Geotechnical Investigation

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Ottawa Catholic School Board
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Nepean, Ontario K2G 3R4

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Project Name:
Geotechnical Investigation
Proposed Findlay Creek Catholic Elementary School
4140 Kelly Farm Drive,
Ottawa, Ontario

Project Number:
OTT-22012007-A0

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Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed new Findlay Creek Catholic Elementary School to be located in the southeast corner of the Kelly Farm Drive and Bradwell Way intersection at 4140 Kelly Farm Drive in Ottawa, Ontario (Figure 1). The terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: OTT-22012007-A0 dated May 4, 2022.

It is our understanding that the proposed school building will be a single-story structure with no basement located in the northern portion of the school property. The gross building floor area will be 4,630 m^2. The proposed school development will also include portables, outdoor sports field, play structure area and paved parking lot and access roads. The design elevation of the ground floor of the proposed school building will be at Elevation 95.05 m.

The test hole fieldwork was undertaken in two (2) stages. The first stage was completed between June 13 and June 15, 2022 and consists of fourteen (14) boreholes (Borehole Nos. 1 to 14) advanced to termination/auger refusal depths ranging from 5.2 m to 8.2 m below existing grade. The second stage was completed on June 20, 2022 an consists of thirteen (13) test pits (Test Pit Nos. 1, 2 and 4 to 14). excavated to termination depths of 1.8 m to 2.1 m below existing grade. Test Pit No. 3 was not excavated. The fieldwork was supervised on a full-time basis by a representative from EXP.

The fieldwork also included conducting a seismic shear wave survey of the site by Geophysics GPR International Inc. (GPR) on July 21, 2022. The purpose of the survey is to determine the seismic shear wave velocity of the site from the existing ground surface to a 30.0 m depth and based on the results of the survey, provide the classification of the site for seismic response.

The test hole information indicates the subsurface conditions at the site consist of a surficial topsoil and fill underlain by a buried topsoil over native silts and clays followed by glacial till contacted at 5.3 m to 6.5 m depths (Elevation 88.4 m to Elevation 87.4 m) in the boreholes and in one testpit at 1.5 m depth (Elevation 91.7 m) and auger refusal on inferred cobbles, boulders or bedrock at 6.8 m to 8.2 m depths (Elevation 86.8 m to Elevation 85.6 m). The groundwater level ranges from 3.2 m to 4.3 m depths (Elevation 90.6 m to Elevation 89.6 m).

The results of the seismic shear wave survey conducted at the site are provided in the report attached in Appendix A. The survey indicates that the seismic shear wave velocity from the existing ground surface to a 30.0 m depth is 721.8 m/s. Table 4.1.8.4.A of the 2012 Ontario Building Code (as amended May 2, 20219) indicates that the seismic shear wave velocity value of 721.8 m/s falls within the range of velocities for site class C (360 m/s $<V_{s30}<$760 m/s). Therefore, the site classification for seismic response is **Class C.** The subsurface soils are not considered to be susceptible to liquefaction during a seismic event.

Based on the borehole and test hole information, a maximum grade raise at the site of 2.0 m is considered to be acceptable from a geotechnical perspective.

The design finished floor elevation of the proposed school building is Elevation 95.05 m. Based on a review of the borehole information, it is considered feasible to support the proposed building by spread and strip footings. It is our understanding that the design elevation of the underside of the footings will be Elevation 93.4 m. Based on a review of the boreholes located within the footprint of the proposed school building, the footings, at the design underside of footing elevation of Elevation 93.4 m, would be founded on the existing fill. The topsoil (surficial and buried) and the existing fill are not suitable to support the footings and would have to be excavated, removed and replaced with an engineered fill pad that is constructed on top of the undisturbed native soil. Therefore, the footings that will support the proposed school building with an underside of footing elevation of Elevation 93.4 m, will have to be founded on a properly constructed engineered fill pad constructed on the approved undisturbed native soil.

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 at Elevation 93.4 m on a minimum 600 mm thick properly prepared engineered fill pad, constructed in accordance with the procedure in Section 9 of the attached report, may be designed for a bearing capacity at serviceability limit state (SLS) of 100 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 150 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 2.0 m is respected.

The floor slab for the proposed building may be designed and constructed as a slab-on-grade 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 constructed in accordance with Section 9 of the attached report.

It is recommended that a perimeter drainage system should be provided around the proposed school building. Based on the design finished floor elevation of Elevation 95.05 m and the groundwater level at Elevation 90.6 m to 89.6 m, an underfloor drainage system is not required for the proposed school building.

Excavation for the construction of footings and the installation of underground services are anticipated to extend to a maximum depth of 3.0 m below the existing grade and will extend through the topsoil (surficial and buried) fill and into the native sand, silt, clay and glacial till. The excavations are anticipated to be above the groundwater level.

Excavations may be undertaken by conventional heavy equipment capable of removing debris, cobbles and boulders present within the fill and cobbles and boulders within the native soils.

The 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 sidewalls of open cut excavations 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 cannot be achieved due to space restrictions on site, such as the proximity of open cut excavations to the property limits, existing infrastructure or to foundations of adjacent existing buildings, the excavation for the new building construction would have to be undertaken within the confines of an engineered support system (shoring system). If space restrictions prevent open cut excavations, the underground services may be installed within the confines of a prefabricated support system (trench box) which is designed and installed in accordance with the above-noted regulations.

Excavations that terminate within the native sand, silt, clay and till above the groundwater table are not expected to experience a base-heave type failure. Open cut excavations which extend below the groundwater level within the sand and silt soils are susceptible to instability of the base of the excavation in the form of piping or heave. Should the excavations extend below the groundwater table, EXP should be contacted prior to the start of excavation to provide comments and recommendations to minimize instability of the excavation base.

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 in the interior and exterior of the proposed building and for trench backfill would have to be imported and should preferably conform to Ontario Provincial Standard Specification (OPSS) for Granular B Type II and OPSS Select Subgrade Material (SSM).

Pavement structure for light duty traffic areas should consist of 65 mm thick asphaltic concrete, 150 mm thick OPSS Granular A base and 450 mm thick OPSS Granular B Type II subbase. Pavement structure for heavy duty traffic areas should consist of 110 mm thick asphaltic concrete, 150 mm thick OPSS Granular A base and 600 mm thick OPSS Granular B Type II subbase.

The above and other related considerations are discussed in greater detail in the main body of 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 Findlay Creek Catholic Elementary School to be located in the southeast corner of the Kelly Farm Drive and Bradwell Way intersection at 4140 Kelly Farm Drive in Ottawa, Ontario (Figure 1). The terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: OTT-22012007-A0 dated May 4, 2022.

It is our understanding that the proposed school building will be a single-story structure with no basement located in the northern portion of the school property. The gross building floor area will be 4,630 m^2. The proposed school development will also include portables, outdoor sports field, play structure area and paved parking lot and access roads. The design elevation of the ground floor of the proposed school building will be at Elevation 95.05 m.

A Phase One Environmental Site Assessment (ESA) of the site was also carried out by EXP and the results of the assessment are documented in a separate report dated June 10,2022.

The geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at 27 test holes located on the site (fourteen (14) boreholes and thirteen (13) test pits),

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 provide 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 and comment on the anticipated total and differential settlements of the recommended foundation type,

e) Provide comment 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) Provide pipe bedding requirements for underground services,

h) Discuss backfilling requirements and suitability of on-site soils for backfilling purposes,

i) Recommend pavement structure thicknesses for access roads and parking lot,

j) Comment on the corrosion potential of subsurface soils buried concrete and steel structures/members; and

k) Provide comment regarding restrictions to tree planting.

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 has the municipal address 4140 Kelly Farm Drive and is located in the southeast corner of the Kelly Farm Drive and Bradwell Way intersection. The site is bounded to the north by Kelly Farm Drive and residential development beyond, to the south by a public park, to the east by Vimy Ridge Public School and to the west by Bradwell Way and residential development beyond.

The site is currently vacant and is covered by tall grass, shrubs and trees.

The topography of the site gradually slopes downward in a south-southeast direction based on borehole and test pit ground surface elevations ranging from Elevation 94.22 m to Elevation 92.84 m.

3. Site Geology

3.1 Surficial Geology Maps

The surficial geology was reviewed via the Google Earth applications published by the Ontario Ministry of Energy, Northern Development and Mines available le via www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth/surficial-geology and was last modified on May 23, 2017. The map indicates the Site is underlain by coarse-textured glaciomarine deposits consisting of sand, gravel, minor silt and clay overlying stone-poor, sandy silt to silty sand-textured glacial till deposit. The southern part of the site is indicated to contain organic deposits consisting of peat, muck and marl. The surficial deposits are shown in Image 1 below.

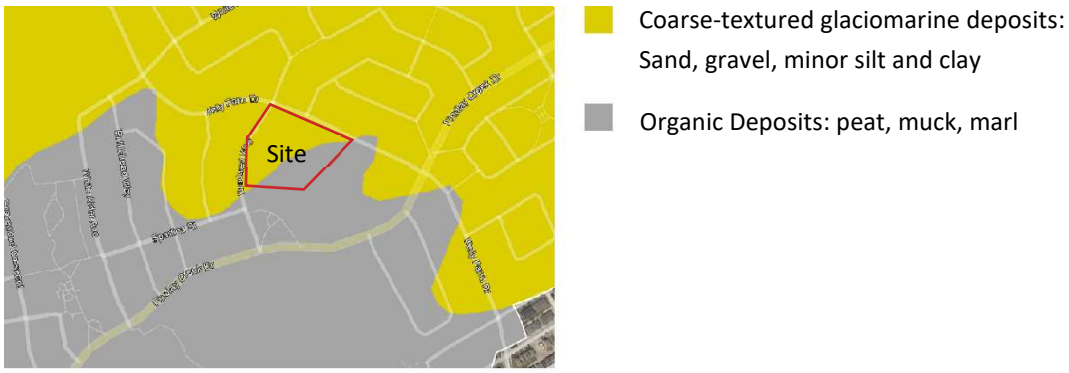


Image 1 – Surficial Geology

3.2 Bedrock Geology Maps

The bedrock geology map (Ontario Geological Survey, Map P. 2611 – Geology and Mineral Deposits, Kingston Area, printed by the Government of Ontario, 1985) indicates the site is underlain by sandstone, dolostone or dolomitic sandstone of the March formation or sandstone, or minor conglomerate of the Nepean formation. The bedrock geology is show in Image 2 below.

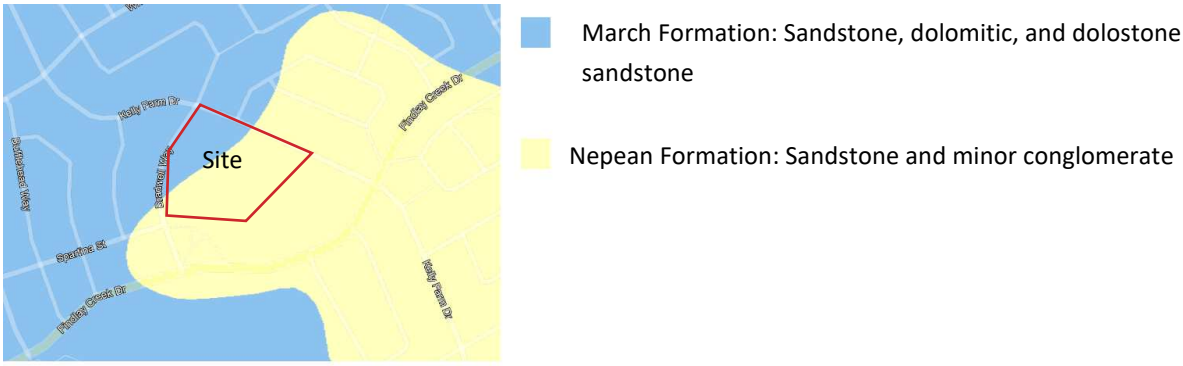


Image 2 – Bedrock Geology

4. Procedure

4.1 Test Hole Fieldwork and Laboratory Testing Program

The test hole (boreholes and test pits) fieldwork was undertaken in two (2) stages. The first stage was completed between June 13 and June 15,2022 and consists of fourteen (14) boreholes (Borehole Nos. 1 to 14) advanced to termination/auger refusal depths ranging from 5.2 m to 8.2 m below existing grade. The second stage was completed on June 20,2022 and consists of thirteen (13) test pits (Test Pit Nos. 1, 2 and 4 to 14) excavated to termination depths of 1.8 m to 2.1 m below existing grade. Test Pit No. 3 was not excavated. The fieldwork was supervised on a full-time basis by a representative from EXP.

The locations and geodetic elevations of the test holes were established on site by EXP and are shown on the Test Hole Location Plan, Figure 2. The exception to this is the ground surface elevation of Test Pit Nos. 12 to 14 which were approximated from the ground surface spot elevations shown on the drawing titled, *Site Plan Zoning Matrix* dated May 11,2022 and prepared by Pye and Richards, Temprano and Young Architects Inc. Therefore, the ground surface elevations for Test Pit Nos. 12 to 14 should be considered approximate.

The borehole and test pit locations were cleared of private and public underground services, prior to the start of drilling and excavating operations.

The boreholes were drilled using a CME-850 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. Dynamic cone penetration tests (DCPT) were conducted next to Borehole Nos. 1, 4, 8 and 12 from ground surface to cone refusal depths of 6.7 m to 8.1 m below existing grade. The undrained shear strength of the clayey cohesive soils was measured by conducting in-situ vane tests. The subsurface soil conditions in each borehole were logged with each soil sample placed in a labelled plastic bag.

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

Test pits were carried out with a Kubota KR-808 type excavator. Soil samples (grab samples) of the different soil types exposed in the test pits were retrieved and the soil conditions from the test pits were logged with each soil sample placed in a labeled plastic bag. The test pits were backfilled upon completion of excavating.

On completion of the test hole 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 (2006 Fourth Edition of the Canadian Foundation Engineering Manual (CFEM)).

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	153
Unit Weight Determination	24
Grain Size Analysis	12
Atterberg Limit Determination	10
Corrosion Analysis (pH, sulphate, chloride and resistivity)	3

4.2 Seismic Shear Wave Survey

A seismic shear wave survey of the site was undertaken by Geophysics GPR International Inc. (GPR) on July 21, 2022. The purpose of the survey is to determine the seismic shear wave velocity of the site from the existing ground surface to a 30.0 m depth and based on the results of the survey, provide the classification of the site for seismic response. The location of the seismic survey line is shown in Figure 2. The seismic shear wave survey report is attached in Appendix A.

5. Subsurface Conditions and Groundwater Levels

A detailed description of the subsurface conditions and groundwater levels from the borehole and test pits are given on the attached Borehole and Test Pit Logs, Figure Nos. 3 to 29. The borehole and test pit 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.

The boreholes were drilled and the test pits were excavated 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 and test pit 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 and test pit logs form an integral part of this report and should be read in conjunction with this report.

A review of the borehole and test pit logs indicates the following subsurface conditions with depth and groundwater level measurements.

5.1 Topsoil

A 50 mm to 400 mm thick surficial topsoil layer was encountered in Boreholes Nos. 1 to 8 and 13 and Test Pit No. 10.

5.2 Fill

Fill was contacted surficially and underlying the topsoil layer in all the test holes, with the exception test Pit No. 10. The fill extends to depths of 0.3 m to 1.8 m (Elevation 92.9 m to Elevation 91.7 m). The fill ranges from silty sand with gravel to silty clay. The fill contains cobbles and boulders, construction debris and asphalt. The fill is in a very loose to very dense state based on standard penetration test (SPT) N-values ranging from 3 to 58. Higher N values with low sampler penetration, i.e. 50 for 125 mm sampler penetration into the fill is likely a result of the split spoon sampler making contact with a cobble, boulder or debris within the fill. The moisture content and unit weight of the fill ranged from 3 percent to 41 percent and 18.9 kN/m^3 to 22.9 kN/m^3, respectively.

The results from the grain-size analysis conducted on two (2) samples of the fill are summarized in Table II. The grain-size distribution curves are shown in Figures 30 and 31.

Table II: Summary of Results from Grain-Size Analysis - Fill Samples

Test Pit No. (TP) – Grab Sample No. (GS)	Depth (m)	Grain-Size Analysis (%) and Atterberg Limits			
		Gravel	Sand	Fines (Silt and Clay)	Soil Classification (USCS)
TP1-GS1	0.4 - 0.6	25	34	41	Silty Sand with Gravel (SM)
TP8-GS1	0.3 - 0.6	21	17	62	Gravelly Silt with Sand (ML)

Based on a review of the results from the grain size analysis, the fill may be classified as a silty sand with gravel (SM) and a gravelly silt with sand (ML) in accordance with the Unified Soil Classification System (USCS).

