Geotechnical Investigation

Client:
Conseil des écoles catholiques du Centre-Est (CECCE)
4000, rue Labelle
Ottawa, Ontario
K1J 1A1

Type of Document:
Final Report

Project Name:
Proposed School Addition, New Pavilion and Bus Loop
Paul Desmarais Catholic Secondary School
5315 Abbott Street East
Ottawa, Ontario

Project Number:
OTT-22013695-A0

Prepared By:
EXP Services Inc.
100-2650 Queensview Drive
Ottawa, Ontario K2B 8H6
Canada

Date Submitted:
November 2,2022

Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed new development at the property of the Paul Desmarais Catholic Secondary School, 5315 Abbott Street East, Ottawa, Ontario (Figure 1). The proposed new structures will include an addition to the existing school building to be located on the north side of the existing school, a new pavilion building to be located south of the existing sports dome and a new paved bus loop to be located east of the sports dome. The terms and conditions of this assignment were outlined in EXP's proposal number: OTT-22007289-A0 dated May 24, 2022.

EXP completed two (2) previous geotechnical investigations at the school site for the design and construction of the existing school building (2014) and for the inflatable sports dome and outdoor mechanical compound area (2018).

It is our understanding that the proposed addition to the school building will be a two-storey structure with no basement. The new pavilion building will be a single-storey structure with no basement. The proposed addition to the school building and the pavilion building are considered to be heated structures. The design elevation of the finished floor (ground floor) of the proposed building addition will match the elevation of the ground floor of the existing school at Elevation 104.90 m. Similarly, the design elevation of the floor of the new pavilion building will match the elevation of the playing surface of the existing sports dome at Elevation 104.08 m. The new development on the school property will also include a new paved bus loop to be located east of the existing sports dome with access from the future Robert Grant Avenue.

The borehole fieldwork for this geotechnical investigation was undertaken on August 2 and August 10,2022 and consists of eleven (11) boreholes (Borehole Nos. 22-01 to 22-11) advanced to termination and auger refusal depths ranging from 2.1 m to 8.2 m below the existing ground surface. The fieldwork was supervised on a full-time basis by a representative from EXP.

The borehole information indicates the subsurface conditions consist of a surficial topsoil layer and asphaltic concrete layer underlain by fill, silty clay, silt and glacial till with auger refusal met on inferred cobbles, boulders or bedrock at 7.0 m to 7.4 m depths below existing grade (Elevation 96.6 m and 96.5 m). The groundwater level ranges from 1.9 to 2.9 m depths (Elevation 101.7 m and Elevation 101.0 m).

This geotechnical investigation revealed that the subsurface conditions are similar to the conditions encountered in the area of the existing school building, sports dome and outdoor mechanical compound. As with these existing structures, the area of the proposed school building addition and new pavilion building are underlain by silt that is susceptible to liquefaction during a seismic event. Liquefaction analysis of the borehole data from this geotechnical investigation indicates that the post-liquefaction settlement, following a seismic event would be 80 mm. Therefore, the design of the shallow foundations and slab-on-grade options provided for the proposed school building addition and new pavilion building should take into consideration the post-liquefaction settlement of 80 mm.

Since the silt is liquefiable during a seismic event, the site classification for seismic site response would be Class F. However, based on the 2012 Ontario Building Code (as amended May 2, 2019), if the fundamental period of vibration for the proposed addition to the school building and new pavilion will be the same as for the existing school building and sports dome, less than 0.5 seconds, the site may be classified for seismic response as Class E. Based on the 2015 National Building Code of Canada Seismic Hazard Calculation, for a fundamental period of vibration of less than 0.5 seconds and site class E, the design spectral response values for the site are provided in the attached geotechnical report.

Based on a review of the borehole information, the maximum anticipated grade raise of 1.0 m for the proposed addition to the school building and for the new pavilion building is considered to be acceptable from a geotechnical perspective.

Based on a review of the borehole information, the **proposed school addition** may be supported by strip and spread footings founded on the surface of the native silty clay contacted at 1.4 m and 2.2 m depths below existing grade (Elevation 102.7 m to Elevation 102.2 m) or at a shallower depth on a minimum 600 mm thick engineered fill pad constructed on the approved surface of the native silty clay. The existing fill is not considered suitable to support the foundations and floor slab of the proposed building. A mat or raft foundation placed on an engineered fill pad constructed on the native silty clay was also considered for the proposed school addition. However, the mat foundation may impose additional load onto the pile foundations along the north wall of the existing school. Therefore, a mat foundation is not considered feasible to support the proposed school addition.

Square spread footings having a maximum width and length of 3.0 m and strip footings having a maximum width of 1.5 m founded on the surface of the native silty clay or properly prepared engineered fill pad may be designed for a bearing capacity at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 225 kPa. The factored geotechnical resistance value at ULS includes a resistance factor of 0.5. The total and differential settlements of the footings are expected to be less than 25 mm and 19 mm respectively. The SLS and factored ULS values are valid provided the site grade raise to a maximum of 1.0 m is respected. The design of the footings and slab-on-grade for the proposed school addition should take into consideration the post-liquefaction settlement of 80 mm in addition to the above noted total and differential settlements.

Based on a review of the borehole information, the **proposed new pavilion building** may be supported by a thickened reinforced concrete slab (mat or raft foundation) placed near final grade and supported by an engineered fill pad constructed on the native silty clay and designed for an SLS bearing pressure value of 50 kPa and factored geotechnical resistance at ULS of 125 kPa. Alternatively, the new pavilion building may be supported by 1.5 m maximum width strip and maximum 3.0 m wide by 3.0 m long spread square footing founded on the surface of the native silty clay or on an engineered fill pad constructed on the native silty clay contacted at 1.4 m depth (Elevation 102.5 m and Elevation 102.3 m) and at a 2.2 m depth (Elevation 101.4 m) and designed for a bearing capacity at serviceability limit state (SLS) of 75 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 125 kPa. The factored geotechnical resistance value at ULS includes a resistance factor of 0.5. Settlements of the raft foundation and footings designed for the SLS value above and properly constructed are expected to be within the normally tolerated limits of 25 mm total and 19 mm differential movements. The SLS and factored ULS values are valid provided the site grade raise to a maximum of 1.0 m is respected. The design of the foundations should also consider the post-liquefaction settlement of 80 mm in addition to the total and differential settlements.

If the design of the footing and mat foundations for the proposed building addition and new pavilion building and ground floor slabs for the proposed two (2) structures cannot tolerate the post-liquefaction settlement in addition to the total and differential settlements of the foundations (25 mm total and 19 mm differential settlements), the proposed new structures and their floor slabs would have to supported by pile foundation. The option of pile foundation is discussed in the attached geotechnical report.

The ground floors of the proposed school addition and pavilion building may be designed as slabs-on-grade provided the floor slab can tolerate the post-liquefaction settlement of 80 mm. As previously indicated, if the ground floor of the proposed school addition and new pavilion building cannot tolerate the post-liquefaction settlement of 80 mm, the floor slabs will have to be designed as structural slabs supported by piles.

Excavations for the structures are expected to extend to approximately a 2.2 m depth below the existing ground surface through the surficial topsoil, surficial asphaltic concrete, fill and to the silty clay. The excavations are anticipated to be above the groundwater level.

Open cut excavation within the subsurface soils should comply with the most recent Occupational Health and Safety Act (OHSA), Ontario Regulations 213/91 (August 1, 1991). Based on the definitions contained in OHSA, the subsurface soils at the site are classified as Type 3 soil and as such the excavation sidewalls must be cut back at 1H:1V from the bottom of the excavation. Below the groundwater table, the excavation side slopes are expected to slough and will eventually stabilize at a slope of 2H:1V to 3H:1V.

Seepage of the 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. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated and will require high-capacity pumps to keep the excavation dry.

It is anticipated that the majority of the material required for backfilling purposes, interior and exterior to the proposed building addition and new pavilion building, would have to be imported and should preferably conform to Ontario Provincial Standard Specification (OPSS) Granular B Type II and Select Subgrade Material (SSM).

The pavements structure for the proposed bus loop should consist of 110 mm thick asphaltic concrete underlain by 150 mm thick OPSS Granular A base followed by 600 mm thick OPSS Granular B Type II material.

The above and other related considerations are discussed in greater detail in the attached geotechnical report.

1. Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed new development at the property of the Paul Desmarais Catholic Secondary School, 5315 Abbott Street East, Ottawa, Ontario (Figure 1). The proposed new structures will include an addition to the existing school building to be located on the north side of the existing school, a new pavilion building to be located south of the existing sports dome and a new paved bus loop to be located east of the sports dome. The terms and conditions of this assignment were outlined in EXP's proposal number: OTT-22007289-A0 dated May 24, 2022.

It is our understanding that the proposed addition to the school building will be a two-storey structure with no basement. The new pavilion building will be a single-storey structure with no basement. The proposed addition to the school building and the pavilion building are considered to be heated structures. The design elevation of the finished floor (ground floor) of the proposed building addition will match the elevation of the ground floor of the existing school at Elevation 104.90 m. Similarly, the design elevation of the floor of the new pavilion building will match the elevation of the playing surface of the existing sports dome at Elevation 104.08 m. The new development on the school property will also include a new paved bus loop to be located east of the existing sports dome with access from the future Robert Grant Avenue.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at eleven (11) boreholes located on the school site,

b) Classify the site for seismic site response in accordance with the requirements of the 2012 Ontario Building Code (as amended May 2, 2019) and assess the potential for liquefaction of the subsurface soils during a seismic event,

c) Comment on grade-raise restrictions and site grading requirements,

d) Make recommendations regarding the most suitable type of foundations, founding depth and bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) of the founding strata for the proposed school addition and new pavilion building and comment on the anticipated total and differential settlements of the recommended foundation type,

e) Provide comments regarding slab-on-grade construction and the requirement for perimeter and underfloor drainage systems,

f) Comment on excavation conditions and de-watering requirements during construction,

g) Discuss backfilling requirements and suitability of on-site soils for backfilling purposes; and

h) Recommend a pavement structure thickness for the proposed bus loop.

The comments and recommendations given in this report are based on the assumption that the above-described design concepts will proceed into 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.

2. Site Description

The site is occupied by the existing two-storey school building, portables, outdoor soccer practice field, an inflatable sports dome structure, outdoor mechanical compound area, parking lots and access roads.

The site is bounded to the east by the future Robert Grant Avenue, to the south by Abbott Street East, to the west by commercial development and to the north by undeveloped land.

Based on the ground surface elevation of the boreholes for this geotechnical investigation, the topography of the site is relatively flat with borehole ground surface elevations ranging from Elevation 104.4 m to Elevation 103.4 m.

3. Background Information

EXP completed two (2) previous geotechnical investigations at the school site for the design and construction of the existing school building and for the inflatable sports dome and outdoor mechanical compound area. The results of the previous geotechnical investigations are provided in the following geotechnical reports and were used as reference material in the preparation of this geotechnical engineering report:

a) *Geotechnical Investigation, Proposed Dome, Paul Desmarais Catholic Secondary School, 5315 Abbott Street, Ottawa, Ontario dated February 16, 2018 (EXP Project No. OTT-00242399-A0).*

b) Geotechnical Investigation, Proposed New Fernbank Secondary High School, 5315 Abbott Street, Ottawa, Ontario dated May 2, 2014 (EXP Project No, OTT-00212742-A0).

The previous two (2) geotechnical investigations indicate the subsurface soil/bedrock and groundwater conditions at the site consist, in order of depth, of surficial topsoil underlain by fill, native silty clay, silt, glacial till followed by limestone bedrock contacted at 4.8 m to 7.1 m depths (Elevation 98.7 m to Elevation 96.3 m). Groundwater levels ranged from Elevation 102.7 m to Elevation 101.1 m.

From the 2018 geotechnical investigation, the borehole logs for Borehole Nos.18-01 to 18-07 (formerly Borehole Nos. 1 to 7) located within the footprints of the sports dome (Borehole Nos. 18-01 to 18-04 and 18-07) and proposed new pavilion building (Borehole Nos. 18-05 and 18-06) are shown in Appendix A. The locations of the boreholes are shown in Figure 2. EXP conducted footing base evaluations during the construction of the footings for the existing sports dome in 2018 and 2019.

From the 2014 geotechnical investigation, the borehole logs for Borehole Nos. 14-06, 14-09 and 14-10 (formerly Borehole Nos. 6, 9 and 10) situated along the north wall of the existing school building at the location of the proposed school addition, are shown in Appendix B. The locations of the boreholes are shown in Figure 2. EXP also monitored the installation of the piles for the existing school building in 2014.

The results of the previous two (2) geotechnical investigations indicate that the native silt underlying the site is liquefiable during a seismic event. The post-liquefaction settlement following a seismic event was estimated to be greater than the normal total and differential settlements of 25 mm and 19 mm respectively that can be tolerated by a shallow foundation system (footings) and by a slab-on-grade design. Therefore, the school building was supported by a deep foundation system, pipe pile foundation (245 mm outside diameter by 10 mm wall thickness), bearing in the bedrock and the ground floor for the school building was designed as a structural slab also supported by the pile foundation.

The sports dome is supported by a shallow foundation system, a grade beam type foundation, bearing on the native soils and the outdoor mechanical compound for the sports dome is also supported by a shallow foundation system, a thickened concrete slab (raft or mat foundation), bearing on an engineered fill pad constructed on top of the native soils. The foundation design for the sports dome and the outdoor mechanical compound considered the post-liquefaction settlement of 80 mm in addition to the normally tolerated total and differential settlements of the foundations.

4. Procedure

The borehole fieldwork was undertaken on August 2 and August 10,2022 and consists of eleven (11) boreholes (Borehole Nos. 22-01 to 22-11) advanced to termination and auger refusal depths ranging from 2.1 m to 8.2 m below the existing ground surface. The fieldwork was supervised on a full-time basis by a representative from EXP.

The locations and the geodetic elevations of the boreholes were established on site by EXP and are shown on the Borehole Location Plan, Figure 2.

The boreholes were cleared of private and public underground services, prior to the start of drilling operations.

The boreholes were drilled using a CME-55 track mounted drill rig equipped with continuous flight hollow stem augers and soil sampling capabilities. Standard penetration tests (SPTs) were performed in all the boreholes at depth intervals of 0.75 m to 1.5 m with soil samples retrieved by the split-barrel sampler. The undrained shear strength of the clayey soil was measured by conducting a penetrometer test on selected recovered soil samples and in-situ shear vane tests at selected depths. The subsurface soil conditions in each borehole were logged and each soil sample was placed in a labelled plastic bag.

A nineteen (19) mm diameter standpipe with slotted section was installed in selected boreholes for long-term monitoring of the groundwater levels. The standpipes were installed in accordance with EXP standard practice. The installation configuration is documented on the respective borehole log. The boreholes were backfilled upon completion of drilling.

On completion of the fieldwork, the soil samples were transported to the EXP laboratory in Ottawa. The soil samples were visually examined in the laboratory by a geotechnical engineer. All soil samples were classified in accordance with the Unified Soil Classification System (USCS) and the modified Burmeister System (as per the 2006 Fourth Edition Canadian Foundation Engineering Manual (CFEM)) and borehole logs prepared.

The geotechnical engineer also assigned the laboratory testing program which is summarized in Table I.

Table I: Summary of Laboratory Testing Program

Type of Test	Number of Tests Completed
Soil Samples	
Moisture Content Determination	81
Unit Weight Determination	18
Grain Size Analysis	3
Atterberg Limit Determination	3

5. Subsurface Conditions and Groundwater Levels

A detailed description of the subsurface conditions and groundwater levels from the boreholes are given on the attached borehole logs, Figures 3 to 13. 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 the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling operations. 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 indicates the following subsurface conditions with depth and groundwater level measurements.

5.1 Topsoil

A surficial 50 mm to 180 mm thick topsoil layer was contacted in all boreholes with the exception of Borehole Nos. 22-02 and 22-09.

5.2 Asphaltic Concrete

Borehole No. 22-02 is located in a paved area and indicates the surficial asphaltic concrete layer is 95 mm thick.

5.3 Fill

Fill was contacted at ground surface in Borehole No. 22-09 and beneath the surficial topsoil and asphaltic concrete layers in the remaining boreholes. The fill extends to depths of 0.7 m to 2.2 m (Elevation 102.7 m to Elevation 101.4 m). The fill consists of sand and gravel to silty sand, sandy silt to silty clay. The fill contains rootlets, topsoil inclusions and wood fragments. The fill material is in a loose to very dense state as indicated by the standard penetration test (SPT) N-values of 5 to 77. The moisture content and unit weight of the fill ranges from 2 percent to 46 percent and 19.2 kN/m^3 to 22.7 kN/m^3, respectively.

5.4 Silty Clay and Clayey Silt

The fill in all boreholes is underlain by silty clay and clayey silt encountered at 0.7 m to 1.4 m depths (Elevation 102.7 m to Elevation 101.4 m). The silty clay and clayey silt extend to depths of 2.1 m to 4.5 m (Elevation 101.9 m to Elevation 99.4 m). Based on undrained shear strength measurements of 48 kPa to 120 kPa, the silty clay and clayey silt have a firm to very stiff consistency. The natural moisture content and unit weight of the silty clay and clayey silt range from 14 percent to 62 percent and 17.0 kN/m^3 to 19.3 kN/m^3, respectively.

The results from the grain-size analysis and Atterberg limits determination of one (1) sample of the silty clay are summarized in Table II. The grain-size distribution curve is shown in Figure 14.

Table II Summary of Results from Grain-Size Analysis and Atterberg Limit Determination –Silty Clay Sample

Borehole No. (BH) – Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)				Atterberg Limits (%)				Soil Classification (USCS)
		Gravel	Sand	**Silt**	**Clay**	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	
BH 22-01-SS6	3.8-4.4	5	31	37	27	34	24	14	10	Sandy Silty Clay of Low Plasticity (CL)

A review of the test results indicates the soil may be classified as a sandy silty clay of low plasticity (CL) in accordance with the Unified Soil Classification System (USCS).

5.5 Silt

A silt was contacted beneath the silty clay and clayey silt in Borehole Nos. 22-01 to 22-07 at 2.2 m to 4.5 m depths (Elevation 101.9 m to Elevation 99.4 m) and extends to depths of 3.7 m to 6.0 m (Elevation 100.4 m to Elevation 97.7 m). Based on the SPT N-values of 2 to 11, the silt is considered to be in a very loose to compact state. The natural moisture content of the silt ranges from 11 percent to 62 percent.

The results from the grain-size analysis and Atterberg limits determination of one (1) sample of the silt are summarized in Table III. The grain-size distribution curve is shown in Figure 15.

Table III Summary of Results from Grain-Size Analysis and Atterberg Limit Determination –Silt Sample

Borehole No. (BH) – Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)				Atterberg Limits (%)				Soil Classification (USCS)
		Gravel	Sand	**Silt**	**Clay**	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	
BH 22-02-SS6	4.6-5.2	3	19	66	12	15	--	--	N.P.	Silt with Sand (ML)

Based on a review of the laboratory test results, the soil may be classified as a silt with sand (ML) in accordance with the USCS.

5.6 Glacial Till

The clayey silt and silt in Borehole Nos. 22-01 to 22-07 and 22-11 are underlain by glacial till contacted at 2.2 m to 6.0 m depths (Elevation 101.5 m to Elevation 97.7 m). The glacial till ranges from a sandy silt to silty sand with gravel, shale fragments, cobbles and boulders. Based on the SPT N-values of 3 to 53 the glacial till is in a very loose to very dense state. High N-values for low sampler penetration, such as N equals 50 for 75 mm of sampler penetration were recorded and may be a result of the sampler resting on a cobble or boulder within the glacial till. The natural moisture content of the glacial till ranges from 4 percent to 54 percent. The natural unit weight of glacial till is 23.6 kN/m^3.

The results from the grain-size analysis and Atterberg limits determination of one (1) sample of the glacial till are summarized in Table IV. The grain-size distribution curve is shown in Figure 16.

Table IV: Summary of Results from Grain-Size Analysis and Atterberg Limit Determination – Glacial Till Sample

Borehole No. (BH) – Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)				Atterberg Limits (%)				Soil Classification (USCS)
		Gravel	Sand	**Silt**	**Clay**	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	
BH22-033-SS8	5.3-5.9	14	36	40	10	28	--	--	N.P.	Sandy Silt (ML)

Based on a review of the laboratory test results, the glacial till may be classified as a sandy silt (ML) based on the USCS. The glacial till contains cobbles and boulders.

5.7 Inferred Boulders or Bedrock

Auger refusal was met in Borehole Nos. 22-01 to 22-04 at 7.0 m to 7.4 m depths (Elevation 96.6 m and Elevation 96.5 m). Auger refusal may have occurred on cobbles/boulders within the glacial till or on bedrock.

5.8 Groundwater Level Measurements

A summary of the groundwater level measurements taken on August 22,2022 in the boreholes equipped with standpipes is summarized in Table V.

Table V: Summary of Groundwater Level Measurements

Borehole No. (BH)	Ground Surface Elevation (m)	Elapsed Time in Days from Date of Installation	Depth Below Ground Surface (Elevation), m
BH22-01	103.90	17 days	2.2 (101.7)
BH-22-04	103.56	17 days	1.9 (101.7)
BH 22-05	103.91	9 days	2.9 (101.0)

The groundwater level ranges from 1.9 to 2.9 m depths (Elevation 101.7 m to Elevation 101.0 m).

