(	HE	CKE	D:										ı	ENCI	L. NO.	: 19	
	SOIL PROFILE		SA	MPL	.ES			T	DYN	IAMI				ATIC	N T	EST	-			Natura	al			REMARKS
					33	H.			0 :	SPT 20		z Co 0	one 6		blow 80	s/0.3เ า	m	Plas Limi	tic 1	Moistur Conter	re nt	Liquid Limit	(kN/m³)	AND
EL E./		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	ž	$\cdot$		SHEA								$\mathbf{W}_{P}$		w		$\mathbf{W}_{\mathrm{L}}$	\ <u>\{\</u>	GRAIN SIZE DISTRIBUTION
ELEV DEPTH	DESCRIPTION	TAF	3ER		δ	N Q	NO F	<u> </u>	Unco									WA	TFR	—o− CON	TENT	(%)	UNIT WT	(%)
(m)		TRA	NUMBER	TYPE	E E	ROL	2		Quicl	cTria: 20		I Per 0	netror 6		+ L		ane					40		GR SA SI CL
0.0	ASPHALT CONCRETE: (120 mm)	S	z	-	-	٥		+	Т	1	T -			T		, 	$\dashv$					40	-	GR SA SI CL
0.1	GRANULAR BASE/SUBBASE:	$\boxtimes$																						
-	(400 mm)	$\bowtie$	1A	AS														0						
- 0.5	FILL: gravelly sand, some silt,	$\bowtie$			-																			
- 0.5	trace clay, brown, moist, compact	$\bowtie$	1B	AS														0						
-																								
1		$\bowtie$	2	SS	21					þ								0						
-		$\bowtie$																						
-	<b></b>	$\bigotimes$																						
1.4	FILL: sandy silt to sand and silt, trace clay, trace gravel, containing																							
-	cobbles, brown, moist to wet, loose	$\bowtie$	3																					
-	to very dense	SS	6			Ι'												0						
2		$\otimes$																						
-		$\bowtie$																						
-		$\bowtie$			50 /	l																		
-		$\bowtie$	4	SS	145											> >	100 (	)	0					
-		$\bowtie$			mm	ll																		
-		$\otimes$																						
<u>3</u> 2.9		T v																						
-	gravel, very dense auger grinding		5	SS	50 /											> >	100 C	0						
-	aager gag				75 mm																			
-																								
-																								
-																								
- _4																								
- 4.0	GRAVELLY SAND: some silt,	ö. Ö.																						
-	trace clay, containing rock fragments, containing cobbles and																							
-	boulders, brown, moist, very dense	.0.																						
-		6.0	6	SS	50 /	l										> >	100 (	0						
4.7	END OF BOREHOLE				100																			
	Note:				mm																			
	1) Borehole caved at a depth of 3.8 m below ground surface (mBGS)																							
	upon completion of drilling.																							
	-																							
																							1	





PROJ	IECT: Preliminary Geotechnical Invest	igation	for	Urba	n Ce	ntre Wastev	vater S	ervic	ing						[	DRII	LLII	NG D	ATA					
	NT: Ainley Group						M	ETHC	)D: (	Con	tinu	ous	Flig	ht A	uge	r - <i>F</i>	Auto	Ham	mer	[	DIAM	ETER	: 155	mm
PROJ	IECT LOCATION: Town of Erin and Hi	illsburg	gh, C	)ntari	o		FII	ELD E	ENG	INE	ER	: KL	•							[	DATE	: 201	7-11-	13
DATU	JM: N/A						SA	MPL	E RI	EVI	EW	:TY	′							F	REF.	NO.: 1	16-12	55
BH LO	OCATION: See Borehole Location Plan	n					Cŀ	IECK	ED:	DL										E	NCL	NO.:	20	
	SOIL PROFILE		SA	MPL		_~			YNA SP			ENE Co				ES <sup>2</sup>		Plas	tio N	Natura	1	Liamid	3)	REMARKS
		77			"N" BLOWS/0.3m	GROUND WATER			20		4(		6		8		1111	Limi		/loistur Conten	it	Liquid Limit	(kN/m³)	AND GRAIN SIZE
ELEV	DESCRIPTION	STRATA PLOT	œ		/S/	Š	NO							тн				W <sub>P</sub>				W <sub>L</sub>	t)	DISTRIBUTION
DEPTH (m)	BESSIAI FISIA	3AT/	NUMBER	Щ	BLO	N N N	ELEVATION	● Un ▲ Qι										WA	ATER	CONT	ΓEΝΤ	(%)	UNIT WT	(%)
		STE	N	TYPE	ż	GR.	===		20		40		6		80			1	0 2	0 3	0 -	40	5	GR SA SI CL
0.0 0.1	ASPHALT CONCRETE: (85 mm)	$\otimes$				1																		
-	(545 mm)		1A	AS														0						
-		$\bowtie$	''`	,														-						
- - 0.6	FILL: gravelly sand, trace to some		1B	AS														0						
-	silt, brown, moist, compact	$\bowtie$		,		1																		
1		$\otimes$	2	SS	24				-	0								0						
-		$\bowtie$																						
1.4	GRAVELLY SAND TO SAND																							
- 1.4	AND GRAVEL: trace to some silt,	60																						
-	trace clay, containing rock fragments, containing cobbles and	0 0	3	ss	46							0						0						
-	boulders, dense to very dense	. O.	ľ		.																			
_2		0.0				1																		
-		0																						
-		6.0.																						
-		[ <i>o</i> . 0	4	SS	53								0					0						
-		60																						
<u>3</u> 2.9	NO RECOVERY DUE TO	D. ∵.																						
- ]	COBBLES: likely sand and gravel,		5	SS	50 /	1										>>	100 (	0						
-	very dense auger grinding				100 mm																			
-																								
-																								
-																								
- <sub>4</sub> 3.9	GRAVELLY SAND TO SAND AND GRAVEL: trace to some silt,	6 O.																						
-	trace clay, containing rock	P																						
-	fragments, containing cobbles and boulders, dense	0																						
-	,	0. Q.																						
-		0																						
- - <u>5</u>		( O	6	SS	32					C	0							0						
5.0	END OF BOREHOLE:	0 0							+	_		_	$\dashv$	_									Н	
5.0																								
	Note: 1) Borehole caved at a depth of 4.0																							
	m below ground surface (mBGS)																							
	upon completion of drilling.																							
		1			1				- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1			i			1		







**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-13 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 21 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 20 40 60 80 GR SA SI CL ASPHALT CONCRETE: (95 mm) -Concrete GRANULAR BASE/SUBBASE: (625 mm) 1A AS 1B AS 0.7 FILL: silty sand, some gravel, trace clay, trace organics, dark brown, 2 SS 20 moist, compact 1.2mBGS Dec 17 **GRAVELLY SAND TO SAND** AND GRAVEL: trace to some silt, ٥٠ () trace clay, layers/zones of sand, 3 SS 41 containing rock fragments, 0.0 containing cobbles and boulders, brown, wet, dense to very dense Ö. ن ه ). . O SS 46 0 4 .O ن ن SS 61 --- layers of sand . O Sand ٥ () Screen Ó SANDY SILT TILL: trace to some clay, trace gravel, containing cobbles and boulders, grey, moist, dense SS 47 Natural О 6 Pack **END OF BOREHOLE** 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) W.L. Depth Dec. 17, 2017



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



CLIE	JECT: Preliminary Geotechnical Investi NT: Ainley Group JECT LOCATION: Town of Erin and Hi JM: N/A OCATION: See Borehole Location Plar SOIL PROFILE					ntre Wastewa	ME		D: C			-	jht A			ING I o Han	<b>DATA</b> nmer		DIAME	TER	: 155	mm
PRO. DATU	JECT LOCATION: Town of Erin and Hi JM: N/A DCATION: See Borehole Location Plar	illsburg	gh, O	)ntari	0							-	jht A	uger	- Aut	o Han	nmer		DIAME	TER	155	mm
DATU	JM: N/A DCATION: See Borehole Location Plan	llsburg	gh, O	ntari	0		FIE	ו חו=														
	OCATION: See Borehole Location Plan			PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario															DATE:	201	7-11-	14
BH L							SA	MPL	E RE	VIE۱	W: T	Υ						F	REF. N	NO.: 1	6-12	55
	SOIL PROFILE	า					CH	HECK	(ED: I	DL								Е	ENCL.	NO.:	22	
			SA	MPL	ES			D,	YNAN	/IC F	PENE	ETR/	ATIO	N T	EST			Natura	1			REMARKS
		Ι.				Ä			SPT 20		≥ C 40	Cone 6		blows 80	s/0.3m	Pla Lim	stic l	Moistur Conten	e Li it	iquid Limit	$(kN/m^3)$	AND
		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	z									w <sub>P</sub>		w		WL	(KN	GRAIN SIZE
ELEV DEPTH	DESCRIPTION	TAF	3ER		wo.	ΔN	ΔTIC	● Ur	SHE			ENG				,,,	ATER		FENIT /	— (%)	WT	DISTRIBUTION (%)
(m)		TRA	NUMBER	TYPE	۱. BI	ROL	ELEVATION	<b>≜</b> Qı	iick Tri 20		⊠ Pe 40	netror		+ La	ab Van	9					UNIT WT	
0.0	ASPHALT CONCRETE: (95 mm)	S	z	-	-	0	Ш	Н	-20	Τ.	40		T	-80		+	10 2	20 3	4			GR SA SI CL
0.1	GRANULAR BASE/SUBBASE:	$\bowtie$																				
-	(465 mm)	$\bowtie$	1A	AS												0						
		$\bigotimes$																				
0.6	FILL: gravelly sand to sand and gravel, some silt, trace clay, dark	$\otimes$	1B	AS												0						
-	brown, moist to wet, compact to	$\bowtie$																				
_1	very dense	$\bowtie$	2	SS	19				þ							0	,					
-		$\bowtie$																				
-		$\bowtie$																				
-	wat	$\bowtie$																				
-	wet	$\bowtie$	2		40																	
-		$\bowtie$	3	SS	13				2								0					
-		$\bowtie$																				
-	auger grinding	$\bowtie$	4	SS	50 /												0					
-		$\otimes$			130 mm																	
-					ш																	
-		$\bowtie$																				
3 3 0	PROBABLE BEDROCK:	$\otimes$																				
3.1	dolostone, brown		5/	(55)	50 / 25																	
	END OF BOREHOLE DUE TO AUGER REFUSAL ON				mm																	
	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.																					







**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-11-01 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 23 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND 'N" BLOWS/0.3m 60 Content 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 30 40 40 60 10 20 GR SA SI CL 8.9 (ASPHALT CONCRETE: (45 mm) 1A AS GRANULAR BASE/SUBBASE: \(205 mm) FILL: gravelly sand, trace to some AS 1B silt, trace clay, brown, moist, compact 2 SS 17 0 **GRAVELLY SAND TO SAND** AND GRAVEL: trace to some silt, ٥ () trace clay, containing cobbles and 3 SS 22 boulders, brown, wet, compact to 0. very dense Ö. ٥ () ). . O 4 AS 0 Ō. 93 ٥٠0 5 SS 230 > > 100 d mm --- auger grinding . O ٥. () Ó ن ہ Q. ن ه 6 ASS 4.6 END OF BOREHOLE 25 mm 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.



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155m PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-23 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 24 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (170 mm) -Concrete GRANULAR BASE/SUBBASE: 0.2 (400 mm) 1A AS 0.6 FILL: sand to silty sand, trace 1B AS 0 gravel, trace organics, trace roolets, pockets of sandy silt, brown to grey, moist, loose to compact 2 ss 7 0 1.2mBGS Dec 17 --- grey ss 3 8 7 79 14 0 4 SS 14 0 SAND: trace to some silt, trace to some gravel, containing rock fragments, grey, wet, dense SS 40 Sand Screen 6A SS SANDY GRAVEL: some silt, Natural 38 6B SS containing cobbles and boulders, Pack brown, saturated, dense **END OF BOREHOLE** 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



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-15 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 25 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (290 mm) -Concrete GRANULAR BASE/SUBBASE: 1A AS FILL: sandy silt to silty sand, trace 1B AS clay, trace gravel, trace organics, dark brown, moist, very dense 2 SS 54 0 1.1mBGS Dec 17 **GRAVELLY SAND TO SAND** AND GRAVEL: some silt, trace ٥٠ () clay, grey, wet, very dense SS | 54 3 0 o Ö. Ö. ن ه Q ن ه Ō. ٥ () ۲*۰* ۰٥. SS 62 0 Sand ٥ () Screen Ó ن ہ Ó ٥. ٥ Ö. ن ن SS 51 Natural 6 Pack ,. O **END OF BOREHOLE** 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) W.L. Depth Dec. 17, 2017



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-11-01 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 26 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (80 mm) GRANULAR BASE/SUBBASE: 1A AS 0 (340 mm) FILL: silty sand, some gravel, trace 0.4 1B AS clay, brown, moist **GRAVELLY SAND:** trace to some 0.8 silt, trace clay, containing cobbles ٥. () 2 SS 25 0 38 48 12 2 and boulders, brown, moist, compact to dense . O ٥ () , , O ن ه SS 21 0 Ó ن ه .O 4 AS 0 ن ن Ó ن ه Ó SS 39 0 ٥ ٥ Ó SAND AND GRAVEL: trace clay, trace silt, containing cobbles and boulders, brown, wet, compact SS 26 0 6 5.0 END OF BOREHOLE 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.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing  CLIENT: Ainley Group  METHOD: Continuous Flight Auger - Auto Hammer  DIA																							
PROJ	ECT: Preliminary Geotechnical Investi	Serv	icing	ı					DF	RILLI	NG E	ATA											
CLIEN	IT: Ainley Group						M	ETH	HOD	Co	ntinu	ious	Fligh	nt Au	ger	- Auto	Ham	mer		DIAM	ETER	: 155	mm
PROJ	ECT LOCATION: Town of Erin and Hi	illsburg	gh, C	Ontari	io		F	IELD	EN	GIN	EEF	R: KL								DATE	: 201	7-11-	15
DATU	IM: N/A						S	AMF	LE I	REV	/IEV	/: TY	,						F	REF.	NO.: 1	16-12	55
BH LC	OCATION: See Borehole Location Plan	n					С	HEC	KE	D: DI	L								Е	ENCL	NO.:	: 27	
	SOIL PROFILE		SA	MPL	.ES			1	OYN	AMI			TRA	TION	I TE	ST			Natura	ı			REMARKS
						띪			0 5	PT 20		z Co O	ne 60		lows/ 80	0.3m	Plas Limi	tic N	/loistur Conten	e L t	iquid. Limit	(kN/m³)	AND
EL EV		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	z			_			ENG		_		W <sub>P</sub>		w		$\mathbf{W}_{\mathrm{L}}$	동	GRAIN SIZE DISTRIBUTION
ELEV DEPTH	DESCRIPTION	IĀ	NUMBER		δ	S S	ELEVATION	•	ی Uncoi	nfine	d >	<b>S</b> Field	d Van	i⊓ (r e & S	ensiti	vity	w	ATER	—o— CONT	FNT	(%)	UNIT WT	(%)
(m)		Ĭ.	I™	TYPE	巨	JO H	LEV	<b>A</b> (		Triax		I Pen 0	etrom 60		+ Lab 80	Vane	l		0 3		40	ΙΞ	GR SA SI CL
0.0	ASPHALT CONCRETE: (160 mm)	, o	Z	┢	F		ш	+	T	<del> </del>		П	Ť	Т	Ť	Т			Ĭ	_	†	۲_	GR SA SI CL
0.2	GRANULAR BASE/SUBBASE:	$\times\!\!\times$				1 1																	
-	(500 mm)	$\bowtie$	1A	AS																			
-		$\bowtie$	'^	٨٥													ľ						
- 0.7	FILL: silty sand, trace to some	$\times$	1B	AS	-												0						
-	gravel, brown, moist, dense	$\bowtie$				1 1																	
_1		$\bowtie$	2	SS	35						0						0						
-																							
- 11	SAND: trace silt, trace gravel,	$\bowtie$																					
1.4	brown, moist, compact		-																				
-			3	ss	16				0														
_			l <sup>3</sup>	33	10				"								ľ						
- 2 - -						1 1																	
-																							
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- - - -			4	SS	12				0								0						
-																							
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<u>3</u>																							
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-			5	SS	12				0								0						
-																							
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4																							
4.0	<b>GRAVELLY SAND:</b> trace silt, containing cobbles and boulders,	0.0.																					
-	brown, moist, dense	0 0																					
-		, O																					
-		P. ().																					
-		0.0	6	SS	38						c						0						
- 5	END OF PORTUGUE	مما	_			Ш		_	_						4								
5.0	END OF BOREHOLE																						
	Note: 1) Borehole caved at a depth of 4.4																						
	m below ground surface (mBGS)																						
	upon completion of drilling.																						





