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June 11, 2019

Xinyi Zhu
for 11059955 Canada Inc.
203 Northwestern Ave
Ottawa, Ontario K1Y 0M1

E-mail: zhuxinyi@gmail.com

Project Name:	Proposed Residential Development, 95 Sweetland Avenue, Ottawa, Ontario
EXP Project Number:	OTT-00252495-A0
Subject:	**Geotechnical Investigation**

Dear Mr. Zhu:

A geotechnical investigation was undertaken at the site of the proposed residence to be located at 95 Sweetland Avenue, Ottawa, Ontario (Figure 1). This work was authorized by yourself on behalf of 11059955 Ltd. on March 25, 2019.

It is proposed to construct a three-storey low-rise apartment building with one basement level at the above site.

The geotechnical investigation was undertaken to:

1.) Establish the geotechnical and groundwater conditions at the site; and
2.) Make recommendations regarding the most suitable type of foundations, founding depth and Serviceability Limit State (SLS) and Ultimate Limit State (ULS) bearing pressures of the founding soils.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed to construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

Procedure

The geotechnical investigation was completed April 12, 2018 and comprised the drilling of three boreholes (Borehole Nos. 1, 2 and 2A) to depths ranging between 3.7 m to 6.2 m.

The fieldwork was undertaken with a CME 75 truck mount drill rig equipped with continuous flight hollow-stem augers and was supervised on a full-time basis by a representative of EXP. The locations of the boreholes are shown on the Site Plan, Figure 2.

Standard penetration tests were performed in all the boreholes at 0.75 m depth intervals and soil samples retrieved by split barrel sampler. The undrained shear strength of clayey soils was established by field-vane shear tests.

Water levels were measured in the open boreholes on completion of drilling. In addition, a long-term groundwater monitoring installation consisting of 25 mm diameter PVC (polyvinyl chloride) pipe was placed in Borehole No. 2. The installation configuration is documented on the respective borehole log. The remaining boreholes were backfilled upon completion of the fieldwork. The locations of the boreholes were established by an EXP representative in the field.

All the soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified. On completion of the fieldwork, all the soil samples were transported to the EXP laboratory in the City of Ottawa, Ontario.

All the soil samples were visually examined in the laboratory by a geotechnical engineer and borehole logs prepared. The engineer also assigned the laboratory testing which consisted of performing natural moisture content, unit weight, grain size analysis, and Atterberg Limits on selected soil samples.

Site Description

The site is located on the east side of Sweetland Avenue at civic address 95 in the City of Ottawa, Ontario. It is bounded by Sweetland Drive on the west side and by existing residences on all other sides. The site was previously occupied by a residence which has since been demolished. The site currently exists as a construction site containing the foundations of the previous residence. The east and west portions of the site are bare. The site elevation is generally flat.

Soil Description

A detailed description of the subsurface soil and groundwater conditions determined from the current geotechnical investigation is given on the attached Borehole Logs, Figures 3 to 5. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time also may result in changes in the conditions interpreted to exist at the locations where sampling was conducted. Boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of potential environmental conditions.

It should be noted that soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. “The Notes on Sample Descriptions” preceding the borehole logs form an integral part of this report and should be read in conjunction with this report.

A review of the borehole logs (Figures 3 to 5) indicates the following subsurface soil and groundwater conditions with depth.

Fill

The surficial soil in the vicinity of Borehole Nos. 1 and 2 is a layer of crusher-run limestone sand and gravel which extends to a depth of approximately 2.5 m to 3.0 m below grade.

Peat

In Borehole No. 1, fill is underlain by a layer of black consolidated peat with wood fragments, and topsoil inclusions, and extends to a depth of around 2.9 m below grade. The peat is very loose ('N' value of 3 blows per 300 mm penetration) and wet (moisture content of 57 to 129 percent).

Silty Clay to Clayey Silt

The fill in Borehole Nos. 2 and 2A is underlain by a layer of silty clay to clayey silt, which extends to a depth of around 3.8 m below grade in Borehole No. 2 and to a depth of 4.6 m in Borehole No. 2A. The silty clay to clayey silt is grey in color and is soft to firm ('N' value of 2 to 5 blows per 300 mm penetration) and has shear strength of 60 kPa. It has a moisture content of 22 to 34 percent. Its liquid limit is 58 percent and plastic limit is 39 percent.

Silty Sand and Gravel Till

The peat in Borehole 1 is underlain by slightly cohesive silty sand and gravel till, which extends to auger refusal depth of 3.7 m. It is very dense ('N' value of 50 blows for 25 mm penetration of split-barrel samples). Its moisture content is 21 to 4 percent. It's unit weight is 17.1 kN/m^3. A grain-size analysis performed on this stratum yielded a soil composition of 40 percent clay and silt, 28 percent sand and 32 percent gravel (Figure 6).

Clayey Silt Till

In Borehole Nos. 2 and 2A, the silty clay to clayey silt is underlain by clayey silt till, which extends to 4.7 m depth in Borehole 2 and to auger refusal dept of 5.1 m in Borehole 2A. The natural moisture content of clayey silt till varies from 16 percent to 7 percent. Its gradation consists of 71 percent clay and silt, 13 percent sand and 16 percent gravel (Figure 7).

Limestone Bedrock

Auger refusal was reached in all borehole locations. Washboring and core drilling techniques were used to advance further in Borehole No. 2 which revealed limestone bedrock. It is therefore likely that auger refusal was also reached on limestone bedrock at the other borehole locations.

A review of the recovered bedrock cores and published geology maps indicate that the bedrock consists of limestone of the Ottawa Formation overlaying sandstone of the Nepean formation. It is also noted that only limestone was recovered from the coring at the site.

The limestone reviewed is very fine to fine grained. It is light grey to grey in color, with occasional dark grey laminations.

A Total Core Recovery (TCR) and Rock Quality Designation (RQD) of 100 percent and 38 percent respectively were obtained from the recovered bedrock core. On this basis, the bedrock quality within the depth investigated may be classified as fair.