The groundwater levels were determined in the boreholes at the time and under the condition stated in this report. Note that fluctuations in the level of groundwater may occur due to a seasonal variation such as precipitation, snowmelt, rainfall activities, and other factors not evident at the time of measurement and therefore may be at a higher level during wet weather periods.

6. Liquefaction Potential of Soils and Site Classification for Seismic Site Response

6.1 Liquefaction Potential

This geotechnical investigation revealed that the subsurface conditions are similar to the conditions encountered in the area of the existing school building, sports dome and outdoor mechanical compound. As with these existing structures, the area of the proposed school building addition and new pavilion building are underlain by very loose to loose silt that is susceptible to liquefaction during a seismic event. Liquefaction analysis of the borehole data from this geotechnical investigation indicates that post-liquefaction settlement following a seismic event would be 80 mm. Therefore, the design of the shallow foundations and slab-on-grade recommended for the proposed school building addition and new pavilion building discussed in Sections 9 and 10 of this report should take into consideration the post-liquefaction settlement of 80 mm.

6.2 Site Classification for Seismic Site Response

Since the silt is liquefiable during a seismic event, the site classification for seismic site response would be Class F. However, based on the 2012 Ontario Building Code (as amended May 2, 2019), if the fundamental period of vibration for the proposed addition to the school building and new pavilion will be the same as for the existing school building and sports dome, less than 0.5 seconds, the site may be classified for seismic response as Class E. Based on the 2015 National Building Code of Canada Seismic Hazard Calculation shown in Appendix C, for a fundamental period of vibration of less than 0.5 seconds and site class E, the design spectral response values for the site are summarized in Table VI.

Table VI: Summary of Updated Site-Specific Seismic Parameters

5 Percent Damped Spectral Response Acceleration (2015 National Building Code seismic hazard calculator (1))	**Site Coefficient for Spectral Acceleration, F(T) (Based on calculated PGA reference value (PGA_{ref} = 0.2024)**	**Design Spectral Response, S(T) for the Site (For Site Class E and fundamental period of vibration equal to or less than 0.5 s)**	
$S_a(0.2) = 0.396g$	0.4910 (the greater of F(0.2) $S_a(0.2)$ = (1.24)(0.396g) =0.4910 or F(0.5)$S_a(0.5)$ = 0.3870)	0.4910g	
$S_a(0.3) = 0.302g$	1.4600	0.4409g	
$S_a(0.5) = 0.215g$	1.800	0.3870g	
$S_a(1.0) = 0.109g$	2.0800	0.2267g	
$S_a(2.0) = 0.052g$	2.2400	0.1165g	
$S_a(5.0) = 0.014g$	2.4000	0.0336g	
$S_a(10.0) = 0.005g$	2.1800	0.0109g	
PGA = 0.253g	1.2300	0.3111g	
PGV = 0.179g	1.8000	0.3222g	

Notes:

(1) "Hazard Calculator" from the Earthquakes Canada Website of the Geological Survey of Canada for the site identified as 5315 Abbott Street East, Ottawa, Ontario. Values are based on earthquake having a 2 percent probability of exceedance in 50 years. Latitude: 45.274N Longitude: 75.899W. "Hazard Calculator" shown in Appendix C).

(2) g = gravitational acceleration

If the fundamental period of vibration for the structures is greater than 0.5 seconds, this office should be contacted to provide revised parameters for seismic design.

7. Grade Raise Restrictions

Based on the current ground surface elevation of Elevation 103.91 m to Elevation 104.38 m at Borehole Nos. 22-05 to 22-07 located within the footprint of the proposed school building addition that will have a design floor elevation of Elevation 104.90 m, the site grade raise will be up to 1.0 m. Based on the current ground surface elevation of Elevation 103.56 m to Elevation 103.91 m at Borehole Nos. 22-01 to 22-04 located in the footprint of the proposed pavilion building that will have a design floor elevation of Elevation 104.08 m, the site grade raise will be up to 0.5 m.

Based on a review of the borehole information, the maximum anticipated grade raise of 1.0 m for the proposed addition to the school building and for the new pavilion building is considered to be acceptable from a geotechnical perspective. However, should the design grade raise exceed 1.0 m, EXP should be contacted to review the acceptability of the proposed new grade raise and to provide updated bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) for the building foundations.

8. Site Grading

Site grading within the **proposed addition to the school building and pavilion footprints** should consist of the removal of all existing surficial topsoil, asphaltic concrete, fill and organic stained soils down to the native undisturbed silty clay material. The native subgrade should be examined by a geotechnician. Any loose/soft areas identified during the subgrade examination should be excavated, remove and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II material compacted to 98 percent standard Proctor maximum dry density (SPMDD). Once the subgrade has been approved the grades may be raised to the design underside footing and floor slab elevation by the construction of an engineered fill pad constructed in accordance with Section 9 of this report.

Site grading within the **bus loop** should consist of the removal of the surficial topsoil layer and organic stained soils down to the existing fill. The existing fill subgrade should be proofrolled in the presence of a geotechnician. Any loose/soft areas identified during the proofrolling process should be excavated, removed and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II or OPSS Select Subgrade Material (SSM) compacted to 95 percent standard Proctor maximum dry density (SPMDD). Once the existing fill subgrade has been approved, the grades may be raised to the design subgrade level for the bus loop pavement structure by the placement of OPSS Granular B Type II or SSM compacted to 95 percent SPMDD. Alternatively, portions of the excavated and removed existing fill that is free of debris, cobbles, boulders and topsoil (organic soils), may be reused to raise the site grades to the design subgrade level. The suitability of re-using the existing fill to raise the grades will have to be further assessed at time of construction by examining the fill material and conducting additional tests on the material.

In place density tests should be performed on each lift of placed material to ensure that it has been compacted to the project specifications.

9. Foundation Considerations

9.1 Proposed Addition to School Building (Borehole Nos. 22-05 to 22-07)

Based on a review of the borehole information, the proposed school addition may be supported by strip and spread footings founded on the surface of the native silty clay contacted at 1.4 m and 2.2 m depths below existing grade (Elevation 102.7 m to Elevation 102.2 m) or at a shallower depth on a minimum 600 mm thick engineered fill pad constructed on the approved surface of the native silty clay. The existing fill is not considered suitable to support the foundations and floor slab of the proposed building addition. A mat or raft foundation placed on an engineered fill pad constructed on the native silty clay was also considered for the proposed school addition. However, the mat foundation may impose additional load onto the pile foundations along the north wall of the existing school. Therefore, a mat foundation is not considered feasible to support the proposed school addition.

If the footings and floor slab (slab-on-grade) of the proposed building addition cannot tolerate the post-liquefaction settlement of 80 mm in addition to the foundation total and differential settlements of 25 mm and 19 mm respectively or if the differential settlement between the foundations and floor slab of the existing school building and the proposed building addition (including total settlement of 25 mm, differential settlement between footings of 19 mm and the post-liquefaction settlement of 80 mm) cannot be tolerated, the proposed building addition and floor slab of the addition would have to be supported by pile foundation similar to the existing school building.

The two (2) foundation options of footings and pile foundation are discussed in the following sections of this report.

9.1.1 Footings

Square spread footings having a maximum width and length of 3.0 m and strip footings having a maximum width of 1.5 m founded on the surface of the native silty clay or properly prepared engineered fill pad constructed in accordance with the procedure indicated in the paragraph below, may be designed for a bearing capacity at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 225 kPa. The factored geotechnical resistance value at ULS includes a resistance factor of 0.5. The total and differential settlements of well designed and constructed footings placed in accordance with the above recommendations are expected to be less than 25 mm and 19 mm respectively. The SLS and factored ULS values are valid provided the site grade raise to a maximum of 1.0 m is respected. The design of the footings and slab-on-grade (discussed in Section 10 of this report) should take into consideration the post-liquefaction settlement of 80 mm in addition to the above noted total and differential settlements.

If the founding depth for the proposed footings will extend below the surface of the silty clay to a deeper founding depth than noted above, EXP should be contacted to provide updated SLS and factored ULS values for the footings.

The construction of the engineered fill pad should consist of the removal of the existing surficial topsoil, fill, asphaltic concrete (where applicable) and organic stained soils down to the native undisturbed silty clay material. The native subgrade should be examined by a geotechnician. Any loose/soft areas identified during the subgrade examination should be excavated, removed and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II material compacted to 98 percent standard Proctor maximum dry density (SPMDD). Once the subgrade has been approved, the grades may be raised to the design underside footing and floor slab elevation by the construction of an engineered fill pad. The excavation for the removal of the topsoil and fill should extend to a sufficient distance beyond the limits of the proposed structure to accommodate a 1.0 m wide horizontal bench of engineered fill that extends beyond the perimeter of the proposed building addition on all sides, which should thereafter be sloped at an inclination of 1H to 1V down to the approved subgrade. The engineered fill should consist of OPSS Granular B Type II material that is placed in 300 mm thick lifts and each lift compacted to 100 percent SPMDD. The placement and compaction of the engineered fill can in this way be undertaken to the founding level of the footings. From the footing level to the underside of the floor slab, each lift of the Granular B Type II material should be compacted to 98 percent of SPMDD. The engineered fill should be placed under the full-time supervision of a geotechnician working under the direction of a geotechnical engineer. In-place density tests should be undertaken on each lift of the engineered fill to ensure that it is properly compacted prior to placement of subsequent lift.

The outer edge of the footings along the wall of the proposed building addition that will be closest to the north wall of the existing building should be located a minimum horizontal distance of 2.0 m from the exterior wall of the existing school building so as not to impose any additional load on the pile foundation of the existing building.

Consideration should be given to conducting test pits along the north wall of the existing school building where the new addition will be located to confirm the depth of the fill and depth to native silty clay, as their depths may vary close to the existing building from those shown on the borehole logs. The test pits may also be able to confirm the depth of the grade beam.

A minimum of 1.5 m of earth cover should be provided to the footings of the heated proposed school addition to protect them from damage due to frost penetration. Rigid insulation thermally equivalent to the required soil cover may be used instead of the soil cover. Alternatively, a combination of rigid insulation and soil cover may be used to achieve the required frost protection for the footings.

9.1.2 Pile Foundation

9.1.2.1 Impact of Liquefiable Soils on Driven Piles

The seismic response of piles in liquefiable soil occurs in two (2) phases. Firstly, a cyclic phase during the ground shaking and development of liquefaction and secondly, lateral spreading following liquefaction. The soil-pile interaction in the cyclic phase is characterized by dynamic loads on the pile from both ground movements and inertial loads from the superstructure. The very loose to loose silt will liquefy during/following a seismic event and will not provide any lateral support to the pile resulting in high bending moments and lateral deflection of the piles.

In addition to imparting high bending moments and lateral deflection to the piles, soil liquefaction may also impart down-drag loads (negative skin friction) on the piles due to consolidation of the very loose to loose silt following a seismic event. The computed down-drag loads shown in Table VII include the effect from fill placement to raise the site grades within the footprint of the proposed building addition and from the liquefaction of the soil.

The second phase is the lateral spreading of the soil following liquefaction. It is characterized by large unilateral ground displacements and relatively small inertial effects. During this phase, the strength and stiffness of the liquefied sols are very low. It is noted that the site is flat-lying and localized zones (pockets) of the liquefiable soil were encountered in the boreholes. Localized zones (pockets) of liquefiable soil are not prone to lateral spread (Kramer, Steven L. – Geotechnical Earthquake Engineering, Copyright 1996 by Pearson Education Inc.). Therefore, lateral spreading is not a consideration for this site.

Since the site is underlain by liquefiable soil, the pile foundation should be designed in accordance with *Section 4.1.8.16 Foundation Provisions* of the 2012 OBC (as amended May 2,2019) regarding such items as *pile or pile or pile caps tied in two (2) directions* and other items applicable for pile design.

9.1.2.2 Pile Capacity

The proposed school addition may be supported by closed end steel pipe piles driven to practical refusal in the bedrock. The 2014 boreholes (Borehole Nos. 14-06, 14-09 and 14-10) located along the north wall of the existing school building (where the proposed addition will be located) indicate the bedrock is at Elevation 95.9 m and Elevation 95.5 m. Based on a review of the EXP *Pile Installation Summary Report* dated June 15, 2015, the piles installed along the north wall met refusal at Elevation 96.70 m to Elevation 95.17 m. Along with the 2014 borehole and pile installation information, consideration should be given to conducting additional boreholes located north of the north wall of the existing school building and within the footprint of the proposed school addition to confirm the bedrock elevation for pile design and installation purposes.

The factored axial geotechnical resistance values at ULS for three (3) pipe pile sections are shown in Table VII. The factored geotechnical resistance values at ULS are based on steel piles with a yield strength of 350 MPa and concrete compressive strength of 35 MPa and a resistance factor of 0.4. Closed end steel pipe piles have been selected to support the proposed school addition, since the existing school building is supported by 245 mm outside diameter (10 mm wall thickness) closed end steel pipe piles.

Since the piles are expected to meet refusal in the bedrock, the factored axial geotechnical resistance at ultimate limit state (ULS) will govern the design.

As previously discussed, the down-drag loads (negative skin friction) due to the fill placement to raise the grades within the proposed school addition and due to the liquefaction of the soils is also presented in Table VII. The estimated load carrying capacity of the pile may be computed by subtracting the down-drag load (negative skin friction) from the factored geotechnical resistance at ULS.

Table VII: Factored Geotechnical Resistance at Ultimate Limit State (ULS) and Estimated Negative Skin Friction of Piles

Type	Pile Section	Factored Geotechnical Resistance at ULS (kN)	Estimated Negative Skin Friction (kN)	Estimated Load Carrying Capacity of Pile (kN)
Steel Pipe	245 mm O.D. by 10 mm wall thickness	1275	55	1220
	245 mm O.D. by 12 mm wall thickness	1445	55	1390
	324 mm O.D. by 12 mm wall thickness	2120	70	2050

Total settlement of piles designed for the estimated load carrying capacity is expected to be less than 10 mm.

To achieve the capacity given previously, the pile-driving hammer must seat the pile in the overburden without overstressing the pile material. For guidance purposes, it is estimated that a hammer with rated energy of 54 kJ to 70 kJ (40,000 to 52,000 ft. lbs.) per blow would be required to drive the piles to practical refusal. Practical refusal is considered to have been achieved at a set of 5 blows for 6 mm or less of pile penetration. However, the driving criteria for a particular hammer-pile system must be established at the beginning of the project using the Pile Driving Analyzer.

The site is underlain by glacial till with cobbles and boulders. It is therefore recommended that the piles should be equipped with a driving shoe to protect them from damage during driving as per Ontario Provincial Standard Drawing (OPSD) 3001.100, Type II, Revision No. 2 dated November 2017.

A number of test piles should be monitored with the Pile Driving Analyzer during the initial driving and re-striking at the beginning of the project. This monitoring will allow for the evaluation of transferred energy into the pile from the hammer, determination of driving criteria and an evaluation of the ultimate bearing capacity of the piles. Depending on the results of the pile driving analysis, the pile capacity may have to be proven by at least one pile load test for each pile type before production piling begins. If necessary, the pile load test should be performed in accordance with the American Society for Testing and Materials (ASTM) D 1143.

Closed end pipe piles tend to displace a relatively large volume of soil. When driven in a cluster or group, they may tend to jack up the adjacent piles in the group. Consequently, the elevation and the location of the top of each pile in a group should be monitored immediately after driving and after all the piles in the group have been driven. This is to ensure that the piles are not heaving or being displaced. Any piles found to heave more than 3 mm should be re-tapped.

Piles driven at the site may be subject to relaxation (loss of set with time). It is therefore recommended that all the piles should be re-tapped at least 24 hours after initially driving and at 24-hour intervals thereafter until it can be proven that relaxation is no longer a problem.

The installation of the piles at the site should be monitored on a full-time basis by a geotechnician working under the direction and supervision of a qualified geotechnical engineer to verify that the piles are driven in accordance with the project specifications.

The concrete grade beams and pile caps for the heated school addition should be protected from frost action by providing the beams and caps with 1.5 m of earth cover. Alternatively, frost protection may be provided by rigid insulation or a combination of rigid insulation and earth cover

9.2 Proposed New Pavilion Building (Borehole Nos. 22-01 to 22-04)

Based on a review of the borehole information, the proposed new pavilion building may be supported by a thickened reinforced concrete slab (mat or raft foundation) founded on an engineered fill pad constructed on the native silty clay or by strip and spread footings founded on the surface of the native silty clay or on an engineered fill pad constructed on the silty clay. Both foundation options are discussed in the following section of this report.

If the footings and floor slab (slab-on-grade) or mat foundation of the proposed pavilion building cannot tolerate the post-liquefaction settlement of 80 mm in addition to the foundation total settlement of 25 mm and 19 mm differential settlement, the proposed new pavilion building would have to be supported by pile foundation similar to the existing school building.

For the pile foundation option, reference is made to Section 9.1.2 of this report regarding the design of the piles. From the 2018 geotechnical investigation, Borehole No. 18-06 located near the footprint of the proposed pavilion indicates bedrock is at Elevation 96.3 m. From this geotechnical investigation auger refusal was met at Elevation 96.6 m and Elevation 96.5 m in Borehole Nos. 22-01 to 22-04. Comparison between the confirmed bedrock elevation of Elevation 96.3 m in Borehole No. 18-06 and auger refusal elevation of Elevation 96.6 m and Elevation 96.5 m in Borehole Nos. 22-01 to 22-04 indicates the bedrock elevation is anticipated to be at approximately +/- 96.6 m to Elevation 96.3 m.

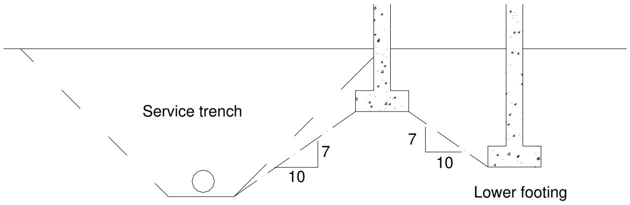
9.2.1 Footings

The proposed pavilion building may be supported by strip and spread footings founded on the surface of the native silty clay contacted at a 1.4 m depth (Elevation 102.5 m and Elevation 102.3 m) and at a 2.2 m depth (Elevation 101.4 m) or on a minimum 600 mm thick engineered fill pad constructed on the approved surface of the native silty clay. At Borehole No. 22-04 where the silty clay is at a deeper depth compared with the remaining boreholes, the footing may be stepped down to the silty clay or the footing may be placed at shallower depth and founded on an engineered fill pad constructed on the native silty clay.

Square spread footings having a maximum width and length of 3.0 m and strip footings having a maximum width of 1.5 m founded on the surface of the native silty clay or properly prepared engineered fill pad constructed in accordance with the procedure indicated in Section 9.1.1 of this report, may be designed for a bearing capacity at serviceability limit state (SLS) of 75 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 125 kPa. The factored geotechnical resistance value at ULS includes a resistance factor of 0.5. The total and differential settlements of well designed and constructed footings placed in accordance with the above recommendations are expected to be less than 25 mm and 19 mm respectively. The design of the footings and slab-on-grade design (discussed in Section 10 of this report) should also take into consideration the post-liquefaction settlement of 80 mm. The SLS and factored ULS values are valid provided the site grade raise to a maximum of 1.0 m is respected.

The footings for the proposed pavilion building may be located adjacent to the grade beam type foundation of the existing sports dome. In this case, the footings for the new pavilion building should be founded at the same level as the grade beam footing of the existing sports dome. This is subject to confirmation that the founding soil at the same level as the existing footing is capable of supporting the design SLS and factored ULS values noted above. If deeper excavation is required for the new footings located adjacent to the footing of the existing sports dome, underpinning of the existing footings may be required.

Footings placed at different elevations, should be located such that the higher footing is set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing, as indicated on the following sketch. This also applies to service trenches as shown in the sketch below.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

A minimum of 1.5 m of earth cover should be provided to the footings of the heated pavilion building. Rigid insulation thermally equivalent to the required soil cover may be used instead of the soil cover. Alternatively, a combination of rigid insulation and soil cover may be used to achieve the required frost protection for the footings.

9.2.2 Thickened Concrete Slab Foundation (Raft or Mat Foundation)

The proposed pavilion building may be supported by a thickened reinforced concrete slab (mat or raft foundation) set at final grade and placed on an engineered fill pad constructed on the approved native silty clay subgrade in accordance with Section 9.1 of this report. The raft (mat) foundation may be designed for an SLS bearing pressure value of 50 kPa and factored geotechnical resistance at ULS of 125 kPa. The factored ULS value includes a resistance factor of 0.5. The above SLS and ULS values area considered valid, provided the site grade raise of up to 1.0 m is respected.

Settlements of the raft designed for the SLS value above and properly constructed are expected to be within the normally tolerated limits of 25 mm total and 19 mm differential movements. In addition, the design of the thickened concrete slab foundation should also consider the post-liquefaction settlement of 80 mm along with the total and differential settlements.

The modulus of subgrade reaction is estimated at 25 MPa/m for a minimum thick bed of Ontario Provincial Standard Specification (OPSS) Granular A or Granular B Type II compacted to 100 percent standard Proctor maximum dry density (SPMDD).

For the raft (mat) foundation founded at final grade for the heated pavilion building will require frost protection in the form of 50 mm thick rigid insulation beneath the raft and extending 1.0 m beyond all sides of the perimeter of the mat.

9.3 Additional Foundation Comments for Both Buildings

All footing beds and mat foundation subgrade should be examined by a geotechnical engineer to ensure that the founding silty clay subgrade and engineered fill subgrade are capable of supporting the bearing pressure at SLS and that the footings have been properly prepared.

