



GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Geotechnical Investigation

Proposed Residential Developments

County Road 27, Barrie, Ontario

Prepared For:

Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI



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Professional, Proficient, Proactive

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1. INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI (the Client) to conduct a geotechnical investigation for the proposed residential developments located on the east side of County Road 27, west of Essa Road and north of Salem Road, City of Barrie, Ontario.

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

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

This report is provided on the basis of the terms of reference presented in our approved proposal prepared based on our understanding of the project. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this report can be relied upon.

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

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

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

2. FIELD AND LABORATORY WORK

The field work for the geotechnical investigation was carried out on April 23 to 26, 30 and May 1, 2, 2018, during which time twenty-six (26) boreholes (Boreholes BH1 to BH26) were advanced at the location shown on the Borehole and Monitoring Well Location Plan, Drawing 1. The boreholes were drilled to depths from about 3.7 m and 15.3 m below the existing ground surface.

The requested borehole locations were provided by the Client. The boreholes were located and staked in the field by GeoPro according to the requested borehole location plan provided by the Client; the borehole locations in the field were adjusted according to the drill rig accessibility and the underground utility conditions. The field work for this investigation was monitored by a member of our engineering staff who logged the boreholes and cared for the recovered samples.

The boreholes were advanced using continuous flight auger and continuous split spoon equipment supplied by a drilling specialist subcontracted to GeoPro. Samples were retrieved with a 51 mm (2 inches) O.D. split-barrel (split spoon) sampler driven with a hammer weighing 624 N and dropping 760 mm (30 inches) in accordance with the Standard Penetration Test (SPT) method.

The groundwater conditions were noted in the open boreholes during drilling and immediately upon completion of drilling. Boreholes BH2 to BH6, BH8 to BH13, BH16, BH19, BH20, BH22, BH24 and BH26 were backfilled and sealed upon completion of drilling. Monitoring well (51 mm or 38 mm in diameter) was installed in each of Boreholes BH1, BH7, BH14, BH15, BH17, BH18, BH21, BH23 and BH25 to monitor long-term groundwater conditions.

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

The approximate elevations at the as-drilled borehole locations were surveyed using a DGPS unit. The elevations at the as-drilled borehole locations were not provided by a professional surveyor and should be considered to be approximate. Contractors performing the work should confirm the elevations prior to construction. The borehole locations plotted on Borehole Location Plan Drawing 1 were based on the measurements of the site features and should be considered to be approximate.

3. SUBSURFACE CONDITIONS

Notes on sample descriptions are presented in Enclosure 1A. An explanation of terms used in the borehole logs is presented in Enclosure 1B. The subsurface conditions in all boreholes are presented on the borehole logs (Enclosure 2 to 27 inclusive). The following are the detailed descriptions of the major soil strata encountered in the boreholes.

3.1 Soil Conditions

Existing Paved Shoulder Asphalt and Granular Base/Subbase

Borehole BH16 was advanced through the existing shoulder of County Road 27. The paved shoulder asphalt thickness encountered in the borehole was about 60 mm, the pavement asphalt thickness may vary; the thicknesses of granular base/subbase materials was about 780 mm.

Topsoil

Topsoil with thicknesses ranging from 170 mm to 360 mm was encountered surficially in all boreholes with the exception of Borehole BH16.

It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site.

Fill Materials

Fill materials consisting of organic sandy silt to organic silt, sandy silt, sand and silt, silty sand and gravelly sand were encountered in Boreholes BH4 and BH16 below the topsoil or granular base/subbase, and extended to the depths ranging from about 0.6 m to 2.1 m below the existing ground surface. SPT N values ranging from 6 to 16 blows per 300 mm penetration indicated a loose to compact compactness. The in-situ moisture contents measured in the soil samples ranged from approximately 4% to 23%.

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

Reworked (fine) sand and silt, sandy silt and silty (fine) sand were encountered below the topsoil in Boreholes BH1 to BH3, BH5 to BH15, BH17 to BH21, BH23 and BH24, and extended to depths ranging from about 0.6 m to 1.2 m below the existing ground surface. SPT N values ranging from 1 to 17 blows per 300 mm penetration indicated a very loose to compact compactness. The in-situ moisture contents measured in the soil samples ranged from approximately 10% to 34%.

Clayey Silt and Silty Clay

Clayey silt and silty clay deposits were encountered below the reworked soils, native sandy silt and silty sand deposits in Boreholes BH6, BH7, BH17, BH19 and BH24, and extended to depths ranging from about 0.9 m to 5.6 m below the existing ground surface. SPT N values ranging from 2 to 49 blows per 300 mm penetration indicated a very soft to hard consistency. The natural moisture content measured in the soil sample was approximately 13% to 37%.

Sand and Silt Till and Silty Sand Till

Sand and silt till and silty sand till deposits were encountered below the fine sand or within sandy silt to sand and silt deposits in Boreholes BH19 and BH26, and extended to the depths ranging from about 2.9 m to 6.6 m below the existing ground surface. Borehole BH26 was terminated in these deposits. SPT N values ranging from 17 to 57 blows per 300 mm penetration indicated a compact to very dense compactness. The natural moisture content measured in the soil samples was approximately 9%.

Sandy Silt, (Fine) Sand and Silt, Silty (Fine) Sand, (Fine) Sand, Gravelly Sand and Sand and Gravel

Sandy silt, (fine) sand and silt, silty (fine) sand, (fine) sand, gravelly sand and sand and gravel deposits were encountered below the topsoil, fill materials, reworked soils, clayey silt and silty clay deposits in all boreholes, and extended to the depths ranging from about 3.7 m to 15.3 m below the existing ground surface. Boreholes BH1 to BH25 were terminated in these deposits. SPT N values ranging from 2 to greater than 100 blows per 300 mm penetration indicated a very loose to very dense compactness. The natural moisture contents measured in the soil samples ranged from approximately 2% to 25%.

3.2 Groundwater Conditions

Groundwater condition observations were made in the boreholes during and upon completion of drilling. The groundwater condition observations are summarized in the following table:

BH No.	Depth of Drilling (mBGS)	Depth of Water encountered during Drilling (mBGS)	Water Level upon Completion of Drilling (mBGS)	Cave in Depth upon Completion of Drilling (mBGS)
BH1	6.2	4.6	N/A	3.0
BH2	6.3	N/A	dry	open
BH3	6.2	N/A	dry	open
BH4	7.7	N/A	N/A	4.1

BH5	6.4	N/A	dry	open
BH6	7.7	N/A	dry	open
BH7	15.3	N/A	N/A	N/A
BH8	7.9	N/A	dry	7.3
BH9	6.2	N/A	N/A	5.0
BH10	6.4	N/A	dry	5.9
BH11	6.4	N/A	N/A	5.2
BH12	7.8	N/A	N/A	6.3
BH13	6.2	N/A	N/A	5.4
BH14	6.3	2.3	3.7	4.0
BH15	6.4	2.1	N/A	5.5
BH16	6.6	4.6	5.5	6.0
BH17	3.7	0.8	0.2	N/A
BH18	5.9	2.3	3.5	5.3
BH19	6.4	N/A	N/A	5.3
BH20	6.3	N/A	N/A	5.6
BH21	9.3	N/A	N/A	7.9
BH22	6.2	0.3	N/A	0.6
BH23	6.2	3.1	3.7	5.9
BH24	6.5	4.6	5.2	5.8
BH25	6.6	0.3	N/A	N/A
BH26	6.6	0.6	0.7	0.7

Note: mBGS = meter below ground surface

Monitoring well construction details and the measured groundwater levels are shown in the borehole logs and also summarized in the following table.

Monitoring Well ID	Screen Interval (mBGS)	Water Level
		May 11, 2018
BH1	4.6 ~ 6.1	3.23
BH7	13.7 ~ 15.2	14.83
BH14	4.6 ~ 6.1	5.94
BH15	4.6 ~ 6.1	1.51
BH17	2.2 ~ 3.7	0.23
BH18	3.8 ~ 5.3	1.20
BH21	7.4 ~ 8.9	dry
BH23	4.6 ~ 6.1	2.20
BH25	4.6 ~ 6.1	0.48

Note: mBGS = meter below ground surface

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

4. DISCUSSION AND RECOMMENDATION

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

The design drawings of the project are not available at the time of preparing this report. Once the design drawings and detail site plan are available, this report should be reviewed by GeoPro and further recommendations be provided as appropriate.

4.1 Subgrade Preparation and Engineered Fill

Proposed site grading plans are not available at this time. However, it is anticipated that cut and fill operations would be required to establish appropriate subgrade levels throughout the site. In

the areas where earth fill is required for site grading purposes, engineered fill may be utilized to support house foundations, roads, utilities, etc.

For the preparation of subgrade prior to the placement of the engineered fill, all topsoil, reworked soils and existing fill materials (up to depths ranging from about 0.6 m to 2.1 m below existing ground surface) and surficially softened native soils must be removed and the exposed subgrade proof rolled. Any soft spots revealed during proof rolling must be sub-excavated and re-engineered, and the excavation base must be inspected and approved by GeoPro prior to the placement of backfill. The extent and thickness of the existing fill materials must be inspected at the time of construction to make sure that all fill materials are removed prior to the placement of the engineered fill. Materials for the use of engineered fill must be approved by GeoPro prior to placement.

Based on the measured water contents, the majority of the reworked soils and glacial tills have water contents generally near their estimated laboratory optimum water contents for compaction. However, some of the cohesionless silty/sandy/gravelly deposits above groundwater levels are generally drier than their estimated laboratory optimum water contents for compaction. In consideration of the poorly graded and fine textured nature of these materials, some difficulties should be anticipated in using these soils for compaction. These materials will likely require some adjustments in their water content (wetting) prior to placement and compaction. On the other hand, the cohesionless silty/sandy/gravelly soils and cohesive clayey soils below the prevailing groundwater tables are expected to be generally wet of their optimum water contents for compaction and these soils will likely require some drying prior to placement.

It should be noted that due to the fine-grained nature of the soils encountered at the site, their workability is sensitive to moisture conditions and some difficulty would be expected in achieving adequate compaction. In this regard, imported materials may have to be used for engineered fill. The materials used for engineered fill must be approved by GeoPro at the source(s), prior to hauling to the site. The engineered fill consisting of approved inorganic material should be placed in maximum 300 mm loose lifts and uniformly compacted to 98% Standard Proctor Maximum Dry Density (SPMDD) throughout.

General guidelines for the preparation of the subgrade and the placement of engineered fill are presented in Appendix A. The recommended procedures for the placement of engineered fill is outlined below:

1. Prior to the site work involving engineered fill, a kick-off site meeting to discuss all aspects of the engineered fill placement must be carried out with all parties. The surveyor, contractor, design engineer and geotechnical engineer must attend the kick-off meeting. At the meeting, the construction schedule and the detailed design information in regard to the engineered fills, such as the boundary, the thickness will be determined. The contractor must provide with the construction schedule

- including the source site(s) of the fill materials, which will have to be reviewed by the geotechnical engineer. The geotechnical engineer will arrange for the soil sampling at the source site(s) and carry out related laboratory testing. No soils can be hauled to the site prior to the approval by the geotechnical engineer.
2. Detailed design drawings such as grading drawings indicating the underside elevations of the engineered fill as well as the finished elevations of the engineered fill must be made available at the site meeting and be approved by the geotechnical engineer.
 3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and GeoPro. Without this confirmation in writing, no responsibility for the performance of the structure can be accepted by GeoPro. Survey drawings of the pre and post fill location and elevations will also be required.
 4. The subgrade area must be stripped of all topsoil, existing fill materials and reworked soils. Subgrade must be proof-rolled by a qualified engineering staff from GeoPro. Any soft/loose spots revealed by proofroll must be subexcavated and be replaced with engineered fill. The stripped native subgrade must be examined and approved by a GeoPro engineer prior to placement of engineered fill.
 5. The approved engineered fill must be compacted to 98% Standard Proctor Maximum Dry Density throughout. Granular fill materials consisting well graded cohesionless sand and gravel are preferred. Engineered fill should not be placed (where it will support footings) during the winter months. Engineered fill compacted to 98% SPMDD will settle under its own weight approximately 0.25% to 0.75% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur.
 6. Full-time geotechnical inspection and compaction testing by GeoPro during placement of engineered fill must be required. The placement of the engineered fill must not commence or continue without the presence of the GeoPro's representative.
 7. Excavations must be carried out in accordance with the Occupational Health and Safety Regulations of Ontario.
 8. Surface water cannot be allowed to pond in any area of the engineered fill footprint.

9. Clear stone backfill must not be used in any portion of the engineered fill unless it is approved by GeoPro in writing.
10. Upon completion of engineered fill, the surface of the pad must be protected from disturbance from traffic, rain and frost.
11. Should the construction of the structures on the engineered fill be not carried out for a period of time, the finished engineered fill pad must be inspected and accepted by GeoPro. The location of the structure must be reconfirmed that it remains within the pad.

Engineered fill compacted to 98% of SPMDD will settle under its own weight approximately 0.25% to 0.75% of the fill thickness. The designer and the structural engineer must be aware of this settlement. For example, where the engineered fill is 5 m in thickness, the settlement of fill under its own weight is expected to be in the range of 25 mm on a non-yielding subgrade. The settlement of the engineered fill will occur with time. For engineered fill consisting of sandy silt to silty sand material, about 75% of the settlement is expected to occur within 3 months after the placement of the engineered fill; for engineered fill consisting of clayey silt to silty clay material, about 75% of the settlement is expected to occur within 3 to 6 months or longer after the placement of the engineered fill.

Engineered fill which consists of Granular B material (sand and gravel) will undergo less self-weight settlement (say about 0.25% to 0.5% of the fill thickness). In addition, the settlement of engineered Granular B fill will be completed in a shorter period of time. For engineered fill consisting of Granular B material compacted to 98% of SPMDD, a major portion (75% or higher) of the settlement due to the self-weight is expected to be completed during the construction stage before the placement of the structures.

4.2 Foundation Conditions

Footings founded on approved engineered fill, the geotechnical bearing resistance may be taken as 100 kPa at Serviceability Limit States (SLS), and a factored bearing resistance of 150 kPa at Ultimate Limit States (ULS), provided that all requirements on Appendix A are adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the construction must be considered.

The native subsoils at the site are considered to be suitable for supporting conventional shallow foundations for light residential houses with basements. A geotechnical bearing resistance of 100 kPa at Serviceability Limit States (SLS), and a factored geotechnical bearing resistance of 150 kPa at Ultimate Limit States (ULS), may be assumed for conventional shallow spread and/or strip

footings bearing in the native, undisturbed, competent subsoils below the existing fill materials or reworked soils.

Variations in the soil conditions are expected between and beyond the borehole locations, and during construction, the actual subgrade and its bearing capacity should be carefully inspected and evaluated by the geotechnical engineer from GeoPro.

In general, for any houses placed wholly or in part on engineered fill, it is recommended that the foundations be provided with nominal reinforcement using steel rebar. Once the final thicknesses and extent of engineered fill are known, the need for and design of any reinforcement can be determined on a lot-by-lot basis by the builder's structural engineer, in consultation with the geotechnical engineer.

All foundation excavations at the site should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. 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 materials as bearing strata. Prior to pouring concrete for the footings, the foundation excavations **must** be inspected by GeoPro to confirm that the footings are founded on an undisturbed and competent bearing stratum that has been cleaned of ponded water and all disturbed, softened, loosened, organic and other deleterious material.

All footings exposed to seasonal freezing and thawing must be provided with a minimum earth cover of 1.6 meters or equivalent insulation to satisfy frost protection requirements.

Settlements induced by the recommended SLS bearing pressures will be less than 25 mm total and 19 mm differential and within the tolerable limits of construction.