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-15 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 28 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (195 mm) GRANULAR BASE/SUBBASE: 0.2 (485 mm) 1A AS FILL: gravelly sand, some silt, containing cobbles and boulders, 1B AS brown, moist, compact to dense SS 30 SS 3 19 þ 0 SAND: trace to some gravel, trace silt, containing cobbles and boulders, brown, moist, compact SS 14 0 0 5 SS 12 0 GRAVELLY SAND: trace silt, containing rock fragments, containing cobbles and boulders, ٥ () , , , , brown, moist, compact to dense ن ه ). . O. SS 30 6 **END OF BOREHOLE** 1) Borehole caved at a depth of 2.7 m below ground surface (mBGS) upon completion of drilling.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-15 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 29 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (255 mm) GRANULAR BASE/SUBBASE: (365 mm) 1A AS 0.6 FILL: sandy silt to silty sand, trace 1B AS clay, trace gravel, trace organics, dark brown to brown, moist, very 2 ss 5 0 loose to loose SS 3 3 0 ---brown **GRAVELLY SAND TO SANDY** GRAVEL: trace silt, trace clay, ه () containing rock fragments, containing cobbles and boulders, 4 ss 47 0 0 Ö brown, moist to wet, compact to ٥. ٥ Ó --- auger grinding, wet ن ہ SS 15 0 57 34 9 Ó Ó Ö. ٥ ٥ SS 41 6 **END OF BOREHOLE** 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.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-10-31 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 30 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (100 mm) GRANULAR BASE/SUBBASE: 1A AS 0 (400 mm) 0.5 FILL: sandy silt, some clay, trace 1B AS 0 gravel, brown, moist GRAVELLY SAND TO SAND 0.8 AND GRAVEL: trace to some ٥ () 2 SS 24 0 clay, trace to some silt, containing cobbles and boulders, brown, moist .O to wet, compact to dense ن ه Ö. ٥. () SS | 38 3 0 .Q ن ہ .O 4 ss 19 0 ن ن Ó ه ٥ --- wet Ö. SS 35 0 O ٥ ٥ Ó O. Ö. ٥ ٥ Ι΄. .Ο. SS 23 lo 6 5.0 END OF BOREHOLE 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.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-13 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 31 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (115 mm) 0.1 GRANULAR BASE/SUBBASE: (665 mm) AS 0 1 0 **GRAVELLY SAND TO SAND** AND GRAVEL: trace to some silt, ٥٠٥ 2B SS 48 containing cobbles and boulders, brown, moist, dense to very dense .Q ٥. () Ö. SS | 65 3 0 ن ه Ö. SAND: trace silt, trace gravel, brown, wet, compact SS 4A 26 0 **GRAVELLY SAND:** trace to some 4B SS 0 silt, containing rock fragments, containing cobbles and boulders, brown, wet, compact 0 ن ن 5 SS 19 d Ö. Ö. SAND: trace silt, trace gravel, 4.0 brown, wet, compact 6A SS 0 28 0 4.9 SAND AND GRAVEL: trace silt, 6B SS O containing cobbles and boulders, brown, wet, compact **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.



2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-02 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 32 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (85 mm) GRANULAR BASE/SUBBASE: (565 mm) 1A AS FILL: gravelly sand, trace clay, 1B AS 0 trace silt, brown, moist, compact SS 24 0 FILL: silty sand, trace to some gravel, trace clay, containing cobbles, brown, moist, dense ЗА SS 0 1.8 FILL: sandy silt, trace to some 3B SS 0 clay, trace gravel, trace organics, dark brown, moist to wet, dense SILTY SAND: trace clay, trace gravel, layers of silty sand, pockets of sand, brown, moist, compact 5 SS 22 4 61 30 5 SAND: trace silt, trace gravel, 4.0 brown, moist, very dense SS 71 0 6 **END OF BOREHOLE** 1) Borehole was open and dry upon completion of drilling.



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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





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PROJ	IECT: Preliminary Geotechnical Invest	igation	for	Urba	n Ce	ntre	Wastewater	Ser	vicin	g					I	DRII	LLII	NG D	ATA					
CLIEN	NT: Ainley Group						N	1ET	HOD	: Co	ntin	uous	s Fli	ght A	Auge	er - <i>F</i>	∖uto	Ham	mer		DIAM	ETER	: 155	mm
PROJ	JECT LOCATION: Town of Erin and H	illsburg	gh, C	ntari	io		F	IEL	D EN	IGIN	IEEI	R: K	L								DATE	E: 201	7-11-	02
DATU	JM: N/A						S	ΑN	PLE	RE\	/IEV	V: T	Y							F	REF.	NO.: 1	16-12	55
BH L	OCATION: See Borehole Location Plan	n					C	HE	CKE	D: D	L									Е	ENCL	NO.:	: 33	
	SOIL PROFILE		SA	MPL	.ES				DYN	IAM				ATIC	T NC	ΓES	Т			Natura	ı			REMARKS
						띮				SPT 20		≥ C 10	one 6	0	blow 8	/s/0.3 n	ßm	Plas Limi	tic N	Moistur Conten	e l	Liquid Limit	(kN/m³)	AND
EL E) /		STRATA PLOT			"N" BLOWS/0.3m	GROUND WATER	2	$\cdot$		SHE		_		_				W <sub>P</sub>		w		$\mathbf{W}_{\mathrm{L}}$	(K)	GRAIN SIZE DISTRIBUTION
ELEV DEPTH	DESCRIPTION	TAF	3ER		δ	a N	OI F	۱.	Unco								y	W	TFR	—o— CONT	FNT	(%)	W	(%)
(m)		TRA	NUMBER	TYPE	E E	ROL	NO EAVE IS	1	Quic	k Tria 20		⊠ Pe 40		mete 0	r + L 8		ane'					40	UNIT WT	GR SA SI CL
— <u>- g</u> .g.	ASPHALT CONCRETE: (45 mm)	σ Λ	z		-	9		+	$\top$	1	Τ.	1	Т			Ш			0 2	.0 3		40		GR SA SI CL
- 0.1	GRANULAR BASE/SUBBASE:	$\bowtie$																						
-	(525 mm)	$\bowtie$	1A	AS														0						
-		$\bowtie$																						
0.6	FILL: gravelly sand, trace clay, trace silt, brown, moist, dense	$\times$	1B	AS																				
-	trace siit, brown, moist, dense																							
_1		$\bowtie$	2	SS	32						0							0						
-		$\otimes$																						
- 4.4	CAND: trees to some money to	XX																						
1.4	<b>SAND:</b> trace to some gravel, trace silt, brown, moist, compact to very																							
-	dense		3	SS	20													0						
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-			6A	SS														0						
- 4.7	SAND AND GRAVEL: trace silt,	60.0	6B	SS	52								0					0						
- 5	brown, moist, very dense		ОБ	33																				
5.0	END OF BOREHOLE							Γ					1											
	Note:																							
	1) Borehole caved at a depth of 2.4 m below ground surface (mBGS)																							
	upon completion of drilling.																							
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PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-22 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 34 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone Plastic Limit Liauid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 GR SA SI CL 0.0 ASPHALT CONCRETE: (145 mm) Concrete GRANULAR BASE/SUBBASE: (545 mm) AS 0 0 FILL: sand and silt to silty sand, 1B AS trace clay, trace gravel, trace organics, brown, moist to wet, very loose to loose 2 SS 6 0 --- wet 3 3 SS 0 1 9mBGS Dec 17 SAND: trace to some silt, trace gravel, brown, wet, loose SS 4 6 0 0 Bentonite 5 SS 7 0 SS 6 7 0 7 SS 4 0 -Sand Screen 8 SS 7 -Natural 0 8.1 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 1.93



2018-01-04 11:03

-8.GPJ

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-02 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 35 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND 'N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL 8.9 \ASPHALT CONCRETE: (45 mm) -Concrete GRANULAR BASE/SUBBASE: (565 mm) 1A AS 0 0.6 FILL: silty fine sand to sand and 1B AS 0 silt, trace clay, trace gravel, layers of organic silt, brown, moist to wet, 2 ss 7 0 loose Bentonite --- wet ss 7 3 0 0 **GRAVELLY SAND TO SAND** AND GRAVEL: trace clay, trace ن ه silt, containing cobbles and boulders, brown, moist to wet, 4 SS 23 0 0 Ö compact to very dense ٥. ٥ Q ن ہ SS 60 0 Ó Sand Ó Screen Q 4.5mBGS Dec 05 Ö. --- wet ٥ ٥ SS 64 Natural 0 6 Pack **END OF BOREHOLE** 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



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-02 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 36 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (135 mm) -Concrete 0.1 GRANULAR BASE/SUBBASE: 1A AS o 0 FILL: silty sand, trace to some 1B AS clay, trace gravel, containing cobbles, brown, moist, loose to 2 SS 6 0 compact Benonite SS | 22 3 **GRAVELLY SAND TO SAND** AND GRAVEL: trace clay, trace ن ن silt, containing cobbles and boulders, brown, moist to wet, very Ö. dense ٥ ٥ 5 SS 60 0 .Q Sand Q ن ه Screen Ó ی ہ 4.4mBGS Dec 05 Ó --- wet ٥ () SS 81 6 o -Natural .O **END OF BOREHOLE** 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) W.L. Depth Dec. 5, 2017 4.38



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-02 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 37 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (80 mm) GRANULAR BASE/SUBBASE: (520 mm) 1A AS 0 SAND AND SILT: some gravel, 0.6 1B AS 0 trace clay, brown, moist, compact 2 SS 18 15 40 38 7 d 3A SS 24 0 SILTY SAND: some gravel, trace 3B SS 0 clay, containing cobbles and boulder, brown, moist, compact to very dense 4 SS 29 0 SS 65 0 **GRAVELLY SAND:** trace silt, containing cobbles and boulders, ه 🔿 brown, moist, dense .O ن ه ). . O. SS | 33 0 0 6 5.0 END OF BOREHOLE 1) Borehole caved at a depth of 2.4 m below ground surface (mBGS) upon completion of drilling.



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-22 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 38 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (130 mm) -Concrete GRANULAR BASE/SUBBASE: 0.1 (440 mm) AS 1A 0.6 FILL: silty sand to sand and silt, 1B AS 0 trace clay, trace gravel, pockets of organic silt, brown, moist, loose to compact 2 SS 22 Bentonite ss 7 3 0 0 2.1 PROBABLE FILL: sand and 2.3mBGS Dec 17 gravel, trace to some silt, brown, moist, compact SS 13 0 4 5 SS 26 0 Sand Screen SAND: trace to some silt, trace gravel, brown, saturated, loose to compact SS 10 Natural 6 0 Pack 5.0 END OF BOREHOLE 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



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-22 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 39 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (115 mm) -Concrete 0.1 GRANULAR BASE/SUBBASE: (475 mm) 1A AS FILL: silt, trace clay, trace sand, 1B AS o trace gravel, layers of silty sand, 2A SS brown, wet, compact \_1 0.9 FILL: sand, trace to some silt, 0 14 ss 2B trace gravel, brown, moist, compact Bentonite 1.4 ORGANIC SANDY SILT: trace gravel, dark grey, moist, compact 3A SS 0 **GRAVELLY SAND TO SAND** 17 0 3B SS AND GRAVEL: trace to some silt, ٥ ٥ 0 trace clay, containing rock fragments, containing cobbles and .O boulders, brown, moist to wet, ٥٠٥ compact to dense --- wet Ö. SS 19 4 0 ن ه Ö. 3.1mBGS Dec 17 5 SS 18 0 Ö. -Sand Q Screen Q ن ه . O ٥ ٥ ار .0. SS 32 Natural 0 6 Pack **END OF BOREHOLE** 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



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-22 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 40 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL ASPHALT CONCRETE: (120 mm) -Concrete GRANULAR BASE/SUBBASE: 0.1 (380 mm) 1A AS 0 FILL: silty sand to sand and silt, 0.5 1B AS 0 trace clay, trace gravel, trace organics, trace rootlets, layers of sandy silt, brown, moist, compact 2 ss 11 Bentonite ЗА SS 0 11 1.8 FILL:organic sandy silt, dark grey, 3B SS 0 moist, compact 2.1 FILL: sand and silt, some gravel, trace to some clay, brown, wet, 4 SS 8 2.8mBGS Dec 17 3 2.9 PROBABLE FILL: gravelly sand, some silt, trace clay, brown, wet, compact 5 SS 20 0 Sand Screen SAND AND GRAVEL: some silt, trace clay, containing cobbles and boulders, brown, wet, dense SS 33 Natural 0 6 Pack **END OF BOREHOLE** 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



2018-01-04 11:03

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Split Spoon DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-28 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 41 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL TOPSOIL: (330 mm) -Concrete FILL: sandy silt to sand and silt, SS 5 0 0 trace clay, trace gravel, trace organics, trace rootlets, brown, moist to wet, loose Renonite SS 2 4 0 PROBABLE FILL: gravelly sand, trace to some silt, pockets of clayey silt, brown, moist, loose 3 SS 4 0 0 GRAVELLY SAND TO SANDY **GRAVEL:** trace to some silt, trace ٥. ( clay, containing rock fragments, containing cobbles and boulders, , .O. 4 SS 22 77 17 6 brown, moist, compact to very ٥ () dense . O ٥ () Þ. O 5 SS 25 0 0 ٥٠ () Ó ن ہ SS 30 0 -Natural . O Pack ٥ ٥ 50 SS 7 75 > >1000 Ó 4.8 END OF BOREHOLE mm 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) W.L. Depth Dec. 5, 2017



2018-01-04 11:02

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ



**LOG OF BOREHOLE BH102** 1 OF 1 PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** METHOD: Continuous Split Spoon CLIENT: Ainley Group DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-04-12 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 42 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH × DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 GR SA SI CL 40 60 80 TOPSOIL: (250 mm) FILL: sandy silt, trace clay, trace SS 3 0 gravel, zones of sand and silt, brown, moist to wet, very loose to SS 2 2 3 SS 4 0 GRAVELLY SAND TO SAND AND GRAVEL: trace silt, ٥ () containing rock fragments, containing cobbles and boulders, , .O. SS 4 11 0 brown, moist to wet, compact to ٥ () dense Ō. ٥ () Þ. O SS 21 0 Ó ن ہ SS 29 . O 2018-01-04 11:02 ٥ ٥

# 5.3 END OF BOREHOLE

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL

GEOPRO SOIL LOG

1) Borehole caved at a depth of 2.8 m below ground surface (mBGS) upon completion of drilling.