For footings and mat foundation founded on an engineered fill pad constructed on the native silty, the native silty clay subgrade is susceptible to disturbance due to the effects of weather and construction traffic. Therefore, it is recommended that the approved native subgrade be covered within the same day of approval with at least one lift of the OPSS Granular B Type II engineered fill material.

For footings founded directly on the native silty clay and to prevent disturbance to the silty clay subgrade, the footing beds should be protected by covering the silty clay subgrade with a 50 mm thick concrete mud slab following examination and approval of the founding soil.

The recommended factored geotechnical resistance at ULS and bearing pressure at SLS have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field monitoring provided by an experienced geotechnical engineer to validate the information for use during the construction stage.

10. Floor Slab and Drainage Requirements

The ground floors of the proposed school addition and pavilion building may be designed as slabs-on-grade provided the floor slab can tolerate the post-liquefaction settlement of 80 mm. As previously indicated, if the ground floor of the proposed school addition and new pavilion building cannot tolerate the post-liquefaction settlement of 80 mm, the floor slabs will have to be designed as structural slabs supported by piles.

The floor slab should be placed on a 200 mm thick 19 mm sized clear stone bed placed on a minimum 300 mm thick engineered fill pad set on the approved native subgrade prepared in accordance with Section 8 of this report. The clear stone would minimize the capillary rise of moisture from the sub-soil to the floor slab. Alternatively, the floor slab may be cast on a 200 mm thick bed of OPSS Granular A overlain by a vapour barrier. Adequate saw cuts should be provided in the floor slabs to control cracking.

A perimeter drainage system should be provided around the proposed addition to the school building and around the new pavilion building. If a perimeter drainage system is encountered along the north wall of the existing school building during the construction of the proposed building addition, it should be reinstated following construction.

Based on the design elevation of the ground floor of the proposed school addition (Elevation 104.90 m) and the new pavilion building (Elevation 104.08 m) and that the groundwater level is at Elevation 101.7 m to Elevation 101.0 m, underfloor drainage systems are not required for both proposed structures.

The ground floor for both proposed structures should be set a minimum of 150 mm above the surrounding finished grade level.

The finished exterior grade surrounding the proposed school addition and pavilion building should be sloped away from the proposed structures to prevent ponding of surface water close to the exterior walls of the proposed school building addition and new pavilion building.

11. Excavation and De-Watering Requirements

11.1 Excess Soil Management

Ontario Regulation 406/19 specifies protocols that are required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols need to be implemented and followed based on the volume of soil to be managed and the requirements of the receiving site. The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work. EXP would be pleased to assist with the implementation of a soil management and testing program that would satisfy the requirements of Ontario Regulation 406/19.

11.2 Excavation

Excavations for the structures are expected to extend to approximately a 2.2 m depth below the existing ground surface through the surficial topsoil, surficial asphaltic concrete, fill and to the silty clay. The excavations are anticipated to be above the the groundwater level.

Open cut excavation within the subsurface soils should comply with the most recent Occupational Health and Safety Act (OHSA), Ontario Regulations 213/91 (August 1, 1991). Based on the definitions contained in OHSA, the subsurface soils at the site are classified as Type 3 soil and as such the excavation sidewalls must be cut back at 1H:1V from the bottom of the excavation. Below the groundwater table, the excavation side slopes are expected to slough and will eventually stabilize at a slope of 2H:1V to 3H:1V.

If side slopes noted above for the construction of the proposed building addition and new pavilion building cannot be achieved due to space restrictions on site, such as the proximity of open cut excavations to the property limits or existing infrastructure, the excavations would have to be undertaken within the confines of an engineered support system (shoring system) that is designed and installed in accordance with the above-noted regulations.

The need for a shoring system, the most appropriate type of shoring system and the design and installation of the shoring system should be determined by the contractors bidding on this project. The design of the shoring system should be undertaken by a professional engineer experienced in shoring design and the installation of the shoring system should be undertaken by a contractor experienced in the installation of shoring systems. The shoring system should be designed and installed in accordance with latest edition of Ontario Regulation 213/91 under the OHSA and the 2006 Fourth Edition of the Canadian Foundation Engineering Manual (CFEM). The shoring system as well as adjacent settlement sensitive structures (buildings) and infrastructure should be monitored for movement (deflection) on a periodic basis during construction operations.

A pre-construction condition survey of the existing structures as well as the surrounding infrastructure (such as utilities) located within the construction zone of influence should be undertaken prior to the start of any construction activities.

It is recommended that vibration monitoring of the existing school building, sports dome and outdoor mechanical compound area as well as any other adjacent structures and infrastructure (such as utilities) located within the construction zone of influence should be undertaken during construction activities.

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.

11.3 De-Watering Requirements

Seepage of the 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. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated and will require high-capacity pumps to keep the excavation dry.

For construction dewatering, an Environmental Activity and Sector Registry (EASR) approval may be obtained for water takings greater than 50 m^3 and less than 400 m^3 per day. If more than 400 m^3 per day of groundwater are generated for dewatering purposes, then a Category 3 Permit to Take Water (PTTW) must be obtained from the Ministry of the Environment, Conservation and Parks (MECP). A Category 3 PTTW would require a complete hydrogeological assessment and would take at least 90 days for the MECP to process once the application is submitted.

Although this investigation has estimated the groundwater levels at the time of the fieldwork, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring and excavating 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 adequately engineer construction dewatering systems.

12. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

The on-site soils to be excavated are anticipated to consist of topsoil, asphaltic concrete, fill and silty clay. The asphaltic concrete should be discarded. The existing topsoil is not considered suitable for reuse as backfill material but may be used in landscaped areas, subject to review by a landscape architect. Portions of the existing fill (free of debris, topsoil (organic soil), cobbles and boulders) and native silty clay from above the groundwater table may be re-used as fill material to raise the grades at the site to the design subgrade level in areas outside and beyond the footprints of the proposed building addition and new pavilion building and in the proposed bus loop area provided that their moisture content remains within +/- 2 percent of the optimum value. These soils are susceptible to moisture absorption due to precipitation and therefore should be protected from the elements if stockpiled on site. The suitability of re-using these soils should be assessed during the early stages of construction. Should excavations extend below the groundwater level, the native soils below the groundwater table are expected to be too wet for adequate compaction and should be discarded. They may, however, be used for general grading purposes in the landscape areas if left in the sun to dry or mixed with drier material.

It is anticipated that the majority of the material required for backfilling purposes in the interior and exterior of the proposed building addition and new pavilion building would have to be imported and should preferably conform to the following specifications:

- Engineered fill under footings and mat foundation for the proposed school building addition and new pavilion building - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 100 percent SPMDD,
- Engineered fill under the floor slab of the proposed school building addition and pavilion building - OPSS 1010 Granular B Type II placed in 300mm thick lifts and each lift compacted to 98 percent SPMDD,
- Backfill material against foundation walls located outside the proposed school building addition and pavilion building – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 95 percent SPMDD; and
- Fill for landscaped areas should be clean fill free of debris, topsoil (organic soil), cobbles and boulders placed in 300 mm thick lifts and each lift compacted to 92 percent SPMDD.

13. Bus Loop Pavement Structure

The subgrade for the pavement structure for the proposed bus loop is anticipated to consist of existing fill, OPSS Granular B Type II material, select subgrade material (SSM) and approved on-site material. The pavement structure thickness required for the proposed bus loop set on approved subgrade material was computed and is shown in Table VIII. The pavement structure assumes a functional design life of 15 to 20 years. The proposed functional design life represents the number of years to the first rehabilitation, assuming regular maintenance is carried out.

Table VIII: Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Computed Pavement Structure
Asphaltic Concrete	92 percent to 97 percent percent MRD	50 mm HL3/SP12.5 Category D (PG 64-34) 60 mm HL8/SP 19 Category D (PG 64-34)
OPSS 1010 Granular A Base (crushed limestone)	100% percent SPMDD	150 mm
OPSS 1010 Granular B Type II Sub-base	100% percent SPMDD	600 mm

Notes:

1. SPMDD denotes standard Proctor maximum dry density, ASTM, D-698-12e2.
2. MRD denotes Maximum Relative Density, ASTM D2041.
3. The upper 300 mm of the subgrade fill must be compacted to 98% SPMDD.
4. The approved subgrade should be covered with a woven geotextile prior to placement of granular sub-base of the pavement structure.

The foregoing design assumes that construction is carried out during dry periods and that the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather and, heaving or rolling of the subgrade is experienced, additional thickness of granular material may be required in addition to the woven geotextile indicated in Table VII.

Additional comments on the construction of the proposed bus loop are as follows:

1. As part of the subgrade preparation, the areas of the proposed parking area and access roads should be stripped of all existing surficial topsoil organic-stained soils down to the existing fill. The subgrade should be properly shaped, crowned, then proofrolled in the full-time presence of a representative of this office. Any soft/loose or spongy subgrade areas detected should be sub excavated and properly replaced with suitable approved backfill compacted to 95 percent SPMDD.
2. The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. The need for adequate drainage cannot be over-emphasized. Subdrains should be installed on both sides of the proposed bus loop area. Subdrains must be installed within the proposed bus loop at low points and should be continuous between catchbasins to intercept excess surface and subsurface moisture and to prevent subgrade softening. This will ensure no water collects in the granular course, which could result in pavement failure during the spring thaw. The location and extent of subdrains required within the paved areas should be reviewed by this office in conjunction with the proposed site grading.
3. To minimize the problems of differential movement between the pavement and catchbasins/manhole due to frost action, the backfill around the structures should consist of free-draining granular preferably conforming to OPSS

Granular B Type II material. Weep holes should be provided in the catchbasins/manholes to facilitate drainage of any water that may accumulate in the granular fill.

4. The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, temporary construction roadways, etc., may be required, especially if construction is carried out during unfavorable weather.
5. The finished pavement surface should be free of depressions and should be sloped (preferably at a minimum cross fall of 2 percent) to provide effective surface drainage towards catch basins. Surface water should not be allowed to pond adjacent to the outside edges of paved areas.
6. Relatively weaker subgrade may develop over service trenches at subgrade level. These areas may require the use of thicker/coarser sub-base material and the use of a geotextile at the subgrade level. If this is the case, it is recommended that additional 150 mm thick granular sub-base, OPSS Granular B Type II, should be provided in these areas, in addition to the use of a geotextile at the subgrade level.
7. The granular materials used for pavement construction should conform to Ontario Provincial Standard Specifications (OPSS 1010) for Granular A and Granular B Type II and should be compacted to 100 percent of the SPMDD.

The asphaltic concrete used, and its placement should meet OPSS 1150 or 1151 requirements. It should be compacted from 92 percent to 97 percent of the MRD (ASTM D2041). Asphalt placement should be in accordance with OPSS 310 and OPSS 313.

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

14. Additional Comments

All earthwork activities from subgrade preparation to placement and compaction of engineered fill and backfill material placement and compaction of granular materials and asphaltic concrete for the pavement structure should be inspected by qualified geotechnicians to ensure that construction proceeds according to the project specifications.

All the footing beds and mat foundation subgrades should be examined by a geotechnical engineer to ensure that the founding surfaces are capable of supporting the design bearing pressure and that the footing beds/mat foundation subgrade have been properly prepared.

The installation of the piles at the site should be monitored on a full-time basis by a geotechnician working under the direction and supervision of a qualified geotechnical engineer to verify that the piles are driven in accordance with the project specifications.

15. 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 the 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 specific 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 report will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

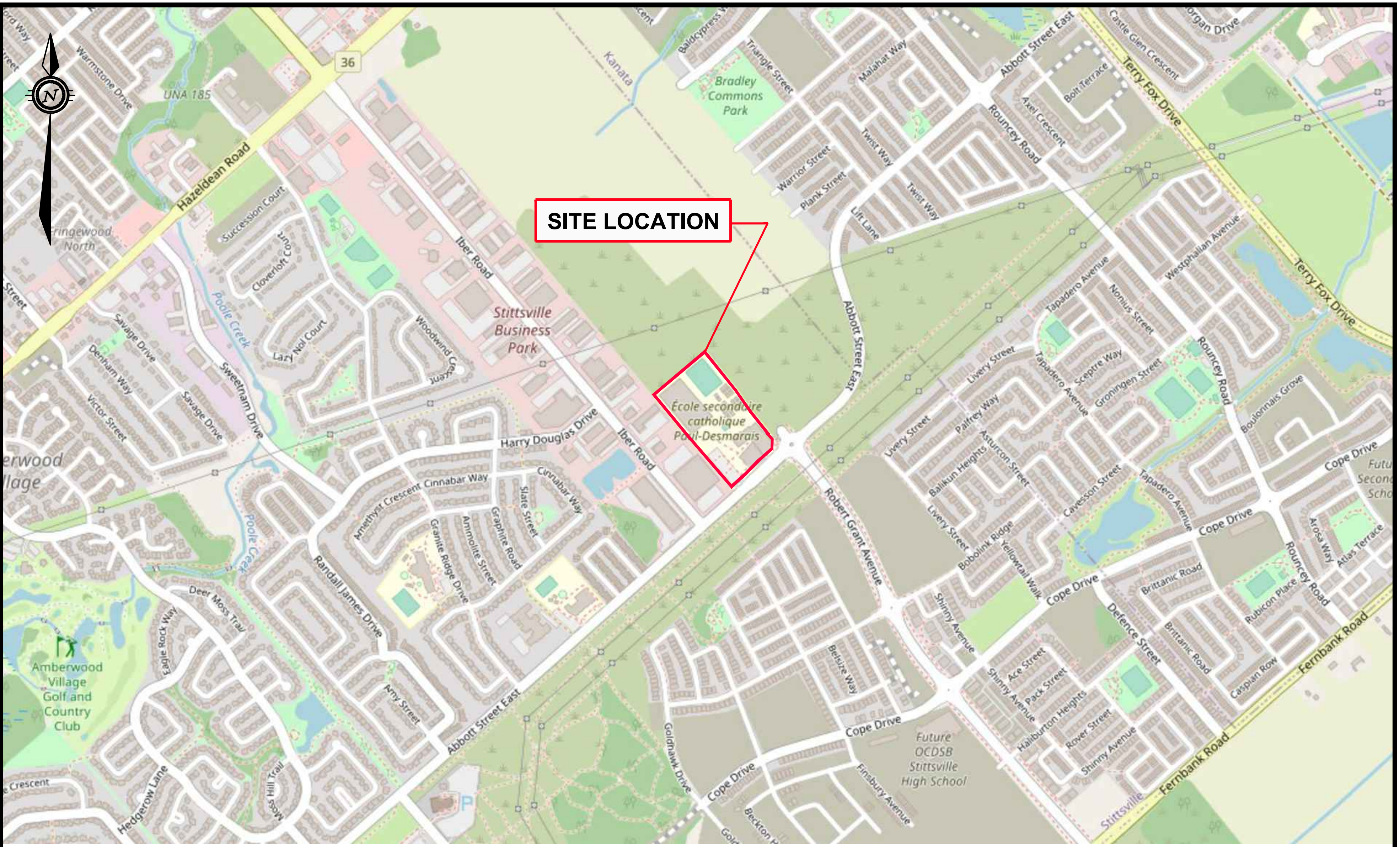
Sincerely,

Susan M. Potyondy, P.Eng.
Geotechnical Engineer
Earth & Environment

LICENSED PROFESSIONAL ENGINEER
Nov.02, 2022
S.M. POTYONDY
37232568
PROVINCE OF ONTARIO

Ismail M. Taki, M.Eng., P.Eng.
Senior Manager
Earth & Environment
Eastern Region

Figures



0 150m 300m 600m

HORIZONTAL 1:15,000

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

www.exp.com

DESIGN SP/DW
DRAWN AS
DATE SEPT. 2022
FILE NO OTT-22013695-A0

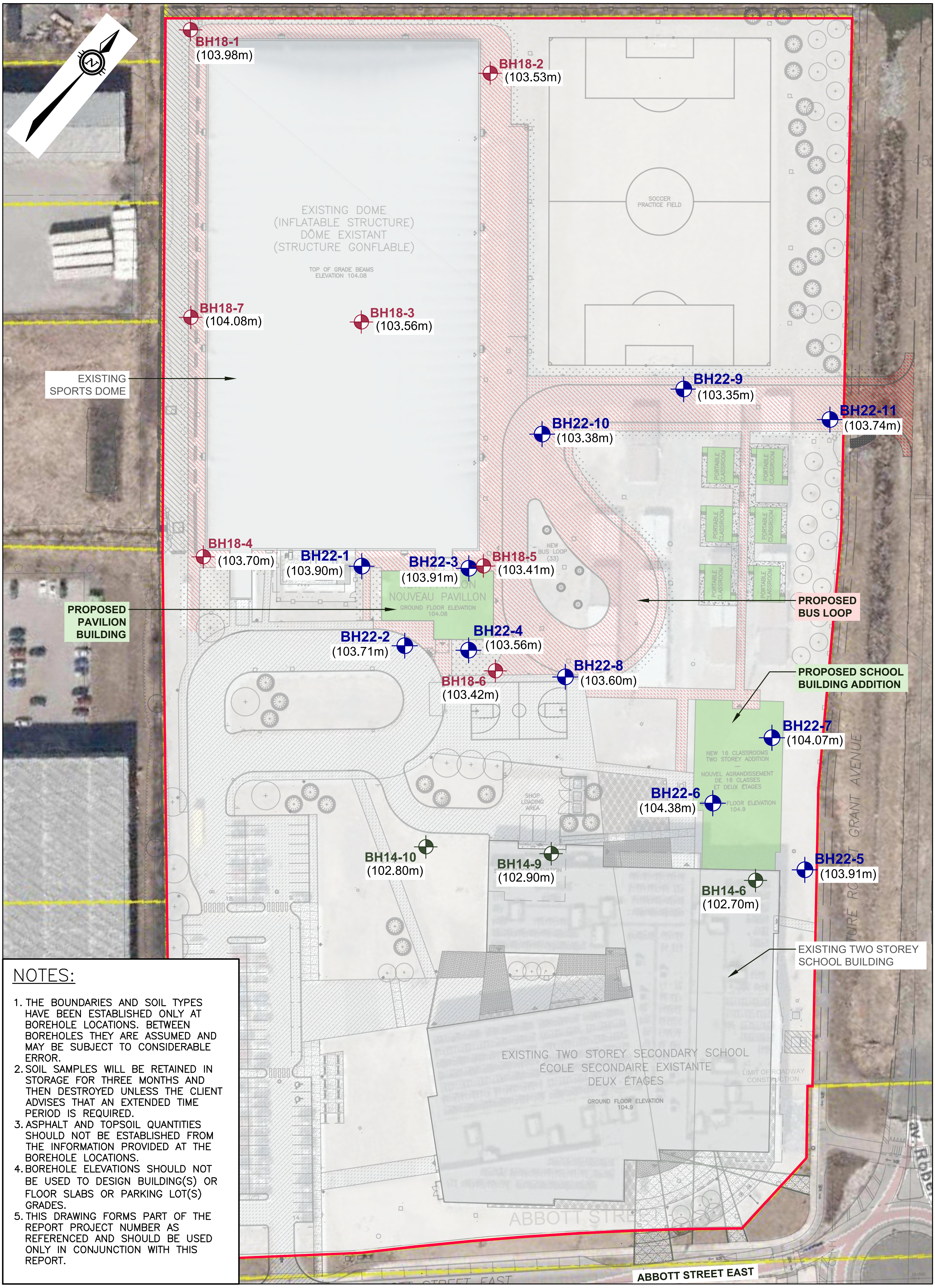
GEOTECHNICAL INVESTIGATION
PAUL-DESMARAIS CATHOLIC SECONDARY SCHOOL
5315 ABBOTT STREET EAST, OTTAWA, ON

SITE LOCATION PLAN

SCALE 1:15,000
SKETCH NO

FIG 1

Filename: E:\OTT\OTT-22013695-A0\60 Execution\65 Drawings\22013695-A0_Geo.dwg
Last Saved: Sep 8, 2022 12:05 PM Last Plotted: Sep 8, 2022 12:06 PM Plotted by: SeverA

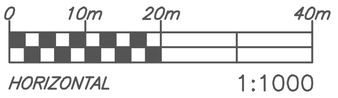


NOTES:

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 WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. ASPHALT AND 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

🟥	PROPERTY BOUNDARY
BH22-1 ⊕ (103.90m)	BOREHOLE NO. & LOCATION [CURRENT 2022 EXP GEOTECHNICAL INVESTIGATION] (X.XX) - GROUND SURFACE ELEVATION (m)
BH18-7 ⊕	BOREHOLE NO. & LOCATION [2018 EXP GEOTECHNICAL INVESTIGATION (PROJ.: OTT-00242399-A0)]
BH14-6 ⊕	BOREHOLE NO. & LOCATION [2014 EXP GEOTECHNICAL INVESTIGATION (PROJ.: OTT-00212742-A0)]



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

exp.