5.3 Buried Topsoil

A topsoil layer was encountered beneath the fill at depths of 0.3 m to 1.5 m (Elevation 92.9 m to Elevation 92.2 m) in Boreholes Nos. 2, 4, 5, 9, 11 and 12 and Test Pits Nos. 1, 2, 5, 8, 11 to 14. The buried topsoil ranges in thickness from 25 mm to 300 mm.

5.4 Silty Clay/Clayey Silt

A clayey silt to silty clay layer was contacted below the fill and buried topsoil in Borehole Nos. 3, 5 and 10 and in Test Pit Nos. 1, 2, 5, 7, 8, 11 and 14. The clayey silt to silty clay extends to depths of 1.8 m to 2.9 m (Elevation 91.9 m to Elevation 90.8 m). The clayey silt to silty clay has a consistency of soft to firm as indicated by the SPT N-values which range from 3 to 5. The undrained shear strength of the clayey silt to silty clay ranges from 90 kPa to 200 kPa indicating a stiff to hard consistency. The natural moisture content and unit weight of the clayey silt to silty clay ranges from 17 percent to 31 percent and 18.7 kN/m^3 to 21.1 kN/m^3, respectively.

Results from a grain-size analysis conducted and an Atterberg limit determination conducted on one (1) sample of the silty clay are summarized in Table III. The grain-size distribution curve is shown in Figure 32.

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

Borehole No. (BH) – Sample No. (SS)	Depth (m)	Grain-Size Analysis (%) and Atterberg Limits							
		Gravel	Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	Soil Classification (USCS)
BH 05-SS3	1.5 – 2.1	0	9	62	29	30	18	12	Silty Clay of Low Plasticity (CL)

Based on a review of the results of the grain-size analysis and Atterberg limits, the soil may be classified as a silty clay of low plasticity (CL) in accordance with the Unified Soil Classification System (USCS).

5.5 Sandy Silt to Silt

Sandy silt to silt was contacted beneath the fill, topsoil, clayey silt or the silty clay in all the boreholes and in Test Pits Nos. 4 to 6, 9, 10, 12 and 13. In Borehole No. 9, this deposit ranged from silty sand to silt. In Borehole No. 7, a clayey silty sand is present and is described as a possible fill, since it has a slightly disturbed/reworked appearance. The silty sand to silt, clayey silty sand (possible fill) and sandy silt to silt extend to depths of 1.5 m to 6.5 m (Elevation 91.8 m to Elevation 87.4 m). The SPT N-values of this deposit range from 1 to 20 indicating the soil is in a very loose to compact state. The moisture content and unit weight of this deposit ranged from 12 to 45 percent and 17.8 kN/m^3 to 21.7 N/m^3 respectively.

Results from the grain-size analysis conducted on seven (7) samples from this deposit are summarized in Table IV and grain-size distribution curves are shown in Figures Nos. 33 to 39.

Table IV: Summary of Results from Grain-Size Analysis and Atterberg Limit Determination Silt Samples

Borehole No. (BH) – Sample No. (SS)	Depth (m)	Grain-Size Analysis (%) and Atterberg Limits					
		Gravel	Sand	Silt	Clay	Plasticity Index	Soil Classification (USCS)
BH 02-SS 5	3.0 – 3.6	0	3	90	7	N.P.	Silt (ML)
BH 03-SS 4	2.3 – 2.9	0	5	83	12	N.P.	Silt (ML)
BH 06-SS 6	3.8 – 4.4	0	1	83	16	N.P.	Silt (ML)
BH 07-SS 7	4.6 – 5.2	0	30	65	5	N.P.	Sandy Silt (ML)
BH08-SS 5	3.0 – 3.6	0	1	85	14	N.P.	Silt (ML)
BH08-SS 7	4.6 - 5.2	0	0	91	9	N.P.	Silt (ML)
BH 11-SS 5	3.0 – 3.6	0	30	64	6	N.P.	Sandy Silt (ML)

N.P = Non-plastic

Based on a review of the results of the grain-size analysis, the soil may be classified as a sandy silt (ML) to slit (ML) in accordance with the USCS.

5.6 Glacial Till

In Borehole Nos. 1 to 4, 6 to 8, 10 and 12, glacial till was contacted beneath the sandy silt to silt at depths of 5.3 m to 6.5 m (Elevation 88.4 m to Elevation 87.4 m). The glacial till was also encountered in Test Pit No. 10 at 1.5 m depth (Elevation 91.7 m). The glacial till contains varying amounts of gravel, sand, silt and clay within the soil matrix as well as cobbles and boulders. The SPT N-values of the glacial till range from 2 to 57 indicating the glacial till is in a very loose to very dense state. Higher N values with low sampler penetration such as N equal to 50 for 100 mm sampler penetration into the glacial till are likely a result of the split spoon sampler making contact with a cobble or boulder within the glacial till. The natural moisture content of the glacial till is 7 percent to 18 percent.

The results from the grain-size analysis conducted on two (2) samples of the glacial till are summarized in Table V. The grain-size distribution curves are shown in Figures Nos. 40 and 41.

Table V: Summary of Results from Grain-Size Analysis and Atterberg Limit Determination
Glacial Till Samples

Borehole No. (BH)– Sample No. (SS)	Depth (m)	Grain-Size Analysis (%) and Atterberg Limits					
		Gravel	Sand	Silt	Clay	Plasticity Index	Soil Classification (USCS)
BH 04-SS 9	6.1 – 6.7	15	55	23	7	N.P.	Silty Sand with Gravel (SM)
BH 12-SS 9	6.1 – 6.7	27	42	27	4	N.P.	Silty Sand with Gravel (SM)

N.P = Non-plastic

Based on a review of the results of the grain-size analysis, the glacial till may be classified as silty sand with gravel (SM) in accordance with the USCS. The glacial till contains cobbles and boulders.

5.7 Inferred Bedrock

In Borehole Nos. 1, 3 and 8 rock fragments were encountered at a 7.2 m depth (Elevation 87.0 m to Elevation 86.6 m). The rock fragments may be possible weathered bedrock, cobbles and/or boulders.

Auger refusal occurred in Boreholes Nos. 2, 6, 7, 10 and 12 at depths ranging from 6.8 m to 8.2 m (Elevation 86.8 m to Elevation 85.6 m).

5.8 Groundwater Level Measurements

A summary of the groundwater level measurements taken in the boreholes equipped with standpipes on July 5,2022 is shown in Table VI.

Table VI: 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	
BH-01	94.22	22 days	3.7	(90.6)
BH-04	93.68	22 days	4.0	(89.7)
BH-08	93.77	20 days	3.4	(90.4)
BH-10	93.82	21 days	4.3	(89.6)
BH-14	92.97	21 days	3.2	(89.8)

The groundwater level ranges from 3.2 m to 4.3 m (Elevation 90.6 m to Elevation 89.6 m) below the existing ground surface.

All test pits remained dry during and upon completion of the excavation operation. The groundwater level was not contacted in all of the test pits excavated to termination depths of 1.8 m to 2.1 m (Elevation 92.8 m to Elevation 91.8 m).

The groundwater levels were determined in the boreholes and test pits at the time and under the condition stated in the 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. Site Classification for Seismic Site Response and Liquefaction Potential of Soils

6.1 Site Classification for Seismic Site Response

The results of the seismic shear wave survey conducted at the site are provided in the report attached in Appendix A. The survey indicates that the seismic shear wave velocity from the existing ground surface to a 30.0 m depth is 721.8 m/s. Table 4.1.8.4.A of the 2012 Ontario Building Code (as amended May 2, 20219) indicates that the seismic shear wave velocity value of 721.8 m/s falls within the range of velocities for site class C (360 m/s $<V_{s30}<$760 m/s). Therefore, the site classification for seismic response is **Class C.**

6.2 Liquefaction Potential of Soils

The subsurface soils are not considered to be susceptible to liquefaction during a seismic event.

7. Grade Raise Restrictions

The design elevation for the ground floor of the proposed school building will be at Elevation 95.05 m. The ground surface elevations of the boreholes (Borehole Nos. 1 to 12) and the approximate ground surface elevations of the test pits (Test Pit Nos. 12 to 14) located within the footprint of the proposed school building range from Elevation 94.22 m to Elevation 93.3 m. Therefore, the site grade raise within the proposed building footprint will range from 0.8 m to 1.8 m.

The ground surface elevation of the boreholes and test pits located outside the or beyond the footprint of the proposed building range from Elevation 93.88 m to Elevation 92.84 m. Based on the assumption that the final design grades in the remaining portion of the site beyond the footprint of the proposed school building will be slightly below the design finished floor elevation of the proposed school building, the anticipated maximum grade raise outside the proposed building footprint will be approximately 2.0 m.

Based on the borehole and test hole information, a maximum grade raise at the site of 2.0 m is considered to be acceptable from a geotechnical perspective. However, should the design grade raise exceed 2.0 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

For budgeting purposes, the contractor should assume that all existing fill, surficial and buried topsoil (organic) layers and organic stained soils within the footprints of the proposed building, portable(s), play structure, sports field, parking lots and access roads would require removal and replacement with well-compacted fill as indicated below.

Site grading within the **proposed building footprint** should consist of the removal of all existing fill, surficial and buried topsoil (organic) layers and organic stained soils down to the native undisturbed 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 constructed in accordance with Section 9 of this report.

Site grading within the **proposed portable area** should consist of the removal of all existing fill, surficial and buried topsoil (organic) layers and organic stained soils down to the native undisturbed 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 subgrade level by the construction of an engineered fill pad constructed in accordance with the procedure in Section 9 of this report.

Site grading within the **proposed play structure area** should consist of the removal of all existing fill, surficial and buried topsoil (organic) layers and organic stained soils down to the native undisturbed material. The native subgrade should be proofrolled in the full-time 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 material compacted to 95 percent standard Proctor maximum dry density (SPMDD). Once the subgrade has been approved, the grades may be raised to the design subgrade level by the placement of engineered fill as discussed in Section 9 of this report. The engineered fill should be compacted to a minimum 95 percent SPMDD.

Site grading within the **proposed sports field, parking lot and access road areas** should consist of the removal of all existing fill, surficial and buried topsoil (organic) layers and organic stained soils down to the native undisturbed material. The native 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). 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

The design finished floor elevation of the proposed school building is Elevation 95.05 m. Based on a review of the borehole information, it is considered feasible to support the proposed building by spread and strip footings. It is our understanding that the design elevation of the underside of the footings will be Elevation 93.4 m. Based on a review of the boreholes located within the footprint of the proposed school building, the footings, at the design underside of footing elevation of Elevation 93.4 m, would be founded on the existing fill. The topsoil (surficial and buried) and the existing fill are not suitable to support the footings and would have to be excavated, removed and replaced with an engineered fill pad that is constructed on top of the undisturbed native soil. Therefore, the footings that will support the proposed school building with an underside of footing elevation of Elevation 93.4 m will have to be founded on a properly constructed engineered fill pad constructed on the approved undisturbed native soil.

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 at Elevation 93.4 m and on a minimum 600 mm thick properly prepared engineered fill pad, constructed on the approved native soil, in accordance with the procedure in the paragraph below, may be designed for a bearing capacity at serviceability limit state (SLS) of 100 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 150 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 2.0 m is respected.

If the founding depth for the proposed footings will be at a lower elevation than Elevation 93.4 m, 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 all existing fill, surficial and buried topsoil (organic) layers and organic stained soils down to the native undisturbed sand, silt and 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 native 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 fill and topsoil layers 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 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.

Since the native clay and silt subgrade are susceptible to disturbance due to the effects of weather and construction traffic, 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.

All the footing beds 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 have been properly prepared.

A minimum of 1.5 m of earth cover should be provided to the footings to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity. If snow will be removed from the vicinity of the unheated structures, the frost cover should be increased to 2.4 m. 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.

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 floor slab for the proposed building may be designed and constructed as a slab-on-grade 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 constructed in accordance with Section 9 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.

It is recommended that a perimeter drainage system should be provided around the proposed school building. Based on the design finished floor elevation of Elevation 95.05 m and the groundwater level at Elevation 90.6 m to 89.6 m, an underfloor drainage system is not required for the proposed school building.

The floor slab should be set at a minimum of 150 mm higher than the surrounding final exterior grade.

The final exterior grade surrounding the proposed building should be sloped away from the proposed building to prevent ponding of surface water close to the exterior walls of the proposed 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

Excavation for the construction of footings and the installation of underground services are anticipated to extend to a maximum depth of 3.0 m below the existing grade and will extend through the topsoil (surficial and buried), fill and into the native sand, silt, clay soils and glacial till. The excavations are anticipated to be above the groundwater level.

Excavations maybe undertaken by conventional heavy equipment capable of removing debris, cobbles and boulders present within the fill and cobbles and boulders within the native soils.

The 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 sidewalls of open cut excavations 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 cannot be achieved due to space restrictions on site, such as the proximity of open cut excavations to the property limits, existing infrastructure or to foundations of adjacent existing buildings, the excavation for the new building construction would have to be undertaken within the confines of an engineered support system (shoring system). If space restrictions prevent open cut excavations, the underground services may be installed within the confines of a prefabricated support system (trench box) which 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.

Excavations that terminate within the native sand, silt and clay soils above the groundwater table are not expected to experience a base-heave type of failure. Open cut excavations which extend below the groundwater level within the sand and silt are susceptible to instability of the base of the excavation in the form of piping or heave. Should the excavations extend below the groundwater table, EXP should be contacted prior to the start of excavation to pride comments and recommendations to minimize instability of the excavation bases.

The native soils are susceptible to disturbance due to movement of construction equipment and personnel on its surface. It is therefore recommended that the excavation at the site should be undertaken by construction equipment that does not travel on the excavated surface, such as a gradall or mechanical shovel.

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. Pipe Bedding Requirements

The depth at which municipal services will be installed is anticipated to be a maximum of 3.0 m depth below existing grade. Therefore, the subgrade for the underground service pipes is expected to be either silty clay, sand and silt or glacial till.

The bedding for the underground services including material specifications, thickness of cover material and compaction requirements conform to municipal requirements and/or Ontario Provincial Standard Specification and Drawings (OPSS and OPSD).

It is recommended that the pipe bedding be 300 mm thick and consist of OPSS Granular A. The bedding material should be placed along the sides and on top of the pipe to provide a minimum cover of 300 mm. The bedding should be compacted to at least 98 percent of the SPMDD.

The bedding thickness may be further increased in areas where the subgrade becomes disturbed. Trench base stabilization techniques, such as the removal of loose material, placement of sub-bedding, consisting of Ontario Provincial Standard Specification (OPSS) Granular B Type II completely wrapped in a non-woven geotextile, may be used if trench base disturbance becomes a problem in wet or soft/loose areas.

To minimize settlement of the pavement structure over services trenches, the trench backfill material within the frost zone, to 1.8 m depth below final grade, should match the existing material along the trench walls to minimize differential frost heaving of the subgrade soil, provided this material is compactible. Otherwise, frost tapers may be required.

The municipal services should be installed in short open trench sections that are excavated and backfilled the same day.

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

The on-site soils to be excavated are fill, surficial and buried topsoil (organic soil) and native sands, silts and clays and glacial till. Portions of the existing fill (free of debris, topsoil (organic soil), cobbles and boulders) and native soils (free of cobbles and boulders) 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 of the proposed play structure, sports field, parking lots, access roads and landscaped areas, provided that their moisture content remains within +/- 2 percent of the optimum value as established by ASTM Method D698-12e1. 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 early stages of construction. 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. The existing topsoil (surficial and buried)/organic soil are not considered suitable for use as backfill material.

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

- Engineered fill under footings for the proposed school building and for the portables - 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 - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent SPMDD,
- Backfill material for footing trenches and against foundation walls located outside the proposed school building – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 95 percent SPMDD,
- Trench backfill and subgrade fill should consist of OPSS 1010 Granular B Type II for the play structure and OPSS 1010 Select Subgrade Material (SSM) for the sports field, parking lot and access roads, 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.

14. Access Roads and Parking Lot

The subgrade for the pavement structures is anticipated to consist of the native silts and clays, OPSS Granular B Type II material, OPSS Select Subgrade material (SSM) and approved on-site material. Pavement structure thicknesses required for the access roads and parking lots set on the anticipated approved subgrade materials were computed and are shown in Table VII. The pavement structures assume 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 VII: Recommended Pavement Structure Thicknesses

Pavement Layer	Compaction Requirements	Computed Pavement Structure	
		Light Duty Traffic (Cars Only)	Heavy Duty Traffic (Buses and Trucks)
Asphaltic Concrete	92 percent-97 percent MRD	65 mm HL3/SP12.5 mm/ Cat. B (PG 58-34)	50 mm HL3/SP12.5 Cat. B (PG 58-34) 60 mm HL8/SP 19 Cat. B (PG 58-34)
OPSS 1010 Granular A Base (crushed limestone)	100% percent SPMDD	150 mm	150 mm
OPSS 1010 Granular B Type II Sub-base	100% percent SPMDD	450 mm	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 percent 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 parking lot and access roads are as follows:

1. As part of the subgrade preparation, the proposed parking area and access roads should be stripped of all existing fill, surficial and buried topsoil (organic) layers, organic stained soils and other obviously unsuitable material. The subgrade should be properly shaped, crowned, then proofrolled with a heavy vibratory roller in the full-time presence of a representative of this office. Any soft or spongy subgrade areas detected should be sub excavated and properly replaced with suitable approved backfill compacted to 95 percent SPMDD (ASTM D698-12e2).
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 access road(s). Subdrains must be installed in the proposed parking area 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 light-duty 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.