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SS | 38



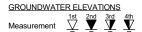




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**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing METHOD: Continuous Split Spoon CLIENT: Ainley Group DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-28 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 43 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL TOPSOIL: (300 mm) -Concrete 0.3 FILL: sandy silt, trace gravel, trace SS 9 organics, trace rootlets, dark brown, moist, loose GRAVELLY SAND TO SAND AND GRAVEL: trace to some silt, ٥ () layers of sand, containing rock , , O SS 28 fragments, containing cobbles and 2 0 Bentonite boulders, brown, moist, compact to ٥ ٥ very dense Ö. ٥. () 3 SS 19 þ 0 .Q ن ه .O ٠.0 SS 20 0 Ó ن ن -Sand Q ٥ ٥ SS 35 0 0 Screen Ø. ن ه Ö. ن ہ 6 SS 35 0 Ö. -Natural pack ٠. 🗘 7 SS 50 / > 100 0 **END OF BOREHOLE** mm 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



2018-01-04 11:02

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL -8.GPJ



**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-20 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 44 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 20 40 60 80 GR SA SI CL ASPHALT CONCRETE: (60 mm) -Concrete GRANULAR BASE/SUBBASE: (490 mm) 1A AS 0 FILL: silty sand to sand and silt, 1B AS trace clay, trace gravel, brown, moist, compact 2 SS 16 0 FILL: gravelly sand, some silt, trace clay, brown, moist, loose Bentonite ss 7 3 31 42 22 5 0 2.1 FILL: sandy silt, trace to some clay, trace gravel, trace organics, layers of organic silt, brown, wet, 4 SS 5 0 0 2.7mBGS Dec 21 ORGANIC SILT: some sand, trace clay, trace gravel, seams of silty sand, black, moist, loose 5 SS 7 0 0 SAND: trace silt, trace gravel, 4.0 brown, wet, dense SS 31 6 **END OF BOREHOLE** Pack 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



2018-01-04 11:02

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-20 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 45 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone (kN/m³ Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL ASPHALT CONCRETE: (110 mm) Concrete GRANULAR BASE/SUBBASE: (520 mm) 1A AS 0 FILL: silty sand, trace clay, trace 1B AS 0 gravel, layers/zones of sand, containing cobbles, brown, moist, 2 SS 9 3 SS 7 0 0 2.1 NO RECOVERY: likely silty sand AS 4 0 SILTY SAND: some gravel, trace clay, containing cobbles and boulders, brown, moist, compact SS 26 0 SAND AND GRAVEL: containing Ö. rock fragments, containing cobbles and boulders, brown, moist, compact --- auger grinding · io SS 29 6 0 5.1mBGS Dec 21 GRAVELLY SAND: trace silt, containing cobbles and boulders, ن ه grey, saturated, dense , o , o ٥ () 7 SS 33 0 0 Pack 6.6 END OF BOREHOLE 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



2018-01-04 11:02

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL







#### **LOG OF BOREHOLE SPS01BE**

**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-08 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 46 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL TOPSOIL: (240 mm) Concrete 7 SS 0.2 FILL: sandy silt, some gravel, trace 1 0 to some clay, trace organics, trace rootlets, containing cobbles, brown, moist, loose to dense 2 SS 34 1.0mBGS Dec 05 0 Bentonite **GRAVELLY SAND TO SAND** AND GRAVEL: some silt, trace ه 🔿 3 clay, containing cobbles and SS 43 0 boulders, brown, wet, compact to Ö. very dense .O SS 4 64 0 ن ه Ö. ن ن 5 SS 24 0 Ō. Screen ٥ ٥ SANDY SILT TILL: trace to some clay, trace gravel, containing cobbles and boulders, grey, moist, dense to very dense 6 SS 38 -Natural 50 SS > >100 ( pack 100 mm/ 7.8 END OF BOREHOLE 125 mm 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) W.L. Depth Date Dec. 5, 2017 1.02



2018-01-04 11:03

-8.GPJ

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL







#### **LOG OF BOREHOLE SPS01H**

**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing METHOD: Continuous Flight Auger - Auto Hammer CLIENT: Ainley Group DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-03 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 47 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL TOPSOIL: (125 mm) Concrete **ORGANIC SANDY SILT:** trace 3 1 SS 0 clay, trace garvel, trace rootlets, dark brown, moist, very loose **GRAVELLY SAND TO SANDY** ٥. () GRAVEL: trace to some clay, 2 SS 17 0 0 trace to some silt, containing cobbles and boulders, brown, moist .Q to wet, loose to very dense ٥ () 3 SS 12 Ō. ٥ ٥ , , O SS 6 4 0 0 ٥٠0 Ó --- wet ن ه 3.2mBGS Dec 05 SS 23 0 0 . O ٥ ٥ --- auger grinding Ó ٥ ٥ Ó SS ٥. () 51 Ģ. -Sand ٥. () O. ٥. () 7 SS 50 --- auger grinding Ö. 125 mm ٥. () Ō. -Screen ن ه . O ن ہ --- auger grinding ). . O. 8 SS 76 -Natural 0 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 2.7 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



2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





#### **LOG OF BOREHOLE SPS02E**

**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing METHOD: Continuous Flight Auger - Auto Hammer CLIENT: Ainley Group DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-03 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 48 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n Content Limit 60 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 GR SA SI CL TOPSOIL: (75 mm) Concrete FILL: sandy silt, trace clay, trace SS 6 0 1 0 gravel, trace organics, trace rootlets, dark brown, moist, loose FILL: sandy silt, trace clay, trace gravel, containing red bricks, 2 SS 2 brown, moist, very loose 3 3 SS **GRAVELLY SAND TO SAND** Bentonite AND GRAVEL: some silt, SS containing cobbles and boulders, 4 14 0 0 brown, moist, compact Ö. ٥ () .Q 5 SS 29 0 ن ه 0 3.7mBGS Dec 05 SAND: trace to some gravel, trace silt, containing cobbles and boulders, dark brown, wet, compact to very dense -Sand SS 6 14 0 0 -Screen 2018-01-04 11:03 7A SS 72 > >100 ¢ 0 205 7B SS mm **GRAVELLY SAND TO SAND** AND GRAVEL: trace silt, brown, ٥. ٥ wet, very dense Q -Natural pack ن ه . Ģ. 8 85/50 **END OF BOREHOLE** 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

**GROUNDWATER ELEVATIONS** 

-8.GPJ

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





#### **LOG OF BOREHOLE SPS03E**

**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: GH DATE: 2017-10-30 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 49 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone (kN/m³ Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 GR SA SI CL 89 (ASPHALT CONCRETE: (70 mm) Concrete GRANULAR BASE/SUBBASE: 1A AS (430 mm) FILL: silty sand, some gravel, trace 1B AS 0 clay, containing cobbles, brown, moist, compact 2 SS 17 0 --- auger grinding **GRAVELLY SAND TO SAND** AND GRAVEL: trace clay, trace ه 🔿 Bentonite 3 silt, containing cobbles and SS 62 0 46 46 8 boulders, brown, moist to wet, Ö. compact to very dense 2.3mBGS Dec 11 Ö. SS 4 50 ٥٠ () --- wet Ö. ٥ () 5 SS 44 0 Ō. ٥ () -Sand Ō. ن ن Screen . O 6A SS 11 4.9 SAND AND SILT TILL: some 6B SS gravel, trace clay, containing cobbles and boulders, brown, moist, compact to very dense 7 SS 50 > >100 🕏 0 75 mm -Natural pack ss 50 8 7.9 END OF BOREHOLE mm 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

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20180101- RL

GEOPRO 16-1255 BH LOG PROJECT DATA



#### **LOG OF BOREHOLE SPS04E**

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-03 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 50 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n Content Limit 60 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL TOPSOIL: (90 mm) Concrete FILL: sandy silt, trace to some SS 6 0 1 clay, trace gravel, some organics, brown, moist, loose 2A SS 0 ORGANIC SANDY SILT: trace 2B SS 6 0 ∖clay, dark brown, moist, loose 2C SS SANDY SILT: trace to some clay, some organics, brown, moist, loose ن ن **GRAVELLY SAND:** some silt, 3 SS 11 brown, wet, compact 1.9mBGS Dec 05 O. FINE SAND: trace silt, trace gravel, brown, saturated, loose 4 SS 4 0 0 5 SS 5 0 SAND: trace to some silt, trace gravel, brown, saturated, compact Sand 6 SS 21 Screen SILT: trace clay, layers of clay silt, containing cobbles and boulders, brown, moist, very dense 7 SS 53 0 -Natural **GRAVELLY SAND TO SAND** AND GRAVEL: trace clay, trace ن ن silt, containing cobbles and boulders, brown, moist, very dense .Q 8 SS 71 0 ن ہ 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

1st 2nd 3rd 4th

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2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



#### **LOG OF BOREHOLE SPS06E**

**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-21 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 51 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL TOPSOIL: (150 mm) Concrete 0.2 FILL: sandy silt, trace clay, trace SS 14 0 1 0.4mBGS Dec 21 0 gravel, trace organics, trace rootlets, containing rock fragments, brown, moist, compact 0.7 PROBABLE FILL: gravelly sand, 2 SS 20 some silt, trace gravel, brown, wet to saturated, compact to dense --- saturated 3 SS 31 Bentonite SAND: trace to some gravel, trace silt, brown, wet, very loose to compact 5 SS 13 0 -Sand -Screen SS 2 6 GRAVELLY SAND TO SAND AND GRAVEL: some silt, trace ٥. () 0.0 clay, containing rock fragments, containing cobbles and boulders, 50 brown, wet, very dense 7 SS > >100 🕏 0 ٥. () 90 mm Natural Ö. Pack ن ہ Q. ن ن **END OF BOREHOLE** 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

2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



#### **LOG OF BOREHOLE SPS08E**

**DRILLING DATA** PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing METHOD: Continuous Flight Auger - Auto Hammer CLIENT: Ainley Group DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-12-15 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 52 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 GR SA SI CL ASPHALT CONCRETE: (110 mm) Concrete GRANULAR BASE/SUBBASE: 1A AS (510 mm) FILL: silty sand to sand and silt, 1B AS some gravel, trace clay, trace rootlets, pockets of silt, containing 2 SS 10 cobbles, brown, moist to wet, loose to compact 3 SS 6 0 2.1mBGS Dec 21 SS 7 4 0 -Bentonite --- wet 5 SS 5 0 **GRAVELLY SAND TO SAND** AND GRAVEL: trace to some silt, ٥٠ () containing rock fragments, containing cobbles and boulders, . Ģ. brown, wet, compact to dense SS 25 6 0 0 ٥ () Ó ن ه Ó ن ه SS 48 --- auger grinding .O ن ن Screen Ó ٥ ٥ .O 8 SS 43 -Natural ٥ ٥ pack 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



2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-07 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 53 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3rr 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL GRAVEL SURFACE: (90 mm) FILL: sandy silt, trace to some clay, trace gravel, trace organics, SS 10 layers of clayey silt, brown, moist to wet, very loose to compact 2 ss 0 FILL: sand and silt to silty sand, trace clay, trace gravel, pockets of clayey silt, brown, moist, very loose ss 5 0 to compact 0 4 SS 3 5A SS **GRAVELLY SAND TO SAND** 26 0 5B SS AND GRAVEL: trace clay, trace ٥. () 0 silt, containing cobbles and boulders, brown, moist to wet, Ö. compact to dense ٥ ٥ Q Ö. ٥ () --- wet SS 46 0 0 6 Ö. END OF THE BOREHOLE 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.



2018-01-04 11:03

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GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-17 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 54 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 20 40 60 80 GR SA SI CL GRAVEL SURFACE: (170 mm) -Concrete 0.2 FILL: silty sand, some gravel, trace SS 11 0 to some clay, containing rock fragments, containing cobbles, brown, moist to wet, loose to compact 2 ss 9 1 2mBGS Dec 05 **GRAVELLY SAND TO SAND** AND GRAVEL: some silt, trace ٥٠ () clay, containing rock fragments, 3 SS 24 0 containing cobbles and boulders, .O. brown, moist to wet, compact to ٥. () dense Ö. --- wet ن ه 0 SS 27 0 0 4 ن ن Ō. ن ن ا .0. SS 34 0 Sand ٥ () Screen Ó ٥ () Ó ٥. ٥ Ö. ن ن SS 31 Natural 6 Pack **END OF BOREHOLE** 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



2018-01-04 11:04

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL





PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-17 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 55 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid Limit GROUND WATER AND "N" BLOWS/0.3m 60 Content STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL GRAVEL SURFACE: (20 mm) -Concrete FILL: sand and silt to silty sand, 5 0 trace clay, trace gravel, trace SS 0 organics, trace rootlets, brown, moist to wet, very loose to loose --- cobbles 2 ss 2 Bentonite --- wet ss 5 3 0 0 2.2mBGS Dec 21 SILTY FINE SAND TO FINE SAND AND SILT: trace clay, trace gravel, brown, saturated, loose to 0 29 68 3 compact SS 9 0 5 SS 8 Sand Screen SS 11 Natural 0 6 Pack 5.0 END OF BOREHOLE: 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



2018-01-04 11:04

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



PROJ	Wastewater	rewater Servicing DRILLING DATA  METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm																						
CLIEN	IT: Ainley Group						ı	ИEТ	HOD	: Co	ntin	uous	Fliç	ght A	Auge	er - A	Auto	Ham	mer	[	DIAMI	ETER	: 155	mm
PROJ	ECT LOCATION: Town of Erin and Hi	illsburg	gh, C	)ntari	0		F	FIEL	D EN	1GIN	IEEF	R: KI	L								DATE	: 201	7-11-	16
DATU	M: N/A								IPLE			V: T	Y							F	REF.	NO.: 1	16-12	55
BH LC	OCATION: See Borehole Location Plan	n					(	CHE	CKE	D: D	L									E	NCL	. NO.:	56	
	SOIL PROFILE		SA	MPL		_			DYN	IAM SPT				ATIC				Diag	4:- N	Natura	atural		3)	REMARKS
		Τ			"N" BLOWS/0.3m	GROUND WATER				20		z C 10	6	0	blows/0.3m Plas			t (	/loistur Conten	t L	iquid Limit	(kN/m³)	AND GRAIN SIZE	
ELEV	DESCRIPTION	STRATA PLOT	r		MS/(	) M	Ġ		5	SHE	AR S	STR	ENG	тн	(kP	—— а)		W <sub>P</sub> ⊢				W <sub>L</sub>	×)	DISTRIBUTION
DEPTH (m)	DESCRIPTION	\ATA	NUMBER	щ	BLO	N			Unco Quic									WA	ATER	CONT	ENT	(%)	JNIT WT	(%)
		STF	INN	TYPE	ż	GR	. i			20		10	6		8		unc	1	0 2	0 3	0 4	10	<u>S</u>	GR SA SI CL
- 0.0 - 0.1	GRAVEL SURFACE: (65 mm)	$\otimes$	1A	ss														0						
	FILL: silty sand, trace gravel, brown, moist, loose			-	7				0															
0.3	FILL: gravelly sand, some silt,		1B	SS														0						
-	trace organics, dark brown, moist, loose	$\bowtie$				ł																		
0.7	GRAVELLY SAND TO SAND	2.6				ł																		
_1	AND GRAVEL: trace silt, layers/zones of sand, containing	0.00	2	ss	39							}						0						
-	rock fragments, containing cobbles and boulders, brown, moist to wet,	0																						
-	compact to very dense	ø. O.				1																		
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	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.																							
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PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-16 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 57 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL GRAVEL SURFACE: (70 mm) -Concrete FILL: silty sand, some gravel, trace clay, brown, moist, loose SS 8 0 0 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 2 SS 3 loose to loose Bentonite --- brown ss 7 3 0 0 SILT: trace clay, layers/zones of sand and silt, brown, wet, compact SS 16 9 88 3 4 0 2.6mBGS Dec 21 5 SS 19 d 0 Sand Screen **GRAVELLY SAND:** some silt, trace clay, containing cobbles and ه 🔿 boulders, brown, wet, dense .O ن ہ ). . O. SS 31 Natural 6 0 Pack 5.0 END OF BOREHOLE 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



2018-01-04 11:04

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-07 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 58 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 30 40 40 60 80 10 20 GR SA SI CL GRAVEL SURFACE: (75 mm) FILL: silty sand, trace to some gravel, trace clay, grey to brown, SS 6 0 0 moist, loose --- brown FILL: sandy silt, trace clay, trace 0.7 gravel, brown, moist, loose 2 SS 7 0 FILL: silty sand, trace to some gravel, trace clay, brown, moist, loose SS 3 9 0 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 0 --- wet SS 5A 0 0 ORGANIC SILT: trace clay, trace 5B SS rootlets, black, moist, loose SAND: trace silt, brown, wet, 4.0 compact 6A SS 0 **GRAVELLY SAND:** trace clay, 0 27 6B SS trace silt, containing cobbles and ن ن boulders, brown, wet, compact **END OF BOREHOLE** 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.