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

It is suggested that finalized basement floor elevations should be set at least 1.0 m above the local water table. Underfloor drains and upgraded level of water-proofing would be necessary in areas of the site if basements are proposed to be located below the local groundwater table and in potentially water bearing soils. Under-floor-slab drainage may be required for basements under such conditions and these conditions should be identified in the field by GeoPro on a lot-by-lot basis. The drainage tiles consisting of 100 mm diameter perforated pipes with filter fabric, should discharge into a positive frost-free outlet, as shown on Drainage and Backfill Recommendations, Drawing 2. Exterior basement walls should be damp-proofed above the water table and water-proofed below the water table. The backfill against the footing and foundation walls should consist of free-draining, non-frost-susceptible granular or equivalent. The majority of the on-site

materials have adfreezing potential; if these soils are used to backfill against the perimeter foundation walls, a polyethylene slip-membrane should be placed below ground surface on the perimeter foundations walls. Vertical drains should be installed at the window wells and connected to the perimeter drains to reduce basement dampness. GeoPro recommends that 'dimple board' be used on all below ground surfaces.

4.3 Earth Pressures on Basement Walls

The lateral earth pressures acting on basement walls may be calculated from the following expression:

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

where p = Lateral earth pressure in kPa acting at depth h

K = Earth pressure coefficient equal to 0.40 for vertical walls and horizontal backfill used for permanent construction. Water pressure must be considered, if continuous wall drains are not used.

γ = Unit weight of backfill, a value of 21 kN/m³ may be assumed

h = Depth to point of interest in meters

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the buildup of any hydrostatic pressure behind the walls.

4.4 Roads

Based on the subsurface conditions encountered at the site and the assumed traffic usage for residential local streets, the following pavement designs are recommended for the subdivision streets:

Material		Thickness of Pavement (mm)	
		Local	Collector
Hot-Mix Asphalt (OPSS 1150)	HL 3 Top Course	40	40
	HL4 or HL 8 Bottom Course	70	100 (2 lifts)
	Granular A Base	150	150

Granular Material (OPSS.MUNI 1010)	Granular B Type I Subbase	450	540
		Prepared and Approved Subgrade	

The recommended pavement structures should be considered for preliminary design purposes only. A functional design life of ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific traffic data input from the Client.

Subject to the subgrade conditions (i.e. backfill materials wet of optimum water contents being placed) and weather conditions (i.e. during wet weather), the placement of thicker granular base/sub-base layer in order to facilitate the construction may be required. The need for filter fabric/geo-grid can be evaluated during construction. Furthermore, heavy construction equipment/vehicles may cause the disturbance to the subgrade and granular base/subbase before the placement of asphalt, especially during wet weather, which should be considered during construction.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength in the trench backfill areas may not be adequate to support heavy construction loading, especially during wet weather or where backfill materials wet of optimum water contents have been placed. In any event, the subgrade should be proofrolled and inspected by qualified the geotechnical engineer prior to placing the Granular B subbase and additional granular material placed, as required, consistent with the prevailing weather conditions and anticipated use by construction traffic.

4.4.1 Stripping, Sub-excavation and Grading

The site should be stripped of all topsoil, and any organic or other unsuitable soils to the full depth of the pavement areas.

Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled by a heavily loaded truck, in the presence of the geotechnical engineer from GeoPro. Any soft spots exposed during the proofroll should be completely removed and replaced by select fill material, similar to the existing subgrade soil and approved by the geotechnical engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). If the moisture content of the local material cannot be maintained at $\pm 2\%$ of the optimum moisture content, imported select material may need to be used.

The final subgrade should be cambered or shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate. Proper cambering which allows the water to escape towards the sides (where it can be removed by means of subdrains or ditches) should be considered for the project. Otherwise, any water trapped in the granular base and subbase materials may cause problems due to softened subgrade, and differential frost heave, etc.

Any fill materials required for re-grading the site or backfill should be free of topsoil, organic or any other unsuitable matter and must be approved by the geotechnical engineer from GeoPro. The approved fill materials should be placed in thin layers not exceeding 300 mm (uncompacted loose lift thickness) and compacted to at least 95 percent of its SPMDD. The compaction should be increased to 98 percent of the SPMDD within 1.0 m below the subgrade, or as per local municipal standards. The compaction of the new fill should be checked by frequent field density tests by GeoPro, which should satisfy the engineers and/or local municipal standards.

4.4.2 Construction

Once the subgrade has been inspected, proofrolled and approved by the geotechnical engineer from GeoPro, the granular base and subbase course materials should be placed in layers not exceeding 300 mm (uncompacted loose lift thickness) and should be compacted to at least 98% of their respective SPMDD. The construction and grading of the granular material should conform to current OPS Specifications.

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

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

The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted access lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavorable weather.

4.4.3 Drainage

Should ditch drainage be considered, the bottom of the ditch should be at least 0.5 m lower than the underside elevation of the granular subbase. The ditch should be provided with sufficient gradient to promote the drainage.

Alternatively, installation of full-length subdrains along all roads or parking areas, should be required. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

The sub-drains system should consist of 100 mm or 150 mm diameter geotextile wrapped perforated pipe, placed inside a 300 mm X 300 mm trench and surrounded on all sides by 20 mm clear stone (minimum 50 mm at the bottom side) and wrapped in filter cloth (Terrafix 270R or the equivalent approved by the engineers). The filter cloth wrap should have a minimum overlap of at least 150 mm. The pipes should be placed such that the top of the sand filter is at subgrade level and connected to catchbasins or some other permanently frost free outlet to provide positive drainage. In addition, the subgrade should be graded at a slope of minimum 3% downwards towards the subdrains to promote the drainage.

All paved surfaces should be sloped to provide satisfactory drainage towards catchbasins. The finished pavement surface and underlying subgrade should be free of depressions and should be crowned and sloped (at a crossfall of minimum 2% for the paver surface and minimum 3% for the subgrade subject to the design engineers or local design standards) to provide effective drainage. As discussed above, by means of good planning any water trapped in the granular base materials should be drained rapidly towards subdrains or other interceptors.

4.5 Site Servicing

The invert depths of the proposed site services are not available at the time of preparing the report. We have assumed that the majority of the sewer and watermain installations will require excavations between about 2 m and 4 m below the existing ground surface. The native soils and properly constructed engineered fills are considered to be suitable for supporting the pipes, provided the integrity of the base of the trench can be maintained during construction. The suitability of the existing fill materials to support the pipes, if encountered at the base of the trenches, should be further assessed during construction. This assessment will require inspection during construction by qualified geotechnical personnel from GeoPro to determine the suitability of the fill materials for supporting the pipes. It should be noted that some difficulties may be encountered in excavating the very dense/hard silty/sandy/gravelly soils and glacial tills at some locations. In addition, these native deposits and tills are inferred containing cobbles and boulders, as previously noted. Once the actual service invert depths are finalized, the following comments and recommendations should be reviewed and revised as necessary.

4.5.1 Trenching Excavation

Based on the results of this investigation, excavations (assumed up to 4 m below existing ground surface) for the site servicing will be subexcavated through fill materials, reworked soils, gravelly/sandy/silty/clayey deposits, glacial tills and/or potential engineered fill. The site servicing

pipes is anticipated to be generally be above, below or at the measured groundwater table at borehole locations.

Groundwater control during excavation within the glacial tills and stiff to hard clayey deposits can be handled, as required, by pumping from properly constructed and filtered sumps located within the excavations. Perched groundwater may be expected in the fill materials, reworked soils and native cohesionless silty/sandy/gravelly soils above the groundwater tables at various depths. Groundwater control during excavation within the fill materials, reworked soils and native silty/sandy/gravelly soils above the groundwater tables at the site can be handled, as required, by pumping from properly constructed and filtered sumps located within the excavations. However, more significant groundwater seepage may be expected from any wet cohesionless silty/sandy/gravelly deposits or very soft to firm clayey deposits encountered at the site and wet cohesionless silty/sandy layers/zones within the tills below the prevailing groundwater tables at the time of construction. Depending upon the actual thickness and extent of the silty/sandy/gravelly deposits/layers and the finalized design pipe invert depths, some form of positive (pro-active) groundwater control or depressurization might be required to maintain the stability of the base and side slopes of the trench excavations, in addition to pumping from sumps. The groundwater level should be lowered to at least 1 m below the excavation base prior to excavating for the site services.

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

In this regard, it may be prudent to carry out a "public digging" (i.e. test pitting) during the tender stage, to allow prospective bidders to assess the subsurface conditions and determine the type of groundwater control required, consistent with their equipment capabilities and the actual groundwater conditions at that time. The locations of the test pits should be determined in consultation with the geotechnical engineer.

It is anticipated that the trench excavations will consist of conventional temporary open cuts with side slopes not steeper than 1H:1V. However, depending upon the construction procedures adopted by the contractor, groundwater seepage conditions and weather conditions at the time of construction, some local flattening of the slopes may be required, especially in looser/softer zones (i.e. in fills or wet silty/sandy/gravelly deposits) or where localized seepage is encountered. Care should be taken to direct surface runoff away from the open excavations and all excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations

for Construction Projects. According to OHSA, the glacial till deposits and stiff to hard clayey soils would be classified as Type 2 soils above the groundwater table and Type 3 soils below groundwater table; the fill materials, reworked soils, soft to firm clayey soils and native silty/sandy/gravelly soils would be classified as Type 3 soils above groundwater table and Type 4 soils below groundwater table and unless supported by shoring or other approved retaining method, the excavations will require minimum side slopes of 3H:1V. In addition, care must be taken during excavation to ensure that adequate support is provided for any existing structures and underground services located adjacent to the excavations.

Where the excavation side slopes must be steepened to limit the extent of the excavation, some form of temporary trench support, such as a trench box system, will be required. Where cohesionless silty/sandy/gravelly soils are present in close proximity to the proposed excavation above the invert elevations, some loss of ground should be expected for the sections of nearly vertical excavation where a trench box is used. It is anticipated that the unsupported cohesionless soils on the trench sides will relax, filling the void between the trench walls and trench box. This may lead to loss of ground. In order to minimize this effect, the gap between the trench walls and trench box should be minimized during the excavation and trench box installation. It must be emphasized that a trench liner box provides protection for construction personnel but does not provide any lateral support for the adjacent excavation walls, underground services or existing structures. In addition, steepened excavations should be left open for as short a duration as possible and completely backfilled at the end of each working day.

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

4.5.2 Pipe Support and Bedding

The bedding for the service pipes should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions and should be designed in accordance with the standards of the local municipality or Ontario Provincial Standard Specifications (OPSS). Where granular bedding is deemed to be acceptable, it should consist of at least 150 mm of OPSS Granular A or 19 mm crusher run limestone material. The thickness of the bedding may, however, have to be increased (i.e. 300 mm to 450 mm) depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soils at the trench base level consists of wet sandy/silty deposits. From springline to 300 mm above obvert of the pipe, sand cover could be used. All bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 98 percent of the material's Standard Proctor Maximum Dry Density (SPMDD).

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

4.5.3 Backfilling of Trenches

Based on visual and tactile examination and the measured water contents of the soil samples, the majority of the on-site existing fill materials, reworked soils and native soils above the prevailing groundwater tables and glacial till deposits will generally be at or near their estimated optimum water contents for compaction. However, the existing fill materials, reworked soils and native cohesionless soils below the prevailing groundwater tables may be wetter than their estimated optimum water contents for compaction, which should require some aeration prior to reuse as backfill materials.

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

The backfill should be placed in maximum 300 mm loose lifts at or near ($\pm 2\%$) their optimum moisture content and each lift should be compacted to at least 95% SPMDD. From 1 m below subgrade to subgrade elevation, the materials should be placed in maximum 300 mm loose lifts and uniformly compacted to at least 98 % SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling. In pavement areas, the upper zone of the trench backfill within the depth of 1.6 m below the pavement surface should be non-frost susceptible materials without excessive fines and compacted to at least 98% SPMDD. The fine grained silty/sandy soils encountered at the site is potentially of high frost susceptibility, which should not be used in the upper zone of the trench backfill within the depth of 1.6 m below the pavement surface. Cobbles and boulders were encountered in the boreholes carried out at the site. Provision of removal of the cobbles and boulders shall be considered in the contract.

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

Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in-situ material, then an approved imported sandy material which meets the

requirements for OPSS Select Subgrade Material (SSM) could be used. It should be placed in loose lift thicknesses as indicated above and uniformly compacted to at least 95% SPMDD.

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

5. EXCESS SOIL CHARACTERIZATION

5.1 Soil Sample Submission

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

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
BH4 SS1	0.2 – 0.6	Fill: Sand and Silt to Silty Sand	Metals and Inorganics
BH5 SS1+SS2	0.3 – 1.2	Reworked Soils: Fine Sand and Silt to Silty Fine Sand and Sand and Silt to Sandy Silt; Native: Sand and Silt	Metals and Inorganics
BH7 SS1+SS2+SS3	0.4 – 1.8	Reworked Soil: Sandy Silt to Sand and Silt; Native: Clayey Silt and Sand and Silt	Metals and Inorganics
BH10 SS4+SS5	2.3 – 3.5	Sand and Silty Sand	Metals and Inorganics
BH13 SS2+SS3	0.6 – 1.8	Sand and Silt to Sandy Silt	Metals and Inorganics
BH15 SS4+SS5	2.3 – 3.5	Sand and Silt to Silty Sand	Metals and Inorganics
BH17 SS2+SS3	0.8 – 2.1	Silty Clay and Sandy Silt	Metals and Inorganics
BH22 SS2+SS3	0.6 – 1.8	Fine Sand	Metals and Inorganics
BH24 SS1+SS2	0.3 – 1.2	Reworked soils: Fine Sand and Silt to Silty Fine Sand;	Metals and Inorganics

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
		Native: Clayey Silt	
BH26 SS2+SS3	0.6 – 1.8	Fine Sand	Metals and Inorganics

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

5.2 Soil Analytical Results

A total of ten (10) soil samples were analysed for the parameters of metals and inorganics, under Ontario Regulation 153/04 (“O. Reg. 153/04”) as amended. A copy of the soil analytical results is provided in the Laboratory Certificates of Analysis, attached in Appendix B.

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

Based on the comparison, exceedances of MOECC Table 1 standard were noted for Sodium Adsorption Ratio (SAR) or Metals (Molybdenum) in the tested soil samples in the Boreholes BH7 and BH17. The exceedance values detected in the soil samples are summarized in the following table.

Soil Sample ID	Parameter	Detected Value	MOECC Table 1 Standards Guideline Value	MOECC Table 2 and 3 Standards (R/P/I) Guideline Value	MOECC Table 2 and 3 Standards (I/C/C) Guideline Value
BH7 SS1+SS2+SS3	Molybdenum	3 µg/g	<u>2 µg/g</u>	6.9 µg/g	40 µg/g
BH17 SS2+SS3	SAR	3.19	<u>2.4</u>	5	12

Note: SAR = Sodium Absorption Ratio
R/P/I = Residential, Parkland and Institutional Property Use
I/C/C = Industrial, Commercial and Community Property Use
2.4 = Standard value exceeded by the analytical result
NV = No value derived

5.3 Discussion of Soil Analytical Results

Based on the analytical results, exceedances of MOECC Table 1 Standard were noted for SAR or Molybdenum in the tested soil samples. It should be noted that the sample BH17 SS2+SS3 selected for analysis was taken from the borehole located close to the roadways. The elevated SAR value in the tested soil sample may likely be attributed to the application of de-icing salt on the road. The source of the elevated Molybdenum value in the tested soil sample is unknown.

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

- 1) The soils generated near Boreholes BH4, BH5, BH10, BH13, BH15, BH22, BH24 and BH26 at the tested depths with no identified exceedances can be re-used on Site or re-used at a receiving site which is not used for agricultural purposes and would accept the soils as per the test results; and
- 2) The soils generated at the same tested sample depth from Boreholes BH7 and BH17 can be re-used at a receiving site which is not considered as an environmentally sensitive site and would accept the soil as per the test results.

