GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

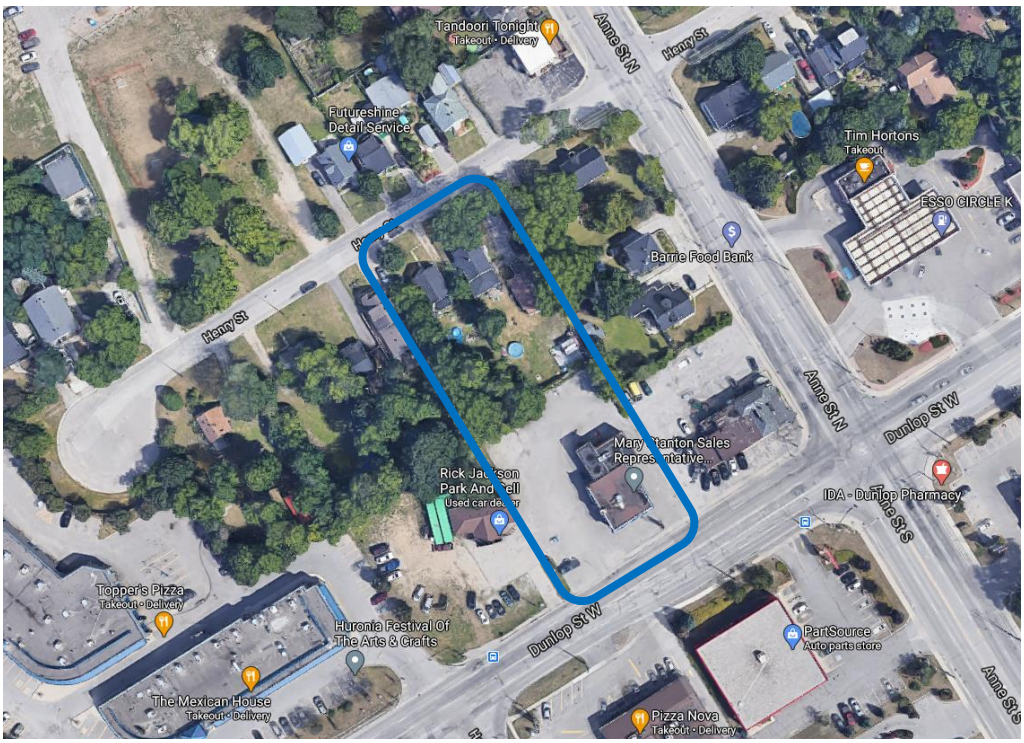
Geotechnical Investigation

Proposed 16-Storey Building

284 & 286 Dunlop Street West and 119 & 121 Henry Street, City of Barrie, Ontario

Prepared For:

Arten Development Group



GeoPro Project No.: 20-3280GH01

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1. INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by Arten Development Group (the Client) to conduct a geotechnical investigation for the proposed 16-storey building with 2 underground parking levels located at 284 & 286 Dunlop Street West and 119 & 121 Henry Street, 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 and/or 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 and geo-environmental 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. PROJECT DESCRIPTION

The subject site is located at 284 & 286 Dunlop Street West and 119 & 121 Henry Street, City of Barrie, Ontario. The proposed development consists of a 16-storey building with two levels of underground parking.

Currently, the site of the proposed development has existing detached dwellings along Henry Street and a two-storey commercial building along Dunlop Street West.

3. INVESTIGATION PROCEDURE

The field work for the geotechnical investigation was carried out on October 28, 29 and November 9, 19, 23, 2020 during which time four (4) boreholes (Boreholes BH1 to BH4) were advanced to depths ranging from about 11.3 m to 17.2 m below the existing ground surface. The borehole locations are shown on attached Drawings.

A proposed borehole location plan prepared by GeoPro was provided to the Client for review prior to the field investigation work. The approved borehole locations were staked in the field by GeoPro; 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 a continuous flight auger drilling 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.

Groundwater condition observations were made in the boreholes during drilling and upon completion of drilling. A monitoring well (51 mm in diameter) was installed in each of selected boreholes to measure the groundwater tables as well as to facilitate the in-situ hydrogeological testing. The remaining borehole was backfilled and sealed upon completion of drilling.

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

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.

4. SUBSURFACE CONDITIONS

Notes on sample descriptions are presented in Enclosure 1A. Explanations of terms used in the borehole logs are presented in Enclosure 1B. The subsurface conditions in the boreholes are presented in the individual borehole logs. Detailed descriptions of the major soil strata encountered in the boreholes drilled at the site are provided as follows.

4.1 Soil Conditions

Pavement Structure

Flexible Pavement Structure (284 and 286 Dunlop Street Parking Lot)

The composition thicknesses of pavement structure at borehole locations are summarized in the following table.

BH No.	Pavement Structure (mm)	
	Asphalt	Granular Base/Subbase
BH1	45	250
BH2	70	450
Range (Average)	45 – 70 (60)	250 – 450 (350)

Note: due to the generally sandy nature of the subgrade soils, the exact depth of granular subbase was difficult to distinguish.

Rigid Pavement Structure (119 Henry Street Driveway)

The composition thickness of pavement structure at the borehole location is summarized in the following table.

BH No.	Pavement Structure (mm)	
	Portland Cement Concrete	Granular Base/Subbase
BH4	75	210

Note: due to the generally sandy nature of the subgrade soils, the exact depth of granular subbase was difficult to distinguish.

Gravel Pavement Structure (121 Henry Street Driveway)

Granular base and subbase materials with a thickness of about 110 mm were encountered in Borehole BH3. Due to the generally sandy nature of the subgrade soil, the exact depth of granular subbase was difficult to distinguish.

Fill Materials

Fill materials consisting mainly of sandy silt, sand and silt, silty (fine) sand, (fine) sand, fine to medium sand and gravelly sand were encountered below the granular base/subbase materials in all boreholes, and extended to depths ranging from about 1.4 m to 2.1 m below the existing ground surface. SPT N values ranging from 3 to 23 blows per 300 mm penetration indicated a very loose to compact compactness. The in-situ moisture content measured in the soil samples ranged from approximately 4% to 12%.

Silt, Fine Sand and Silt, Silty Fine Sand, (Fine) Sand, Fine to Medium Sand, Sand and Silty Gravelly Sand

Silt, fine sand and silt, silty fine sand, (fine) sand, fine to medium sand, sand and silty gravelly sand deposits were encountered below the fill materials in all boreholes, and extended to depths ranging from about 11.3 m to 17.2 m below the existing ground surface. Boreholes BH1 to BH4 were terminated in these deposits. SPT N values ranging from 3 to greater than 100 blows per 300 mm penetration indicated a very loose to very dense compactness. The natural moisture content measured in the soil samples ranged from approximately 4% to 23%.

Clayey Silt

Clayey silt deposits were encountered below the fine sand and silt and sand deposits in Boreholes BH2 and BH3, and extended to depths ranging from about 3.4 m to 13.2 m below the existing ground surface. SPT N values ranging from 3 to 27 blows per 300 mm penetration indicated a soft to very stiff consistency. The natural moisture content measured in the soil samples is approximately 21%.

4.2 Groundwater Conditions

Groundwater condition observations made in the boreholes during and immediately upon completion of drilling are shown in the borehole logs and are also summarized in the following table.

Borehole No.	BH Depth (m)	Depth of Water Encountered during Drilling (mBGS)	Water Level upon Completion of Drilling (mBGS)	Cave-in Depth upon Completion of Drilling (mBGS)
BH1	15.7	4.6	-*	-*
BH2	17.2	4.5	-*	-*

BH3	15.7	3.4	-*	-*
BH4	11.3	4.0	-*	-*

Note: mBGS = meters below ground surface; *water level and cave-in were not measured upon completion of drilling due to use of hollow auger or drilling mud.

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

Monitoring Well ID	Screen Interval (mBGS)	Water Level (mBGS)
		December 8, 2020
BH1	10.7 – 12.2	4.56
BH2	13.3 – 16.3	4.50
BH4	6.5 – 9.5	3.73

Note: mBGS = meters below ground surface

It should be noted that groundwater levels can vary and are subject to seasonal fluctuations in response to weather events. We have noted that the groundwater tables measured in this year were noticeably lower than those measured in the previous years in our other projects, as such, a long term monitoring of groundwater tables should be considered to measure the anticipated groundwater table fluctuation.

5. DISCUSSIONS AND RECOMMENDATIONS

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 may not be sufficient to determine all the factors that may affect construction methods and costs. Subsurface and groundwater 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 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 upon the construction.

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

5.1 Foundation Design Considerations

5.1.1 Raft Foundation

Based on the geotechnical investigation, sporadic low N values in the native soils were encountered in the some of the boreholes drilled at the site, as such, consideration may be given to a raft foundation in conjunction with a sufficient water proof system wrapped the entire raft foundation and foundation walls to at least 2.5 m above the highest groundwater table at the site, which can bridge over areas of low strengths that may be present between and beyond boreholes, additional CFA under the raft foundation may be required to provide sufficient bearing capacity.

Should very loose to loose/soft native soils encountered at the founding elevation, consideration may be given to removing and replacing the very loose to loose/soft native soils and replacing with lean concrete materials to minimize the differential settlement of the raft foundation.

For the raft foundations founded completely on the native undisturbed competent compact to very dense soil deposits at a depth of about **6 m** below the ground surface, a soil bearing resistance of 200 kPa at Serviceability Limit States (SLS) and a factored bearing resistance of 300 kPa at Ultimate Limit States (ULS) may be considered.

As the above founding depths will be about 2 to 3 m below the local groundwater levels measured in the monitoring wells, positive construction dewatering will be required to temporarily lower the groundwater level to minimum 1.5 m below the base of the excavation.

The founding materials are extremely susceptible to disturbance by construction activity, especially during the wet weather. Therefore, care should be taken to preserve the integrity of the materials as bearing strata. Prior to pouring concrete for the footings, the foundation excavations should be inspected by the geotechnical engineer.

Due to the anticipated relatively high permeability of the cohesionless soils at the site, the zone of influence of the dewatering would be anticipated to be great, as such, the potential impact to the adjacent structures and utilities caused by dewatering settlement should be evaluated prior to the detailed designs of the proposed building.

It should be noted that consideration must be given in the structural design considering the potential variation of the soil conditions at the site to control the differential settlement of the raft foundation (i.e. the rigidity of the raft designed properly to control the differential settlement). The analyses of the total and differential settlement of the raft foundation must be carried out to evaluate the potential maximum settlement, which shall be considered in selecting the appropriate waterproof materials that can tolerate the anticipated potential maximum settlement. It should also be noted that the total and differential settlement of the raft foundation may cause cracking of the mud slabs that protect the waterproof materials and potentially cause cracking in the raft foundations. As such, it may be prudent to place a layer of

clear stones under the floor slabs in case any minor water seepage may seep through the water proof system.

5.1.2 Continuous Flight Auger (CFA) Piles

Alternatively, consideration may be given to the use of continuous flight auger (CFA) piles in conjunction with structural slabs (for water proof installations) to support the proposed building.

CFA piles are installed by advancing a hollow stem auger. Once the auger has reached the design founding depth, the hole created by the auger is grouted continuously as the auger is removed; a reinforcing steel cage is placed in the grout. Based on the soil conditions encountered, the following tables provide the estimated ultimate bearing resistances that may be used for the designs of the proposed CFA piles.

Depth of the Founding Soils for CFA Pile	Estimated Ultimate Pile Shaft Resistances (kPa)
Compact to Dense to Very Dense Silty/Sandy/Gravelly Soils & Very Stiff Clayey Soils	100-110*

*A minimum factor of safety (FOS) of 3 should be considered without a pile load testing.

Should the CFA piles be considered for uplifting resistances, a reduction factor of 0.75 should be considered.

It is highly recommended that static load testing of the piles be carried out to confirm the bearing resistances provided in the above table, as a lower factor of safety (i.e. FOS =2.0) can be used when static load testing results are available. The results of the static load testing may also be used to optimize the design lengths of the CFA foundations.

The load testing should be carried out as far in advance of the anticipated start of production piling to permit any required changes in the design of the foundations, if necessary, prior to the production phase of the foundation installation.

Based on the soil conditions encountered at the site, there is a potential for “necking” of the CFA piles during installation, and as such, Pile Integrity Testing (PIT) must be carried out as part of the Quality Assurance process for the piling works to confirm that the piles installed have a consistent diameter over their full length.

Cobbles and Boulders and other Obstructions

Cobbles and boulders and other obstructions should be anticipated in the native soils and fill materials, and as such, prospective foundation contractors should be alerted to this and an allowance for coring or removing boulders should be made in the contract. Some of the piles may

encounter the obstructions in the fill materials and cobbles and boulders in the native soils. Should this be the case, alternation of the pile location would be required. A provision including modification of pile cap and slight alternation of pile location should be considered in the contract.

Group Effect for Axial Resistances

In consideration of the predominant sandy/silty soils and shallow groundwater tables at the site, a reduction factor shall be considered to count for soil disturbances caused during installation of piles. A minimum center to center space of 2.5 diameters shall be considered for piles. The reduction factors for axial resistances may be considered as follows:

- The reduction factor =0.65 for a center-to-center spacing of 2.5 diameters;
- The reduction factor =1.0 for a center-to-center spacing of 6.0 diameters;

The reduction factor shall be determined by linear interpolation for spacing between 2.5 and 6.0 diameters.

5.2 Lateral Resistances for Piles

The design of piles subjected to lateral loads should take into account such factors as the batter of the piles (if any), the relative rigidity of the pile to the surrounding soils, the fixity condition at the head of the pile (pile cap level), the structural capacity of the pile to withstand bending moments, the soil resistance that can be mobilized, the tolerable lateral deflections at the head of the pile and pile group effects. For design purposes, both the structural and geotechnical resistances should be evaluated to establish the governing case. The lateral resistance of the piles can be supplemented, if desired, by horizontal components of battered piles.