2018-01-04 11:04

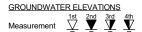
GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL







PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-08 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 59 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT (kN/m<sup>3</sup> blows/0.3m ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH ¥ DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL GRAVEL SURFACE: (150 mm) 0.2 FILL: silty sand, trace to some gravel, trace clay, brown, moist, SS 9 0 loose to dense 2A SS 46 0 1.1 FILL: sandy silt, trace to some 2B SS gravel, trace clay, trace organics, trace rootlets, containing cobbles, brown, moist, very loose to dense 3A SS PEAT: black, moist, very loose to 3 3B SS 0 compact 11, 4A SS SAND: trace silt, trace gravel, 0 13 4B SS brown, wet, loose to compact 5 SS 10 **GRAVELLY SAND:** some clay, ٥ () some silt, layers/zones of clayey í.*o* .o. silt, grey, wet, dense ن ه ). . O. SS 34 0 6 o **END OF BOREHOLE** 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.



2018-01-04 11:04

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 205 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-17 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 60 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3n 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 40 60 80 GR SA SI CL \GRAVEL SURFACE: (50 mm) FILL: silty sand to sand and silt, SS 6 0 trace clay, trace gravel, layers/zones of sand, brown, moist to wet, loose 2 SS 2 SS 3 3 SS 3 5A SS 0 SILTY SAND: trace to some clay, 0 5B SS trace gravel, containing cobbles and boulders, brown, wet to saturated, very loose to loose --- saturated SS 2 6 SANDY SILT TILL: some clay, 5.6 trace gravel, layer s of clayey silt, containing cobbles and boulders, brown, moist, compact 7 SS 26 0 6.6 END OF BOREHOLE: 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.



2018-01-04 11:04

-8.GPJ

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL







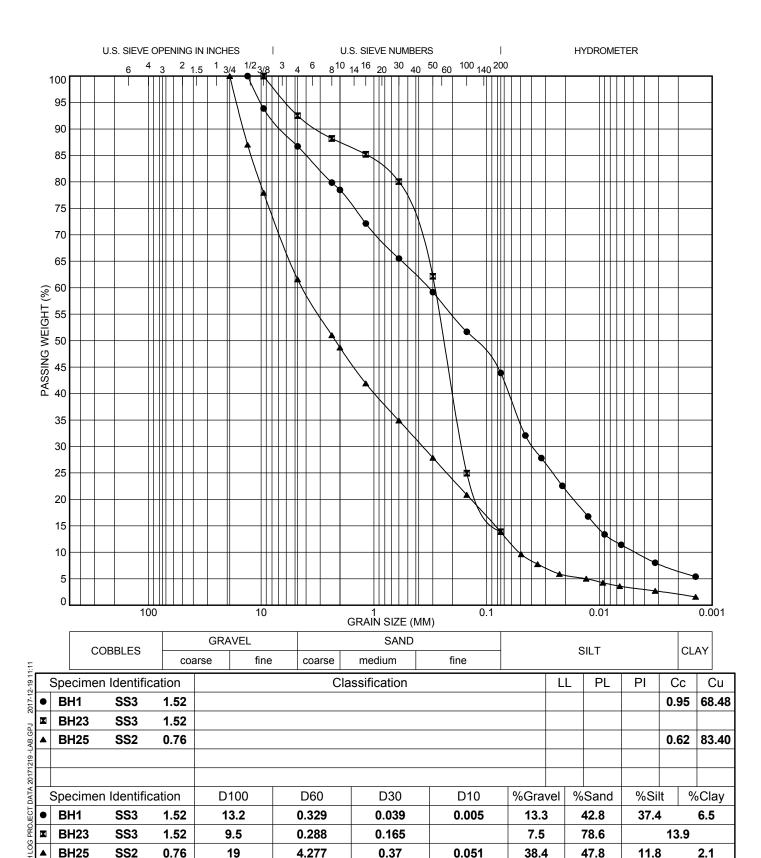
PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing **DRILLING DATA** CLIENT: Ainley Group METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm PROJECT LOCATION: Town of Erin and Hillsburgh, Ontario FIELD ENGINEER: KL DATE: 2017-11-07 DATUM: N/A SAMPLE REVIEW: TY REF. NO.: 16-1255 BH LOCATION: See Borehole Location Plan CHECKED: DL ENCL. NO.: 61 SAMPLES DYNAMIC PENETRATION TEST SOIL PROFILE REMARKS Natural O SPT blows/0.3m (kN/m<sup>3</sup> ≥ Cone Plastic Limit Liquid GROUND WATER AND "N" BLOWS/0.3m 60 Content Limit 80 STRATA PLOT **GRAIN SIZE** SHEAR STRENGTH (kPa) DISTRIBUTION ELEV DEPTH DESCRIPTION NUMBER ● Unconfined X Field Vane & Sensitivity (%) WATER CONTENT (%) (m) ▲ Quick Triaxial ☑ Penetrometer + Lab Vane 10 20 30 40 20 40 60 80 GR SA SI CL GRAVEL SURFACE: (100 mm) -Concrete FILL: silty sand, trace to some clay, trace to some gravel, trace SS 11 0 organics, dark brown, moist to wet, very loose to compact 2 SS 7 0 Bentonite ss 3 3 0 ORGANIC SILT: trace clay, trace gravel, trace rootlets, black, moist, loose 4 SS 6 0 FINE SAND AND SILT: trace clay, brown, moist to wet, loose 7 5 SS 0 -Sand 3.8mBGS Dec 05 SAND: trace silt, brown, wet, 4.0 compact SS 19 Natural 0 6 Pack 5.0 END OF BOREHOLE 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) W.L. Depth Dec. 5, 2017 3.79

2018-01-04 11:04

GEOPRO 16-1255 BH LOG PROJECT DATA 20180101- RL



# **FIGURES**



GeoPro
CONSULTING LIMITED

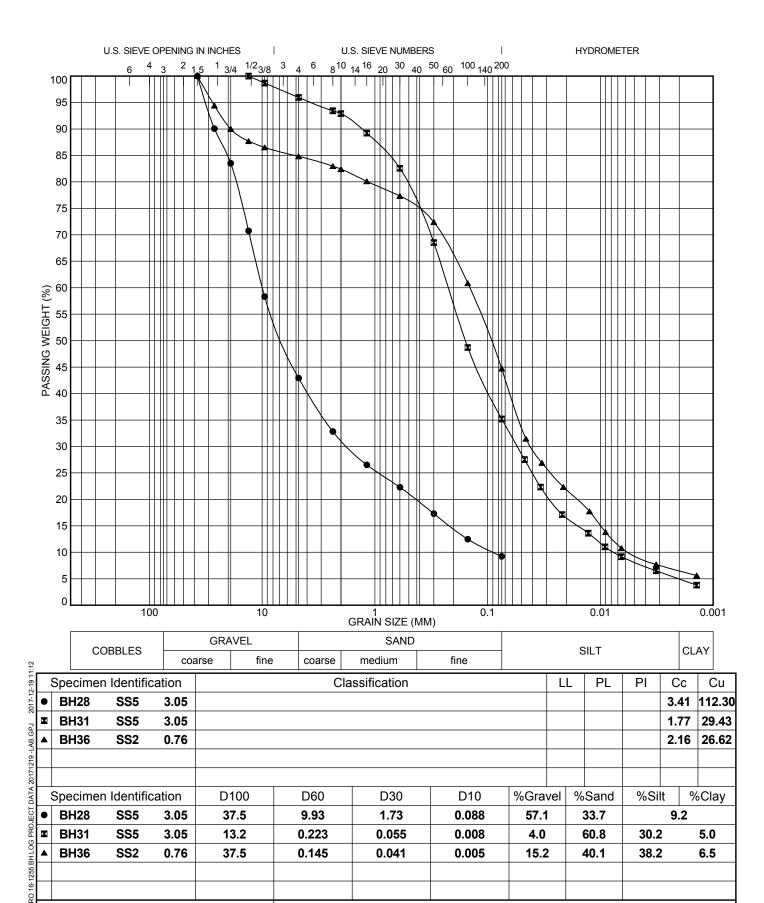
### **GRAIN SIZE DISTRIBUTION**

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

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



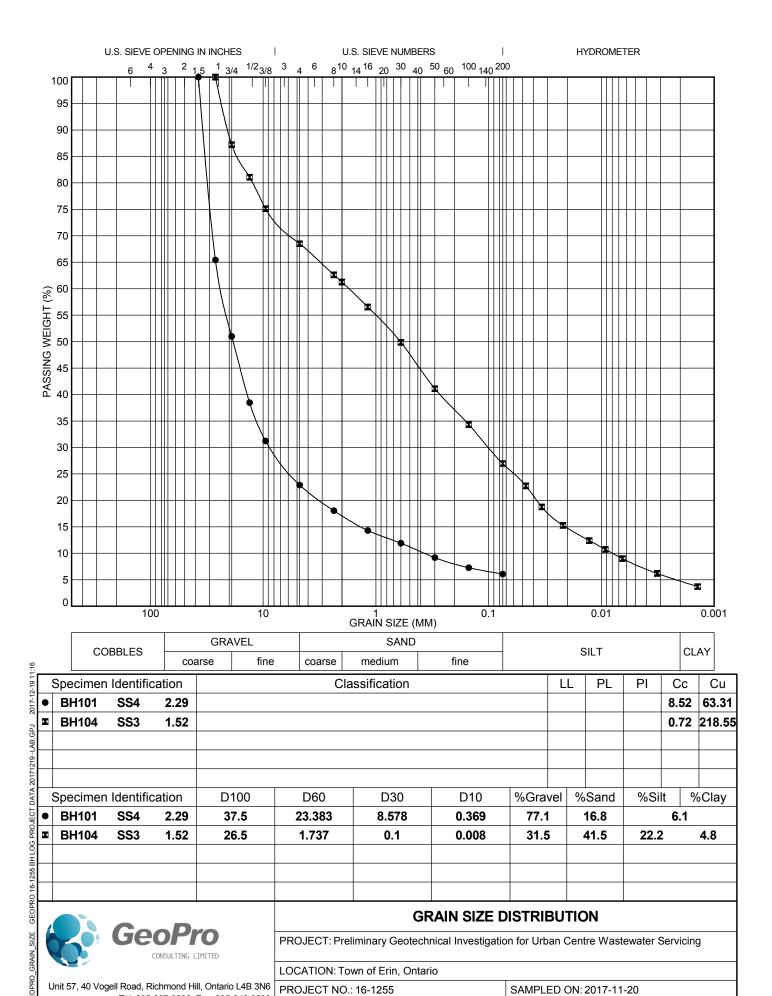


### **GRAIN SIZE DISTRIBUTION**

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

LOCATION: Town of Erin, Ontario

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

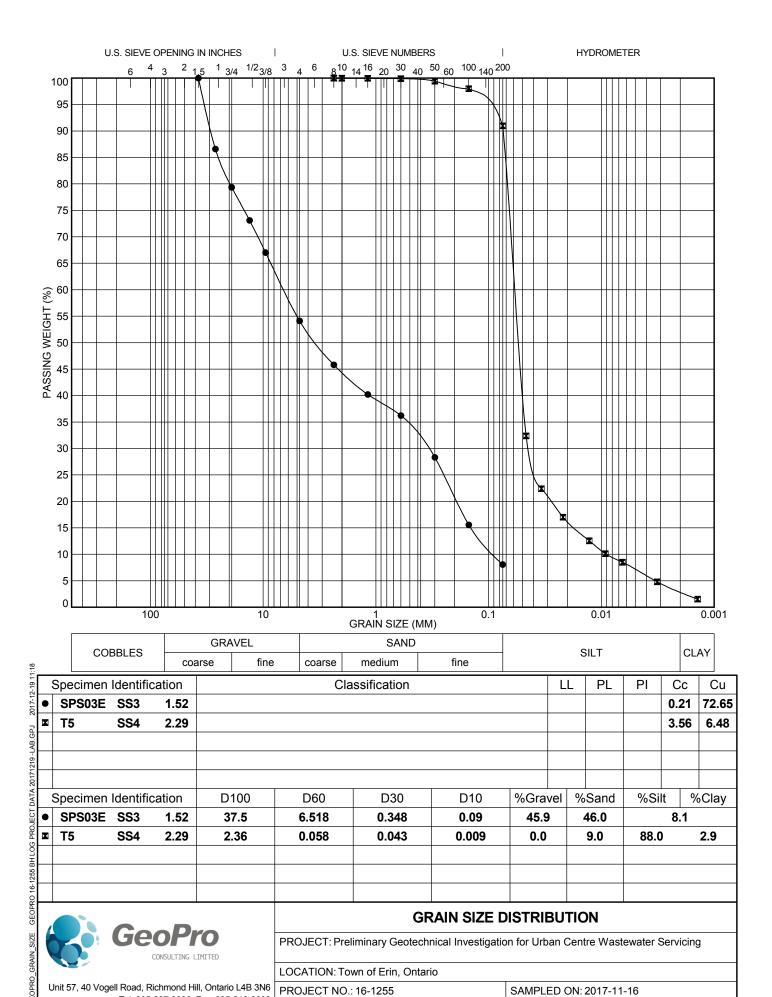


Tel: 905-237-8336 Fax: 905-248-3699

office@geoproconsulting.ca www.geoproconsulting.ca

FIGURE NO.: 3

TESTED ON: 2017-11-30

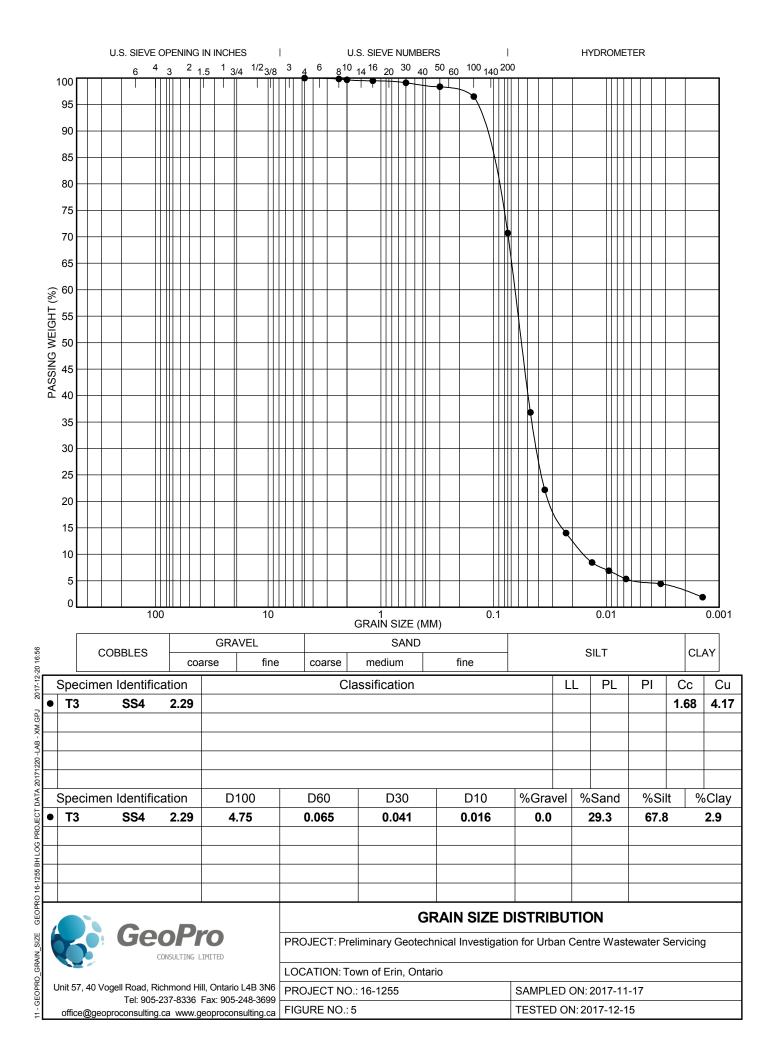


Tel: 905-237-8336 Fax: 905-248-3699

office@geoproconsulting.ca www.geoproconsulting.ca

FIGURE NO.: 4

TESTED ON: 2017-11-30





# **APPENDIX A**



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 (V1)

\*NOTEO

Page 1 of 5

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA) AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.