DESIGN SP/DW
DRAWN AS
DATE SEPT. 2022
FILE NO OTT-22013695-A0

GEOTECHNICAL INVESTIGATION
PAUL-DESMARAIS CATHOLIC SECONDARY SCHOOL
5315 ABBOTT STREET EAST, OTTAWA, ON

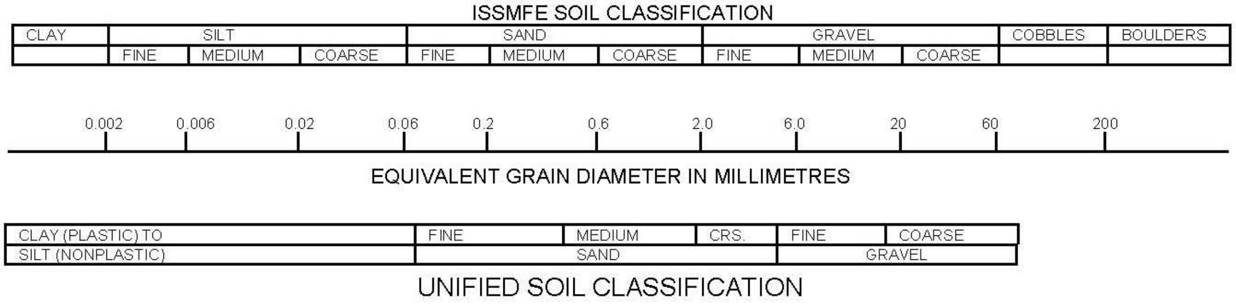
BOREHOLE LOCATION PLAN

SCALE 1:1,000
SKETCH NO
FIG 2

Filename: E:\OTT\OTT-22013695-A0\60 Execution\65 Drawings\22013695-A0_Geo.dwg
Last Saved: Sep 8, 2022 2:26 PM Last Plotted: Sep 8, 2022 2:27 PM Plotted by: SeverA

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 22-01

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 3

Page. 1 of 1

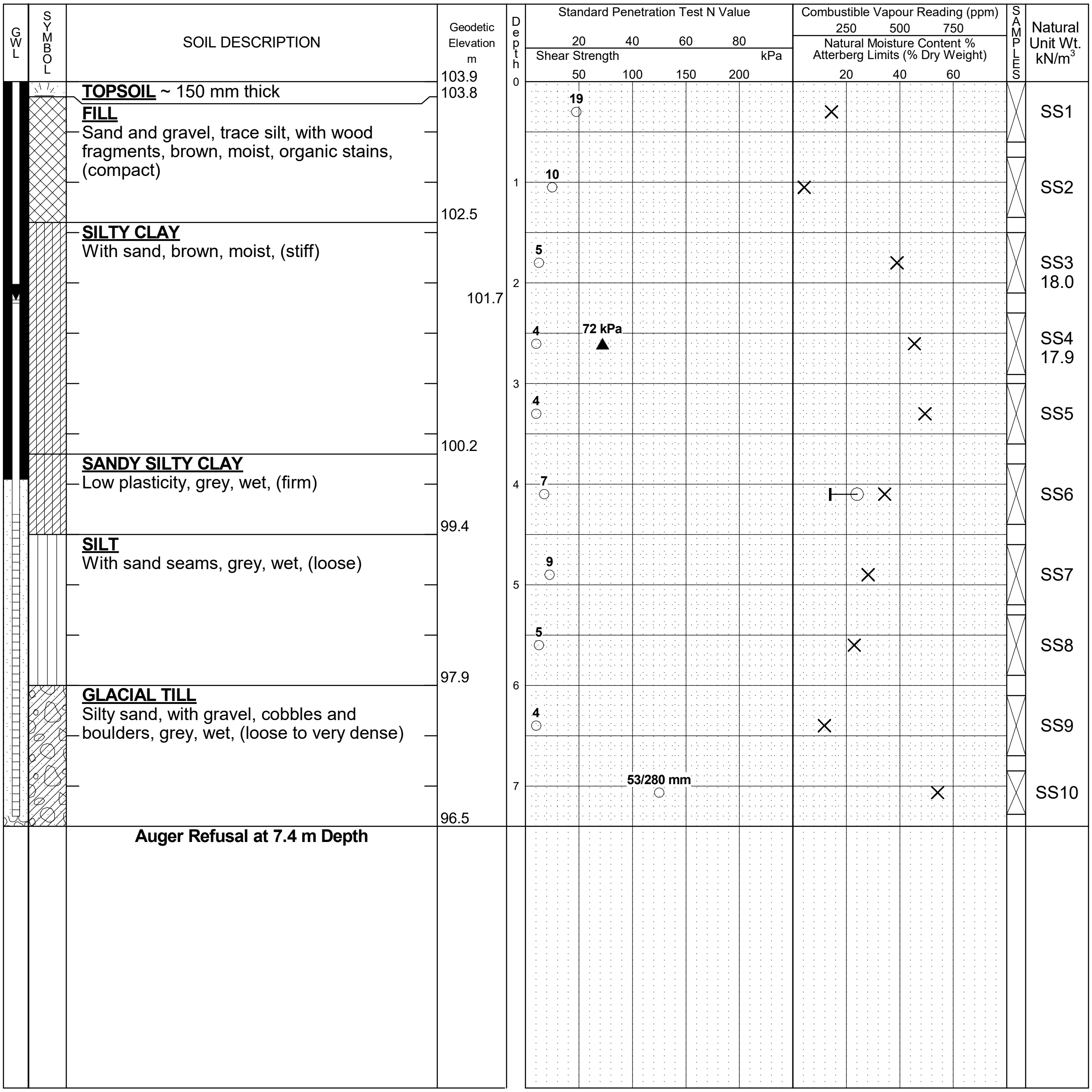
Date Drilled: 'August 02, 2022

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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		



SOIL DESCRIPTION	Geodetic Elevation m
	103.9
TOPSOIL ~ 150 mm thick	103.8
FILL Sand and gravel, trace silt, with wood fragments, brown, moist, organic stains, (compact)	102.5
SILTY CLAY With sand, brown, moist, (stiff)	101.7 100.2
SANDY SILTY CLAY Low plasticity, grey, wet, (firm)	99.4
SILT With sand seams, grey, wet, (loose)	97.9
GLACIAL TILL Silty sand, with gravel, cobbles and boulders, grey, wet, (loose to very dense)	96.5
Auger Refusal at 7.4 m Depth	

Standard Penetration Test N Value	SAMPLES	Natural Unit Wt. kN/m^3
19	SS1	
10	SS2	
5	SS3	18.0
4 (72 kPa)	SS4	17.9
4	SS5	
7	SS6	
9	SS7	
5	SS8	
4	SS9	
53/280 mm	SS10	

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
August 19, 2022	2.2	

CORE DRILLING RECORD

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

Log of Borehole 22-02

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 4

Page. 1 of 1

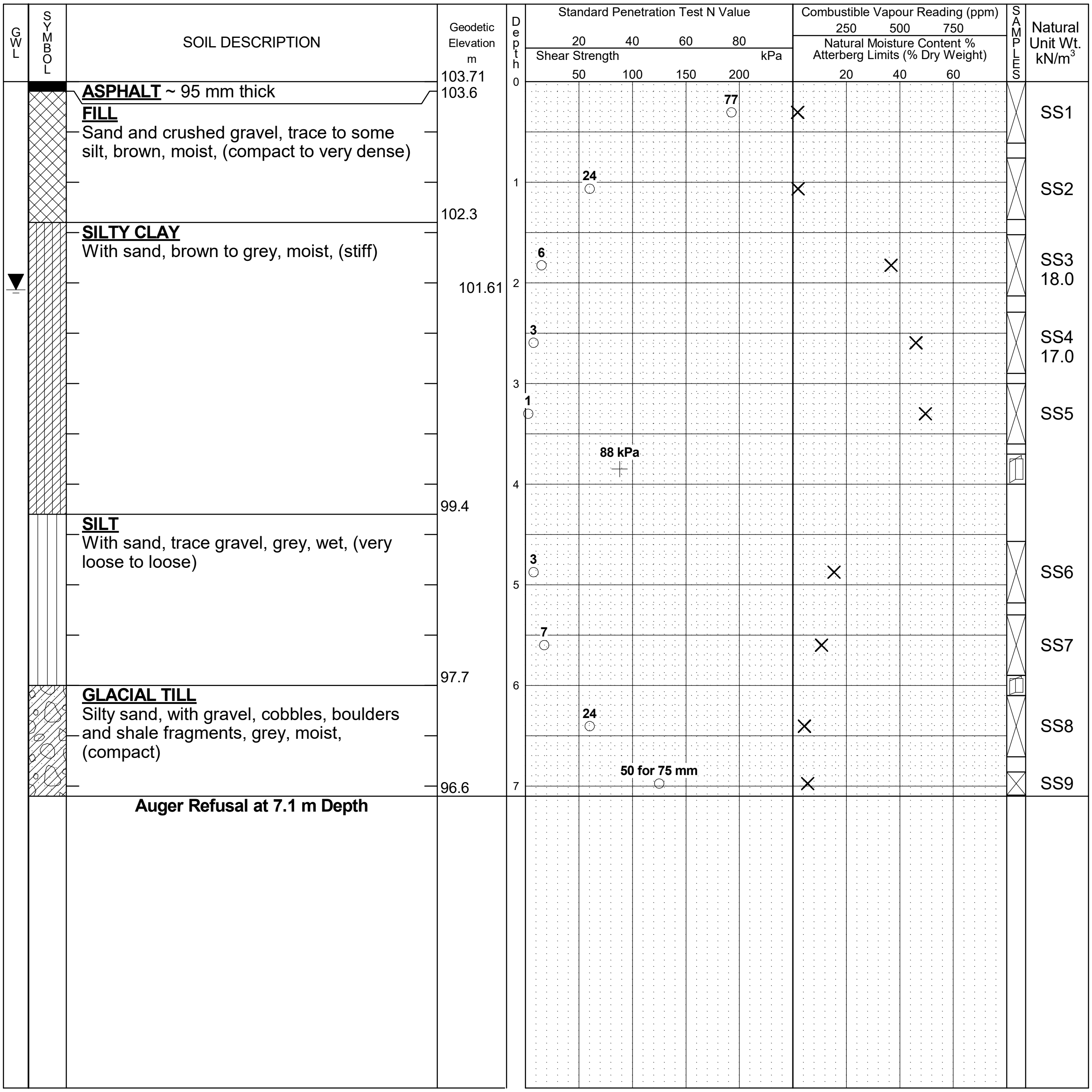
Date Drilled: 'August 02, 2022

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲



Geodetic Elevation m	SOIL DESCRIPTION
103.71	
103.6	**ASPHALT** ~ 95 mm thick
102.3	**FILL** Sand and crushed gravel, trace to some silt, brown, moist, (compact to very dense)
101.61	**SILTY CLAY** With sand, brown to grey, moist, (stiff)
99.4	
97.7	**SILT** With sand, trace gravel, grey, wet, (very loose to loose)
96.6	**GLACIAL TILL** Silty sand, with gravel, cobbles, boulders and shale fragments, grey, moist, (compact)

Auger Refusal at 7.1 m Depth

SAMPLES	Standard Penetration Test N Value	Natural Unit Wt. kN/m³
SS1	77	
SS2	24	
SS3	6	18.0
SS4	3	17.0
SS5	1	
	88 kPa	
SS6	3	
SS7	7	
SS8	24	
SS9	50 for 75 mm	

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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	2.1	7.1

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22013695-A0 PAUL DESMARAIS EXPANSION BOREHOLE LOGS.GPJ TROW OTTAWA.GDT 9/12/22

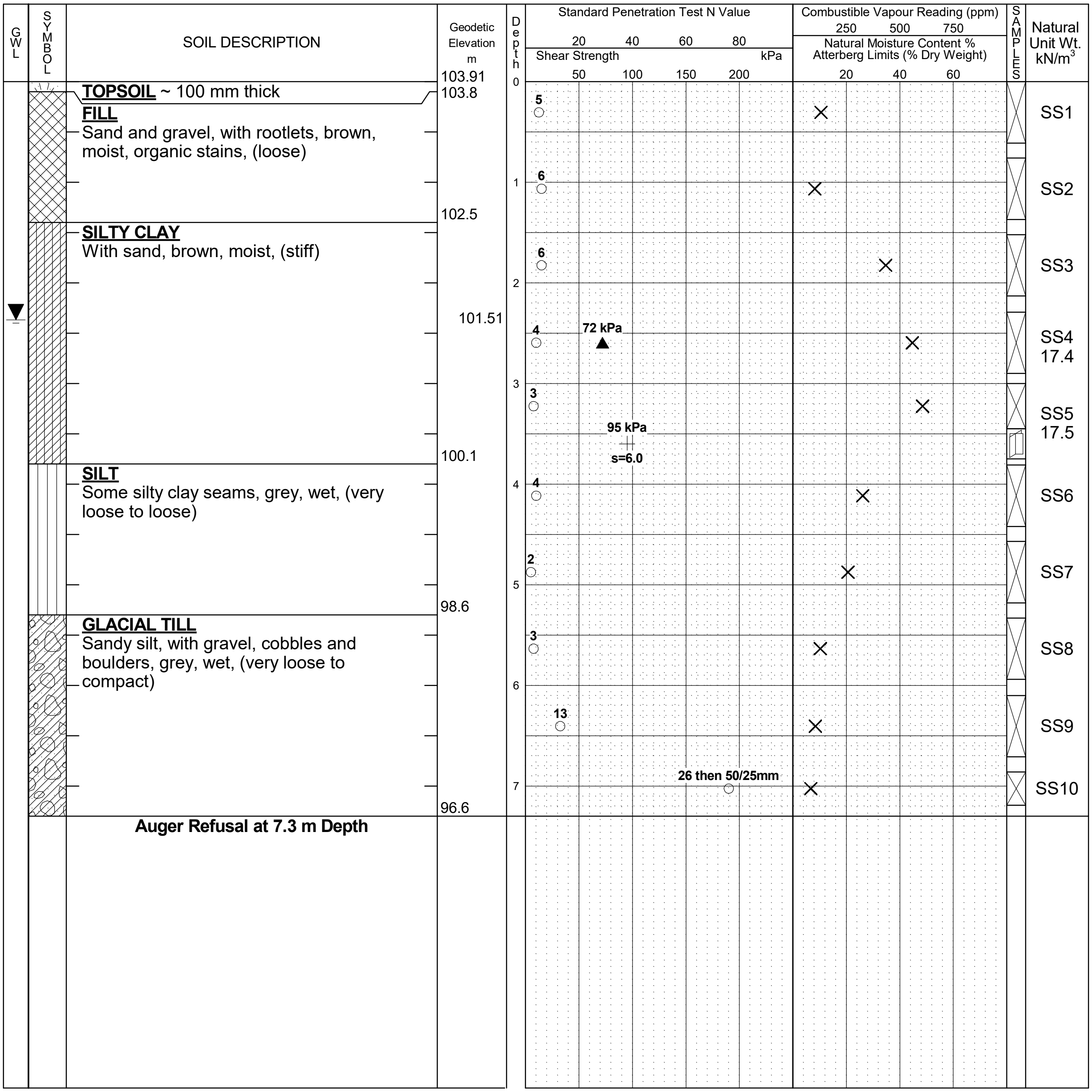
Log of Borehole 22-03

Project No: OTT22013695-A0
Project: Proposed School Addition, New Pavilion and Bus Loop
Location: Paul Desmarais Catholic Secondary School

Figure No. 5
Page. 1 of 1

Date Drilled: 'August 02, 2022
Drill Type: CME-55 Track Mounted Drill Rig
Datum: Geodetic Elevation
Logged by: G.C. Checked by: D.W.

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		



TOPSOIL ~ 100 mm thick

FILL
Sand and gravel, with rootlets, brown, moist, organic stains, (loose)

SILTY CLAY
With sand, brown, moist, (stiff)

SILT
Some silty clay seams, grey, wet, (very loose to loose)

GLACIAL TILL
Sandy silt, with gravel, cobbles and boulders, grey, wet, (very loose to compact)

Auger Refusal at 7.3 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	7.0

CORE DRILLING RECORD

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

Log of Borehole 22-04

Project No: OTT22013695-A0

Figure No. 6

Page. 1 of 1

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

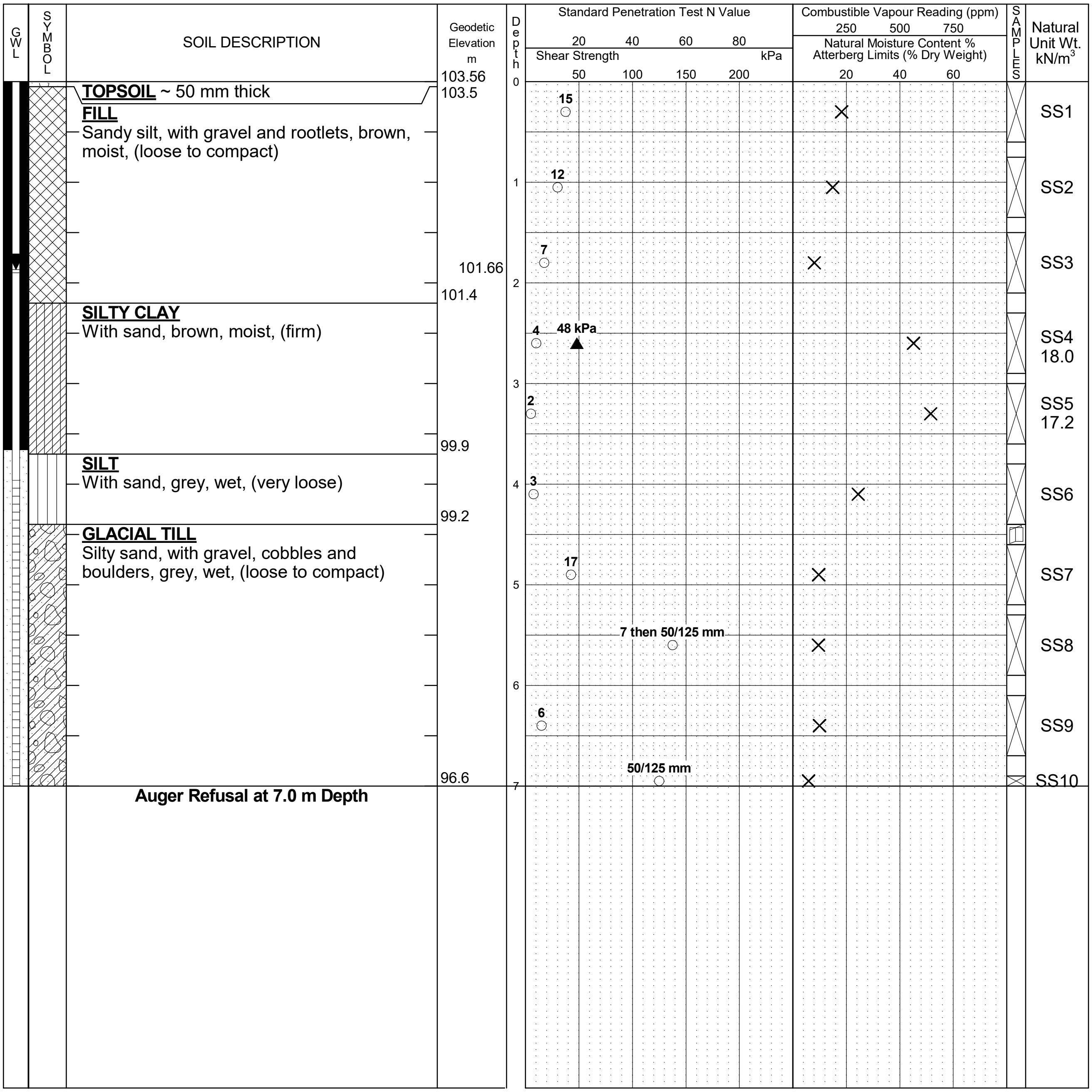
Date Drilled: 'August 02, 2022

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲



Geodetic Elevation m	Soil Description	Sample	SPT N Value	Natural Unit Wt. kN/m3
103.56				
103.5	**TOPSOIL** ~ 50 mm thick			
	FILL Sandy silt, with gravel and rootlets, brown, moist, (loose to compact)	SS1	15	
		SS2	12	
101.66		SS3	7	
101.4	**SILTY CLAY** With sand, brown, moist, (firm)	SS4	4 48 kPa	18.0
		SS5	2	17.2
99.9	**SILT** With sand, grey, wet, (very loose)	SS6	3	
99.2	**GLACIAL TILL** Silty sand, with gravel, cobbles and boulders, grey, wet, (loose to compact)	SS7	17	
		SS8	7 then 50/125 mm	
		SS9	6	
96.6		SS10	50/125 mm	

