



REPORT

Supplementary Geotechnical Investigation

Block C - RioCan Windfields Development, Oshawa, Ontario

Submitted to:

RioCan Realty Inv. Partner 11LP

2300 Yonge Street, Suite 500

Toronto, Ontario

M4P 1E4

Attention: Ms. Thais Osso

Submitted by:

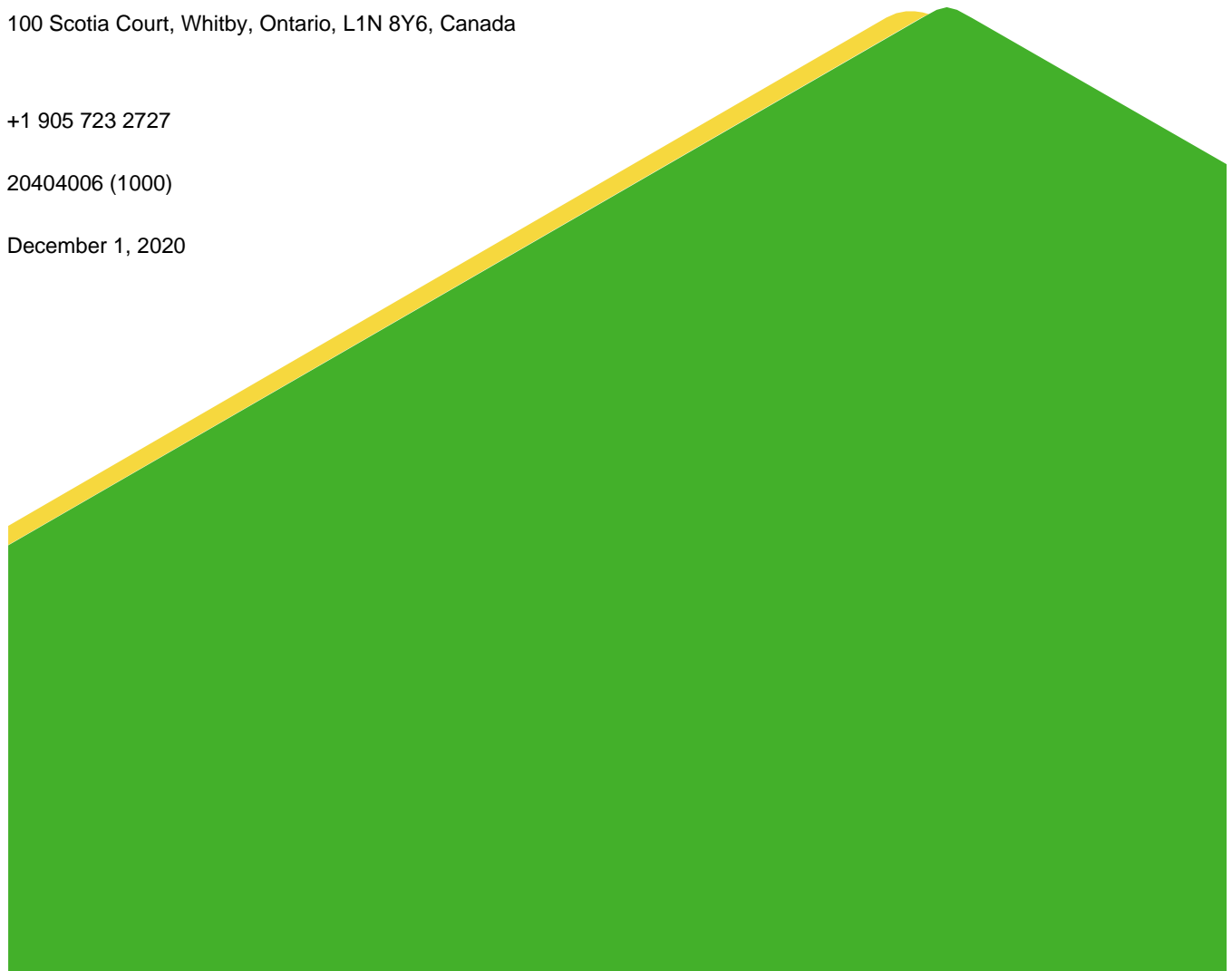
Golder Associates Ltd.

100 Scotia Court, Whitby, Ontario, L1N 8Y6, Canada

+1 905 723 2727

20404006 (1000)

December 1, 2020



Distribution List

Electronic Copy (.pdf) - RioCan Realty Inv. Partner 11LP

Electronic Copy (.pdf) - Golder Associates Ltd.

Table of Contents

| | |
|--|----------|
| 1.0 INTRODUCTION | 1 |
| 2.0 SITE DESCRIPTION | 1 |
| 3.0 INVESTIGATION PROCEDURES | 2 |
| 4.0 SITE GEOLOGY AND STRATIGRAPHY | 2 |
| 4.1 Regional Geology | 2 |
| 4.2 Subsurface Conditions | 3 |
| 4.2.2 Fill | 3 |
| 4.2.3 Engineered Fill | 3 |
| 4.2.4 Glacial Till | 4 |
| 4.2.5 (SM) Silty Sand | 4 |
| 4.2.6 (CL) Silty Clay | 5 |
| 4.2.7 Groundwater | 5 |
| 5.0 DISCUSSION AND RECOMMENDATIONS..... | 5 |
| 5.1 Site Preparation | 6 |
| 5.1.1 Subgrade Preparation | 6 |
| 5.1.2 Engineered Fill | 7 |
| 5.2 Foundation Design | 8 |
| 5.2.1 Seismic Design | 9 |
| 5.3 Slab-on-Grade | 9 |
| 5.4 Excavations | 10 |
| 5.5 Groundwater Control | 10 |
| 5.6 Site Servicing | 11 |
| 5.6.1 Pipe Bedding and Cover | 11 |
| 5.6.2 Trench Backfill | 11 |
| 5.7 Pavement Design | 12 |
| 5.7.1 Drainage | 12 |

| | | |
|------------|--|-----------|
| 5.7.2 | General Construction Recommendations..... | 13 |
| 5.7.2.1 | Subgrade Preparation..... | 13 |
| 5.7.2.2 | Granular Materials | 13 |
| 5.7.2.3 | Hot Mix Asphalt Types and Asphalt Construction | 13 |
| 5.7.2.4 | Performance Graded Asphalt Cement (PGAC)..... | 13 |
| 6.0 | ADDITIONAL CONSIDERATIONS..... | 14 |
| 7.0 | CLOSURE..... | 14 |

ATTACHMENTS

Figure 1: Key Plan

Figure 2: Borehole Location Plan

Figures 3 to 8: Plasticity Chart and Grain Size Distribution Curves

APPENDICES

APPENDIX A

Important Information and Limitations of This Report

APPENDIX B

Borehole Logs (20-1 to 20-15)

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by RioCan Realty Inv. Partner 11LP (RioCan) to carry out a supplementary geotechnical investigation for the proposed commercial development as part of Block C – RioCan Windfields Development, located at the southwest corner of Simcoe Street and Windfields Farm Drive West in Oshawa, Ontario, as shown on the Key Plan, Figure 1 (the site).

The purpose of this supplementary geotechnical investigation is to provide geotechnical engineering information on the soil and groundwater conditions within the proposed building areas and based on our interpretation of the subsurface data and to provide geotechnical engineering recommendations for the proposed commercial development.

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location, or elevation, or if the project is not initiated within eighteen months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid. This report should be read in conjunction with the attached "*Important Information and Limitations of This Report*" which are included in Appendix A. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2.0 SITE DESCRIPTION

The site is bounded by Simcoe Street North to the east, Windfields Farm Drive to the north, uncultivated lands to the west and residential buildings to the south of the site. In addition, the site is split into two areas (west and east side) by Thoroughbred Street. At the time of the investigation, the site was mostly occupied by stockpiled materials and sparse vegetation. An existing pond was also observed at the southwest corner of Windfields Farm Drive and Thoroughbred Street. In general, the site is regarded to be of a gentle slope with a downward gradient from east to west. Due to recent site grading activities, the site has been brought up close to the proposed pre-grade for the proposed development using engineered fill which was monitored by Golder during fill placement in 2017.

Details of the proposed development (i.e. site grading, building structures, servicing depths, etc.) have been provided to Golder and are shown in the following drawings:

- Drawing No.'s 10-10613-GR4 and GR5 entitled "*RioCan Windfields, Lot Grading Plan*" Revision 3 prepared by MMM Group, dated February 2016;
- Drawing No. A1-251 entitled "*Site C Plan Concept*" prepared by Turner Fleischer, dated July 2020; and
- Sample prototype drawings for Mr. Lube entitled "*New Build Orillia, 3285 Monarch Road, Orillia, Ontario*" dated March 20, 2020.

Based on these drawings, it is understood that the commercial development area is to be comprised of commercial buildings, drive lanes, site servicing and parking lots. It is also understood that Block C will consist of six buildings designated as C1 to C6 and ranging between approximately 221 m² and 966 m² in size. The proposed buildings will each consist of a single storey slab-on-grade building with the exception of Mr. Lube building (Building C1). Building C1 will consist of a single storey building with a basement extending to 3m below the ground floor. The locations of the proposed buildings are shown on Figure 2.

3.0 INVESTIGATION PROCEDURES

The geotechnical field investigation for this assignment was carried out between November 3 and 9, 2020, during which time fifteen boreholes (designated as Boreholes 20-1 to 20-15) were advanced to depths varying between 6.0 m and 6.5 mbgs. The borehole locations are shown on the Borehole Location Plan, Figure 2.

The boreholes were advanced using a conventional track-mounted drill rig supplied and operated by Golder. Standard penetration testing (SPT) and sampling in the overburden soils were carried out at regular intervals of depth using conventional 50 mm outer diameter split spoon sampling equipment driven by an automatic hammer in accordance with ASTM D1586. The split-spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 35 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension would not be sampled or represented in the grain size distributions. The results of the in-situ field tests (i.e. SPT 'N'-values) as presented on the borehole records and in Section 4 of this report are uncorrected.

The groundwater conditions were noted in the open boreholes upon completion of drilling. Monitoring wells were installed in Boreholes 20-2, 20-8, 20-11 and 20-14 following the completion of drilling to allow for further groundwater measurements. Each monitoring well consisted of a 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. A sand filter pack surrounded the screen, and above the screen the annulus was backfilled to the surface with bentonite. The monitoring well installation details, and water level reading are presented on the borehole records. The remaining boreholes were backfilled in accordance with current environmental regulations.

The field work was observed by a member of our technical staff, who arranged for the clearance of underground utility services, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined and took custody of the recovered soil samples. The samples were identified in the field, placed in appropriate containers, labelled, and transported to our Whitby geotechnical laboratory for further examination and selected laboratory testing. Index and classification tests, consisting of water content determinations as well as selective gradation and Atterberg limit testing were carried out on the recovered soil samples. The results of the geotechnical laboratory tests are presented on Figures 3 to 8 and on the borehole records.

The ground surface elevations and corresponding Universal Transverse Mercator (UTM) coordinates at the borehole locations were surveyed by J.D. Barnes Ltd. on November 6, 2020 and are shown on the Record of Borehole sheets. The borehole elevations are based on the City of Oshawa Benchmark No. 214 having Elevation 182.701 m.

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geology

The surficial geology aspects of the general Site area are referenced from: Chapman, L.J., and Putnam, D.F., 2007, *"The Physiography of Southern Ontario"*; 4th Edition, Ontario Geological Survey. Based on the physiographic mapping for the vicinity of the Site, the site lies within the physiographic region of Southern Ontario known as the South Slope.

The South Slope region slopes gradually downward towards Lake Ontario. The overburden immediately below ground surface within the South Slope generally consists of silty clay to clayey silt till and at depth consists of alternating deposits of dense lacustrine sands and silts and over consolidated lacustrine clays and clay tills overlying the bedrock.

4.2 Subsurface Conditions

The subsurface soil and shallow groundwater conditions encountered in the boreholes, as well as the results of the field and laboratory testing are shown on the borehole records in Appendix B and on Figures 3 to 8, respectively, following the text of this report. Golder's "*Method of Soil Classification*", "*Abbreviations and Terms Used on Records of Boreholes and Test Pits*" and "*List of Symbols*" are attached to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the soil strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes.

The following is a summarized account of the subsurface conditions encountered in the boreholes drilled during this investigation, followed by more detailed descriptions of the major soil strata and shallow groundwater conditions.

In general, the subsurface conditions within the proposed building areas consist of fill and engineered fill materials and an occasional upper silty sand deposit underlain by a non-cohesive and cohesive glacial till deposit interlayered with silty clay. The recent groundwater levels measured in the monitoring wells ranged between 2.6 mbgs and 4.5 mbgs.

4.2.2 Fill

Fill material consisting of silty clay and silty sand soils, containing organic staining were encountered in Boreholes 20-2, 20-3, 20-9, 20-13, 20-14 and 20-15 at existing ground surface and extended up to 2.1 mbgs. Topsoil was observed to be mixed with the fill material in Boreholes 20-2, 20-9, and 20-14.

The SPT 'N'-values measured within the cohesive fill material ranges from 11 blows to 18 blows per 0.3 m of penetration indicating a stiff to very stiff consistency. The SPT 'N'-values measured within the non-cohesive fill material ranges from 3 blows to 29 blows per 0.3 m of penetration indicating a very loose to compact very dense state of compactness. At the surface of Borehole 20-9, one measured SPT 'N'-value is 84 blows per 0.08 m of penetration indicating the presence of very dense fill or an obstruction.

The in situ water contents measured in the fill samples generally ranges from about 7 percent to 15 percent with one value of 21 percent where the silty sand fill was mixed with topsoil in Borehole 20-9 and is representative of a higher organic content.

4.2.3 Engineered Fill

Engineered fill material consisting of silty clay and predominant silty sand soils, gravelly to a trace of gravel were encountered in Boreholes 20-1, 20-4, 20-5, 20-6, 20-7, 20-8, and 20-10 at existing ground surface extending up to 2.9 mbgs. The fill material was observed to contain organic and oxidation staining in some boreholes. In Borehole 20-1, wood fragments were observed at a depth of 1.5 m.