Certificate of Analysis

AGAT WORK ORDER: 17T282046

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:Kirby

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

SAMPLING SITE:Erin

	O. Reg. 153(511) - ORPs (Soil)												
DATE RECEIVED: 2017-11-07									DATE REPORTED: 2017-11-15				
		SAMPLE DESC	RIPTION:	SPS03E SS2	BH 5 SS3	BH 14 SS2	BH 31 SS2	BH 32 SS3					
		SAMP	LE TYPE:	Soil	Soil	Soil	Soil	Soil					
		DATE S	AMPLED:	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



## **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

SAMPLING SITE: Erin

AGAT WORK ORDER: 17T282046 ATTENTION TO: Bujing Guan

SAMPLED BY:Kirby

	Soil Analysis													
RPT Date: Nov 15, 2017			D	UPLICAT	E		REFEREN	ICE MATERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPIK	ΚE
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured	Acceptable Limits	Recovery	Acceptable Limits		Recovery	Accep Lim	
		Iu		·			Value	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



# **Method Summary**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

AGAT WORK ORDER: 17T282046
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





5835 Coopers Avenue Mississauga, Ontario L4Z 1Y2 **Laboratory Use Only** 

AGAT Laboratories SL6 Work Order #: 177282046 Ph: 905.712.5100 Fax: 905.712.5122 webearth.agatlabs.com Cooler Quantity:

Chain of C	ustody Record	If this is	a Drinking Wat	ter sample, p	lease use	Drinking Water Chain of	Custody Form (	potable	water c	onsume	d by huma	ns)		<b>(</b> 0	Ar	rival 1	emp	eratu	res:	3	Po	12	9 1	33
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Phone: Reports to be sent to: 1. Email:	905-137-8336 bguan@geopro	Fax:				Res/Park    Agriculture    Soil Texture (Check One)	□Stor	m ite One	_		rov. Wate bjectives ther				1 '	sh T	AT (R	tush Sui		es Apply)	2 Busi Days		•	ext Busines ay
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AGAT Quote #:	Please note: If quotation number is	PO: not provided, client w	rill be billed full price	e for analysis	- 11	Sample Matrix Leg B Biota	gend (	Hg, CrVI	17	O. Reg	153	0								D DCBs		Inen	Lieve Servi	HORSE SERVICE
Invoice Inform Company: Contact: Address: Email:	ation:		Bill To Same:	Ye II No		GW Ground Water O Oil P Paint S Soil SD Sediment SW Surface Water		Field Filtered - Metals, Hg	Metals and Inorganics	☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides)	□ B-HWS □ CI· □ CN	etals Scan	Custom Met	Tts:   TP   DNH,   TKN   DNO,   DNO,   DNO, +NO,		F1 - F4			☐ Total ☐ Aroclors	Organochlorine Pesticides	Use		mry goden	days days Assign
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Document ID: DIV 28 1011 014			Pink Copy - Client   Yellow Cor	py - AGAT   White	Copy- AGAT Date Issued: February 22, 201
Document ID: DIV.28 1011.034	0,70,77		Pink Copy - Client   Yellow Cop	py - AGAT   White	Copy- AGAT Date Issued: February 22, 201



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 (V1)

\*NOTEO

Page 1 of 5



Certificate of Analysis

AGAT WORK ORDER: 17T283347

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

CANADA L4Z 1Y2 TEL (905)712-5100 FAX (905)712-5122 http://www.agatlabs.com

5835 COOPERS AVENUE

MISSISSAUGA, ONTARIO

CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

SAMPLED BY:

	O. Reg. 153(511) - ORPs (Soil)											
DATE RECEIVED: 2017-11-10									DATE REPORTED: 2017-11-20			
		SAMPLE DESCR	RIPTION:	SPS01H SS2	SPS02E SS2	SPS04E SS3	T1 SS3A	T6 SS2				
		SAMPL	E TYPE:	Soil	Soil	Soil	Soil	Soil				
		DATE SA	MPLED:	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



## **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			D	UPLICAT	E		REFEREN	ICE MAT	ΓERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPI	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured	Accep Lim		Recovery	Accel Lin		Recovery	Lin	ptable nits
		ld		- '			Value	Lower	Upper		Lower	Upper	,	Lower	Upper

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

Sodium Adsorption Ratio 0.078 8902126 NA NA NA 0.094 18.6% NA

Comments: NA signifies Not Applicable.

Certified By:

Amanjot Bhela



# Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

SAMPLING SITE:

AGAT WORK ORDER: 17T283347 ATTENTION TO: Bujing Guan

SAMPLED BY:

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

SW-846 6010C





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

<b>Laboratory Use</b>	Only		
Work Order #:	アンと	3334	7
Cooler Quantity:			- 4
Arrival Temperatures:	32	30	29
Custody Seal Intact: Notes:	□Yes	□No	□N/A

Chain of Custody Recor	d If this is a	a Drinking Wa	ter sample,	please us	se Drinking Water Cha	aln of Custody Form	potable	water c	consume	d by human	s)	_		Arriv	al Ter	npera	atures	: ,	3	2	3	2/8	29
Report Information: Greo fro Consulting Company: Contact: Bujing Gran Tim In					Regulatory Requirements: No Regulatory Requirement  (Preuse Chack all applicable boxes)  Regulation 153/04 Sewer Use Regulation 558							Custody Seal Intact:   Yes   No   N/A											
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Phone: Reports to be sent to:  1. Empile:  Gran @ ges p	1 01.	ivel ca			Res/Park Agriculture Soil Texture (Check On	☐Sto	rm			rov. Water			ا	Rush			Surcha	rges Ap	pply)				
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Project: 16-1255	-				Record of Site	Condition?				te of An			Ш									r rush T/	
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Invoice Information: Company: Contact: Address:		Bill To Same:	,	o 🗆	B Biota GW Ground Wate O Oil P Paint S Soil		Field Filtered - Metals, Hg, CrVI	ganics	☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides)	EOC II HE		Regulation/Custom Metals Nutrients: © TP © NH. © TKN	NO3+ÑO2	C L BTEX L THM			☐ Aroclors	Pesticides	□ABNs □B(a)P			- (A)	
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Samples Relinquished By (Print Name and Sign):	-	Date	I Tri	me	Samples Ryceivee	f By (Print Name and Sign);	11.		11	10	_	goty /	in	In	Time	11	12	-					1 1
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Samples Relinquished By (Print Name and Stan):  Date  Time				IIIU	Date					1,5	Page of												
Samples Relinquished By (Print Name and Stee):	1	Paty/a	11/2	124	Samples Received	By (Print Name and Sign):						Date			Time			No	: <b>T</b>	$\bigcap$	50	12	1
Oncurrent ID: DIV-78.1511.014	/	V6/80	47	10	7					Pink (	Ору - (	Client	Yello	w Co	DV - AC	GAT	l Whit	te Coi	py- AG	 AT	Date Isa	ued: Febri	nry 22, 2017



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 (V1)

\*NOTEO

Page 1 of 6

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CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Certificate of Analysis

AGAT WORK ORDER: 17T284728

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:

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

		(
() Rea	153(511)	- ORPs (Soil)

				0.110	9. 100(011)	0111 0 (00	,,,,	
DATE RECEIVED: 2017-11-15								DATE REPORTED: 2017-11-27
		SAMPLE DES	CRIPTION:	BH9 SS2	BH10 SS2	BH15 SS2	SPS01bE SS3	
		SAM	PLE 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



#### **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



#### **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255 SAMPLING SITE: AGAT WORK ORDER: 17T284728 ATTENTION TO: Bujing Guan

SAMPLED BY:

	Soil Analysis														
RPT Date: Nov 27, 2017			С	UPLICAT	E		REFEREN	ICE MAT	ΓERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPII	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured	Acceptable Limits		Recovery	Lin	ptable nits	Recovery	Lin	ptable nits
		ld	- '	.,			Value	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

Comments: NA signifies Not Applicable.

Certified By:



# **Method Summary**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

AGAT WORK ORDER: 17T284728
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



# Laboratories

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

Work Order #:	T 284728	
Cooler Quantity:	4	
Arrival Temperatures:	30 25 06	
Custody Seal Intact:	□Yes □No □N/A	1000
Notes:		

**Laboratory Use Only** 

Chain of Cu	istody Reco	rd If this is	a Drinking Wa	ter sample, pl	ease us	se Drinking Water Chain of Custody Form	(potable	water co	onsume	d by humans)			Ar	rival	Temp	oeratı	ures:		7	(_	135	5	5.7	-
Report Informa Company:	teopho	Consultin	g			Regulatory Requirements:		No Re	egula	tory Requir	eme	nt		ustod otes:	y Sea	al Inta	act:	Ċ	TYES	0	181	]No	78	N/A
Contact: Address:	Bujing Gran Unit 57 ( Richmond Hill	to vogel	n Yu 1 Rd.			☐Ind/Com	nitary			Regulation 558				Turnaround Time (TAT) Required:  Regular TAT  5 to 7 Business Days  Rush TAT (Rush Surcharges Apply)										
Phone: Reports to be sent to: 1. Email: 2. Email:	905-237-83 bgvan@geop timy@geop	procon sult				☐Agriculture  Soil Texture (Check One) Region	cate One			Prov. Water Qui Objectives (PW Other					3 Bu Days	isines	ss		2 E Day	-	ess charges		lext Busir	nes
Project Inform: Project: Site Location: Sampled By:	ation: 16-1255 Erin Kurby	5				Is this submission for a Record of Site Condition?  Yes No	1	Cert	_	Guideline of Analy	sls	0			P. TAT	lease is exc	prov clusiv	r <b>ide</b> p	rlor i veek	notific ends	cation f and sta	or rush atutory i		
AGAT Quote #:	Please note: If quotation number	PO: ris not provided, client w		-		Sample Matrix Legend B Biota	1g, CrVI		O. Reg				>						(a)P □PCBs				2	
Invoice Information Company: Contact: Address: Email:	Az abre		Bill To Same:	Ye No		GW Ground Water O Oil P Paint S Soil SD Sediment SW Surface Water	Field Filtered - Metals, Hg, CrVI	Metals and Inorganics	☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydric	ORPs: □B-HWS □Cl □CN- □Cr* □EC □FOC □Hg □DH NAAR Full Metals Scan Regulation/Custom Metals Nutrients: □TP □NH, □TKN □NO, □NO, □NO,+NO,		tiles: □voc □BTEX □THM	F1 - F4			☐ Total ☐ Aroclors	Organochlorine Pesticides	M&I □VOCs □ABNs □B(a)P	Jse			ii Lole		
Sample	dentification	Date Sampled	Time Sampled	# of Containers	Sampl Matri:		Y/N	Metals	☐ All Me☐ Hydrid	ORPs: DB	Regula	Nutrients: DI	Volatiles:	PHCs F	ABNS	PAHs	PCBs: □ Total	Organo	TCLP: ☐ M&I	Sewer Use			11	
BH 9	552	امد, ۱۹۷۹	AM	(	551			177		V					1								- 9	
BH 10	352	Nov8,2017	Ann		611																	117	- oit	T
BH 15	552	105 Poch	Ahr	1	Soi			340																
SPSOIDE	553	Nov 8,2017	AM	(	Soi														1					
	in per	- 1.5											14											
Samples Relinguished By (Print	Name and Sign!		Date	Tim	e	Sample Received By (Print Name and Sign)	2,	411	11.		I But	1			me /									
Tim Yu Samples Relinquished By (Print	Ton		Nov 1 S			Samples Received by (Print Namo and Sign):	U	1		7	( Dai	10	10	7	me /	0	5		15	Page	1	of	1	
Samples Religioushed By (Print	ome and Signs:	M	[1/15	17	13	Samples Received By (Print Name and Sign):				Diale Cons	Dat				me		****	N°:	_	0	59	35	16	



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 (V1)

\*NOTE O

Page 1 of 6

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### Certificate of Analysis

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
SAMPLING SITE:

SAMPLED BY:Kirby

ATTENTION TO: Bujing Guan

	O. Reg. 153(511) - ORPs (Soil)											
DATE RECEIVED: 2017-11-21 DATE REPORTED: 2017-11-30												
		SAMPLE DES	CRIPTION:	BH 1 SS3	BH 19 SS2	BH 21 SS2	BH 26 SS2	BH 28 SS2	BH 30 SS3			
		SAMI	PLE TYPE:	Soil	Soil	Soil	Soil	Soil	Soil			
		DATE S	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:



#### **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



#### **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT:

SAMPLING SITE:

AGAT WORK ORDER: 17T286765
ATTENTION TO: Bujing Guan

SAMPLED BY:Kirby

	Soil Analysis														
RPT Date: Nov 30, 2017			D	UPLICAT	E		REFEREN	ICE MAT	ERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPI	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured	Accep Lim	ite	Recovery	Lin	ptable nits	Recovery	Lin	ptable nits
		ld	.,	.,			Value	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:



# **Method Summary**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT:

AGAT WORK ORDER: 17T286765

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



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

Work Order #:	-7286	765	
Cooler Quantity:	BAL	7	
Arrival Temperatures:	4.6	43	431
Custody Seal Intact:	□Yes	□No	□N/A