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

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

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

6. MONITORING AND TESTING

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

7. CLOSURE

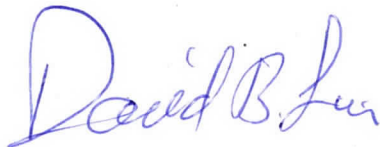
We appreciate the opportunity to be of service to you and trust that this report provides sufficient geotechnical engineering information to facilitate the detail design of this project. We look forward to providing you with continuing service during the construction stage. Please do not hesitate to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

Yours very truly,

GEOPRO CONSULTING LIMITED



Dylan Q. Xiao, M.A.Sc., P.Eng.
Geotechnical Group



David B. Liu, P.Eng., Principal

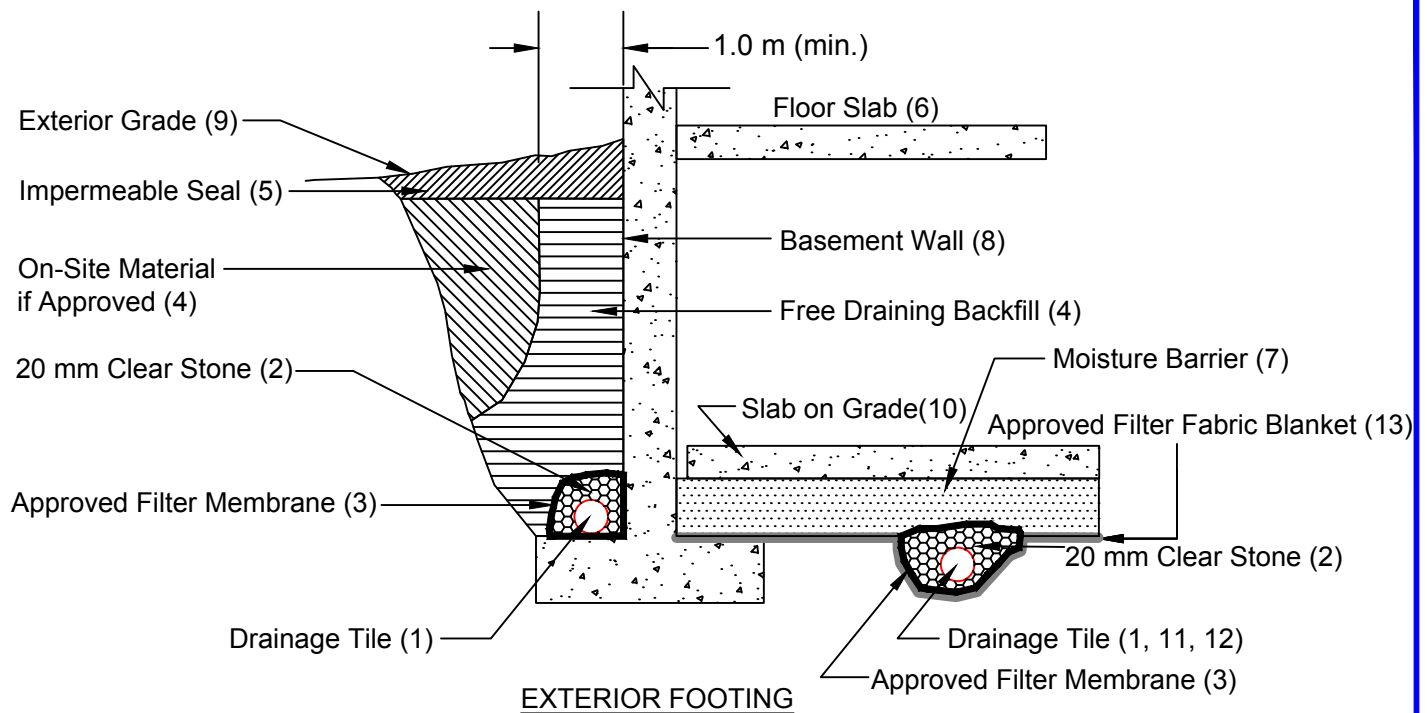




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DRAWINGS



Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place 100 mm (4 inches) of stone below drain.
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS

Basement with Underfloor Drainage

(not to scale)



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ENCLOSURES



Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil strata is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.
2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.



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

Sample Type

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

Penetration Resistance

Standard Penetration Resistance (SPT), N:

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

PM – Samples advanced by manual pressure

WR – Samples advanced by weight of sampler and rod

WH – Samples advanced by static weight of hammer

Dynamic Cone Penetration Resistance, N_d :

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

Piezo-Cone Penetration Test (CPT):

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

Textural Classification of Soils (ASTM D2487)

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

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

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

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

Soil Description

a) Cohesive Soils(*)

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

(*) Hierarchy of Shear Strength prediction

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

b) Cohesionless Soils

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

Soil Tests

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

PROJECT: Geotechnical Investigation for Proposed Residential Developments					DRILLING DATA														
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI					METHOD: Continuous Flight Auger - Auto Hammer					DIAMETER: 155 mm									
PROJECT LOCATION: County Road 27, Barrie, Ontario					FIELD ENGINEER: HR					DATE: 2018-04-30									
DATUM: Geodetic					SAMPLE REVIEW: DX					REF. NO.: 17-2099GE									
BH LOCATION: See Borehole Location Plan					CHECKED: DL					ENCL. NO.: 2									
SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit			Natural Moisture Content		Liquid Limit		UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		SPT				W _p	W	W _L	WATER CONTENT (%)		GR	SA	SI	CL	
						20	40	60	80										
289.7	TOPSOIL: (300 mm)																		
289.4	REWORKED SILTY SAND TO SAND AND SILT: trace organics, trace rootlets, dark brown to brown, moist, loose		1	SS	4														
289.0	SILTY SAND TO SAND AND SILT: trace clay, trace gravel, organic stain, brown, wet, loose to compact		2	SS	8														
288.1	SAND AND SILT: trace clay, trace gravel, brown, moist to wet, compact		3A	SS	18														
287.6	SAND: some silt, trace gravel, containing cobbles and boulders, brown, moist, dense		3B	SS	36														
287.1	FINE SAND TO SILTY FINE SAND: brown, moist to wet, dense to very dense		4A	SS	50 / 100 mm														
286.4	--- auger grinding		4B	SS	69 / 280 mm														
285.6	--- layers of clayey silt till		5	SS	140 mm														
285.0	SILTY SAND: trace to some gravel, trace clay, containing cobbles and boulders, brown, wet, very dense		6	SS	50 / 100 mm														
283.4	END OF BOREHOLE		7	SS	50 / 100 mm														
Notes: 1) Water was encountered at a depth of 4.6 m below ground surface (mBGS) during drilling. 2) Borehole caved at a depth of 3.0 mBGS upon completion of drilling. 3) 51 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Reading Date May 11, 2018 W. L. Depth (mBGS) 3.23																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments

DRILLING DATA

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

METHOD: Continuous Flight Auger - Auto Hammer

DIAMETER: 155 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario

FIELD ENGINEER: RR

DATE: 2018-04-24

DATUM: Geodetic

SAMPLE REVIEW: DX

REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan

CHECKED: DL

ENCL. NO.: 3

SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit			UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		ELEVATION	○ SPT	≥ Cone	blows/0.3m	W _p	W	W _L		
292.7							20	40	60	80				GR SA SI CL
0.0	TOPSOIL: (310 mm)													
292.4			1	SS	8	292	○				○			
0.3	REWORKED SAND AND SILT: trace clay, trace gravel, trace organics, trace rootlets, dark brown, moist, loose to compact		2	SS	17		○				○			
291.5						291		○						
1.2	NO SAMPLE RECOVERY: likely sand and silt to silty sand		3	NR	30									
290.7						290			○		○			
2.1	SAND AND SILT TO SILTY SAND: trace clay, trace gravel, layers/zones of sandy silt, containing cobbles and boulders, brown, moist, dense to very dense --- auger grinding		4	SS	49	290					○			
			5	SS	39			○			○			5 69 23 3
						289								
			6	SS	62	288			○		○			
						287								
287.2														
5.6	SAND: trace to some silt, trace gravel, brown, moist, very dense													
286.5			7	SS	50 /									
6.3	END OF BOREHOLE Note: 1) Borehole was open and dry upon completion of drilling.				150 mm									

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA											
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm					
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-26					
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE					
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 4					
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Natural Moisture Content				UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SHEAR STRENGTH (kPa)				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L				
							SPT Cone blows/0.3m 20 40 60 80										
							● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ☒ Penetrometer + Lab Vane				WATER CONTENT (%)				GR SA SI CL		
294.3 0.0	TOPSOIL: (280 mm)																
294.1 0.3	REWORKED SAND AND SILT: trace clay, trace gravel, trace organics, trace rootlets, pockets of topsoil, brown, moist, loose SAND AND SILT: trace to some gravel, trace clay, organic stain, containing cobbles and boulders, brown, moist to wet, loose to very dense ---layers of sand		1	SS	4												
293.7 0.6			2	SS	10												3 41 48 8
			3	SS	50 / 150 mm												
292.4 1.9	SAND AND SILT TO SILTY SAND: trace gravel, containing cobbles and boulders, brown, moist, very dense		4	SS	93 / 230 mm												
291.5 2.8	SAND: some silt, trace gravel, layers of sandy silt, brown, moist, very dense		5	SS	50 / 80 mm												
290.4 3.9	GRAVELLY SAND: some silt to silty, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense		6	SS	50 / 50 mm												
289.0 5.4	SAND: some silt, trace to some gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense																
288.2 6.2	auger grinding END OF BOREHOLE Note: 1) Borehole was open and dry upon completion of drilling.		7	SS	50 / 80 mm												

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments					DRILLING DATA								
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI					METHOD: Continuous Flight Auger - Auto Hammer		DIAMETER: 155 mm						
PROJECT LOCATION: County Road 27, Barrie, Ontario					FIELD ENGINEER: HR		DATE: 2018-04-30						
DATUM: Geodetic					SAMPLE REVIEW: DX		REF. NO.: 17-2099GE						
BH LOCATION: See Borehole Location Plan					CHECKED: DL		ENCL. NO.: 5						
SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				REMARKS AND GRAIN SIZE DISTRIBUTION (%)			
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		SHEAR STRENGTH (kPa)							
						○ SPT 20 40 60 80	≥ Cone 20 40 60 80	blows/0.3m 20 40 60 80	Plastic Limit W _p Natural Moisture Content W Liquid Limit W _L				
295.0						● Unconfined × Field Vane & Sensitivity ▲ Quick Triaxial □ Penetrometer + Lab Vane							
294.7	TOPSOIL: (230 mm)												
0.2	FILL: sand and silt to silty sand, trace clay, trace gravel, containing red brick fragments, brown, moist, compact		1	SS	16								
294.4													
0.6	SILTY SAND TO SAND: trace to some gravel, containing cobbles and boulders, brown, moist, compact to very dense		2	SS	29								
1	---												
	auger grinding		3	SS	67					10 67 18 5			
2	---												
	auger grinding												
3	---												
	auger grinding		4	SS	64								
3	---												
	auger grinding		5	SS	50 / 50 mm								
291.1													
3.9	SILTY FINE SAND: pockets of sandy silt, containing cobbles and boulders, brown, moist, very dense												
4	---												
	auger grinding		6	SS	50 / 100 mm								
5	---												
	auger grinding												
289.5													
5.5	SAND AND SILT TO SILTY SAND: trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense												
6	---												
	auger grinding		7	SS	50 / 130 mm								
6	---												
	auger grinding												
288.0													
6.9	SAND: some gravel, trace to some silt, containing cobbles and boulders, brown, moist, very dense												
7	---												
	auger grinding		8	SS	50 / 100 mm								
287.2													
7.7	END OF BOREHOLE												
	Note: 1) Borehole caved at a depth of 4.1 m below ground surface (mBGS) upon completion of drilling.												

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

01 - GEOPRO SOIL LOG GEOPRO 17-2099 BH LOG PROJECT DATA 20180529-DC-DX-GPJ 2018-05-29 17:03

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA												
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm						
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-26						
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE						
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 6						
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit			Natural Moisture Content		Liquid Limit	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		ELEVATION	SHEAR STRENGTH (kPa)				WATER CONTENT (%)						
							○ SPT ≧ Cone blows/0.3m 20 40 60 80				W _p W W _L							
							● Unconfined X Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane				WATER CONTENT (%)							
							20 40 60 80				10 20 30 40							
296.3	0.0	TOPSOIL: (330 mm)					296											
295.9	0.3	REWORKED FINE SAND AND SILT TO SILTY FINE SAND: trace organics, trace rootlets, pockets of sandy silt, brown, moist, very loose	1	SS	3													
295.7	0.6	REWORKED SAND AND SILT TO SANDY SILT: trace to some clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose	2A	SS	4													
295.4	0.9	SAND AND SILT: trace clay, trace gravel, containing cobbles and boulders, brown, moist, loose	2B	SS														
295.0	1.2	SAND: trace to some gravel, layers/zones of sandy silt, containing cobbles and boulders, brown, moist, dense	3	SS	35													
294.2	2.1	SILTY SAND: trace to some gravel, layers/zones of sandy silt, seams of silt, layers of sand, containing cobbles and boulders, brown, moist, very dense																
		--- auger grinding																
292.2	4.0	SAND: some gravel, trace to some silt, brown, moist, very dense																
		--- auger grinding	6	SS	50 / 130 mm													
290.8	5.5	SAND AND SILT TO SILTY SAND: trace gravel, containing cobbles and boulders, brown, moist, very dense																
289.9	6.4	END OF BOREHOLE	7	SS	50 / 100 mm													
		Note: 1) Borehole was open and dry upon completion of drilling.																

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments

DRILLING DATA

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

METHOD: Continuous Flight Auger - Auto Hammer

DIAMETER: 155 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario

FIELD ENGINEER: RR

DATE: 2018-04-26

DATUM: Geodetic

SAMPLE REVIEW: DX

REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan

CHECKED: DL

ENCL. NO.: 7

SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit Natural Moisture Content Liquid Limit			UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		20	40	60	80	W _p	W	W _L		
298.6														
298.3	TOPSOIL: (245 mm)													
0.2	REWORKED SAND AND SILT: trace clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist to wet, very loose to compact		1	SS	2									
297.7			2A	SS										
0.8	SAND AND SILT TO SILTY SAND: trace to some clay, trace gravel, organic stain, containing cobbles and boulders, brown, moist, compact		2B	SS	11									
			3	SS	11									
296.5														
2.1	SILTY SAND: trace gravel, layers/zones of sand and silt, containing cobbles and boulders, brown, moist, very dense		4	SS	67									
	--- auger grinding		5	SS	82									
294.5														
4.0	CLAYEY SILT: some sand to sandy, trace gravel, zones/layers of silty sand, containing cobbles and boulders, brown, moist, hard		6	SS	49									
	--- auger grinding													
293.0														
5.6	SAND TO SILTY SAND: trace to some gravel, containing cobbles and boulders, brown, moist, very dense		7	SS	50 / 130 mm									
	--- auger grinding													
290.9														
7.7	END OF BOREHOLE Note: 1) Borehole was open and dry upon completion of drilling.		8	SS	50 / 80 mm									

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA													
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 205 mm							
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-25							
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE							
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 8							
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Natural Moisture Content				UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SHEAR STRENGTH (kPa)				Plastic Limit W _p	Natural Moisture Content W	Liquid Limit W _L	WATER CONTENT (%)					
301.4						○ SPT	≥ Cone	blows/0.3m											
0.0	TOPSOIL: (360 mm)																		
301.0			1	SS	5														
0.4	REWORKED SANDY SILT TO SAND AND SILT: trace to some clay, trace gravel, trace organics, trace rootlets, layers of clayey silt, dark brown to brown, moist, loose		2	SS	11														
300.8																			
0.6	CLAYEY SILT: some sand, trace organics, brown, moist, stiff																		
300.2	SAND AND SILT: trace clay, trace gravel, pockets of organics, brown, moist, loose		3	SS	6														
1.2																			
299.3																			
2.1	SILTY SAND: trace clay, trace gravel, layers of sand, containing cobbles and boulders, brown, moist, dense		4	SS	40													1	63
298.5																		31	5
2.9	FINE SAND AND SILT TO SILTY FINE SAND: trace gravel, layers/zones of silt, brown, moist, dense to very dense		5	SS	34														
3																			
4																			
5	--- auger grinding ---layers of clayey silt		6	SS	85 / 260 mm														
6																			
295.8																			
5.6	SILTY SAND: trace to some gravel, layers of sand and silt, containing cobbles and boulders, brown, moist, very dense		7	SS	50 / 150 mm														
6																			
294.4	--- auger grinding																		
6.9	SAND: some silt, some gravel, containing cobbles and boulders, brown, moist, very dense		8	SS	50 / 130 mm													15	73
8																		12	
292.9																			
8.5	FINE SAND: trace to some silt, trace gravel, brown, moist, very dense		9	SS	50 / 80 mm														
9																			
10																			