Ultimate Lateral Earth Resistance

The equations presented in the following may be used to analyze the interaction between a pile and the surrounding soil. The lateral pressures obtained from the analysis must not exceed the ultimate lateral resistance or the factored structural flexural resistance of the pile.

For cohesive soils, the passive earth pressure on the pile at a depth Z can be determined from the following expression:

$$p_{ult} = 6C_u$$

For cohesionless soils, the p_{ult} value can be calculated using the following equation:

$$p_{ult} = 3\gamma ZK_p$$

The ultimate lateral earth resistance (force) on a short pile section of length l_z at depth Z can be expressed as

$$\Delta R_u = l_z B p_{ult}$$

Where

p_{ult} = the passive earth pressure on the pile at a depth Z, in kPa.

ΔR_u = ultimate lateral earth resistance on a pile section of length l_z and at depth Z, in kN.

Z = depth below final grade, in metre.

L = length of pile, in metre. Should be limited within six times the pile diameter/size

B = size (diameter) of pile, in metre

γ = unit weight of soil, in kN/m^3

K_p = passive earth pressure coefficient

C_u = undrained shear strength of clayey silt and bedrock, in kPa.

The passive lateral resistance of the soils within the frost depth should be ignored.

The direction of the lateral earth resistance (ΔR_u) is opposite to the direction of the lateral movement of the pile at depth *Z*.

The lateral capacity of the pile itself depends on the lateral earth resistance (ΔR_u) along the pile, and on the constraint conditions at the top of the pile. For analyses of the proposed piles founded in the hard/very dense soils, it can be assumed that the base (bottom) of the piles will not move in both the vertical and horizontal directions.

For a short pile section of length l_z at depth Z, the factored lateral geotechnical resistance (ΔR_{ULS}) at the ultimate limit states (ULS) can be determined from the following expression:

$$\Delta R_{ULS} = \Phi_h \Delta R_u$$

where Φ_h is the lateral earth resistance factor. According to the Canadian Foundation Engineering Manual, 4th Edition (CFEM, 2006), the lateral earth resistance factor can be taken as Φ_h = 0.5.

The lateral capacity of piles at SLS should be determined according to the lateral deflection of the piles calculated using the modulus of horizontal subgrade reaction of the soil (k_h) described in the following sections.

Modulus of Horizontal Subgrade Reaction (k_h)

The modulus of horizontal subgrade reaction of the soil (k_h) can be used to evaluate the lateral deflection and bending of the proposed piles, where k_h is determined as given in the section below.

In the model of pile-soil interaction, the lateral earth resistance of soil can be simulated by a series of linear springs, and the stiffness coefficient of the springs or spring constant (K_{spr}) can be obtained from the calculated values of the modulus of horizontal subgrade reaction (k_h). For a pile with a diameter of *B* and a distance of *t* between two adjacent springs, the value of K_{spr} can be calculated using

$$K_{spr} = B \cdot t \cdot k_h.$$

The unit of K_{spr} is kN/m, and the unit of *t* is metre (m).

Cohesive Clayey Soils:

The modulus of horizontal subgrade reaction (k_h) of the cohesive soils can be calculated using the following equation:

$$k_h = \frac{67 C_u}{B}$$

where *B* represents the diameter of the pile and C_u is the undrained shear strength of the cohesive soils as given in Table 1.

Non-cohesive Silty/Sandy/Gravelly Soils:

For the sand and gravel soils, the value of the modulus of horizontal subgrade reaction k_h can be estimated using

$$k_h = n_h \frac{Z}{B}$$

Where *Z* is the depth, *B* is the diameter of pile, and n_h is a coefficient related to soil density, as listed on following table.

It should be noted that the lateral resistance of soil is limited and the linear springs used in the analysis should not be loaded beyond the allowable passive lateral resistance of the corresponding soil. The SLS resistance should be taken as that corresponding to an acceptable horizontal deflection resulting from the structural designs.

Geotechnical Design Parameters for Lateral Resistance Design

For the lateral resistance design, pile-soil interaction analysis may be carried out using the geotechnical parameters provided in the following table:

Recommended Geotechnical Parameters for Lateral Resistance Design

Borehole Location and Soil Types	Parameter for Horizontal Subgrade Reaction η_h (MN/m^3)	Passive Earth Pressure Coefficient, K_p	Undrained Shear Strength, C_u (kPa)	Unit Weight, γ (kN/m^3)
Soft Clayey Deposits (below groundwater table)	-	2.6	12	6
Very Stiff Clayey Deposits (below groundwater table)	-	2.9	100	9
Very Loose Silty/Sandy/Gravelly Deposits (below groundwater table)	-	2.7	-	8
Loose Silty/Sandy/Gravelly Deposits (below groundwater table)	1.3	2.8	-	9
Compact Silty/Sandy/Gravelly Soils (below groundwater table)	4.4	3.0	-	10
Dense to Very Dense Silty/Sandy/Gravelly Soils (below groundwater table)	11	3.1	-	11

Group Effect

The horizontal spacing of the caissons should be at least 3.0 times the caisson size. For end bearing caissons in the very dense soil deposits, the vertical resistances will not be significantly affected by the caisson spacing.

For lateral soil/pile group interaction analysis, the modulus of subgrade reaction (k_h) may have to be reduced based on pile spacing.

Where a pile group is oriented **parallel** to the direction of loading, the group action may be considered by reducing the values of coefficient of horizontal subgrade reaction (k_h) by a reduction factor, R as follows:

Pile Spacing in direction of Loading (B = Pile Diameter)	Subgrade Reaction Reduction Factor (R)*
8B	1.0
6B	0.7
4B	0.4
3B	0.25

*Intermediate values may be obtained by interpolation.

Where a pile group is oriented **perpendicular** to the direction of loading, the group action may be considered by reducing the values of the coefficient of horizontal subgrade reaction (k_h) by a reduction factor (R), which can be expressed as

$$R = 0.5\left(1 + \frac{x}{3B}\right)$$

In the above equation, *x* represents the centre-to-centre distance between adjacent piles, and B is the diameter of the pile. If the centre-to-centre distance between the adjacent piles is equal to or greater than 3 times its diameter (3B), the group action effect can be ignored.

5.3 General Foundation Design Consideration

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

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

5.4 Frost Protection

All footings exposed to seasonal freezing conditions must have at least 1.6 meters of soil cover for frost protection.

It is also emphasized that underfloor drainage and/or an adequate free draining gravel base is required to minimize the risk of floor dampness. Floor dampness could lead to temporary icing and the risk of accidents.

5.5 Uplift Consideration

Due to the high water tables and the anticipated two levels of the underground parking, the uplift forces resulting from the hydrostatic pressures for the water tight foundation system must be considered in the structural designs.

Due to the fluctuation nature of the groundwater table, the groundwater level considered for the uplifting resistances can be assumed to be at least 2.5 m above the highest groundwater table at the site in consideration of the storm events, or as an alternative, groundwater level at the ground surface can be assumed for the uplifting resistance analysis by the structural engineer. A sufficient factor of safety should be considered for the design of the uplifting resistance by the structural engineer.

5.6 Floor Slab and Permanent Drainage

The raft foundation or structural slabs are below the prevailing groundwater tables, and the exposed subgrade is anticipated to consist mainly of cohesionless gravel, sand, silt or the mixture of the three, which are extremely easy to be disturbed. Therefore, a sufficient dewatering shall be carried out to draw down the groundwater tables to at least 1.5 m or more below the base of the excavations to ensure a stable undisturbed native subgrade. The subgrade shall be proof rolled and inspected by a geotechnical engineer prior to placing lean concrete mat for the placement of the waterproof membrane. It is essential to maintain the stability of the subgrade during the entire course of the construction. Any disturbance, fluctuation of groundwater tables that may cause ground heave, may result in excessive settlement of the raft foundation or structural slabs, which may in turn adversely impact the integrity of the waterproof membrane.

The raft foundation or structural slabs are below the prevailing groundwater tables, it is expected that the raft foundation/structural slabs and underground parking will be a water tight structure. However, a moisture barrier consisting of a layer of 19 mm clear crushed stone and subdrains should be installed between the top of the raft/structural slabs and the underside of the floor slab, in case minor water seepage may migrate through the water proof system. Typical drainage and backfill recommendations for the underground parking structures are illustrated on Drawings 2 to 4 for shored and open cut excavations.

Where the backfill against the exterior walls is to support settlement sensitive structures, such as concrete slabs, pavements or walkways, it should be uniformly compacted to at least 98% of SPMDD.

5.7 Elevator Pits

Drainage systems at the base level of the elevator pits are not recommended, due to the concern of loss of fines. The elevator pits can be designed as water-tight structures together with the raft foundation and structural slab designs, and water pressure on the pit walls and the slab should be taken into consideration by the design engineer, assuming the water pressure on the pit wall

and the slab at least 2.5 m higher than the highest measured groundwater table or at ground surface.

Should it be required by the designer, a drainage system at the base level of the elevator pits may also be considered together with the water tight design of the elevator pits, in case possible minor water seepage migrating through the water proof system.

5.8 Excavations, Groundwater Control and Backfill

Based on the anticipated two levels of underground parking, it is anticipated that the excavations will continue to a depth up to 6.0 m below the existing ground surface. It should be noted that some difficulties may be encountered in excavating the native soils at some locations. In addition, these native soils are inferred to contain cobbles and boulders. Obstruction may be expected in the existing fill materials. It is recommended that provisions should be made in the excavation contract for the removal of such obstructions. Sumps, footings and elevator pits may require localized excavations to continue approximately one to two meters deeper.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the existing loose to compact fill materials and native loose to very dense/very stiff soil deposits at the site can be classified as Type 3 soil above groundwater table and Type 4 soil below groundwater table; the existing very loose fill materials, native very loose silty/sandy/gravelly soils and native soft clayey deposits at the site can be classified as Type 4 soil.

Based on the results of the investigation, the subsurface conditions consisted of predominant water bearing sandy/silty/gravelly soils below groundwater levels. Significant groundwater seepage would be expected should excavations extend into these deposits. Therefore, positive dewatering measures will be required to depressurize the groundwater levels to at least 1.5 m below the excavation base. 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). A hydrogeological investigation was concurrently carried out by GeoPro and would be reported under a separate cover.

Dewatering may be required for shoring lagging in the cohesionless soils below the groundwater table, should the timber lagging and soldier pile shoring system be utilized.

The selected inorganic fill and native soils free from topsoil and organics can be used as general construction backfill where it can be compacted by sheep foot roller with loose lifts of soil not exceeding 300 mm. Imported granular fill, which can be compacted with small compacting equipment, should be used in confined areas; however, the loose lifts of soil, which are to be

compacted, should not exceed 200 mm. Any fill materials should be compacted to at least 98 % of Standard Proctor Maximum Dry Density (SPMDD).

Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use. The existing soils are not considered to be free drained materials. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

The existing soft clayey soils are not suitable for reuse as backfill materials, which may need to be wasted or used in the landscape area.

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

Where the backfill against the exterior walls is to support settlement sensitive structures, such as concrete slabs, pavements or walkways, it should be uniformly compacted to at least 98% of SPMDD.

The final footprint of the excavation in relation to the property boundary is unknown, however, no excavation shall extend below the foundation of the existing adjacent structure without adequate alternative support being provided. The guideline related to underpinning of the existing foundation is provided in Drawing 5.

5.9 Temporary Shoring and Ground Movement Monitoring

Subject to the space at the site and the anticipated excavation depths, excavations supported by a temporary shoring system consisting of continuous caisson walls, soldier piles and timber lagging or sheet pile walls with an anchor system or raker/strut system may be required. Unsupported open cut excavation may be utilized in area where sufficient space exists.

The potential impacts and suitable protection for the nearby buried service utilities and structures should also be considered in the design and construction of a temporary support system.

The shoring system must be designed in accordance with the 4th Edition of the Canadian Foundation Engineering Manual (2006). The soil parameters estimated to be applicable for this design are as follows:

1) Earth pressure coefficient for shoring:
   (a) where movement must be minimal K = 0.45
   (b) where minor movement can be tolerated K = 0.25
   (c) passive earth pressure for soldier piles (unfactored) K_p = 3.0 for dense to very dense soils

2) For stability check:

$\phi = 28°$

$c = 0$

$\gamma = 21$ kN/m^3

surcharge is to be determined by shoring contractor

For the design of tieback anchors, a preliminary unfactored bond stress value of 20 kPa may be considered; these bond values depend upon anchor installation methods and grouting procedures. Gravity poured concrete can result in low bond values, while pressure grouted anchors will give higher values and produce a more satisfactory anchor. The bearing value for soldier pile caissons in dense to very dense soils can be taken as q = 700 kPa provided that the caisson holes are clean and dry prior to pouring concrete. Assuming a slurry procedure and tremie concrete placement method, the bearing value of 450 kPa may be considered.

The soldier piles should be installed in pre-augered holes filled with concrete below the excavation level. The concrete strength must be specified by the shoring designer. Temporary liners would be required in order to help prevent the silty/sandy/gravelly zones from caving-in during installation. The potential for encountering obstructions such as cobbles and boulders in the soils that may impact the soldier pile/caisson installations should be considered by the shoring contractor. The sandy/silty/gravelly soils at the site are easy to be disturbed below groundwater tables and positive dewatering would be needed should the caissons be extending below the groundwater tables. Provisions may be made in contract for the removal of possible cobbles and boulders in the native soils or potential obstructions in the fill materials.

Positive measures may be required to prevent the loss of soil through the openings between the lagging boards. This could probably be achieved by placing a geotextile filter cloth behind the lagging boards.

The shoring wall will be required to support by either a soil anchor system or raker/strut system. The shoring system is commonly supported by pre-stressed soil anchors extending beneath the adjacent lands. Pre-stressed anchors are installed and stressed in advance of excavation and this minimize movement of the shoring system. The use of anchors on adjacent properties will require consent of the adjacent land owners.