The SPT 'N'-values measured within the cohesive engineered fill material ranges from 12 blows to 23 blows per 0.3 m of penetration indicating a stiff to very stiff consistency. The SPT 'N'-values measured within the non-cohesive engineered fill material ranges from 10 blows to 54 blows per 0.3 m of penetration indicating a compact to very dense state of compactness.

The in situ water contents measured in the fill samples ranges from about 4 percent to 20 percent and generally between 7 and 13 percent.

4.2.4 Glacial Till

A deposit of glacial till was encountered in all boreholes advanced at the site with the exception of Boreholes 20-1 and 20-6. The till ranges in composition from non-cohesive silty sand to silt and sand to cohesive sandy silty clay to clayey silt. The deposit generally extends to the borehole termination depths and contains silty clay and silty sand interlayers. Although cobbles and boulders were not noted during drilling through the till deposits at this site, cobbles and boulders are commonly encountered in glacially derived materials and should be expected within these deposits. Further, the presence of cobbles and/or boulders in the cohesive and non-cohesive till deposits can be inferred from the multiple instances of auger grinding during drilling as well as the split-spoon sampler not advancing the full sample depth. In addition, oxidation staining was encountered in the glacial deposit in the upper zones.

(SM/ML) Silty Sand to Silt and Sand (Till)

A non-cohesive till deposit comprising of silty sand or silt and sand, containing trace to some gravel was encountered in Boreholes 20-4, 20-9, and 20-11 to 20-15. The non-cohesive till deposit was generally encountered underlying the cohesive till and silty clay deposit or at ground surface in Boreholes 20-11 and 20-12.

The SPT 'N'-values measured within the non-cohesive till deposit ranges from 14 blows per 0.3 m of penetration to 50 blows per 0.05 m of penetration, indicating a compact to very dense state of compactness, and generally dense to very dense and also becoming denser with depth. The natural water content measured on selected samples ranges from about 5 percent to 11 percent.

Grain size distribution curves for three samples of the non-cohesive till deposit are shown on Figures 3 and 4.

(CL/CL-ML) Silty Clay to Clayey Silt (Till)

A cohesive till deposit comprised of sandy silty clay to clayey silt, containing a trace of gravel to some gravel was encountered in Boreholes 20-1 to 20-5, 20-7 to 20-10, 20-12, 20-14 and 20-15. The cohesive till deposit was generally encountered underlying engineered fill, non-cohesive till, silty sand, or silty clay deposits. Oxidation staining and sand pockets/seams were also observed in some boreholes.

The SPT 'N'-values measured within the cohesive till deposit range from 16 blows per 0.3 m of penetration to 50 blows per 0.08 m of penetration, indicating a very stiff to hard consistency. The natural water content measured on selected samples ranges from about 8 percent to 14 percent.

Grain size distribution curves for two samples of the cohesive till is shown on Figure 5. Atterberg limits testing was performed a sample of the cohesive till deposit and is shown on a plasticity chart on Figure 6. The results of the Atterberg limit test indicate the tested sample is classified as an inorganic silty clay to clayey silt of low plasticity.

4.2.5 (SM) Silty Sand

A non-cohesive silty sand deposit was encountered in Boreholes 20-2, 20-3, 20-5 and 20-13 underlying existing fill and engineered fill and extending up to 2.9 mbgs.

The SPT 'N'-values measured within the silty sand deposit ranges from 9 blows to 30 blows per 0.3 m of penetration, indicating a loose to dense state of compactness. The natural water content measured on samples of the silty sand deposit ranges from about 10 percent to 14 percent.

4.2.6 (CL) Silty Clay

A cohesive silty clay deposit, sandy to a trace of sand, trace gravel was encountered in Boreholes 20-1 to 20-7, and 20-13 below or interlayered within the till. A gravel layer was observed in Boreholes 20-2 and 20-4. Oxidation staining was also observed in some boreholes.

The SPT 'N'-values measured within the silty clay deposit ranges from 11 blows to 54 blows per 0.3 m of penetration, indicating a stiff to hard consistency. The natural water content measured on samples of the silty clay deposit ranges from about 12 percent to 19 percent.

Grain size distribution curves for three samples of the silty clay deposit and are shown on Figure 7. Atterberg limits testing was performed on three samples of the silty clay deposit and are shown on a plasticity chart on Figure 8. The results of the Atterberg limit test indicate the samples tested are classified as an inorganic silty clay of low plasticity.

4.2.7 Groundwater

Groundwater observations during or upon completion of drilling ranged approximately between 4.6 mbgs and 6.1 mbgs, and dry in six boreholes. The groundwater level measurements in the monitoring wells ranged approximately between 2.6 mbgs and 4.5 mbgs (Elevations 172.4 m and 175.3 m) and are summarized in the table below.

| Borehole | Ground Surface Elevation (m) | Groundwater Depth/Elevation | | Date |
|----------|------------------------------|-----------------------------|---------------|-------------------|
| | | Depth (m) | Elevation (m) | |
| 20-2 | 176.62 | 4.2 | 172.42 | November 24, 2020 |
| 20-8 | 177.59 | 2.6 | 174.99 | |
| 20-11 | 177.77 | 4.0 | 173.77 | |
| 20-14 | 179.76 | 4.5 | 175.26 | |

It should be noted that these observations and measurements reflect the shallow groundwater conditions encountered in the boreholes during the time of the field investigation and that water level at the site is expected to fluctuate seasonally in response to changes in precipitation and snow melt.

5.0 DISCUSSION AND RECOMMENDATIONS

This section of the report provides engineering information and recommendations for the geotechnical design aspects of the project based on our interpretation of the borehole information, the laboratory test data and our understanding of the project requirements. In addition, this report addresses the geotechnical (physical) aspects of the subsurface conditions as encountered at this site. The chemical/environmental aspects are beyond the terms of reference for this investigation and were not addressed. The information in this portion of the report is provided for planning and design purposes for the design guidance of the design engineers and architects. Where comments are made on construction, they are provided only in order to highlight those aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should

examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

The proposed Buildings C1 to C6 will each consist of a single storey slab-on-grade building. At the time of this report, the finished floor elevations (i.e. FFE) have not been finalized. However, proposed pre-grade has been provided and ranges between approximately Elevations 175.1 m and 178.2 m at the west side of Thoroughbred Street and between Elevations 177.6 m and 180.3 m at the east side of Thoroughbred Street within the site. The relevant boreholes for each proposed building are as follows:

| Building | Proposed Pre-Grade (m) | Relevant Borehole(s) |
|---------------|--|----------------------|
| C1 (Mr. Lube) | 175.1 m to 178.2 m (West side of Thoroughbred Street) | 20-2, 20-3, 20-4 |
| C2 | | 20-5, 20-6 |
| C3 | | 20-7, 20-8 |
| C4 | | 20-9, 20-10 |
| C5 | 177.6 m to 180.3 m (East side of Thoroughbred Street) | 20-12, 20-13 |
| C6 | | 20-14, 20-15 |

Based on the result of this investigation, the subsurface soil conditions encountered at the site are considered to be generally suitable for the proposed commercial buildings utilizing conventional shallow strip/spread footings, with slab-on-grade construction and serviced shallow underground utilities.

5.1 Site Preparation

5.1.1 Subgrade Preparation

Soils containing organics and unacceptable fill material should be stripped from the site prior to placement of engineered fill. The non-cohesive fill material and any excavated silty sand soils can be reused as engineered fill provided that organics or deleterious materials are not present, and the materials water content is within +/- 2 percent of the standard Proctor maximum dry density (SPMDD).

Finished floor elevations for the proposed buildings have not been provided at the time of this report. Based on the grading plan, the existing ground surface elevations at the time of the field investigation are mostly at the pre-grade. However, it is anticipated that grade raise up to 1 m will be required within the proposed Building C4 envelope (vicinity of Borehole 20-10) up to Elevation 177.9 m. In addition, grade cut may be required at the proposed Building C1. As such, any filling carried out at the site in conjunction with re-grading (with exception of future green spaces) should be carried out as engineered fill. Recommendations for the placement of engineered fill are outlined in Section 5.1.2.

5.1.2 Engineered Fill

Where cut and fill are required to achieve final grade within the site, the non-cohesive fill (as noted above), glacial till, and silty sand deposits can be reused as engineered fill. Based on the soil classification and frost group described in Table 13.1 of the Canadian Foundation Engineering Manual (CFEM, 2006), the non-cohesive fill, glacial till, and silty sand deposits encountered on the site are regarded as being of low to moderate frost susceptibility. This should be considered for any design elements exposed to freezing temperatures (concrete flatworks, exterior concrete slabs, and the like). The existing cohesive fill and native silty clay are not suitable for reuse as engineered fill due to the high water content and potential to induce long-term and differential settlement below the buildings.

Based on the measured natural water contents, majority of the native soils are generally at or above their estimated laboratory optimum water contents for compaction. Alternatively, imported materials may be used for engineered fill and must be approved by Golder at the source(s), prior to hauling to the site. In this regard, imported granular materials which meet the requirements for OPSS.PROV 1010 (Aggregates) Select Subgrade Material (SSM) would be suitable for use as engineered fill. In any event, the approved materials for engineered fill should be placed in maximum 300 mm loose lifts and uniformly compacted to 98 percent SPMDD. The imported materials for reuse as engineered fill must be maintained within about 2 percent of optimum moisture content to achieve the required compaction.

All oversize cobbles and boulders (i.e. greater than 150 mm in size) or any other deleterious materials should be removed from engineered fill materials.

Prior to placement of engineered fill, all buried topsoil, soil containing organics and non-engineered fill materials must first be removed from the development area. The exposed engineered fill or native subgrade area(s) should then be heavily proofrolled in conjunction with an inspection by geotechnical personnel from Golder to confirm the base is free of ponded water, loosened/softened or any other deleterious materials. Remedial work (further sub-excavation, replacement, etc.) may be required as per recommendations from Golder during proofrolling.

Subexcavation of the fill materials and loose silty sand deposit encountered in Boreholes 20-2 and 20-3 should be carried out up to Elevation 173.8 m within Building C1 envelope. The cohesive fill material should be separated during excavation and not reused as engineered fill. Also, subexcavation of the non-cohesive fill material mixed with topsoil should be carried out up to Elevation 176.1 m at the north portion of Building C4 (vicinity of Borehole 20-9). The upper 1.2 m consisting of inorganic silty sand fill material should be separated during excavation and may be reused as engineered fill. The engineered fill should extend laterally beyond the limits of the proposed foundations at least 1.0 m plus the thickness of the fill, and replaced with granular fill (SSM or Granular B Type I) or acceptable existing fill material.

Full-time monitoring and in situ density testing must be carried out by Golder during placement of engineered fill below all structures and settlement sensitive areas.

The final surface of the engineered fill should be protected as necessary from construction traffic and should be sloped to provide positive drainage for surface water prior to construction. During periods of freezing weather, additional soil cover should be placed above final subgrade to provide for temporary frost protection.

5.2 Foundation Design

Based on the grading plan, the proposed buildings will likely be founded on existing or new engineered fill for Buildings C1 to C4, and in glacial till or silty sand for Buildings C5 and C6. As a result, we recommend that the proposed buildings be supported on conventional spread/strip footings founded on the competent engineered fill or native soils which consists of compact silty sand and silty sand till, and very stiff silty clay till. Proposed foundations should not be founded within the loose silty sand deposit encountered in Borehole 20-3 (which are recommended to be removed as discussed above).

Footings for Buildings C1 to C6, founded on engineered fill or competent native soils at a minimum depth 1.2 m below finished grade may be designed using a factored geotechnical resistance at Ultimate Limit States (ULS) of 300 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 200 kPa for 25 mm of settlement. The fill placed within the building envelope and extending at least 1 m beyond the building perimeter should be compacted to 100 percent of the material's SPMDD.

For the soil reactions listed above, the footings must have widths ranging from 450 mm to 900 mm for strip footings and 1,000 mm to 2,500 mm for spread footings. Should larger footing sizes be required, Golder must be consulted to provide additional recommendations. Additional reinforcement must be utilized for footings placed in the transition between existing and new engineered fill to further minimize the effects of differential settlement and should be specified by the Structural Engineer.

The foundation subgrade for footings founded on engineered fill is subject to inspection and approval by Golder prior to pouring concrete. Remedial action (sub-excavation and replacement, etc.) may be required during excavations of footings especially when footing design elevations coincide with softened or loosened soils or any deleterious material in engineered fill or native soils. These soils must be sub-excavated and replaced with lean mix concrete having a minimum strength of 0.7 MPa as directed by geotechnical personnel from Golder.

If stepped spread footings are constructed at different founding levels, the difference in elevation between individual footings should not be greater than one half the clear distance between the footings. Should this not be possible, Golder should be consulted to provide field inspection to ensure that the footings exceeding the above requirement are stable and the bearing for the upper footing is not compromised. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevations of the upper footings can be adjusted accordingly. Stepped strip footings, if required, should be constructed in accordance with the 2012 Ontario Building Code (2012 OBC), Section 9.15.3.9.

The founding materials are susceptible to disturbance by construction activity especially during wet weather and care should be taken to preserve the integrity of the bearing strata, including engineered fill. Prior to pouring concrete for the footings, the foundation excavations must be inspected by Golder to confirm that the footings are located in a competent bearing stratum, which has been cleaned of ponded water and loosened or softened material. If the concrete for the footings on the soil cannot be poured immediately after excavation and inspection, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing strata. The bearing soil and fresh concrete must be protected from freezing during cold weather construction.

Where excavation is carried out for proposed footings, temporary heating and insulation (i.e. use of straw) should be provided. During footing excavation, frozen soils (if any) encountered within the underside of footing must be removed and replaced with non-frost susceptible (granular) materials. It is recommended that concrete pour be

carried out immediately after excavation to reduce the potential for frost penetration. Protection of concrete shall be in accordance to OPSS 904.

All exterior footings and footings in unheated areas must be provided with at least 1.2 m of cover or a thermally equivalent thickness of insulation after final grading, in order to reduce the potential for damage due to frost action.