Photographs of the bedrock core recovered are presented in Figure 8.

Groundwater

Boreholes 1 and 2 were dry on completion of drilling. Water level in Borehole 2A was measured at 2.5 m below grade on completion of drilling. Water level observations made in the standpipe installed in Borehole 2 approximately 56 days after completion of the fieldwork recorded the water level at 3.8 m depth.

The groundwater at the site is subject to seasonal fluctuations and may be at a higher level during wet weather periods.

Foundation Considerations

The geotechnical investigation has revealed that the site contains very loose to loose granular fill, which extends to 2.5 m to 3.0 m depth. The fill in Borehole 1 is underlain by a layer of peat to 2.9 m depth. These soils are not considered suitable for founding the proposed structure. It is considered that there are two foundation alternatives available at the site as follows:

1.) Remove existing fill to 3 m depth approximately and backfill the excavation with engineered fill to the proposed founding level.

2.) Found the proposed structure on caissons socketed in the limestone bedrock with a slab-on-grade floor.

The two options are discussed in greater detail below.

Spread and Strip Footings

It is considered that there is a potential of undermining the footings of the adjacent structures if open-cut excavations are undertaken at the site. In order to investigate the feasibility of undertaking open-cut excavation at the site, it is recommended that the founding level of the adjacent buildings and their distance from the property boundary should be determined. Based on this information, it would be possible to determine if open-cut excavation will be feasible. If open-cut excavations are determined to be not feasible, the excavation sides will have to be shored.

For the purpose of founding the proposed structure on spread and strip footings, it would be necessary to undertake the excavation to the natural inorganic soils underlying the fill and the peat (i.e. to 2.9 m to 3 m deep). Care would have to be exercised during the excavation work to ensure that the excavation in the vicinity of Borehole No. 1 extends to the surface of the silty sand and ground till and that the till is not excavated. This is to ensure that the entire structure would be founded in the overburden to minimize differential settlements, which may result if the structure is founded partly on the overburden and partly on the bedrock.

The footprint of the excavation should extend at least 1 m beyond the perimeter of the structure and should thereafter be cut back at 45 degrees. The exposed surface should be examined by a geotechnical engineer and approved. Crusher-run limestone fill conforming to Ontario Provincial Standard Specifications (OPSS) Granular B, Type II should then be placed in a maximum of 300 mm lift thickness and compacted to 100 percent of Standard Proctor Maximum Dry Density (SPMDD). In-place density test should be performed on each lift to ensure the specified degree of compaction has been achieved. The placement and compaction of the engineered fill should be undertaken in this manner to the proposed founding level and spread and strip footings constructed.

The Serviceability Limit State (SLS) bearing pressure of the engineered fill may be taken at 100 kPa and its factored geotechnical resistance at Ultimate Limit State (ULS) at 150 kPa.

A minimum of 1.5 m of earth cover should be provided to all the footings of a heated structure to prevent frost damage due to frost heave. The earth cover should be increased to 2.1 m depth in the case of unhated structure if snow will not be removed from the vicinity. If the snow will be removed from the vicinity of the footings, the earth cover should be increased to 2.4 m.

The settlements of the footings designed and constructed according to the above recommendations are expected to be within the normally tolerated limit of 25 mm total and 19 mm differential movement.

Cast-in-place Concrete Piles with Slab-on-Grade Floor

If it is determined that spread and strip footings will not be feasible, the proposed structure may be founded on cast-in-place concrete piles (caissons) socketed 150 mm to 300 mm into the limestone bedrock and designed to carry the load in end bearing. These caissons may be designed for factored geotechnical resistance at ULS of 1 Mpa. The use of this bearing pressure is dependent on proper cleaning of the caisson bases. The bases of the caissons may be augered clean by mixing the loose material at the base of the caisson with a small quality of concrete. It is possible that more than one attempt may be required to achieve a clean base.

During caisson drilling, a temporary liner would be required to prevent caving and to seal off any water that may be perched in the fill or in the more permeable seams above the founding level. For this purpose, the caisson hole should be advanced through the water bearing strata without removal of material down to bedrock. The caisson liner can then be vibrated through the disturbed soil and seated into the bearing strata. The disturbed soil can then be removed from within the liner using caisson auger. This procedure would avoid loss of ground from surrounding soil.

Depending on the quantity of water present in the bottom of the caisson hole, the concrete may have to be placed using the tremie method. If this is the case, a positive head of concrete with respect to any exterior groundwater levels must be maintained during withdrawal of the liner. A 150 mm slump concrete is recommended to use to prevent the concrete from honey-combing and to avoid bridging of concrete in the liner upon its withdrawal.

Routine placement of concrete in the caisson can be undertaken into a maximum of 50 mm of free-standing water provided cement is added to the water in the caisson hole to create a slurry, after which the concrete can be placed. Any quantity of water greater than this would require placement of concrete by the tremie method.

The caisson installation procedure must be monitored on a full-time basis by geotechnical personnel from EXP to verify bedrock quality, geotechnical related design parameters, etc. and to ensure that the caisson bases have been cleaned satisfactorily.

Settlement of the structure founded on caissons designed and constructed according to the above-recommendations are expected to be less than 10 mm.

Floor Slab and Drainage Requirements

It has been recommended that the floor slab of the building may be constructed as slab-on-grade. If the building is founded on spread and strip footings, the excavation would have been undertaken to 3 m depth approximately and backfilled to the founding level with engineered fill. In this case, the placement and compaction of the engineered fill should be continued from the founding level to the subgrade level as described previously except that the fill may be compacted to 98 percent of SMPDD. If structure is to be founded on cast-in-place piles (caissons), it would be necessary to sub-excavate the existing fill to 1.5 m depth prior to installation of the caissons, and to backfill the excavation to the subgrade level with engineered fill. The exposed surface should be thoroughly compacted with a heavy ride-on type of roller to achieve at least 98 percent of SMPDD in the upper 300 mm of the fill. Granular fill conforming to OPSS Granular B, Type II should be placed in 300 mm lift thicknesses and compacted to 98 percent SPMDD as described previously to the subgrade level.