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Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA										
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 205 mm				
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-25				
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE				
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 8				
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Natural Moisture Content				UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		ELEVATION	SHEAR STRENGTH (kPa)				Plastic Limit W _p	Natural Moisture Content W	Liquid Limit W _L		
								SPT Cone blows/0.3m								
							● Unconfined X Field Vane & Sensitivity ▲ Quick Triaxial Penetrometer + Lab Vane				WATER CONTENT (%)					
							20 40 60 80				10 20 30 40					

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, x 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments

DRILLING DATA

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

METHOD: Continuous Flight Auger - Auto Hammer

DIAMETER: 155 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario

FIELD ENGINEER: RR

DATE: 2018-04-23

DATUM: Geodetic

SAMPLE REVIEW: DX

REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan

CHECKED: DL

ENCL. NO.: 9

SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit			UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		20	40	60	80	W _p	W	W _L		
301.8														
0.0	TOPSOIL: (330 mm)													
301.5			1	SS	11									
0.3	REWORKED SILTY SAND: trace gravel, trace organics, trace rootlets, pockets of organic silt, brown, moist to wet, compact													
301.2			2	SS	6									
0.6	SILTY SAND: trace gravel, organic stain, dark brown to brown, wet, loose to compact													
			3	SS	4									
299.4			4A	SS										
2.4	SAND AND SILT TO SILTY SAND: trace clay, trace gravel, brown, moist to wet, compact		4B	SS	29									
298.9														
2.9	SAND: trace to some silt, trace to some gravel, containing cobbles and boulders, brown, moist, compact to very dense		5	SS	43									
	--- auger grinding		6	SS	97 / 260 mm									
	---zones of silty sand		7	SS	24									
294.0			8	SS	50 / 80 mm									
7.9	END OF BOREHOLE													
	Notes: 1) Borehole was dry upon completion of drilling. 2) Borehole caved at depth of 7.3 m below ground surface (mBGS) upon completion of drilling.													

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments

DRILLING DATA

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

METHOD: Continuous Flight Auger - Auto Hammer

DIAMETER: 155 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario

FIELD ENGINEER: RR

DATE: 2018-04-23

DATUM: Geodetic

SAMPLE REVIEW: DX

REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan

CHECKED: DL

ENCL. NO.: 10

SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit			UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		blows/0.3m	blows/0.3m	blows/0.3m	blows/0.3m	W _p	W	W _L		
302.9														
0.0	TOPSOIL: (330 mm)													
302.6			1	SS	4									
0.3	REWORKED SILTY FINE SAND: trace organics, trace rootlets, dark brown to brown, moist, loose													
302.3			2	SS	5									
0.6	SILTY SAND TO SANDY SILT: trace organics, organic stain, brown, moist to wet, loose													
301.7	---zones of clayey silt													
1.2	SILTY SAND: trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, compact to very dense		3	SS	20									
			4	SS	48									
299.7			5A	SS	50 /									
3.2	SAND AND GRAVEL: trace silt, containing cobbles and boulders, brown, moist, very dense		5B	SS	100 mm									
298.9														
4.0	SAND AND SILT TO SILTY SAND: trace to some gravel, containing cobbles and boulders, brown, moist, very dense		6	SS	50 / 80 mm									
296.7			7	SS	50 / 100 mm									
6.2	END OF BOREHOLE Note: 1) Borehole caved at a depth of 5.0 m below ground surface (mBGS) upon completion of drilling.													

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA																
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm										
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-23										
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE										
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 11										
SOIL PROFILE			SAMPLES			GROUND WATER			DYNAMIC PENETRATION TEST				Natural Moisture Content				Liquid Limit		REMARKS AND GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	SPT				Cone				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	GR	SA	SI	CL
							20	40	60	80	blows/0.3m	blows/0.3m	blows/0.3m	blows/0.3m								
● Unconfined X Field Vane & Sensitivity																						
▲ Quick Triaxial ▣ Penetrometer + Lab Vane																						
SHEAR STRENGTH (kPa)																						
20 40 60 80																						
10 20 30 40																						
WATER CONTENT (%)																						
20 40 60 80																						
300.8																						
0.0																						
TOPSOIL: (310 mm)																						
300.5																						
0.3																						
REWORKED SAND AND SILT TO SILTY SAND: trace organics, trace rootlets, dark brown to brown, moist to wet, very loose																						
300.2																						
0.6																						
SAND AND SILT TO SILTY SAND: trace clay, trace gravel, organic stain, dark brown to brown, moist to wet, very loose to compact																						
299.3																						
1.5																						
SAND AND SILT TO SILTY SAND: trace clay, trace gravel, pockets of sand, containing cobbles and boulders, brown, moist, compact																						
298.8																						
2.1																						
SAND: some silt, trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense																						
297.9																						
2.9																						
SILTY SAND: trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense																						
296.5																						
5.4																						
SILTY FINE SAND: trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense																						
294.5																						
6.4																						
END OF BOREHOLE																						
Notes: 1) Borehole was dry upon completion of drilling. 2) Borehole caved at a depth of 5.9 m below ground surface (mBGS) upon completion of drilling.																						

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA														
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm								
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-23								
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE								
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 12								
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Natural Moisture Content				UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SHEAR STRENGTH (kPa)				WATER CONTENT (%)									
							SPT Cone blows/0.3m				Plastic Limit Natural Moisture Content Liquid Limit									
							20	40	60	80	W _p	W	W _L							
298.9	0.0	TOPSOIL: (310 mm)																		
298.6	0.3	REWORKED SAND AND SILT: trace clay, trace organics, trace rootlets, brown, moist, very loose		1	SS	2														
298.3	0.6	SAND AND SILT: trace to some clay, trace gravel, containing cobbles and boulders, brown, moist, loose		2A	SS	9														
297.8	297.7			2B	SS															
1.2		SAND: trace to some silt, trace gravel, layers of sandy silt, brown, moist, loose		3	SS	51											4	65	24	7
		SAND AND SILT TO SILTY SAND: trace clay, trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense		4	SS	69														
													</							

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments

DRILLING DATA

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

METHOD: Continuous Flight Auger - Auto Hammer

DIAMETER: 155 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario

FIELD ENGINEER: RR

DATE: 2018-04-23

DATUM: Geodetic

SAMPLE REVIEW: DX

REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan

CHECKED: DL

ENCL. NO.: 13

SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit Natural Moisture Content Liquid Limit			UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		○ SPT 20	≥ Cone 40	blows/0.3m 60	80	W _p	W	W _L		
295.3						SHEAR STRENGTH (kPa)				WATER CONTENT (%)				
						● Unconfined × Field Vane & Sensitivity ▲ Quick Triaxial ▣ Penetrometer + Lab Vane								
295.0	TOPSOIL: (290 mm)													
295.0			1	SS										
294.7	REWORKED SANDY SILT TO SAND AND SILT: trace clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose		2A	SS										
294.2	SAND AND SILT: trace clay, trace gravel, organic stain, brown, moist to wet, loose		2B	SS										
294.1	SAND AND SILT: trace clay, trace gravel, containing cobbles and boulders, brown, moist, loose		3	SS										
293.2	SAND: some gravel, some silt, containing cobbles and boulders, brown, moist, dense													
293.2	SILTY SAND: trace gravel, layers/zones of sand and silt, brown, moist, very dense		4	SS										
292.4														
292.4	SILTY FINE SAND: seams/pockets of silt, brown, moist, very dense		5	SS										
291.3														
291.3	SAND AND SILT TO SILTY SAND: trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense		6	SS										
291.3	--- auger grinding													
290.0														
290.0														
289.0														
289.0	--- auger grinding		7	SS										
289.0														
287.6	--- containing cobbles and boulders		8	SS										
287.6	END OF BOREHOLE													
287.6	Note: 1) Borehole caved at a depth of 6.3 m below ground surface (mBGS) upon completion of drilling.													

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments					DRILLING DATA									
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI					METHOD: Continuous Flight Auger - Auto Hammer					DIAMETER: 155 mm				
PROJECT LOCATION: County Road 27, Barrie, Ontario					FIELD ENGINEER: RR					DATE: 2018-04-24				
DATUM: Geodetic					SAMPLE REVIEW: DX					REF. NO.: 17-2099GE				
BH LOCATION: See Borehole Location Plan					CHECKED: DL					ENCL. NO.: 14				
SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Natural Liquid			UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		SPT Cone blows/0.3m				Limit	Moisture	Limit		
294.6						20 40 60 80				W _p	W	W _L		GR SA SI CL
294.5	TOPSOIL: (170 mm)					20 40 60 80				WATER CONTENT (%)				
0.2	REWORKED SANDY SILT: trace to some clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, very loose		1	SS	3									
294.0	SAND AND SILT TO SANDY SILT: some clay, trace gravel, sand pockets, containing cobbles and boulders, brown, moist, compact		2	SS	11									1 39 42 18
0.6			3	SS	17									
292.6	SAND AND SILT TO SILTY SAND: trace gravel, containing cobbles and boulders, brown, moist, very dense		4	SS	64									
2.1														
291.7	FINE SAND: trace to some silt, trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense --- auger grinding		5	SS	59									
2.9														
290.6	SILTY FINE SAND: trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense		6A	SS	69									
4.0														
289.8	SAND AND SILT: trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense		6B	SS										
4.9														
289.1	SILTY SAND: trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense													
5.6														
288.4	END OF BOREHOLE		7	SS	50 / 140 mm									
6.2	Note: 1) Borehole caved at a depth of 5.4 m below ground surface (mBGS) upon completion of drilling.													

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-24																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 15																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION TEST								REMARKS AND GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	SPT				Cone				SHEAR STRENGTH (kPa)				WATER CONTENT (%)				UNIT WT (kN/m³)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
							○ SPT 20 40 60 80				≥ Cone blows/0.3m 20 40 60 80				● Unconfined ▲ Quick Triaxial				X Field Vane & Sensitivity ⊠ Penetrometer + Lab Vane				Plastic Limit w _p				Natural Moisture Content w				Liquid Limit w _L				GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
293.3 0.0	TOPSOIL: (340 mm)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	</

PROJECT: Geotechnical Investigation for Proposed Residential Developments								DRILLING DATA													
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI								METHOD: Continuous Flight Auger - Auto Hammer								DIAMETER: 155 mm					
PROJECT LOCATION: County Road 27, Barrie, Ontario								FIELD ENGINEER: HR								DATE: 2018-04-30					
DATUM: Geodetic								SAMPLE REVIEW: DX								REF. NO.: 17-2099GE					
BH LOCATION: See Borehole Location Plan								CHECKED: DL								ENCL. NO.: 16					
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION TEST								Natural Moisture Content				Liquid Limit		REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	SPT 20	Cone 40	blows/0.3m 60	blows/0.3m 80	Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	GR	SA	SI	CL		
291.3	TOPSOIL: (330 mm)																				
291.0	REWOKED SAND AND SILT: trace clay, trace gravel, trace organics, trace rootlets, dark brown, wet, very loose		1	SS	2		291.0						o								
290.7	SAND AND SILT: trace clay, trace gravel, organic stain, brown, wet, loose		2	SS	9		290.7						o								
290.1	SAND AND SILT TO SILTY SAND: trace to some clay, trace gravel, layers of silty sand, pockets of sand, brown, moist to wet, loose to very dense		3	SS	7		290.1						o								
289.8							289.8/May 11														
289.0			4	SS	9		289.0						o					3	56	27	14
288.0			5	SS	11		288.0						o								
287.0							287.0														
286.0			6	SS	10		286.0						o								
285.0			7	SS	50 / 100		285.0						o								
6.4	END OF BOREHOLE																				
Notes: 1) Water was encountered at a depth of 2.1 m below ground surface (mBGS) during drilling. 2) Borehole caved at a depth of 5.5 mBGS upon completion of drilling. 3) 51 mm dia. monitoring well was installed upon completion of drilling. Water Level Reading Date W. L. Depth (mBGS) May 11, 2018 1.51																					

PROJECT: Geotechnical Investigation for Proposed Residential Developments							DRILLING DATA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI							METHOD: Continuous Flight Auger - Auto Hammer							DIAMETER: 155 mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
PROJECT LOCATION: County Road 27, Barrie, Ontario							FIELD ENGINEER: HR							DATE: 2018-04-30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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BH LOCATION: See Borehole Location Plan							CHECKED: DL							ENCL. NO.: 17																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST								Natural Moisture Content	Liquid Limit	REMARKS AND GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SPT				Cone							Plastic Limit w _p	WATER CONTENT (%)	UNIT WT (kN/m ³)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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299.0	PAVED SHOULDER ASPHALT: (60 mm) GRANULAR BASE/SUBBASE: (780 mm)		1	AS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments							DRILLING DATA												
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI							METHOD: Continuous Split Spoon							DIAMETER: 51 mm					
PROJECT LOCATION: County Road 27, Barrie, Ontario							FIELD ENGINEER: HR							DATE: 2018-05-02					
DATUM: Geodetic							SAMPLE REVIEW: DX							REF. NO.: 17-2099GE					
BH LOCATION: See Borehole Location Plan							CHECKED: DL							ENCL. NO.: 18					
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST								Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SHEAR STRENGTH (kPa)				WATER CONTENT (%)								
							○ SPT	≧ Cone	blows/0.3m		● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⓧ Penetrometer + Lab Vane								
298.4	TOPSOIL: (320 mm)						20	40	60	80									
298.1	REWORKED SANDY SILT: some clay, trace to some organics, trace rootlets, brown, wet, very loose		1	SS	1	298.2/May 11													
297.6	SILTY CLAY: sandy, trace gravel, trace organics, organic stain, sand pockets, brown, wet, very soft to soft		2	SS	2	Bentonite													
296.9	SANDY SILT: some clay, trace gravel, layers/seams of clayey silt, brown, wet, loose to compact		3	SS	10														
296.3	CLAYEY SILT TO SILTY CLAY: trace to some sand, trace gravel, seams of silty sand, layers of sandy silt, brown, wet, stiff		4	SS	9	Sand													
295.3	SAND AND SILT: trace clay, trace gravel, containing cobbles and boulders, brown to grey, moist to wet, compact		5	SS	27	Screen													
294.7	END OF BOREHOLE																		
3.7	Notes: 1) Water was encountered at a depth of 0.8 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 0.2 mBGS upon completion of drilling. 3) 38 mm dia. monitoring was installed in borehole upon completion of drilling. Water Level Reading Date W. L. Depth (mBGS) May 11, 2018 0.23																		