5.2.1 Seismic Design

The 2012 Ontario Building Code (2012 OBC) came into effect on January 1, 2014 and contains updated seismic analysis and design methodology. Seismic hazard is defined for an earthquake with a 2 percent probability of exceedance in 50 years (i.e. a return period of 2,400 years) which encompasses a larger earthquake hazard than in prior editions of the OBC. Design earthquakes are commonly defined by an earthquake magnitude, distance, and peak ground acceleration (PGA). The 2012 OBC uses the uniform hazard spectra (UHS) to define the response of the structure to the design earthquake and also considers the effects of the localized site conditions on the structural response. The 2012 OBC also uses a refined site classification system defined by the average soil/bedrock properties in the top 30 metres of the subsurface profile beneath the structure(s). There are six site classes designated as A to F related to decreasing ground stiffness from A for hard rock to E for soft soil and Site Class F for problematic soils (e.g. sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain acceleration- and velocity-based site coefficients, F_a and F_v , respectively, used to modify the reference UHS to account for the effects of site-specific soil conditions in design.

Based on the results of the investigation, the building foundations may be designed using a Site Class D designation. It is possible that the site class could be improved by in situ testing. Should optimization of the site class be recommended by the structural engineer, in situ geophysical testing should be carried out at the site, although a higher site class is not guaranteed.

5.3 Slab-on-Grade

The floor slab for the proposed commercial buildings can be designed as a concrete slab-on-grade. The floor slab may be placed on approved engineered fill placed and compacted as per the requirements of Section 5.1.3.

Prior to the placement of new engineered fill, the exposed subgrade should be inspected by Golder. Remedial work should be carried out on any softened, disturbed, wet or poorly performing zones as directed by Golder. Any low areas may then be brought up to within at least 200 mm of the underside of the floor slab, as required, using OPSS Granular 'B', Type I material or other approved material, placed in maximum 200 mm loose lifts and uniformly compacted to at least 100 percent of the material's SPMDD.

The final lift of granular fill beneath floor slab should consist of a minimum thickness of 200 mm of OPSS Granular 'A', uniformly compacted to at least 100 percent of SPMDD. This should provide a modulus of subgrade reaction, for a 1-foot square plate placed directly on the subgrade material, k_{v1} , of approximately 40 MPa/m. Special care should be taken to ensure adequate compaction around columns and adjacent to foundation walls. Any filling operations should be monitored and tested by Golder.

The floor slabs should be structurally separate from the foundation walls and columns and sawcut control joints should be provided at regular intervals and along column lines to minimize shrinkage cracking and to allow for any differential settlement of the floor slabs. Depending on the fill type, additional joints should be provided within the slab at the boundaries between the new and existing engineered fill.

In general, where the floor slab is at or above the exterior final grade, no perimeter drainage at the footing level is required. Where the finished floor slab will be below exterior grade, a perimeter drainage system should be provided. The footing drainage system should be provided with a permanent frost-free outlet.

5.4 Excavations

Based on the final grading plan, the trench excavations for foundations and site servicing is generally anticipated to be above the measured groundwater table and extend into engineered fill, glacial till deposit and silty sand at varying depths across the site. Conventional excavation equipment can be used to excavate through these native soils.

It is anticipated that the excavations will likely consist of conventional temporary open cuts. All excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. Based on the OHSA, the engineered fill, glacial till and silty sand deposits are generally classified as a Type 3 soil and all excavations in excess of 1.2 m in depth through these soils should be sloped no steeper than 1 horizontal to 1 vertical above the groundwater level.

There is a potential for sloughing of excavation side slopes and/or disturbance of the base of the excavations. In this regard, it is recommended that test pits be carried out prior to construction activities to further assess dewatering requirements at the time of construction. Care should be taken to direct surface runoff away from the open excavations.

Where side slopes of excavations are required to be steepened to limit the extent of the excavation, then some form of trench support system may be required. 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. It is imperative that any underground services or existing structures adjacent to the excavations be accurately located prior to construction and adequate support provided where required. In addition, steepened excavations should be left open for as short a duration as possible and completely backfilled at the end of each working day.

If required to support adjacent services or structures, shoring could consist of braced soldier pile and lagging, braced sheet piles and the requirements of OPSS.PROV 539 should be followed. Design of temporary works will be entirely the responsibility of the contractor.

5.5 Groundwater Control

The groundwater level in the monitoring wells ranged between 2.6 mbgs and 4.5 mbgs (Elevations 172.4 m and 175.3 m) on November 24, 2020. Based on the grading plan, trench excavations will not advance below the measured groundwater table and therefore proactive dewatering will not be required. However, any water trapped or perched water due to rainfall or surface runoff within the required excavations can likely be handled by pumping from properly constructed and filtered sumps located within the excavations.

The rate and volume required for dewatering will be dependent on the depth of the required excavations, the groundwater levels at the time of construction and the construction methods and staging chosen by the Contractor. An application under the Environmental Activity Section Registry (EASR) of the Ontario Ministry of the Environment, Conservation and Parks (MECP) should be submitted in the event that the pumping volumes exceed 50,000 L/day. Under the EASR, a Permit to Take Water (PTTW) is not required for water taking for construction site dewatering for volumes less than 400,000 L/day. However, based on the excavation depth and soil conditions encountered, it is unlikely that an EASR or PTTW will be required at this site. It is recommended

that a hydrogeological assessment be carried out to address details pertaining to the requirements, assist in registration, and obtain the required documentation, where required.

5.6 Site Servicing

Based on the grading plan, the proposed storm sewer has inverts between approximately Elevations 174.2 m and 176.6 m at the west side of Thoroughbred Street and between Elevations 177.1 m and 178.5 m at the east side of Thoroughbred Street. Therefore, the pipe inverts will range from 0.5 m to 1.0 m depth below the final pre-grade. The proposed services are anticipated to be founded on the existing or new engineered fill which are above the measured groundwater table. In general, the engineered fill is considered to be suitable for supporting sewers and water mains, provided that the integrity of the base can be maintained during construction. However, if softened/loose, organic soil/topsoil or deleterious materials are encountered at the proposed invert level, these materials must be removed and replaced with approved engineered fill to provide a suitable founding stratum.

Based on the final grade as shown on the lot grading plan, the invert of the proposed underground services within the site is not deep enough (at least 1.2 below finished grade) to provide adequate soil cover against frost. As such, the site servicing plan should be reviewed to ensure adequate soil cover is provided for frost protection.

The excavation and groundwater control recommendations for service trenching is generally addressed in Sections 5.4 and 5.5.

5.6.1 Pipe Bedding and Cover

The bedding for water mains and sewers should be compatible with the size, type, and class of pipe, surrounding soil and loading conditions and should be designed in accordance with the Regional and Municipal standards. Where granular bedding is deemed to be acceptable, it should consist of at least 150 mm of OPSS Granular 'A' or 19 mm crusher run limestone material. Clear stone should never be used as bedding material or to stabilize the base. Sand cover may be used from the spring line to 300 mm above the obvert of the pipes. All bedding material and cover should be placed in maximum 150 mm loose lifts and uniformly compacted to a minimum of 98 percent of the material's SPMDD.

5.6.2 Trench Backfill

The majority of the excavated materials from the site will generally be the fill and engineered fill material, glacial till, and silty sand, with the majority of soils excavated during underground service installation anticipated to be at or slightly above their estimated optimum water contents for compaction.

The excavated materials at suitable water contents may be reused as trench backfill provided they are free of significant amounts of topsoil, organic or other deleterious materials. Any oversized cobbles and boulders (i.e. greater than 150 mm in size) encountered during excavation should be removed from the backfill. All trench backfill from the top of the cover material to 1.0 m below subgrade elevation should be uniformly compacted to at least 95 percent of the material's SPMDD. From 1.0 m below subgrade to subgrade elevation, the materials should be placed in maximum 300 mm loose lifts and uniformly compacted to at least 98 percent of material's SPMDD.

Alternatively, if placement water content at the time of construction are too high, or if there is a shortage of suitable in situ materials, then an approved imported granular material which meets the requirements for SSM may be used.

Backfilling during cold weather must avoid inclusions of frozen lumps of material, snow and ice.

5.7 Pavement Design

This section of the report provides preliminary engineering information for the pavement structures within the Windfields development.

As traffic information was not available, we have made assumptions based on the number of parking spaces available and the anticipated heavy truck traffic that could be experienced at the development. Once traffic data is known, Golder should be engaged to verify that the pavement designs are suitable to support the required traffic loading at the site.

Based on the results of the geotechnical investigation and the subgrade soils encountered, the following pavement designs may be considered for the internal roads and parking areas.

| Material | Thickness of Pavement Elements (mm) | |
|---|-------------------------------------|------------------------------|
| | <i>Light Duty/Parking Lot</i> | <i>Heavy Duty/Fire Route</i> |
| HL 3 (Surface) ¹ | 40 | 40 |
| HL 8 Binder (Base) ¹ | 50 | 75 |
| New Granular A, Base ² | 150 | 150 |
| New Granular B, Type 1 Subbase ² | 300 | 450 |
| Subgrade | Prepared and Approved Subgrade | |

Notes:

¹ Asphaltic Material shall be in accordance with OPSS 1150 (November 2010)

² Granular Materials shall be in accordance with OPSS.MUNI 1010 (November 2013)

5.7.1 Drainage

Adequate surface and subsurface drainage are critical if the pavement is to provide satisfactory service over the design life. The drainage system in the parking areas could consist of a system of catchbasins connected to subdrains draining to a permanent storm water outlet. In this regard, the asphalt surface should be graded to drain towards the catchbasins and the subgrade should be carefully proof-rolled to a smooth surface and sloped towards the catchbasins to prevent ponding or entrapment of water in the subbase which would lead to weakened sections. Moderately frost susceptible soils were encountered within the footprint of the proposed parking areas. As a result, consideration should be given to installing stub-drains 6 m in length and extending in all four directions from the catchbasins.

For the fire route and driving lanes, continuous subdrains should be placed at the edge of pavement along each side of the road with intermittent catchbasins. The pavement drainage system should consist of a 150 mm diameter wrapped perforated pipe, placed inside a 300 mm by 300 mm trench and surrounded by clean free draining sand, such as concrete sand. The drain invert should be at approximately 250 mm below the bottom of the granular subbase and should be sloped to drain to the catchbasins.

5.7.2 General Construction Recommendations

5.7.2.1 Subgrade Preparation

Prior to placing granular materials, the exposed subgrade should be proofrolled and inspected by Golder. Remedial work (that is, further sub-excavation and replacement) should be carried out on any disturbed, softened or poorly performing areas, as directed by Golder. Additionally, subgrade soils containing organic matter should be removed and replaced with approved fill or granular material regardless of depth. The existing pond located at the southwest corner of Windfields Farm Drive and Thoroughbred Street is located within the proposed parking lot. This area should be backfilled and compacted to 98 percent SPMDD with a maximum lift of 300 mm and brought up to the subgrade level.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength may not be adequate to support heavy construction loading especially during wet weather or where subgrade soils are wet of optimum. In this regard, the design subbase thickness may not be sufficient for a construction haul road and additional granular materials (in the order of 300 mm) may be required. The subgrade should be proofrolled and inspected by Golder prior to placing the subbase and additional material placed as required to address the subgrade soil conditions and the anticipated construction traffic.

5.7.2.2 Granular Materials

The granular base and subbase materials should be uniformly placed and compacted to 100 percent of their SPMDD. Compaction of the granular materials and subgrade soils should be carried out at a moisture content that is between optimum moisture content and 2 percent of the optimum. Granular A can be used in place of Granular B Type I, but to provide adequate frost protection, the total thickness of the granular materials should not be reduced. The lateral extent of granular subbase/base material for the pavement should not be terminated vertically behind the curb and a 3 horizontal to 1 vertical frost taper should be provided. Granular A material should have a minimum thickness of 150 mm below any sidewalk.

5.7.2.3 Hot Mix Asphalt Types and Asphalt Construction

The asphalt materials should be compacted to minimum of 92 percent of their Maximum Relative Density (MRD), as measured in the field using a nuclear density gauge; asphalt material and placement requirements should be as per OPSS.MUNI 310 and OPSS 1150, as amended by the applicable Municipal standards.

Transverse and longitudinal joints should be cleaned, and tack coated prior to placing new asphalt. Where the new pavement abuts the existing pavement (e.g., at tie-ins to existing pavement), proper longitudinal lap joints should be constructed to key the new asphalt surface course into the existing pavement. The existing asphalt should be sawcut to provide a vertical face prior to keying-in the new asphalt surface course. Any undermined or broken edges resulting from the construction activities should be removed by the sawcut.

5.7.2.4 Performance Graded Asphalt Cement (PGAC)

It is recommended that PG 58-28 asphalt cement be used for both the HL 3 surface course and the HL 8 binder course mixes for the parking areas in accordance with OPSS.MUNI 1101. It is recommended that PG 64-28 Polymer Modified asphalt cement be used for the asphalt mixes within the Fire Route and internal roads.

6.0 ADDITIONAL CONSIDERATIONS

The native, undisturbed, competent soils, and engineered fill should be exposed and heavily proofrolled in conjunction with an inspection by Golder to confirm the subgrade is cleaned of ponded water, loose/softened soils, organics or other deleterious material. Any soft spots identified during proofrolling as directed by Golder should be subexcavated to expose competent soils prior to placement of new engineered fill.

The soils at this site are sensitive to disturbance from ponded water, construction traffic and frost. During construction, sufficient foundation inspections, subgrade inspections and in situ material 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. All bearing surfaces must be inspected by Golder prior to concreting to ensure that strata having adequate bearing capacity have been reached and that the bearing surfaces have been properly prepared.



7.0 CLOSURE

This report is intended to summarize available data on subsurface soil and groundwater conditions and provide geotechnical comments and recommendations for the proposed Buildings C1 to C6, underground services and pavements. We trust that this geotechnical report provides sufficient geotechnical engineering information for the designers to proceed with detailed design for the Windfields Block C property.

If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Yours truly,

Golder Associates Ltd.