The lowest level floor of the proposed structure may be constructed as slab-on-grade provided it is set on a bed of well compacted 19 mm clear stone at least 200 mm thick, placed on the natural soil or on well compacted fill. The clear stone would prevent the capillary rise of moisture from the sub-soil to the floor slab. Adequate saw cuts should be provided in the floor slabs to control cracking.

Perimeter as well as underfloor drains should be provided for the structure with basement (Figure 9). The perimeter and sub-surface drains should preferably be connected separately to storm sewers. All subsurface walls should be properly damp proofed. The exterior grade should be sloped away from the structures at an inclination of 1 to 2 percent to prevent the ingress of surface runoff.

Lateral Earth Pressure Against Subsurface Walls

The subsurface walls should be backfilled with free draining material, such as OPSS 1010 for Granular B, Type II and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls.

For design purposes, the lateral static earth thrust against the subsurface walls may be computed from the following equation:

$$P = K_0 H (q + \tfrac{1}{2} \gamma H)$$

where P = Lateral earth thrust acting on the subsurface wall; kN/m

K_0 = Lateral earth pressure coefficient for 'at rest' condition for Granular B Type II backfill material = 0.5

γ = Unit weight of free draining granular backfill; Granular B = 22 kN/m^3

H = Height of backfill adjacent to foundation wall, m

q = Surcharge load, kPa

Excavations

Excavations for construction of spread and strip footings are expected to extend to a maximum depth of 3 m below the existing ground surface and to 1.5 m depth approximately if it is founded on caissons. In the former case, the excavation will extend through the fill to the underlying natural soil. In the latter case, the excavation will extend part way into the existing fill. The excavation is expected to be above the groundwater table.

Excavations above the groundwater table in the existing fill are expected to be stable when cut back at 45 degrees. If open-cut excavation is not feasible due to space restrictions, the excavation may have to be shored. This office should be contacted to make recommendations regarding the design of shoring, if required.

Seepage of surface and subsurface water into the excavations is anticipated. However, it should be possible to collect any water entering the excavations in perimeter ditches and to remove it by pumping from sumps. Although this investigation has estimated the groundwater levels at the time of the field work, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring techniques and which may affect the type and nature of dewatering procedures used by the contractor in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile, thin layers of soil with large or small permeabilities compared with the soil mass, etc. Only carefully controlled tests using pumped wells and observation wells will yield the quantitative data on groundwater volumes and pressures that are necessary to engineer construction dewatering systems adequately.

Many geologic materials deteriorate rapidly upon exposure to meteorological elements. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from moisture, desiccation, and frost action throughout the course of construction.

It is anticipated that Permit to Take Water will not be required since the excavations will not extend below the groundwater table.

Backfilling Requirements and Suitability of On-site Soils for Backfilling Purposes

It has been recommended that the excavation undertaken at the site (whether to 3 m depth or 1.5 m depth) should be backfilled with engineered fill conforming to OPSS Granular B, Type II. The backfill against the subsurface walls should also conform to OPSS, Granular B, Type II.

The backfill from the excavation base to the proposed founding level should be compacted to 100 percent SPMDD. The backfill inside the building from the founding level to the subgrade level (underfloor fill) should be compacted to 98 percent SPMDD. The backfill against the subsurface walls should be compacted to 95 percent SPMDD.

The material to be excavated from the site is expected to be crusher-run limestone fill and peat. The peat should be discarded. The crusher-run limestone fill may be suitable for backfilling purposes if it conforms to OPSS Granular B, Type II. This should be confirmed during early stage of the excavation work.

General Comments

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions, between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well, as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information contained in this report is not intended to reflect on environmental aspects of the soils. Should specified information be required, including for example, the presence of pollutants, contaminants or other hazards in the soil, additional testing may be required.

We trust that the information contained in this letter will be satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely,
EXP Services Inc.