Auger Refusal at 7.0 m Depth

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
August 19, 2022	1.9	

CORE DRILLING RECORD

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

Log of Borehole 22-05

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 7

Page. 1 of 1

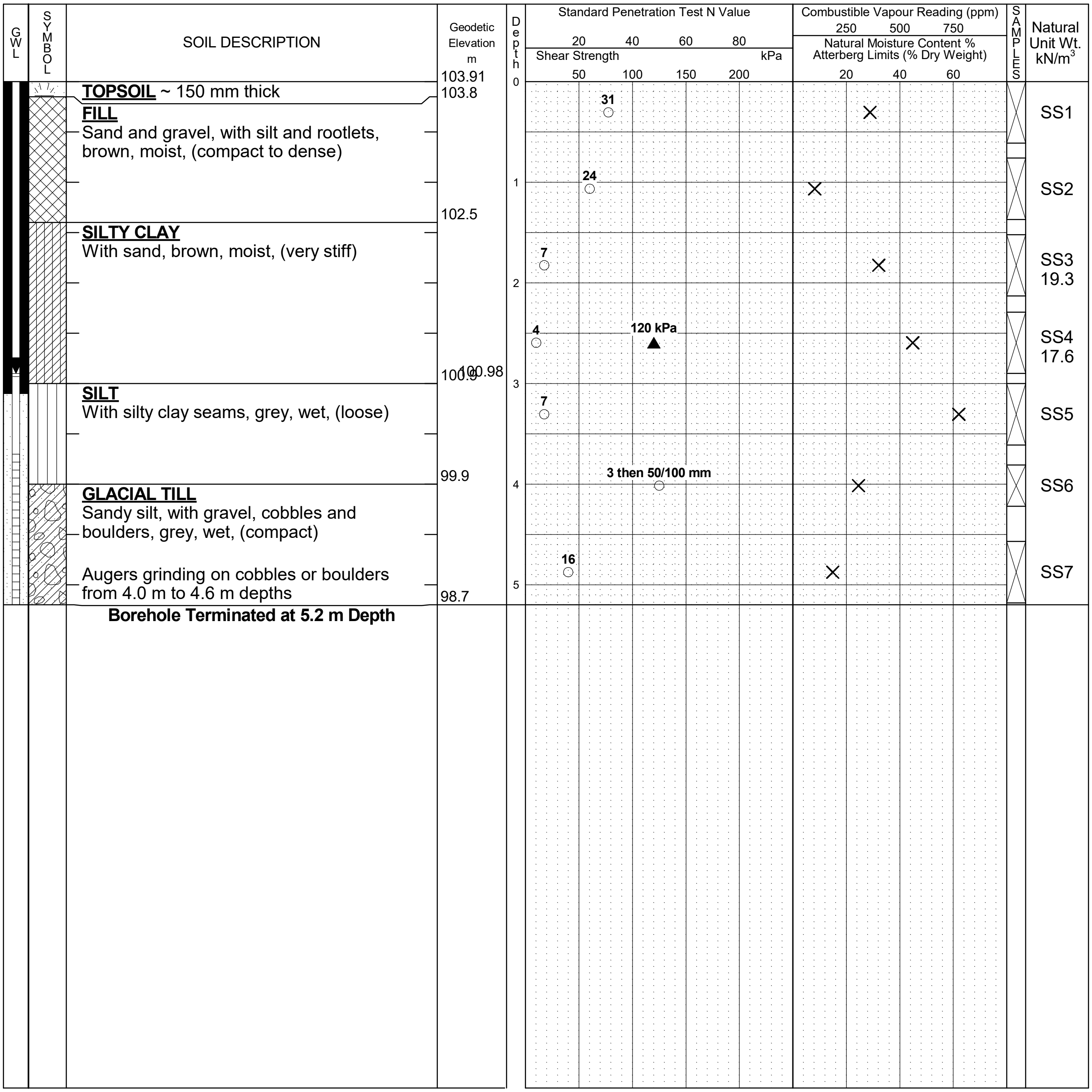
Date Drilled: 'August 10, 2022

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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		



SOIL DESCRIPTION	Geodetic Elevation m	Samples	Natural Unit Wt. kN/m³
	103.91		
TOPSOIL ~ 150 mm thick	103.8	SS1	
FILL Sand and gravel, with silt and rootlets, brown, moist, (compact to dense)	102.5	SS2	
SILTY CLAY With sand, brown, moist, (very stiff)	100.9 100.98	SS3 SS4	19.3 17.6
SILT With silty clay seams, grey, wet, (loose)	99.9	SS5 SS6	
GLACIAL TILL Sandy silt, with gravel, cobbles and boulders, grey, wet, (compact) Augers grinding on cobbles or boulders from 4.0 m to 4.6 m depths	98.7	SS7	

Borehole Terminated at 5.2 m Depth

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
August 19, 2022	2.9	

CORE DRILLING RECORD

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

Log of Borehole 22-06

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 8

Page. 1 of 1

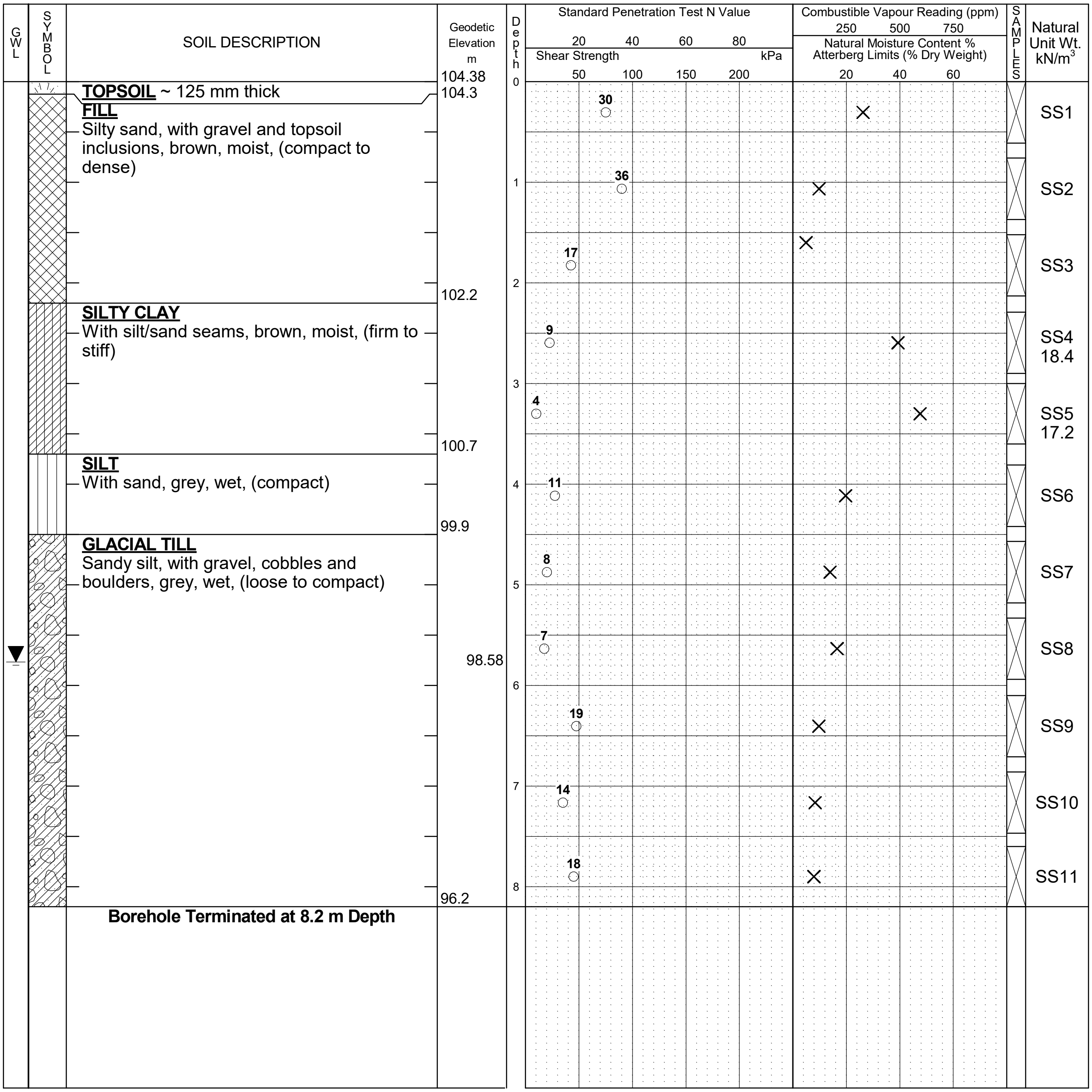
Date Drilled: 'August 10, 2022

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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		



Geodetic Elevation (m)	Soil Description
104.38	
104.3	**TOPSOIL** ~ 125 mm thick
	FILL Silty sand, with gravel and topsoil inclusions, brown, moist, (compact to dense)
102.2	**SILTY CLAY** With silt/sand seams, brown, moist, (firm to stiff)
100.7	**SILT** With sand, grey, wet, (compact)
99.9	**GLACIAL TILL** Sandy silt, with gravel, cobbles and boulders, grey, wet, (loose to compact)
98.58	▼
96.2	**Borehole Terminated at 8.2 m Depth**

Sample	SPT N Value	Natural Unit Wt. kN/m³
SS1	30	
SS2	36	
SS3	17	
SS4	9	18.4
SS5	4	17.2
SS6	11	
SS7	8	
SS8	7	
SS9	19	
SS10	14	
SS11	18	

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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	5.8	6.1

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22013695-A0 PAUL DESMARAIS EXPANSION BOREHOLE LOGS.GPJ TROW OTTAWA.GDT 9/12/22

Log of Borehole 22-07

Project No: OTT22013695-A0

Figure No. 9

Page. 1 of 1

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Date Drilled: 'August 10, 2022

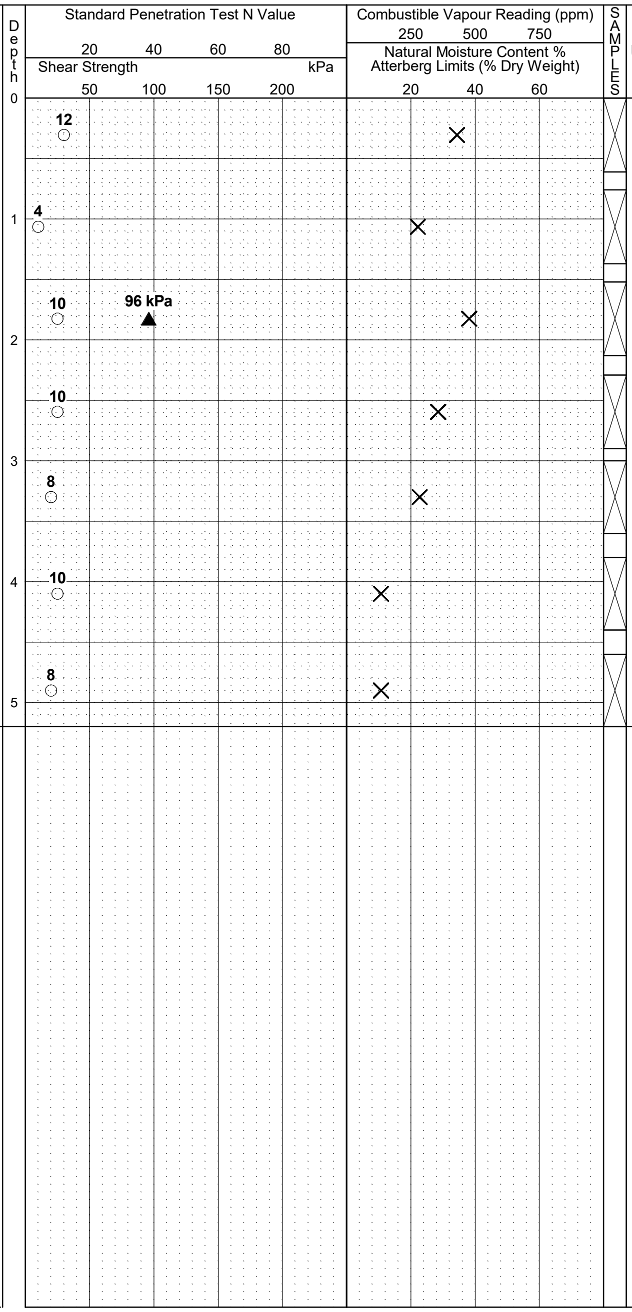
Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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 Elevation m
			104.07
		TOPSOIL ~ 180 mm thick	103.9
		FILL Sand and gravel, with silt, brown, wet, (compact)	103.4
		FILL Silty clay, with sand and gravel, brown, moist, (loose)	102.7
		SILTY CLAY With sand, brown, moist, (stiff)	101.9
		SILT With sand seams, brown, wet, (loose to compact)	100.4
		GLACIAL TILL Silty sand, with gravel, cobbles and boulders, grey, wet, (loose to compact)	98.9
		Borehole Terminated at 5.2 m Depth	



SAMPLES	SPT N Value	Natural Unit Wt. kN/m³
SS1	12	
SS2	4	21.4
SS3	10	
SS4	10	
SS5	8	
SS6	10	
SS7	8	

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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	No Cave

CORE DRILLING RECORD

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

Log of Borehole 22-08

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 10

Page. 1 of 1

Date Drilled: 'August 10, 2022

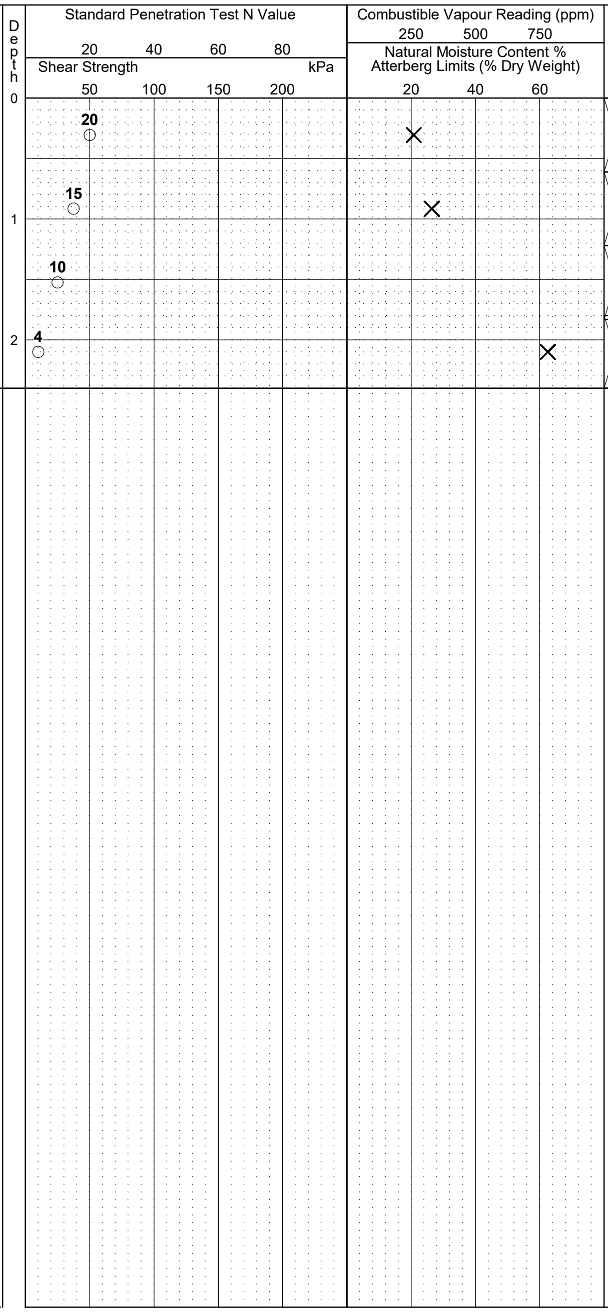
Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m³
		103.6	0		
	TOPSOIL ~ 150 mm thick	103.5			
	FILL Silty sand with gravel, clay pockets and wood fragments, brown, moist, (compact)			☒	SS1
			1	☒	SS2 22.7
	CLAYEY SILT With sand, grey, wet, (firm to stiff)	102.1		☒	SS3
			2	☒	SS4
		101.2			
	Borehole Terminated at 2.4 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	No Cave

CORE DRILLING RECORD

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

Log of Borehole 22-09

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 11

Page. 1 of 1

Date Drilled: 'August 10, 2022

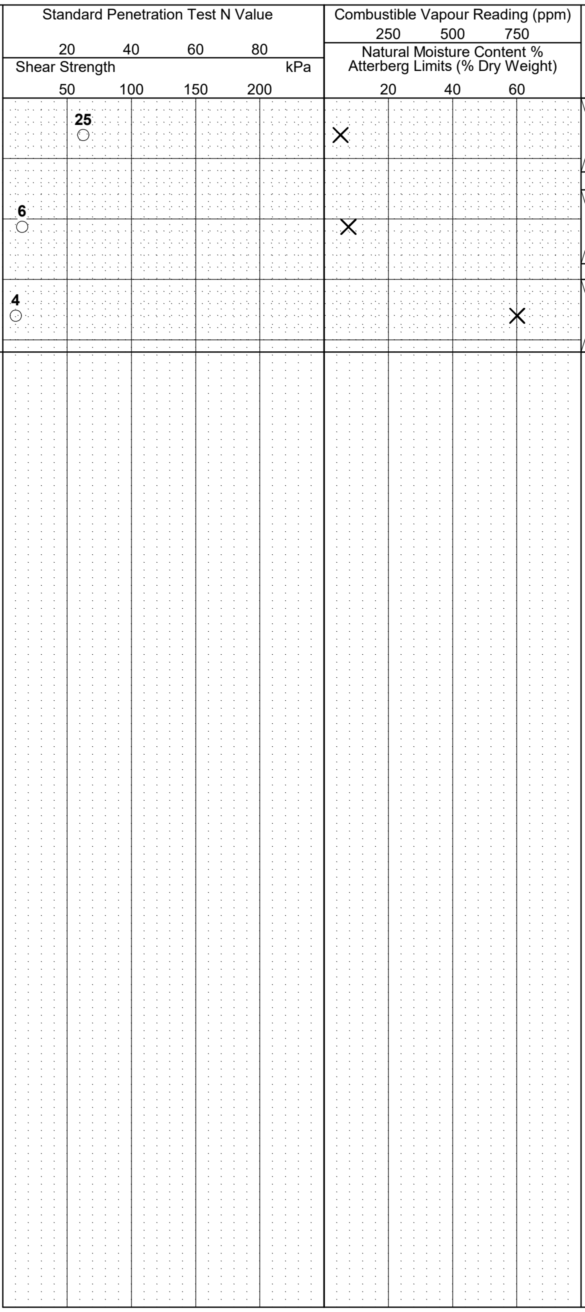
Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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 Elevation m	Depth	Samples	Natural Unit Wt. kN/m³
	▨	**FILL** Sand and gravel to silty clay, brown, moist, (loose to compact)	103.35	0	SS1	
				1	SS2	
	▥	**SILTY CLAY** With sand, brown grey, moist, (firm)	102.0		SS3	
			101.3	2		
		Borehole Terminated at 2.1 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	No Cave

CORE DRILLING RECORD

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

Log of Borehole 22-10

Project No: OTT22013695-A0

Project: Proposed School Addition, New Pavilion and Bus Loop

Location: Paul Desmarais Catholic Secondary School

Figure No. 12

Page. 1 of 1

Date Drilled: 'August 10, 2022

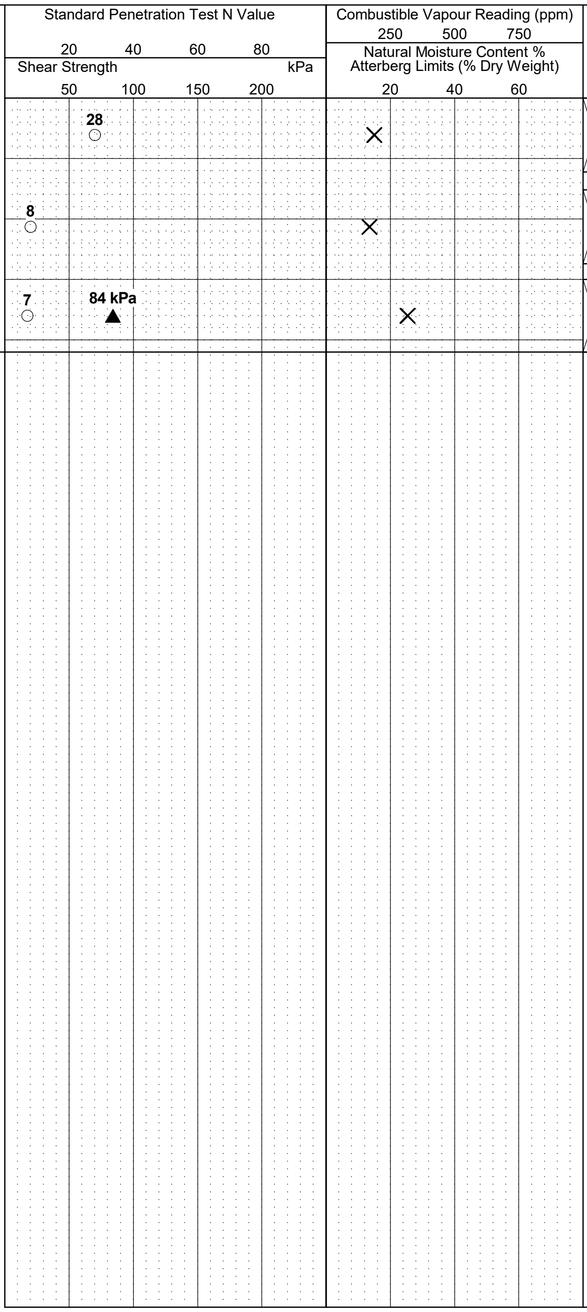
Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C.   Checked by: D.W.