Timi Olumuyiwa, M.Sc., P.Eng., PMP
Geotechnical Engineer

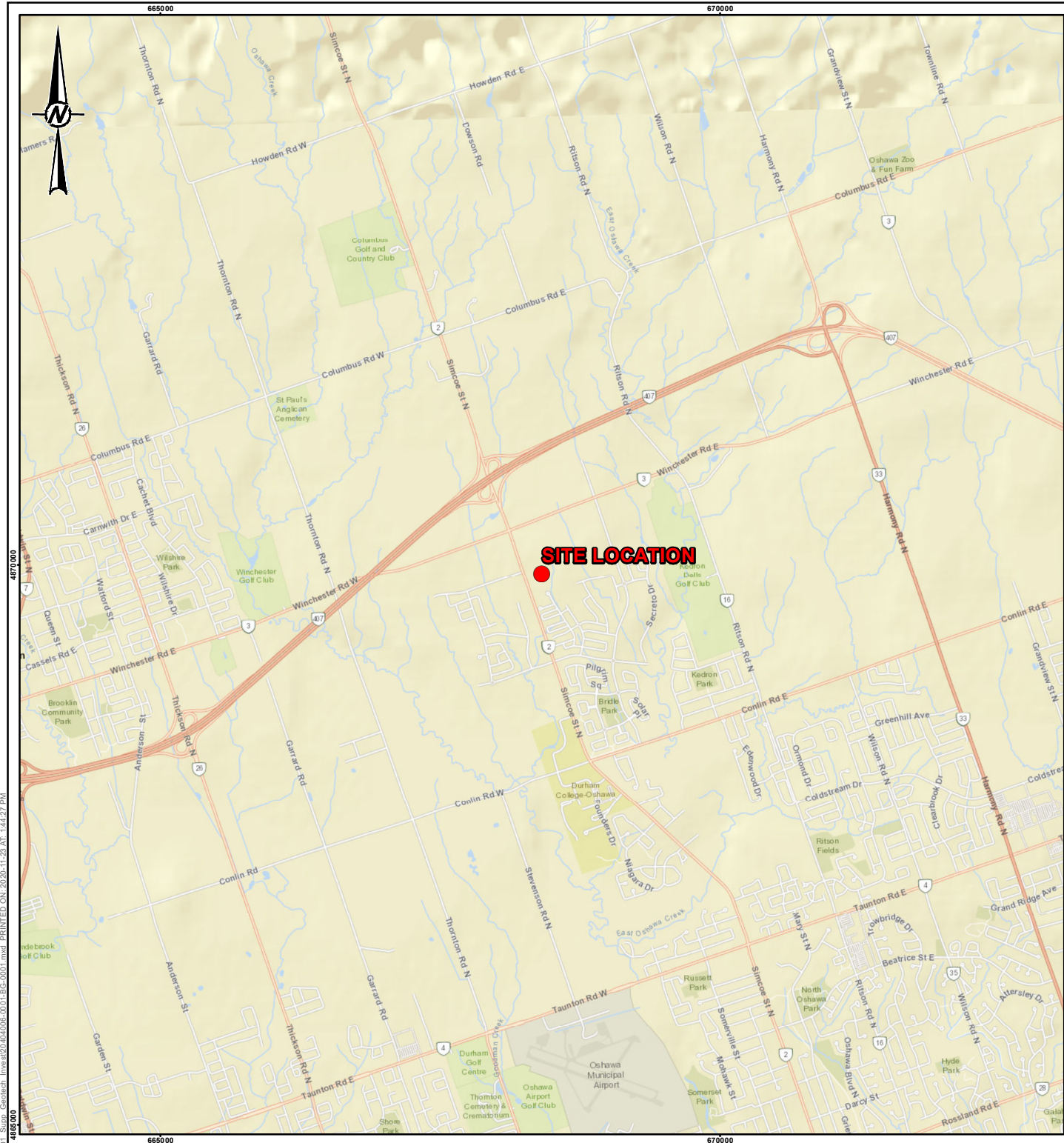


Sarah E.M. Poot, P.Eng.
Associate, Senior Geotechnical Engineer

TO/SEMP/to/mlk/js

Golder and the G logo are trademarks of Golder Associates Corporation

[https://golderassociates.sharepoint.com/sites/136522/project files/6 deliverables/01. geotech/03. report/20404006 \(1000\) rep 2020'12'11 geotechnical report - windfields block c \(rev.0\).docx](https://golderassociates.sharepoint.com/sites/136522/project%20files/6%20deliverables/01.%20geotech/03.%20report/20404006%20(1000)%20rep%2020%2012%2011%20geotechnical%20report%20-%20windfields%20block%20c%20(rev.0).docx)



CLIENT
RIOCAN REALTY INV PARTNER 11LP

PROJECT
SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
BLOCK C – RIOCAN WINDFIELDS DEVELOPMENT
OSHAWA, ONTARIO

TITLE
SITE LOCATION

CONSULTANT

YYYY-MM-DD 2020-11-23

DESIGNED JT

PREPARED JT

REVIEWED TO

APPROVED



GOLDER

PROJECT NO.
20404006

CONTROL
0001

REV.
A

FIGURE
1

NOTE(S)

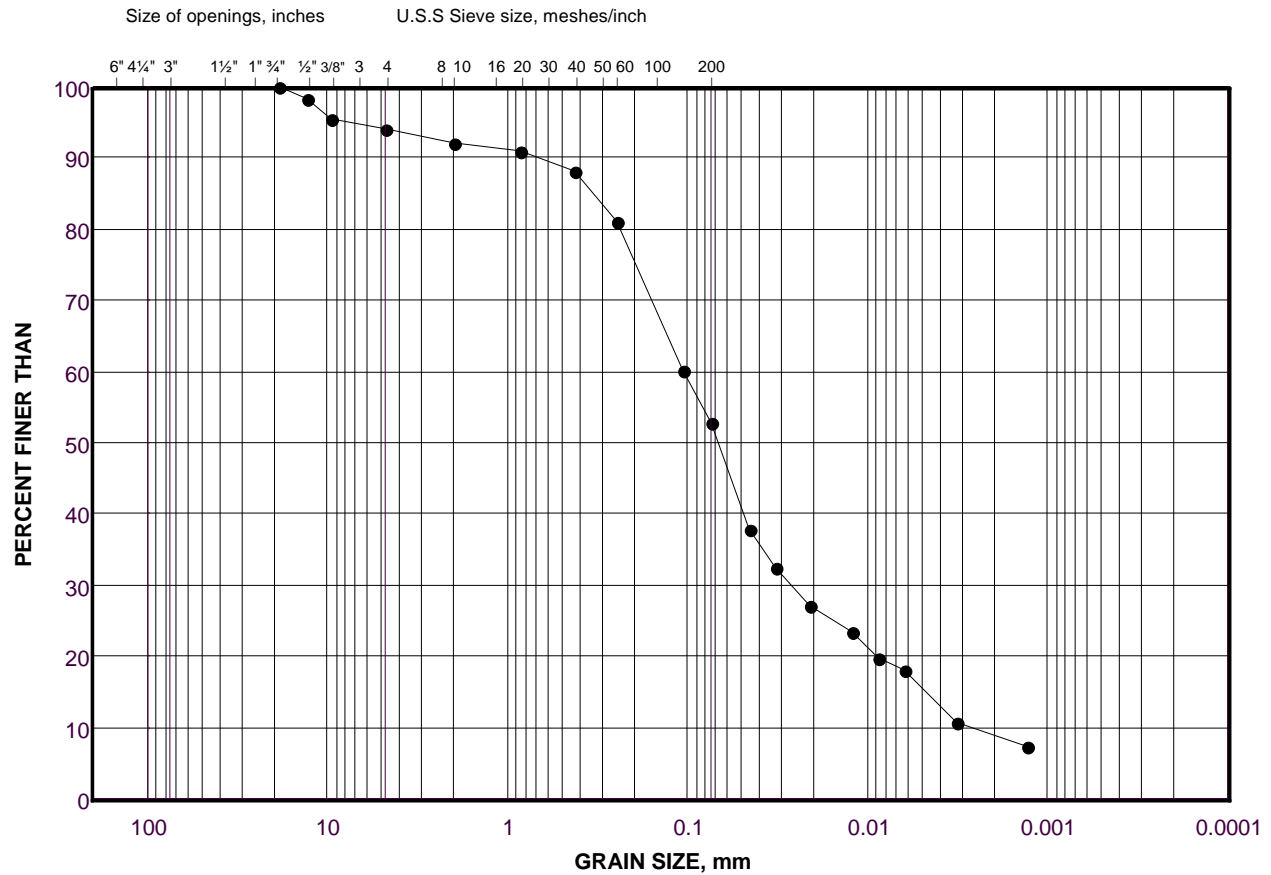
REFERENCE(S)

1. BASE MAP - SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
2. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17

GRAIN SIZE DISTRIBUTION

SILT and SAND (TILL)

FIGURE 3



| COBBLE SIZE | COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY SIZES |
|----------------|-------------|------|-----------|--------|------|---------------------|
| | GRAVEL SIZE | | SAND SIZE | | | FINE GRAINED |

LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH(m) |
|--------|----------|--------|----------|
| • | 20-11 | 2 | 0.9 |

Project Number: 20404006

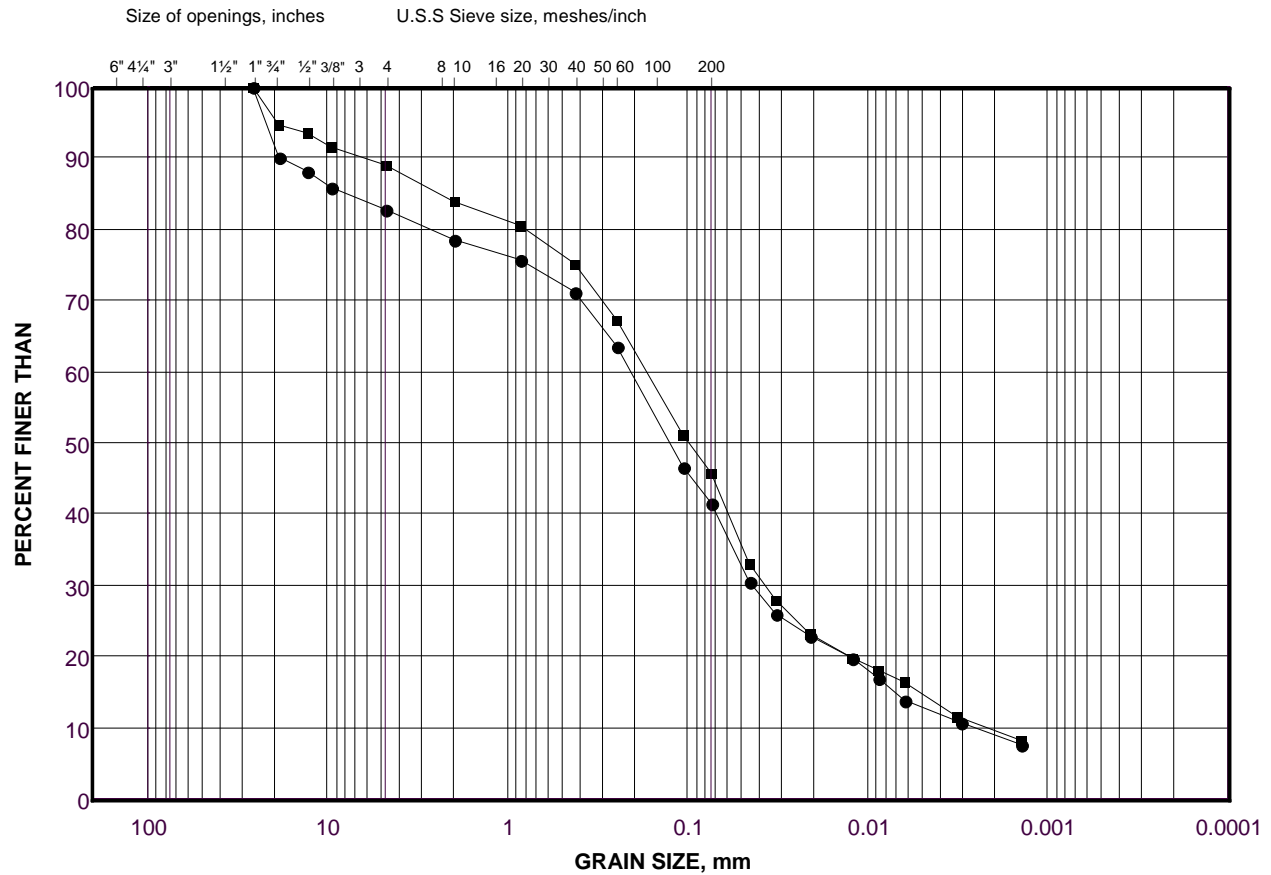
Checked By: TO

Golder Associates

Date: 01-Dec-20

GRAIN SIZE DISTRIBUTION (SM) SILTY SAND (TILL)

FIGURE 4



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH(m) |
|--------|----------|--------|----------|
| ● | 20-15 | 5 | 3.3 |
| ■ | 20-9 | 7 | 2.3 |