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments							DRILLING DATA																		
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI							METHOD: Continuous Split Spoon							DIAMETER: 51 mm											
PROJECT LOCATION: County Road 27, Barrie, Ontario							FIELD ENGINEER: RR							DATE: 2018-05-01											
DATUM: Geodetic							SAMPLE REVIEW: DX							REF. NO.: 17-2099GE											
BH LOCATION: See Borehole Location Plan							CHECKED: DL							ENCL. NO.: 19											
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION TEST											REMARKS AND GRAIN SIZE DISTRIBUTION (%)								
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				SHEAR STRENGTH (kPa)				WATER CONTENT (%)				UNIT WT (kN/m³)	GR	SA	SI	CL	
								○ SPT	≧ Cone	blows/0.3m	20	40	60	80	● Unconfined	✕ Field Vane & Sensitivity	▲ Quick Triaxial	⊠ Penetrometer + Lab Vane	W _p						W
296.6	TOPSOIL: (300 mm)																								
296.3	REWORKED SAND AND SILT: trace clay, trace gravel, brown, moist to wet, very loose		1	SS	2		296																		
295.8	SAND AND SILT: trace clay, trace gravel, trace rootlets, layers/seams /pockets of sand, containing cobbles and boulders, brown, moist to wet, loose to compact		2	SS	6		295.4/May 11																		
			3	SS	8		295																		
			4	SS	9		294																		
			5	SS	17		293																		
			6	SS	13		292																		
			7	SS	10		291																		
291.4	NO SAMPLE RECOVERY: likely silty sand		8	NR	19		291																		
290.7	END OF BOREHOLE:																								
5.9	Notes: 1) Water was encountered at a depth of 2.3 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 3.5 mBGS upon completion of drilling. 3) Borehole caved at a depth of 5.3 mBGS upon completion. 4) 38 mm dia. monitoring was installed in borehole upon completion of drilling. Water Level Reading Date W. L. Depth (mBGS) May 11, 2018 1.20																								

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+3, X3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA											
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm					
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: RR						DATE: 2018-04-24					
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE					
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 20					
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Natural Moisture Content			UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)		
ELEV	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SHEAR STRENGTH (kPa)				Plastic Limit w _p	w	Liquid Limit w _L				
DEPTH (m)							● Unconfined ▲ Quick Triaxial	○ Cone blows/0.3m	✕ Field Vane & Sensitivity ⊠ Penetrometer + Lab Vane								
295.3	TOPSOIL: (290 mm)																
0.0																	
295.0																	
0.3	REWORKED FINE SAND AND SILT: trace organics, trace rootlets, pockets of organics, dark brown to brown, moist, loose		1	SS	4												
294.7																	
0.6			2A	SS	4												
294.4	CLAYEY SILT: trace to some sand, trace organics, trace rootlets, zones of silty fine sand, organic stain, dark brown to brown, moist, soft to firm		2B	SS													
1.0																	
294.1			3	SS	9												
1.2	SAND AND SILT: trace to some clay, trace gravel, brown, moist to wet, loose																
293.3																	
2.1	SANDY SILT TO SAND AND SILT: trace to some clay, trace gravel, layers of clayey silt, containing cobbles and boulders, brown, moist to wet, loose		4	SS	17												
292.4																	
2.9	SAND AND SILT TILL: trace clay, trace gravel, layers of sand and silt, containing cobbles and boulders, brown, moist, compact		5	SS	16												
3.0																	
4.0																	
5.0	--- auger grinding		6	SS	87 / 260 mm												
5.6																	
289.8	SILTY SAND: trace gravel, containing cobbles and boulders, brown, moist, very dense																
6.0																	
288.9			7	SS	50 / 150 mm												
6.4	END OF BOREHOLE																
Note: 1) Borehole caved at a depth of 5.3 m below ground surface (mBGS) upon completion of drilling.																	

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments							DRILLING DATA									
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI							METHOD: Continuous Flight Auger - Auto Hammer							DIAMETER: 155 mm		
PROJECT LOCATION: County Road 27, Barrie, Ontario							FIELD ENGINEER: RR							DATE: 2018-04-24		
DATUM: Geodetic							SAMPLE REVIEW: DX							REF. NO.: 17-2099GE		
BH LOCATION: See Borehole Location Plan							CHECKED: DL							ENCL. NO.: 21		
SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Natural Moisture Content				UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		SHEAR STRENGTH (kPa)				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	WATER CONTENT (%)		
							○ SPT 20 40 60 80	≥ Cone 20 40 60 80	blows/0.3m							
							● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ✕ Penetrometer + Lab Vane									
297.3	TOPSOIL: (280 mm)															
0.0																
297.0																
0.3	REWORKED SANDY SILT TO SAND AND SILT: trace clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose		1	SS	4											
296.7																
0.6	SAND AND SILT TO SILTY SAND: trace to some clay, trace gravel, layers/pockets of sand, containing cobbles and boulders, brown, moist, compact to very dense ---auger grinding		2	SS	14											
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PROJECT: Geotechnical Investigation for Proposed Residential Developments

DRILLING DATA

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

METHOD: Continuous Flight Auger - Auto Hammer

DIAMETER: 155 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario

FIELD ENGINEER: RR

DATE: 2018-04-23

DATUM: Geodetic

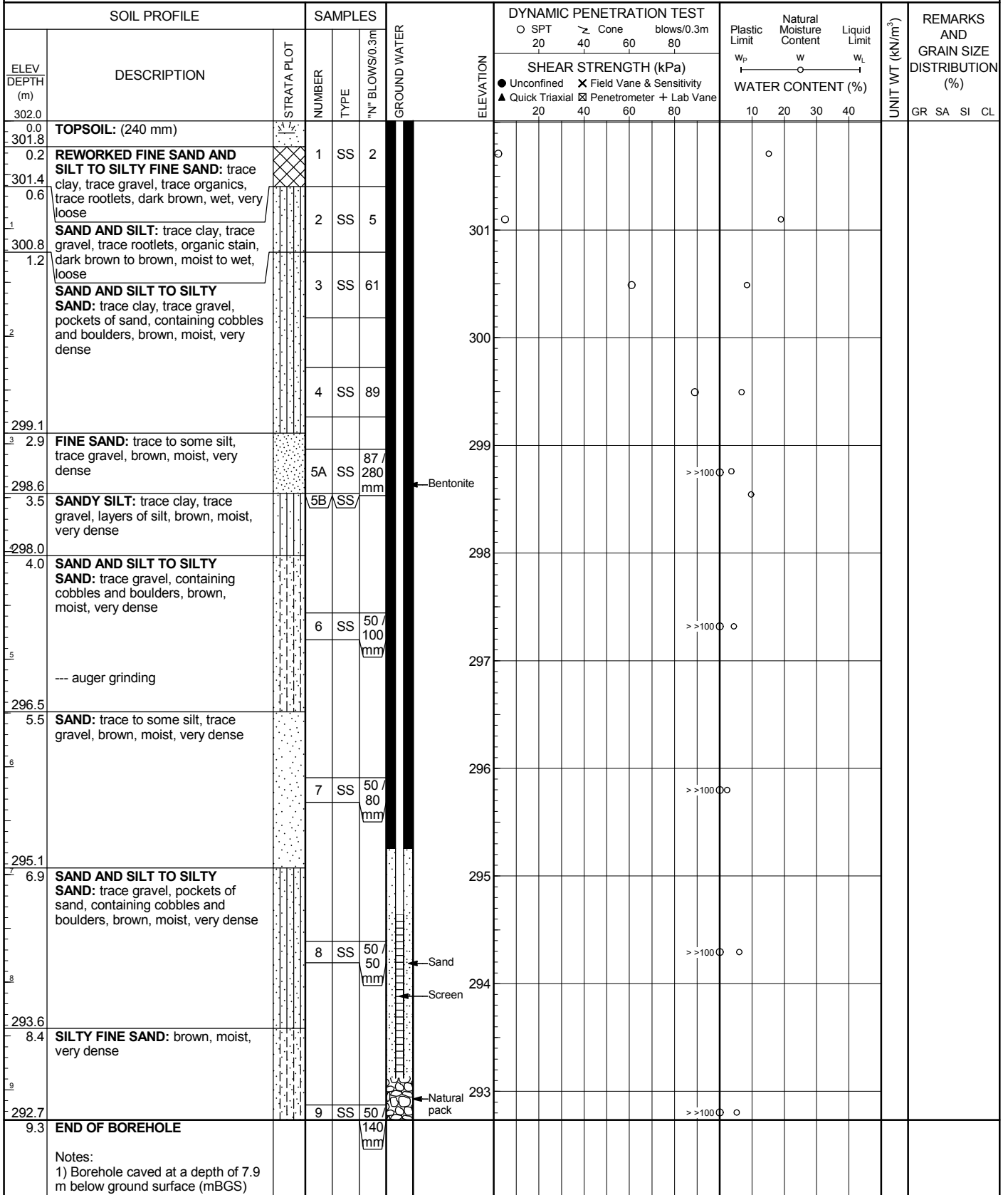
SAMPLE REVIEW: DX

REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan

CHECKED: DL

ENCL. NO.: 22



01 - GEOPRO SOIL LOG - GEOPRO 17-2099 BH LOG PROJECT DATA 20180529-DC-DX-GPJ - 2018-05-29 17:04

Continued Next Page

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

[illegible]

PROJECT: Geotechnical Investigation for Proposed Residential Developments						DRILLING DATA																				
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI						METHOD: Continuous Flight Auger - Auto Hammer						DIAMETER: 155 mm														
PROJECT LOCATION: County Road 27, Barrie, Ontario						FIELD ENGINEER: HR						DATE: 2018-04-30														
DATUM: Geodetic						SAMPLE REVIEW: DX						REF. NO.: 17-2099GE														
BH LOCATION: See Borehole Location Plan						CHECKED: DL						ENCL. NO.: 23														
SOIL PROFILE			SAMPLES			GROUND WATER			DYNAMIC PENETRATION TEST				Natural Moisture Content				UNIT WT (kN/m ³)		REMARKS AND GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m				ELEVATION	SHEAR STRENGTH (kPa)				WATER CONTENT (%)												
							○ SPT ≧ Cone blows/0.3m 20 40 60 80				Plastic Limit Natural Moisture Content Liquid Limit w _p w w _L															
							● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ☒ Penetrometer + Lab Vane																			
							20 40 60 80								10 20 30 40				GR SA SI CL							
305.1	TOPSOIL: (230 mm)		1	SS	8			305	○								○									
304.9			2	SS	40															○						
0.2			3	SS	36															○						
303.0	SILTY FINE SAND: brown, saturated, loose to compact								303	○										○						
2.1			4	SS	10																					
302.2	FINE SAND: trace to some silt, brown, saturated, compact								302	○										○						
2.9			5	SS	15																					
301.1	SAND AND SILT: trace to some clay, trace gravel, sand pockets, containing cobbles and boulders, brown, moist to wet, very dense					301																				
4.0			6	SS	59														○							
299.5	SAND: some silt, trace gravel, brown, wet, very dense					299											○									
5.6			7	SS	50																					
298.9	END OF BOREHOLE					100 mm																				
6.2																										
Notes: 1) Water encountered at a depth of 0.3 m below ground surface (mBGS) during drilling. 2) Borehole caved at a depth of 0.6 mBGS upon completion of drilling.																										

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments										DRILLING DATA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI										METHOD: Continuous Flight Auger - Auto Hammer										DIAMETER: 155 mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity

▲ s=3% Strain at Failure

PROJECT: Geotechnical Investigation for Proposed Residential Developments							DRILLING DATA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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SOIL PROFILE			SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				SHEAR STRENGTH (kPa)				WATER CONTENT (%)				UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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PROJECT: Geotechnical Investigation for Proposed Residential Developments					DRILLING DATA					
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI					METHOD: Continuous Flight Auger - Auto Hammer		DIAMETER: 155 mm			
PROJECT LOCATION: County Road 27, Barrie, Ontario					FIELD ENGINEER: HR		DATE: 2018-04-30			
DATUM: Geodetic					SAMPLE REVIEW: DX		REF. NO.: 17-2099GE			
BH LOCATION: See Borehole Location Plan					CHECKED: DL		ENCL. NO.: 27			
SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		SPT 20 40 60 80 blows/0.3m	Cone 20 40 60 80 blows/0.3m	Plastic Limit W _p	Natural Moisture Content W	
306.5										
0.0	TOPSOIL: (300 mm)									
306.2			1	SS	14					
0.3	SAND AND SILT TO SILTY SAND: trace clay, trace gravel, trace to some organics, trace rootlets, layers of peats, dark brown, moist, compact		2	SS	33					
305.9			3	SS	18					
0.6	FINE SAND: trace to some silt, trace gravel, brown, wet, compact to very dense									
1										
2			4	SS	37					
3			5	SS	54					
4										
5			6A	SS						
301.8	SILTY SAND TILL TO SAND AND SILT TILL: some clay to clayey, trace gravel, layers of clayey silt, zones/layers of sand and silt, containing cobbles and boulders, brown, moist to wet, dense to very dense		6B	SS	47					
4.7										
6										
7			7	SS	57					
300.0										
6.6	END OF BOREHOLE									
Notes: 1) Water encountered at a depth of 0.6 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 0.7 mBGS upon completion of drilling. 3) Borehole caved at a depth of 0.7 mBGS upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

 +³, ×³: Numbers refer to Sensitivity

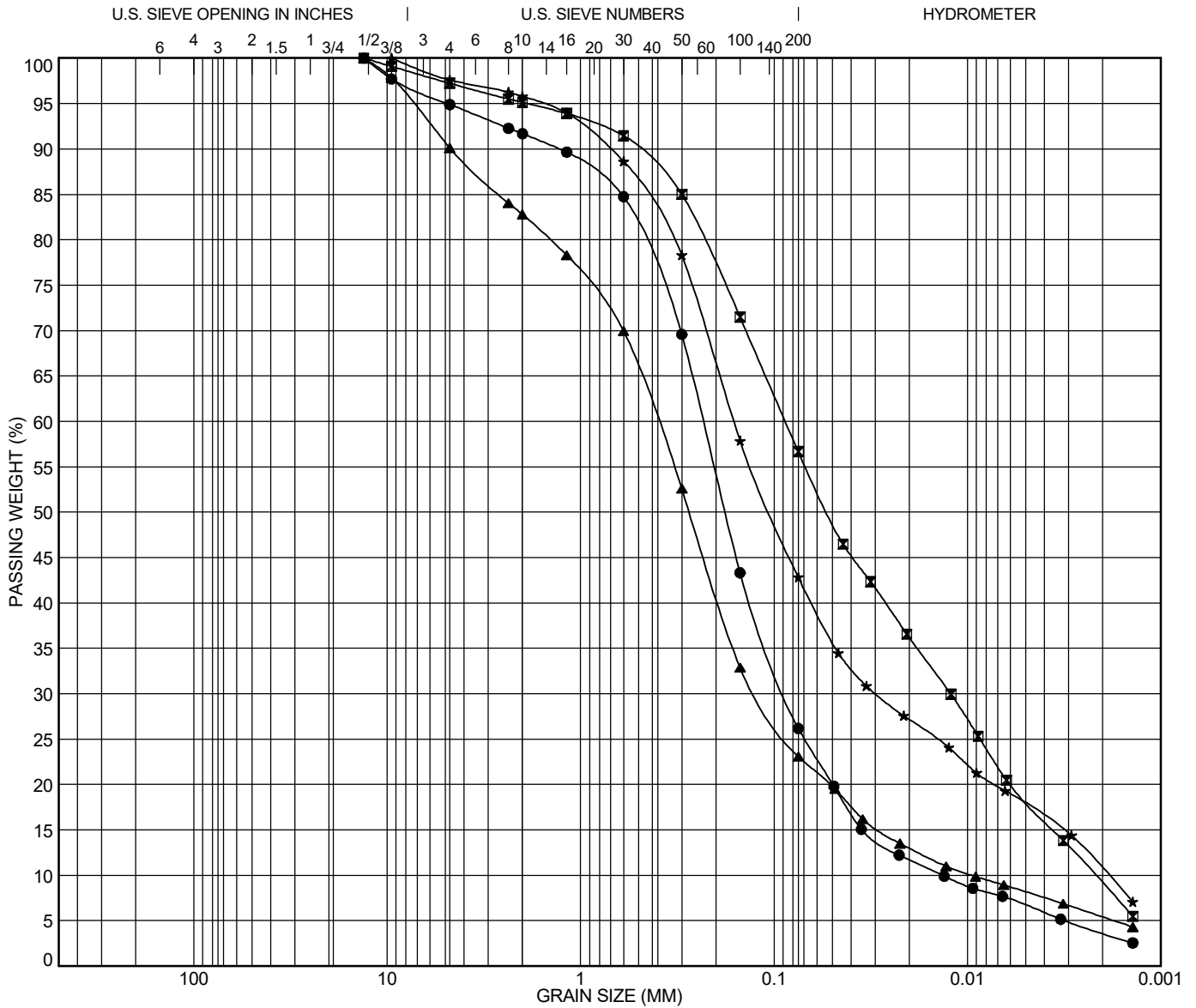
▲ s=3% Strain at Failure



GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

FIGURES



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	BH02	SS5	3.05							2.43	17.20
■	BH03	SS2	0.61							0.78	40.03
▲	BH04	SS3	1.22							3.91	42.36
★	BH06	SS3	1.22							2.93	86.12
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	BH02	SS5	3.05	13.2	0.233	0.088	0.014	5.1	68.7	22.5	3.6
■	BH03	SS2	0.61	13.2	0.088	0.012	0.002	2.8	40.6	47.6	9.1
▲	BH04	SS3	1.22	13.2	0.403	0.122	0.01	9.9	67.0	17.7	5.4
★	BH06	SS3	1.22	9.5	0.161	0.03	0.002	2.4	54.8	32.2	10.7