15. Corrosion Potential

Chemical tests limited to pH, sulphate, chloride and resistivity were undertaken on three (3) soil samples. A summary of the results is shown in Table VIII. The laboratory certificate of analysis is shown in Appendix B.

Table VIII: Corrosion Test Results on Soil Samples

Borehole – Sample No.	Depth (m)	Soli Type	pH	Sulphate (%)	Chloride (%)	Resistivity (ohm-cm)
BH 2 SS4	2.3 – 2.9	Silt	7.15	0.0282	0.0049	2250
BH 3 SS4	2.3 – 2.9	Silt	7.61	0.0527	0.0010	1550
BH 7 SS4	2.3 – 2.9	Sandy Silt	7.74	0.0482	0.0004	1760

The results indicate the soils have a negligible sulphate attack on subsurface concrete. The concrete should be designed in accordance with CSA A.23.1-14.

The results of the resistivity tests indicate that the sandy silt and silt are corrosive to mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be taken to protect the buried bare steel from corrosion.

16. Tree Planting Restrictions

Based on the subsurface soil types encountered in the test holes, there are no restrictions to tree planting on site from a geotechnical perspective.

17. Additionnal Comments

All earthwork activities from subgrade preparation to placement and compaction of engineered fill, fill in service trenches, placement and compaction of granular materials and asphaltic concrete, should be inspected by qualified geotechnicians to ensure that construction proceeds according to the project specifications.

All the footing beds 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 have been properly prepared.

18. General Comments

The comments given in this report are intended only for the guidance of design engineers. The number of test holes (boreholes and test pits) required to determine the localized underground conditions between test holes 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 and test pit 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.

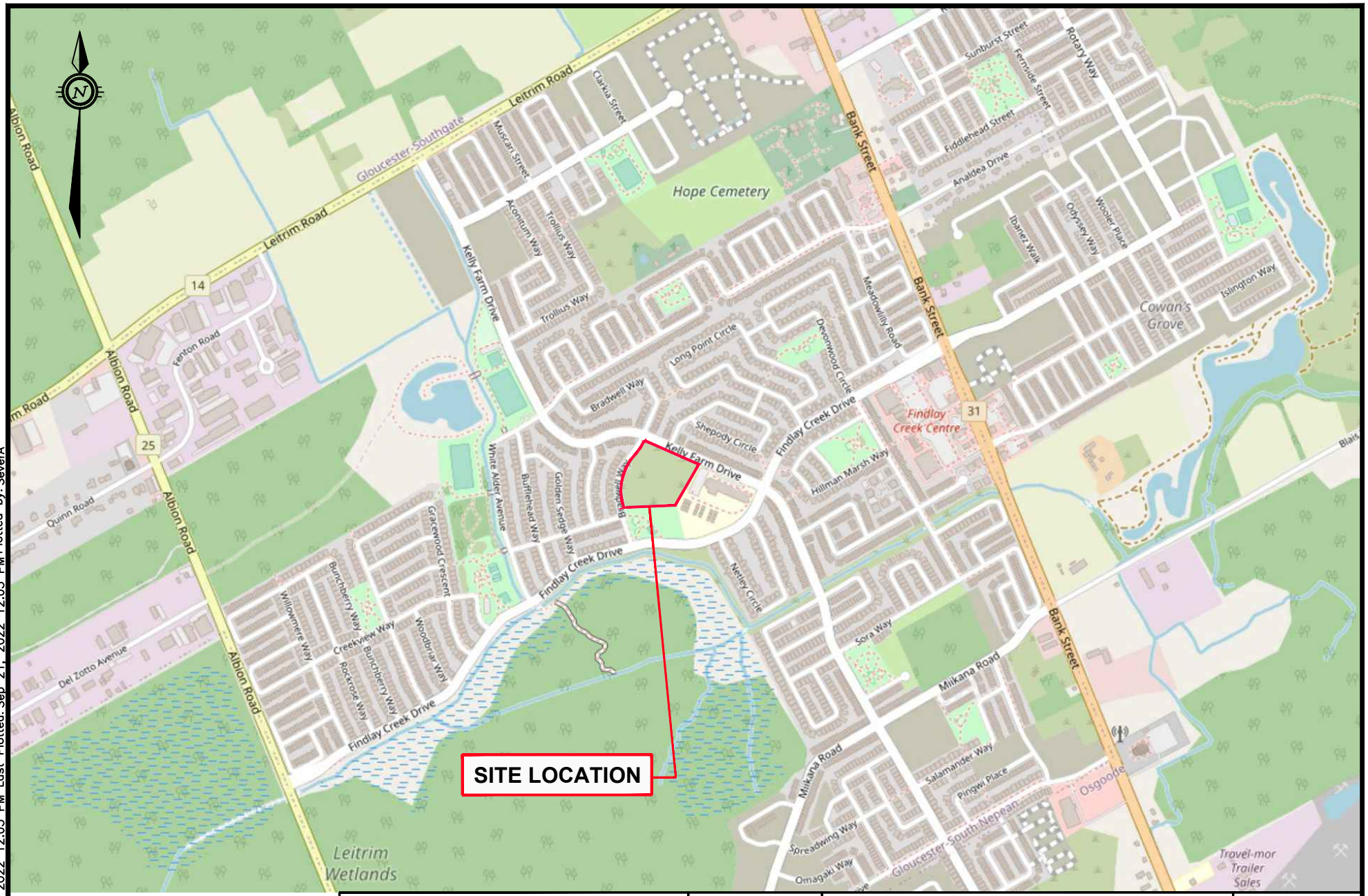
We trust that the information contained in this report will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Sincerely

Daniel Wall, M. Eng., P.Eng.
Geotechnical Engineer
Earth & Environment

Susan M. Potyondy, P.Eng.
Senior Project Manager
Earth & Environment

Figures



0 150m 300m 600m

HORIZONTAL 1:15,000

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DESIGN	DW/SP
DRAWN	AS
DATE	SEPT. 2022
FILE NO	OTT-22012007-A0

GEOTECHNICAL INVESTIGATION
PROPOSED FINDLAY CREEK CATHOLIC ELEMENTARY SCHOOL – 4140 KELLY FARM DR., OTTAWA, ON

SITE PLAN

SCALE 1:15,000

SKETCH NO FIG 1

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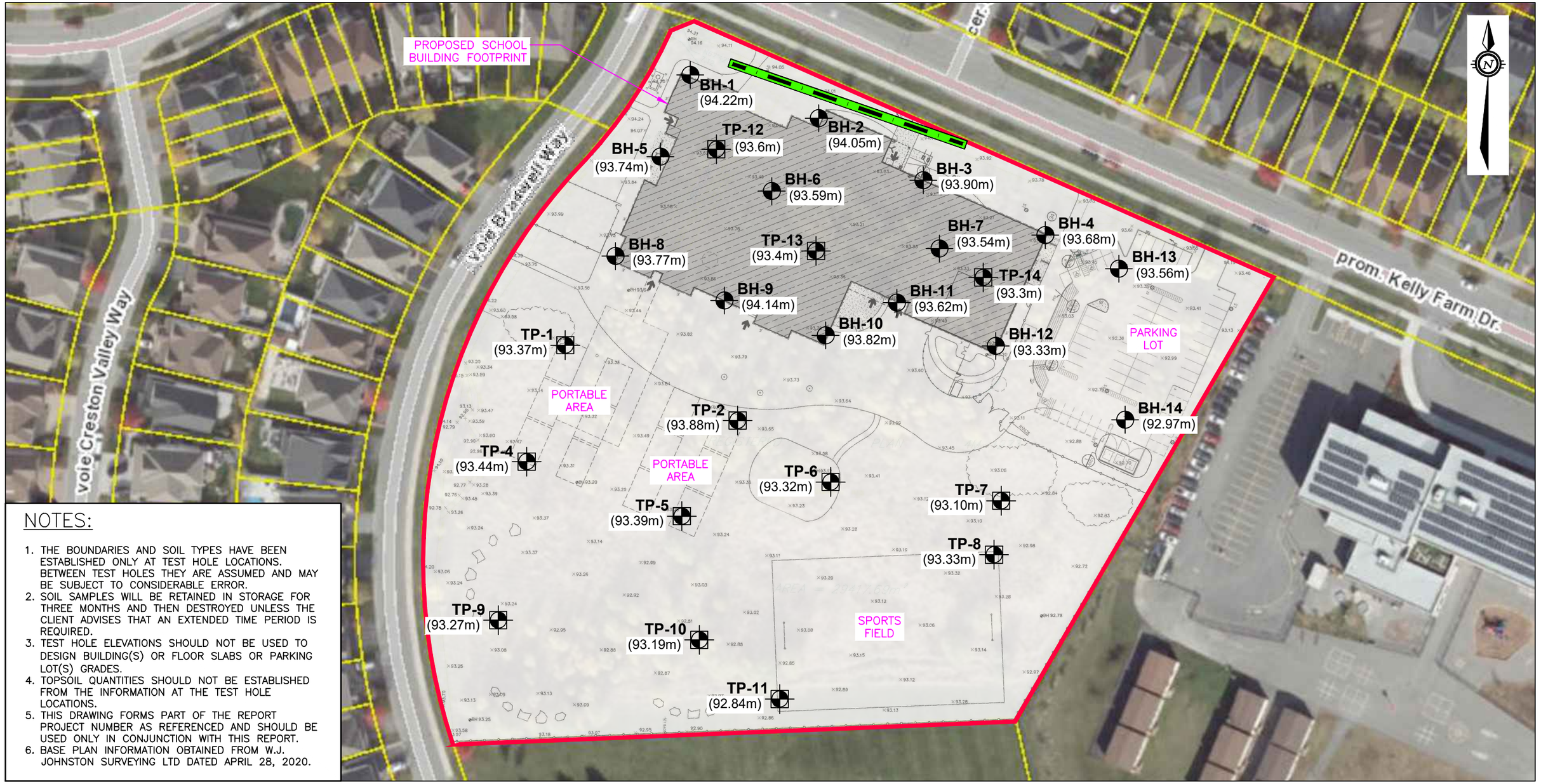

NOTES:

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT TEST HOLE LOCATIONS. BETWEEN TEST HOLES 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. TEST HOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
4. TOPSOIL QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION AT THE TEST HOLE LOCATIONS.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE PLAN INFORMATION OBTAINED FROM W.J. JOHNSTON SURVEYING LTD DATED APRIL 28, 2020.

LEGEND

PROPERTY LINE

APPROXIMATE LOCATION OF SEISMIC SHEAR WAVE SURVEY LINE BY GPR

BH-1 (94.22m) — BOREHOLE NO. & LOCATION (X.XX) – GROUND SURFACE ELEVATION (m)

TP-1 (93.37m) — TEST PIT NO. & LOCATION (X.XX) – GROUND SURFACE ELEVATION (m)

0 10m 20m 40m
HORIZONTAL 1:1000

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DESIGN	DW/SP
DRAWN	AS
DATE	SEPT. 2022
FILE NO	OTT-22012007-A0

GEOTECHNICAL INVESTIGATION
PROPOSED FINDLAY CREEK CATHOLIC ELEMENTARY SCHOOL – 4140 KELLY FARM DR., OTTAWA, ON

TEST HOLE LOCATION PLAN

SCALE 1:1,000
SKETCH NO FIG 2

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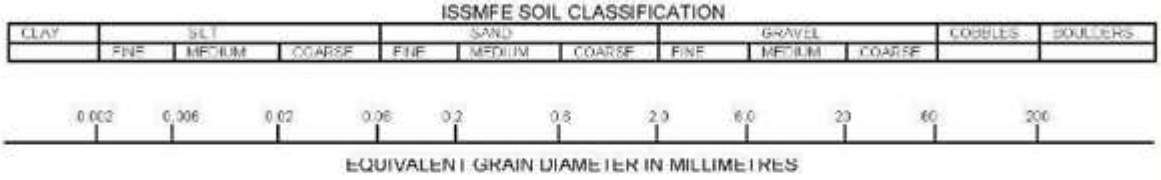
Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION



UNIFIED SOIL CLASSIFICATION

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

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

Log of Borehole BH-01

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 13, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 3

Page. 1 of 1

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~ 100 mm thick	94.22	0
		FILL Silty sand with gravel, brown, moist, (loose to dense)	94.1	
		With rootlets and asphalt fragments from 0.1 m to 0.7 m depths.		
		With shale fragments from 1.5 m to 1.6 m depths.		
		SANDY SILT to SILT Some clay, grey, wet, (loose to compact)	92.4	2
			90.57	4
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet	87.7	5
		Auger grinding from 6.1 m to 7.7 m termination depth	87.0	6
		POSSIBLE WEATHERED BEDROCK Sand and gravel sized rock fragments, grey, wet	86.5	7
		Borehole Terminated at 7.7 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

Sample	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	21.0
SS4	
SS5	
SS6	
SS7	
SS8	
SS9	
SS10	

5, 44, 11, 7, 18, 16, 13, 10, 11, 50/100 mm

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 OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'July 05, 2022	3.7	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-02

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 13, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 4

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test ——— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits |—○— | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 150 mm thick	94.05	0				
		TOPSOIL ~ 150 mm thick	93.9					
		FILL Silty sand with gravel, cobbles, silty clay pockets and rootlets, brown, moist, (loose to compact)			8	×	SS1	
		Augers grinding from 0.8 m to 1.5 m depths		1	15 then 50/125mm	×	SS2	22.9
			92.6					
		TOPSOIL ~ 75 mm thick	92.5					
		SILT With sand seams, grey, moist, (loose to compact)			10	×	SS3	
				2				21.5
					12	×	SS4	
				3	14	×	SS5	
				4	12	×	SS6	
					6	×	SS7	
				5	11	×	SS8	
				6				
			87.7		7	×	SS9	
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet, (loose)						
		Augers grinding from 6.1 m to 7.4 m depths		7				
			86.7					
		Auger Refusal at 7.4 m Depth						

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	4.3	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-03

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 13, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 5

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits |—○—| | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 100 mm thick	93.9	0	8	×	SS1	19.7
		FILL Silty clay to sandy silt, with rootlets, brown, moist, (loose to very dense)	93.8					
		Shale fragments (cobble sized) below 1.0 m depth	92.5	1	58		SS2	
		SILTY CLAY With sand seams, brown, moist, (firm)		2	5	×	SS3	18.7
			91.7		6	×	SS4	
		SILT Trace sand, grey, wet, (loose to compact)		3	20	×	SS5	
				4	17	×	SS6	
				5	10	×	SS7	
					8	×	SS8	
			87.9	6				
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet, (compact)			26	×	SS9	
		Augers grinding 6.1 m to 7.6 m depths		7				
			86.7					
		POSSIBLE WEATHERED BEDROCK Sand and gravel sized rock fragments, grey, wet, (very dense)			57	×	SS10	
			85.8	8				
		Borehole Terminated at 8.1 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 OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.6	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-04

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 13, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 6

Page. 1 of 1

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~ 130 mm thick	93.68	0
		FILL Silty sand and gravel, with roots/rootlets, brown, moist, (loose to compact)	93.6	
			92.2	1
		TOPSOIL ~ 100 mm thick	92.1	
		SANDY SILT TO SILT Grey, wet, (loose to compact)		2
			89.69	3
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet, (very loose to very dense)	88.4	4
		Augers grinding from 6.1 m to 7.6 m depths		5
				6
				7
			85.6	8
		Borehole Terminated at 8.1 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	17.8
SS4	
SS5	
SS6	
SS7	
SS8	
SS9	
SS10	

5
12
5
10
9
7
7
10
3
88 then 50/100 mm

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

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 OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'July 05, 2022	4.0	

CORE DRILLING RECORD

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

Log of Borehole BH-05

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 15, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 7

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 150 mm thick	93.74	0				
		FILL Silty sand and gravel with shale fragments and cobbles, grey, wet, (dense)	93.6		46	×	SS1	
					32	×	SS2	
			92.6	1				
		TOPSOIL ~ 100 mm thick	92.5					
		SILTY CLAY Low plasticity, trace roots, grey, moist to wet, (stiff)						
				2	3	×	SS3	19.3
					90 kPa s=9			
			90.8	3				
		SILT Grey, wet, (compact)			14	×	SS4	
		Trace gravel below 3.8 m depth		4	14	×	SS5	
					11	×	SS6	
			88.5	5				
		Borehole Terminated at 5.2 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.0	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-06