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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m³
			103.38	0		
		TOPSOIL ~ 150 mm thick	103.2		☒	SS1
		FILL Sandy silt, with gravel, brown to grey, moist, (compact)	102.7			
		SILTY CLAY WIth sand, brown grey, moist, (stiff)		1	☒	SS2 20.4
			101.3	2	☒	SS3 17.6
		Borehole Terminated at 2.1 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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	No Cave

CORE DRILLING RECORD

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

Log of Borehole 22-11

Project No: OTT22013695-A0

Figure No. 13

Project: Proposed School Addition, New Pavilion and Bus Loop

Page. 1 of 1

Location: Paul Desmarais Catholic Secondary School

Date Drilled: 'August 10, 2022

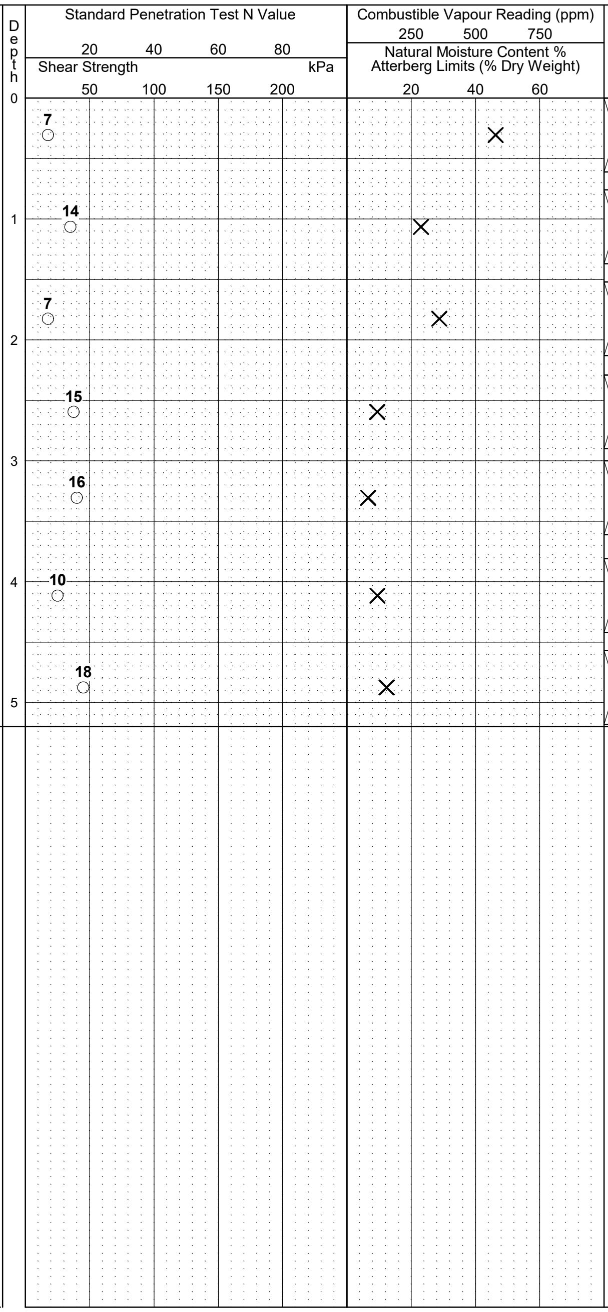
Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: D.W.

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	SOIL DESCRIPTION	Geodetic Elevation m
		103.74
	TOPSOIL ~ 150 mm thick	103.6
	FILL Silty clay, with sand, gravel and rootlets, brown, moist, (loose to compact)	
	CLAYEY SILT With sand, brown grey, moist, (firm)	102.3
	GLACIAL TILL Silty sand, with gravel, cobbles and boulders, grey, wet, (compact)	101.5
▼		98.84
		98.5
	Borehole Terminated at 5.2 m Depth	



SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	19.2
SS3	
SS4	
SS5	23.6
SS6	
SS7	

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 OTT22013695-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	4.9	5.2

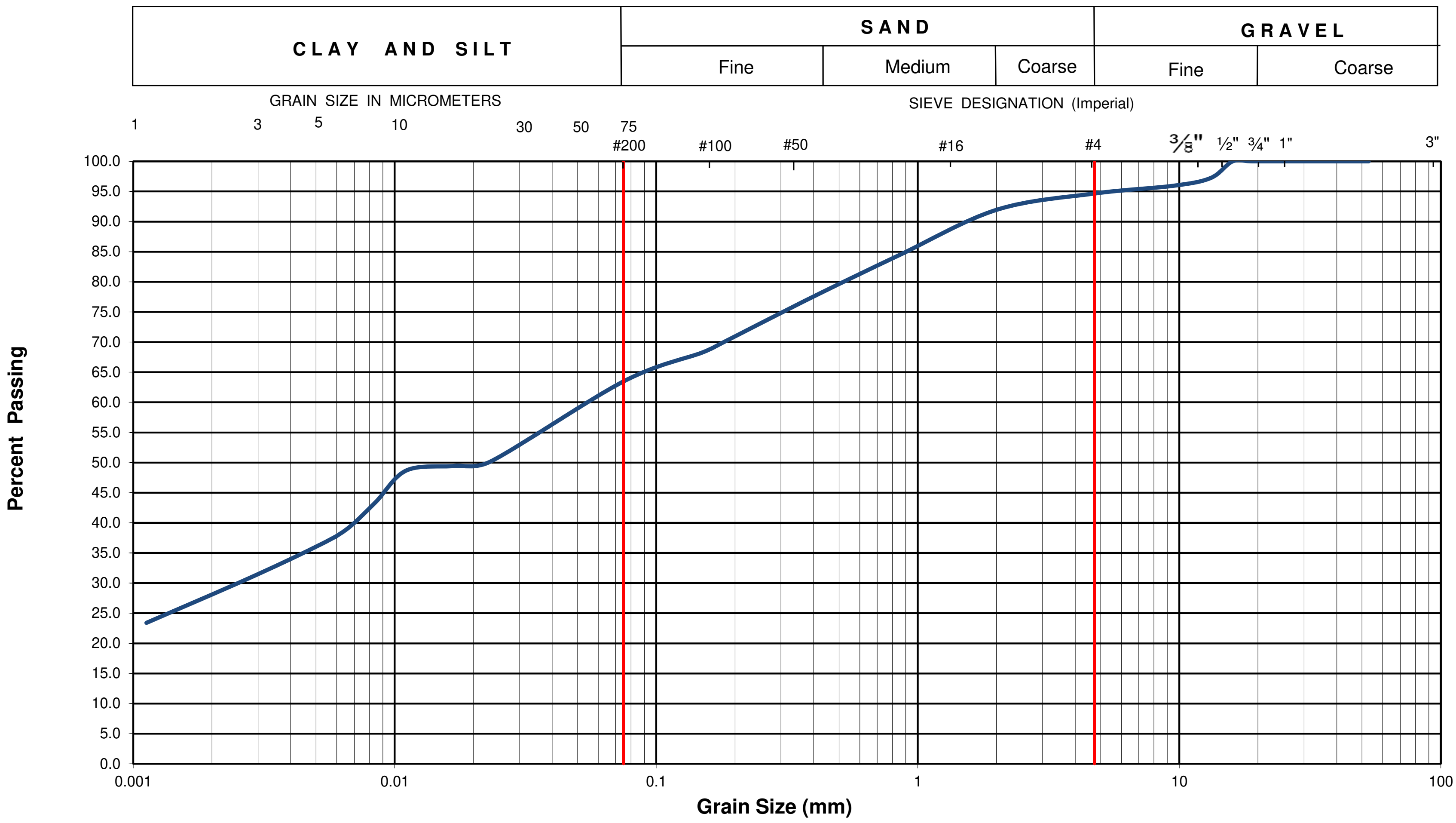
CORE DRILLING RECORD

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

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

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

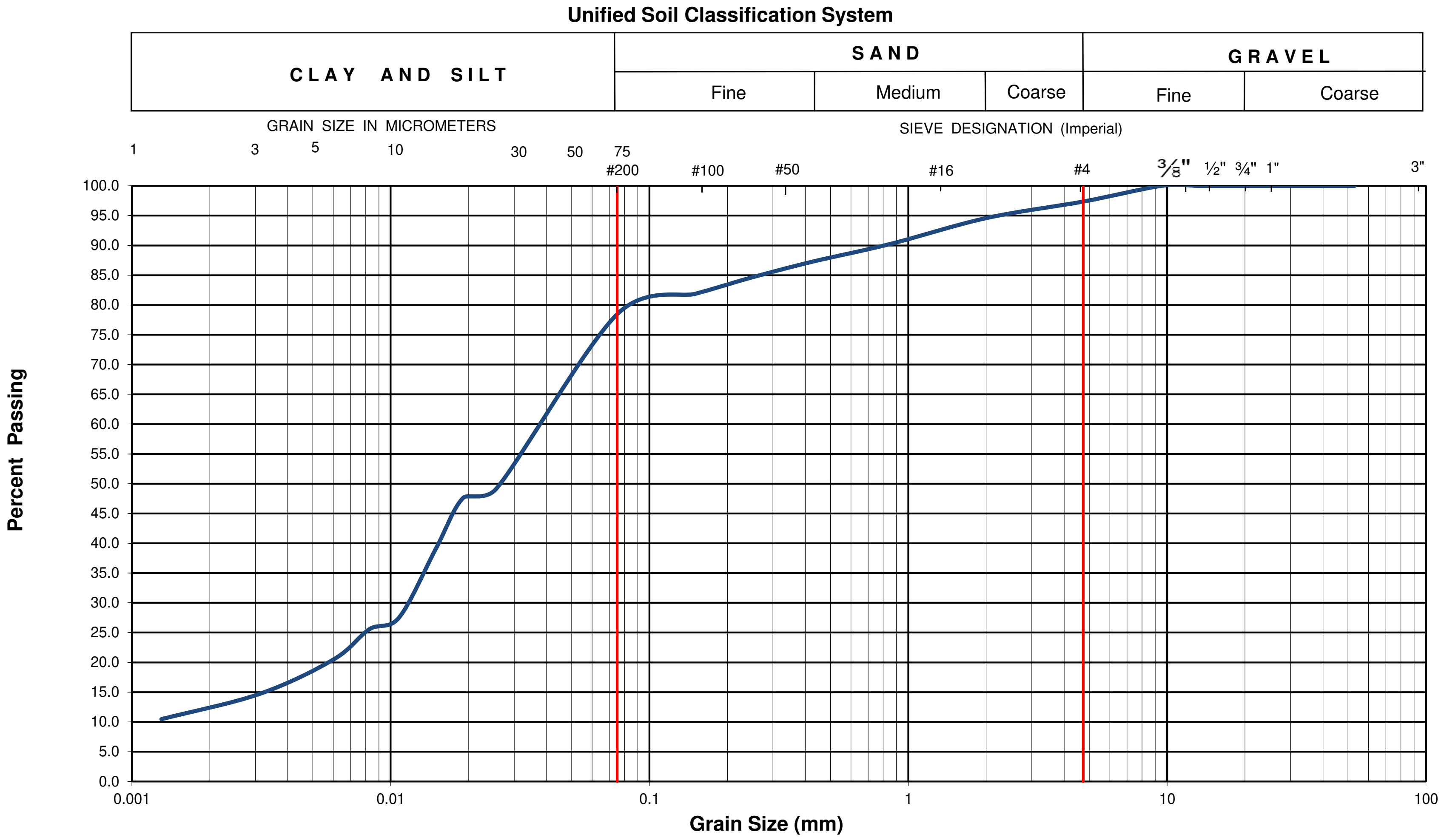
Unified Soil Classification System



EXP Project No.:	**OTT-22013695-A0**	**Project Name :**	**Proposed School Addition, New Pavilion and Bus Loop**						
Client :	**CECCE**	**Project Location :**	**5315 Abbott Street East, Ottawa, ON**						
Date Sampled :	**August 1, 2022**	**Borehole No:**	**BH22-01**	**Sample No.:**	**SS6**			**Depth (m) :**	**3.8-4.4**
Sample Description :		**% Silt and Clay**	**64**	**% Sand**	**31**	**% Gravel**	**5**	**Figure :**	**14**
Sample Description :	**Sandy Silty Clay of Low Plasticity (CL)**								

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

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

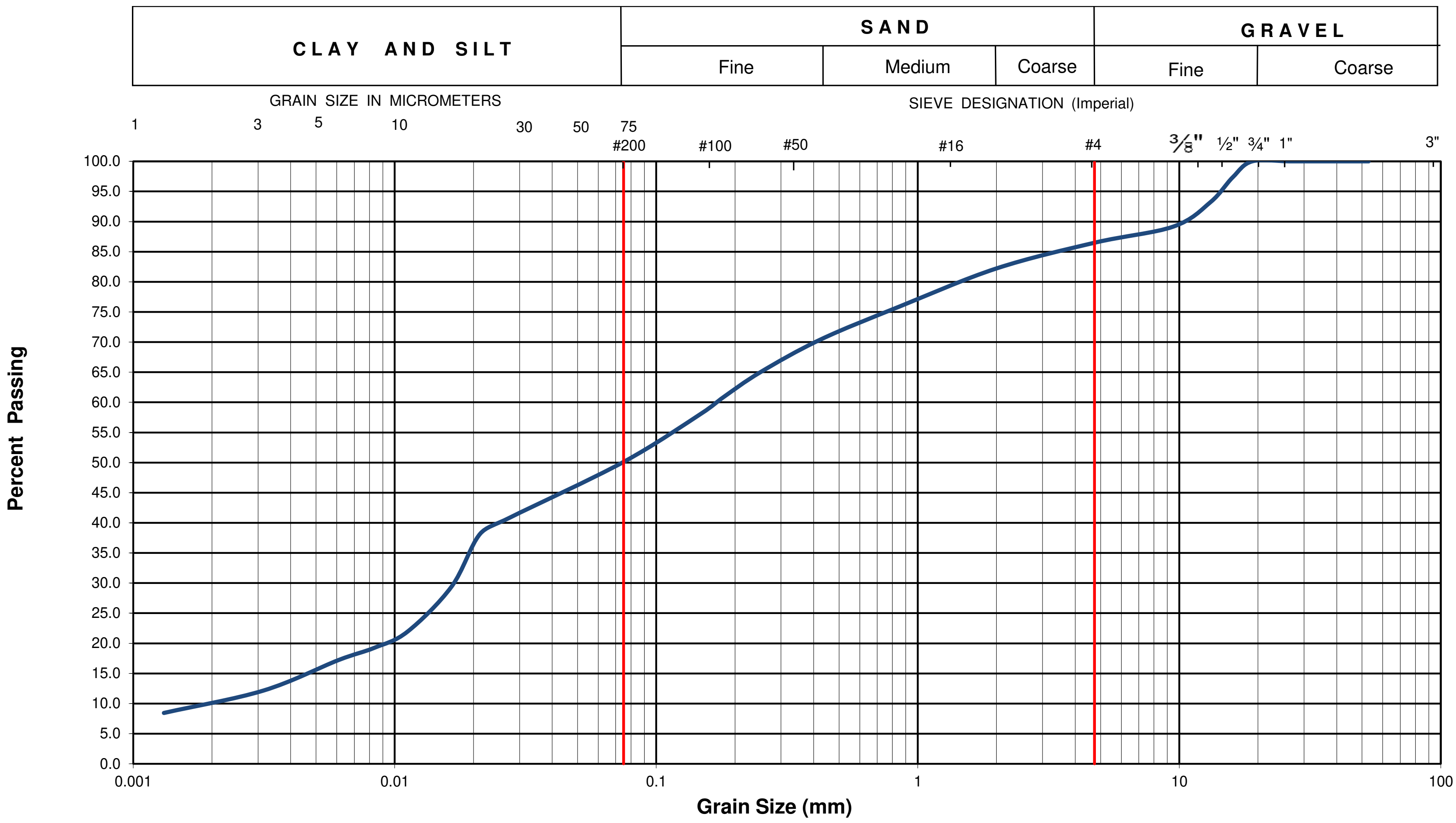


EXP Project No.:	**OTT-22013695-A0**	**Project Name :**	**Proposed School Addition, New Pavilion and Bus Loop**						
Client :	**CECCE**	**Project Location :**	**5315 Abbott Street East, Ottawa, ON**						
Date Sampled :	**August 1, 2022**	**Borehole No:**	**BH 22-02**	**Sample No.:**	**SS6**			**Depth (m) :**	**4.6-5.2**
Sample Description :		**% Silt and Clay**	**78**	**% Sand**	**19**	**% Gravel**	**3**	**Figure :**	**15**
Sample Description :		**Silt with Sand (ML)**							

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

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

Unified Soil Classification System



EXP Project No.:	**OTT-22013695-A0**	**Project Name :**	**Proposed School Addition, New Pavilion and Bus Loop**						
Client :	**CECCE**	**Project Location :**	**5315 Abbott Street East, Ottawa, ON**						
Date Sampled :	**August 1, 2022**	**Borehole No:**	**BH 22-03**	**Sample No.:**	**SS8**			**Depth (m) :**	**5.3-5.9**
Sample Description :		**% Silt and Clay**	**50**	**% Sand**	**36**	**% Gravel**	**14**	**Figure :**	**16**
Sample Description :	**GLACIAL TILL: Sandy Silt (ML)**								

Appendix A – 2018 EXP Geotechnical Investigation (Borehole Nos. 18-01 to 18-07)

Log of Borehole BH-1

Project No: OTT-00242399-A0

Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School

Location: 5315 Abbott Street East, City of Ottawa, Ontario

Figure No. A-1

Page. 1 of 1

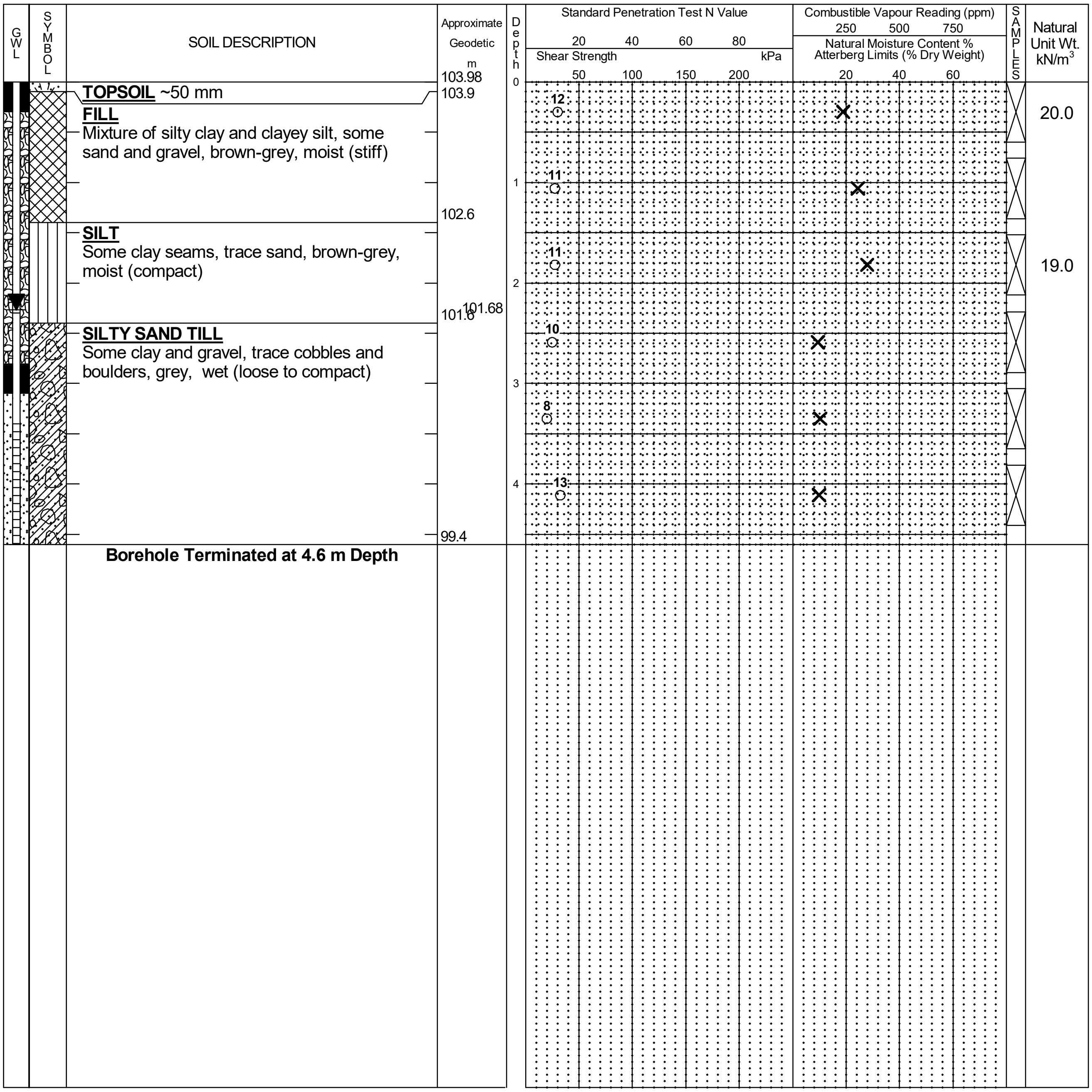
Date Drilled: 'September 29, 2017

Drill Type: CME-750 Rubber Tired Drill Rig

Datum: Approximate Geodetic

Logged by: M.L. 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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲



SOIL DESCRIPTION	Approximate Geodetic m
	103.98
TOPSOIL ~50 mm	103.9
FILL Mixture of silty clay and clayey silt, some sand and gravel, brown-grey, moist (stiff)	
SILT Some clay seams, trace sand, brown-grey, moist (compact)	102.6
SILTY SAND TILL Some clay and gravel, trace cobbles and boulders, grey, wet (loose to compact)	101.6 101.68
	99.4

Borehole Terminated at 4.6 m Depth

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Upon completion of drilling, 19 mm diameter standpipe installed in borehole as shown.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	N/A	N/A
11 days	2.3	