The top anchor must not be placed lower than 3.0 m below the top of level of the ground surface. Casings will be required for the anchors when penetrating through the sandy/silty/gravelly deposits to prevent the soil from caving-in. The preliminary bond values provided in the report are arbitrary since the contractor's installation procedures will determine the actual soil-to-concrete bond value. Hence, the contractor must decide on a capacity and confirm its availability. All anchors must be tested as indicated in the Foundation Engineering Manual, 4th edition. These anchors must be of a length that meets the Canadian Foundation Engineering Manual

recommendations. Adhesion on the buried caisson shaft, or behind the shoring system, must be neglected when designing this shoring system.

Movement of the shoring system is inevitable. Vertical movement will result from the vertical load on the soldier piles resulting from the inclined tiebacks, and inward horizontal movement resulting from earth and water pressures. The magnitude of this movement can be controlled by sound construction practices, and it is anticipated that the horizontal movement will be in the range of 0.1% to 0.25% H.

To ensure that movements of the shoring are within an acceptable range, a monitoring program must be carried out. Vertical and horizontal targets on the soldier piles must be located and surveyed before excavation begins. Weekly readings during excavation should show that movement is within the predicted values; if it is not, then the monitoring results will enable directions to be given to improve the shoring.

This movement should be monitored throughout the construction period. GeoPro would be pleased to provide a movement monitoring plan upon request.

If shoring is to be carried out over the winter months or if the excavation is to be left open for any period during below zero temperature, shored walls must be protected against frost penetration by means of insulation or heated hoarding.

A pre-construction condition survey of the adjacent structures within the zone of influence shall be considered prior to construction.

5.10 Preconstruction Condition Survey

It is recommended that a preconstruction survey of the neighbouring buildings and houses and other nearby utilities and structures be carried out prior to commencing excavation. In addition, the types and conditions of all adjacent structures and underground services should be reviewed by the structural and geotechnical engineer. Each utility owner should be contacted to establish deformation limits.

The deformation should be monitored throughout the construction period. GeoPro would be pleased to provide a preconstruction condition survey plan upon request.

5.11 Earth Pressure on Walls

The lateral earth pressure acting at depths on underground walls can be calculated as follows:

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

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

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

γ_1 = unit weight of overburden soil assuming 21.5 kN/m^3

h_1 = depth in overburden soil

q = value of surcharge in kPa

The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall. Should the hydrostatic pressure be built up behind the walls (which is the case for water proof system wrapped raft foundation and foundation walls), they must be included in calculating the lateral earth pressure. The hydrostatic water pressure must also be added assuming a water table at least 2.5 m above the highest groundwater table at the site. In this case, however, in the earth pressure calculations, the unit weight of the soil below the water level should be taken as the submerged unit weight (11.7 kN/m^3).

5.12 Seismic Considerations

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

The conservative site classification is based on physical borehole information obtained at depths of less than 30 m and on general knowledge of the local geology and physiography. Accordingly, GeoPro's drilling program and previous investigation included boreholes drilled to depths up to 17.2 m below the existing ground surface. Based on this borehole information and our local experience, a Site Class **D** may be used for the building design.

Should optimization of the site class be recommended by the structural engineer, in-situ geophysical testing or a deep borehole extending to 30 m may be required.

5.13 Pavement Design of the Proposed Parking Lots and Access Road

Based on the subsurface soil conditions encountered at the site and the assumed traffic usage for the parking lots and access road, the pavement designs have been provided in the following table.

Material		Thickness of Pavement Elements (mm)	
		Light Duty Parking Lot	Heavy Duty Access Road
Asphaltic Material (OPSS 1150)	HL 3 Surface Course	40	40
	HL 8 Binder Course	50	80
Granular Material (OPSS 1010)	OPSS Granular A Base (or 19 mm Crusher Run Limestone)	150	150
	OPSS Granular B (or 50 mm Crusher Run Limestone)	200	300
On Approved Subgrade			

The recommended pavement structures should be considered for preliminary design purposes only. The pavement thickness should also conform to the requirements of the local municipality. 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.

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

Additional comments on the construction of parking areas and access roadways are as follows:

1. As part of the subgrade preparation, all topsoil, any organic or other unsuitable soils must be completely removed to the full depth of the pavement areas. The subgrade should then be proof-rolled in the presence of the geotechnical engineer from GeoPro. Any soft spots exposed during the proofroll should be completely removed and replaced by selected fill materials, similar to the existing subgrade soils and approved by the geotechnical engineer from GeoPro. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD).

2. Fill materials required to raise the grade to proposed subgrade level 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.

3. The construction of the pavement structures (i.e. grading of the granular materials, spreading and rolling of the asphalt) should conform to current OPS Specifications or the requirements from the local authorities. The compaction of the asphalt and granular materials should be evaluated by frequent field density tests carried out by the geotechnical engineer from GeoPro.

4. The locations and extent of sub-drainage required within the paved areas should be reviewed by GeoPro in conjunction with the proposed lot grading. Assuming that satisfactory crossfalls in the order of 2% have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that shallower crossfalls are considered, a more extensive subdrain system may be necessary and should be reviewed by GeoPro.

5. 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.

It is recommended that GeoPro be retained to review the final pavement structure designs and drainage plans prior to finalizing the designs to ensure that they are consistent with the recommendations of this report.

6. ENVIRONMENTAL SOIL ANALYTICAL RESULTS

6.1 Soil Sample Submission

Selected soil samples were submitted to a laboratory which is a member of Canadian Association for Laboratory Accreditation ("CALA") for chemical analyses. Descriptions of the selected soil samples, sample depths and analytical parameters are presented in the following table:

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
BH1 SS4	2.3 – 2.7	Fine Sand	M&I
BH2 AS1B	0.5 – 0.8	Fill: Silty Sand	M&I; PAHs; PHCs; VOCs and PCBs

BH3 SS4	2.3 – 2.7	Sand	M&I
BH4 AS1B	0.3 – 0.8	Fill: Silty Fine Sand	M&I; PAHs; PHCs; VOCs and PCBs

Notes: M&I = Metals and Inorganics
PAHs = Polycyclic aromatic hydrocarbons
PHCs = Petroleum Hydrocarbons Fractions F1 to F4
VOCs = Volatile Organic Compounds
PCBs = Polychlorinated Biphenyl

6.2 Soil Analytical Results

Selected soil samples were analysed for M&I, PAHs, PHCs, VOCs and PCBs under Ontario Regulation 153/04 ("O. Reg. 153/04") as amended. A copy of the soil analytical results is provided in the Laboratory Certificates of Analysis, attached in Appendix A.

The soil analytical results were compared with the Ministry of the Environment, Conservation and Parks ("MECP") "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 MECP Table 1 Standards"); Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition ("2011 MECP Table 2 Standards"), and Table 3: Full Depth Generic Site Condition Standards in a non-potable Ground Water Condition ("2011 MECP Table 3 Standards").

Based on the comparison, exceedances of MECP Table 1, Table 2 or Table 3 standards were noted. The exceedance values detected in the soil samples are summarized in the following table.

Soil Sample ID	Parameter	Detected Value / Unit	MECP Table 1 Standards Guideline Value	MECP Table 2 and 3 Standards (R/P/I) Guideline Value	MECP Table 2 and 3 Standards (I/C/C) Guideline Value
BH2 AS1B	SAR	2.71	**2.4**	5.0	12.0
	Petroleum Hydrocarbons F4g	200 ug/g	**120** ug/g	2800 ug/g	3300 ug/g
	Mercury	0.4 ug/g	**0.27** ug/g	**0.27** ug/g	3.9 ug/g

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

6.3 Discussion of Analytical Results

Based on the analytical results, exceedances of MECP Table 1, Table 2 or Table 3 standards were noted in the tested soil samples. It should be noted that the samples with exceedances of SAR values were taken from the boreholes located on the parking lot. The elevated SAR values in the tested soil samples may likely be attributed to the application of de-icing salt on the pavement. Although no elevated Electrical Conductivity (EC) and/or Sodium Adsorption Ratio (SAR) values were detected in the tested samples from Boreholes BH1, BH3 and BH4, elevated EC/SAR values

may be expected in the soils at different depth due to the application of de-icing salt on the pavement. The potential source of other elevated parameters is unknown.

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

1) The soils generated near Boreholes BH1 and BH3 at the tested depths can be re-used at a receiving site would accept the soils as per the test results. Additional chemical testing may be required by these sites;
2) The soils generated near Borehole BH4 at the tested depth with no indicated exceedances can be re-used at the Site or a receiving site would accept the soils as per the test results; and
3) The soils generated at the same tested sample depth from Borehole BH2 can be re-used at a receiving site which is not considered as an environmental sensitive site and not a residential/parkland/institution property, provided that the soils will not be in contact with groundwater and would accept soil as per the test results.

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

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

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

7. 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 conditions remain consistent with those encountered in the boreholes, and to monitor conformance to the pertinent project specifications.

8. CLOSURE

We appreciate the opportunity to be of service to you and trust that this report provides sufficient geotechnical engineering information to meet the requirements of the terms of reference. 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

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DRAWINGS

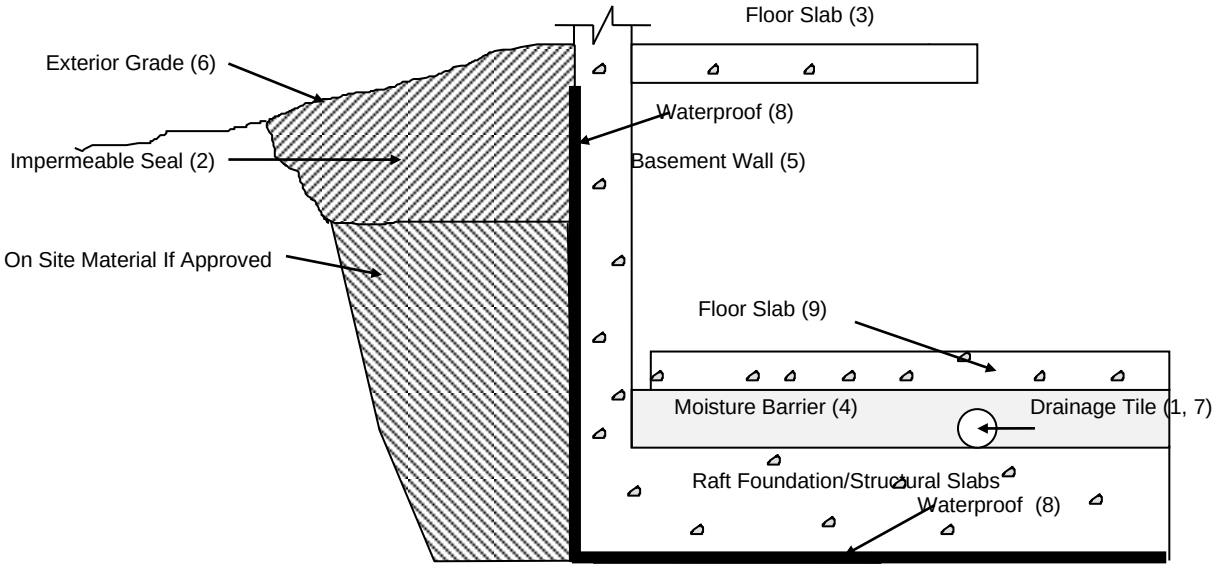
Legend:

- Borehole Location
- Monitoring Well Location

Client: Arten Development Group		Project No.: 20-3280GH01	Drawing No.: 1
Drawn: PL	Approved: DL	Title: Borehole/Monitoring Well Location Plan	
Date: December 2020	Scale: N.T.S.	Project: Geotechnical Investigation Proposed 16-Storey Building 284 & 286 Dunlop Street West and 119 & 121 Henry Street, City of Barrie, ON	
Original Size: Letter	Rev: DL	GeoPro Consulting Limited	

Project: 20-3280GH01

Drawing No. 2



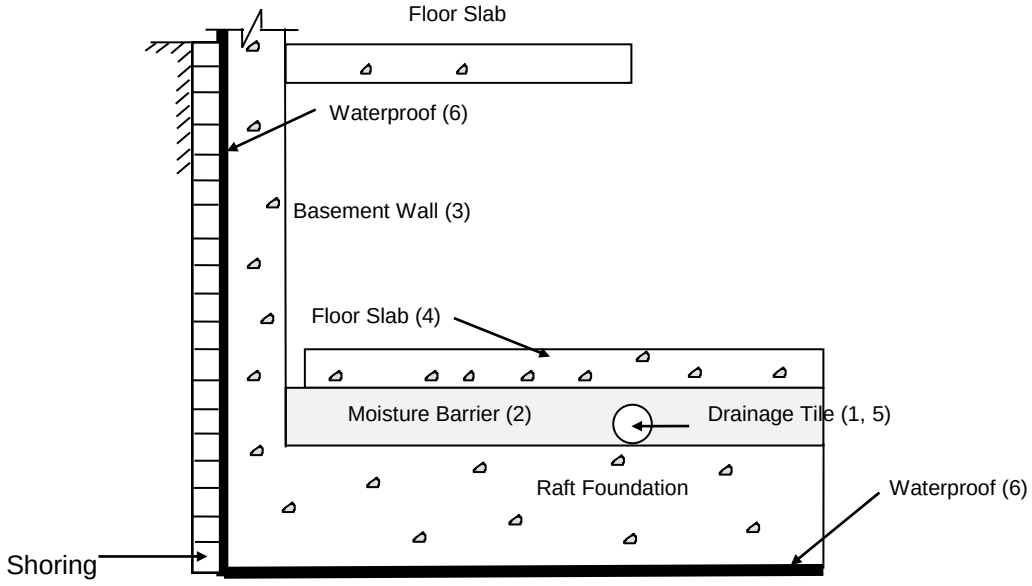
Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be a minimum of 150 mm (6") below underside of floor slab.
2. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
3. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
4. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material.
5. Basement wall to be water-proofed and the wall has to be designed in consideration of the hydrostatic water pressure.
6. Exterior grade to slope away from building.
7. Underfloor drain invert to be placed on raft foundation slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centres one way.
8. The waterproof should be at least 1 m above the highest groundwater tables. The water-proofing must be designed and approved by design engineer.
9. Slab on grade should not be structurally connected to the wall or footing.