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 15, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 8

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits |—○—| | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~ 250 mm thick	93.59	0
		FILL Silty sand and gravel, trace silt, brown, moist, (dense)	93.3	
		With shale fragments below 0.7 m depth		1
		CLAYEY SANDY SILT With sand seams, grey, moist, (very loose to loose)	92.2	
		SILT Trace sand, grey, wet, (loose to compact)	91.4	2
				3
				4
				5
			87.6	6
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet, (compact) Augers grinding from 6.1 m to 6.8 m depths	86.8	
		Auger Refusal at 6.8 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³	SPT N	Shear Strength kPa	Natural Moisture Content %
SS1		30		
SS2		38		
SS3		4		
SS4		11		
SS5		5		
SS6		9		
SS7		7		
SS8		7		
SS9		16		

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.1	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-07

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 14, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 9

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits —○— | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 150 mm thick	93.54	0	33	×	SS1	
		FILL Silty sand with gravel, brown and grey, moist, (dense)	93.4					
				1	43	×	SS2	
		CLAYEY SILTY SAND (POSSIBLE FILL) With gravel, grey, moist, (compact)	92.1					
				2	14	×	SS3	
		SANDY SILT Trace clay, grey, wet, (loose to compact)	91.3					
					20	×	SS4	
				3	11	×	SS5	
				4	8	×	SS6	
				5	7	×	SS7	
					8	×	SS8	
		GLACIAL TILL Silty sand, with gravel, cobbles and boulders, grey, wet, (very loose)	87.7	6	2	×	SS9	
		Augers grinding from 5.8 m to 7.1 m depths	86.4	7				
		Auger Refusal at 7.1 m Depth						

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	4.3	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-08

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 15, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 10

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test ——— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits |—○—| | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~ 50 mm thick	93.77	0
		FILL Silty sand and gravel, with shale fragments, cobbles and organic silt, brown and black, moist, (compact)	93.7	
			92.4	1
		SILT Grey, wet, (very loose to compact)		
		With sand seams in upper 1.2 m		2
			90.41	3
				4
				5
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet, (compact)	87.8	6
		Augers grinding from 6.1 m to 7.6 m depths		
		POSSIBLE WEATHERED BEDROCK Sand and gravel sized rock fragments, grey, wet	86.6	7
			85.8	8
		Borehole Terminated at 8.0 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	22.9
SS3	18.7
SS4	
SS5	
SS6	
SS7	
SS8	
SS9	
SS10	

27, 26, 5, 13, 10, 9, 1, 5, 10, 12 then 50/50 mm

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

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 OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
07/05/2022	3.4	

CORE DRILLING RECORD

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

Log of Borehole BH-09

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 15, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 11

Page. 1 of 1

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay to silty sand, with rootlets and roots, brown, moist, (loose to dense)	94.14	0	4		SS1	19.2
				1	30		SS2	
			92.8					
		TOPSOIL ~ 25 mm thick	92.7					
		SILTY CLAY With sand seams and rootlets, grey, moist, (very stiff to hard)		2	5		SS3	20.6
					200 kPa s=5.5			
			91.3	3				
		SILTY SAND to SILT Grey, wet, (loose to compact)			8		SS4	
				4	12		SS5	
					10		SS6	
			88.9	5				
		Borehole Terminated at 5.2 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-10

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 14, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 12

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits —○— | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		FILL Silty clay to silty sand, with roots, rootlets and organic silt layers, brown to grey, moist (loose to compact)	93.82	0
		CLAYEY SILT Grey, moist (very soft to firm)	92.5	1
		SANDY SILT TO SILT Grey, wet, (very loose to compact)	91.9	2
			89.57	4
		GLACIAL TILL Silty sand, with gravel, rock fragments, cobbles and boulders, grey, wet (loose to compact)	87.6	6
			85.6	8
		Auger Refusal at 8.2 m Depth		

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³	SPT N	Shear Strength (kPa)	Natural Moisture Content %
SS1	20.4	5		
SS2	21.3	19		
SS3		5		
SS4		1		
SS5		18		
SS6		10		
SS7		7		
SS8		10		
SS9		7		
SS10		15		

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 OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'July 05, 2022	4.3	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-11

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 14, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 13

Page. 1 of 1

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay to silty sand, with gravel and trace roots, brown, moist. (loose to compact)	93.62	0	9		SS1	19.9
			92.7		11		SS2	20.2
		TOPSOIL ~ 125 mm thick	92.6	1				
		SANDY SILT Grey, wet, (loose to compact)			5		SS3	
		With silty clay seams from 1.4 m to 2.2 m depths		2	15		SS4	
				3	11		SS5	
				4	8		SS6	
			88.4	5	9		SS7	
		Borehole Terminated at 5.2 m Depth						

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-12

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 14, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 14

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits —○— | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay, trace sand, with rootlets, grey, moist, (very loose)	93.33	0	3	×	SS1	18.9
			92.3	1	7	×	SS2	20.1
		TOPSOIL ~ 50 mm thick	92.2					
		SANDY SILT TO SILT Trace gravel, grey, wet, (loose to compact)			4	×	SS3	
		With clayey silt seams from 1.4 m to 2.2 m depths		2	13	×	SS4	
				3	13	×	SS5	
				4	6	×	SS6	
				5	7	×	SS7	
					8	×	SS8	
			87.4	6	7	×	SS9	
		GLACIAL TILL Silty sand with gravel, cobbles and boulders, grey, wet, (loose)						
			86.1	7				
		Auger Refusal at 7.2 m Depth						

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	3.8	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-13

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 13, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 15

Page. 1 of 1

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 100 mm thick	93.56	0				
		FILL	93.5					
		Silty clay to silty sand, gravel, cobbles, boulders, rootlets, wood fragments, brown to grey, moist, (loose to compact)			11		SS1	19.5
				1	8		SS2	21.3
			92.2					
		SANDY SILT TO SILT						
		Grey, wet, (loose to compact)		2	7		SS3	
					10		SS4	
				3	10		SS5	
				4	10		SS6	
		WIth gravel below 5.0 m depth	88.4	5	11		SS7	
		Borehole Terminated at 5.2 m Depth						

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Borehole BH-14

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Date Drilled: 'June 14, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Figure No. 16

Page. 1 of 1

Split Spoon Sample ⊠ | Auger Sample ▮▯ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay, with gravel and rootlets, grey, moist, (loose)	92.97	0	6		SS1	19.9
			92.3					
		SANDY SILT TO SILT Grey, wet, (very loose to compact)		1	11		SS2	20.7
				2	9		SS3	
					5		SS4	
			89.76	3	3		SS5	
				4	4		SS6	
				5	12		SS7	
		Borehole Terminated at 5.2 m Depth	87.8					

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

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 OTT-22012007-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'July 05, 2022	3.2	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-01

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 17

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		FILL Silty sand with gravel, cobbles, boulders, rootlets and brick fragments, brown, moist	93.37	0
		TOPSOIL - 200 mm thick	92.7	
		CLAYEY SILT Grey, moist	92.5	1
		Test Pit Terminated at 1.9 m Depth	91.5	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES: GS1, GS2, GS3

Natural Unit Wt. kN/m³

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-02

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 18

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay with gravel, cobbles and construction debris, brown, moist	93.88	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
			92.8	1				
		TOPSOIL - 200 mm thick	92.6			×	GS1	
		CLAYEY SILT Grey, moist				×	GS2	
			91.8	2				
		Test Pit Terminated at 2.1 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-04

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 19

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		FILL Silty clay with gravel, cobbles and construction debris (styrofoam pieces), brown, moist	93.44	0
				1
			91.7	
		SANDY SILT Grey, wet	91.4	2
		Test Pit Terminated at 2.0 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
GS1	
GS2	

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-05

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 20

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 50 100 150 200)	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay with gravel and cobbles, brown, moist	93.39	0				
		TOPSOIL - 300 mm thick	92.9					
		CLAYEY SILT Grey, moist	92.6	1		×	GS1	
		Test Pit Terminated at 1.9 m Depth	91.5					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-06

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 21

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		FILL Silty clay with rootlets and topsoil pockets, grey, moist	93.32	0
			92.6	
		SANDY SILT Grey, moist		1
			91.3	2
		Test Pit Terminated at 2.0 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
GS1	
GS2	

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-07

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 22

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay with gravel, cobbles and boulders, brown, moist	93.1	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		CLAYEY SILT With sand seams, grey, moist	92.3	1		×	GS1	
		Test Pit Terminated at 1.8 m Depth	91.3					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-08

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 23

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		FILL Gravelly silt with sand and cobbles, grey, moist	93.33	0
		TOPSOIL - 200 mm thick	92.6	
		CLAYEY SILT With sand seams, grey, moist	92.4	1
		Test Pit Terminated at 1.8 m Depth	91.5	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
GS1	
GS2	

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-09

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 24

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay with gravel, cobbles, boulders and rootlets, grey, moist	93.27	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
			92.5			×	GS1	
		SANDY SILT Grey, moist		1		×	GS2	21.7
			91.5					
		Test Pit Terminated at 1.8 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-10

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 25

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL - 400 mm thick	93.19	0
		SANDY SILT Grey, moist	92.8	
				1
		GLACIAL TILL Silty sand, with gravel, cobbles and boulders, grey, moist	91.7	
		Test Pit Terminated at 1.9 m Depth	91.3	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
GS1	
GS2	

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-11

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 26

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Gravelly sandy silt, with clay, gravel and cobbles, brown, moist	92.84	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60	GS1	
		TOPSOIL - 300 mm thick	92.5					
		CLAYEY SILT Grey, moist	92.2	1			GS2	21.1
		With boulders and cobbles noted at 1.9 m depth						
		Test Pit Terminated at 1.9 m Depth	90.9					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-12

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 27

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		FILL Silty sand and gravel, with cobbles and boulders and construction debris, brown, moist	93.6	0
		FILL Shale fragments, dark brown, damp	92.8	
		TOPSOIL ~ 200 mm thick	92.4	1
		SANDY SILT TO SILT Grey, moist	92.2	
		Test Pit Terminated at 2.0 m Depth	91.6	2

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
GS1	
GS2	
GS3	21.3

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-13

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 28

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 50 100 150 200)	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay with gravel and roots, brown, moist	93.4	0		×	GS1	
		FILL Sandy silt, with gravels, cobbles, boulders and shale fragments, brown, moist	93.1			×	GS2	
		TOPSOIL - 200 mm thick	92.5					
		SANDY SILT TO SILT Grey, moist	92.3	1		×	GS3	
		Test Pit Terminated at 1.8 m Depth	91.6					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

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

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

Log of Test Pit TP-14

Project No: OTT-22012007-A0

Project: Proposed Findlay Creek Catholic Elementary School

Location: 4140 Kelly Farm Drive, Ottawa, ON

Figure No. 29

Page. 1 of 1

Date Drilled: 'June 20, 2022

Drill Type: Kubota KR-808 Excavator

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ▮▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty clay with cobbles, grey, moist	93.3	0				
		TOPSOIL - 200 mm thick	92.7			×	GS1	
			92.5			×	GS2	
		CLAYEY SILT Grey, moist		1				
		Sand layer at 1.6 m depth				×	GS3	
			91.3	2				
		Test Pit Terminated at 2.0 m Depth						

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
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-22012007-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

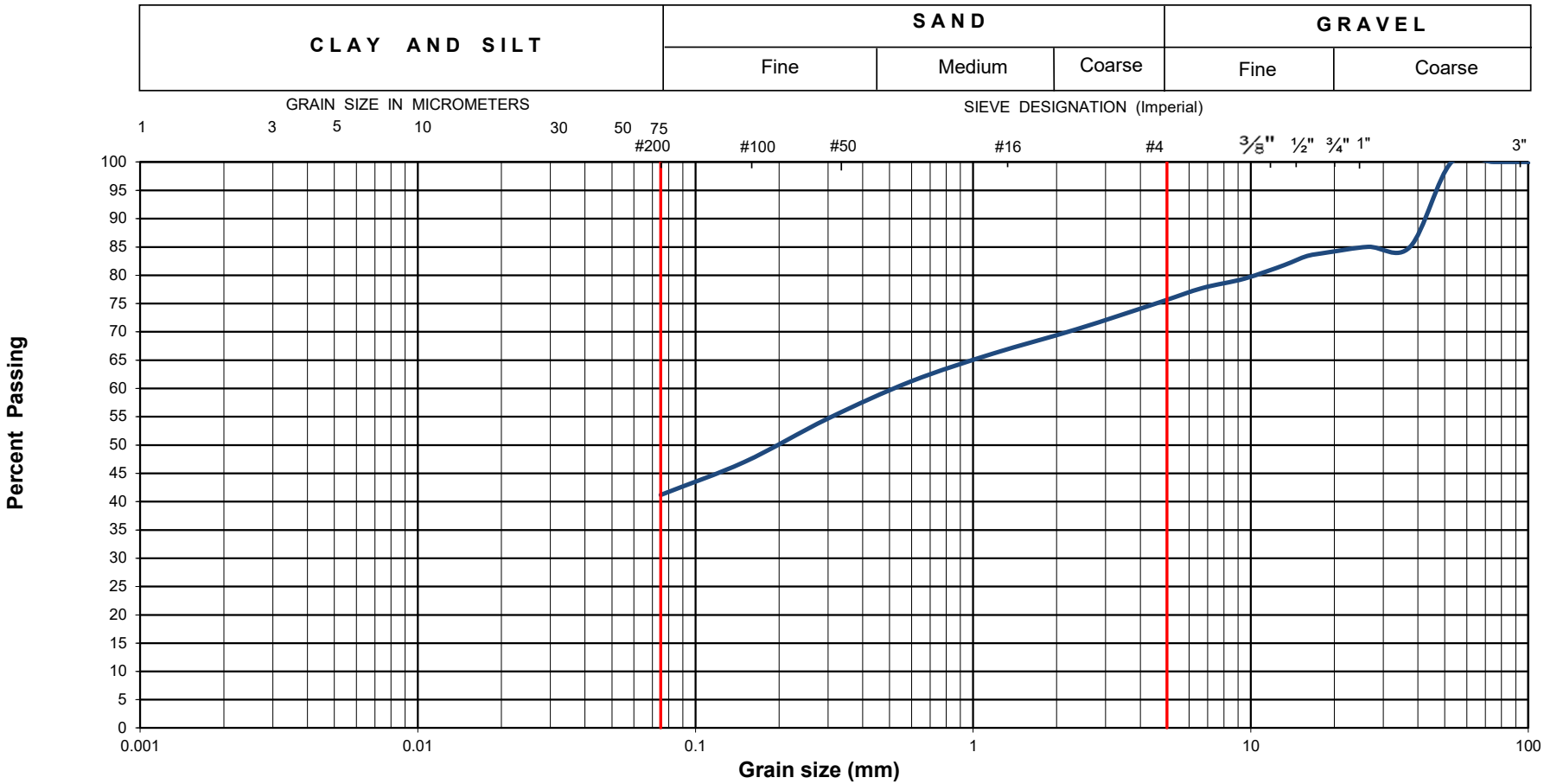
Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT OTT-22012007-A0 LOGS - USE THIS ONE.GPJ TROW OTTAWA.GDT 9/28/22

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

Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 20, 2022**	**Borehole No:**	**TP 1**	**Sample:**	**GS-1**	**Depth (m) :**	**0.5 - 0.7**		
Sample Composition :		**Gravel (%)**	**25**	**Sand (%)**	**34**	**Silt & Clay (%)**	**41**	**Figure :**	**30**
Sample Description :		**FILL: Silty Sand with Gravel (SM)**							