LICENSED PROFESSIONAL ENGINEER
June 11/19
S. K. AGGARWAL
PROVINCE OF ONTARIO

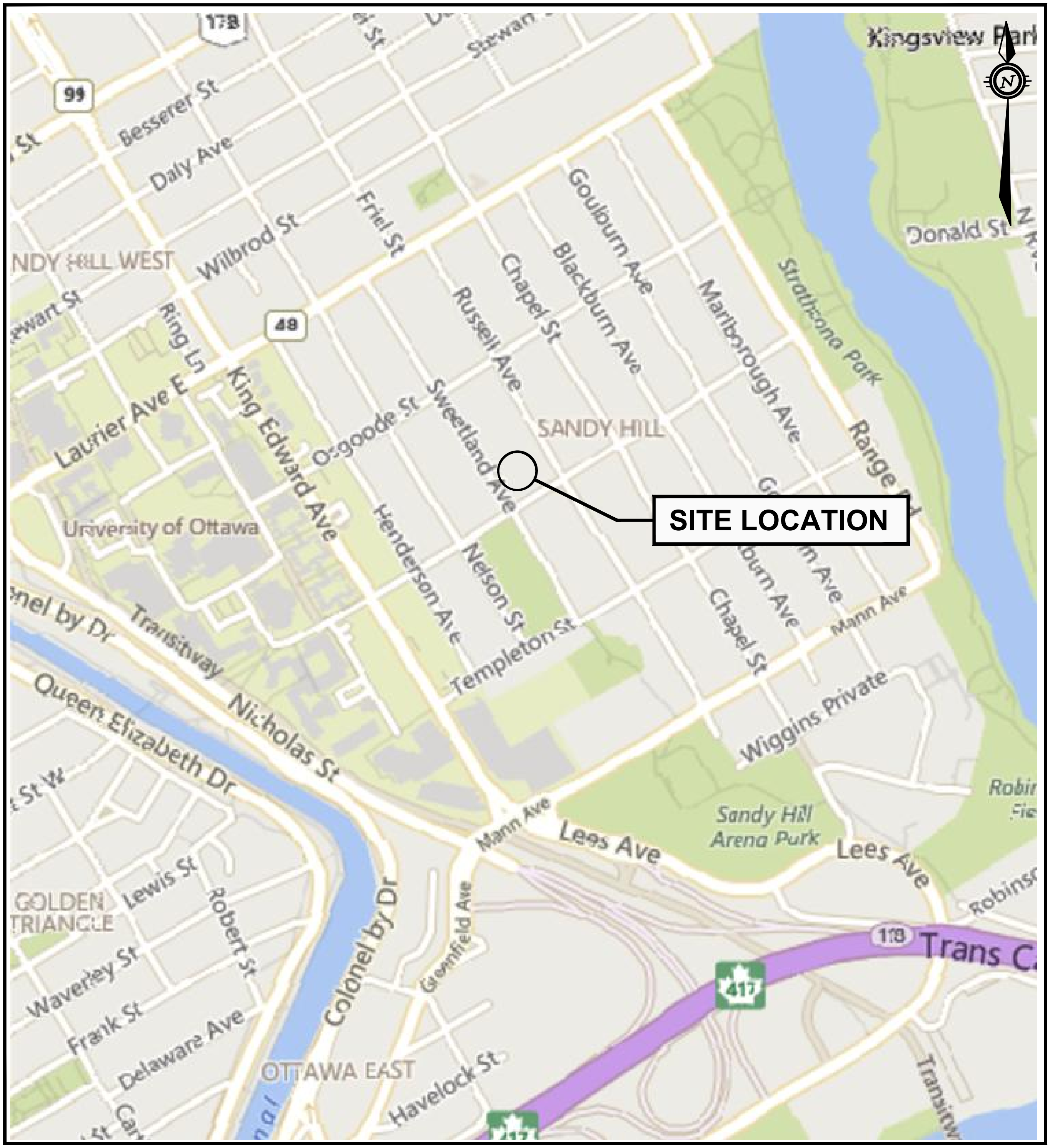
Surinder K. Aggarwal, M.Sc., P.Eng.
Senior Project Manager, Geotechnical Services
Earth and Environmental

Ismail M. Taki, M.Eng., P.Eng.
Manager, Geotechnical Services
Earth and Environmental

Attachments:

- Figure 1: Site Location Plan
- Figure 2: Borehole Location Plan
- Figures 3 to 5: Borehole Logs
- Figures 6 to 7: Grain-size Analyses
- Figure 8: Rock Core Photographs
- Figure 9: Perimeter and Underfloor Drainage System

Figures



MAP DATA ©2018 GOOGLE, IMAGE LANDSAT/ COPERNICUS, IMAGE DATA ©2018 DIGITALGLOBE

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DATE: APRIL 2019		CLIENT: 11059955 CANADA INC	project no. OTT-00252495-A0
DESIGN: C.H.	CHECKED: P.S.	TITLE: SITE LOCATION PLAN 95 SWEETLAND AVENUE, OTTAWA, ON	scale N.T.S
DRAWN BY: A.O.			FIG 1

Filename: r:\250000\250000\252496 - piesa 95 sweetland\252496-slp.dwg
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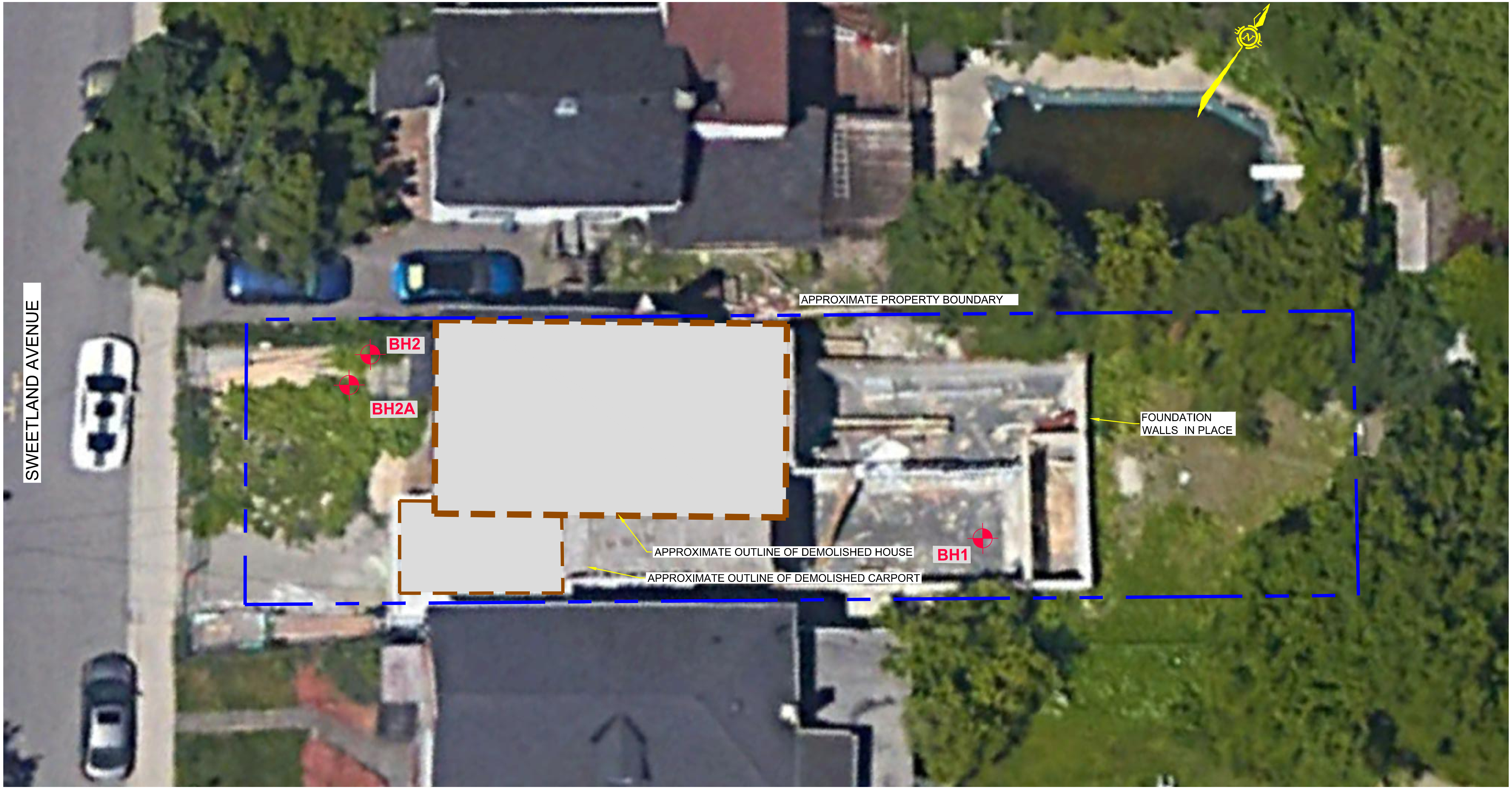