DRAINAGE AND BACKFILL RECOMMENDATIONS

Open Excavation Basement with Underfloor Drainage System
(raft foundations)
(not to scale)

Project: 20-3280GH01 **Drawing No. 3**



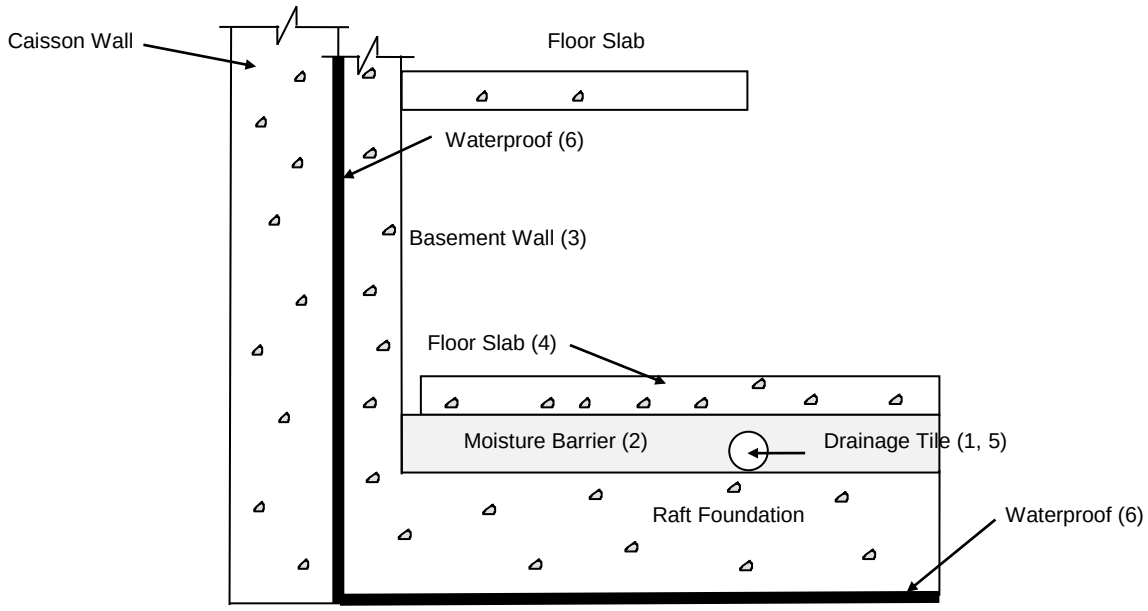
Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be a minimum of 150 mm (6") below underside of floor slab.
2. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material.
3. Basement wall to be water-proofed and the wall has to be designed in consideration of the hydrostatic water pressure.
4. Slab on grade should not be structurally connected to the wall or footing.
5. Underfloor drain invert to be placed on raft foundation slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centres one way.
6. The waterproof should be at least 1 m above the highest groundwater tables. The water-proofing must be designed and approved by design engineer.

DRAINAGE RECOMMENDATIONS

Waterproofed Underground Parking Structure/Basement with Underfloor Drainage System (raft foundations) (not to scale)

Project: 20-3280GH01 **Drawing No. 4**



Notes

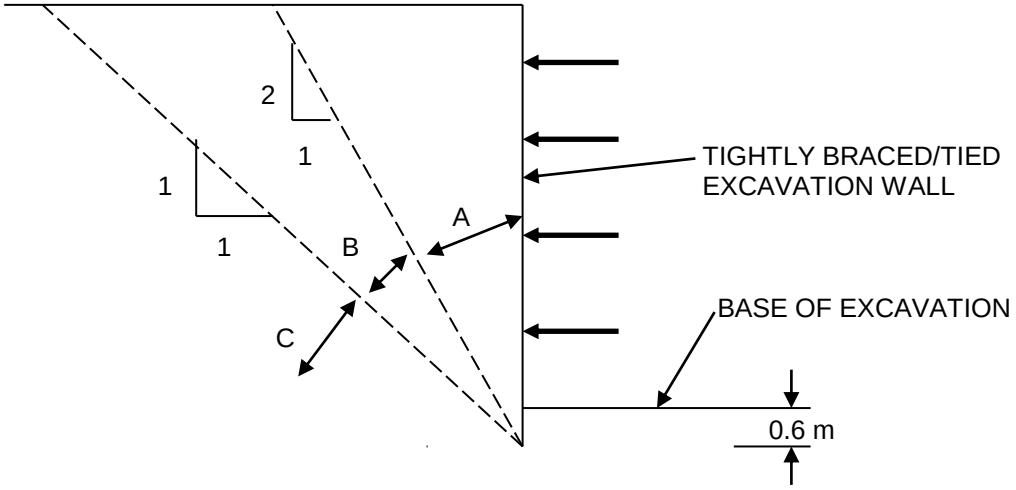
1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be a minimum of 150 mm (6") below underside of floor slab.
2. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material.
3. Basement wall to be water-proofed and the wall has to be designed in consideration of the hydrostatic water pressure.
4. Slab on grade should not be structurally connected to the wall or footing.
5. Underfloor drain invert to be placed on raft foundation slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centres one way.
6. The waterproof should be at least 1 m above the highest groundwater tables. The water-proofing must be designed and approved by design engineer.

DRAINAGE RECOMMENDATIONS

Waterproofed Underground Parking Structure/Basement with Underfloor Drainage System (raft foundations) (not to scale)

Guidelines for Underpinning in Soil and Excavation Support

Existing foundations located within Zone A normally require underpinning, especially for heavy structures. For some foundations in Zone A, it may be possible to eliminate underpinning and control foundation movement by tightly braced excavation walls, such as caisson walls.



Zone A Foundations located within this zone normally require underpinning. Horizontal and vertical pressures on the excavation wall of non underpinned foundations must be considered

Zone B Foundations located within this zone normally do not require underpinning. Horizontal and vertical pressures on the excavation wall of non underpinned foundations must be considered

Zone C Underpinning to structures is normally founded in this zone. Lateral pressure from underpinning is not normally considered

(Reference: Figure 26.27 from Canadian Foundation Engineering Manual, 4th Edition)

ENCLOSURES

Enclosure 1A: Notes on Sample Descriptions

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

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

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 300 mm) or boulders (over 300 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	<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	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

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

LOG OF BOREHOLE BH1

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building

CLIENT: Arten Development Group

PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

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

FIELD ENGINEER: JM | DATE: 2020-11-19

SAMPLE REVIEW: CK | REF. NO.: 20-3280GH01

CHECKED: DX | ENCL. NO.: 2

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
230.4				
230.3 0.1	**ASPHALT:** (45 mm)	1A	AS	
230.2 0.2	**GRANULAR BASE:** (70 mm)	1B	AS	
230.1 0.3	**GRANULAR SUBBASE:** (180 mm)	1C	AS	
229.6 0.8	**FILL:** fine to medium sand, some silt, trace gravel, containing wood fragments and plastic fragments, brown, moist to wet	2	SS	3
229.0 1.4	**FILL:** silty sand, trace gravel, organic inclusions, containing plastic fragments, dark brown to brown, moist, very loose	3	SS	4
228.3 2.1	**FILL:** fine to medium sand, trace silt, trace gravel, brown, moist, very loose to loose	4	SS	28
	FINE SAND: some silt, trace gravel, layers of silt, containing cobbles and boulders, brown, moist, compact	5	SS	27
	--- auger grinding			
226.4 4.0	**SAND:** some silt, trace gravel, layers/pockets of silt, brown, wet, compact	6	SS	28
224.8 5.6	**SILT:** trace clay, trace sand, brown, wet, very dense	7	SS	96 / 250 mm
		8	SS	51
		9	SS	86

Concrete

225.8/Dec 08

Bentonite

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

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

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

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

> >100

UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
GR	SA	SI	CL	
0	89	11		

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building

CLIENT: Arten Development Group

PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

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

FIELD ENGINEER: JM | DATE: 2020-11-19

SAMPLE REVIEW: CK | REF. NO.: 20-3280GH01

CHECKED: DX | ENCL. NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
220.3					
10.1	**SILTY FINE SAND:** trace gravel, brown to grey, wet, dense	10	SS	44	220
218.7					
11.7	**SILT:** trace clay, trace sand, grey, wet, compact to dense	11	SS	36	218
	--- layers of clayey silt	12	SS	21	217
214.7		13	SS	48	215
15.7	**END OF BOREHOLE**				

Ground water: Sand; Screen; Natural pack

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

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

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

WATER CONTENT (%) 10 20 30 40

UNIT WT (kN/m³)

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

Notes:

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

Water Level Reading

Date	W.L. Depth (mBGS)
Dec. 8, 2020	4.56

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH2

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building

CLIENT: Arten Development Group

PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: JM

SAMPLE REVIEW: CK

CHECKED: DX

DIAMETER: 205 mm

DATE: 2020-10-28 & 11-09

REF. NO.: 20-3280GH01

ENCL. NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
230.8				
230.8 / 0.0	**ASPHALT:** (70 mm)			
230.7 / 0.1	**GRANULAR BASE/SUBBASE:** (450 mm)	1A	AS	
230.3 / 0.5	**FILL:** silty sand, trace gravel, organic inclusions, rootlet inclusions, containing shale fragments and glass fragments, dark brown to brown, moist	1B	AS	
230.0 / 0.8		2	SS	4
229.4 / 1.4	**FILL:** fine sand, some silt, trace gravel, organic inclusions, pockets of organic silt, containing rubber fragments, brown, moist, very loose to loose	3A	SS	23
229.1 / 1.7		3B	SS	
	FILL: sandy silt to sand and silt, trace clay, trace gravel, layers of silty sand, brown, moist, compact			
	SAND: some silt, trace gravel, pockets of sandy silt, brown, moist, compact to dense	4	SS	41
227.9 / 2.9	**FINE TO MEDIUM SAND:** some silt, trace gravel, brown, moist, dense	5	SS	31
226.8 / 4.0	**SILT:** trace clay, trace sand, containing cobbles and boulders, brown to grey, moist to wet, dense			
	--- grey	6	SS	37
		7	SS	47
	--- layers of silty sand --- auger grinding	8	SS	33
222.2 / 8.6	**SILTY FINE SAND:** grey, saturated, compact	9A	SS	24
221.4 / 9.4	**SILT:** trace clay, interlayers of clayey silt, grey, moist, compact	9B	SS	

Concrete

Bentonite

GROUND WATER: 226.3/Dec 08

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

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

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

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH2

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building
CLIENT: Arten Development Group
PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer
FIELD ENGINEER: JM
SAMPLE REVIEW: CK
CHECKED: DX

DIAMETER: 205 mm
DATE: 2020-10-28 & 11-09
REF. NO.: 20-3280GH01
ENCL. NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
220.7				
10.1	**SILTY FINE SAND:** containing cobbles and boulders, grey, saturated, compact --- auger grinding	10	SS	27
219.1				
11.7	**FINE SAND AND SILT:** trace clay, grey, wet, very loose	11A	SS	3
218.3		11B	SS	
12.5	**CLAYEY SILT:** trace sand, interlayers/zones of silt, grey, moist to wet, soft			
217.6				
13.2	**SILT:** trace clay, trace sand, containing cobbles and boulders, grey, wet, dense --- auger grinding	12	SS	47
	--- auger grinding from 15.5 m to 15.9 m	13	SS	43
	--- layers of clayey silt, layers/zones of silty fine sand	14	SS	42
213.6				
17.2	**END OF BOREHOLE**			

Notes:

1) Water encountered at a depth of 4.5 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

Date	W.L. Depth (mBGS)
Dec. 8, 2020	4.50

Sand
Screen
Natural pack

ELEVATION: 220, 219, 218, 217, 216, 215, 214

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

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

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

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH3

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building

CLIENT: Arten Development Group

PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

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

FIELD ENGINEER: JM | DATE: 2020-11-23

SAMPLE REVIEW: CK | REF. NO.: 20-3280GH01

CHECKED: DX | ENCL. NO.: 4

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
230.3					
230.2 / 0.1	**GRANULAR BASE/SUBBASE:** (110 mm)	1A	AS		
	FILL: sand, trace to some silt, trace to some gravel, organic inclusions, brown, moist, loose	1B	AS		230
229.3		2A	SS	6	
1.0 / 228.9	**FILL:** gravelly sand, trace silt, brown, moist, loose	2B	SS		
1.4	**FINE TO MEDIUM SAND:** some silt, trace gravel, layers of fine sand and silt, brown, moist, compact	3	SS	21	229
2 / 228.1					
2.1	**SAND:** some silt, trace gravel, brown, moist, compact	4	SS	32	228
227.4					
3 2.9	**CLAYEY SILT:** trace sand, trace gravel, zones/interlayers of silty sand, brown, moist, very stiff	5A	SS	27	227
226.9		5B	SS		
3.4	**SAND:** some silt, trace gravel, layers of silty sand, brown, wet, dense				
4 / 226.2					
4.0	**SILTY FINE SAND:** brown, wet, compact to dense				226
5		6	SS	28	
6	--- zones of fine sand and silt	7	SS	32	224
7					223
	--- layers/pockets of sand	8	SS	48	
8					222
9		9	SS	50	221
10					

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

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

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

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH3

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building
CLIENT: Arten Development Group
PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan

DRILLING DATA
METHOD: Continuous Flight Auger - Auto Hammer
FIELD ENGINEER: JM
SAMPLE REVIEW: CK
CHECKED: DX
DIAMETER: 155 mm
DATE: 2020-11-23
REF. NO.: 20-3280GH01
ENCL. NO.: 4

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST (SPT / Cone, blows/0.3m) & SHEAR STRENGTH (kPa) (Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY FINE SAND: brown, wet, compact to dense(Continued)						220				
	--- grey		10	SS	48		219				
218.6											
11.7	**SILT:** trace to some clay, trace sand, layers of clayey silt, grey, wet, compact to very dense		11	SS	23		218				0 2 90 8
			12	SS	58		217				
							216				
			13	SS	35		215				
214.6											
15.7	**END OF BOREHOLE**										