**Laboratory Use Only** 

Chain of Custody Record	ord	ec	Re	ody	Cust	า of	ıain	C
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Chain of C	ustody Recor	d If this is a	a Drinking Wat	er sample, p	lease use Drin	king Water Chain of Cus	tody Form (p	otable w	ater co	onsumed	by human	s)			Arriva	l Tem	perat	tures:		4.	8h	43	242	1
Report Informa Compány:	Dies In C				Reg	gulatory Require	ments:		lo Re	egulat	ory Red	uirei	nent		Custo Notes	dy Se	al Int	act:		Yes	P	□No	<del>-1</del> 0	□N∕A
Contact: Address:  Phone: Reports to be sent to: 1. Email:	Bujing Gran Unit \$7. 4: 12: Amond H: 905-237-83: Will byran@, timy@.geopi	11 DIV 36 Fax: _ geoprocor	rsulting	Cer	Ta	egulation 153/04  able	Sewer	tary n	-	Co	ov. Water ojectives	Qualit		F	egu	TAT	AT Rush S	Surchar	/	5 to 7	siness	ess Days	Next Bu Day	ısiness
2. Email:	Zimy G John		J. Lac		=	]Fine	MISA		Į,	-	Indicate					OR	Date	Requ	iired (F	Rush S	urcharg	ges May	Apply):	
Project Inform Project: Site Location: Sampled By: AGAT Quote #:	ation: 16-1255 Eria oly Kirby	PO:	ill be billed full prices	for analysis.	Re	s this submission for cord of Site Condition  Yes V No	tion?	CrVI	Cert	Yes  O. Reg					For	*TAT	is ex	clusiv	e of w	eeken	ds and	on for rus statutor	y holiday	
Invoice Inform Company: Contact: Address: Email:			Bill To Same:	-	B GW O P S SD SW	Biota Ground Water Oil Paint Soil Sediment Surface Water		Field Filtered - Metals, Hg, C	Metals and Inorganics	☐ All Metals ☐ 153 Metals (excl., Hydrides) ☐ Hydrides ☐ 153 Metals (Incl. Hydrides)	ORPS: DB-HWS CIC! CICN CICH CIFC CIPC CIPE CIPH CIPH CIPH	Full Metals Scan	Regulation/Custom Metals  Nutrients: □ TP □ NH, □ TKN	CINO, LINO3+NO2	F4			□ Total □ Aroclors	ticides	TCLP:   M&I   VOCs   ABNs   B(a)P   Sower Lise				
Sample	Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instruction	ons	Y/N	Metals	☐ All Me ☐ Hydric	ORPs:	Full Me	Regula Nutrier	L NO.	PHCs F1 - F4	ABNS	PAHs	PCBs: [	Organo	TCLP:	3	1-0		
BH 1	553	NOV 14,2017	Prin	1	50;1	_					V			4		, 0		To				1011	1	
BH 19	552	VOV 13, 2017	Pin	1	5011						5			r)								III		
BH 21	452	Nov14,2017	PM	1	Soil			THE			V			in										
BH 26	552	Nov 15, 2017	Pm	1	1,02									1						100		MIT		
BH 28	552	Nov15,2017	Pm	- t	70,1																			
BH 30	553	Novi3.2017	Pm	(	50'1						V			15								100		
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Samples Relinquished By (Print Samples Relinquished By (Print	Name and Sign):	-	Nov 20	,2017 Tin	ne	Sample Received By (Print Na	ime and Sign):	<i>&gt;</i>				-	Date	7/1	21	Time	2'	27	4				-	
Samples Relinquisifed by (Frint	Name and Sign):		2017 Date	III PA TIN	4.10	Samples Received By (Print Na	ime and Sign):		_				Date			Time			Nin	_	ge	of _	<del></del>	
DIVIDE 4444 044				/							Pink (	Copy (	liont I	Volla	u Cor	N AC	AT I	Whit	Nº:	_	<u>U5</u>	93	83	2 2017



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 (V1)

\*NOTE O

Page 1 of 6

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CLIENT NAME: GEOPRO CONSULTING LTD

Certificate of Analysis

AGAT WORK ORDER: 17T289318

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:

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

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

				O. Re	g. 153(511)	- URPS (50	11)				
DATE RECEIVED: 2017-11-28								[	DATE REPORT	ED: 2017-12-05	
						BH104	BH107				
		SAMPLE DES	CRIPTION:	BH37 SS3	BH 38 SS2	SS2&SS3	SS2&SS3	T3 SS2	T8 SS2	SPSO6E SS2	
		SAMI	PLE TYPE:	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
		DATES	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:

SAMPLING SITE:

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:



#### **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



#### **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			D	UPLICAT	E		REFEREN	NCE MAT	ΓERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPII	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured	Accep Lim	ite	Recovery	Lin	ptable nits	Recovery	Lin	otable nits
		ld	.,	.,			Value	Lower Upper		,	Lower	Upper	, , ,	Lower	Upper

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

Sodium Adsorption Ratio 8941978 8941978 NA NA NA 11.2 11.4 1.8% NA

Comments: NA signifies Not Applicable.

Certified By:



# **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



5835 Coopers Avenue

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

<b>Laboratory Use</b>	Only HULOSSISS	æ
Work Order #:	TOCBERRICH	_
Cooler Quantity:	son In le Cooks	
Arrival Temperatures:	48 45 43	5
	4 13.7 134	)
Custody Seal Intact:	Dyes O ON	/A

Chain of C	Custody Reco	rd If this is:	a Drinking Wa	iter sample in	Jesee use F	Drinking Water Chain of	Custody Form	(notable	water con	cumod	l by buman	c/			ł			ntity: perati		AC	17	312	25	1 4	
Report Information Company:	mation: (Teo Pro	Consult in Tim	ne		R	Regulatory Requ	irements:		No Reg	gulat	ory Red	uire	eme	nt		stody	y Sea	al Inta	act:	rg)	4	13	IF 18	3	4
Address:	Unit 57, 4 Richmond Hi	o Vogell	RU		_    -	Table Indicate One	☐ Sewe			□ Re	egulation CME	558			Tur				Time		/	equir	ed: ss Days		
Phone: Reports to be sent to:	905-237-83	36 Fax:	ine Ca		Sc	☐Res/Park ☐Agriculture  Oil Texture (Check One)	Stoi	rm			ov. Water bjectives (				"	sh T	<b>AT</b> (R	tush Su		es Apply)					
Email:     Email:	bguan@geop timy@geop	to Consul-	ting. Co	<b>A</b>		Coarse		ale One			Indicate (	One	_		[	ا ل	Days			Ш	2 Busi Days ush Su			Next B Day Apply):	
Project Information Project: Site Location: Sampled By:	mation: 16-1255 Erin on kirby				- 10	Is this submissio Record of Site Cor				icat	iuidelin e of An		ls		F		TAT i	s exc	lusive	e of we	ekend:	s and s	for rusi tatutory	/ holida	í.,
AGAT Quote #:	Please note: If quotation number	PO:	ill be billed full priç	e for analysis,	S	Sample Matrix Leg	(end	CrVI		). Reg	153									B. B.	3				\$C2
Invoice Inford Company: Contact: Address: Email:	mation: As above		Bill To Same:	Yes □ No	O P S SI	Paint Soil		Field Filtered - Metals, Hg,	and Inorganics	iens — 153 metals (ext. nyumes)	ORPS: □B-HWS □CI □CN □CA* □EC □FOC □Hg □pH USAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: DTP DNH, DTKN DNO, DNO, DNO, DNO, +NO, +NO, +NO, +NO, +NO, +NO, +NO, +	ss: □voc □BTEX □THM	1-F4			☐ Total ☐ Aroclors	Organochlorine Pesticides	Use Use				
	le Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Commen Special Instru		Y/N	Metals	Hydric	ORPS:	Full Me	Regula	Nutrier No.	Volatiles:	PHCs F1 - F4	ABNS	PAHS	PCBs: [	Organo	Sewer				
BH37	553	YOV 11,2017	b/w	1	160				100		V				×.		4		2						N.
BH 38	332	Nov12,2017	PIN		Soil						/														
BH104	552 8 553	Nov 25, 2017	PM	ı,to	1,05			Challe .	100	_															an
BH 107	552 & 553	Nov10,2017	PIV	(	5011			11-27		_						4		_					150		
T3	352	NOV17,2017	pm	1	(01)	_			-							4	-	_				4			
5P306E	552	VOV17,2017	PIV	- !	Soil					-	1					_		_		-		lan.		$\vdash$	
37306E	\$\$ Z	Nau11,2317	PM		38(																				
															1						14				
Samples Relinquished By (Pr	LAN		Nou2	7 2917 Tor	le e	Samples Ratolved By (Pril	nt Name and Signi	3					Doto Zi	77/1	1/2	Tir	ne //.	10	2						

Samples Received By (Print Name and Sign):



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 (V1)

\*NOTE O

Page 1 of 5

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Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA) AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.



Certificate of Analysis

AGAT WORK ORDER: 17T291834

PROJECT: 16-1255

MISSISSAUGA, ONTARIO CANADA L4Z 1Y2 TEL (905)712-5100

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

5835 COOPERS AVENUE

CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

ATTENTION TO: Bujing Guan

SAMPLED BY:

				O. Re	g. 153(511) -	- ORPs (Soil)
DATE RECEIVED: 2017-12-05						DATE REPORTED: 2017-12-11
		SAMPLE DES	CRIPTION:	BH103 SS2	BH101 SS2	
		SAMI	PLE TYPE:	Soil	Soil	
		DATES	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:



AGAT WORK ORDER: 17T291834

ATTENTION TO: Bujing Guan

#### **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

SAMPLING SITE: SAMPLED BY:

	Soil Analysis														
RPT Date: Dec 11, 2017			D	UPLICAT	E		REFEREN	ICE MA	TERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPII	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured			Recovery	Lin	otable nits	Recovery		ptable nits
		ld	.,	.,			Value	Lower Upper		,	Lower Upp		,	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:



# 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



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

	Laboratory	Use Or	nly	
Work Order #: 17T291831	Work Order #:	177	129	1834

work Order #:		1100	
Cooler Quantity:	of cars	5	4
Arrival Temperatures:	37	4.5	45
Custody Seal Intact:	□Yes	□No	□N/A

Chain of Custody Reco	rd If this is	a Drinking Wa	ter sample, p	olease use	Drinking Water Chain of Custody Form (	ootable	water	consume	d by humar	s)			Arriva	l Tem	pera	tures	: .	3	F	4.0	Ş .	\$
Report Information: Geoph	Consultine	1			Regulatory Requirements:		No R	egula	tory Re	quire	ment	11	Custo Notes		al Ini	tact:	1	⊃Y . □Yes	0	□No	) )	□N/A
Contact:  Address:  Unif 57, 4  Richmond Hill	an . Tim	r Yu Rd			Regulation 153/04 Sewer				Regulation	558		Т	urna	arou		Tin	-	9	-	uired:		
Phone: Reports to be sent to:  1. Email:  2. Email:  Phone:  905-237-8330  Gran @ geo plane:  timy @ geo plane:		Nes/Park  ☐ Agriculture  Soil Texture (Check One)  Coarse  Soil Texture (Check One)  Indicates	Storm  Region		Prov. Water Quality Objectives (PWQ0) Other			Ш	Regular TAT 5 to 7 Business Days  Rush TAT (Rush Surcharges Apply)  3 Business 2 Business Next Business Days Days Day  OR Date Required (Rush Surcharges May Apply):													
Project Information: Project: Site Location: Sampled By:  Project Information:    16 - 1255	5				Is this submission for a Record of Site Condition?  Yes No		Cer		Guidelir te of An	е оп				F *TAT	Pleas is ex	e pro	vide į ve of	orior n	n <b>otifica</b> ends a	ation for nd status	rush TA1 tory holi	T days
Invoice Information: Company: Contact: Address: Email:		Sample Matrix Legend B Biota GW Ground Water O Oil P Paint S Soil SD Sediment SW Surface Water	Field Filtered - Metals, Hg, CrVI	Metals and Inorganics	☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals   Incl. Hydrides)	OC DHg	Full Metals Scan	Regulation/Custom Metals  Nutrients: □ TP □ NH <sub>3</sub> □ TKN	INO2 □ NO3+NO2 5: □ VOC □ BTEX □ THM				□ Total □ Aroclors	Organochlorine Pesticides	TCLP: ☐M&I ☐VOCS ☐ABNS ☐B(a)P ☐PCBS	Use		Dy rou				
Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix		Y/N	Metals	☐ All Met	ORPs:	Full Me	Regulat Nutrien	Volatiles:	PHCs F1 - F4	ABNs	PAHs	PCBs:	Organo	TCLP:	Sewer			
BH 103 552 BH 101 112	Nov28,2317 Nov28,2017	PM	1	5011		judi limbi			7			9.				6						A 19
												- D						136				181
						$\bigcirc$						40								+		(19)
Samples Relinquished By (Print Name and Sign):  Samples Relinquished By (Print Name and Sign):  Samples Relinquished By (Print Name and Sign):		Date Date	2017 Tim	ne H o	Sumples Received By (Print Name and Sign):  Samples Received By (Print Name and Sign):  Samples Received By (Print Name and Sign):	1	7			- 0	Date Date	2/12		Time	15	7	N°	T	Page _	°	of _	
15 50120 4514 044													m 1 0593									



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 (V1)

\*NOTE O

Page 1 of 6

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Certificate of Analysis

AGAT WORK ORDER: 17T297671

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY: Kirby

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

TEL (905)712-5100

5835 COOPERS AVENUE

MISSISSAUGA, ONTARIO CANADA L4Z 1Y2

CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

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

8992116 Parameter Unit G/S **RDL** NA 2.4 3.41 Sodium Adsorption Ratio

RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil -Comments:

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.

SAR was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). 8992116

Certified By:





#### **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



#### **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		С	UPLICAT	E		REFEREN	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER			Measured	Accep Lim	ite	Recovery	Acceptable Limits		Recovery	Acceptable Limits					
				Value	Lower	Upper	,	Lower	Upper		Lower	Upper			

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

Sodium Adsorption Ratio 0.673 8994392 0.688 2.2% NA

Comments: NA signifies Not Applicable.