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

GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

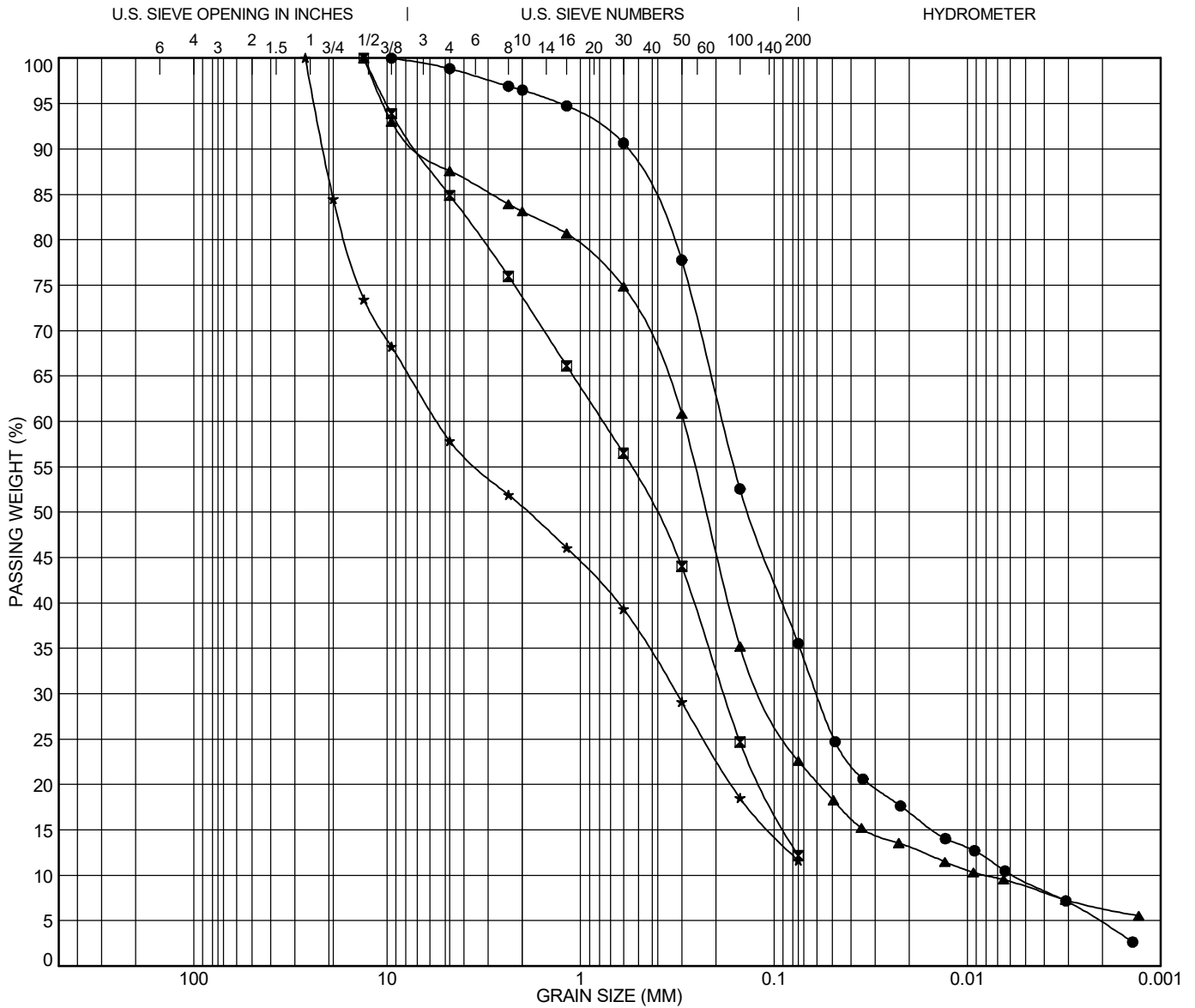
LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE

SAMPLED ON: 2018-04-26

FIGURE NO.: 1

TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification				Classification				LL	PL	PI	Cc	Cu
●	BH07	SS4	2.29								3.38	31.91
▣	BH07	SS8	7.62								0.64	11.54
▲	BH08	SS5	3.05								5.33	36.13
★	BH09	SS5B	3.20								0.29	86.23
Specimen Identification				D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	BH07	SS4	2.29	9.5	0.184	0.06	0.006	1.2	63.3	30.9	4.7	
▣	BH07	SS8	7.62	13.2	0.768	0.181		15.1	72.7	12.2		
▲	BH08	SS5	3.05	13.2	0.293	0.113	0.008	12.4	65.0	16.2	6.4	
★	BH09	SS5B	3.20	26.5	5.487	0.319		42.2	46.2	11.6		



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GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

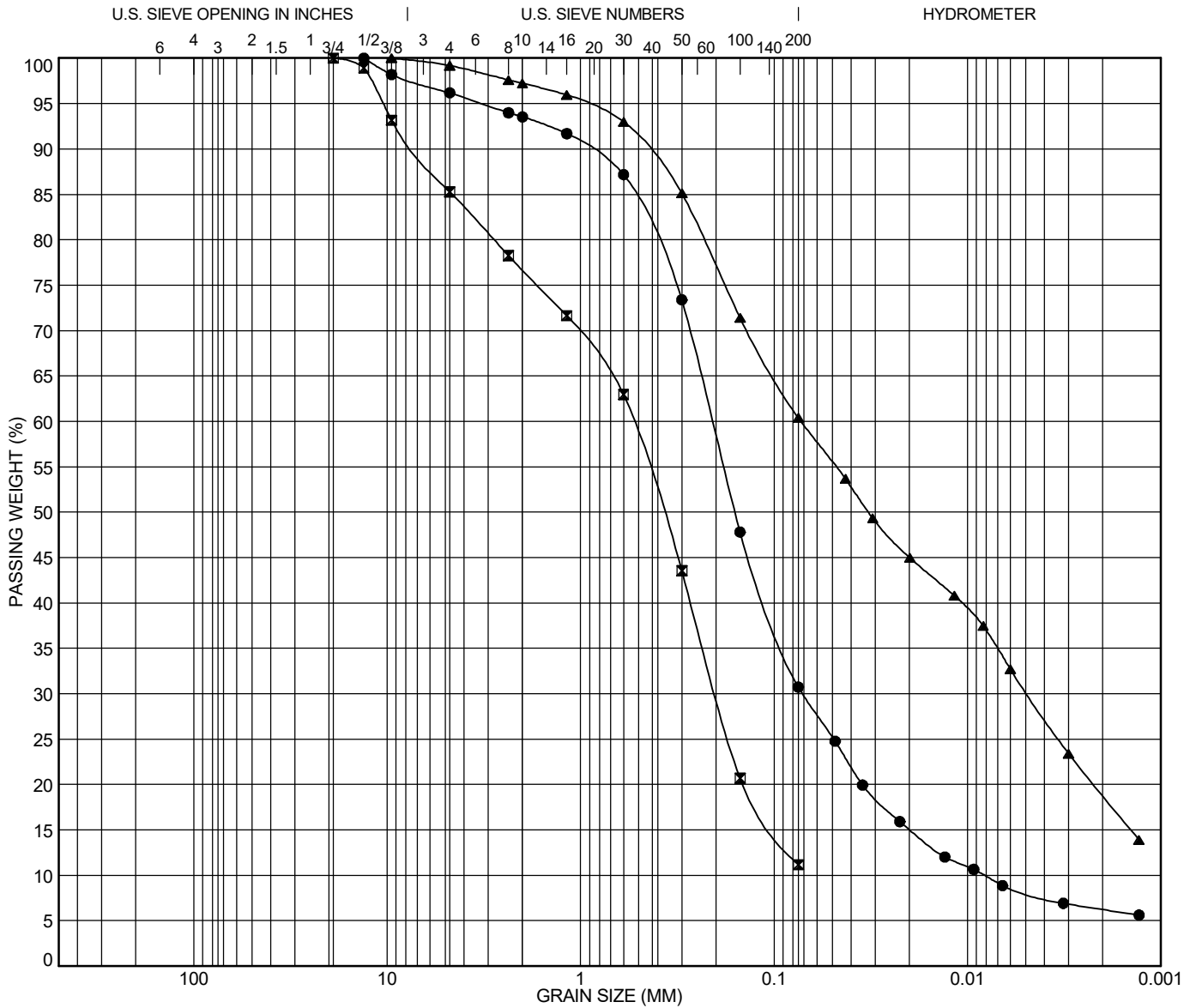
LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE

SAMPLED ON: 2018-04-23

FIGURE NO.: 2

TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	BH11	SS3	1.22							2.94	25.41
■	BH12	SS3	1.22							1.06	7.84
▲	BH13	SS2	0.61								
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	BH11	SS3	1.22	13.2	0.209	0.071	0.008	3.8	65.4	24.5	6.2
■	BH12	SS3	1.22	19	0.54	0.199		14.7	74.1	11.2	
▲	BH13	SS2	0.61	9.5	0.073	0.005		0.8	38.8	41.6	18.8



GeoPro
CONSULTING LIMITED

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GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

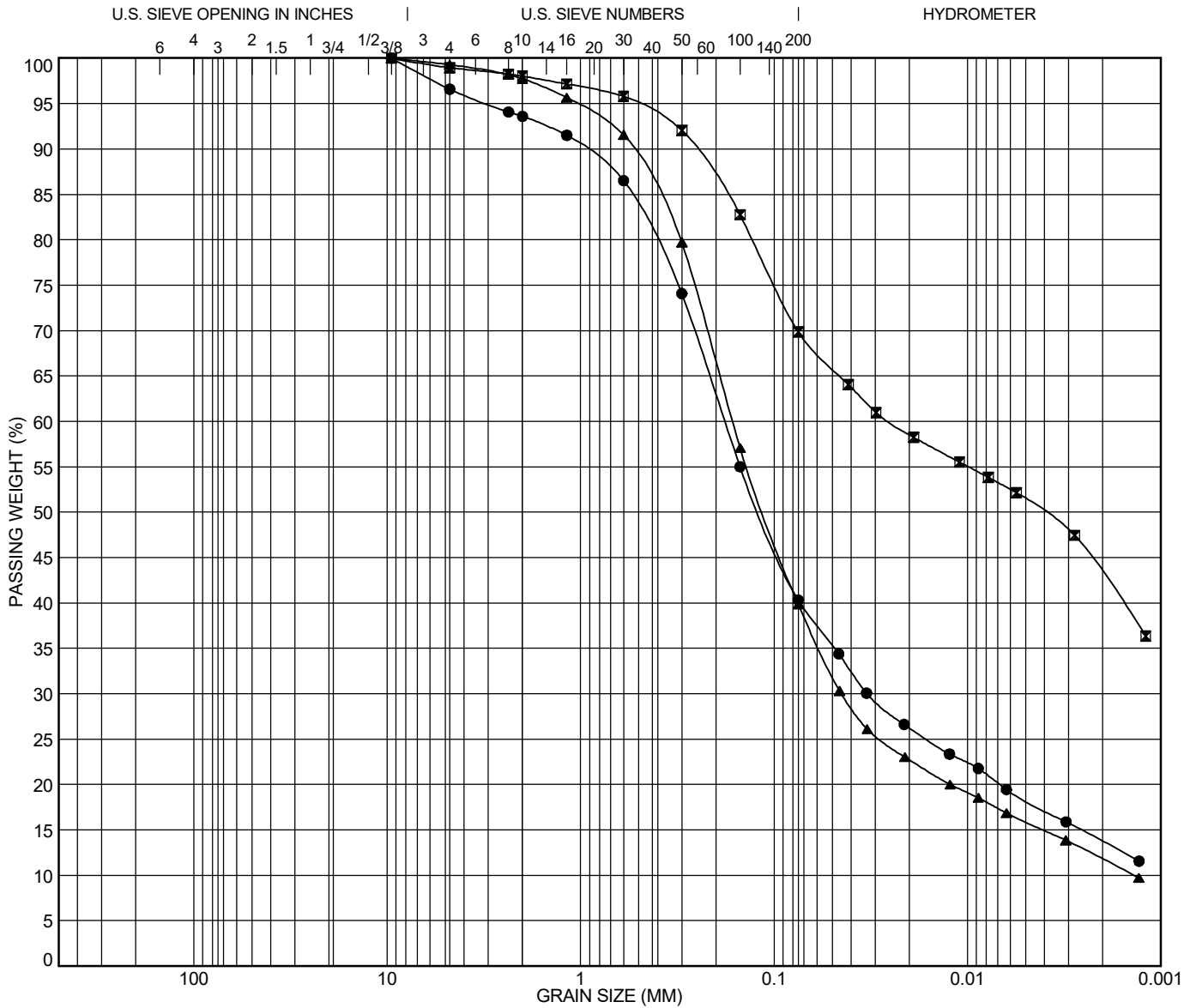
LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE

SAMPLED ON: 2018-04-24

FIGURE NO.: 3

TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	BH15	SS4	2.29								
■	BH17	SS2	0.76								
▲	BH20	SS4	2.29							8.85	118.54
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	BH15	SS4	2.29	9.5	0.18	0.033	3.4	56.3	26.6	13.7	
■	BH17	SS2	0.76	9.5	0.025		1.0	29.1	26.8	43.0	
▲	BH20	SS4	2.29	9.5	0.164	0.045	0.001	0.7	59.4	28.1	