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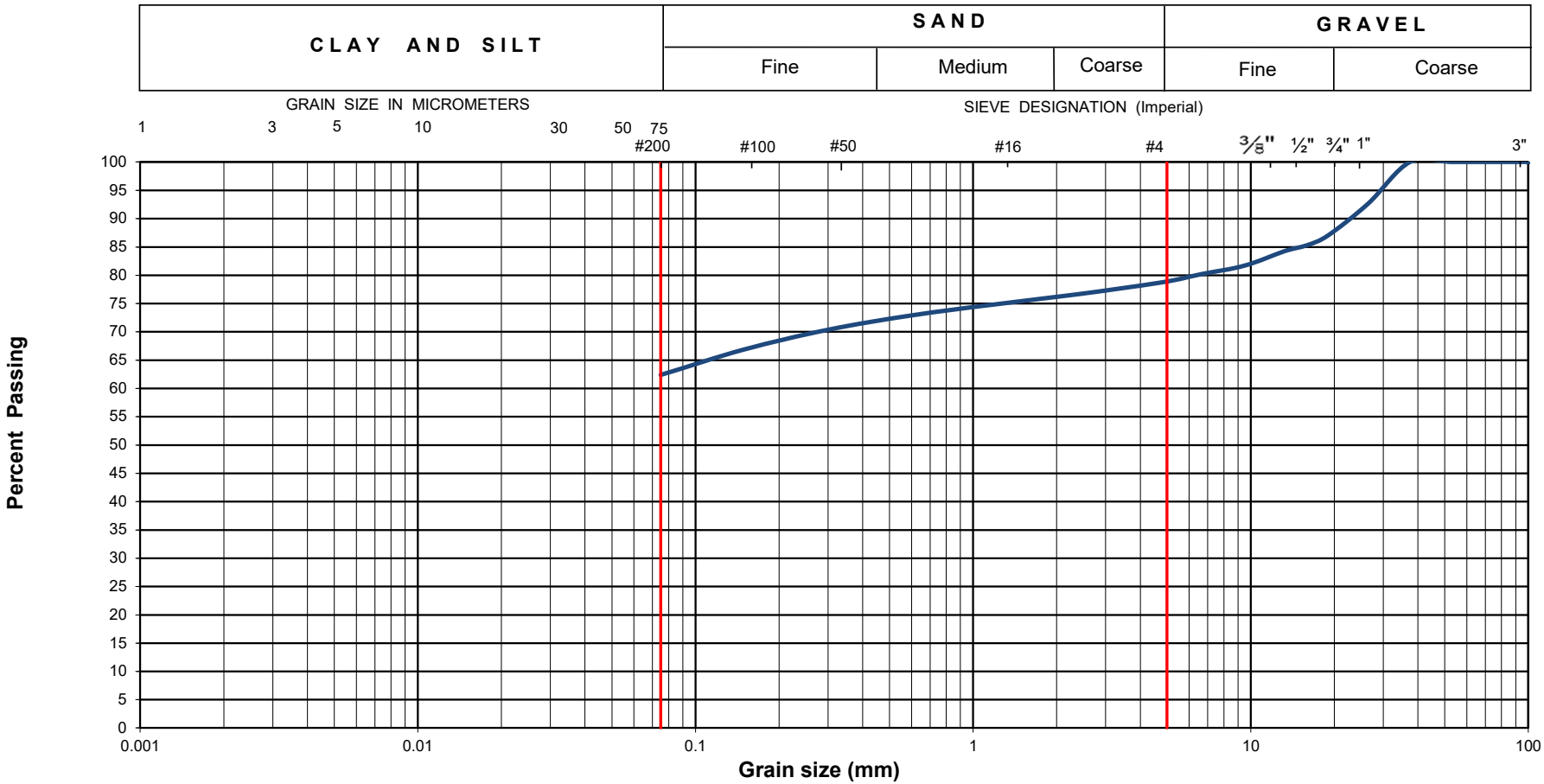
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 20, 2022**	**Borehole No:**	**TP 8**	**Sample:**	**GS-1**	**Depth (m) :**	**0.3-0.6**		
Sample Composition :		**Gravel (%)**	**21**	**Sand (%)**	**17**	**Silt & Clay (%)**	**62**	**Figure :**	**31**
Sample Description :		**FILL: Gravelly Silt with Sand (ML)**							

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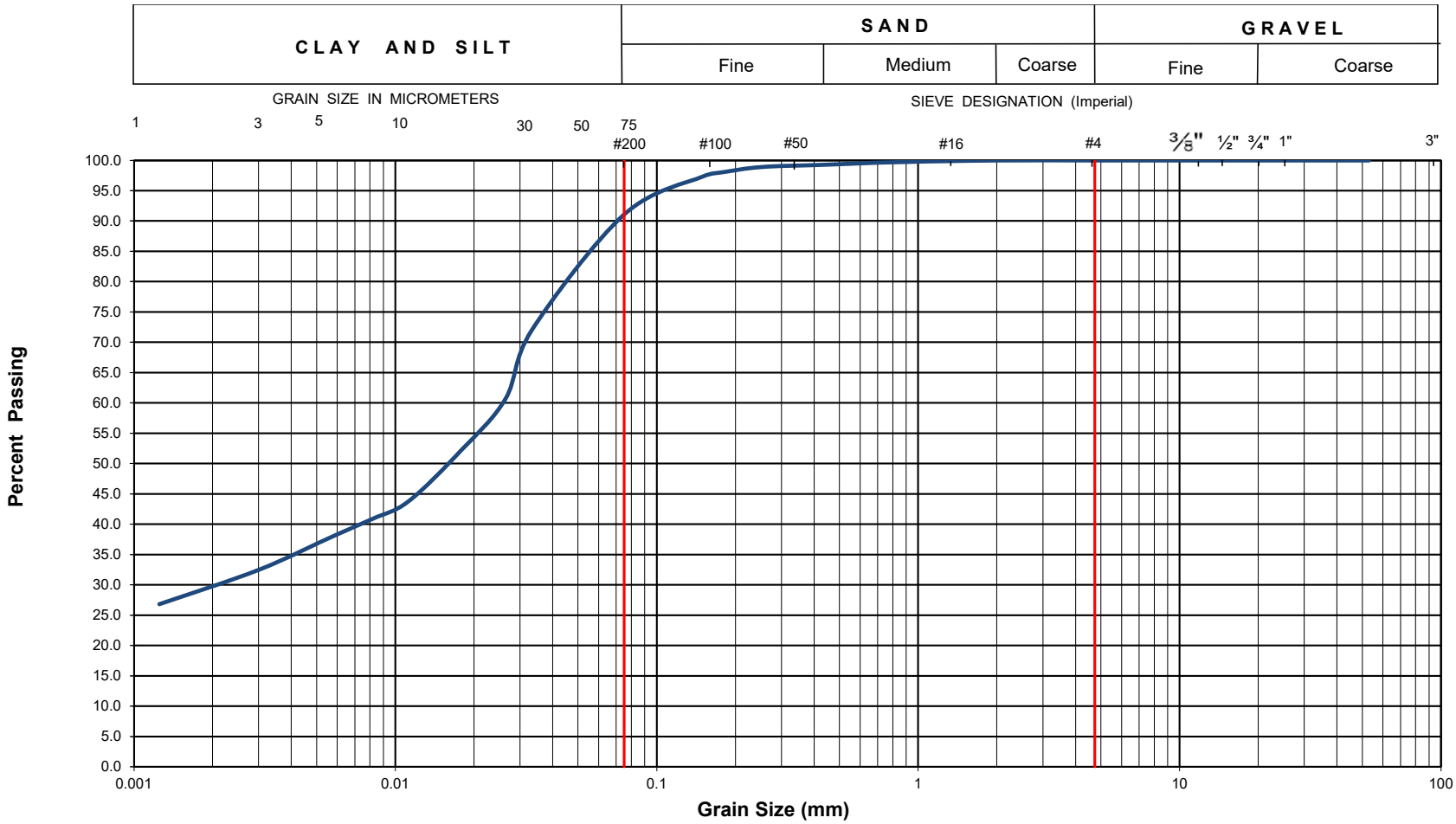
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 15, 2022**	**Borehole No:**	**BH 5**		**Sample No.:**	**SS3**		**Depth (m) :**	**1.5-2.1**
Sample Description :		**% Silt and Clay**	**91**	**% Sand**	**9**	**% Gravel**	**0**	**Figure :**	**32**
Sample Description :		**Silty Clay of Low Plasticity (CL)**							

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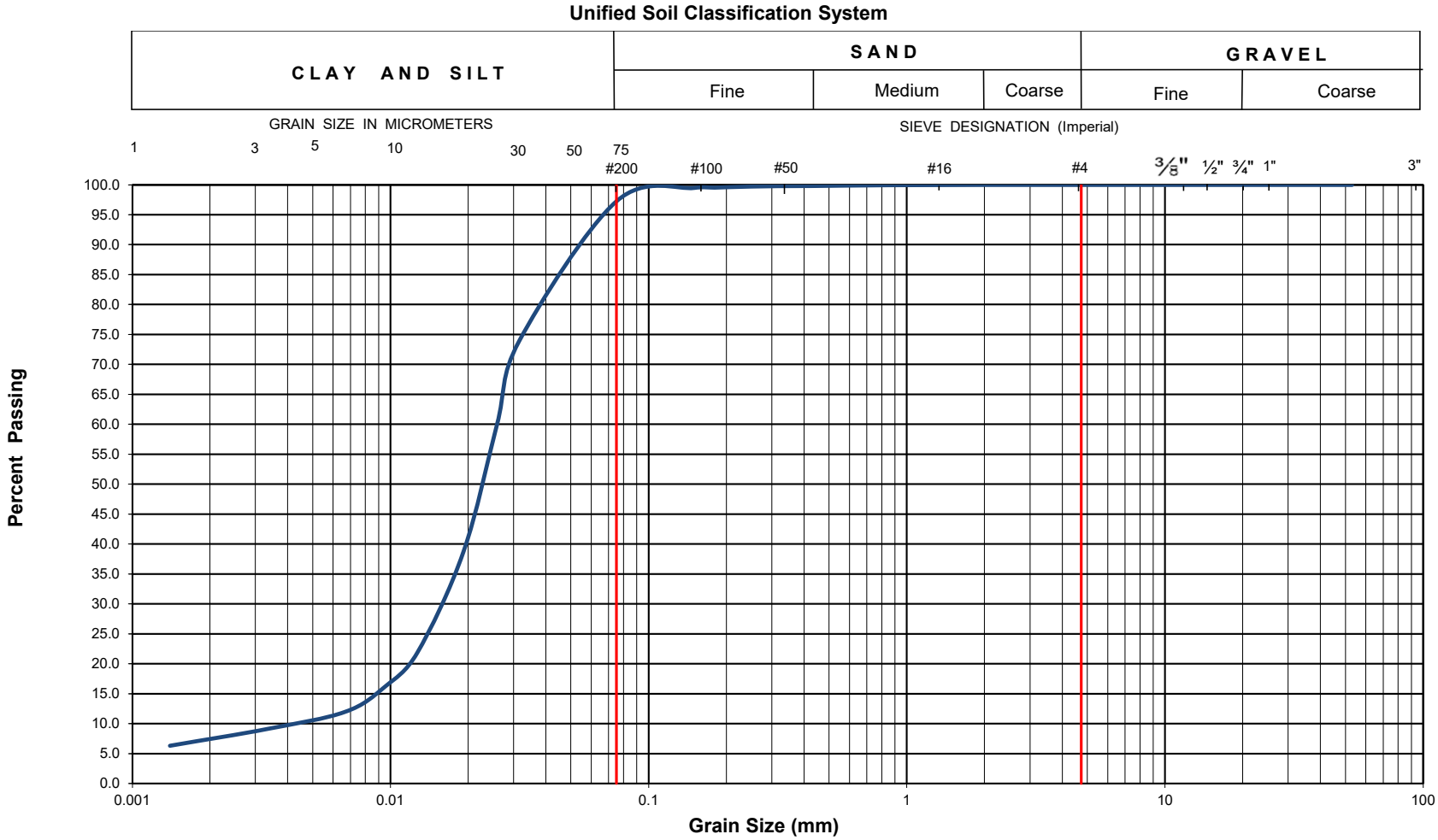
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 13, 2022**	**Borehole No:**	**BH 2**		**Sample No.:**	**SS5**		**Depth (m) :**	**3.0-3.6**
Sample Description :		**% Silt and Clay**	**97**	**% Sand**	**3**	**% Gravel**	**0**	**Figure :**	**33**
Sample Description :		**Silt (ML)**							

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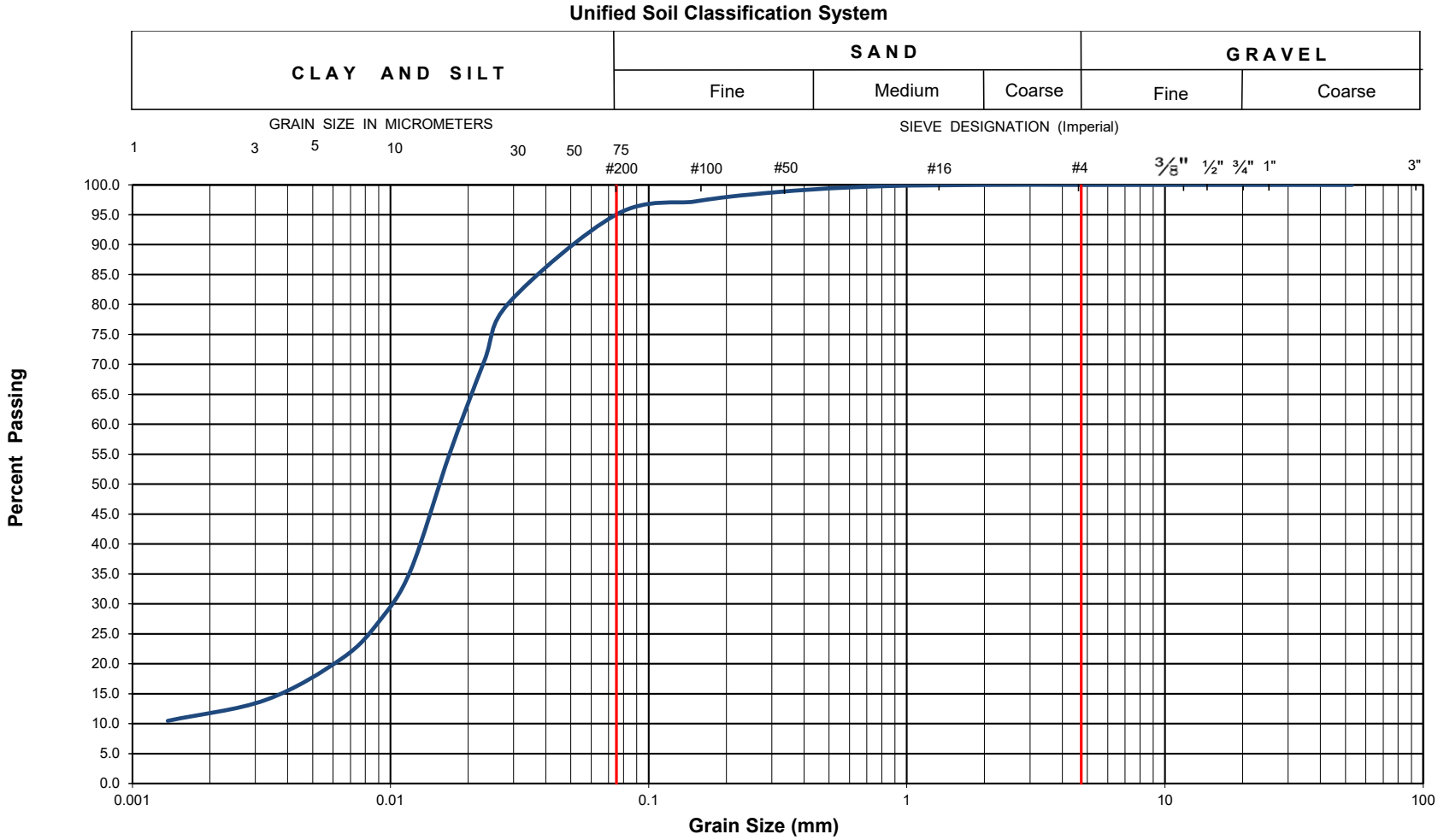
Ottawa, ON K2B 8H6

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



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 13, 2022**	**Borehole No:**	**BH 3**		**Sample No.:**	**SS4**		**Depth (m) :**	**2.3-2.9**
Sample Description :		**% Silt and Clay**	**95**	**% Sand**	**5**	**% Gravel**	**0**	**Figure :**	**34**
Sample Description :		**Silt (ML)**							