NOTES:

1. *THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.*
2. *SOIL SAMPLES AND ROCK WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.*
3. *TOPSOIL QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE BOREHOLE LOCATIONS.*
4. *BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.*
5. *THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.*

LEGEND

BH1 — BOREHOLE NUMBER AND LOCATION

0 1m 2m 5m
HORIZONTAL 1:125

exp.

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

scale 1:125	CLIENT:	11059955 CANADA INC.	project no. OTT-00252495-A0
date JUNE 2019	TITLE:	BOREHOLE LOCATION PLAN 95 SWEETLAND AVENUE, OTTAWA, ON	FIG 2
drawn by A.O./ M.N.			

Filename: p:\projects\geotechnical\250000\252000\252495 geo phase i 95 swweetland ave ottawa\o - dwgs\252495-a0 bh plan.dwg
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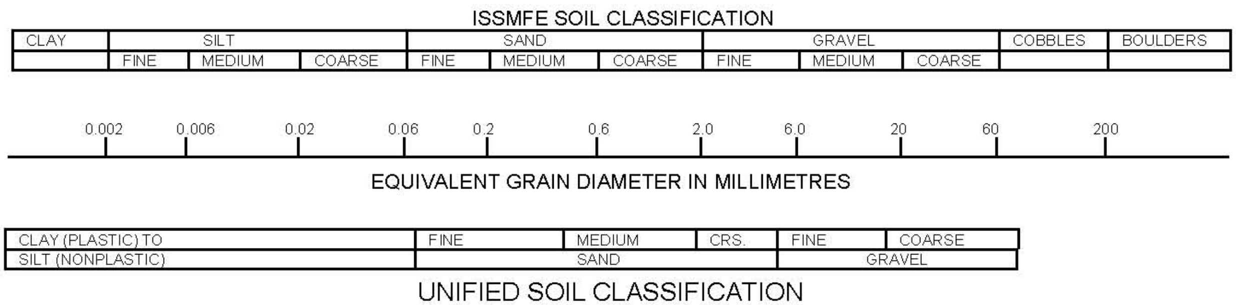
Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. 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 geotechnical site investigation.

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

Log of Borehole BH-1

Project No: OTT-00252495-A0

Project: Phase I ESA & Geotechnical Investigation - Proposed Residential Development

Location: 95 Sweetland Avenue, Ottawa, ON

Figure No. 3

Page. 1 of 1

Date Drilled: 'April 12, 2019

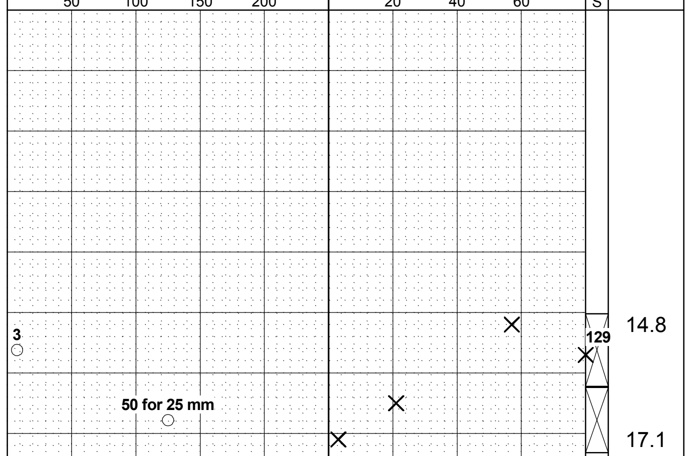
Drill Type: CME-75 Track Mounted Drill Rig - HSA

Datum: Geodetic

Logged by: A.N. Checked by: I.T.

Split Spoon Sample	Combustible Vapour Reading
Auger Sample	Natural Moisture Content
SPT (N) Value	Atterberg Limits
Dynamic Cone Test	Undrained Triaxial at % Strain at Failure
Shelby Tube	Shear Strength by Penetrometer Test
Shear Strength by Vane Test (S)	

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value (20, 40, 60, 80) / Shear Strength kPa (50, 100, 150, 200)	Combustible Vapour Reading (ppm) (250, 500, 750) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) (20, 40, 60)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL OPSS Granular 'A', crusher run limestone		0				
				1				
				2				
		PEAT Decayed wood pieces, black			3		129	14.8
		SILTY SAND AND GRAVEL TILL Trace clay, grey, moist		3	50 for 25 mm			17.1
		Auger Refusal at 3.7 m Depth						



NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00252495-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion	Dry	3.6

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-2

Project No: OTT-00252495-A0

Project: Phase I ESA & Geotechnical Investigation - Proposed Residential Development

Location: 95 Sweetland Avenue, Ottawa, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'April 12, 2019

Drill Type: CME-75 Track Mounted Drill Rig - HSA

Datum: Geodetic

Logged by: A.N. Checked by: I.T.