Note:

1) Water encountered at a depth of 3.4 m below ground surface (mBGS) during drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH4

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building

CLIENT: Arten Development Group

PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

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

FIELD ENGINEER: JM | DATE: 2020-10-29 & 11-09

SAMPLE REVIEW: CK | REF. NO.: 20-3280GH01

CHECKED: DX | ENCL. NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
230.2				
230.0 / 0.2	**PORTLAND CEMENT CONCRETE:** (75 mm)	1A	AS	
0.3	**GRANULAR BASE/SUBBASE:** (210 mm)	1B	AS	
229.5 / 0.8	**FILL:** silty fine sand, trace gravel, organic inclusions, dark brown to brown, moist	2	SS	15
228.9 / 1.4	**FILL:** sand, trace silt, trace gravel, organic inclusions, brown, moist, compact			
	SAND: some silt, trace gravel, pockets of sand and silt, brown, moist, compact	3	SS	20
228.1 / 2.1	**FINE TO MEDIUM SAND:** some silt, trace gravel, pockets of sandy silt, containing cobbles and boulders, brown, moist, compact to dense	4	SS	24
	--- auger grinding	5	SS	35
226.2 / 4.0	**SAND:** trace to some silt, trace to some gravel, containing cobbles and boulders, brown, wet, loose to dense	6	SS	49
		7	SS	10
		8	SS	24
	--- auger grinding from 8.5 m to 9.1 m	9	SS	9

GROUND WATER: Concrete; Bentonite; 226.5/Dec 08; Sand; Screen

ELEVATION: 230, 229, 228, 227, 226, 225, 224, 223, 222, 221

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

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

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

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
12	86	2	

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH4

PROJECT: Geotechnical Investigation for Proposed 16-Storey Building

CLIENT: Arten Development Group

PROJECT LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: JM

SAMPLE REVIEW: CK

CHECKED: DX

DIAMETER: 205 mm

DATE: 2020-10-29 & 11-09

REF. NO.: 20-3280GH01

ENCL. NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST (SPT ○, Cone ≳, blows/0.3m; 20 40 60 80) / SHEAR STRENGTH (kPa) (● Unconfined ▲ Quick Triaxial ✕ Field Vane & Sensitivity ⊠ Penetrometer + Lab Vane; 20 40 60 80)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%) (10 20 30 40)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
220.0											
10.2	**SILTY GRAVELLY SAND:** grey, wet, compact					Natural pack	220				
11			10	SS	25			○	○		
219.0							219				
11.3	**END OF BOREHOLE**										

Notes:

1) Water encountered at a depth of 4.0 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

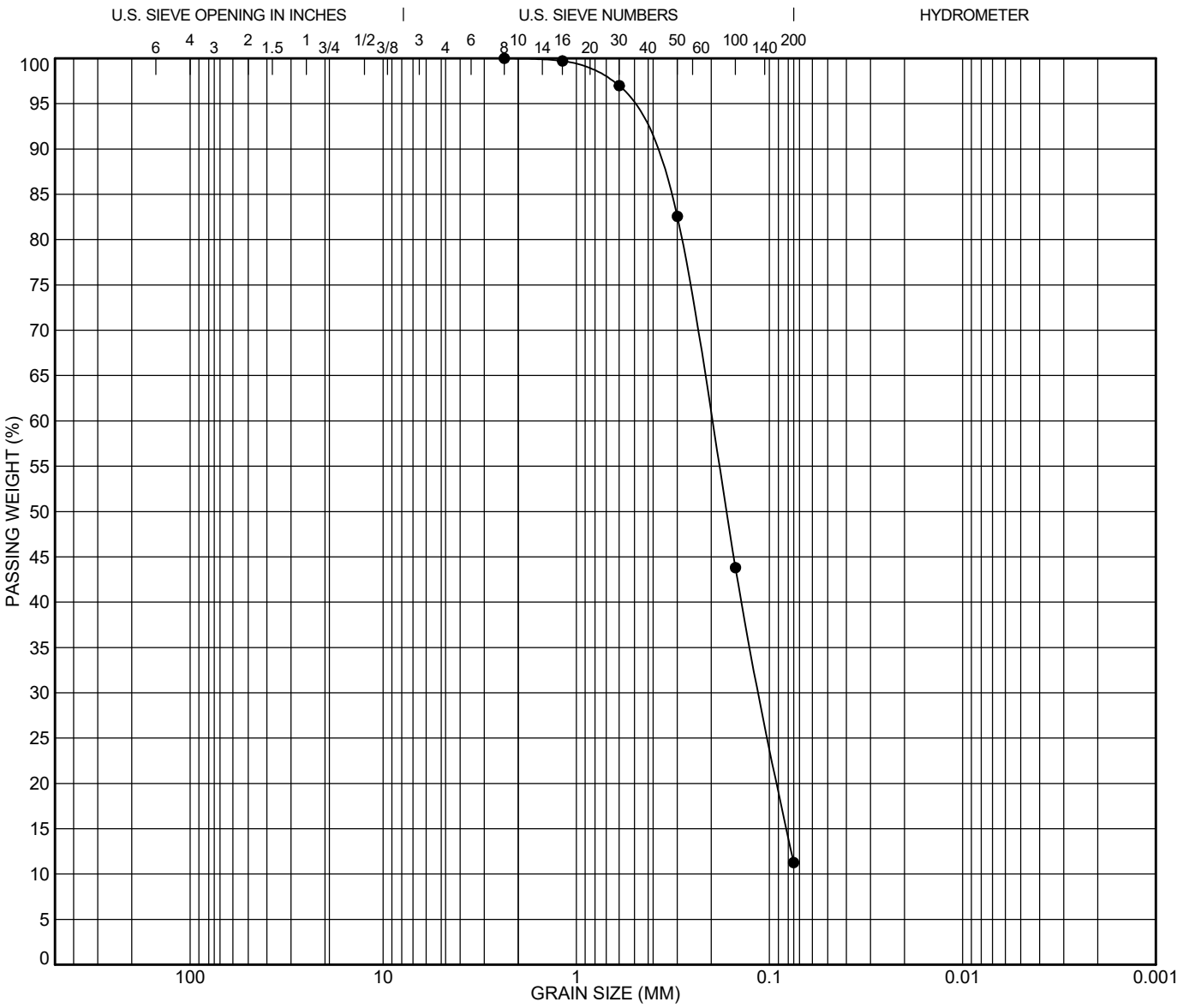
Date	W.L. Depth (mBGS)
Dec. 8, 2020	3.73

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

FIGURES



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**BH1**	**SS4**	**2.29**					**0.85**	**2.74**

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH1**	**SS4**	**2.29**	**2.36**	**0.2**	**0.112**		**0.0**	**88.7**	**11.3**	

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

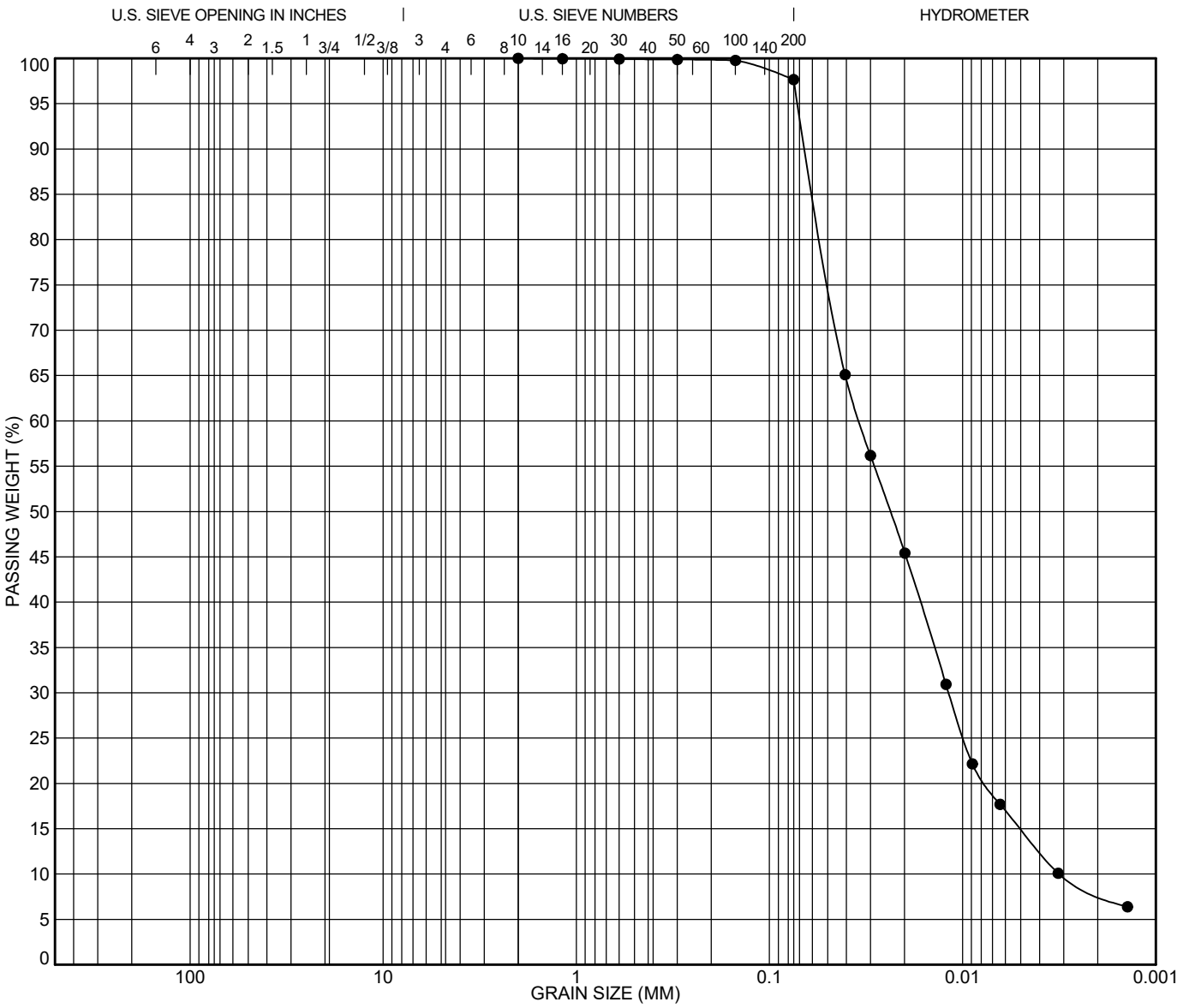
GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation for Proposed 16-Storey Residential/Commercial Building Development

LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

PROJECT NO.: 20-3280GH01 | SAMPLED ON: 2020-11-19

FIGURE NO.: 1 | TESTED ON: 2020-12-04



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **BH3 SS11 12.19**					**1.30**	**10.86**

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH3 SS11 12.19**	**2**	**0.034**	**0.012**	**0.003**	**0.0**	**2.3**	**89.7**	**8.0**

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office@geoproconsulting.ca www.geoproconsulting.ca

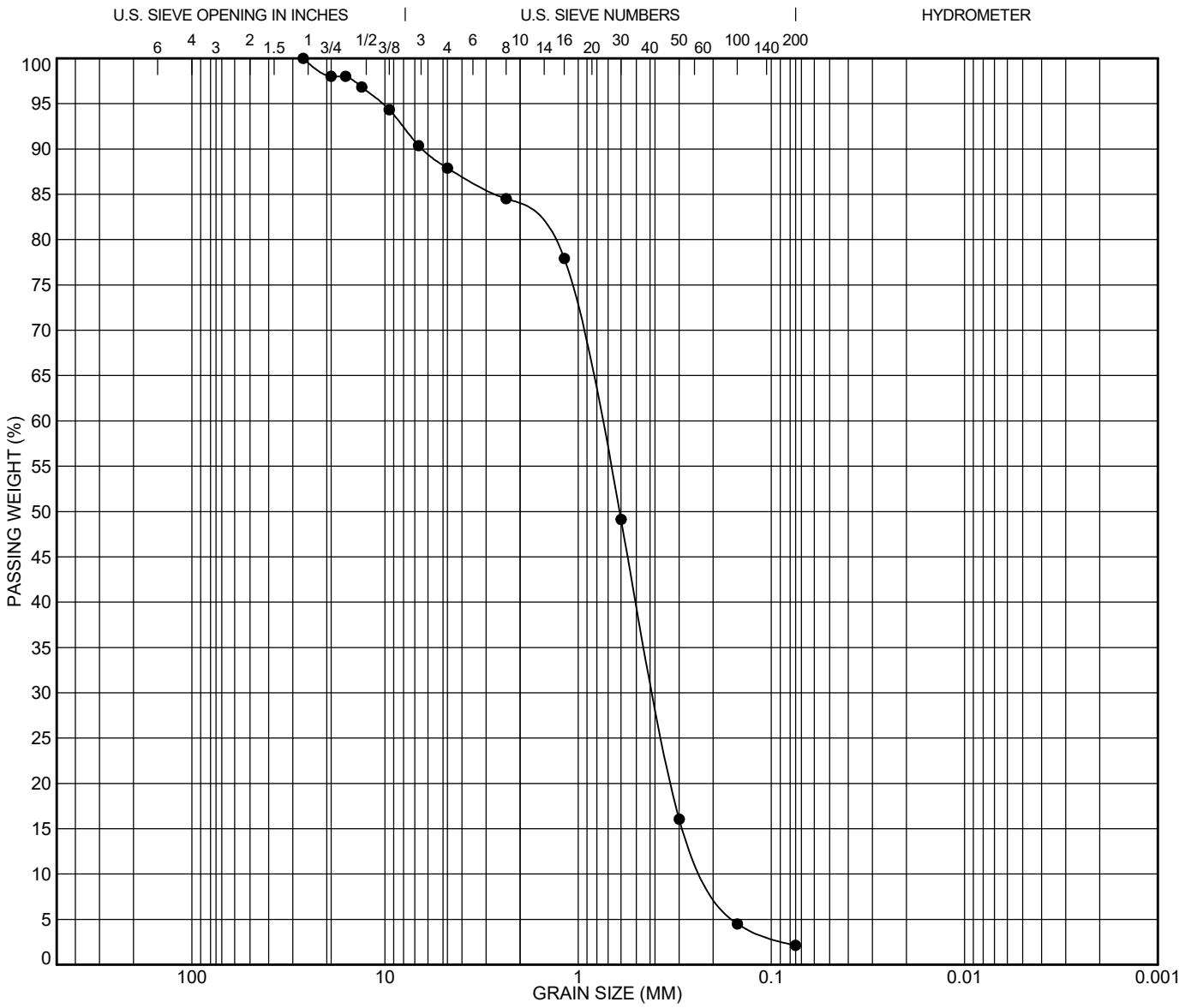
GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation for Proposed 16-Storey Residential/Commercial Building Development

LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

PROJECT NO.: 20-3280GH01 | SAMPLED ON: 2020-11-23

FIGURE NO.: 2 | TESTED ON: 2020-12-04



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **BH4 SS8 7.62**					**1.00**	**3.71**

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH4 SS8 7.62**	**26.5**	**0.775**	**0.402**	**0.209**	**12.1**	**85.8**	**2.1**	

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GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation for Proposed 16-Storey Residential/Commercial Building Development

LOCATION: 284&286 Dunlop St W and 119&121 Henry St, Barrie

PROJECT NO.: 20-3280GH01 | SAMPLED ON: 2020-10-29

FIGURE NO.: 3 | TESTED ON: 2020-12-04

APPENDIX A

Certificate of Analysis

Environment Testing

Client: Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
Invoice to: Geo Pro Consulting
PO#:

Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911
Temperature (C): 2
Custody Seal:

Dear Dylan X:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Sample Comment Summary

Sample ID: 1529482	BH2 AS1B	The result for F4 (C34-C50) gravimetric must be substituted if it is greater than the result for F4 (C34-C50).
Sample ID: 1529483	BH4 AS1B	CN (free) MRL elevated due to matrix interference (dilution was done).