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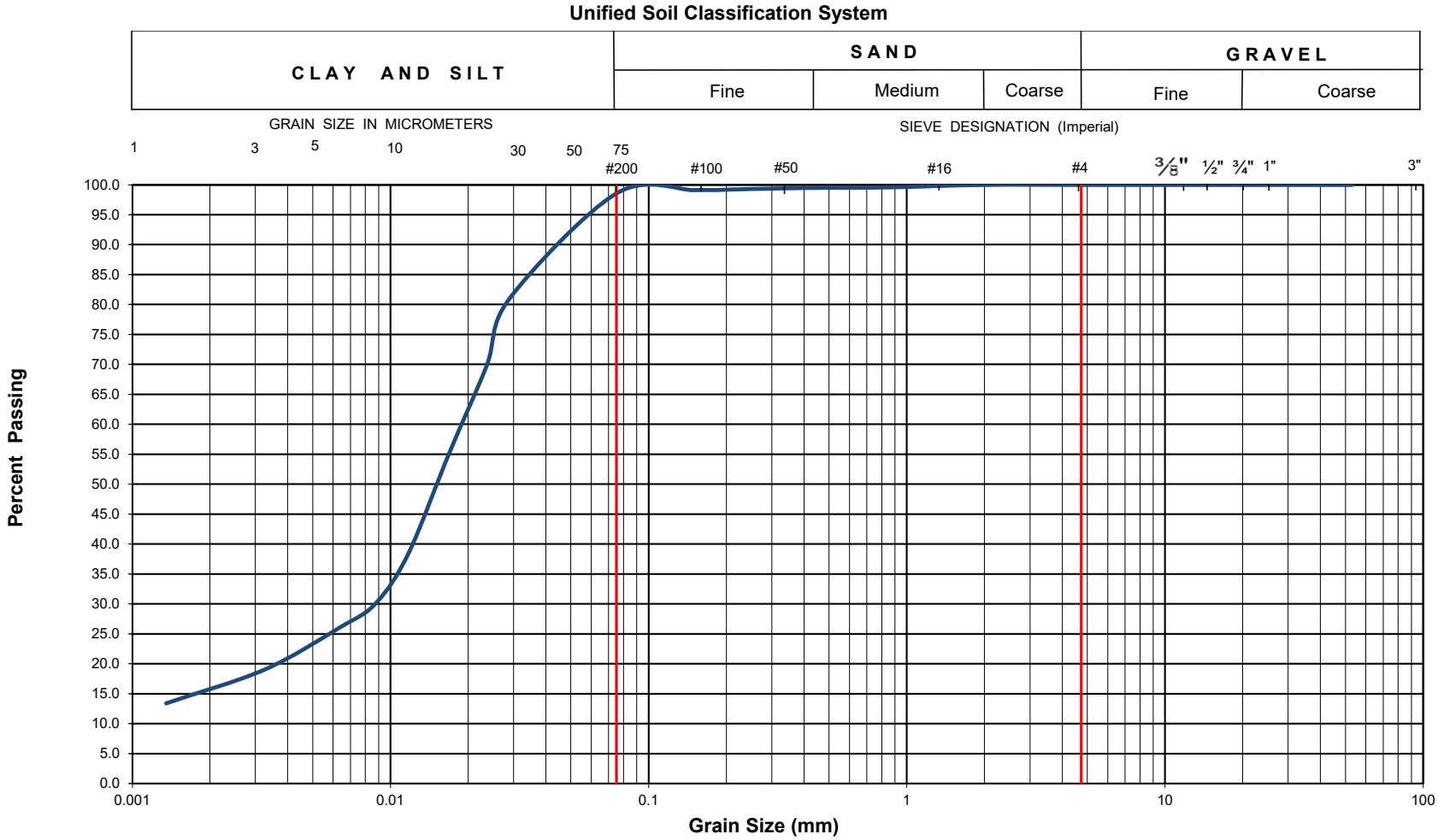
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 15, 2022**	**Borehole No:**	**BH 6**		**Sample No.:**	**SS6**		**Depth (m) :**	**3.8-4.4**
Sample Description :		**% Silt and Clay**	**99**	**% Sand**	**1**	**% Gravel**	**0**	**Figure :**	**35**
Sample Description :		**Silt (ML)**							

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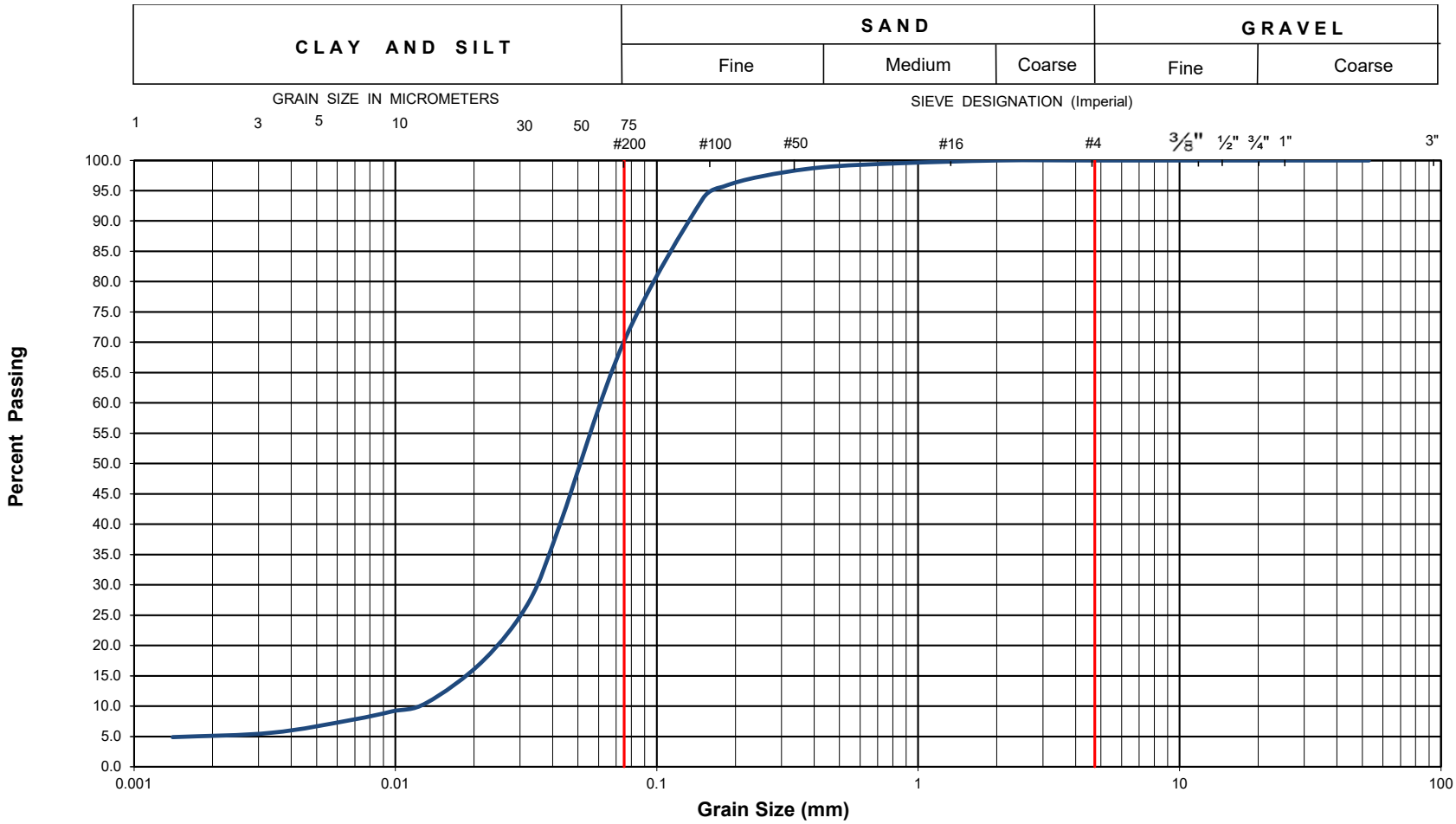
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 14, 2022**	**Borehole No:**	**BH 7**		**Sample No.:**	**SS7**		**Depth (m) :**	**4.6-5.2**
Sample Description :		**% Silt and Clay**	**70**	**% Sand**	**30**	**% Gravel**	**0**	**Figure :**	**36**
Sample Description :		**Sandy Silt (ML)**							

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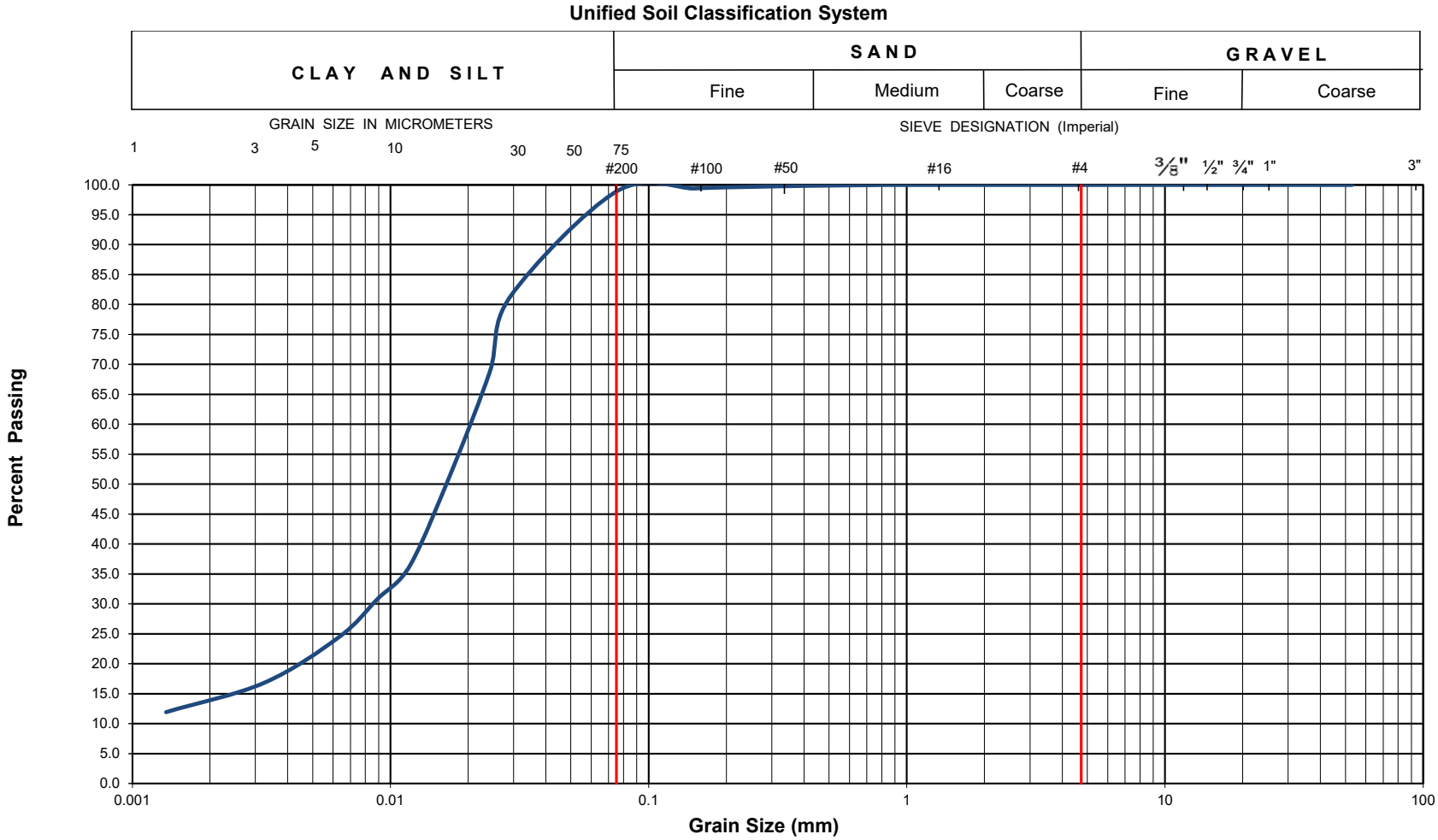
Ottawa, ON K2B 8H6

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



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 15, 2022**	**Borehole No:**	**BH 8**		**Sample No.:**	**SS5**		**Depth (m) :**	**3.0-3.6**
Sample Description :		**% Silt and Clay**	**99**	**% Sand**	**1**	**% Gravel**	**0**	**Figure :**	**37**
Sample Description :		**Silt (ML)**							

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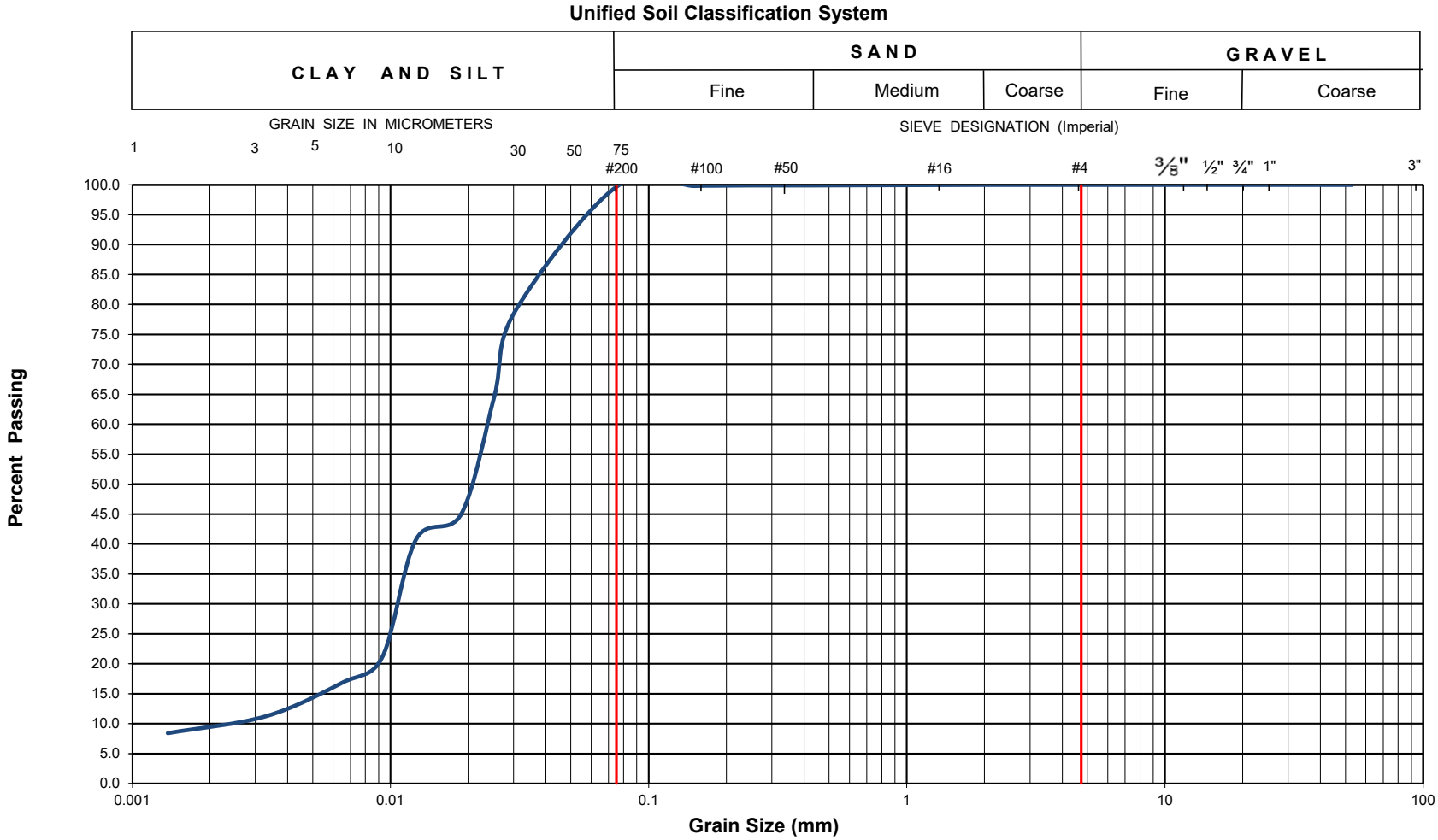
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 15, 2022**	**Borehole No:**	**BH 8**		**Sample No.:**	**SS7**		**Depth (m) :**	**4.6-5.2**
Sample Description :		**% Silt and Clay**	**100**	**% Sand**	**0**	**% Gravel**	**0**	**Figure :**	**38**
Sample Description :		**Silt (ML)**							