Split Spoon Sample	☒
Auger Sample	
SPT (N) Value	○
Dynamic Cone Test	—
Shelby Tube	■
Shear Strength by Vane Test	+ S
Combustible Vapour Reading	□
Natural Moisture Content	×
Atterberg Limits	├—○
Undrained Triaxial at % Strain at Failure	⊕
Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value (20, 40, 60, 80) / Shear Strength kPa (50, 100, 150, 200)	Combustible Vapour Reading (ppm) (250, 500, 750) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) (20, 40, 60)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL OPSS Granular 'A', crusher run limestone		0 – 1 – 2	4	×	☒	
					6	×	☒	
		SILTY CLAY TO CLAYEY SILT Grey, moist, (stiff)		3	5; 60 kPa; S = 2.8	×	☒	
		CLAYEY SILT TILL Some sand and gravel, grey, moist to very moist		4	4	×	☒	
					50 for 25 mm	× ├—○	☒	
		BEDROCK Ottawa Formation limestone - fine grained to very fine grained, light grey to grey limestone with occasional dark grey laminations, moderately to closely spaced horizontal to sub-horizontal fracturing		5 – 6				RUN 1

Borehole Terminated at 6.2 m Depth

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 25 mm diameter monitoring well installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00252495-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion	Dry	3.0
56 days	3.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	4.7 - 6.2	100	58

Log of Borehole BH-2A

Project No: OTT-00252495-A0

Project: Phase I ESA & Geotechnical Investigation - Proposed Residential Development

Location: 95 Sweetland Avenue, Ottawa, ON

Figure No. 5

Date Drilled: 'April 12, 2019

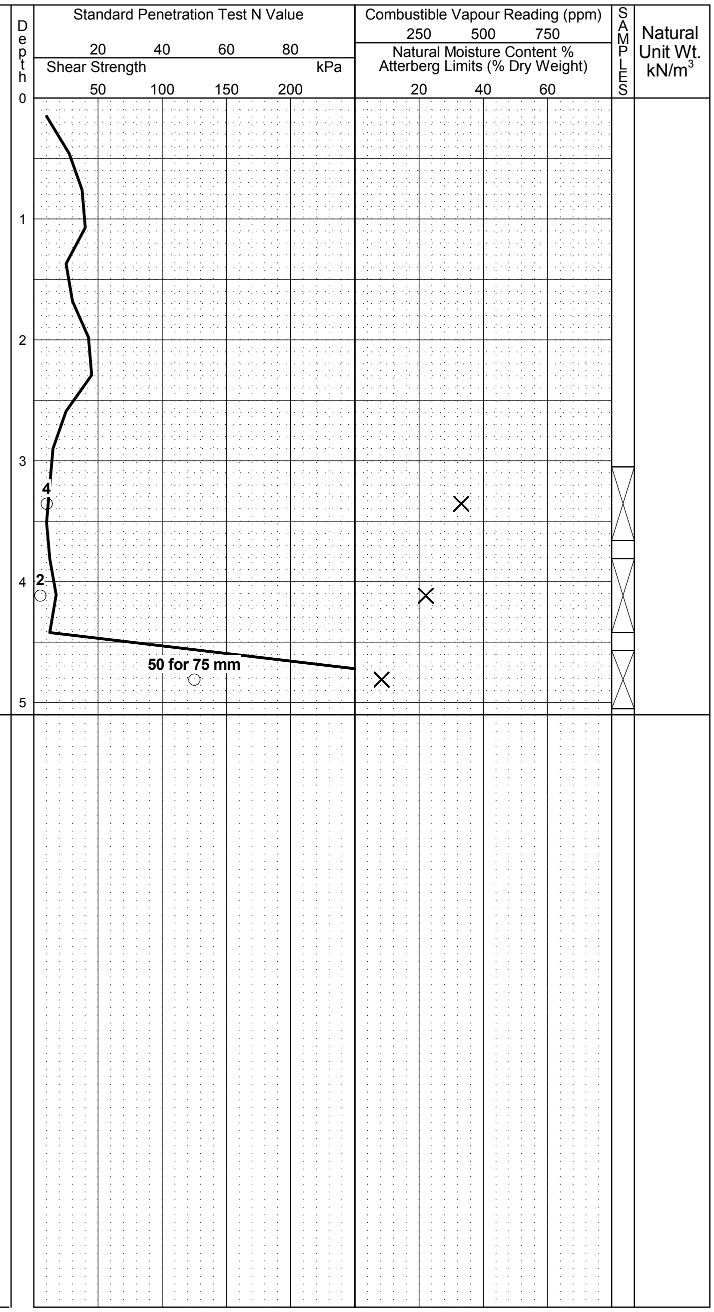
Drill Type: CME-75 Track Mounted Drill Rig - HSA

Datum: Geodetic

Logged by: A.N. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	□
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├──○
Dynamic Cone Test	──	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth (m)
		Casing advanced to 3.0 m; see Figure No. 4 for details on lithology		0
		SILTY CLAY TO CLAYEY SILT Grey, moist		3
		CLAYEY SILT TILL Occasional shale pieces, grey, very moist		4.6
		Auger Refusal at 5.1 m Depth		5.1



NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00252495-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion	2.7	5.0