Report Comments:

Addrine Thomas, Inorganics Supervisor

Long Qu, Organics Supervisor

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise stated
.
Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accrteditation. The scope is available at http://www.cala.ca/scopes/2602.pdf

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline or regulatory limits listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official guideline or regulation as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Client: Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
PO#:
Invoice to: Geo Pro Consulting

Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911

O.Reg 153-T1-All Other Soils

Exceedence Summary

Sample I.D.	Analyte	Result	Units	Criteria
Hydrocarbons				
BH2 AS1B	Petroleum Hydrocarbons F4g	200	ug/g	STD 120
Inorganics				
BH2 AS1B	Sodium Adsorption Ratio	2.71		STD 2.4
Metals				
BH2 AS1B	Mercury	0.4	ug/g	STD 0.27

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
PO#:
Invoice to: Geo Pro Consulting

Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911

Guideline = O.Reg 153-T1-All Other Soils

Hydrocarbons

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
PHC's F1	392739	10	ug/g	STD 25	<10	<10
PHC's F1-BTEX	392747	10	ug/g		<10	<10
PHC's F2	392884	10	ug/g	STD 10	<10	<10
PHC's F3	392884	20	ug/g	STD 240	40	<20
PHC's F4	392884	20	ug/g	STD 120	70	<20
PHC's F4g	392897	100	ug/g	STD 120	200*	

Metals

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
Antimony	392782	1	ug/g	STD 1.3	1	<1
Arsenic	392782	1	ug/g	STD 18	3	2
Barium	392782	1	ug/g	STD 220	64	26
Beryllium	392782	1	ug/g	STD 2.5	<1	<1
Boron (Hot Water Soluble)	392709	0.5	ug/g		<0.5	<0.5
Boron (total)	392782	5	ug/g	STD 36	<5	<5
Cadmium	392782	0.4	ug/g	STD 1.2	<0.4	<0.4
Chromium Total	392782	1	ug/g	STD 70	13	8
Chromium VI	392697	0.20	ug/g	STD 0.66	0.36	<0.20
Cobalt	392782	1	ug/g	STD 21	2	2
Copper	392782	1	ug/g	STD 92	15	11
Lead	392782	1	ug/g	STD 120	49	8
Mercury	392782	0.1	ug/g	STD 0.27		<0.1

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

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PO#:
Invoice to: Geo Pro Consulting

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Project: 20-3280GH01-1029
COC #: 866911

Guideline = O.Reg 153-T1-All Other Soils

Metals

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
Mercury	392917	0.1	ug/g	STD 0.27	0.4*	
Molybdenum	392782	1	ug/g	STD 2	<1	<1
Nickel	392782	1	ug/g	STD 82	5	4
Selenium	392782	1	ug/g	STD 1.5	<1	<1
Silver	392782	0.2	ug/g	STD 0.5	<0.2	<0.2
Thallium	392782	1	ug/g	STD 1	<1	<1
Uranium	392782	0.5	ug/g	STD 2.5	<0.5	<0.5
Vanadium	392782	2	ug/g	STD 86	29	21
Zinc	392782	2	ug/g	STD 290	254	24

PAH

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
1+2-methylnaphthalene	208523	0.05	ug/g		<0.05	<0.05
Acenaphthene	392506	0.05	ug/g	STD 0.072	<0.05	<0.05
Acenaphthylene	392506	0.05	ug/g	STD 0.093	<0.05	<0.05
Anthracene	392506	0.05	ug/g	STD 0.16	<0.05	<0.05
Benz[a]anthracene	392506	0.05	ug/g	STD 0.36	0.15	<0.05
Benzo[a]pyrene	392506	0.05	ug/g	STD 0.3	0.15	<0.05
Benzo[b]fluoranthene	392506	0.05	ug/g	STD 0.47	0.16	<0.05
Benzo[ghi]perylene	392506	0.05	ug/g	STD 0.68	0.09	<0.05
Benzo[k]fluoranthene	392506	0.05	ug/g	STD 0.48	0.17	<0.05
Chrysene	392506	0.05	ug/g	STD 2.8	0.18	<0.05

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PAH

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Soil153 2020-11-09 BH2 AS1B	Lab I.D. 1529483 Soil153 2020-11-09 BH4 AS1B
Dibenz[a h]anthracene	392506	0.05	ug/g	STD 0.1	<0.05	<0.05
Fluoranthene	392506	0.05	ug/g	STD 0.56	0.22	<0.05
Fluorene	392506	0.05	ug/g	STD 0.12	<0.05	<0.05
Indeno[1 2 3-cd]pyrene	392506	0.05	ug/g	STD 0.23	0.14	<0.05
Methlynaphthalene, 1-	392506	0.05	ug/g	STD 0.59	<0.05	<0.05
Methlynaphthalene, 2-	392506	0.05	ug/g	STD 0.59	<0.05	<0.05
Naphthalene	392506	0.05	ug/g	STD 0.09	<0.05	<0.05
Phenanthrene	392506	0.05	ug/g	STD 0.69	<0.05	<0.05
Pyrene	392506	0.05	ug/g	STD 1	0.19	<0.05

Volatiles

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Soil153 2020-11-09 BH2 AS1B	Lab I.D. 1529483 Soil153 2020-11-09 BH4 AS1B
Acetone	392738	0.50	ug/g	STD 0.5	<0.50	<0.50
Benzene	392738	0.02	ug/g	STD 0.02	<0.02	<0.02
Bromodichloromethane	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Bromoform	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Bromomethane	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Carbon Tetrachloride	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Chlorobenzene	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Chloroform	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dibromochloromethane	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichlorobenzene, 1,2-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05

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Volatiles

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Soil153 2020-11-09 BH2 AS1B	Lab I.D. 1529483 Soil153 2020-11-09 BH4 AS1B
Dichlorobenzene, 1,3-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichlorobenzene, 1,4-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichlorodifluoromethane	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloroethane, 1,1-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloroethane, 1,2-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloroethylene, 1,1-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloroethylene, 1,2-cis-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloroethylene, 1,2-trans-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloropropane, 1,2-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloropropene,1,3-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Dichloropropene,1,3-cis-	392738	0.05	ug/g		<0.05	<0.05
Dichloropropene,1,3-trans-	392738	0.05	ug/g		<0.05	<0.05
Ethylbenzene	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Ethylene dibromide	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Hexane (n)	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Methyl Ethyl Ketone	392738	0.50	ug/g	STD 0.5	<0.50	<0.50
Methyl Isobutyl Ketone	392738	0.50	ug/g	STD 0.5	<0.50	<0.50
Methyl tert-Butyl Ether (MTBE)	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Methylene Chloride	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Styrene	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Tetrachloroethane, 1,1,1,2-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Tetrachloroethane, 1,1,2,2-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Tetrachloroethylene	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Toluene	392738	0.20	ug/g	STD 0.2	<0.20	<0.20

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Volatiles

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482	Lab I.D. 1529483
Sample Matrix					Soil153	Soil153
Sample Type						
Sample Date					2020-11-09	2020-11-09
Sampling Time						
Sample I.D.					BH2 AS1B	BH4 AS1B
Trichloroethane, 1,1,1-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Trichloroethane, 1,1,2-	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Trichloroethylene	392738	0.05	ug/g	STD 0.05	<0.05	<0.05
Trichlorofluoromethane	392738	0.05	ug/g	STD 0.25	<0.05	<0.05
Vinyl Chloride	392738	0.02	ug/g	STD 0.02	<0.02	<0.02
Xylene Mixture	392746	0.05	ug/g	STD 0.05	<0.05	<0.05
Xylene, m/p-	392738	0.05	ug/g		<0.05	<0.05
Xylene, o-	392738	0.05	ug/g		<0.05	<0.05

Inorganics

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482	Lab I.D. 1529483
Sample Matrix					Soil153	Soil153
Sample Type						
Sample Date					2020-11-09	2020-11-09
Sampling Time						
Sample I.D.					BH2 AS1B	BH4 AS1B
Cyanide (CN-)	392722	0.02	ug/g	STD 0.051	<0.02	<0.02
Electrical Conductivity	392701	0.05	mS/cm	STD 0.57	0.22	0.18
pH - CaCl2	392700	2.00			7.67	7.64
Sodium Adsorption Ratio	392693	0.01		STD 2.4	2.71*	1.84

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Moisture

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
Moisture-Humidite	392884	0.1	%		7.1	6.8

PCBs

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
Aroclor 1242	392946	0.02	ug/g		<0.02	<0.02
Aroclor 1248	392946	0.02	ug/g		<0.02	<0.02
Aroclor 1254	392946	0.02	ug/g		<0.02	<0.02
Aroclor 1260	392946	0.02	ug/g		<0.02	<0.02
Polychlorinated Biphenyls	392946	0.02	ug/g	STD 0.3	<0.02	<0.02

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PCB Surrogate

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sample Date / Sampling Time / Sample I.D.	
					1529482 Soil153 2020-11-09 BH2 AS1B	1529483 Soil153 2020-11-09 BH4 AS1B
Decachlorobiphenyl	208523	1	%		73	66

PHC Surrogate

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sample Date / Sampling Time / Sample I.D.	
					1529482 Soil153 2020-11-09 BH2 AS1B	1529483 Soil153 2020-11-09 BH4 AS1B
Alpha-androstrane	392884	0	%		90	80

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Certificate of Analysis

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VOCs Surrogates

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1529482 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH2 AS1B	Lab I.D. 1529483 Sample Matrix Soil153 Sample Type Sample Date 2020-11-09 Sampling Time Sample I.D. BH4 AS1B
1,2-dichloroethane-d4	392738	0	%		106	109
4-bromofluorobenzene	392738	0	%		93	95
Toluene-d8	392738	0	%		95	94

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Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
208523	1+2-methylnaphthalene							
392506	Methlynaphthalene, 1-		76	50-140	68	50-140	0	0-40
392506	Methlynaphthalene, 2-		73	50-140	65	50-140	0	0-40
392506	Acenaphthene	<0.05 ug/g	70	50-140	62	50-140	0	0-40
392506	Acenaphthylene	<0.05 ug/g	55	50-140	49	50-140	0	0-40
392506	Anthracene	<0.05 ug/g	70	50-140	62	50-140	0	0-40
392506	Benz[a]anthracene	<0.05 ug/g	73	50-140	65	50-140	0	0-40
392506	Benzo[a]pyrene	<0.05 ug/g	61	50-140	60	50-140	0	0-40
392506	Benzo[b]fluoranthene	<0.05 ug/g	71	50-140	62	50-140	0	0-40
392506	Benzo[ghi]perylene	<0.05 ug/g	60	50-140	55	50-140	0	0-40
392506	Benzo[k]fluoranthene	<0.05 ug/g	75	50-140	65		0	0-40
392506	Chrysene	<0.05 ug/g	73	50-140	64	50-140	0	0-40
392506	Dibenz[a h]anthracene	<0.05 ug/g	68	50-140	61	50-140	0	0-40
392506	Fluoranthene	<0.05 ug/g	76	50-140	66	50-140	0	0-40
392506	Fluorene	<0.05 ug/g	71	50-140	63	50-140	0	0-40
392506	Indeno[1 2 3-cd]pyrene	<0.05 ug/g	66	50-140	61	50-140	0	0-40
392506	Naphthalene	<0.05 ug/g	66	50-140	60	50-140	0	0-40
392506	Phenanthrene	<0.05 ug/g	72	50-140	64	50-140	0	0-40
392506	Pyrene	<0.05 ug/g	74	50-140	65	50-140	0	0-40
392693	Sodium Adsorption Ratio	<0.01					5	
392697	Chromium VI	<0.20 ug/g	115	80-120	87	70-130	0	0-35
392700	pH - CaCl2	5.56	99	90-110			0	
392701	Electrical Conductivity	<0.05	96	90-110			0	0-10
392709	Boron (Hot Water Soluble)	<0.5 ug/g	87	70-130	93	75-125	0	0-30
392722	Cyanide (CN-)	<0.02 ug/g	100	75-125	110	70-130	0	0-20
392738	Tetrachloroethane, 1,1,1,2-	<0.05 ug/g	97	60-130	92	50-140	0	0-50
392738	Trichloroethane, 1,1,1-	<0.05 ug/g	113	60-130	99	50-140	0	0-50
392738	Tetrachloroethane, 1,1,2,2-	<0.05 ug/g	86	60-130	92	50-140	0	0-30
392738	Trichloroethane, 1,1,2-	<0.05 ug/g	93	60-130	86	50-140	0	0-50
392738	Dichloroethane, 1,1-	<0.05 ug/g	108	60-130	92	50-140	0	0-50
392738	Dichloroethylene, 1,1-	<0.05 ug/g	85	60-130	81	50-140	0	0-50
392738	Dichlorobenzene, 1,2-	<0.05 ug/g	93	60-130	103	50-140	0	0-50
392738	Dichloroethane, 1,2-	<0.05 ug/g	102	60-130	84	50-140	0	0-50