CORE DRILLING RECORD

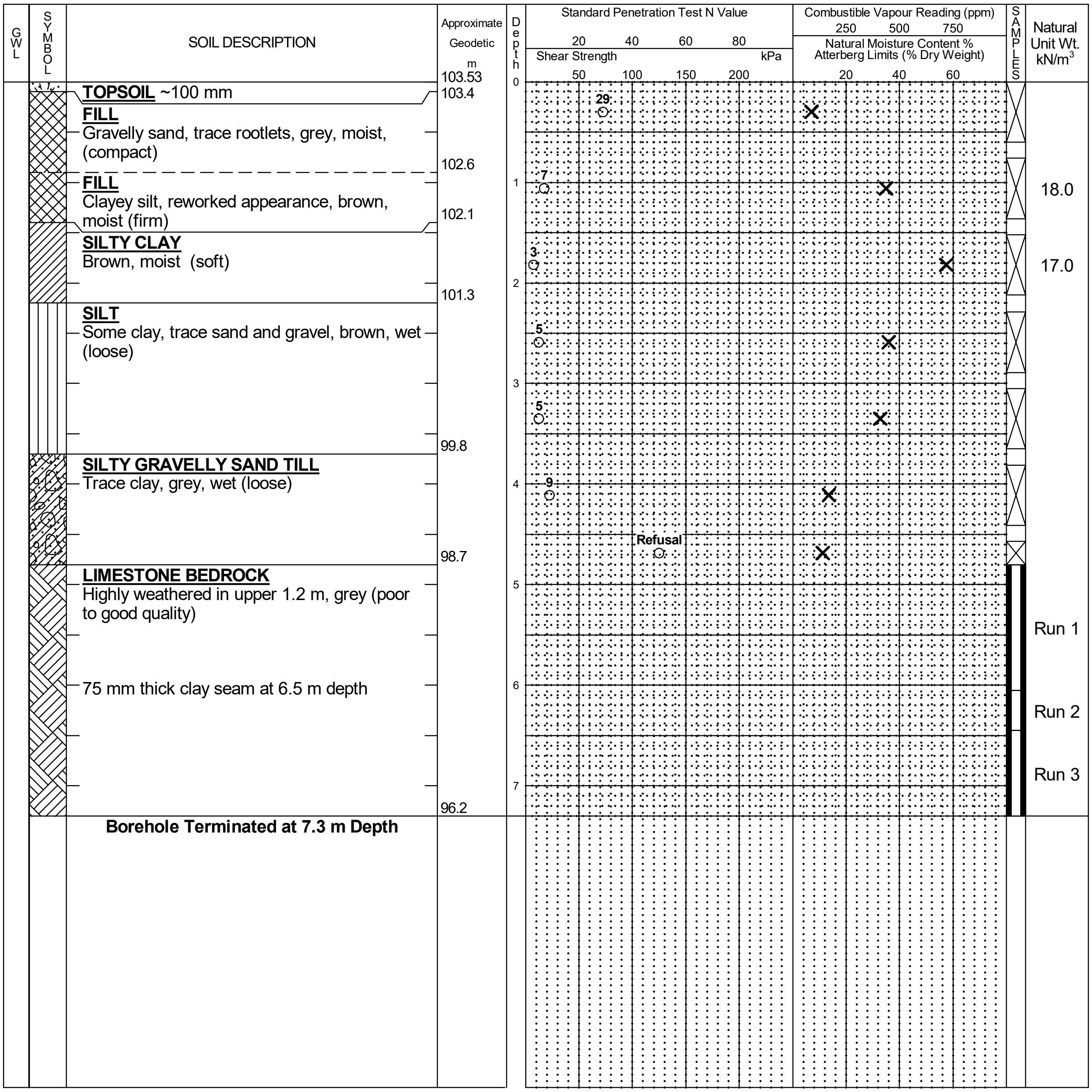
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-2

Project No: OTT-00242399-A0
Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School
Location: 5315 Abbott Street East, City of Ottawa, Ontario
Figure No. A-2
Page. 1 of 1

Date Drilled: 'October 2, 2017
Drill Type: CME-750 Rubber Tired Drill Rig
Datum: Approximate Geodetic
Logged by: M.L. 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		



SOIL DESCRIPTION	Approximate Geodetic m
	103.53
TOPSOIL ~100 mm	103.4
FILL Gravelly sand, trace rootlets, grey, moist, (compact)	102.6
FILL Clayey silt, reworked appearance, brown, moist (firm)	102.1
SILTY CLAY Brown, moist (soft)	101.3
SILT Some clay, trace sand and gravel, brown, wet (loose)	99.8
SILTY GRAVELLY SAND TILL Trace clay, grey, wet (loose)	98.7
LIMESTONE BEDROCK Highly weathered in upper 1.2 m, grey (poor to good quality) 75 mm thick clay seam at 6.5 m depth	96.2

Borehole Terminated at 7.3 m Depth

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	N/A	4.3

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	4.8 - 6.1	88	41
2	6.1 - 6.5	100	81
3	6.5 - 7.3	100	58

LOG OF BOREHOLE BH LOGS - 242399 - PAUL DESMARAIS SCHOOL.GPJ TROW OTTAWA.GDT 2/13/18

Log of Borehole BH-3

Project No: OTT-00242399-A0

Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School

Location: 5315 Abbott Street East, City of Ottawa, Ontario

Figure No. A-3

Page. 1 of 1

Date Drilled: 'October 2, 2017

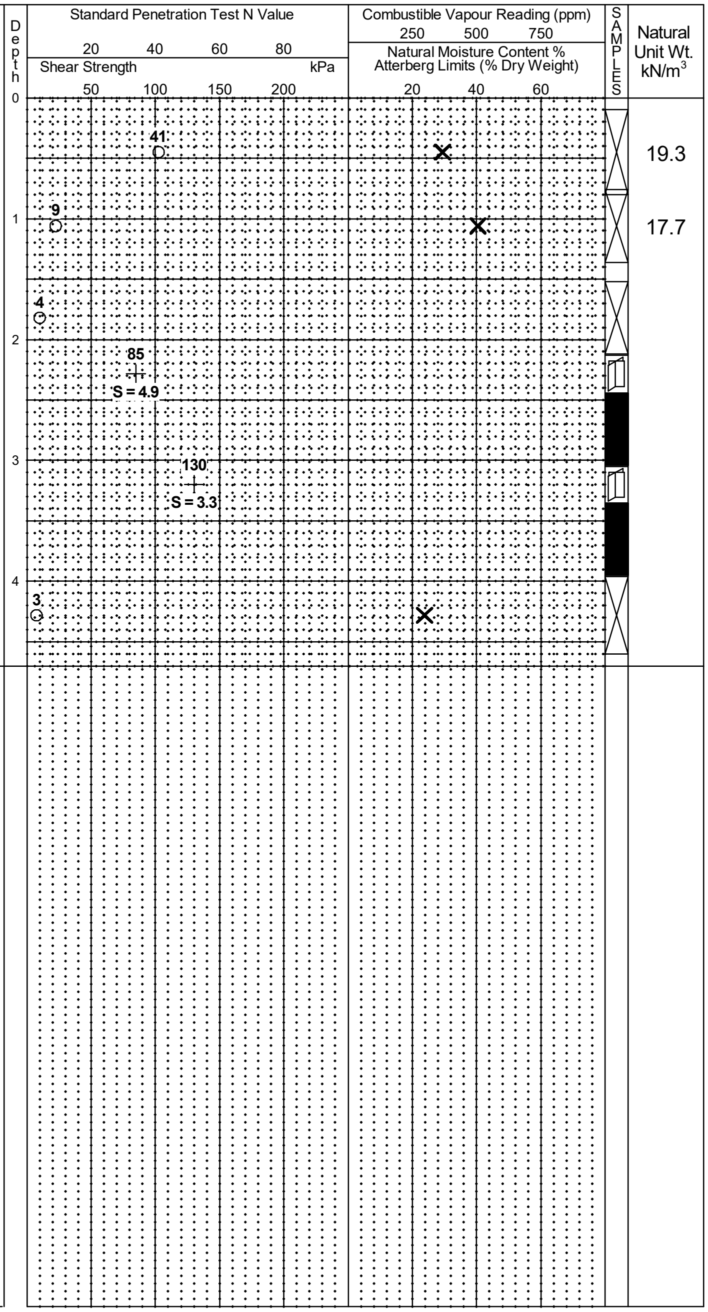
Drill Type: CME-750 Rubber Tired Drill Rig

Datum: Approximate Geodetic

Logged by: M.L. 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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic m
			103.56
		TOPSOIL ~100 mm	103.5
		FILL Silty clay, some sand and gravel, grey-brown, moist, (hard)	102.8
		SILTY CLAY (Desiccated Crust) Trace sand, brown, moist to wet (stiff)	101.7
		SILTY CLAY Some silt seams, trace sand, medium sensitivity to sensitive, grey, wet (stiff to very stiff)	
		possible glacial till at 4.7 m depth	98.9
		Borehole Terminated at 4.7 m Depth	



NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	3.3	3.7

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH LOGS - 242399 - PAUL DESMARAIS SCHOOL.GPJ TROW OTTAWA.GDT 2/13/18

Log of Borehole BH-4

Project No: OTT-00242399-A0

Figure No. A-4

Page. 1 of 1

Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School

Location: 5315 Abbott Street East, City of Ottawa, Ontario

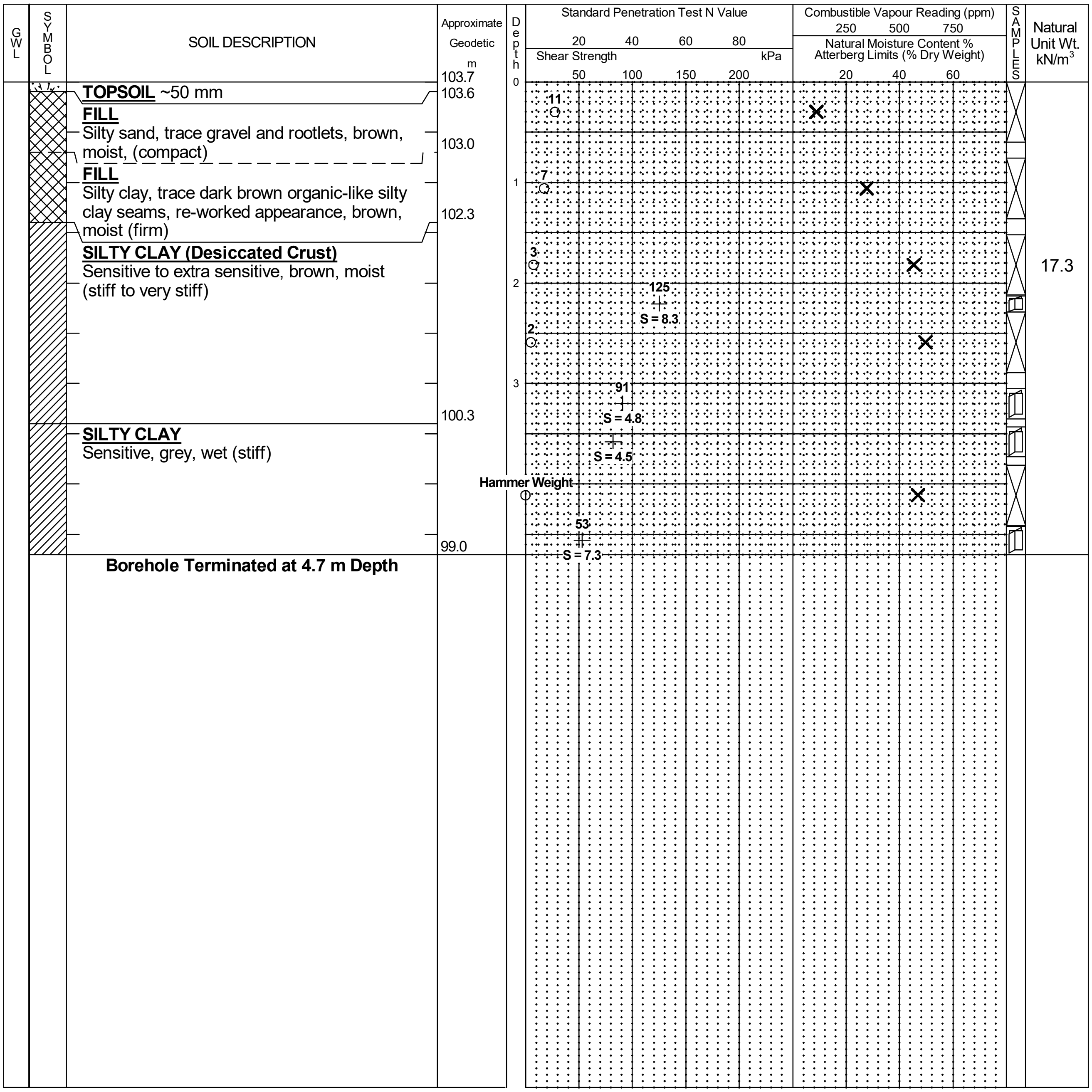
Date Drilled: 'September 29, 2017

Drill Type: CME-750 Rubber Tired Drill Rig

Datum: Approximate Geodetic

Logged by: M.L. 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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲



Soil Description	Approximate Geodetic (m)
	103.7
TOPSOIL ~50 mm	103.6
FILL Silty sand, trace gravel and rootlets, brown, moist, (compact)	103.0
FILL Silty clay, trace dark brown organic-like silty clay seams, re-worked appearance, brown, moist (firm)	102.3
SILTY CLAY (Desiccated Crust) Sensitive to extra sensitive, brown, moist (stiff to very stiff)	100.3
SILTY CLAY Sensitive, grey, wet (stiff)	99.0

Borehole Terminated at 4.7 m Depth

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	dry	3.8

CORE DRILLING RECORD

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

Log of Borehole BH-5

Project No: OTT-00242399-A0

Figure No. A-5

Page. 1 of 1

Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School

Location: 5315 Abbott Street East, City of Ottawa, Ontario

Date Drilled: 'September 29, 2017

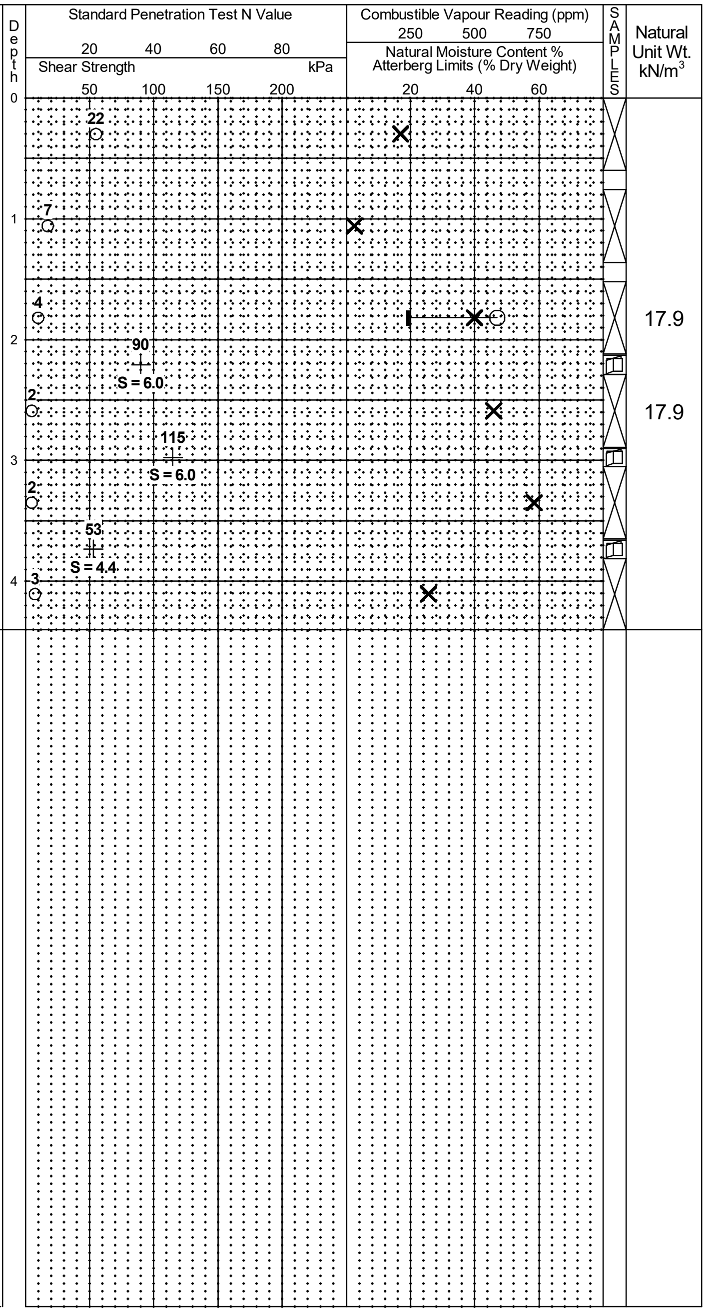
Drill Type: CME-750 Rubber Tired Drill Rig

Datum: Approximate Geodetic

Logged by: M.L. 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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic m
	▩	**FILL** Silty sand, gravelly, trace brown silty clay seams, brown, moist, (loose to compact)	103.41
	▨	**SILTY CLAY (Desiccated Crust)** Trace sand, low to medium plasticity, brown, moist to wet (firm)	102.0
	▨	**SILTY CLAY** Trace horizontal and vertical dark grey silt seams, sensitive, grey, wet (firm to very stiff) possible silt at 4.4 m depth	101.2
		Borehole Terminated at 4.4 m Depth	99.0



NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	dry	3.0

CORE DRILLING RECORD

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

Log of Borehole BH-6

Project No: OTT-00242399-A0

Figure No. A-6

Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School

Page. 1 of 1

Location: 5315 Abbott Street East, City of Ottawa, Ontario

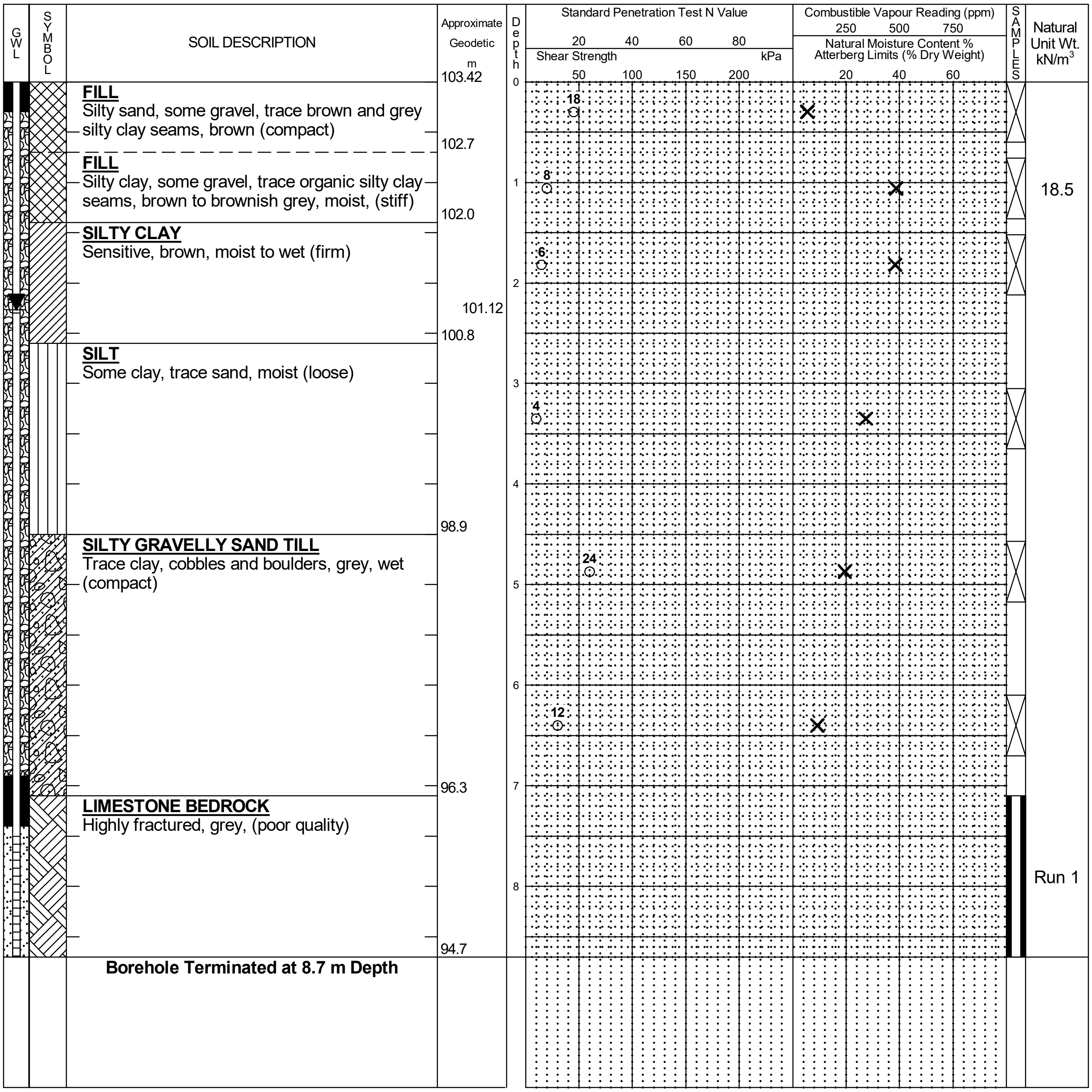
Date Drilled: 'September 29, 2017

Drill Type: CME-750 Rubber Tired Drill Rig

Datum: Approximate Geodetic

Logged by: M.L. 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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲



FILL
Silty sand, some gravel, trace brown and grey silty clay seams, brown (compact)

FILL
Silty clay, some gravel, trace organic silty clay seams, brown to brownish grey, moist, (stiff)

SILTY CLAY
Sensitive, brown, moist to wet (firm)

SILT
Some clay, trace sand, moist (loose)