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

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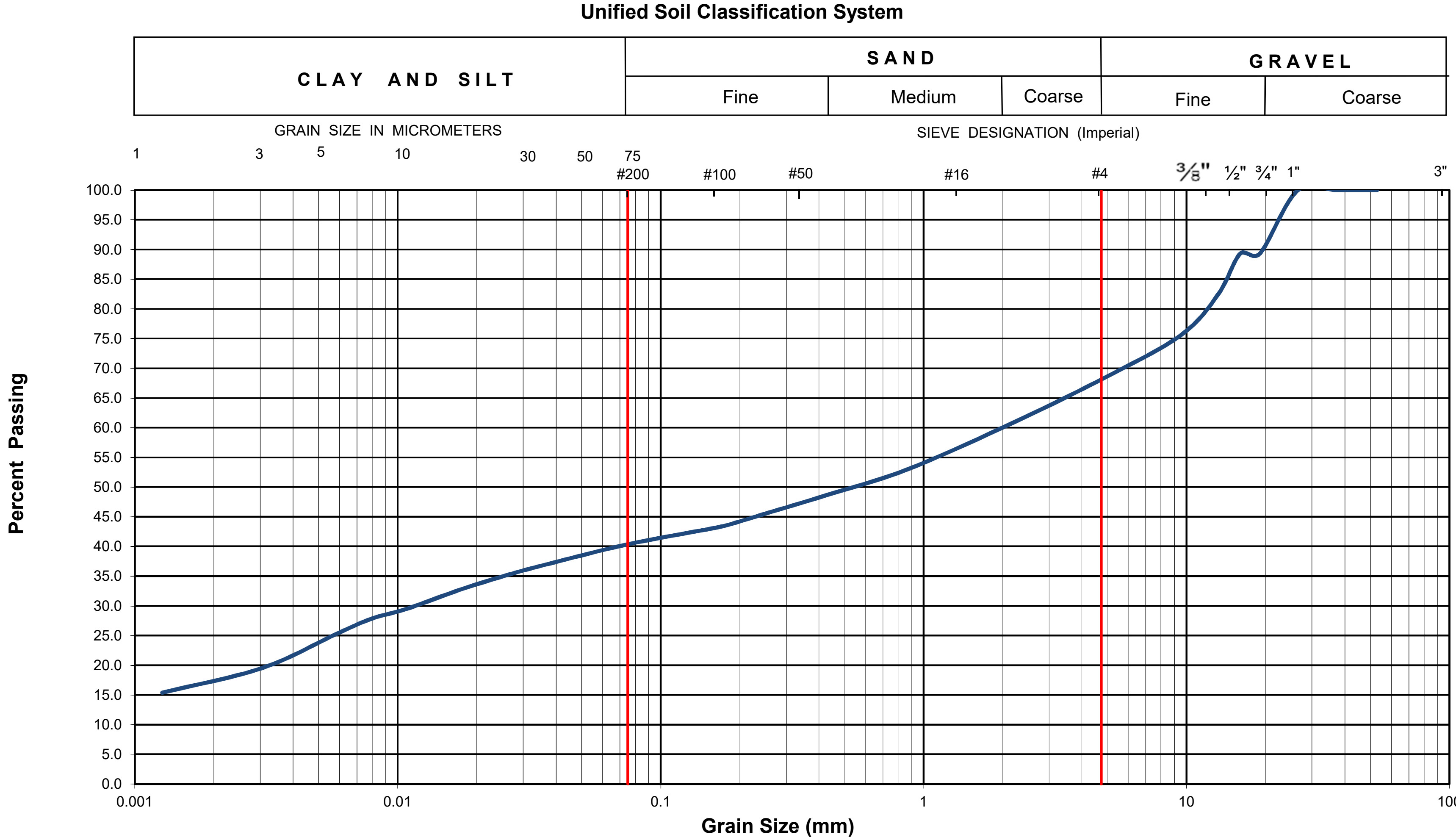
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.: OTT-00252495	Project Name : Geotechnical Investigation - Engineering Services Proposal						
Client : Ottawa Carleton Construction Group Ltd.	Project Location : 95 Sweetland, Ottawa. ON						
Date Sampled : April 12, 2019	Borehole No: BH1		Sample No.: SS2			Depth (m) : 3.1-3.7	
Sample Description :	% Silt and Clay	40	% Sand	28	% Gravel	32	Figure : 6
Sample Description : Gravel-Sand-Clay Mixture with Some Silt (GC)							

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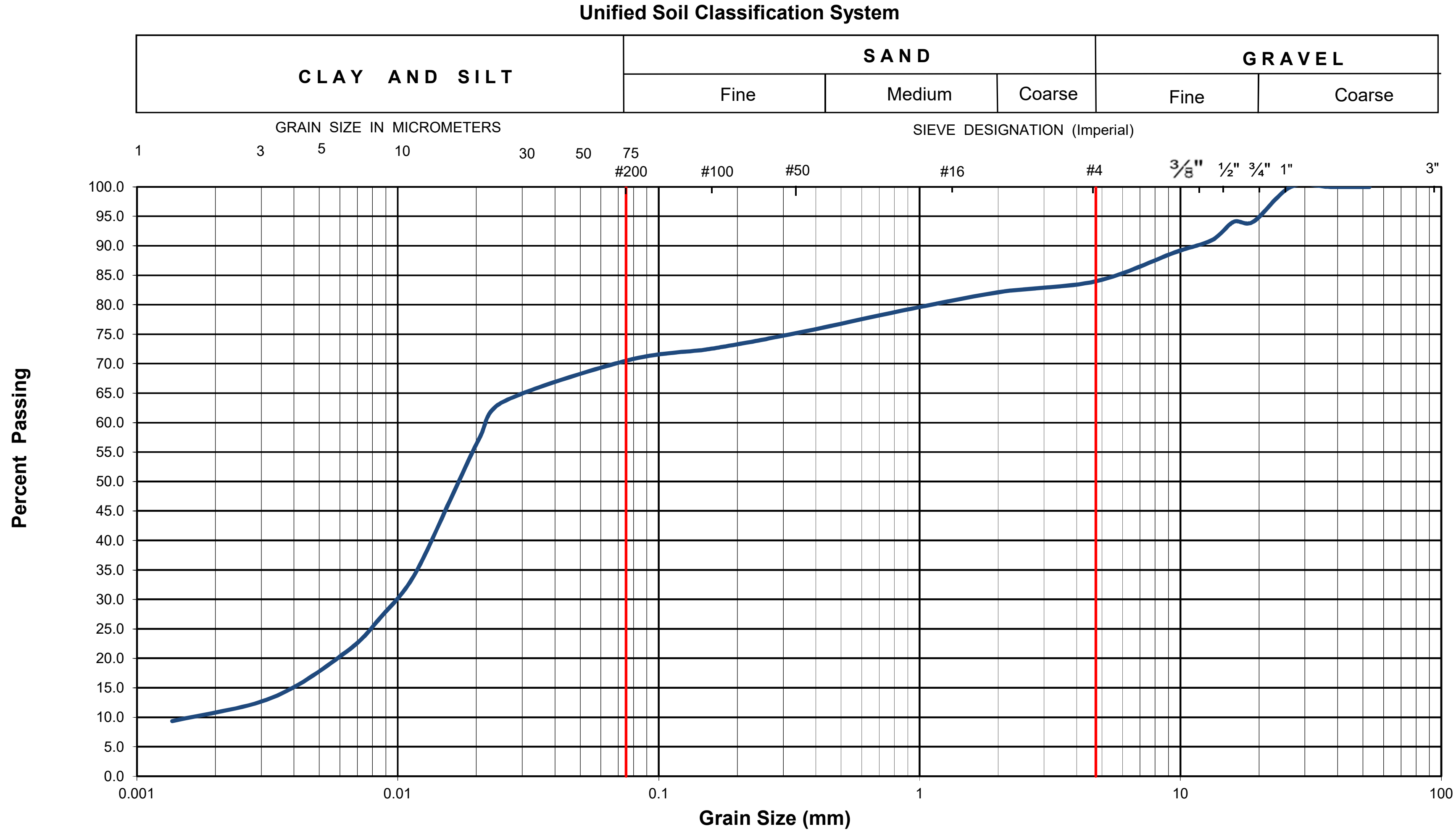
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	OTT-00252495	Project Name :	Geotechnical Investigation - Engineering Services Proposal				
Client :	Ottawa Carleton Construction Group Ltd.	Project Location :	95 Sweetland, Ottawa. ON				
Date Sampled :	April 12, 2019	Borehole No:	BH2	Sample No.:	SS4	Depth (m) :	3.8-4.4
Sample Description :		% Silt and Clay	71	% Sand	13	% Gravel	16
Sample Description :	Non Plastic Silt with Some Sand and Some Gravel, Trace Clay					Figure :	7