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Quality Assurance Summary

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392738	Dichloropropane, 1,2-	<0.05 ug/g	107	60-130	90	50-140	0	0-50
392738	Dichlorobenzene, 1,3-	<0.05 ug/g	93	60-130	103	50-140	0	0-50
392738	Dichloropropene,1,3-							
392738	Dichlorobenzene, 1,4-	<0.05 ug/g	93	60-130	103	50-140	0	0-50
392738	Acetone	<0.50 ug/g	96	60-130	80	50-140	0	0-50
392738	Benzene	<0.02 ug/g	117	60-130	101	50-140	0	0-50
392738	Bromodichloromethane	<0.05 ug/g	113	60-130	95	50-140	0	0-50
392738	Bromoform	<0.05 ug/g	88	60-130	85	50-140	0	0-50
392738	Bromomethane	<0.05 ug/g	102	60-130	92	50-140	0	0-50
392738	Dichloroethylene, 1,2-cis-	<0.05 ug/g	107	60-130	91	50-140	0	0-50
392738	Dichloropropene,1,3-cis-	<0.05 ug/g	112	60-130	91	50-140	0	0-50
392738	Carbon Tetrachloride	<0.05 ug/g	112	60-130	100	50-140	0	0-50
392738	Chloroform	<0.05 ug/g	115	60-130	98	50-140	0	0-50
392738	Dibromochloromethane	<0.05 ug/g	94	60-130	87	50-140	0	0-50
392738	Dichlorodifluoromethane	<0.05 ug/g	91	60-130	80	50-140	0	0-50
392738	Methylene Chloride	<0.05 ug/g	120	60-130	118	50-140	0	0-50
392738	Ethylbenzene	<0.05 ug/g	96	60-130	96	50-140	0	0-50
392738	Ethylene dibromide	<0.05 ug/g	96	60-130	88	50-140	0	0-50
392738	Hexane (n)	<0.05 ug/g	113	60-130	112	50-140	0	0-50
392738	Xylene, m/p-	<0.05 ug/g	99	60-130	98	50-140	0	0-50
392738	Methyl Ethyl Ketone	<0.50 ug/g	104	60-130	109	50-140	0	0-50
392738	Methyl Isobutyl Ketone	<0.50 ug/g	88	60-130	89	50-140	0	0-50
392738	Methyl tert-Butyl Ether (MTBE)	<0.05 ug/g	103	60-130	110	50-140	0	0-50
392738	Chlorobenzene	<0.05 ug/g	100	60-130	96	50-140	0	0-50
392738	Xylene, o-	<0.05 ug/g	101	60-130	100	50-140	0	0-50
392738	Styrene	<0.05 ug/g	96	60-130	95	50-140	0	0-50
392738	Dichloroethylene, 1,2-trans-	<0.05 ug/g	107	60-130	93	50-140	0	0-50
392738	Dichloropropene,1,3-trans-	<0.05 ug/g	114	60-130	94	50-140	0	0-50
392738	Tetrachloroethylene	<0.05 ug/g	116	60-130	114	50-140	0	0-50
392738	Toluene	<0.20 ug/g	115	60-130	104	50-140	0	0-50
392738	Trichloroethylene	<0.05 ug/g	114	60-130	100	50-140	0	0-50
392738	Trichlorofluoromethane	<0.05 ug/g	88	60-130	81	50-140	0	0-50
392738	Vinyl Chloride	<0.02 ug/g	101	60-130	94	50-140	0	0-50

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Client: Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
PO#:
Invoice to: Geo Pro Consulting

Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911

Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
392739	PHC's F1	<10 ug/g	97	80-120	92	60-140		0-30
392746	Xylene Mixture							
392747	PHC's F1-BTEX							
392782	Silver	<0.2 ug/g	109	70-130	98	70-130	0	0-20
392782	Arsenic	<1 ug/g	104	70-130	93	70-130	1	0-20
392782	Boron (total)	<5 ug/g	107	70-130	70	70-130	0	0-20
392782	Barium	<1 ug/g	106	70-130	29	70-130	1	0-20
392782	Beryllium	<1 ug/g	112	70-130	99	70-130	0	0-20
392782	Cadmium	<0.4 ug/g	111	70-130	82	70-130	5	0-20
392782	Cobalt	<1 ug/g	108	70-130	90	70-130	0	0-20
392782	Chromium Total	<1 ug/g	109	70-130	88	70-130	4	0-20
392782	Copper	<1 ug/g	117	70-130	56	70-130	7	0-20
392782	Mercury	<0.1 ug/g	104	70-130	87	70-130	0	0-20
392782	Molybdenum	<1 ug/g	99	70-130	87	70-130	0	0-20
392782	Nickel	<1 ug/g	113	70-130	87	70-130	10	0-20
392782	Lead	<2 ug/g	108	70-130	91	70-130	0	0-20
392782	Antimony	<1 ug/g	85	70-130	82	70-130	0	0-20
392782	Selenium	<1 ug/g	113	70-130	96	70-130	0	0-20
392782	Thallium	<1 ug/g	108	70-130	95	70-130	0	0-20
392782	Uranium	<0.5 ug/g	97	70-130	94	70-130	0	0-20
392782	Vanadium	<2 ug/g	106	70-130	71	70-130	6	0-20
392782	Zinc	<2 ug/g	116	70-130		70-130	17	0-20
392884	PHC's F2	<10 ug/g	84	80-120	91	60-140	0	0-30
392884	PHC's F3	<20 ug/g	84	80-120	91	60-140	0	0-30
392884	PHC's F4	<20 ug/g	84	80-120	91	60-140	0	0-30
392884	Moisture-Humidite		100	80-120			0	
392897	PHC's F4g	<100 ug/g		80-120		60-140		0-30
392917	Mercury	<0.1 ug/g		70-130	104	70-130	0	0-20
392946	Aroclor 1242	<0.02 ug/g	110	60-140	89	60-140	0	0-40
392946	Aroclor 1248	<0.02 ug/g	110	60-140	89	60-140	0	0-40
392946	Aroclor 1254	<0.02 ug/g	110	60-140	89	60-140	0	0-40
392946	Aroclor 1260	<0.02 ug/g	110	60-140	89	60-140	0	0-40
392946	Polychlorinated Biphenyls	<0.02 ug/g	110	60-140	89	60-140	0	0-40

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PO#:
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Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911

Test Summary

Batch No	Analyte	Instrument	Prep aration Date	Analysis Date	Analyst	Method
208523	1+2-methylnaphthalene	GC-MS	2020-11-26	2020-11-26	C_M	P 8270
392506	Methlynaphthalene, 1-	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Methlynaphthalene, 2-	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Acenaphthene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Acenaphthylene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Anthracene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Benz[a]anthracene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Benzo[a]pyrene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Benzo[b]fluoranthene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Benzo[ghi]perylene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Benzo[k]fluoranthene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Chrysene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Dibenz[a h]anthracene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Fluoranthene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Fluorene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Indeno[1 2 3-cd]pyrene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Naphthalene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Phenanthrene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392506	Pyrene	GC-MS	2020-11-23	2020-11-24	C_M	P 8270
392693	Sodium Adsorption Ratio	iCAP OES	2020-11-20	2020-11-20	Z_S	Ag Soil
392697	Chromium VI	FAA	2020-11-20	2020-11-20	Z_S	M US EPA 3060A
392700	pH - CaCl2	pH Meter	2020-11-20	2020-11-20	R_R	Ag Soil
392701	Electrical Conductivity	Electrical Conductivity Mete	2020-11-20	2020-11-20	Z_S	Cond-Soil
392709	Boron (Hot Water Soluble)	iCAP OES	2020-11-20	2020-11-20	Z_S	MOECC E3470
392722	Cyanide (CN-)	Skalar CN Analyzer	2020-11-20	2020-11-20	QT	MOECC E3015
392738	Tetrachloroethane, 1,1,1,2-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Trichloroethane, 1,1,1-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Tetrachloroethane, 1,1,2,2-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Trichloroethane, 1,1,2-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloroethane, 1,1-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloroethylene, 1,1-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichlorobenzene, 1,2-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloroethane, 1,2-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B

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40 Vogell Rd, Unit 57
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L4B 3K6
Attention: Dylan X
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Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911

Test Summary

Batch No	Analyte	Instrument	Prep aration Date	Analysis Date	Analyst	Method
392738	Dichloropropane, 1,2-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichlorobenzene, 1,3-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloropropene,1,3-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichlorobenzene, 1,4-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Acetone	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Benzene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Bromodichloromethane	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Bromoform	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Bromomethane	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloroethylene, 1,2-cis-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloropropene,1,3-cis-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Carbon Tetrachloride	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Chloroform	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dibromochloromethane	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichlorodifluoromethane	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Methylene Chloride	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Ethylbenzene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Ethylene dibromide	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Hexane (n)	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Xylene, m/p-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Methyl Ethyl Ketone	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Methyl Isobutyl Ketone	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Methyl tert-Butyl Ether (MTBE)	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Chlorobenzene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Xylene, o-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Styrene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloroethylene, 1,2-trans-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Dichloropropene,1,3-trans-	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Tetrachloroethylene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Toluene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Trichloroethylene	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Trichlorofluoromethane	GC-MS	2020-11-20	2020-11-20	YH	V 8260B
392738	Vinyl Chloride	GC-MS	2020-11-20	2020-11-20	YH	V 8260B

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Certificate of Analysis

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40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
PO#:
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Report Number: 1943291
Date Submitted: 2020-11-18
Date Reported: 2020-11-26
Project: 20-3280GH01-1029
COC #: 866911

Test Summary

Batch No	Analyte	Instrument	Prep aration Date	Analysis Date	Analyst	Method
392739	PHC's F1	GC/FID	2020-11-20	2020-11-20	YH	CCME
392746	Xylene Mixture	GC-MS	2020-11-22	2020-11-22	YH	V 8260B
392747	PHC's F1-BTEX	GC/FID	2020-11-22	2020-11-22	YH	CCME
392782	Silver	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Arsenic	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Boron (total)	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Barium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Beryllium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Cadmium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Cobalt	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Chromium Total	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Copper	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Mercury	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Molybdenum	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Nickel	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Lead	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Antimony	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Selenium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Thallium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Uranium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Vanadium	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392782	Zinc	ICAPQ-MS	2020-11-23	2020-11-23	H_D	EPA 200.8
392884	PHC's F2	GC/FID	2020-11-25	2020-11-25	A_A	CCME
392884	PHC's F3	GC/FID	2020-11-25	2020-11-25	A_A	CCME
392884	PHC's F4	GC/FID	2020-11-25	2020-11-25	A_A	CCME
392884	Moisture-Humidite	Oven	2020-11-25	2020-11-25	A_A	ASTM 2216
392897	PHC's F4g	GC/FID	2020-11-25	2020-11-25	A_A	CCME
392917	Mercury	ICAPQ-MS	2020-11-25	2020-11-25	H_D	EPA 200.8
392946	Aroclor 1242	GC/ECD	2020-11-23	2020-11-23	C_M	EPA 8081B/8082A
392946	Aroclor 1248	GC/ECD	2020-11-23	2020-11-23	C_M	EPA 8081B/8082A
392946	Aroclor 1254	GC/ECD	2020-11-23	2020-11-23	C_M	EPA 8081B/8082A
392946	Aroclor 1260	GC/ECD	2020-11-23	2020-11-23	C_M	EPA 8081B/8082A
392946	Polychlorinated Biphenyls	GC/ECD	2020-11-23	2020-11-23	C_M	EPA 8081B/8082A

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COC #: 866911

Petroleum Hydrocarbons - CCME Checklist

Samples were analysed by Eurofins Ottawa Method AMCCME2, "Petroleum Hydrocarbons in Water and Soil, CCME/TPH", "Petroleum Hydrocarbons in Water and Soil, CCME/TPH". These methods comply with the reference method for the CCME CWS PHC and are validated for use in the laboratory. Eurofins Ottawa is accredited by CALA (ISO 17025) for all CCME F1-F4 fractions as listed in this report. Eurofins Mississauga is accredited by SCC (ISO 17025) for all CCME F1-F4 fractions as listed in this report. Data for QC samples (blank, duplicate, spike) are available on request

Holding/Analysis Times	Yes/No	If NO, then reasons
All fractions analyzed within recommended hold times/analysis times?	Yes	
F1		
nC6 and nC10 response factors within 30% of toluene	Yes	
BTEX was subtracted from F1 fraction	Yes	
If YES, was F1-BTEX (C6-C10) reported	Yes	
F2		
nC10, nC16 and nC34 response factors within 10% of their average (F2-F4)	Yes	
Linearity within 15% (F2-F4)	Yes	
Napthalene was subtracted from F2 fraction		Naphthalene (PAH) not requested/analysed
If YES was F2-Napthalene reported		
F3		
PAH (selected compounds) subtracted from F3 fraction		PAH not requested/analysed
If YES was F3-PAH reported		
F4		
C50 response factor within 70% of nC10+nC16+nC34 average	Yes	
Chromatogram descended to baseline by retention time of C50	Yes	
if NO was F4 (C34-C50) gravimetric reported		

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eurofins

STANDARD CHAIN-OF-CUSTODY

866911

Eurofins Workorder #: 1943291

146 Colonnade Road, Unit #8, Ottawa, ON, K2E 7Y1 - Phone: 613-727-5692, Fax: 613-727-5222

CLIENT INFORMATION

Company:	GeoPro Consulting Limited
Contact:	ELab elab@geoproconsulting.ca
Address:	40 Vogell Road, Unit 23, Richmond Hill, ON L4B 3N6
Telephone:	905-237-8336 Cell:
Email: #1:	dylanx@geoproconsulting.ca
Email: #2:	elab@geoproconsulting.ca; chriske@geoproconsulting.ca
Project:	20-3280GH01-1029 Quote #: 190539

INVOICE INFORMATION (SAME AS CLIENT INFORMATION: YES ☑ NO ☐)

Company:		Fax:	
Contact:		Email: #1:	
Address:		Email: #2:	
Telephone:		PO #:	

TURN-AROUND TIME (Business Days)

☐ 1 Day* (100%) ☐ 2 Day** (50%) ☐ 3-5 Days (25%) ☑ 5-7 Days (Standard)

Please contact Lab in advance to determine rush availability.
*For results reported after rush due date, surcharges will apply: before 12:00 - 100%, after 12:00 - 50%.