Project Number: 20404006

Checked By: TO

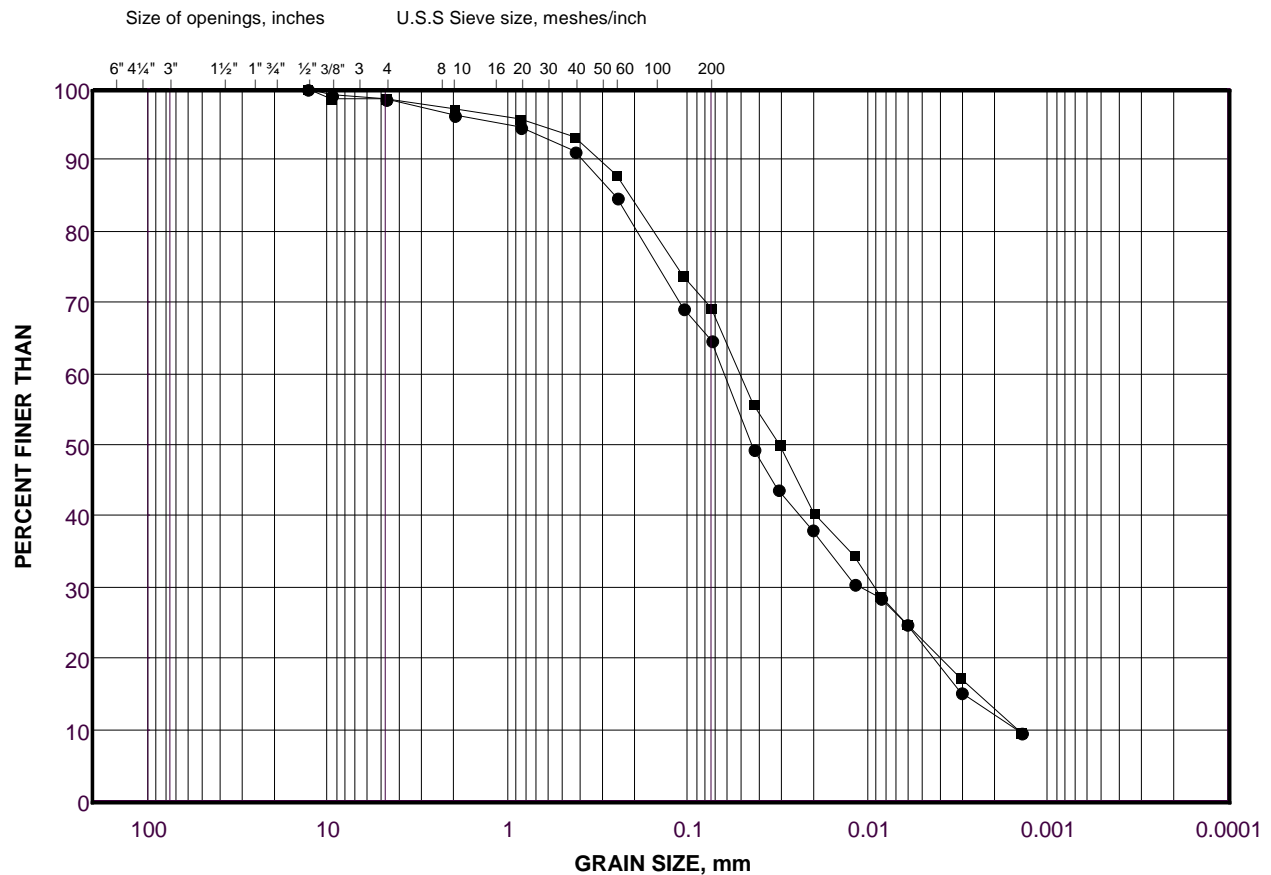
Golder Associates

Date: 20-Nov-20

GRAIN SIZE DISTRIBUTION

(CL-ML) sandy SILTY CLAY to CLAYEY SILT (TILL)

FIGURE 5



| COBBLE SIZE | COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY SIZES |
|----------------|-------------|------|-----------|--------|------|---------------------|
| | GRAVEL SIZE | | SAND SIZE | | | FINE GRAINED |

LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH(m) |
|--------|----------|--------|----------|
| ● | 20-3 | 5 | 3.3 |
| ■ | 20-5 | 6 | 4.7 |

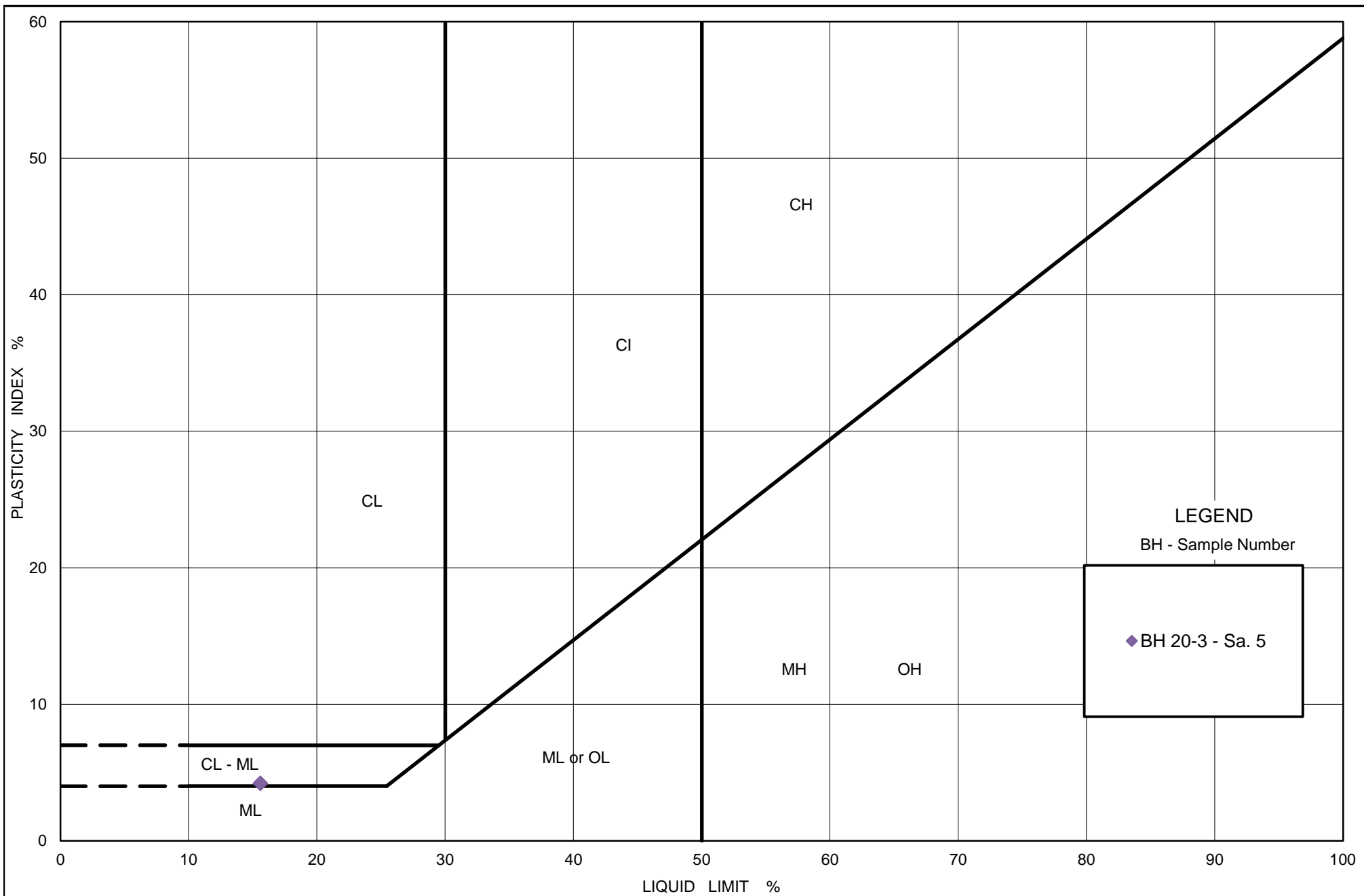
Project Number: 20404006

Checked By: TO _____

Golder Associates

Date: 29-Nov-20

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



PLASTICITY CHART

(CL-ML) sandy SILTY CLAY to CLAYEY SILT (TILL)

Figure No.: 6

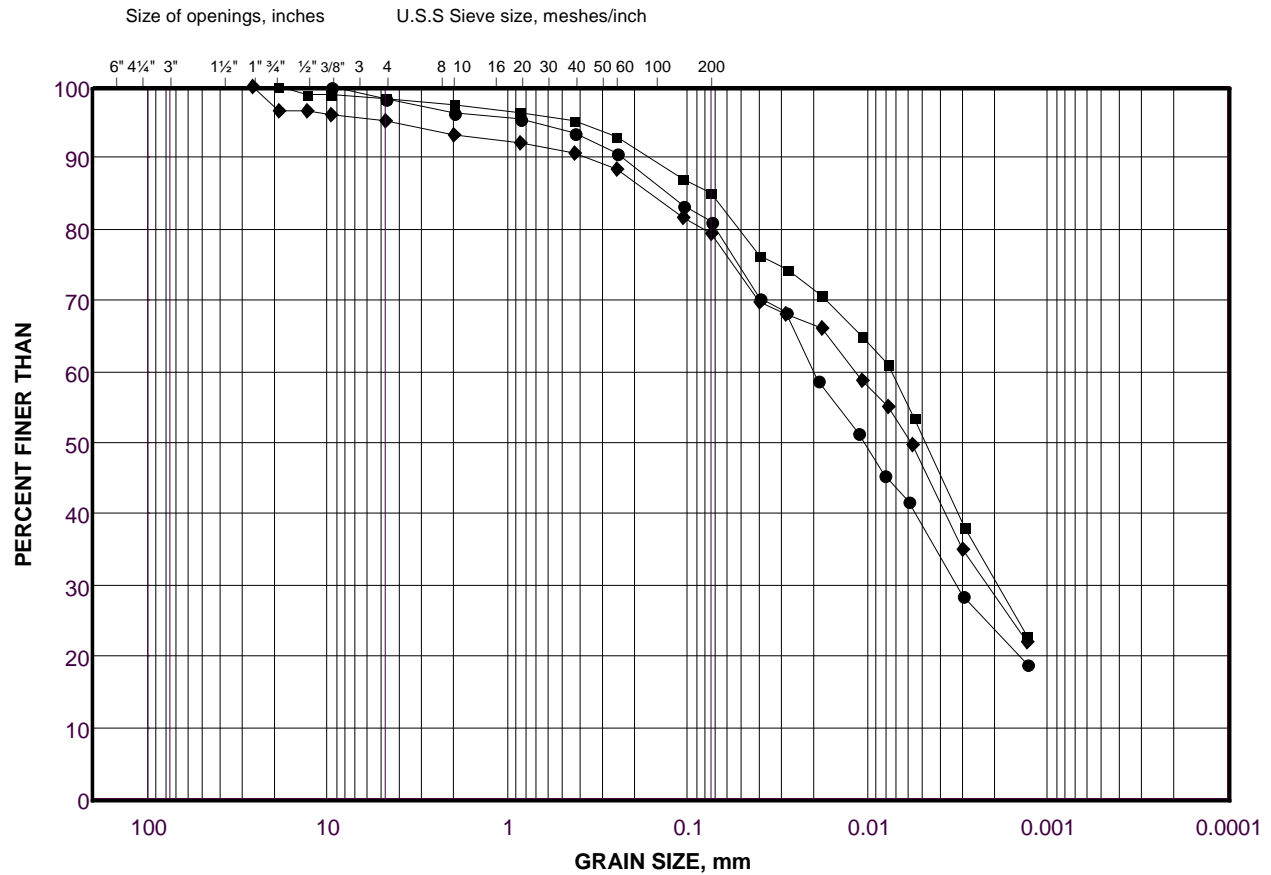
Project No.: 20404006

Checked By: TO

GRAIN SIZE DISTRIBUTION

(CL) sandy SILTY CLAY

FIGURE 7



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH(m) |
|--------|----------|--------|----------|
| ● | 20-13 | 4 | 2.5 |
| ■ | 20-6 | 6 | 4.7 |
| ◆ | 20-1 | 6 | 4.7 |

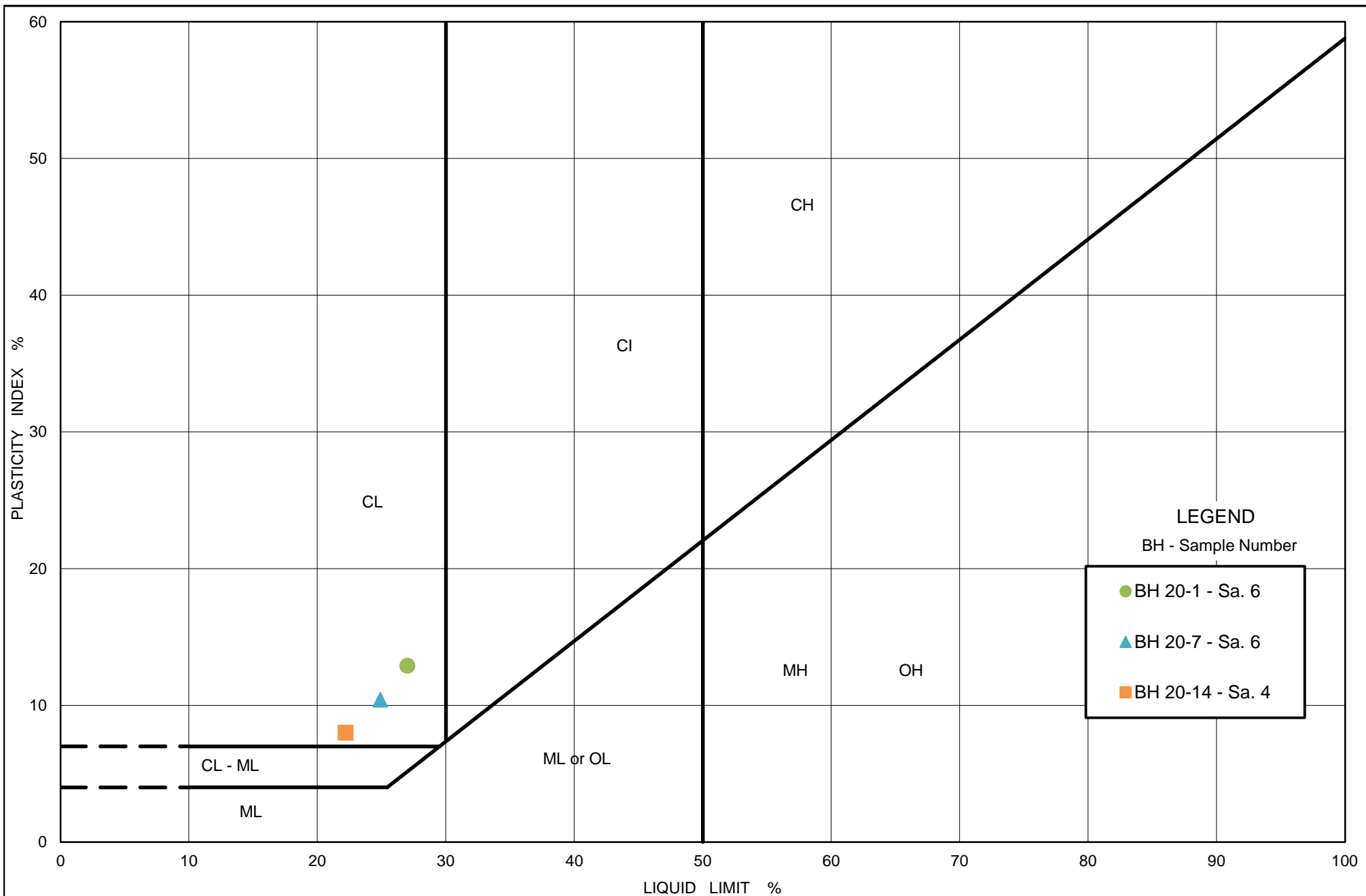
Project Number: 20404006

Checked By: TO _____

Golder Associates

Date: 20-Nov-20

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



PLASTICITY CHART

(CL) sandy SILTY CLAY

Figure No.: 8

Project No.: 20404006

Checked By: TO

APPENDIX A

Important Information and Limitations of This Report

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) 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 are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