Certified By:





# **Method Summary**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

SAMPLING SITE:

AGAT WORK ORDER: 17T297671
ATTENTION TO: Bujing Guan

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



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

Laboratory Use	Only	0.7/	7
Work Order #:	772	4/2	1
Cooler Quantity:	1	MA	1_
Arrival Temperatures:	38	37	35
Custody Seal Intact: Notes:	□Yes	□No	□N/A

Chain of Custody Record If this is a Drinking Water sample, please	se Drinking Water Chain of Custody Form (potable water consumed by humans)	Arrival Temperatures: 4/8/48/
Report Information: Geofro Consulting	Regulatory Requirements:   No Regulatory Requirement (Please check all applicable boxes)	Custody Seal Intact: Yes No Notes:
Contact: Bujing Guan, Tim Yu  Address: Unit 57 40 Vogen Rd.  Richmond Hill, Oly	Regulation 153/04 Sewer Use Regulation 558  Table Indicate One Sanitary CCME	Turnaround Time (TAT) Required: Regular TAT
Phone: Reports to be sent to:  1. Email:  2. Email:  Phone:  905-237-8336  Fax:  bguan @ geo pro con sulting ca  timy @ geo pro con sulting. ca	Storm	Regular TAT
Project Information: Project: Site Location: Sampled By:  Kirby	Is this submission for a Report Guldeline on Certificate of Analysis  Yes No Yes No	Please provide prior notification for rush TAT *TAT is exclusive of weekends and statutory holidays For 'Same Day' analysis, please contact your AGAT CPM
AGAT Quote #: PO:	Sample Matrix Legend  B Biota  O. Reg 153  Solution 153  S	BDCBs
Invoice Information:  Company: Contact: Address: Email:	Samble Matrix Tedend  Metals and Inorganics  A Field Filtered - Metals, Hg, CVVI  B Biota  All Metals   153 Metals (acc)   Hydrides)  ORPs:   Det   Cor   Cr   Cr   Cr   Cr   Cr   Cr   C	Dino, □no,+no, Volatiles: □voc □BTEX □THM PHCS F1 - F4 ABNs PAHS Organochlorine Pesticides TCLP: □ M&I □ Vocs □ ABNs □ B(a)P Sewer Use
Sample Identification  Date Sampled  Time Sampled  # of Containers Ma	Sw   Surface Mater   Surface   Sur	Uno, □no, □no, □no, □no, □no, □no, □noto PHCs F1 - F4  ABNS  PAHS  Organochlor  TCLP:□m&l l
5P508E 552+553 DEC15:207 PM 1 50		
Samples Relinquished By (Print Name and Sign): Date Time	Samples Resolved By (Print Name and Sept.)	A Times
Samples Relinquished by (Print Name and Sam):  Samples Relinquished by (	Samples Received By (Print Name and Sign):	7/12/4/ 11/19 Page
Samples Relinquished By (Print Name and Sigh): Date Time	Samples Received By (Print Name and Sign):  Date  Diely Conv. Client I	Volley Conv. ACAT   White Conv. ACAT   Surface of the surface of t



# **APPENDIX B**



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 (V1)

Page 1 of 5

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CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Certificate of Analysis

AGAT WORK ORDER: 17T282050

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:

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

#### Corrosivity Package

				C	orrosivity	Package			
DATE RECEIVED: 2017-11-07									DATE REPORTED: 2017-11-15
	5	SAMPLE DESCR	IPTION:	SPS 03E SS5	BH 5 SS5	BH 14 SS5	BH 31 SS5	BH 32 SS5	
		SAMPLI	E TYPE:	Soil	Soil	Soil	Soil	Soil	
		DATE SA	MPLED:	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:



### **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		D	UPLICAT	E		REFEREN	ICE MA	TERIAL	METHOD	BLANK	SPIKE	MATRIX SPIKE		KE	
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured		ptable nits	Recovery	Acceptable Limits		Recovery	Acceptable Limits	
		la	·	·			Value L	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:



# 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







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

Cooler Quantity:

Chain of Cu	istody Recor	d If this is	a Drinking Wa	ter sample, p	lease use	Drinking Water Chain o	f Custody Form (p	ootable v	vater consu	ımed b	y humans	+		A	rrival 1	Tempe	eratur	res:	ð	8	25	7 19	30	
Report Information: Geopho Consulting.						Regulatory Requirements:   No Regulatory Requirement  (Please check all applicable boxes)							Custody Seal Intact:   Yes   No   N/A   Notes:											
Contact: Bujing Gran Tim Yy Address: Unit 57, 40 Voyell Rd						Regulation 153/04 Sewer Use					Regulation 558					Turnaround Time (TAT) Required:								
Richmond Hill, DN						Table   Sanitary   CCME							Regular TAT 5 to 7 Business Days											
Phone:  Reports to be sent to:  1. Email:  905-237-8336  Fax:  bgrand geopro consulting ca					_	☐Res/Park ☐Agriculture  Soil Texture (Check One) ☐Coarse	Store	m	Prov. Water Quality Objectives (PWQO) Other				Ru	sh T	TAT (Rush Surcharge			1				.,.		
					:		Region	te One							3 Business Days		, [	2 Business		ess	Next Busines			
2. Email: timy@geophoconsulting.ca						Fine	MISA			-	Indicate O	ne	<del>.</del>				ate R	equired				Мау Арр		
Project Information: Project: 16-1255 Site Location: Eria						Is this submission Record of Site Co		Report Guideline on Certificate of Analysis  Yes No					Please provide prior notification for rush TAT *TAT is exclusive of weekends and statutory holidays											
Sampled By:	Cirby				_   4		China Barri		1 24.2   1 4.0 m					For 'Same Day' analysis, please contact your AGAT CPM										
AGAT Quote #:	Please note: If quotation number i	PO: is not provided, client w	ill be billed full price	e for analysis.		Sample Matrix Legend			0. Reg 153										□PCBs	2016		me cri		
Invoice Information:  Company: Contact: Address: Email:						B Biota GW Ground Water O Oil P Paint S Soil SD Sediment SW Surface Water		Field Filtered - Metals, Hg, CrVI	Metals and Inorganics ☐ All Metals ☐ 153 Metals (exc. Hydrides)	2 C	ONTS: UEHWS UCI UCN CICA* CIEC CIFOC CIH	Full Metals Scan	Nutrients: TP DN TKN	es: □voc □BTEX □THM	PHCs F1 - F4			PCBs: □ Total □ Aroclors Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P	-	rrosiv.ty			
Sample	Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix		The second of the second	Y/N	Metals	□ Hydri		Full M	Nutrie	Volatiles:	PHCs	ABNs	PAHs	PCBs:	TCLP:	Sewer Use	3			
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BH 5	555	Dut 31,2017	PM	1			•			4	100			171	Щ					<u> </u>				
BH 14	555	Det 31,2017	PM	(	<del>                                     </del>		_	1544	De	-				96.	H		_					-		
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BH 32	<b>373</b>	Nov2, 2017	ρM	(	301					-	-	-			H		-				-			
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Samples Relinquished By (Print			Date	( 1017 Tin	ne	Samples Received By (P	rint Name and Saln):	11	1/110	1		//	10/19	2//	7	7/	U	1						
Samples Relinquished By (Print	Name and Sign):		/ V Ju z	Tin	ne	Samples Recourse by	Print Name and Sign):	The	W			-64	pale	11/	Th	me	1	+		Page	- 1	of		
Sample's Rollinguished By (Print	Name and Sign):	7	1094	#//	nn-) /	Samples Received By (F	rint Name and Sign);						Onte		To	me			1º: <b>T</b>	0	EO	10	0	
Document ID: DIV 78 157 048	NOVIV		4//01	1119	110						Pink C	ppy - C	ient 1 \	'ellow	Copy -	- AGA	ГІИ		_ 1	U GAT	Dates	sued: E bri	Jany 22, 2017	



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 (V1)

\*NOTE O

Page 1 015

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Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA) AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.



Certificate of Analysis

156

AGAT WORK ORDER: 17T283345

PROJECT: 16-1255

http://www.agatlabs.com

5835 COOPERS AVENUE

MISSISSAUGA, ONTARIO CANADA L4Z 1Y2

TEL (905)712-5100 FAX (905)712-5122

CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Redox Potential (2:1)

ATTENTION TO: Bujing Guan

180

SAMPLED BY:

171

Corrosivity Package													
DATE RECEIVED: 2017-11-10									DATE REPORTED: 2017-11-20				
		SAMPLE DES	CRIPTION:	SPS01H SS5	SPS02E SS5	SPS04E SS5	T1 SS5A & B	T6 SS5A					
		SAM	PLE TYPE:	Soil	Soil	Soil	Soil	Soil					
		DATE	DATE SAMPLED:		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					
oH (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					

163

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

mV

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).

170

\*Sulphide analyzed at AGAT 5623 McAdam

Certified By:



### **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

AGAT WORK ORDER: 17T283345 ATTENTION TO: Bujing Guan

SAMPLING SITE: SAMPLED BY:

		5 <u></u>													
				Soi	l Ana	alysis	3								
RPT Date: Nov 20, 2017			С	UPLICATI		REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		KE	
PARAMETER	Batch	Sample	Dup #1	Dup #2			Measured			Recovery	Acceptable Limits		Recovery	1 1 1 1 1	ptable mits
		ld	'	·			Value	Lower	Upper	ĺ		Upper	ĺ	Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8903894 8	3903894	< 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:



## 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



**Chain of Custody Record** 

## Laboratories / Bac

Oil

S

Paint

Soil

Sediment Surface Water

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

HWS CICI CON

Laborator	y Use Only
Work Order #:	177283345

Coolor	Quantity

Arrival Temperatures:

3.2	130	29
30	134	30
Tyes	□No	□N//

Custody Seal Intact: Notes:

□No □N/A

☐ Next Business Day

### **Turnaround Time (TAT) Required:**

Regular TAT 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

3 Business	2 Business	
Days	Days	

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

□PCBs

□ B(a)P

☐ ABNs [

□ vocs

ine Pesticides

☐ Aroclors

Chain of C	custody Record If this is a Drinking Water sample, plea	ase use Drinking Water Chain o	f Custody Form (potable water	er consumed by humans)						
Report Inform Company:	nation: Geofro Consulting	Regulatory Requirements:   No Regulatory Re  (Please check all applicable boxes)								
Contact:	Buljing Graan, Tim Yu	Regulation 153/04	Sewer Use	Regulation 5						
Address:	Kichmond Hill UN	Table	☐Sanitary	ССМЕ						
Phone: Reports to be sent to:	905-237-8336 Fax:	Res/Park	□Storm	Prov. Water Q						
1. Email:	bynum & geoproconsulting ca	Soil Texture (Check One)	Region	Other						
2. Email:	timy @ geoproconsulting.ca	Fine	MISA	Indicate One						

<b>Project Inform</b>	nation:
Project:	16-1255
Site Location:	Erlh
Sampled By:	Kirby
AGAT Quote #:	P0:
	Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Inform	nation:	Bill To Same: Yes M No □
Company:	As above	
Contact:		
Address:		
Email:	45	
		-

Regulation 153/04	Sewer	Use	e Regulation 558	
Table	□Sanita	ary	ССМЕ	
□Res/Park □Agriculture	□Storm	ı	Prov. Water Quality Objectives (PWQO)	
Soil Texture (Check One)  ☐Coarse	Region	One	Other	
Fine	□MISA		Indicate One	
Is this submission Record of Site Co			Report Guideline on Certificate of Analysis	
Li ies V	NO PARKET		☐ Yes ♥ No	
Sample Matrix Leg B Biota	gend	Hg, CrVI		
GW Ground Water		-	2 ±	

d Filtered - Metals,

**Regulatory Requirements:** 

No Regulatory Requirement

					!		Fie	and	tals I	DEC SAF	stals	tion,	3:5	7			101	chio	Se se	2			65
Sample Id	entification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals	☐ All Metal: ☐ Hydride N	ORPS:	Full Metals	Regulation,	Volatiles:	PHCs F	ABNs	PAHs	PCBs: [	Organochio	Sewer Use	3			4
SP 5 01 H	355	Nov3,2017	PM	1	Soil			79															9
5P 502E	555	NOV 3, 2017	PIL	1	501														N	<b>V</b>		7117	
SP 5 04E	555	You 3, 2017	PIK	- 1	50%			4														F	T
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THM

□ BTEX

TP ONH DTKN

Custom Metals

of

Page



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 (V1)

\*NOTE O

Page 1 of 5

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CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Certificate of Analysis

AGAT WORK ORDER: 17T284718

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:

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

#### Corrosivity Package

					Juliusivity i	ackage		
DATE RECEIVED: 2017-11-15								DATE REPORTED: 2017-11-27
		SAMPLE DES	CRIPTION:	BH9 SS4	BH10 SS5	BH15 SS5	SPS 01bE SS4	
		SAM	PLE 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:



## **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

AGAT WORK ORDER: 17T284718 ATTENTION TO: Bujing Guan

SAMPLING SITE:							5	SAMP	LED B	Y:							
				Soi	l Ana	alysis	6										
RPT Date: Nov 27, 2017				UPLICATI	Ē		REFEREN	NCE MA	TERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPI	KE		
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured		ptable nits	Recovery	Lie	ptable nits	Recovery	1 1 1 1 1	eptable mits		
		ld					Value	Lower	Upper		l .	Upper	,		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:



## 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



# Laboratories



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

Laboratory Use	Only		
Work Order #:	7726	34718	3
Cooler Quantity:			
Arrival Temperatures:	20	13,0	27
Custody Seal Intact:	DVes	10/00 l	DN/A

Chain of Custody Reco	rd If this is a	a Drinking Wa	ter sample, p	olease use D	rinking Water Chain of Custody Form (	potable v	water con	sumed b	y humans	)			Arrival	Temp	perati	ures:	3	0	13	0.	26
Report Information: Geo Pro G					legulatory Requirements:		No Reg	gulato	ry Req	uirer	nent	1	Custoo Notes:		al Inta	act:	□Ye	es		No	□N/A
		Ya			Regulation 153/04 Sewe	er Use	1	Reg	gulation !	558		=									
	to Vogen	Rd.			Table							Ti	urna	rou	nd '	Time	<b>∶ (TA</b> 1	i) Re	quire	d:	
	NO, ILL				∐Ind/Com	nitary			VIC			R	egul	ar T/	AT		□ 5	to 7 E	Business	Days	
Phone: 905-237-8	336_ Fax:				Res/Park Sto	rm		Pro	v. Water	Qualit	/	R	ush '	TAT (F	Rush S	urcharge	es Apply)				
Reports to be sent to: Gunn (2) 900		ting Co	4	90	oil Texture (Check One) Region			Obj	ectives (	PWQO	)	ļ		2.0			,	) December			
I. Lillali.		-				ate One			ici					Days	ısines s	35		2 Busin Days	ess	□ Ne	xt Business
2. Email: tiny @ gest	iro on sujt	ing . ca			☐Fine ☐MISA			-	Indicate C	ne				OR	Date	Requi	red (Ru	sh Sur	charges	May Apı	oly):
Project Information:					Is this submission for a				ıldelin						V		latt-		741 6	- u	FAT
Project: $16-1253$					Record of Site Condition?				of Ana	-		ŀ							i <b>cation fo</b> and stat		
Site Location:					☐ Yes ☐ No			/es		No			For '	Same	e Dav	√' anal	lvsis. ol	ease (	contact y	our AG	АТ СРМ
Sampled By:					N-127-121-1	-	W ,	). Reg 1	E 2	-	-	-	1		-	1					1 - 1
AGAT Quote #:  Please note: If quotation numb	P0:	West Mad 6 Marin		—    s	ample Matrix Legend	CrV		_	55								□ PCBs				1000
Please note: If quotation numb	er is not provided, client w	ин ве винеа тан ргісі	o for analysis,	В	Biota		116	dride	- 60								₽ □				
Invoice Information:		Bill To Same:	Ye No	□		Field Filtered - Metals, Hg,	90	(Incl. Hydrides)	,		ş	HT O					□ B(a)P			.39	
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Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals and Inorganics	☐ Hydride Metals ☐ 133 in	ORPs: UB-HWS  Crt CEC CF	Full Metals Scan	Nutrients: TP CINH, CT	Volatiles:	PHCs F1 - F4	ABNS	PAHs	PCBs: 🗆 Total	Organochlorine Pesticides TCLP: ☐ M&I ☐ VOCs ☐ ABNs	Sewer Use	Comosi	light	144
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BH 15 555	Nov 9,2017	444	(	55:1		-	5.0					14							<b>V</b>		cmal
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Samples Relinquished By (Print Name and Sign);		Date		me	Sampley Received By (Print Name and Skin)	1	.V	17			99/	16	16	Time /	1	11	<b>T</b>				
Samples Relinquished By (Print Name and Sign):		Nous	140()	me	Sample Received Pu IP at Name particular	11	W	(_			Date	4	1/7	Time!	10	15					
compres remitquished by (Frint Name and Sign):	0	Date	_ ,  "		The first of the f			-			- die			.ane				Page	e	_ of	_
Samples Rentificished By (Print Name and Mapy:	&	19/10	42	42	Samples Received By (Print Name and Sign):						Date			Time			Nº:	- 1	150	30	7
COMMINISTRATION OF THE PARTY OF	<u> </u>	1413	11	13					Pink C	ony - C	lient I	Vallou	' Cors	ν - ΔC		Mhita	Conv	AGAT	Date I	SSUMP Fol	uary 22, 2017



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 (V1)

\*NOTE O

Page 1 of 5

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA) AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.



CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Certificate of Analysis

AGAT WORK ORDER: 17T286763

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:Kirby

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

#### Corrosivity Package

DATE RECEIVED: 2017-11-21								D/	ATE REPORT	ΓED: 2017-11-30	
	,	SAMPLE DES	CRIPTION:	BH 1 SS5	BH 19 SS4	BH 26 SS5		BH 28 SS4		BH 30 SS5	
		SAMI	PLE TYPE:	Soil	Soil	Soil		Soil		Soil	
		DATES	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:



AGAT WORK ORDER: 17T286763

ATTENTION TO: Bujing Guan

## **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

SAMPLING SITE: SAMPLED BY:Kirby

				Soi	l Ana	alysis	3								
RPT Date: Nov 30, 2017			D	UPLICATI	E		REFEREN	ICE MA	TERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPI	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured Value		ptable nits	Recovery	Lie	ptable nits	Recovery	1 1:0	ptable nits
		la	·	·			value	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:



## **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



5R 12	5835 Coopers Avenue Mississauga, Ontario L4Z 1Y2 12.5100 Fax: 905.712.5122 webearth.agatlabs.com	Laboratory Use Only Work Order #: 177286763  Cooler Quantity: 340
of Custody Form (potable wa	eter consumed by humans)	Arrival Temperatures:
uirements: N	o Regulatory Requirement	Custody Seal Intact: Yes No Notes:
Sewer Use	Regulation 558	Turnaround Time (TAT) Required:
Sanitary	ССМЕ	Regular TAT 5 to 7 Business Days
□Storm	Prov. Water Quality Objectives (PWQO)	Rush TAT (Rush Surcharges Apply)
Region	Other	3 Business 2 Business Days Days Days
MISA	Indicate One	<b>OR</b> Date Required (Rush Surcharges May Apply):
on for a pndition?	Report Guideline on Certificate of Analysis  Yes   No	Please provide prior notification for rush TAT *TAT is exclusive of weekends and statutory holidays For 'Same Day' analysis, please contact your AGAT CPM
gend $\gtrsim$	0. Reg 153	Decise

Chain of Custody Reco	ord If this is a	Drinking Wa	nter sample, p	lease us	se Drinking Water Chain o	f Custody Form	(potable v	water cons	umed by huma	ns)			Arriva			ures:	-	五	2 1	13	4-1	
Report Information:	Consultine				Regulatory Requ		<u> </u>	No Regi	ulatory Re	quire	ment	111	Custo Notes	-	al Inta	act:	6	]Yes	0	□No		1/
Contact: Bujing Gru		u Ld			Regulation 153/04	Sew	er Use	1 0	Regulatio	า 558					ınd '	Tim	ο (T	AT\ E	Requir	red:		Ξ
Address: Unit 57 4		ζοι.			Table ————————————————————————————————————	∏Sa	nitary	1	CCME			11	egul				-	1	_	ess Days		
Phone: 905-237-83					Res/Park	□Sto	orm		Prov. Wate			11	ush			urcharg			Dusine	SS Days		
Reports to be sent to:	proconsultiv	y.ca			Soil Texture (Check One)	Region		_  [	Objectives Other	(PWQ	O)			3 Bı	usines	ss		2 Bu	siness		Next Busin	пe
2. Email timy @ geo.	pro Consulti	ng ca			☐Coarse ☐Fine	MISA	cate One		Indicat	One			Ш	Day	S		ired (f	Days			Day	
Project Information:		V			Is this submission		ie.	Repo	rt Guideli			Ш				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					PP-37-	
Project: 16-125:					Record of Site Co			/	cate of A	11										n for rush statutory		
Site Location:	N				☐ Yes 🔯	No	Y.	VZ Y	es [	] No	)										GAT CPM	1
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Contact:				- 1	P Paint S Soil		ed . N	ganics Metals (e	153 Met		M Me	NO3+ÑO2				☐ Aroclors	sticid		>			
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Enail.					SW Surface Water		Field Filtered - Metals, Hg,	and fr	Metals DB-HN DEC	als Sc	ion/C	Q U	- 74			Total	hlorir	N&I	م م			
Sample Identification	Date Sampled	Time Sampled	# of Containers	Samp Matri			Y/N	Metals and Inorganics	ORPs: □ B-HWS □ CI-153 Meta ORPs: □ B-HWS □ CI-15 □ Cr <sup>2</sup> □ EC □ FOC □ H	Full Metals Scan	Regulation/Custom Metals	□ No, □ No, □ No,+Ño, Volatiles: □ Voc □ BTEX	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total	Organochlorine Pesticides	TCLP:  M&I  VOCs  ABNS Court lies	Corrosivity		- 1	
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BH 19 554	Nov 13, 2017	PILL	(	501															V	imun	den	
13426 555	Nov15,2017	P 14		Soil				100		8												
BH 28 154	Nov15,2017	PM	1	501	_						- 39	ā			Ш			To-	V			
BH 30 555	1)013,20(7	PIN	(	50%	_								1				_		V			_
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Samples Relinquished By (Print Name and Sign):		Date /	// / Tim	ie	Samples Received By (P.	rint Name and Sign):					Date	1		Time			1	7	^ E	000	2.0	_

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Date /		Time	Nº: <b>T</b>	0 E	03



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 (V1)

\*NOTE O

Page 1 of 5

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Certificate of Analysis

AGAT WORK ORDER: 17T289231

PROJECT: 16-1255

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

ATTENTION TO: Bujing Guan

SAMPLED BY: Kirby

#### Corrosivity Package

				`		aonago					
DATE RECEIVED: 2017-11-28									DATE REPORTE	D: 2017-12-0	5
					BH38 SS4 &						
	5	SAMPLE DES	CRIPTION:	BH37 SS4	SS5		BH104 SS4		BH107 SS4		T3 SS4
		SAM	PLE 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
	5	SAMPLE DES	CRIPTION:	T8 SS5A&B	SPS06E SS6						
		SAM	PLE 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:



## **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			С	UPLICAT	E		REFERENCE MATERIAL			METHOD	BLANK	SPIKE	MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value			Recovery	Acceptab Recovery Limits		Recovery	Acceptable Limits		
		la la	·	·			value	Lower	Upper		Lower	Upper		Lower	Upper	
Corrosivity Package																
Sulfide (S2-)	8942020 8	3942020	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:



## **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 Part 3		CALCULATION			
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE			



5835 Coopers Avenue Mississauga, Ontario L4Z 1Y2

Ph: 905.712.5100 Fax: 905.712.5122 webearth.agatlabs.com

Laboratory	Use Or	ıly			
Work Order #:	177	12	89	23	1

**Turnaround Time (TAT) Required:** 

Regular TAT

Rush TAT (Rush Surcharges Apply)

3 Business
Days

Cooler Quantity:	Po	7-7	>
Arrival Temperatures:	4.8	45	43
Custody Seal Intact:	□Yes	□No	□N/A

5 to 7 Business Days

Next Business

Day

2 Business

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

Chain of C	SUSTODY RECORD If this is a Drinking Water sample, ple	ase use Drinking Water Chain o	f Custody Form (po	otable water consumed by humans)
Report Inform Company:	nation: Geoph Consulting	Regulatory Requ		☐ No Regulatory Requirement
Contact:	Bujung Guan. Tim In	Regulation 153/04	Sewer	Use Regulation 558
Address:	Kichmond Hill JON	Table	□Sanit	ary CCME
Phone:	905-237-8336 Fax:	Res/Park	Storm	
Reports to be sent to:  1. Email:	bywan@ geopro con sorting. Ca	Soil Texture (Check One)	Region	Objectives (PWQO) Other
2. Email:	timy @ geopro Gh (ulting.ca	Fine	MISA	Indicate One
Project Inform Project: Site Location: Sampled By:	mation:  (6-(255  Erin, ON  Kurby	Is this submission Record of Site Co		Report Guideline on Certificate of Analysis Yes No

AGAT Quote #:  Invoice Inform  Company: Contact: Address: Email:	Please note: If quotation number is nation:		ill be billed full price	1	В	Oil Paint Soil Sediment	l Filtered - Metals, Hg, CrVI	Inorganics	1153 Metals (excl. Hydrides)	OC: OCN	1 8 1	□ TP □ NH, □ TKN	16	<u>-</u>			al	sticides	□ vocs □ ABNs □ B(a)P □PCE	11.75.0	7		
	e Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals and	☐ All Metals ☐ Hydride Met	ORPs: DB-HWS Dcr* DEC DDH DSAR	tals	Nutrients: 01	Volatiles:	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Tot	ochlo		Sewer Use	2	xi u=i	
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BH38	5548135	Nov22, 2017	PAS	1	7															0			
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T8	555A&B	NOV 17, 2017		1	1																		
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Samples Relinquished By (Print Name and Sign):	Date	Samolds Received By (Print Name and Signal	201/1/28 Time 14	63
Samples Replandined By (Print Nation MA Stin):	2017/1/20 417	Samples Received By (Print Name and Sign)	Date	Pageof
Sample's Relinquished By (Print Name and Sign):	Date Time	Samples Received By {Print Name and Sign}:	Date Time	№T 059317
li-	111111111111111111111111111111111111111			



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 (V1)

\*NOTE O

Member of: Association of Professional Engineers and Geoscientists of Alberta

Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.



CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

## Certificate of Analysis

AGAT WORK ORDER: 17T291830

PROJECT: 16-1255

ATTENTION TO: Bujing Guan

SAMPLED BY:

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

0	Daaliaaa
Corrosivity	Package

Corrosivity Lackage													
DATE RECEIVED: 2017-12-05	5					DATE REPORTED: 2017-12-13							
	SA	AMPLE DESC	CRIPTION:	BH103 SS4	BH101 SS5								
		SAMF	PLE TYPE:	Soil	Soil								
		DATE S	SAMPLED:	2017-11-28	2017-11-28								
Parameter	Unit	G/S	RDL	8956047	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:



## **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

AGAT WORK ORDER: 17T291830 ATTENTION TO: Bujing Guan

SAMPLING SITE:	SAMPLED BY:														
Soil Analysis															
RPT Date: Dec 13, 2017 DUPLICATE REFERENCE MATERIAL METHOD BLANK SPIKE MATRIX SPIK														KE	
PARAMETER	PARAMETER Batch Id			Dup #2	RPD	Method Blank	Measured	Acceptable Limits		Recovery	1 1 1 1 1	ptable nits	Recovery	1 1 1 1 1 1	eptable mits
		la la	Dup #1				Value	Lower	Upper	, , ,		Upper	,		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:



## Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255

AGAT WORK ORDER: 17T291830

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



5835 Coopers Avenue Mississauga, Ontario L4Z 1Y2 Ph: 905.712.5100 Fax: 905.712.5122 **Laboratory Use Only** 

Work Order #: 177291830

Chain of	Custody Reco					Drinking Water Chain of Custody Form	(potable v	vater cons	webearth.ag		om		ooler Qu rival Ter			000	A	45	143
Report Info	GEOPIO	Consultion			F	Regulatory Requirements:	☐ <b>1</b>	No Reg	ulatory Re	quirei	nent		ustody S otes:	eal Int	tact:	□Ye	s	□No	
Contact: Address:	Mait &7. Richmond H	40 voger	1 Rd		_    C	Regulation 153/04			Regulation	558			rnaro gular			/		uired:	ys
Phone: Reports to be sent to 1. Email:	905-237-83 bgnan@geoph	s b Fax: _			s	Res/Park	ate One		Prov. Wate Objectives Other			Ru	sh TA1	Busine	Surcharges	Apply)	Busines		Novt Business
2. Email:	timy @ geops	to Con sulti	y. Ca			Fine MISA	<b>\</b>		Indicate	One	= _		Du		Require		•	arges Ma	Day
Project Information Project: Site Location: Sampled By:	rmation: 16-1255 Evin. ON					Is this submission for a Record of Site Condition?  Yes No			ort Guidell licate of A		0		*TA	T is ex	clusive	of wee	kends ai		ush TAT ory holidays
AGAT Quote #:	Please note: If quotation numb	PO: per is not provided, client w	ill be billed full price	for analysis.	9	Sample Matrix Legend Biota	CrVi		Reg 153							)P □PCBs	30/ lin		
Invoice Information:  Company: Contact: Address: Email:					P S S	Paint	Field Filtered - Metals, Hg,	and Inorganics	ORPs: □ B+WS □ Cl □ CN □ Cor □ Cc □ C	Full Metals Scan	Regulation/Custom Metals  Nutrients:  Nutrients	S: \( \text{\tint{\text{\tert{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tin}\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tex{\tex	1-F4		PCBs: □ Total □ Aroclors	Organizationine restitutes  TCLP: □ M&I □ VOCs □ ABNs □ B(a)P		majors ex	
Sam	pple Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals	ORPs:	Full Me	Regulation/Cu Nutrlents: TT	Volatiles:	PHCs F1-	PAHs	PCBs:	TCLP:	Sewer Use	218	
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amples Relinquished By (	(Print Name and Sign):		Date	Time		Samples Received By (Print Name and Sign):					Date		Time			Nº:	0!	593	18



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 (V1)

\*NOTE O

Page 1 01 5

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CLIENT NAME: GEOPRO CONSULTING LTD

SAMPLING SITE:

Redox Potential (2:1)

8991976

Certificate of Analysis

AGAT WORK ORDER: 17T297643

PROJECT: 16-1255

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

ATTENTION TO: Bujing Guan SAMPLED BY: Kirby

#### Corrosivity Package

					<u> </u>	
DATE RECEIVED: 2017-12-2	1					DATE REPORTED: 2017-12
	SA	AMPLE DES	CRIPTION:	SPS08E SS6		
		SAM	PLE 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		

RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil -Comments:

157

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.

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

mV

Certified By:



AGAT WORK ORDER: 17T297643

## **Quality Assurance**

CLIENT NAME: GEOPRO CONSULTING LTD

PROJECT: 16-1255 ATTENTION TO: Bujing Guan

SAMPLING SITE: SAMPLED BY:Kirby

										,					
Soil Analysis															
RPT Date: Dec 29, 2017				UPLICAT		REFEREN	NCE MA	TERIAL	METHOD	BLANK	SPIKE	MAT	RIX SPI	KE	
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	1 1 1 1 1 1	ptable nits	Recovery	1 1 1 1 1	ptable mits
		la		·			value	Lower	Upper	,	Lower	Upper	,	Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8991976 8	3991976	< 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:



## 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
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Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE



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Work Order #: 17T2 97643

**Laboratory Use Only** 

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Cooler Quantity:	-		Mea
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Chain of Custody Record

Cilaili di Ci	istouy Recoi	l U If this is	a Drinking Wa	ter sample, p	olease us	e Drinking Water Chain of Custody Form (	potable	water co	nsumed by h	mans)							=	2 7	2	331	7.5
Report Information Company:	cles to		Regulatory Requirements: (Please check all applicable boxes)		No Re	gulatory	Requ	irem	ent		stody otes:	Seal I	ntact:		Yes	2 0	□No	□N/A			
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Project:	16-1255					Record of Site Condition?			ificate of	Anal	ysis		ľ	*T						for rush tatutory l	
Site Location:	Erin, OH					☐ Yes ☑ No		V	Yes		No		١.								
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#### 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.