**For results reported after rush due date, surcharges will apply: before 12:00 - 50%, after 12:00 - 25%.

REGULATION/GUIDELINE REQUIRED

☐ Sanitary Sewer, City:________
☐ Storm Sewer, City:________
☐ ODWSOG
☐ PWQO
☐ O. Reg 347/558
☐ Other: ________
☐ None

☑ O. Reg 153

Table # ___, Course / Fine, Surface / subsurface.
Type: Com-Ind / Res-Park / Agri / GW / All Other / Sediment

☐ Excess Soil, Table: ________ Type: ________

The sample results from this submission will form part of a formal Record of Site Condition (RSC) under O.Reg. 153/04 ☐ Yes ☐ No

The optimal temperature conditions during transport should be less than 10°C. Sample(s) cannot be frozen, unless otherwise indicated or agreed upon with the Laboratory. Note that this COC is not to be used for drinking water samples. The COC must be complete upon submission of the samples, there will be a $25 surcharge if required information is missing (required fields are shaded in grey).

Sample Details / Sample Analysis Required (Field Filtered --> ; O.Reg.153 parameters)

Sample ID	Date/Time Collected	Sample Matrix	# of Containers	PHC F1 - F4	BTEX	VOCs	PAHs	PCBs	Metals + Inorganics	Metals only										RN# (Lab Use Only)
BH2 AS1B	2020-11-09	Soil	4	✓		✓	✓	✓	✓											1529482
BH4 AS1B	2020-11-09	Soil	4	✓		✓	✓	✓	✓											83

	PRINT	SIGN	DATE/TIME	TEMP (°C)
Sampled By:				
Relinquished By:	Paul Lee		November 18, 2020	
Received By:	Victor Gallant	V.G.	11/18/20 2:13 p.m.	1.9°C

COMMENTS:

CUSTODY SEAL: ☐ YES ☐ NO Ice packs submitted: ☑ Yes ☐ No

401 Magnetic Drive, Unit #1, North York, ON, M3J 3H9 - Telephone: 416-661-5287 • 380 Vansickle Road, Unit #630, St. Catharines, ON, L2S 0B5 - Telephone: 905-680-8887 • 608 Norris Court, Kingston, ON, K7P 2R9 - Telephone: 613-634-9307

AFSTDCOC.5

Copies: White - Laboratory, Yellow - Sampler

Certificate of Analysis

Environment Testing

Client: Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
Invoice to: Geo Pro Consulting
PO#:

Report Number:	1943881
Date Submitted:	2020-11-27
Date Reported:	2020-12-04
Project:	20-3280GH01-1069
COC #:	866010
Temperature (C):	11
Custody Seal:	

Dear Dylan X:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Hongyuan Deng, Inorganics Technician

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise stated
.
Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accrteditation. The scope is available at http://www.cala.ca/scopes/2602.pdf

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline or regulatory limits listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official guideline or regulation as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

Client: Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill, Ontario
L4B 3K6
Attention: Dylan X
PO#:
Invoice to: Geo Pro Consulting

Report Number: 1943881
Date Submitted: 2020-11-27
Date Reported: 2020-12-04
Project: 20-3280GH01-1069
COC #: 866010

Exceedence Summary

Sample I.D.	Analyte	Result	Units	Criteria

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

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Guideline = O.Reg 153-T3-Ind/Com-Coarse

Metals

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1531447 Sample Matrix Soil153 Sample Type Sample Date 2020-11-19 Sampling Time Sample I.D. BH1-SS4	Lab I.D. 1531448 Sample Matrix Soil153 Sample Type Sample Date 2020-11-23 Sampling Time Sample I.D. BH3-SS4
Antimony	393134	1	ug/g	STD 40	<1	<1
Arsenic	393134	1	ug/g	STD 18	<1	<1
Barium	393134	1	ug/g	STD 670	12	10
Beryllium	393134	1	ug/g	STD 8	<1	<1
Boron (Hot Water Soluble)	393128	0.5	ug/g	STD 2	<0.5	<0.5
Boron (total)	393134	5	ug/g	STD 120	<5	<5
Cadmium	393134	0.4	ug/g	STD 1.9	<0.4	<0.4
Chromium Total	393134	1	ug/g	STD 160	6	4
Chromium VI	393205	0.20	ug/g	STD 8	<0.20	<0.20
Cobalt	393134	1	ug/g	STD 80	2	1
Copper	393134	1	ug/g	STD 230	6	
	393357	1	ug/g	STD 230		9
Lead	393134	1	ug/g	STD 120	2	5
Mercury	393134	0.1	ug/g	STD 3.9	<0.1	<0.1
Molybdenum	393134	1	ug/g	STD 40	<1	<1
Nickel	393134	1	ug/g	STD 270	3	2
Selenium	393134	1	ug/g	STD 5.5	<1	<1
Silver	393134	0.2	ug/g	STD 40	<0.2	<0.2
Thallium	393134	1	ug/g	STD 3.3	<1	<1
Uranium	393134	0.5	ug/g	STD 33	<0.5	<0.5
Vanadium	393134	2	ug/g	STD 86	10	10
Zinc	393134	2	ug/g	STD 340	10	9

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Guideline = O.Reg 153-T3-Ind/Com-Coarse

Inorganics

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1531447 Sample Matrix Soil153 Sample Type Sample Date 2020-11-19 Sampling Time Sample I.D. BH1-SS4	Lab I.D. 1531448 Sample Matrix Soil153 Sample Type Sample Date 2020-11-23 Sampling Time Sample I.D. BH3-SS4
Cyanide (CN-)	393262	0.005	ug/g	STD 0.051	<0.005	<0.005
Electrical Conductivity	393173	0.05	mS/cm	STD 1.4	0.25	0.14
pH - CaCl2	393185	2.00			7.87	7.79
Sodium Adsorption Ratio	393189	0.01		STD 12	3.49	2.33

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Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
393128	Boron (Hot Water Soluble)	<0.5 ug/g	97	70-130	93	75-125	0	0-30
393134	Silver	<0.2 ug/g	97	70-130	106	70-130	0	0-20
393134	Arsenic	<1 ug/g	99	70-130	100	70-130	0	0-20
393134	Boron (total)	<5 ug/g	101	70-130	132	70-130	0	0-20
393134	Barium	<1 ug/g	102	70-130		70-130	13	0-20
393134	Beryllium	<1 ug/g	103	70-130	98	70-130	0	0-20
393134	Cadmium	<0.4 ug/g	108	70-130	104	70-130	0	0-20
393134	Cobalt	<1 ug/g	102	70-130	94	70-130	3	0-20
393134	Chromium Total	<1 ug/g	104	70-130	120	70-130	3	0-20
393134	Copper	<1 ug/g	111	70-130	104	70-130	4	0-20
393134	Mercury	<0.1 ug/g	96	70-130	95	70-130	0	0-20
393134	Molybdenum	<1 ug/g	98	70-130	100	70-130	0	0-20
393134	Nickel	<1 ug/g	106	70-130	95	70-130	3	0-20
393134	Lead	<1 ug/g	105	70-130	95	70-130	6	0-20
393134	Antimony	<1 ug/g	85	70-130	90	70-130	0	0-20
393134	Selenium	<1 ug/g	109	70-130	95	70-130	0	0-20
393134	Thallium	<1 ug/g	104	70-130	100	70-130	0	0-20
393134	Uranium	<0.5 ug/g	96	70-130	100	70-130	0	0-20
393134	Vanadium	<2 ug/g	99	70-130	112	70-130	4	0-20
393134	Zinc	<2 ug/g	113	70-130	90	70-130	1	0-20
393173	Electrical Conductivity	<0.05	98	90-110			0	0-10
393185	pH - CaCl2	6.20	99	90-110			0	
393189	Sodium Adsorption Ratio	<0.01					1	
393205	Chromium VI	<0.20 ug/g	99	80-120	87	70-130	0	0-35
393262	Cyanide (CN-)	<0.005 ug/g	100	75-125	104	70-130	0	0-20
393357	Copper	<1 ug/g	120	70-130	97	70-130	17	0-20

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Test Summary

Batch No	Analyte	Instrument	Prep aration Date	Analysis Date	Analyst	Method
393128	Boron (Hot Water Soluble)	iCAP OES	2020-11-30	2020-11-30	SKH	MOECC E3470
393134	Silver	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Arsenic	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Boron (total)	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Barium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Beryllium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Cadmium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Cobalt	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Chromium Total	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Copper	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Mercury	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Molybdenum	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Nickel	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Lead	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Antimony	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Selenium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Thallium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Uranium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Vanadium	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393134	Zinc	ICAPQ-MS	2020-11-30	2020-11-30	H_D	EPA 200.8
393173	Electrical Conductivity	Electrical Conductivity Mete	2020-11-30	2020-11-30	SKH	Cond-Soil
393185	pH - CaCl2	pH Meter	2020-12-01	2020-12-01	R_R	Ag Soil
393189	Sodium Adsorption Ratio	iCAP OES	2020-11-30	2020-12-01	SKH	Ag Soil
393205	Chromium VI	FAA	2020-12-01	2020-12-01	AG	M US EPA 3060A
393262	Cyanide (CN-)	Skalar CN Analyzer	2020-12-02	2020-12-02	QT	MOECC E3015
393357	Copper	ICAPQ-MS	2020-12-03	2020-12-03	H_D	EPA 200.8

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eurofins 866010

STANDARD CHAIN-OF-CUSTODY

146 Colonnade Road, Unit #8, Ottawa, ON, K2E 7Y1 - Phone: 613-727-5692, Fax: 613-727-5222

Eurofins Workorder #: 1943881

CLIENT INFORMATION

Company:	GeoPro Consulting Limited
Contact:	ELab elab@geoproconsulting.ca
Address:	40 Vogell Road, unit 23, Richmond Hill, ON L4B 3N6
Telephone:	905-237-8336 Cell:
Email:	#1: dylanx@geoproconsulting.ca
Email:	#2: elab@geoproconsulting.ca; irisg@geoproconsulting.ca
Project:	20-3280GH01-1069 Quote #: 190500

INVOICE INFORMATION (SAME AS CLIENT INFORMATION: YES ✔ NO ☐)

Company:		Fax:	
Contact:		Email: #1:	
Address:		Email: #2:	
Telephone:		PO #:	

TURN-AROUND TIME (Business Days)

☐ 1 Day* (100%) ☐ 2 Day** (50%) ☐ 3-5 Days (25%) ✔ 5-7 Days (Standard)

Please contact Lab in advance to determine rush availability.
*For results reported after rush due date, surcharges will apply: before 12:00 - 100%, after 12:00 - 50%.

**For results reported after rush due date, surcharges will apply: before 12:00 - 50%, after 12:00 - 25%.

REGULATION/GUIDELINE REQUIRED

☐ Sanitary Sewer, City:____
☐ Storm Sewer, City:____
☐ ODWSOG
☐ PWQO
☐ O. Reg 347/558
☐ Other: ____
☐ None

✔ O. Reg 153

Table #____, Course / Fine, Surface / subsurface.
Type: Com-Ind / Res-Park / Agri / GW / All Other / Sediment

☐ Excess Soil, Table: ____ Type: ____

The sample results from this submission will form part of a formal Record of Site Condition (RSC) under O.Reg. 153/04 ☐ Yes ☐ No

The optimal temperature conditions during transport should be less than 10°C. Sample(s) cannot be frozen, unless otherwise indicated or agreed upon with the Laboratory. Note that this COC is not to be used for drinking water samples. The COC must be complete upon submission of the samples, there will be a $25 surcharge if required information is missing (required fields are shaded in grey).

Sample Details / Sample Analysis Required (O.Reg.153 parameters); Field Filtered -->

Sample ID	Date/Time Collected	Sample Matrix	# of Containers	PHC F1 - F4	BTEX	VOCs	PAHs	PCBs	Metals + Inorganics	Metals only										RN# (Lab Use Only)
BH1-SS4	2020-11-19	Soil	1						✔											1531447
BH3-SS4	2020-11-23	Soil	1						✔											48

	PRINT	SIGN	DATE/TIME	TEMP (°C)
Sampled By:				
Relinquished By:	Chase Lu		November 27, 2020	
Received By:	Victor Gallant	V.G	11/27/20 3:43pm	10.5°C

COMMENTS:

CUSTODY SEAL: ☐ YES ☐ NO Ice packs submitted: ☐ Yes ✔ No

401 Magnetic Drive, Unit #1, North York, ON, M3J 3H9 - Telephone: 416-661-5287 • 380 Vansickle Road, Unit #630, St. Catharines, ON, L2S 0B5 - Telephone: 905-680-8887 • 608 Norris Court, Kingston, ON, K7P 2R9 - Telephone: 613-634-9307

AFSTDCOC.5

Copies: White - Laboratory, Yellow - Sampler

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.