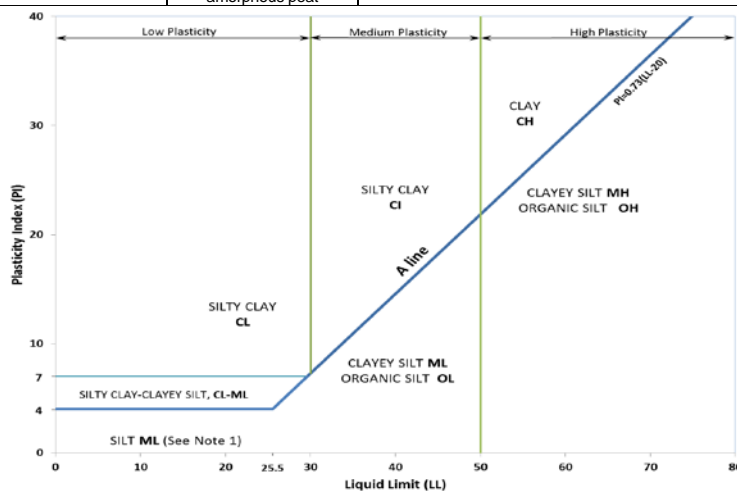
APPENDIX B

Borehole Logs (20-1 to 20-15)

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

| Organic or Inorganic | Soil Group | Type of Soil | | Gradation or Plasticity | $Cu = \frac{D_{60}}{D_{10}}$ | | $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ | | | Organic Content | USCS Group Symbol | Group Name | |
|--|--|---|-----------------------------------|--------------------------------|------------------------------|-----------------|--|------------------------------|-----------------|-------------------|-------------------|---------------|------------------------|
| INORGANIC (Organic Content ≤30% by mass) | COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm) | GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm) | Gravels with ≤12% fines (by mass) | Poorly Graded | <4 | | ≤1 or ≥3 | | | ≤30% | GP | GRAVEL | |
| | | | | Well Graded | ≥4 | | 1 to 3 | | | | GW | GRAVEL | |
| | | | Gravels with >12% fines (by mass) | Below A Line | n/a | | | | | | GM | SILTY GRAVEL | |
| | | | | Above A Line | n/a | | | | | | GC | CLAYEY GRAVEL | |
| | | SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm) | Sands with ≤12% fines (by mass) | Poorly Graded | <6 | | ≤1 or ≥3 | | | | SP | SAND | |
| | | | | Well Graded | ≥6 | | 1 to 3 | | | | SW | SAND | |
| | | | Sands with >12% fines (by mass) | Below A Line | n/a | | | | | | SM | SILTY SAND | |
| | | | | Above A Line | n/a | | | | | | SC | CLAYEY SAND | |
| Organic or Inorganic | Soil Group | Type of Soil | Laboratory Tests | Field Indicators | | | | | Organic Content | USCS Group Symbol | Primary Name | | |
| | | | | Dilatancy | Dry Strength | Shine Test | Thread Diameter | Toughness (of 3 mm thread) | | | | | |
| INORGANIC (Organic Content ≤30% by mass) | FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm) | SILTS (Non-Plastic or Pl and LL plot below A-Line on Plasticity Chart below) | Liquid Limit <50 | Rapid | None | None | >6 mm | N/A (can't roll 3 mm thread) | <5% | ML | SILT | | |
| | | | | Slow | None to Low | Dull | 3mm to 6 mm | None to low | <5% | ML | CLAYEY SILT | | |
| | | | Liquid Limit ≥50 | Slow to very slow | Low to medium | Dull to slight | 3mm to 6 mm | Low | 5% to 30% | OL | ORGANIC SILT | | |
| | | | | Slow to very slow | Low to medium | Slight | 3mm to 6 mm | Low to medium | <5% | MH | CLAYEY SILT | | |
| | | CLAYS (Pl and LL plot above A-Line on Plasticity Chart below) | Liquid Limit <30 | None | Low to medium | Slight to shiny | ~ 3 mm | Low to medium | 0% to 30% | CL | SILTY CLAY | | |
| | | | Liquid Limit 30 to 50 | None | Medium to high | Slight to shiny | 1 mm to 3 mm | Medium | (see Note 2) | CI | SILTY CLAY | | |
| | | | Liquid Limit ≥50 | None | High | Shiny | <1 mm | High | | CH | CLAY | | |
| | | HIGHLY ORGANIC SOILS (Organic Content >30% by mass) | | Peat and mineral soil mixtures | | | | | | | 30% to 75% | PT | SILTY PEAT, SANDY PEAT |
| Predominantly peat, may contain some mineral soil, fibrous or amorphous peat | | | | | | | 75% to 100% | PEAT | | | | | |



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.

Note 2 – For soils with $<5\%$ organic content, include the descriptor “trace organics” for soils with between 5% and 30% organic content include the prefix “organic” before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.

For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between “clean” and “dirty” sand or gravel.

For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.

A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

| Soil Constituent | Particle Size Description | Millimetres | Inches (US Std. Sieve Size) |
|------------------|---------------------------|---|--|
| BOULDERS | Not Applicable | >300 | >12 |
| COBBLES | Not Applicable | 75 to 300 | 3 to 12 |
| GRAVEL | Coarse Fine | 19 to 75 4.75 to 19 | 0.75 to 3 (4) to 0.75 |
| SAND | Coarse Medium Fine | 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 | (10) to (4) (40) to (10) (200) to (40) |
| SILT/CLAY | Classified by plasticity | <0.075 | < (200) |

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

| Percentage by Mass | Modifier |
|--------------------|--|
| >35 | Use 'and' to combine major constituents (i.e., SAND and GRAVEL) |
| > 12 to 35 | Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable |
| > 5 to 12 | some |
| ≤ 5 | trace |

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.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

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

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

SAMPLES

| | |
|----------|--|
| AS | Auger sample |
| BS | Block sample |
| CS | Chunk sample |
| DD | Diamond Drilling |
| DO or DP | Seamless open ended, driven or pushed tube sampler – note size |
| DS | Denison type sample |
| GS | Grab Sample |
| MC | Modified California Samples |
| MS | Modified Shelby (for frozen soil) |
| RC | Rock core |
| SC | Soil core |
| SS | Split spoon sampler – note size |
| ST | Slotted tube |
| TO | Thin-walled, open – note size (Shelby tube) |
| TP | Thin-walled, piston – note size (Shelby tube) |
| WS | Wash sample |

SOIL TESTS

| | |
|---------------------|---|
| w | water content |
| PL , w _p | plastic limit |
| LL , w _L | liquid limit |
| C | consolidation (oedometer) test |
| CHEM | chemical analysis (refer to text) |
| CID | consolidated isotropically drained triaxial test ¹ |
| CIU | consolidated isotropically undrained triaxial test with porewater pressure measurement ¹ |
| D _R | relative density (specific gravity, G _s) |
| DS | direct shear test |
| GS | specific gravity |
| 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 |
| SO ₄ | concentration of water-soluble sulphates |
| UC | unconfined compression test |
| UU | unconsolidated undrained triaxial test |
| V (FV) | field vane (LV-laboratory vane test) |
| γ | unit weight |

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness²

| Term | SPT 'N' (blows/0.3m) ¹ |
|------------|-----------------------------------|
| Very Loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very Dense | >50 |

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grain size. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

| Term | Description |
|-------|---|
| Dry | Soil flows freely through fingers. |
| Moist | Soils are darker than in the dry condition and may feel cool. |
| Wet | As moist, but with free water forming on hands when handled. |

COHESIVE SOILS

Consistency

| Term | Undrained Shear Strength (kPa) | SPT 'N' ^{1,2} (blows/0.3m) |
|------------|--------------------------------|-------------------------------------|
| Very Soft | <12 | 0 to 2 |
| Soft | 12 to 25 | 2 to 4 |
| Firm | 25 to 50 | 4 to 8 |
| Stiff | 50 to 100 | 8 to 15 |
| Very Stiff | 100 to 200 | 15 to 30 |
| Hard | >200 | >30 |

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

| Term | Description |
|--------|--|
| w < PL | Material is estimated to be drier than the Plastic Limit. |
| w ~ PL | Material is estimated to be close to the Plastic Limit. |
| w > PL | Material is estimated to be wetter than the Plastic Limit. |

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

| | |
|-------------|---------------------------------------|
| π | 3.1416 |
| $\ln x$ | natural logarithm of x |
| \log_{10} | x or log x, logarithm of x to base 10 |
| g | acceleration due to gravity |
| t | time |

II. STRESS AND STRAIN

| | |
|--------------------------------|--|
| γ | shear strain |
| Δ | change in, e.g. in stress: $\Delta \sigma$ |
| ε | linear strain |
| ε_v | volumetric strain |
| η | coefficient of viscosity |
| ν | Poisson's ratio |
| σ | total stress |
| σ' | effective stress ($\sigma' = \sigma - u$) |
| σ'_{vo} | initial effective overburden stress |
| $\sigma_1, \sigma_2, \sigma_3$ | principal stress (major, intermediate, minor) |
| σ_{oct} | mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$ |
| τ | shear stress |
| u | porewater pressure |
| E | modulus of deformation |
| G | shear modulus of deformation |
| K | bulk modulus of compressibility |

III. SOIL PROPERTIES

(a) Index Properties

| | |
|--------------------|--|
| $\rho(\gamma)$ | bulk density (bulk unit weight)* |
| $\rho_d(\gamma_d)$ | dry density (dry unit weight) |
| $\rho_w(\gamma_w)$ | density (unit weight) of water |
| $\rho_s(\gamma_s)$ | density (unit weight) of solid particles |
| γ' | unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$) |
| D_R | relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s) |
| e | void ratio |
| n | porosity |
| S | degree of saturation |

(a) Index Properties (continued)

| | |
|-------------|--|
| w | water content |
| w_l or LL | liquid limit |
| w_p or PL | plastic limit |
| I_p or PI | plasticity index = $(w_l - w_p)$ |
| NP | non-plastic |
| w_s | shrinkage limit |
| I_L | liquidity index = $(w - w_p) / I_p$ |
| I_C | consistency index = $(w_l - w) / I_p$ |
| e_{max} | void ratio in loosest state |
| e_{min} | void ratio in densest state |
| I_D | density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density) |

(b) Hydraulic Properties

| | |
|---|---|
| h | hydraulic head or potential |
| q | rate of flow |
| v | velocity of flow |
| i | hydraulic gradient |
| k | hydraulic conductivity (coefficient of permeability) |
| j | seepage force per unit volume |

(c) Consolidation (one-dimensional)

| | |
|-------------|---|
| C_c | compression index (normally consolidated range) |
| C_r | recompression index (over-consolidated range) |
| C_s | swelling index |
| C_α | secondary compression index |
| m_v | coefficient of volume change |
| C_v | coefficient of consolidation (vertical direction) |
| C_h | coefficient of consolidation (horizontal direction) |
| T_v | time factor (vertical direction) |
| U | degree of consolidation |
| σ'_p | pre-consolidation stress |
| OCR | over-consolidation ratio = σ'_p / σ'_{vo} |

(d) Shear Strength

| | |
|------------------|--|
| τ_p, τ_r | peak and residual shear strength |
| ϕ' | effective angle of internal friction |
| δ | angle of interface friction |
| μ | coefficient of friction = $\tan \delta$ |
| c' | effective cohesion |
| c_u, s_u | undrained shear strength ($\phi = 0$ analysis) |
| p | mean total stress $(\sigma_1 + \sigma_3)/2$ |
| p' | mean effective stress $(\sigma'_1 + \sigma'_3)/2$ |
| q | $(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$ |
| q_u | compressive strength $(\sigma_1 - \sigma_3)$ |
| S_t | sensitivity |

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$

PROJECT: 20404006

LOCATION: N 4869775.29; E 668079.24

RECORD OF BOREHOLE: 20-1

SHEET 1 OF 1

BORING DATE: November 6, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | |
|-----------------------|---|--|-------------|-----------------------|---------|------|------------|---|----|--------------------------------|----|------------------------------------|------------------|------------------|------------------|----------------------------|---|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | RESISTANCE, BLOWS/0.3m | | | | k, cm/s | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | nat V. + Q - rem V. ⊕ U - ○ | | WATER CONTENT PERCENT | | | | | | |
| | | | | | | | | | | | | Wp — W — WI | | | | | | |
| | | GROUND SURFACE | | 176.49 0.00 | | | | 20 | 40 | 60 | 80 | | 10 ⁻⁶ | 10 ⁻⁵ | 10 ⁻⁴ | 10 ⁻³ | | |
| 0 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) SILTY SAND, some gravel; brown, organic staining; non-cohesive, moist, dense | | | 1 | SS | 34 | | | | | | | | | | | |
| 1 | | ENGINEERED FILL - (CL) sandy SILTY CLAY, some gravel; brown, oxidation staining; cohesive, w<PL, very stiff | | | 2 | SS | 22 | | | | | | | | | | | |
| | | - Wood fragments at 1.5 m | | | 3 | SS | 23 | | | | | | | | | | | |
| 2 | | (CL) sandy SILTY CLAY, trace gravel; brown (TILL), oxidation staining; cohesive, w<PL to w~PL, very stiff to hard | | | 4 | SS | 23 | | | | | | | | | | | |
| 3 | | | | | 5 | SS | 31 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 4 | | (CL) sandy SILTY CLAY, trace gravel; grey; cohesive, w<PL, hard | | | 6 | SS | 54 | | | | | | | | | | | |
| 5 | - Becoming grey at a depth of 4.6 m | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | 169.94 6.55 | | | | | | | | | | | | | | |
| 8 | | NOTE: 1. Borehole was open and dry upon completion of drilling. | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\ROCANWINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-2