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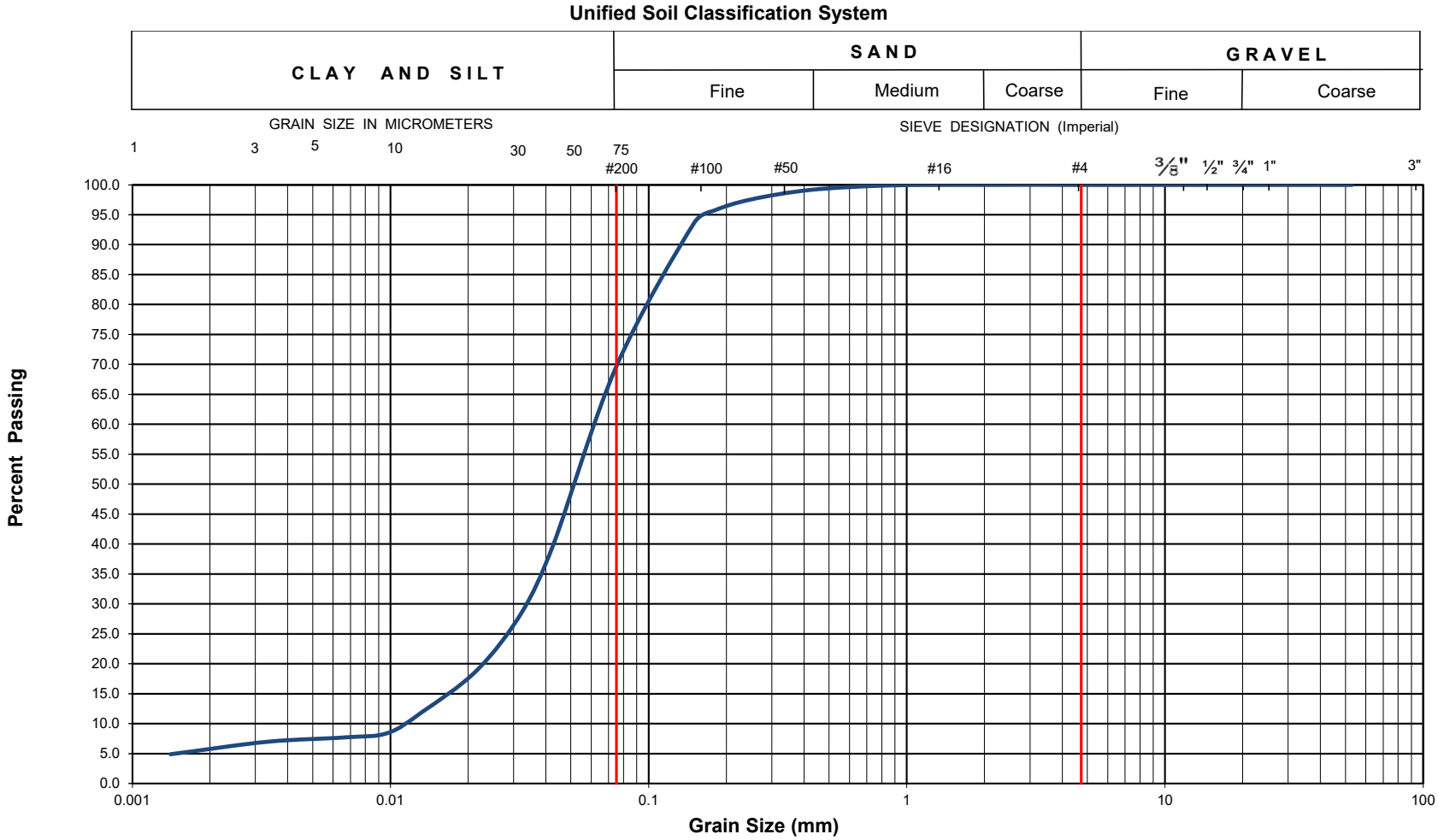
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 14, 2022**	**Borehole No:**	**BH 11**		**Sample No.:**	**SS5**		**Depth (m) :**	**3.0-3.6**
Sample Description :		**% Silt and Clay**	**70**	**% Sand**	**30**	**% Gravel**	**0**	**Figure :**	**39**
Sample Description :		**Sandy Silt (ML)**							

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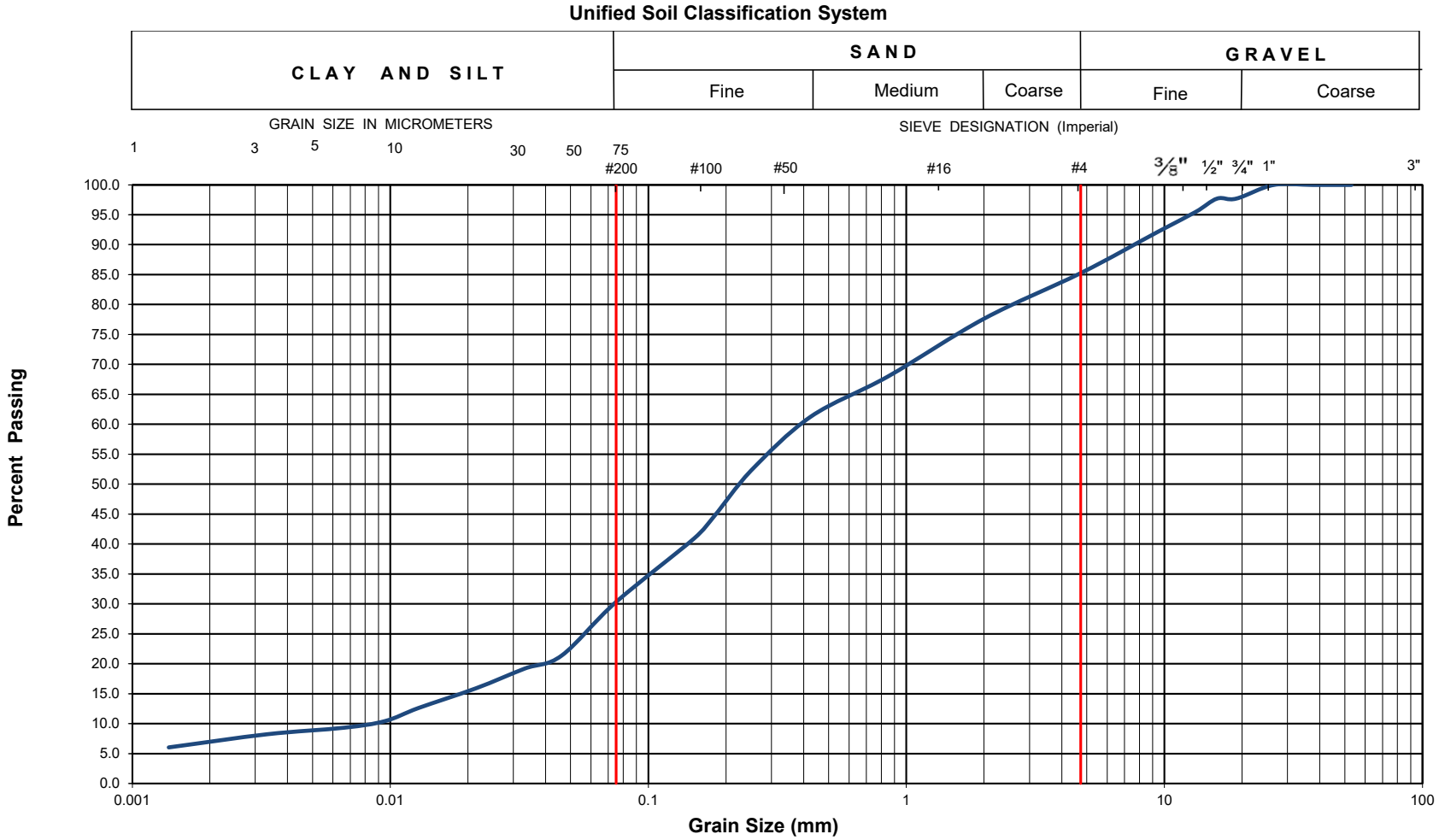
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 13, 2022**	**Borehole No:**	**BH 4**		**Sample No.:**	**SS9**		**Depth (m) :**	**6.1-6.7**
Sample Description :		**% Silt and Clay**	**30**	**% Sand**	**55**	**% Gravel**	**15**	**Figure :**	**40**
Sample Description :		**GLACIAL TILL: Silty Sand with Gravel (SM)**							

EXP Services Inc.
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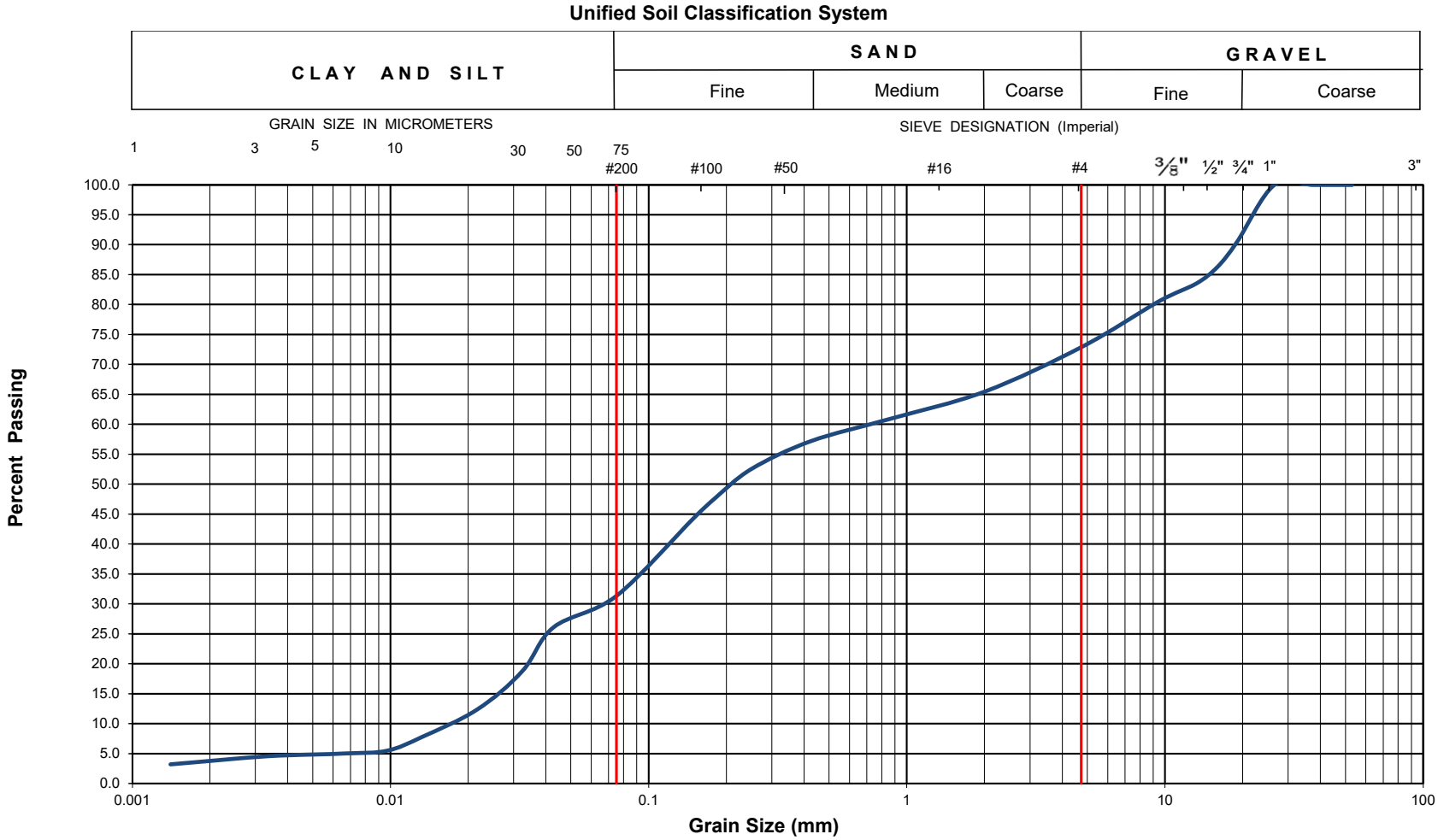
Ottawa, ON K2B 8H6

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



EXP Project No.:	**OTT-22012007-A0**	**Project Name :**	**New Findlay Creek Catholic Elementary School**						
Client :	**OCSB**	**Project Location :**	**4140 Kelly Farm Drive, Ottawa, ON**						
Date Sampled :	**June 14, 2022**	**Borehole No:**	**BH 12**		**Sample No.:**	**SS9**		**Depth (m) :**	**6.1-6.6**
Sample Description :		**% Silt and Clay**	**31**	**% Sand**	**42**	**% Gravel**	**27**	**Figure :**	**41**
Sample Description :		**Glacial Till: Silty Sand with Gravel (SM)**							

Appendix A – Seismic Shear Wave Survey Report – Geophysics GPR International Inc.

GEOPHYSICS GPR INTERNATIONAL INC.

100 – 2545 Delorimier Street
Longueuil (Québec)
Canada J4K 3P7

Tel. : (450) 679-2400
Fax : (514) 521-4128
info@geophysicsgpr.com
www.geophysicsgpr.com

July 25th, 2022

Transmitted by email: Ismail.Taki@exp.com
Our Ref.: GPR-22-03983

Mr. Ismail Taki, M.Eng., P.Eng.
Senior Manager, Earth & Environment, Eastern Region
exp Services inc.
100 – 2650 Queensview Drive
Ottawa ON K2B 8H6

Subject: **Shear Wave Velocity Sounding for the Site Class Determination**
4140 Kelly Farm Drive, Findlay Creek, Ottawa (ON)

[Project: OTT-22012007-A0]

Dear Sir,

Geophysics GPR International inc. has been mandated by **exp** Services inc. to carry out seismic shear wave surveys at 4140 Kelly Farm Drive, Findlay Creek, in Ottawa (ON). The geophysical investigation used the Multi-channel Analysis of Surface Waves (MASW), the Spatial AutoCorrelation (SPAC), and the seismic refraction methods. From the subsequent results, the seismic shear wave velocity values were calculated for the soil and the rock, to determine the Site Class.

The surveys were carried out on July 21st, 2022, by Mr. Louis-Emmanuel Warnock, tech. and Mr. Élliot Lessard, trainee. Figure 1 shows the regional location of the site and Figure 2 illustrates the location of the seismic spreads. Both figures are presented in the Appendix.

The following paragraphs briefly describe the survey design, the principles of the testing methods, and the results presented in table and graph.

MASW PRINCIPLE

The *Multi-channel Analysis of Surface Waves* (MASW) and the *SPatial AutoCorrelation* (SPAC or MAM for *Microtremors Array Method*) are seismic methods used to evaluate the shear wave velocities of subsurface materials through the analysis of the dispersion properties of the Rayleigh surface wave. The MASW is considered an "active" method, as the seismic signal is induced at known location and time in the geophones' spread axis. Conversely, the SPAC is considered a "passive" method, using the low frequency "signals" produced far away. The method can also be used with "active" seismic source records. The SPAC method generally allows deeper Vs soundings. Its dispersion curve can then be merged with the one of higher frequency from the MASW to calculate a more complete inversion. The dispersion properties are expressed as a change of velocities with respect to frequencies. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. The inversion of the Rayleigh wave dispersion curve yields a shear wave (V_S) velocity depth profile (sounding).

Figure 3 schematically outlines the basic operating procedure for the MASW method. Figure 4 illustrates an example of one of the MASW/SPAC records, the corresponding spectrogram analysis and resulting 1D V_S model.

INTERPRETATION

The main processing sequence involved data inspection and edition when required; spectral analysis ("phase shift" for MASW, and "cross-correlation" for SPAC); picking the fundamental mode; and 1D inversion of the MASW and SPAC shot records using the SeisImagerSW™ software. The data inversions used a nonlinear least squares algorithm.

In theory, all the shot records for a given seismic spread should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation, local surface seismic velocities variations, and/or dipping of overburden layers or rock. In general, the precision of the calculated seismic shear wave velocities (V_S) is of the order of 15% or better.

More detailed descriptions of these methods are presented in *Shear Wave Velocity Measurement Guidelines for Canadian Seismic Site Characterization in Soil and Rock*, Hunter, J.A., Crow, H.L., et al., Geological Surveys of Canada, General Information Product 110, 2015.

SURVEY DESIGN

The seismic acquisition spreads were laid on a vacant field, south-east of Kelly Farm Drive and Bradwell Way corner (Figure 2). The geophone spacing was of 3.0 metres for the main spread, using 24 geophones. A shorter seismic spread, with geophone spacing of 1.0 metre, was dedicated to the near surface materials. The seismic records were produced with a seismograph Terraloc Pro 2 (from ABEM Instrument), and the geophones were 4.5 Hz. The seismic records counted 4096 data, sampled at 1000 µs for the MASW surveys, and 40 µs for the seismic refraction. The records included a pre-trigged portion of 10 ms. An 8 kg sledgehammer was used as the energy source with impacts being recorded off both ends of the seismic spreads. A stacking procedure was also used to improve the Signal / Noise ratio for the seismic records.

The shear wave depth sounding can be considered as the average of the bulk area within the geophone spread, especially for its central half-length.

RESULTS

Using seismic refraction (V_P) the rock depth was calculated between 8.5 (West) to 10.3 (East) metres (± 1 metre). Its seismic velocity (V_S) was calculated between 2450 to 2650 m/s for the sound shallow portion. These parameters were used for the initial geophysical models, prior to the MASW results inversions.

The MASW calculated V_S results are illustrated at Figure 5.

The $\overline{V}_{S30}$ value results from the harmonic mean of the shear wave velocities, from the surface to 30 metres deep. It is calculated by dividing the total depth of interest (30 metres) by the sum of the time spent in each velocity layer from the surface down to 30 metres, as:

$$\overline{V}_{S30} = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} {H_i}/{V_i}} \quad | \quad \sum_{i=1}^{N} H_i = 30 \text{ m}$$

(N: number of layers; H_i: thickness of layer "i" ; V_i: V_S of layer "i")

Thus, the $\overline{V}_{S30}$ value represents the seismic shear wave velocity of an equivalent homogeneous single layer response, between the surface and 30 metres deep.