GeoPro
CONSULTING LIMITED

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

GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

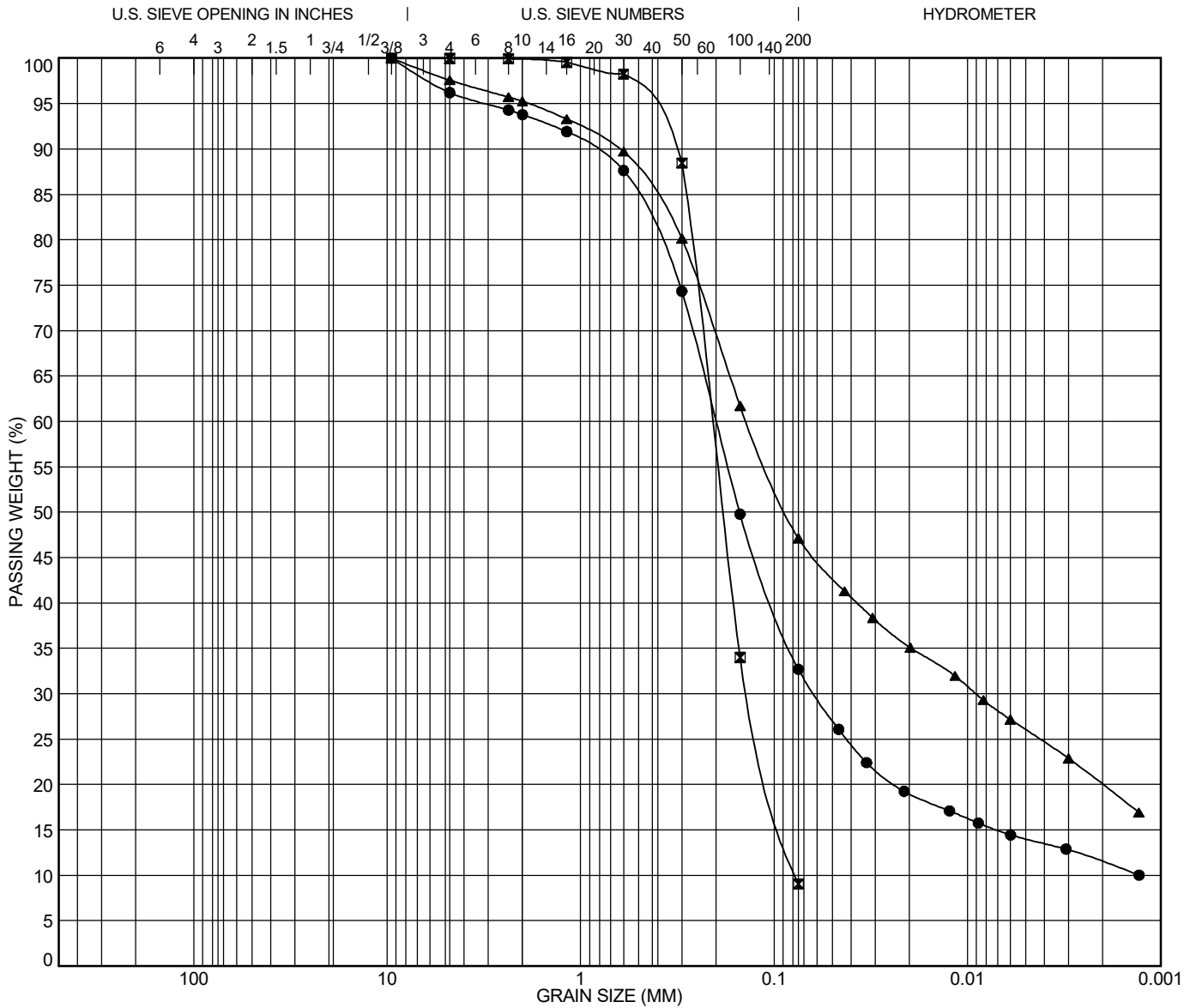
LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE

SAMPLED ON: 2018-04-24

FIGURE NO.: 4

TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification				Classification				LL	PL	PI	Cc	Cu
●	BH23	SS6	4.57									
■	BH25	SS3	1.22								1.12	2.71
▲	BH26	SS6B	4.70									
Specimen Identification				D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	BH23	SS6	4.57	9.5	0.2	0.062		3.8	63.5	21.3	11.4	
■	BH25	SS3	1.22	9.5	0.209	0.134	0.077	0.0	90.9	9.0		
▲	BH26	SS6B	4.70	9.5	0.138	0.009		2.4	50.5	27.2	20.0	



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GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE

SAMPLED ON: 2018-04-30

FIGURE NO.: 5

TESTED ON: 2018-05-15



GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

APPENDIX A



GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted, imported soil that meets specific engineering requirements that is free of organics, topsoil, debris and any other deleterious materials, and that has been continually monitored on a full-time basis by a qualified geotechnical representative under the supervision of the geotechnical engineer is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other site(s). In general, most Ontario soils are too wet to achieve 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be used for engineered fill. Imported non-cohesive granular soils, such as well-graded sandy/granular soils, are preferred for all engineered fill. We recommend that OPSS Granular 'B' sand and gravel materials be used for the engineered fill material.

Adverse weather conditions, such as rain or subzero temperatures, make the placement of engineered fill to the required degree of compaction difficult or impossible; engineered fill cannot be placed during freezing conditions (i.e. normally between December 15 and April 1 in Southern Ontario).

The locations and elevations of the foundations on the engineered fill pad are critical, and certification by a qualified surveyor, to ensure that the proposed foundations are to be located within the stipulated boundaries, is mandatory. Since layout stakes are often damaged or removed during engineered fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same engineered fill as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, and contractors, and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to the site work involving engineered fill, a kick-off site meeting, to discuss all aspects of the engineered fill placement, must be carried out with all parties. The surveyor, contractor, design engineers and geotechnical engineer must attend the kick-off meeting. At the meeting, the construction schedule and the detailed design information regarding the engineered fills (such as the boundaries, thickness, competent subgrade elevations, specifications, and any special requirements from the engineers) will be discussed and determined. The contractor must provide the construction schedule including the source site(s) of the fill materials, which will have to be reviewed by the geotechnical engineer. The geotechnical engineer will arrange for soil sampling at the source site(s) and carry out the related laboratory testing. No soils can be hauled to the site prior to approval by the geotechnical engineer.
2. Detailed design drawings, such as grading drawings and other relevant drawings indicating the proposed structures or utilities as well as the underside and finished elevations of the engineered fill, should be provided in advance, and any concerns from a geotechnical perspective can be discussed at the kick-off site meeting and then approved by the engineers and other relevant parties.
3. The building footprint and base of the pad (including basements, garages, etc.) must be defined by offset stakes that will remain in place until the footings and service connections are all constructed. Confirmation, such as that the footings are within the pad, the service lines are in place, and the

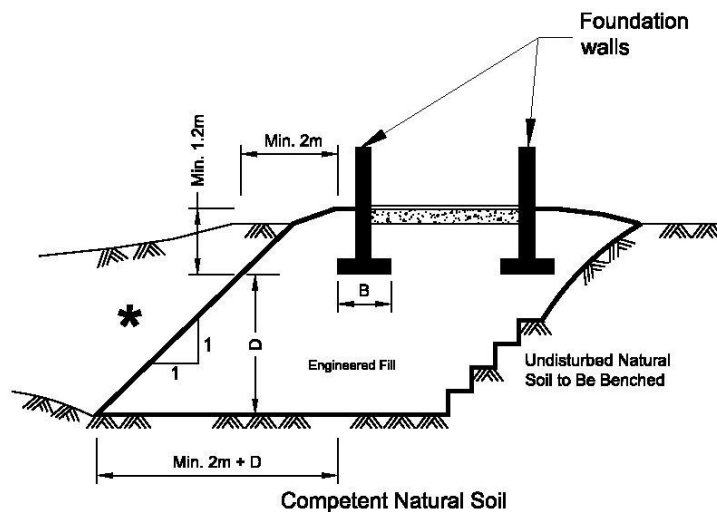
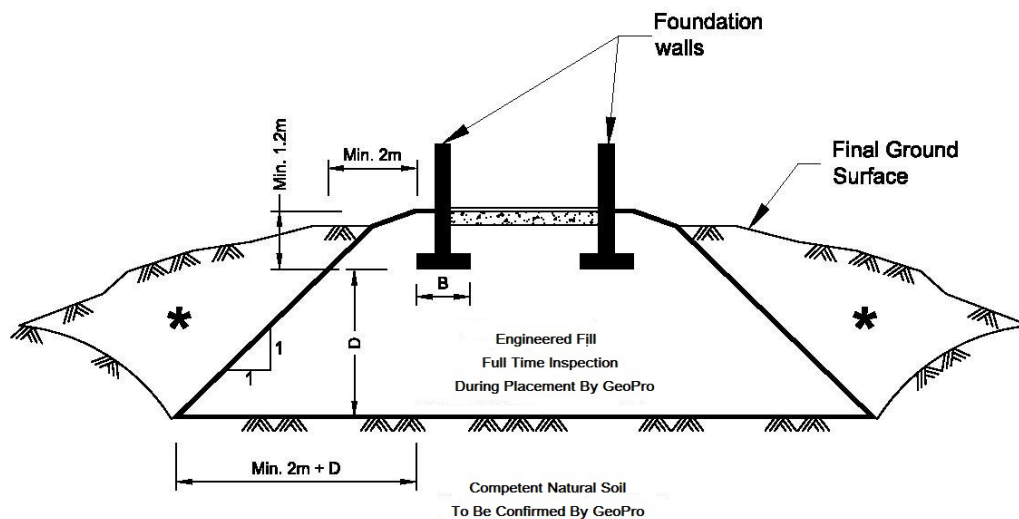


grade conforms to drawings, must be obtained (by the owner) in writing from the surveyor and GeoPro. Without this confirmation in writing, no responsibility for the performance of the engineered fill can be accepted by GeoPro. Survey drawings of the pre and post fill location and elevations will also be required.

4. The subgrade area must be stripped of all topsoil, existing fill materials, loosened/softened native soils and any other deleterious materials. The subgrade must be proof-rolled by a qualified engineering representative from GeoPro. Any soft/loose spots revealed by proof-rolling must be subexcavated and replaced with engineered fill. The stripped subgrade must be examined and approved by a geotechnical engineer prior to the placement of engineered fill.
5. The approved engineered fill must be compacted to 98% SPMDD throughout. Granular fill materials consisting of well-graded, cohesionless sand and gravel are preferred. Engineered fill should not be placed (where it will support foundations) during the winter months. Engineered fill compacted to 98% SPMDD will settle under its own weight to approximately 0.25% to 0.75% of the fill height, and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement, due to consolidation of the underlying soils from the structures and fill loads, will occur and should be evaluated prior to placing the engineered fill.
6. Full-time geotechnical inspection and compaction testing by GeoPro during the placement of engineered fill must be required. The placement of the engineered fill must not commence or continue without the presence of GeoPro's representative.
7. Excavations must be carried out in accordance with the Occupational Health and Safety Regulations of Ontario.
8. Surface water cannot be allowed to pond in any area of the engineered fill footprint.
9. Clear stone backfill must not be used in any portion of the engineered fill unless it is approved by GeoPro in writing.
10. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for the minimum requirements. Take careful note that the projection of the compacted pad beyond the footing (at footing level) is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.
11. A bearing resistance of 100 kPa to 150 kPa at SLS (150 kPa to 225 kPa at a factored ULS), or that being specified in the geotechnical report, can be used provided that all conditions outlined are adhered to. A minimum footing width of 500 mm (20 inches) is suggested, and footings must be provided with nominal steel reinforcement.
12. The owner may choose the same contractor or a different contractor for the foundation construction after completion of the engineered fill pad. In any case, the prepared footing bases must be inspected and evaluated by an engineering representative from GeoPro prior to pouring footing concrete. All excavations must be backfilled, under full-time supervision by GeoPro, to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in the excavations. Clear stone backfill is not allowed unless it is approved by GeoPro.
13. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends, and at any stoppage in work, in order to promote rapid runoff of rainwater and to avoid any ponding of surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take-up.



14. If the engineered fill placement is suspended for a long period of time, the engineered fill pad must be inspected by the geotechnical engineer prior to resuming the engineered fill placement. The locations of the proposed structures must be reconfirmed by the project surveyor, and the offset stakes should be reinstated by the project surveyor prior to resuming the engineered fill placement.
15. The geometry of the engineered fill, as illustrated in these General Requirements, is general and generic in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.
16. These guidelines are to be read in conjunction with GeoPro's report.



* Backfill in this area to be as per the GeoPro report



GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

APPENDIX B

C.O.C.: G73815

REPORT No. B18-12995

Rev. 1

Report To:

GeoPro Consulting Ltd

40 Vogell Rd, Unit 23

Richmond Hill ON L4B 3N6

Attention: Bujing Guan

Caduceon Environmental Laboratories

110 West Beaver Creek Rd Unit 14

Richmond Hill ON L4B 1J9

Tel: 289-475-5442

Fax: 289-562-1963

DATE RECEIVED: 15-May-18

JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	10	Kingston	US	22-May-18	A-CN s K	in house
Conductivity	10	Richmond Hill	ABL	16-May-18	A-COND-02 s RH	MOEE3138
pH	10	Richmond Hill	ABL	15-May-18	A-pH-02 (rh)	MOEE 3137
Chromium (VI)	10	Holly Lane	VK	16-May-18	D-CRVI-02 (o)	EPA7196A
Mercury	10	Holly Lane	PBK	22-May-18	D-HG-01 (o)	EPA 7471A
Boron - HWS	10	Holly Lane	TPR	18-May-18	D-HWE s	MOE3470
Sodium Adsorption Ratio	10	Holly Lane	TPR	22-May-18	D-ICP-01 SAR (o)	SM 3120
Metals - ICP-OES	10	Holly Lane	TPR	22-May-18	D-ICP-02 (o)	EPA 6010
Metals - ICP-MS	10	Holly Lane	RPE	22-May-18	D-ICPMS-01 (o)	EPA 6020

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke

Lab Manager

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C.O.C.: G73815

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JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Client I.D.			BH 5 SS1+SS2	BH 7 SS1+SS2+SS 3	BH 10 SS4+SS5	BH 13 SS2+SS3	O. Reg. 153 Tbl. 1 - All	
Sample I.D. Date Collected			B18-12995-1 26-Apr-18	B18-12995-2 25-Apr-18	B18-12995-3 23-Apr-18	B18-12995-4 24-Apr-18		
Parameter	Units	R.L.						
pH @25°C	pH Units		7.53	7.56	8.07	7.90		
Conductivity @25°C	mS/cm	0.07	0.20	0.25	0.08	0.12	0.57	
Cyanide (Free)	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.051	
Sodium Adsorption Ratio	units		0.168	0.215	0.200	0.165	2.4	
Antimony	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.3	
Arsenic	µg/g	0.5	0.8	1.2	< 0.5	0.8	18	
Barium	µg/g	1	49	116	25	57	220	
Beryllium	µg/g	0.2	0.3	0.6	< 0.2	0.3	2.5	
Boron	µg/g	0.5	4.1	5.7	2.5	5.0	36	
Boron (HWS)	µg/g	0.02	< 0.02	< 0.02	0.02	< 0.02		
Cadmium	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.2	
Chromium	µg/g	1	16	23	10	15	70	
Chromium (VI)	µg/g	0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.66	
Cobalt	µg/g	1	5	8	4	6	21	
Copper	µg/g	1	8	13	5	11	92	
Lead	µg/g	5	< 5	5	< 5	< 5	120	
Mercury	µg/g	0.005	0.013	0.017	< 0.005	< 0.005	0.27	
Molybdenum	µg/g	1	< 1	3	1	< 1	2	
Nickel	µg/g	1	9	15	5	10	82	
Selenium	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.5	
Silver	µg/g	0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.5	
Thallium	µg/g	0.1	< 0.1	0.1	< 0.1	< 0.1	1	
Uranium	µg/g	0.1	0.4	0.5	0.3	0.4	2.5	

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



Christine Burke
Lab Manager

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JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Parameter	Client I.D.		BH 5 SS1+SS2	BH 7 SS1+SS2+SS 3	BH 10 SS4+SS5	BH 13 SS2+SS3	O. Reg. 153 Tbl. 1 - All	
	Sample I.D.	Date Collected	B18-12995-1 26-Apr-18	B18-12995-2 25-Apr-18	B18-12995-3 23-Apr-18	B18-12995-4 24-Apr-18		
	Units	R.L.						
Vanadium	µg/g	1	31	40	30	29	86	
Zinc	µg/g	3	20	38	16	26	290	