SHEET 1 OF 1

LOCATION: N 4869768.83; E 668014.51

BORING DATE: November 9, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | |
|-----------------------|---|---|--|-----------------------|---------|------|------------|---|--|--|--|---|--|--|--|----------------------------|---|-----------------------|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | 20 40 60 80 | | | | 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | nat V. + Q - rem V. ⊕ U - ⊙ | | | | | | WATER CONTENT PERCENT | | | |
| | | | | | | | | 20 40 60 80 | | | | 10 20 30 40 | | | | | | | | | |
| 0 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | GROUND SURFACE | | 176.62 | | | | | | | | | | | | | | | | | |
| | | FILL - (CL) sandy SILTY CLAY, trace gravel; brown; containing plastic fragments; organic inclusions; cohesive, w<PL, stiff - Mixed with topsoil between depths of 0.7 m and 1.2 m | | 0.00 | 1 | SS | 11 | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | |
| | | | 2 | SS | 14 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | (SM) SILTY SAND, trace gravel; brown; non-cohesive, moist, compact - Auger grinding at a depth of 1.8 m | 174.79 | 3A | SS | 18 | | | | | | | | | | | | | | |
| | | | | 1.83 | 3B | | | | | | | | | | | | | | | | |
| | | | (CL) SILTY CLAY, some sand; brown, oxidation staining; cohesive, w>PL, very stiff to stiff | 174.49 | | | | | | | | | | | | | | | | | |
| | | | 2.13 | 4 | SS | 24 | | | | | | | | | | | | | | | |
| 3 | | - A 150 mm gravel layer at a depth of 2.6 m | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | |
| | | (CL) sandy SILTY CLAY, some to trace gravel; brown to grey; oxidation staining to 5.0 m (TILL); cohesive, w~PL to w>PL, very stiff | 172.58 | | | | | | | | | | | | | | | | | | |
| | | | 4.04 | | | | | | | | | | | | | | | | | | |
| 5 | | | | | 6 | SS | 21 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | |
| | | - Becoming grey at a depth of 6.1 m | | | | | | | | | | | | | | | | | | | |
| | | | | | 7 | SS | 16 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | 170.07 | | | | | | | | | | | | | | | | | |
| | | NOTES: 1. Borehole was open and dry upon completion of drilling. 2. Borehole was moved about 0.9 m west of staked borehole due to refusal at 2.1 m. 3. Groundwater level was measured at a depth of 4.2 m (El.172.4 m) on November 24, 2020. | | 6.55 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\ROCANWINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-3

SHEET 1 OF 1













LOCATION: N 4869770.25; E 668003.50

BORING DATE: November 6, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | |
|-----------------------|---|--|--|--|---------|------|------------|---|----|--------------------------------|----|---|---|---|---|----------------------------|---|----|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | 20 40 60 80 | | | | 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | nat V. + Q - rem V. ⊕ U - ⊙ | | WATER CONTENT PERCENT | | | | | | |
| | | | | | | | | | | | | Wp ———— W ———— WI | | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 10 | 20 | 30 | 40 | | | |
| 0 | | GROUND SURFACE | | 175.28 | | | | | | | | | | | | | | |
| | M5T Track-Mounted Rig 150 mm Solid Stem Augers | FILL - (SM) SILTY SAND, trace gravel; brown; non-cohesive, w<PL, very loose |  | 0.00 | 1 | SS | 3 | | | | | |  | | | | | |
| | | (SM) SILTY SAND, trace gravel; brown; non-cohesive, moist, loose to compact |  | 174.67 | | | | | | | | | |  | | | | |
| 1 | | | | 2 | SS | 9 | | | | | | | | | | | | |
| | | | | 3 | SS | 12 | | | | | | | | |  | | | |
| 2 | | | (CL-ML) sandy SILTY CLAY to CLAYEY SILT, trace gravel; brown, oxidation staining (TILL); cohesive, w>PL to w<PL, very stiff |  | 173.15 | | | | | | | | |  | | | | |
| | | 4 | | | SS | 22 | | | | | | | | | | | | |
| 3 | | 5 | | | SS | 26 | | | | | | | |  |  | | | MH |
| 4 | | | (CL) SILTY CLAY, trace sand, trace gravel; brown to grey, oxidation staining to 5.0 m; cohesive, w>PL, stiff to very stiff - Sand pockets between 4.6 m and 5.0 m |  | 171.24 | | | | | | | | | |  | | | |
| | | 6 | | | SS | 11 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| 6 | | - Becoming grey at a depth of 6.1 m | | | 7 | SS | 16 | | | | | |  | | | | | |
| | | END OF BOREHOLE | | 168.73 | | | | | | | | | | | | | | |
| 7 | | NOTES: 1. Borehole was open and dry upon completion of drilling. | | 6.55 | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\ROCANWINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

LOCATION: N 4869788.96; E 667994.44

RECORD OF BOREHOLE: 20-4

SHEET 1 OF 1

BORING DATE: November 9, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | |
|-----------------------|---|---|---|-----------------------|---------|------|------------|---|--|--|--|---|--|--|--|----------------------------|---|-----------------------|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | 20 40 60 80 | | | | 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | nat V. + Q - ● rem V. ⊕ U - ○ | | | | | | WATER CONTENT PERCENT | | | |
| | | | | | | | | 20 40 60 80 | | | | 10 20 30 40 | | | | | | | | | |
| 0 | | GROUND SURFACE | | 175.56 | | | | | | | | | | | | | | | | | |
| | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) SILTY SAND, some gravel; brown, oxidation staining; non-cohesive, moist, compact | | 0.00 | 1 | SS | 10 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | 2 | SS | 25 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | (CL-ML) sandy SILTY CLAY to CLAYEY SILT, some gravel; brown (TILL); cohesive, w<PL, very stiff | | 174.19 | 3 | SS | 21 | | | | | | | | | | | | | | |
| | | | | 1.37 | | | | | | | | | | | | | | | | | |
| 2 | | | (CL) SILTY CLAY, some sand; brown, oxidation staining; cohesive, w~PL, very stiff | | 173.43 | 4 | SS | 20 | | | | | | | | | | | | | |
| | | | - Auger grinding between depths of 2.4 m and 2.6 m | | 2.13 | | | | | | | | | | | | | | | | |
| | | | - A 150 mm gravel layer at a depth of 2.6 m | | 172.66 | | | | | | | | | | | | | | | | |
| | | | | | 2.90 | 5A | | | | | | | | | | | | | | | |
| | | | (SM) SILTY SAND, some gravel; brown (TILL); non-cohesive, moist, dense | | 172.21 | SS | 31 | | | | | | | | | | | | | | |
| | | | (CL) SILTY CLAY, some sand, brown, oxidation staining; cohesive, w~PL, hard | | 3.35 | 5B | | | | | | | | | | | | | | | |
| 4 | | (SM) SILTY SAND, some gravel; brown (TILL); non-cohesive, moist, dense | | 171.52 | | | | | | | | | | | | | | | | | |
| | | | | 4.04 | | | | | | | | | | | | | | | | | |
| 5 | | | | | 6 | SS | 38 | | | | | | | | | | | | | | |
| 6 | | (CL) sandy SILTY CLAY, trace gravel; grey; cohesive, w>PL, very stiff | | 170.00 | | | | | | | | | | | | | | | | | |
| | | | | 5.56 | | | | | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | 169.01 | | | | | | | | | | | | | | | | | |
| | | NOTES: 1. Water measured in open borehole at a depth of 4.6 m (EL. 171.0 m) upon completion of drilling. | | 6.55 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\ROCANWINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

LOCATION: N 4869828.04; E 667980.85

RECORD OF BOREHOLE: 20-5

SHEET 1 OF 1

BORING DATE: November 5, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | | |
|-----------------------|---|---|-------------|-----------------------|-------------|------|---|----------------------------|--|--|------------------------------------|---|--|--|----------------------------|---|-----------------------|--|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | 20 40 60 80 | | | | 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | nat V. + Q - rem V. ⊕ U - ○ | | | | | WATER CONTENT PERCENT | | | | |
| | | | | | | | | 20 40 60 80 | | | | 10 20 30 40 | | | | | | | | | |
| 0 | | GROUND SURFACE | | 176.24 | | | | | | | | | | | | | | | | | |
| | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) SILTY SAND, trace to some gravel; brown to grey, oxidation staining; non-cohesive, moist, very dense to compact | | 0.00 | 1 | SS | 54 | | | | | | | | | | | | | | |
| | | - Becoming grey at a depth of 0.8 m | | | | | | | | | | | | | | | | | | | |
| 1 | | | | 2 | SS | 30 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | 3 | SS | 25 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | |
| | | (SM) SILTY SAND; brown; non-cohesive, moist, dense | | 174.11 | 4 | SS | 30 | | | | | | | | | | | | | | |
| | | | | 2.13 | | | | | | | | | | | | | | | | | |
| 3 | | (CL) sandy SILTY CLAY, some gravel; brown, oxidation staining; cohesive, w>PL, hard | | 173.34 | | | | | | | | | | | | | | | | | |
| | | | | 2.90 | 5A | SS | 50 | | | | | | | | | | | | | | |
| | (CL-ML) sandy SILTY CLAY to CLAYEY SILT, trace gravel; brown, oxidation staining (TILL); cohesive, w<PL, hard | 172.91 | 5B | | | | | | | | | | | | | | | | | | |
| | | 3.33 | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | |
| | - Auger grinding between depths of 4.6 m and 4.9 m | | 6 | SS | 50/ 0.13 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | |
| | (CL) sandy SILTY CLAY, grey; cohesive, w>PL, hard | 170.68 | | | | | | | | | | | | | | | | | | | |
| | | 5.56 | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | 7 | SS | 37 | | | | | | | | | | | | | | |
| | | | | 169.69 | | | | | | | | | | | | | | | | | |
| | | 6.55 | | | | | | | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | | | | | | | | | | | | | | | | | | |
| | | NOTES: 1. Water encountered at a depth of 6.1 m during drilling. 2. Water measured in open borehole at a depth of 5.8 m (El.170.4) upon completion of drilling. | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

LOCATION: N 4869837.69; E 668020.16

RECORD OF BOREHOLE: 20-6



SHEET 1 OF 1

BORING DATE: November 5, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | | | | | |
|-----------------------|---|---|--|-----------------------|---------|------|------------|---|--|--------|--|------------------------------------|--|--------|--|----------------------------|---|------------------|--|------------------|--|------------------|--|------------------|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | | | | | | | | | |
| | | | | | | | | 20 | | 40 | | 60 | | 80 | | | | 10 ⁻⁶ | | 10 ⁻⁵ | | 10 ⁻⁴ | | 10 ⁻³ | |
| | | | | | | | | nat V. rem V. | | + ⊕ | | Q - U - | | ● ○ | | | | Wp | | W | | Wi | | | |
| | | GROUND SURFACE | | 176.98 | | | | | | | | | | | | | | | | | | | | | |
| 0 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) SILTY SAND, brown; non-cohesive, moist, dense to compact |  | 0.00 | 1A | SS | 33 | | | | | | | | | | | | | | | | | | |
| | | | | 1B | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | 2 | SS | 38 | | | | | | | | | | | | | | | | | | |
| | | | | | 3 | SS | 18 | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | (CL) sandy SILTY CLAY, trace gravel; brown to grey; cohesive, w>PL, stiff to very stiff |  | 174.85 | 4 | SS | 13 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | 5 | SS | 27 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\ROCANWINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS GDT 11/30/20

PROJECT: 20404006

LOCATION: N 4869854.81; E 668039.38

RECORD OF BOREHOLE: 20-7

SHEET 1 OF 1

BORING DATE: November 5, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|-----------------------|---|--|-------------|-----------------------|---------|------|------------|---|----|--------------------------------|----|------------------------------------|------------------|------------------|------------------|----------------------------|---|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH | | | | WATER CONTENT PERCENT | | | | | |
| | | | | | | | | Cu, kPa | | nat V. + Q - rem V. ⊕ U - ● | | Wp | | W | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 10 ⁻⁶ | 10 ⁻⁵ | 10 ⁻⁴ | 10 ⁻³ | | |
| 0 | | GROUND SURFACE | | 177.32 | | | | | | | | | | | | | |
| | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) gravelly SILTY SAND, brown; non-cohesive, dense | | 0.00 | 1 | SS | 34 | | | | | | | | | | |
| | | | | 176.63 | | | | | | | | | | | | | |
| 1 | | ENGINEERED FILL - (CL) sandy SILTY CLAY, brown; cohesive, w<PL, very stiff | | 0.69 | 2 | SS | 18 | | | | | | | | | | |
| | | | | 175.95 | | | | | | | | | | | | | |
| 2 | | ENGINEERED FILL - (SM) SILTY SAND, trace to some gravel; brown; organic staining; non-cohesive, moist, compact to dense | | 1.37 | 3 | SS | 19 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | 4 | SS | 38 | | | | | | | | | |
| 3 | | (CL) sandy SILTY CLAY, some gravel; brown to grey, oxidation staining to 4.9 m (TILL); w~PL, hard | | 2.90 | 5 | SS | 36 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | - Becoming grey at a depth of 4.9 m | | | 6 | SS | 31 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 6 | | (CL) sandy SILTY CLAY, trace gravel; grey; cohesive, w>PL, stiff | | 5.56 | 7 | SS | 13 | | | | | | | | | | |
| | | | | 170.77 | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | 6.55 | | | | | | | | | | | | | |
| | | NOTES: 1. Water encountered at a depth of 6.1 m during drilling. 2. Water measured in open borehole at a depth of 4.9 m (EL.172.4 m) upon completion of drilling. | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