The calculated $\overline{V}_{S30}$ value of the actual site is 721.8 m/s (Table 1), corresponding to the Site Class "C".

CONCLUSION

Geophysical surveys were carried out to identify the Site Class at 4140 Kelly Farm Drive, Findlay Creek, in Ottawa (ON). The seismic surveys used the MASW and the SPAC analysis, and the seismic refraction to calculate the $\overline{V}_{S30}$ value. Its calculation is presented at Table 1.

The $\overline{V}_{S30}$ value of the actual site is 722 m/s, corresponding to the Site Class "C" ($360 < \overline{V}_{S30} \leq 760$ m/s), as determined through the MASW and SPAC methods, Table 4.1.8.4.-A of the NBC, and the Building Code, O. Reg. 332/12.

It must also be noted that other geotechnical information gleaned on site; including the presence of liquefiable soils, very soft clays, high moisture content etc. (cf. Table 4.1.8.4.-A of the NBC) can supersede the Site classification provided in this report based on the $\overline{V}_{S30}$ value.

The V_S values calculated are representative of the in situ materials and are not corrected for the total and effective stresses.

Hoping the whole to your satisfaction, we remain yours truly,

Jean-Luc Arsenault, M.A.Sc., P.Eng.
Senior Project Manager

LICENSED PROFESSIONAL ENGINEER
J.-L. ARSENAULT
100148122
PROVINCE OF ONTARIO
2022-07-25

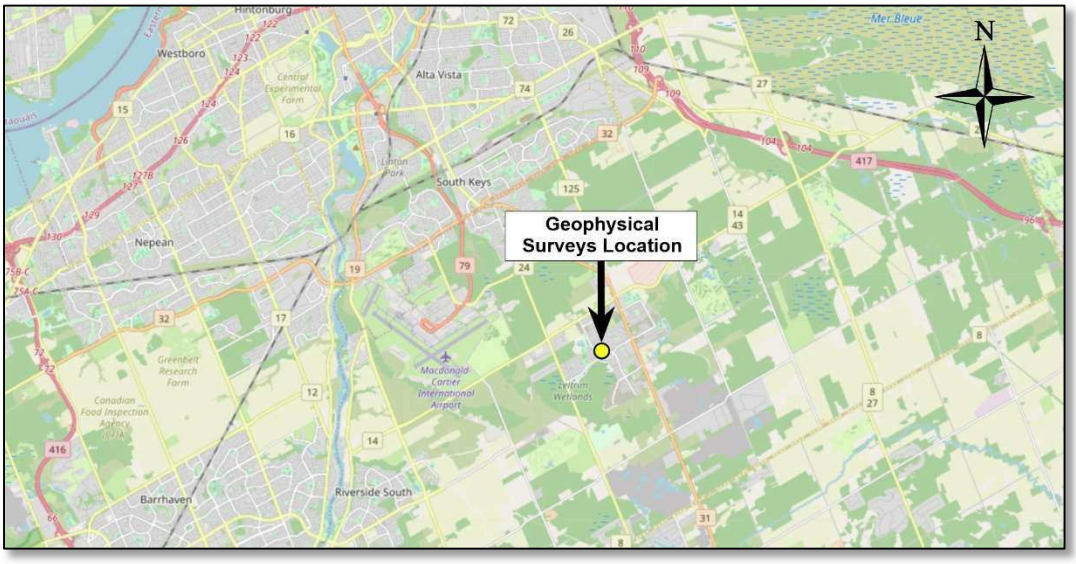


Figure 1: Regional location of the Site
(source: *OpenStreetMap*©)

Figure 2: Location of the seismic spreads
(source: *geoOttawa*)

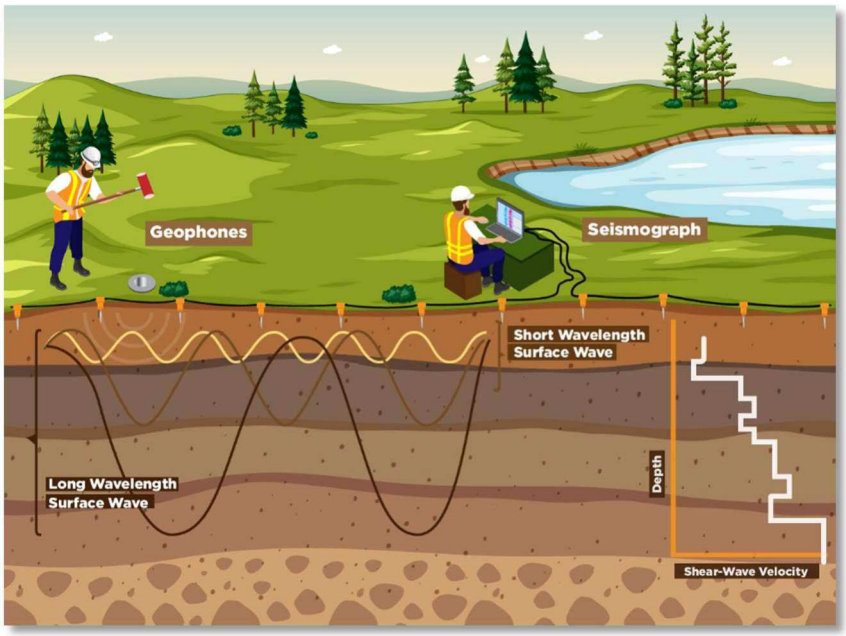


Figure 3: MASW Operating Principle

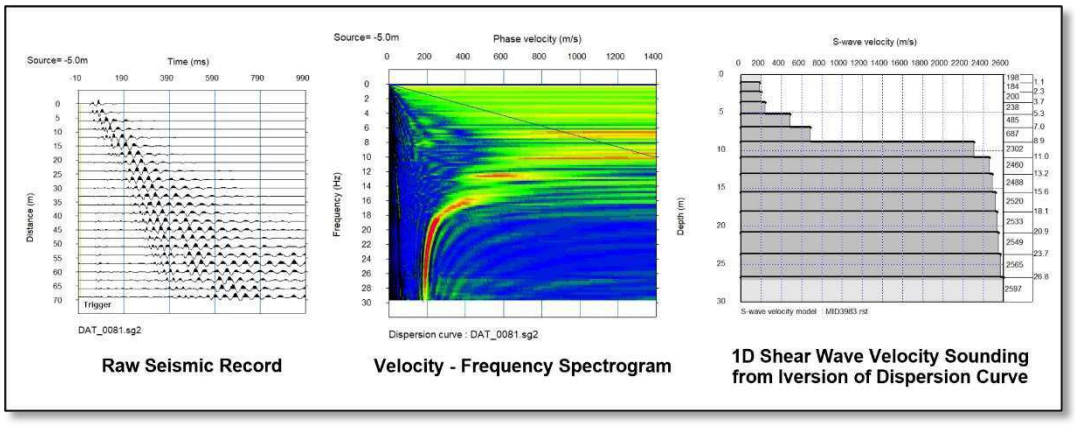


Figure 4: Example of a MASW/SPAC record, Phase Velocity - Frequency curve of the Rayleigh wave and resulting 1D Shear Wave Velocity Model

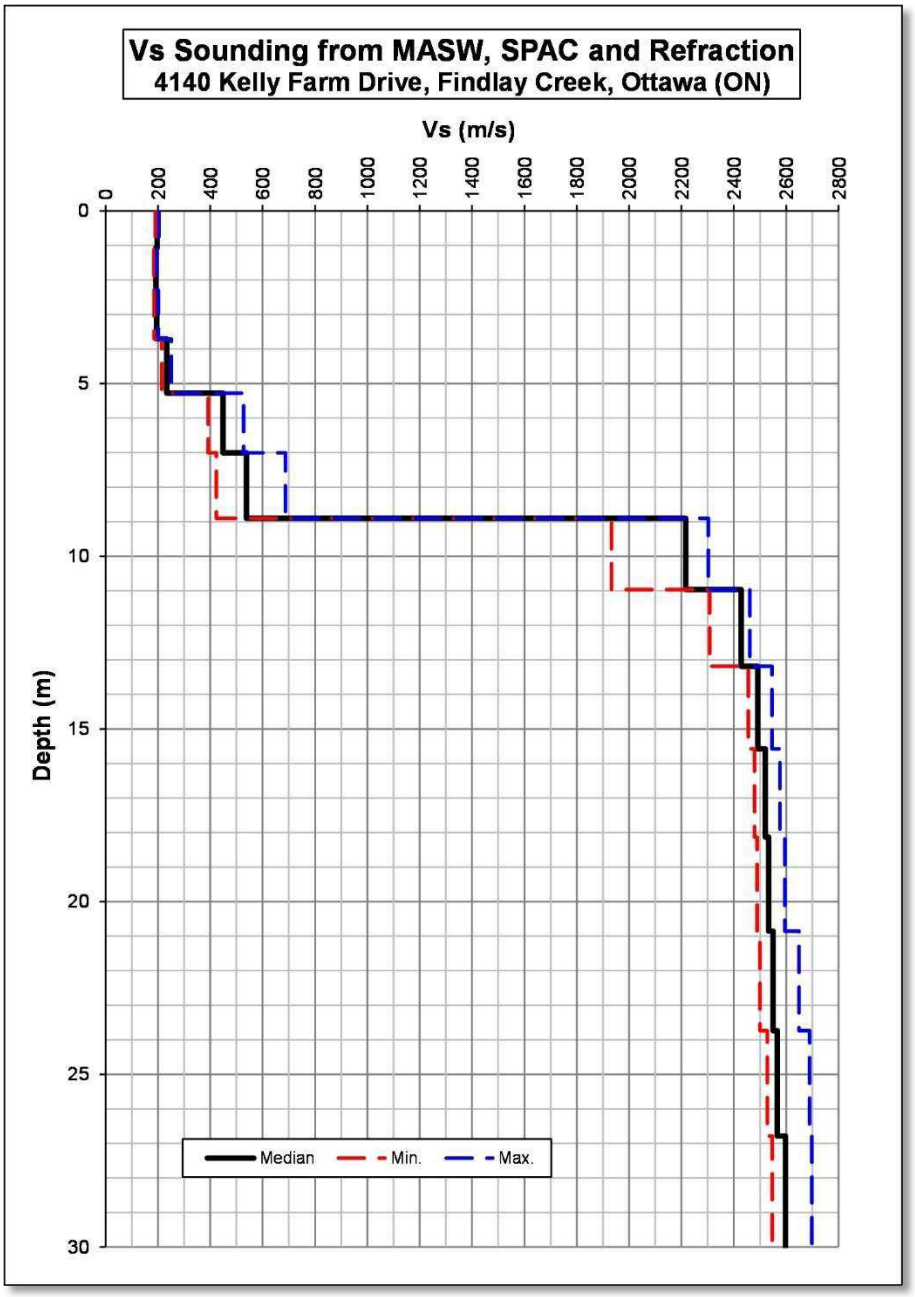


Figure 5: MASW Shear-Wave Velocity Sounding

TABLE 1

V_{S30} Calculation for the Site Class (actual site)

Depth	Vs			Thickness	Cumulative Thickness	Delay for med. Vs	Cumulative Delay	Vs at given Depth
	Min.	Median	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(s)	(m/s)
0	190.2	197.5	204.3	**Grade Level (July 21, 2022)**				
1.07	184.8	192.1	195.2	1.07	1.07	0.005426	0.005426	197.5
2.31	184.9	195.7	201.8	1.24	2.31	0.006435	0.011861	194.6
3.71	214.5	233.3	251.6	1.40	3.71	0.007160	0.019021	195.0
5.27	391.9	448.8	526.9	1.57	5.27	0.006712	0.025733	205.0
7.01	423.1	537.9	687.5	1.73	7.01	0.003857	0.029590	236.8
8.90	1932.4	2216.0	2302.5	1.90	8.90	0.003524	0.033114	268.8
10.96	2307.5	2428.3	2460.9	2.06	10.96	0.000930	0.034044	322.0
13.19	2455.2	2491.3	2545.6	2.23	13.19	0.000916	0.034960	377.2
15.58	2478.8	2520.3	2575.9	2.39	15.58	0.000959	0.035919	433.7
18.13	2489.2	2533.2	2595.0	2.55	18.13	0.001014	0.036933	490.9
20.85	2500.3	2549.5	2649.2	2.72	20.85	0.001074	0.038007	548.6
23.74	2527.5	2565.7	2689.8	2.88	23.74	0.001131	0.039138	606.5
26.79	2546.2	2597.4	2698.3	3.05	26.79	0.001189	0.040327	664.2
30				3.21	30.00	0.001238	0.041564	721.8

V_{S30} (m/s)	**721.8**
Class	**C**

Appendix B – Laboratory Certificate of Analysis Report

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **EXP SERVICES INC**
2650 QUEENSVIEW DRIVE, UNIT 100
OTTAWA, ON K2B8H6
(613) 688-1899

ATTENTION TO: **Daniel Wall**

PROJECT: **OTT-22012007-A0**

AGAT WORK ORDER: **22Z913694**

SOIL ANALYSIS REVIEWED BY: **Amanjot Bhela, Inorganic Lab Manager**

DATE REPORTED: **Jul 06, 2022**

PAGES (INCLUDING COVER): **5**

VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
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AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22Z913694

PROJECT: OTT-22012007-A0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Daniel Wall

SAMPLING SITE:

SAMPLED BY:EXP

Corrosivity Package

DATE RECEIVED: 2022-06-27

DATE REPORTED: 2022-07-06

Parameter	Unit	G / S	RDL	BH#2 SS4 7. 5'-9.5' Soil 2022-06-13 4036080	BH#3 SS4 7. 5'-9.5' Soil 2022-06-13 4036135	BH#7 SS4 7. 5'-9.5' Soil 2022-06-14 4036139
Chloride (2:1)	µg/g		2	49	10	4
Sulphate (2:1)	µg/g		2	282	527	482
pH (2:1)	pH Units		NA	7.15	7.61	7.74
Resistivity (2:1) (Calculated)	ohm.cm		1	2250	1550	1760

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

4036080-4036139 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Amanjot Bhela

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO CHARTERED AMANJOT BHELA CHEMIST

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22Z913694

PROJECT: OTT-22012007-A0

ATTENTION TO: Daniel Wall

SAMPLING SITE:

SAMPLED BY:EXP

Soil Analysis

RPT Date: Jul 06, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	4048161		3	3	NA	< 2	100%	70%	130%	99%	80%	120%	96%	70%	130%
Sulphate (2:1)	4048161		10	9	NA	< 2	120%	70%	130%	110%	80%	120%	101%	70%	130%
pH (2:1)	4036080	4036080	7.15	7.50	4.8%	NA	99%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22Z913694

PROJECT: OTT-22012007-A0

ATTENTION TO: Daniel Wall

SAMPLING SITE:

SAMPLED BY:EXP

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION

AGAT Laboratories
5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Exp Services Inc. Ottawa
Contact: Daniel Wall
Address: 2650 Queensview dr. Unit 100
Ottawa, ON, K2B 8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: daniel.wall@exp.com
2. Email:

Project Information:

Project: OTT-22012007-A0
Site Location: Kelley Farm Drive, Ottawa
Sampled By: EXP
AGAT ID #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Excess Soils R406
Table (Indicate One)
☐ Regulation 558
☐ CCME

☐ Sewer Use ☐ Sanitary ☐ Storm
(Region)
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 22791369 4
Cooler Quantity: n/a - bag 1 small
Arrival Temperatures: 24.8 | 24.7 | 24.8
LT 5.1 | 5.5 | 6.0
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: Bagged Ice

Turnaround Time (TAT) Required:

Regular TAT (Most Analysis) ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	PAHs	Total PCBs ☐ Aroclor	VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	pH	Sulphate	Chloride	Resistivity				Potentially Hazardous or High Concentration (Y/N)
BH #2 SS4 7.5-9.5'	June 13	AM/PM	1	S													✓	✓	✓	✓				
BH #3 SS4 7.5-9.5'	"	AM/PM	1	S													✓	✓	✓	✓				
BH #7 SS4 7.5-9.5'	June 14	AM/PM	1	S													✓	✓	✓	✓				
		AM/PM																						
		AM/PM																						
		AM/PM																						
		AM/PM																						
		AM/PM																						
		AM/PM																						
		AM/PM																						
		AM/PM																						
		AM/PM																						

Samples Relinquished By (Print Name and Sign): Jeff MacMillan for Li Li	Date: June 27/22	Time: 4:30pm	Samples Received By (Print Name and Sign):	Date: JUN 27 2022	Time: 17h00
Samples Relinquished By (Print Name and Sign):	Date: JUN 28 2022	Time: 8h00	Samples Received By (Print Name and Sign): Anthony Da Silva	Date:	Time:
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:

'22 JUN 29 9:15AM

Page 1 of 1

N°: T 114969

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