1. Revised report to correct the project number as per client request

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



Christine Burke
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JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Parameter	Client I.D.		BH 4 SS1	BH 17 SS2+SS3	BH 15 SS4+SS5	BH 22 SS2+SS3	O. Reg. 153	
	Sample I.D.	Date Collected	B18-12995-5 30-Apr-18	B18-12995-6 02-May-18	B18-12995-7 30-Apr-18	B18-12995-8 30-Apr-18	Tbl. 1 - All	
Units	R.L.							
pH @25°C	pH Units		7.89	7.90	7.95	8.12		
Conductivity @25°C	mS/cm	0.07	0.10	0.52	0.11	< 0.07	0.57	
Cyanide (Free)	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.051	
Sodium Adsorption Ratio	units		0.146	3.19	0.326	0.151	2.4	
Antimony	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.3	
Arsenic	µg/g	0.5	0.8	0.5	< 0.5	< 0.5	18	
Barium	µg/g	1	55	76	48	9	220	
Beryllium	µg/g	0.2	0.2	0.4	0.2	< 0.2	2.5	
Boron	µg/g	0.5	4.1	6.0	4.4	1.3	36	
Boron (HWS)	µg/g	0.02	< 0.02	< 0.02	< 0.02	< 0.02		
Cadmium	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.2	
Chromium	µg/g	1	13	19	13	6	70	
Chromium (VI)	µg/g	0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.66	
Cobalt	µg/g	1	5	7	5	2	21	
Copper	µg/g	1	8	11	8	2	92	
Lead	µg/g	5	< 5	< 5	< 5	< 5	120	
Mercury	µg/g	0.005	0.005	0.009	< 0.005	< 0.005	0.27	
Molybdenum	µg/g	1	< 1	< 1	< 1	< 1	2	
Nickel	µg/g	1	8	12	8	2	82	
Selenium	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.5	
Silver	µg/g	0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.5	
Thallium	µg/g	0.1	< 0.1	< 0.1	< 0.1	< 0.1	1	
Uranium	µg/g	0.1	0.4	0.4	0.3	0.3	2.5	
Vanadium	µg/g	1	29	34	28	21	86	

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



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JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

			Client I.D.	BH 4 SS1	BH 17 SS2+SS3	BH 15 SS4+SS5	BH 22 SS2+SS3	O. Reg. 153 Tbl. 1 - All	
			Sample I.D.	B18-12995-5	B18-12995-6	B18-12995-7	B18-12995-8		
			Date Collected	30-Apr-18	02-May-18	30-Apr-18	30-Apr-18		
Parameter	Units	R.L.							
Zinc	µg/g	3		21	30	20	6	290	

1. Revised report to correct the project number as per client request

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



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DATE RECEIVED: 15-May-18

JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Client I.D.			BH 24 SS1+SS2	BH 26 SS2+SS3	O. Reg. 153		
Sample I.D.			B18-12995-9	B18-12995-10	Tbl. 1 - All		
Date Collected			24-Apr-18	24-Apr-18			
Parameter	Units	R.L.					
pH @25°C	pH Units		6.41	7.98			
Conductivity @25°C	mS/cm	0.07	0.23	< 0.07		0.57	
Cyanide (Free)	µg/g	0.05	< 0.05	< 0.05		0.051	
Sodium Adsorption Ratio	units		0.190	0.201		2.4	
Antimony	µg/g	0.5	< 0.5	< 0.5		1.3	
Arsenic	µg/g	0.5	1.4	< 0.5		18	
Barium	µg/g	1	87	12		220	
Beryllium	µg/g	0.2	0.5	< 0.2		2.5	
Boron	µg/g	0.5	3.8	1.9		36	
Boron (HWS)	µg/g	0.02	< 0.02	< 0.02			
Cadmium	µg/g	0.5	< 0.5	< 0.5		1.2	
Chromium	µg/g	1	24	7		70	
Chromium (VI)	µg/g	0.2	< 0.2	< 0.2		0.66	
Cobalt	µg/g	1	9	2		21	
Copper	µg/g	1	12	3		92	
Lead	µg/g	5	6	< 5		120	
Mercury	µg/g	0.005	0.020	< 0.005		0.27	
Molybdenum	µg/g	1	< 1	< 1		2	
Nickel	µg/g	1	14	2		82	
Selenium	µg/g	0.5	< 0.5	< 0.5		1.5	
Silver	µg/g	0.2	< 0.2	< 0.2		0.5	
Thallium	µg/g	0.1	< 0.1	< 0.1		1	
Uranium	µg/g	0.1	0.5	0.5		2.5	
Vanadium	µg/g	1	49	17		86	

O. Reg. 153 - Soil, Ground Water and Sediment Standards

Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



Christine Burke

Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

C.O.C.: G73815

REPORT No. B18-12995

Rev. 1

Report To:

GeoPro Consulting Ltd
40 Vogell Rd, Unit 23
Richmond Hill ON L4B 3N6
Attention: Bujing Guan

Caduceon Environmental Laboratories
110 West Beaver Creek Rd Unit 14
Richmond Hill ON L4B 1J9
Tel: 289-475-5442
Fax: 289-562-1963

DATE RECEIVED: 15-May-18

JOB/PROJECT NO.:

DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Client I.D.			BH 24 SS1+SS2	BH 26 SS2+SS3			O. Reg. 153 Tbl. 1 - All	
Sample I.D.			B18-12995-9	B18-12995-10				
Date Collected			24-Apr-18	24-Apr-18				
Parameter	Units	R.L.						
Zinc	µg/g	3	30	7			290	

1. Revised report to correct the project number as per client request

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



Christine Burke
Lab Manager

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DATE RECEIVED: 15-May-18

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DATE REPORTED: 25-May-18

P.O. NUMBER: 17-2099GE

SAMPLE MATRIX: Soil

WATERWORKS NO.

Summary of Exceedances

Table 1 - Res/Park/Institutional/Indus/Com/Commun		
BH 7 SS1+SS2+SS3	Found Value	Limit
Molybdenum (µg/g)	3	2
BH 17 SS2+SS3	Found Value	Limit
Sodium Adsorption Ratio (units)	3.19	2.4

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 1 - All - Table 1 - Res/Park/Institutional/Indus/Com/Commun



Christine Burke
Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Report To:

GeoPro Consulting Ltd
40 Vogell Rd
Richmond Hill, ON L4B 3N6

Attention: Bujing Guan

Date Submitted: 2018/05/15
Samples Submitted By: Fan Wu
Samples Received By: Christine Burke
Date Reported: 2018/05/23
Sample Matrix: Soil
Temperature Upon Receipt (°C): 7.1

Caduceon Environmental Laboratories

110 West Beaver Creek Rd
Richmond Hill, ON L4B 1J9
Tel: (289) 475-5442
Fax: (866) 562-1963

Job/Project No.:
COC No.: G73815
P.O. Number: 17-2099GE
Waterworks No.: -
Quote No.: P18_GeoPro_Intro
Invoice To: Bujing Guan

Analyses	Qty.	Site Analyzed	Analyst Initials	Date Extracted	Date Analyzed	Time Analyzed	Date Approved	Laboratory Method	Method Reference
Metals - ICP-AES	10	Ottawa	TPR	2018/05/22	2018/05/22	14:03	2018/05/22	D-ICP-02 (o)	EPA 6010
pH	10	Richmond Hill	ABL	NA	2018/05/15	16:50	2018/05/15	A-pH-02 (rh)	MOEE 3137
Conductivity	10	Richmond Hill	ABL	NA	2018/05/16	15:40	2018/05/16	A-COND-02 s RH	MOEE3138
Boron - HWS	10	Ottawa	TPR	2018/05/18	2018/05/18	12:38	2018/05/18	D-HWE s	EPA 200.7
Mercury	10	Ottawa	PBK	2018/05/22	2018/05/22	16:20	2018/05/22	D-HG-01 (o)	EPA 7471A
Metals - ICP-AES	10	Ottawa	TPR	2018/05/22	2018/05/22	14:29	2018/05/22	D-ICP-01 (o)	SM 3120
Cyanide (Free)	10	Kingston	US	NA	2018/05/22	10:55	2018/05/22	A-CN s K	in house
Chromium (VI)	10	Ottawa	VK	2018/05/16	2018/05/16	09:31	2018/05/18	D-CRVI-02 (o)	EPA7196A
Metals - ICP-MS	10	Ottawa	RPE	2018/05/22	2018/05/22	15:47	2018/05/23	D-ICPMS-01 (o)	EPA 6020

NA = Not Applicable

Revised report to correct the project number as per client request

GENERAL COMMENTS



Christine Burke
Lab Manager

Parameters	MDL	QC Data								
		LCS Sample (% Rec.)		Duplicate				Lab Blank	MS/RM (% Rec.)	
		Found	Limits	Result 1	Result 2	R.P.D.	Limits (%)		Found	Limits
Cyanide (Free)	0.05	100	80-120	< MDL	< MDL	NC	35	< MDL	100	70-130
Conductivity @25°C	0.07	91	80-120	0.17	0.18	NC	30	< MDL	NA	70-130
pH @25°C		7.35	7.14-7.54	7.34	7.44	0.10	0.3 pH units	-	NA	70-130
Boron (HWS)	0.02	106	70-130	< MDL	< MDL	NC	40	< MDL	118	60-140
Chromium (VI)	0.2	100	80-120	< MDL	< MDL	NC	35	< MDL	49	25-124
Mercury	0.005	90	80-120	1.73	1.64	5.3	30	< MDL	90	70-130
Barium	1	108	80-120	368	392	6.3	30	1	110	70-130
Beryllium	0.2	108	80-120	1.1	1.2	NC	30	< MDL	100	70-130
Boron	0.5	109	80-120	9.9	11.5	15.0	30	< MDL	98	70-130
Cadmium	0.5	113	80-120	1.6	1.5	NC	30	< MDL	122	70-130
Chromium	1	112	80-120	75	75	0	30	5	100	70-130
Cobalt	1	111	80-120	19	21	10.0	30	< MDL	130	70-130
Copper	1	110	80-120	86	85	1.2	30	< MDL	109	70-130
Lead	5	115	80-120	927	1000	7.6	30	< MDL	114	70-130
Molybdenum	1	101	80-120	1	1	NC	30	< MDL	87	70-130
Nickel	1	113	80-120	38	39	2.6	30	3	120	70-130
Silver	0.2	110	80-120	0.5	1.4	NC	30	< MDL	70	70-130
Vanadium	1	115	80-120	56	59	5.2	30	< MDL	114	70-130
Zinc	3	111	80-120	574	573	0.2	30	< MDL	110	70-130
Antimony	0.5	98	80-120	2.9	3.7	NC	30	< MDL	102	70-130
Arsenic	0.5	84	80-120	19.3	19.2	0.5	30	< MDL	96	70-130
Selenium	0.5	80	80-120	1.6	1.5	NC	30	< MDL	81	70-130
Thallium	0.1	110	80-120	0.6	0.6	NC	30	< MDL	84	70-130
Uranium	0.1	106	80-120	0.8	0.8	NC	30	< MDL	108	70-130

Soil results are expressed in µg/g unless otherwise stated

Water results are expressed in mg/L, except SVOC and VOC are in µg/L, unless otherwise stated

LCS = Laboratory Control Standard

R.P.D. = Relative Percent Difference of Duplicate Pairs at > 10x M.D.L.

MDL = Method Detection Limit

NC = Not Calculated

- = Not Requested/Analyzed

NA = Not Applicable

MS/RM = Matrix Spike or Reference Material

TESTING REQUIREMENTS

☒ O.Reg 153 Table 1 Residential ☐ MISA Guidelines
☐ Surface Soil ☐ Sub Surface Soil (O.Reg 153) ☐ O.Reg 558 Leachate Analysis
☐ Yes ☐ No Record of Site Condition (O.Reg 153) Disposal Site: _____
☐ Provincial Water Quality Objectives ☐ Landfill Monitoring
☐ Sewer Use By-Law: _____ ☐ Other: _____

REPORT NUMBER (Lab Use)

B18-12995

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☒ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Indicate Laboratory Samples are submitted to: ☐ Kingston ☐ Ottawa ☒ Richmond Hill ☐ Windsor ☐ Barrie ☐ London

Organization: <u>Geopro Consulting Ltd</u>	Address and Invoicing Address (if different) <u>Report: 10 Kato @ geoproconsulting.ca</u> <u>3000 Highway 7 East, Unit 10, Richmond Hill, ON L4B 1N1</u> <u>3000 Highway 7 East, Unit 10, Richmond Hill, ON L4B 1N1</u>	ANALYSES REQUESTED (Print Test in Boxes)	Suspected Highly Contaminated	TURNAROUND SERVICE REQUESTED (see back page)	
Contact: <u>Brijing Gnan</u>					
Tel: <u>905-237-8336</u>					
Fax: <u>905-748-3699</u>					
Email: <u>hguan@geoproconsulting.ca</u>	Quote No.: <u>P18-Geopro-Intro</u>	Project Name: <u>18-2086G</u>			
	P.O. No.: _____	Additional Info: _____			

Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

Lab No:	Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	Indicate Test For Each Sample By Using A Check Mark In The Box Provided										Field pH	Field Temp.	# Bottles/ Sample	Field Filtered(Y/N)
1	BH5 SS1+SS2		S	18-04-26	AM	✓												2	
2	BH7 SS1+SS2+SS3		S	18-04-25	AM	✓												2	
3	BH10 SS4+SS5		S	18-04-23	AM	✓												2	
4	BH13 SS2+SS3		S	18-04-24	AM	✓												2	
5	BH4 SS1		S	18-04-30	AM	✓												2	
6	BH17 SS2+SS3		S	18-05-02	AM	✓												2	
7	BH15 SS4+SS5		S	18-04-30	AM	✓												2	
8	BH22 SS2+SS3		S	18-04-30	AM	✓												2	
9	BH24 SS1+SS2		S	18-04-24	AM	✓												2	
10	BH26 SS2+SS3		S	18-04-24	AM	✓												2	
K-D SPLIT FOR CN <u>CH</u> O → JAR RH → JAR																			

SAMPLE SUBMISSION INFORMATION		SHIPPING INFORMATION		REPORTING / INVOICING		SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)	
Print: <u>Pan Wix</u>	Submitted by: _____	Client's Courier ☐	Invoice ☐	Report by Fax ☐	Received By (print): <u>SHERI</u>	Signature: <u>[Signature]</u>	
Sign: <u>[Signature]</u>		Caduceon's Courier ☐	# of Pieces _____	Report by Email ☒	Date Received (yy-mm-dd): <u>18-05-15</u>	Time Received: <u>9:50</u>	
		Drop Off ☐		Invoice by Email ☒	Laboratory Prepared Bottles: ☒ Yes ☐ No		
		Caduceon (Pick-up) ☐		Invoice by Mail ☐	Sample Temperature °C: <u>7.1</u>	Labeled by: <u>CH</u>	
Comments: _____						Page <u>1</u> of <u>1</u>	
						G <u>73815</u>	

LIMITATIONS TO THE REPORT

This report is intended solely for the Client named. The report is prepared based on the work has been undertaken in accordance with normally accepted geotechnical engineering practices in Ontario.

The comments and recommendations given in this report are based on information determined at the limited number of the test hole and test pit locations. The boundaries between the various strata as shown on the borehole logs are based on non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation rather than a precise plane of geological change. Subsurface and groundwater conditions between and beyond the test holes and test pits may differ significantly from those encountered at the test hole and test pit locations. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole and test pit locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

It should be noted that the results of the designated substance and chemical analysis refer only to the sample analyzed which was obtained from specific sampling location and sampling depth, and the presence of designated substance and soil chemistry may vary between and beyond the location and depth of the sample taken. Please note that the level of chemical testing outlined herein is meant to provide a broad indication of soil quality based on the limited soil samples tested. The analytical results contained in this report should not be considered a warranty with respect to the soil quality or the use of the soil for any specific purpose or the acceptability of the soils for any excess soil receiving sites.

The report reflects our best judgment based on the information available to GeoPro Consulting Limited at the time of preparation. Unless otherwise agreed in writing by GeoPro Consulting Limited, it shall not be used to express or imply warranty as to any other purposes. No portion of this report shall be used as a separate entity, it is written to be read in its entirety. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated.

The design recommendations given in this report are applicable only to the project designed and constructed completely in accordance with the details stated in this report. Otherwise, our responsibility is limited to interpreting the subsurface information at the borehole or test pit locations.

Should any comments and recommendations provided in this report be made on any construction related issues, they are intended only for the guidance of the designers. The number of test holes and test pits may not be sufficient to determine all the factors that may affect construction activities, methods and costs. Such as, the thickness of surficial topsoil or fill layers may vary significantly and unpredictably; the amount of the cobbles and boulders may vary significantly than what described in the report; unexpected water bearing zones/layers with various thickness and extent may be encountered in the fill and native soils. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and make their own conclusions as to how the subsurface conditions may affect their work and determine the proper construction methods.

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

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