LOCATION: N 4869855.84; E 668074.47

RECORD OF BOREHOLE: 20-8

SHEET 1 OF 1

BORING DATE: November 5, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | |
|-----------------------|---|--|-------------|-----------------------|---------|------|---|---------------------------|----|----|------------------------------------|-----------------------|------------------|------------------|----------------------------|---|-------------------------------|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | | | | | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | GROUND SURFACE | | 177.59 | | | | 20 | 40 | 60 | 80 | 10 ⁻⁶ | 10 ⁻⁵ | 10 ⁻⁴ | 10 ⁻³ | | | | | |
| 0 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) SILTY SAND, gravelly to trace gravel; brown; non-cohesive, moist, dense to compact | | 0.00 | 1 | SS | 37 | | | | | | | | | | 50 mm Dia. Monitoring Well | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 1 | | ENGINEERED FILL - (CL) sandy SILTY CLAY, trace gravel; organic staining; cohesive, w>PL, stiff | | 176.22 | 2 | SS | 24 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | (CL) sandy SILTY CLAY, trace gravel; brown to grey, oxidation staining (TILL); cohesive, w<PL to w~PL, hard to very stiff | | 175.66 | 3A | SS | 12 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS GDT 11/30/20

PROJECT: 20404006

LOCATION: N 4869846.49; E 668103.64

RECORD OF BOREHOLE: 20-9

SHEET 1 OF 1

BORING DATE: November 6, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | | | | | | |
|-----------------------|--|---|--|-----------------------|---------|------|---|---------------------------|--|----|------------------------------------|-----------------------|--|----|----------------------------|---|------------------|--|------------------|--|------------------|--|------------------|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | | | | | | | | | |
| | | | | | | | | 20 | | 40 | | 60 | | 80 | | | 10 ⁻⁶ | | 10 ⁻⁵ | | 10 ⁻⁴ | | 10 ⁻³ | | |
| | | | | | | | | 20 | | 40 | | 60 | | 80 | | | 10 | | 20 | | 30 | | 40 | | |
| 0 | | GROUND SURFACE | | 178.22 | | | | | | | | | | | | | | | | | | | | | |
| | M5T Track-Mounted Rig 150 mm Solid Stem Augers | FILL - (SM) SILTY SAND, gravelly to trace gravel; brown; non-cohesive, moist, very dense to loose | | 0.00 | 1 | SS | 84/ 0.08 | | | | | | | | | | | | | | | | | | |
| | | - Auger grinding at a depth of 0.3 m | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | 2 | SS | 29 | | | | | | | | | | | | | | | | | | |
| | | - Mixed with topsoil and contains rootlets at a depth of 1.5 m | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | 3 | SS | 9 | | | | | | | | | | | | | | | | | | |
| | | (CL-ML) sandy SILTY CLAY to CLAYEY SILT, trace gravel; brown (TILL); cohesive, w<PL, very stiff | | 176.09 | | | | | | | | | | | | | | | | | | | | | |
| | | | | 2.13 | 4 | SS | 19 | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | - Auger grinding at a depth of 4.0 m | | | | 5 | SS | 27 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | (CL) sandy SILTY CLAY, trace gravel; grey (TILL); cohesive, w<PL, hard | | 174.18 | | | | | | | | | | | | | | | | | | | | | |
| | | | | 4.04 | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | - Auger grinding between depths of 4.0 m and 4.6 m | | | 6 | SS | 50/ 0.08 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | (SM) SILTY SAND, some gravel; grey (TILL); non-cohesive, moist, very dense | | 172.66 | | | | | | | | | | | | | | | | | | | | | | |
| | | | 5.56 | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | 171.74 | 7 | SS | 87/ 0.23 | | | | | | | | | | | | | | | | | | |
| | | | | 6.48 | | | | | | | | | | | | | | | | | | | | | |
| 7 | | NOTES: | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1. Water encountered at a depth of 4.6 m during drilling. | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2. Borehole caved to a depth of 5.8 m upon completion of drilling. | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | 3. Water measured in open borehole at a depth of 5.8 m (EL. 172.4 m) upon completion of drilling. | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02 DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-10

SHEET 1 OF 1

LOCATION: N 4869799.63; E 668087.41

BORING DATE: November 6, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | |
|-----------------------|---|---|-------------|---|---------|----------------|------------|---|----|----|--|---|--|--|--|----------------------------|---|-----------------------|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | 20 40 60 80 | | | | 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | nat V. + Q - rem V. ⊕ U - ⊙ | | | | | | WATER CONTENT PERCENT | | | |
| | | | | | | | | 20 40 60 80 | | | | 10 20 30 40 | | | | | | | | | |
| 0 | | GROUND SURFACE | | 177.04 0.00 | | | | | | | | | | | | | | | | | |
| 1 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | ENGINEERED FILL - (SM) SILTY SAND, some gravel; brown, oxidation staining; non-cohesive, moist, compact | | | 1 | SS | 18 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 2 | SS | 20 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | 3 | | SS | 14 | | | | | | | | | | | | | | | | |
| 2 | | | | (CL) sandy SILTY CLAY, trace to some gravel; brown to grey, oxidation staining to 3.5 m (TILL); cohesive, w>PL to w~PL, hard | | 174.91 2.13 | | 4 | SS | 31 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | 5 | SS | 36 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | |
| 5 | | - Becoming grey at a depth of 4.6 m | | | | 6 | SS | 30 | | | | | | | | | | | | | |
| 6 | | - Auger grinding between depths of 5.2 m and 6.1 m | | | | | | | | | | | | | | | | | | | |
| 7 | | END OF BOREHOLE | | 170.49 6.55 | | | | | | | | | | | | | | | | | |
| 8 | | NOTE: 1. Borehole was open and dry upon completion of drilling. | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-11

SHEET 1 OF 1

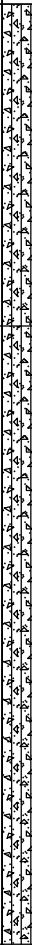
LOCATION: N 4869829.93; E 668154.76

BORING DATE: November 3, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | |
|-----------------------|---|--|--|-----------------------|---------|------|------------|---|----|----|----|------------------------------------|--------|--------|------------|----------------------------|---|--------|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | | | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | nat V. rem V. | + ⊕ | - ⊖ | Q - U - | | | ● ○ |
| | | | | | | | | | | | | | | | | | | |
| | | GROUND SURFACE | | 177.77 | | | | | | | | | | | | | | |
| 0 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | (ML) SILT and SAND, some gravel; brown, oxidation staining (TILL); non-cohesive, moist, compact to dense |  | | | | | | | | | | | | | | | |
| | | | | 1 | SS | 46 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 1 | | | | 2 | SS | 26 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | 3 | SS | 29 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | (SM) SILTY SAND, trace to some gravel; brown, oxidation staining (TILL); non-cohesive, moist, dense to very dense | | | 175.64 | | | | | | | | | | | | | |
| | | | | | 2.13 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 3 | | - Auger grinding between depths of 2.7 m and 4.3 m | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02 DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-12

SHEET 1 OF 1

LOCATION: N 4869890.59; E 668149.20

BORING DATE: November 3, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | | |
|-----------------------|--|---|-------------|-----------------------|-------------|------|------------|---|--|--|--|---|--|--|--|----------------------------|---|-----------------------|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | 20 40 60 80 | | | | 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | nat V. + Q - ● rem V. ⊕ U - ○ | | | | | | WATER CONTENT PERCENT | | | |
| | | | | | | | | 20 40 60 80 | | | | Wp ——— W ——— WI | | | | | | | | | |
| 0 | | GROUND SURFACE | | 179.19 0.00 | | | | | | | | | | | | | | | | | |
| 1 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | (SM) SILTY SAND, trace gravel; brown, oxidation staining (TILL); cohesive, moist, compact | | | 1 | SS | 14 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 2 | SS | 17 | | | | | | | | | | | | | | |
| 2 | | (CL) sandy SILTY CLAY, trace gravel; brown, oxidation staining (TILL); cohesive, w<PL, very stiff to hard | | | 3 | SS | 20 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 4 | SS | 23 | | | | | | | | | | | | | | |
| 3 | | - Auger grinding between depths of 3.1 m and 3.7 m | | | | | | | | | | | | | | | | | | | |
| | | | 5 | SS | 77/ 0.23 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 4 | (SM) SILTY SAND, some gravel, brown to grey, oxidation staining to 5.0 m (TILL); non-cohesive, moist, very dense | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | 6 | SS | 83 | | | | | | | | | | | | | | | | |
| 5 | - Auger grinding between depths of 4.9 m 6.1 m | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 6 | - Becoming grey at a depth of 6.1 m | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | 7 | SS | 50/ 0.13 | | | | | | | | | | | | | | | | |
| 7 | END OF BOREHOLE | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 8 | NOTES: 1. Borehole caved to a depth of 5.8 m upon completion of drilling. 2. Borehole was dry upon completion of drilling. | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02_DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-13

SHEET 1 OF 1

LOCATION: N 4869893.89; E 668180.75

BORING DATE: November 3, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|-----------------------|---------------|--------------|-------------|-----------------------|---------|------|------------|---|----|----|----|------------------------------------|------------------|------------------|------------------|----------------------------|---|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 10 ⁻⁶ | 10 ⁻⁵ | 10 ⁻⁴ | 10 ⁻³ | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | </ | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02 DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-14

SHEET 1 OF 1

LOCATION: N 4869890.96; E 668216.24

BORING DATE: November 3, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | |
|-----------------------|---|---|-----------------|-----------------------|----------------|------|---|---------------------------|----|----|------------------------------------|-----------------------|------------------|------------------|----------------------------|---|--|--|--|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | | | | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | | | |
| | | | | | | | | | | | | Wp — W — Wi | | | | | | | |
| | | GROUND SURFACE | | 179.76 | | | | 20 | 40 | 60 | 80 | | 10 ⁻⁶ | 10 ⁻⁵ | 10 ⁻⁴ | 10 ⁻³ | | | |
| 0 | M5T Track-Mounted Rig 150 mm Solid Stem Augers | FILL - (SM) SILTY SAND, trace gravel; brown; containing rootlets, oxidation staining; non-cohesive, moist, compact | | 0.00 | 1 | SS | 21 | | | | | | | | | | | | |
| 1 | | FILL - (CL) SILTY CLAY, some sand, brown to dark grey; mixed with topsoil; cohesive, w~PL, stiff | | 179.07 0.69 | 2 | SS | 13 | | | | | | | | | | | | |
| | | (CL) sandy SILTY CLAY, trace gravel; brown (TILL); cohesive, w<PL, very stiff | | 178.39 1.37 | 3 | SS | 25 | | | | | | | | | | | | |
| | | (SM) SILTY SAND, some gravel; brown to grey, oxidation staining to 3.5 m (TILL); non-cohesive, moist, compact to very dense | | 177.63 2.13 | 4 | SS | 32 | | | | | | | | | | | | |
| 3 | | | | | 5 | SS | 25 | | | | | | | | | | | | |
| 4 | | - Auger grinding between depths of 3.7 m and 4.6 m | | | | | | | | | | | | | | | | | |
| 5 | | | | | 6 | SS | 56 | | | | | | | | | | | | |
| 6 | | - Auger grinding between depths of 5.4 m and 6.1 m | | | | | | | | | | | | | | | | | |
| | | | | | 173.59 6.17 | 7 | SS | 50/ 0.08 | | | | | | | | | | | |
| | | | END OF BOREHOLE | | | | | | | | | | | | | | | | |
| 7 | | NOTES: 1. Borehole open and dry upon completion of drilling. 2. Groundwater level was measured at a depth of 4.5 m (EL. 175.3 m) on November 24, 2020. | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\ROCANWINDFIELDS FARM\02 DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20

PROJECT: 20404006

RECORD OF BOREHOLE: 20-15

SHEET 1 OF 1

LOCATION: N 4869855.13; E 668235.41

BORING DATE: November 3, 2020

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|-----------------------|---|---|-------------|-----------------------|---------|------|---|---------------------------|----|----|----|------------------------------------|------------------|------------------|------------------|----------------------------|---|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | | | | | | | | | | |
| | | | | | | | | SHEAR STRENGTH Cu, kPa | | | | WATER CONTENT PERCENT | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 10 ⁻⁶ | 10 ⁻⁵ | 10 ⁻⁴ | 10 ⁻³ | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 0 | | GROUND SURFACE | | 179.24 | | | | | | | | | | | | | |
| | M&T Track-Mounted Rig 150 mm Solid Stem Augers | FILL - (SM) SILTY SAND, gravel; brown, organic staining, oxidation staining; non-cohesive, moist, compact | | 0.00 | 1 | SS | 19 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 1 | | (CL) sandy SILTY CLAY, brown, oxidation staining (TILL); cohesive, w<PL, stiff to hard | | 178.55 | 2 | SS | 22 | | | | | | | | | | |
| | | | | 0.69 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | (SM) SILTY SAND, gravelly to some gravel; brown to grey, oxidation staining to 5.0 m (TILL); non-cohesive, moist, dense to very dense | | 177.11 | 4 | SS | 50/ 0.08 | | | | | | | | | | |
| | | | | 2.13 | | | | | | | | | | | | | |
| 3 | | | | | 5 | SS | 35 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 4 | | - Auger grinding between depths of 2.1 m and 6.1 m | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 5 | | | | | 6 | SS | 72 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 6 | | - Becoming grey at a depth of 6.1 m | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: BD

CHECKED: TO

GTA-BHS 001 S:\CLIENTS\RIOCAN\WINDFIELDS FARM\02 DATA\GINT\20404006.GPJ GAL-MIS.GDT 11/30/20



golder.com