DRY BEDROCK CORES

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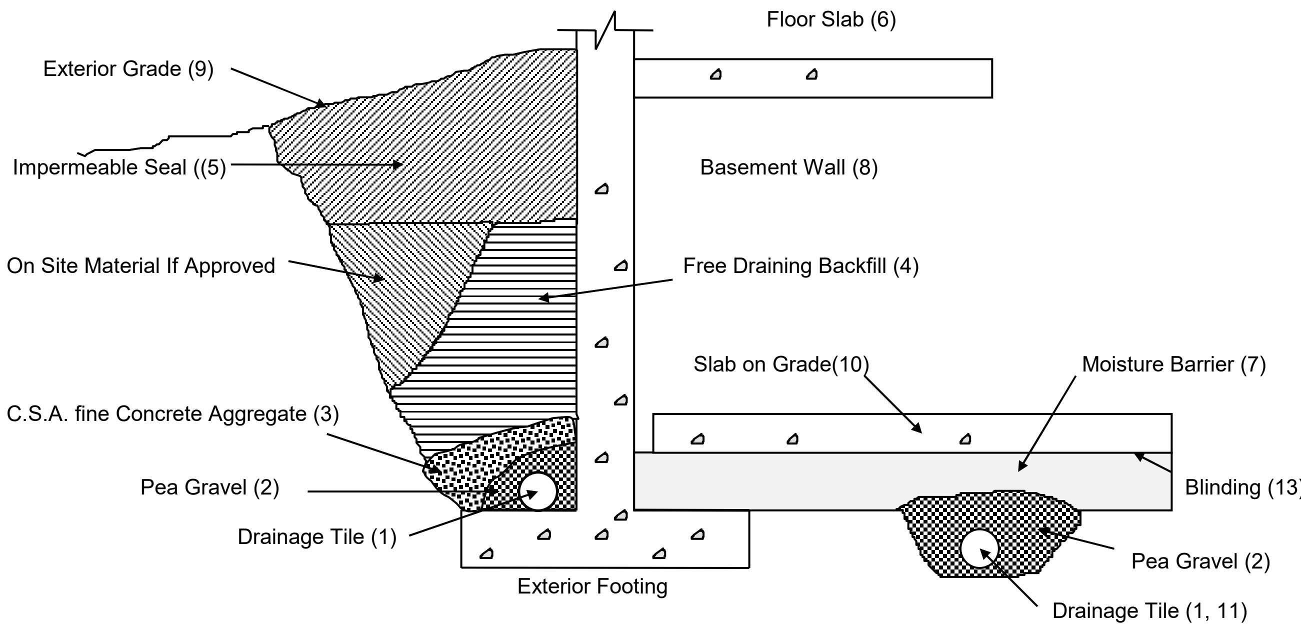
borehole no.	core runs	PROJECT	project no.
BH2	Run 1: 4.7 m - 6.2 m	PROPOSED RESIDENTIAL DEVELOPMENT 95 SWEETLAND AVE, OTTAWA, ON	OTT-00252495-A0
date cored Apr 12, 2019		ROCK CORE PHOTOGRAPHS	**Figure 8**



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. Pea gravel - 150 mm (6") top and side of drain. If drain is not on footing, place 100 mm (4 inches) of pea gravel below drain . 20 mm (3/4") clear stone is an alternative provided it is surrounded by an approved porous plastic membrane (Terrafix 270R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm (12") top and side of tile drain. This may be replaced by an approved porous plastic membrane as indicated in (2).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material.
8. Basement wall to be damp-proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm(12") below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centres one way. Place drain on 100 m (4") pea gravel with 150 mm(6") of pea gravel on top and sides. Provide filter material as noted in (3) if moisture barrier is not clear crushed stone.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20 mm (3/4") stone requires surface blinding, use 6 mm (1/4") clear stone chips.

DRAINAGE AND BACKFILL RECOMMENDATIONS

(not to scale)