SILTY GRAVELLY SAND TILL
Trace clay, cobbles and boulders, grey, wet (compact)

LIMESTONE BEDROCK
Highly fractured, grey, (poor quality)

Borehole Terminated at 8.7 m Depth

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Upon completion of drilling, 19 mm diameter standpipe installed in borehole as shown.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	N/A	8.7
11 days	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	7.1 - 8.7	100	28

Log of Borehole BH-7

Project No: OTT-00242399-A0

Project: Geotechnical Investigation - Proposed Dome - Paul Desmarais Catholic Secondary School

Location: 5315 Abbott Street East, City of Ottawa, Ontario

Figure No. A-7

Page. 1 of 1

Date Drilled: 'October 2, 2017

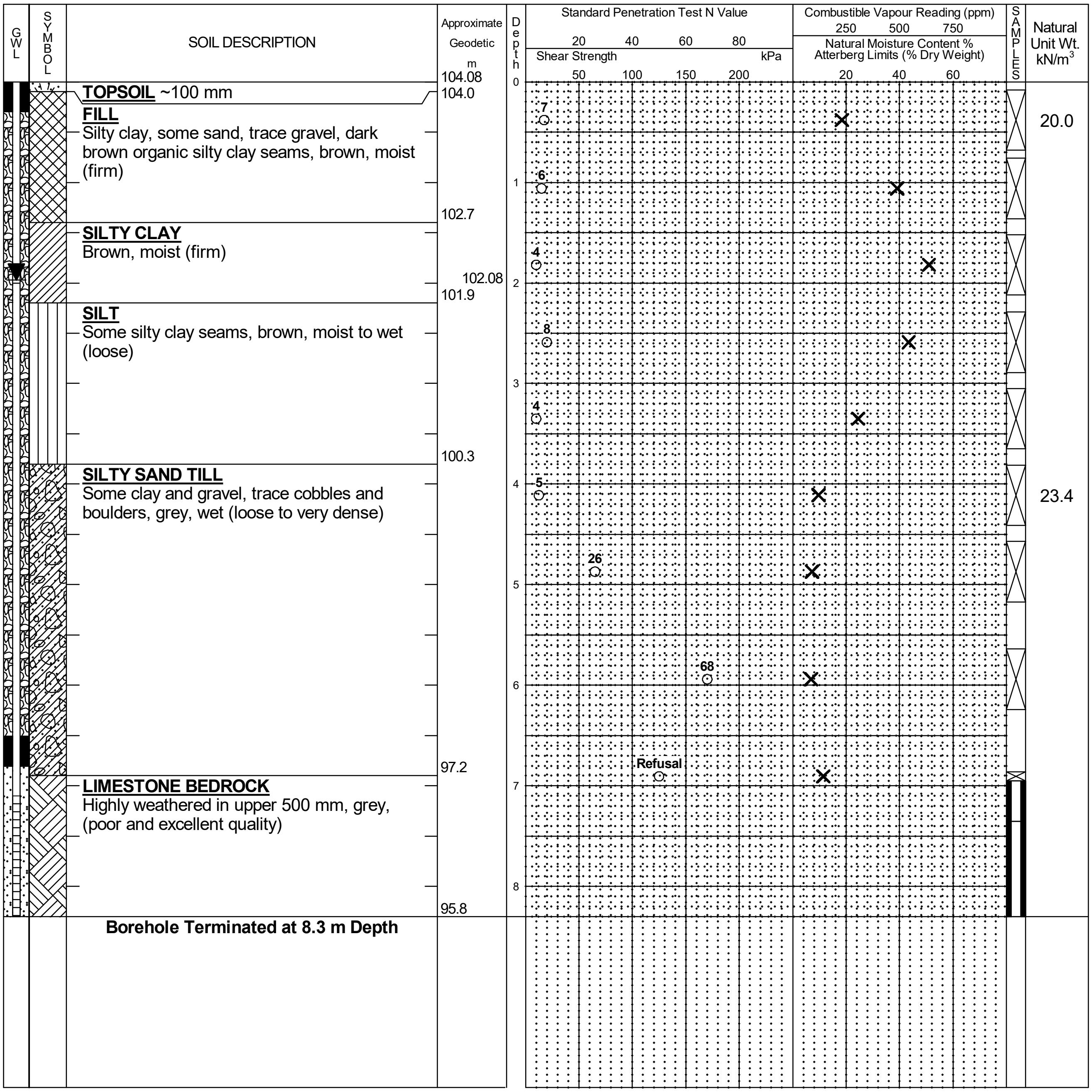
Drill Type: CME-750 Rubber Tired Drill Rig

Datum: Approximate Geodetic

Logged by: M.L. 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	Approximate Geodetic m	Depth (m)
		104.08	0
	TOPSOIL ~100 mm	104.0	
	FILL Silty clay, some sand, trace gravel, dark brown organic silty clay seams, brown, moist (firm)		
	SILTY CLAY Brown, moist (firm)	102.7	
▼		102.08	
	SILT Some silty clay seams, brown, moist to wet (loose)	101.9	
	SILTY SAND TILL Some clay and gravel, trace cobbles and boulders, grey, wet (loose to very dense)	100.3	
	LIMESTONE BEDROCK Highly weathered in upper 500 mm, grey, (poor and excellent quality)	97.2	
		95.8	
	Borehole Terminated at 8.3 m Depth		



NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Upon completion of drilling, 19 mm diameter standpipe installed in borehole as shown.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00242399-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	N/A	6.7
11 days	2.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	7 - 7.4	100	26
2	7.4 - 8.3	100	100

Appendix B – 2014 EXP Geotechnical Investigation (Borehole Nos. 14-06, 14-09 and 14-10)

Log of Borehole BH 6

Project No: OTT-00212742-A0

Project: Geotechnical Investigation - Proposed New Fernbank Secondary High School

Location: Intersection of Abbott Street Extension & Future Founders Way, Ottawa, ON

Figure No. B-1

Page. 1 of 1

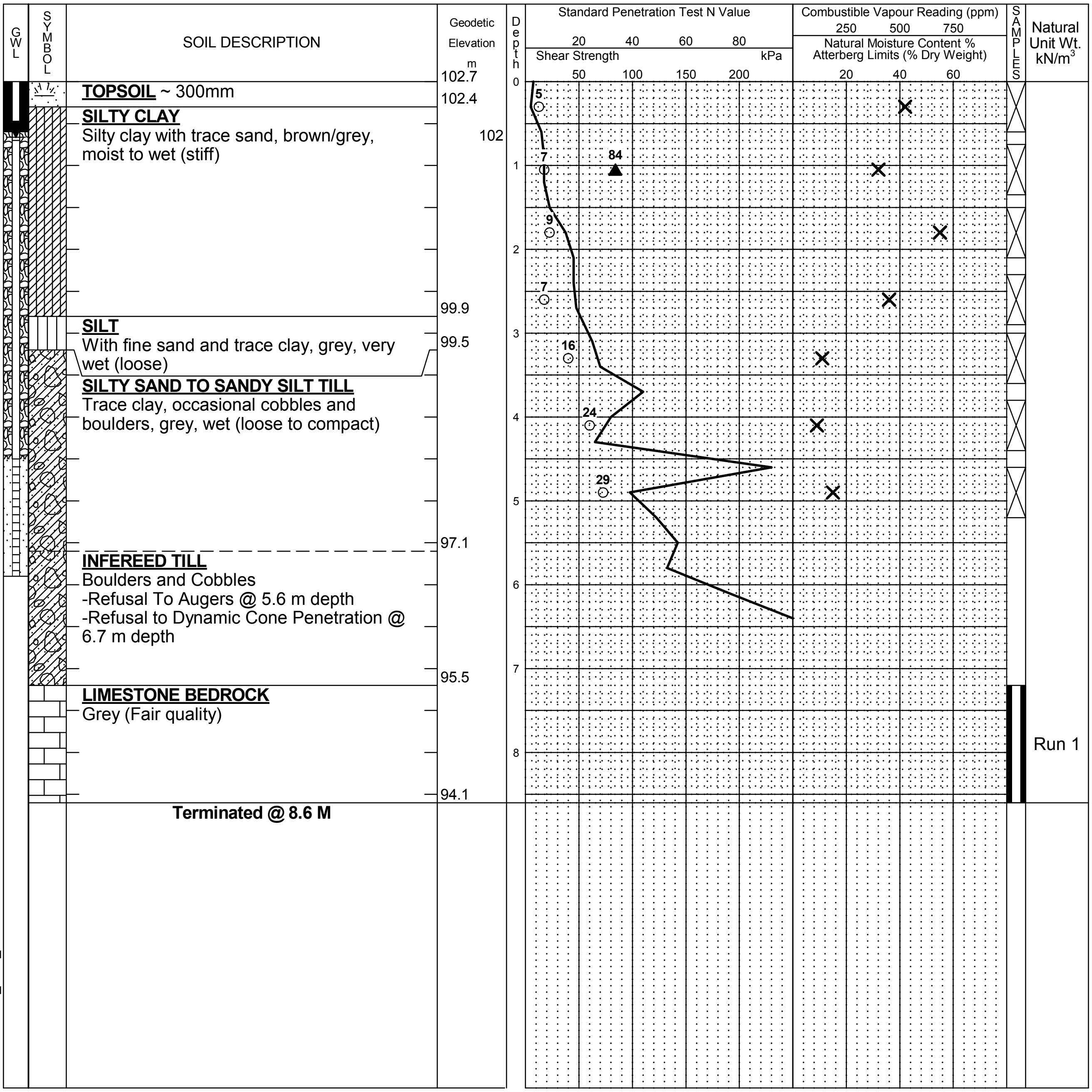
Date Drilled: October 18, 2013 & April 30, 2014

Drill Type: CME 75 track mount

Datum: Geodetic Elevation

Logged by: A.Neguss   Checked by: I. Taki

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		



Geodetic Elevation (m)	Soil Description
102.7 102.4	**TOPSOIL** ~ 300mm
102.4	**SILTY CLAY** Silty clay with trace sand, brown/grey, moist to wet (stiff)
99.9	**SILT** With fine sand and trace clay, grey, very wet (loose)
99.5	**SILTY SAND TO SANDY SILT TILL** Trace clay, occasional cobbles and boulders, grey, wet (loose to compact)
97.1	**INFEREED TILL** Boulders and Cobbles -Refusal To Augers @ 5.6 m depth -Refusal to Dynamic Cone Penetration @ 6.7 m depth
95.5	**LIMESTONE BEDROCK** Grey (Fair quality)
94.1	**Terminated @ 8.6 M**

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm diameter piezometer was installed in the borehole upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00212742-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
completion	3.1	
13 days	0.9	
~ 7 months	0.7	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	7.2 - 8.6	90	60

Log of Borehole BH 9

Project No: OTT-00212742-A0

Project: Geotechnical Investigation - Proposed New Fernbank Secondary High School

Location: Intersection of Abbott Street Extension & Future Founders Way, Ottawa, ON

Figure No. B-2

Page. 1 of 1

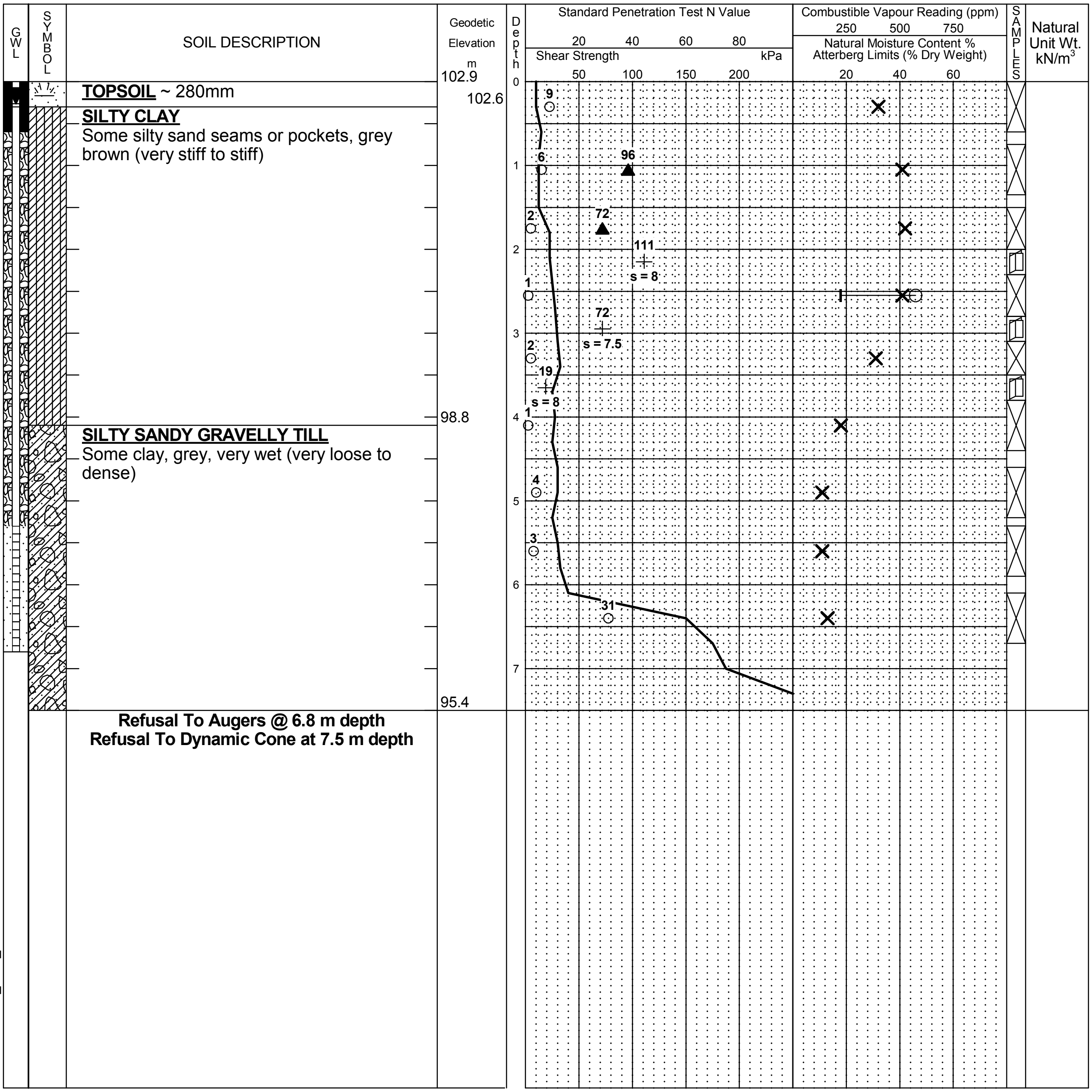
Date Drilled: 10/17/13

Drill Type: CME 75 track mount

Datum: Geodetic Elevation

Logged by: A.Neguss Checked by: I. Taki

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 Vane Test	+ S	Shear Strength by Penetrometer Test	▲



TOPSOIL ~ 280mm

SILTY CLAY
Some silty sand seams or pockets, grey brown (very stiff to stiff)

SILTY SANDY GRAVELLY TILL
Some clay, grey, very wet (very loose to dense)

Refusal To Augers @ 6.8 m depth
Refusal To Dynamic Cone at 7.5 m depth

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm diameter piezometer was installed in the borehole upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00212742-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
completion	3.7	
12 days	1.1	
~ 7 month	0.3	

CORE DRILLING RECORD

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

Log of Borehole BH 10

Project No: OTT-00212742-A0

Project: Geotechnical Investigation - Proposed New Fernbank Secondary High School

Location: Intersection of Abbott Street Extension & Future Founders Way, Ottawa, ON

Figure No. B-3

Page. 1 of 1

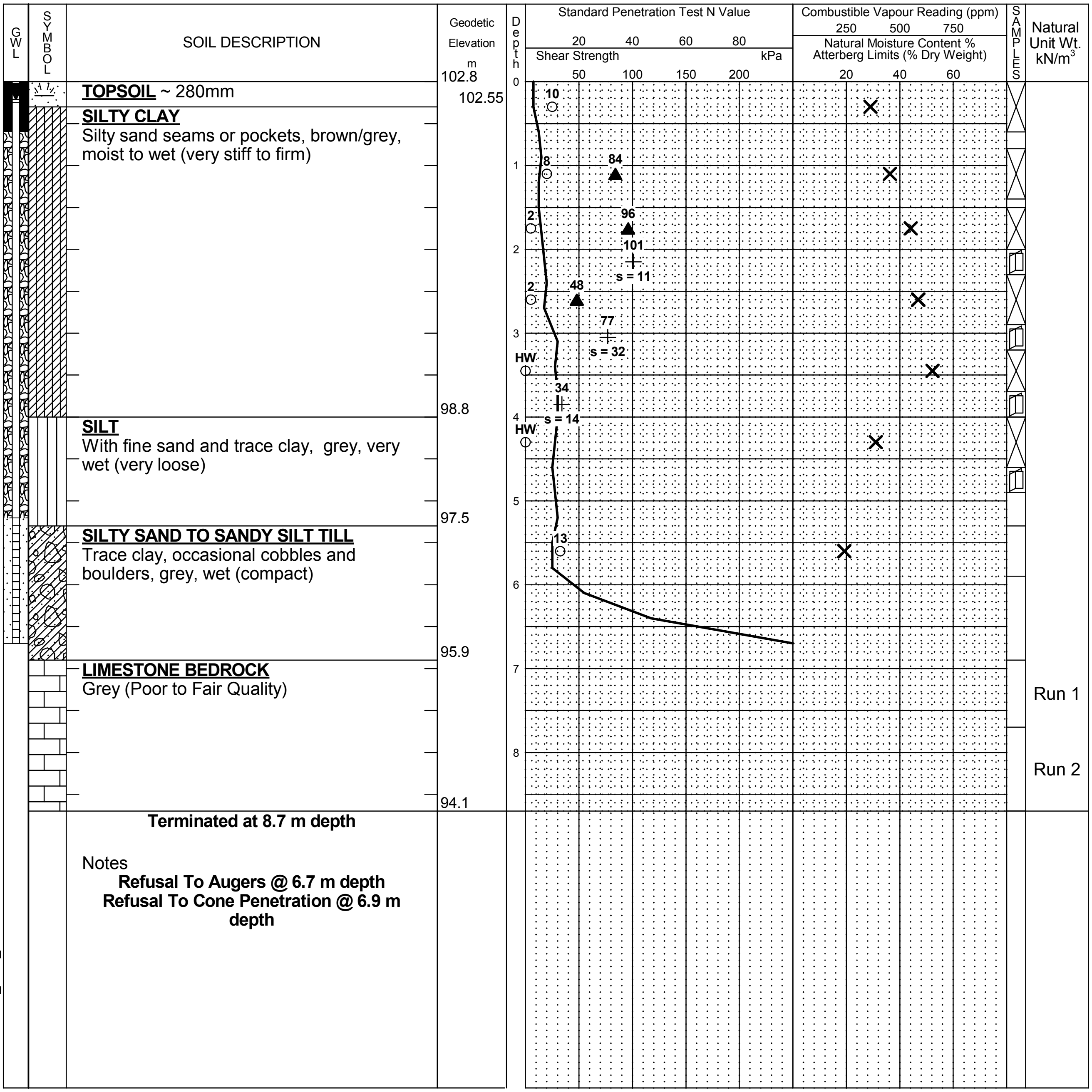
Date Drilled: October 17, 2013 & April 30, 2014

Drill Type: CME 75 track mount

Datum: Geodetic Elevation

Logged by: A.Neguss Checked by: I. Taki

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		



SOIL DESCRIPTION	Geodetic Elevation m
	102.8
TOPSOIL ~ 280mm	102.55
SILTY CLAY Silty sand seams or pockets, brown/grey, moist to wet (very stiff to firm)	98.8
SILT With fine sand and trace clay, grey, very wet (very loose)	97.5
SILTY SAND TO SANDY SILT TILL Trace clay, occasional cobbles and boulders, grey, wet (compact)	95.9
LIMESTONE BEDROCK Grey (Poor to Fair Quality)	94.1

Terminated at 8.7 m depth

Notes

Refusal To Augers @ 6.7 m depth

Refusal To Cone Penetration @ 6.9 m depth

NOTES:

1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm diameter piezometer was installed in the borehole upon completion.
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00212742-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
completion	3.1	
13 days	1.3	
~7 months	0.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	6.9 - 7.7	66	46
2	7.7 - 8.7	82	70

Appendix C – 2015 National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 45.274N 75.899W **User File Reference:** 5315 Abbott Street East, Ottawa, Ontario 2022-09-09 16:24 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.399	0.215	0.127	0.038
Sa (0.1)	0.470	0.264	0.163	0.054
Sa (0.2)	0.396	0.227	0.143	0.049
Sa (0.3)	0.302	0.176	0.112	0.040
Sa (0.5)	0.215	0.126	0.081	0.029
Sa (1.0)	0.109	0.065	0.042	0.014
Sa (2.0)	0.052	0.031	0.019	0.006
Sa (5.0)	0.014	0.008	0.004	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.253	0.144	0.089	0.029
PGV (m/s)	0.179	0.101	0.062	0.020

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Natural Resources Canada Ressources naturelles Canada

Canada

Legal Notification

This report was prepared by EXP Services for the account of Conseil des ecoles catholiques du Centre-Est (CECCE).

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. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

List of Distribution

Report Distributed To:

Jerzy Jurewicz, Edward J. Cuhaci and Associates Architects Inc.; jerzyj@cuhaci.com

Jacques Lavictoire, Conseil des ecoles catholiques du Centre-Est (CECCE); lavicj@ecolecatholique.ca