Geotechnical Investigation
Proposed Addition to Haven Baptist Church
4000 Strandherd Drive
Ottawa, Ontario

Client:
Haven Baptist Church
4000 Strandherd Drive
Ottawa, Ontario K2J 4R8

Type of Document:
Final

Project Number:
OTT-22013837-A0

Prepared By:
Matthew Zammit, M.A.Sc., P.Eng.
Geotechnical Engineer
Geotechnical Services
Earth and Environment

Reviewed / Approved By:
Ismail Taki, M.Eng, P.Eng.
Senior Manager
Geotechnical Services
Earth and Environment

Date Submitted:

November 16, 2023

100 - 2650 Queensview Drive, Ottawa, Ontario K2B 8H6
T: +1.613.688.1899 • F: +1.613.225.7337 • www.exp.com

Table of Contents:

Executive Summary **1**

1. Introduction **3**

2. Site Description **4**

3. Procedure **5**

4. Subsurface Soil and Groundwater Conditions **6**

4.1 Topsoil 6
4.2 Fill 6
4.3 Clay 6
4.4 Glacial Till 7
4.5 Inferred Boulders or Bedrock 7
4.6 Groundwater Level 8

5. Seismic Site Classification and Liquefaction Potential of Soils **9**

5.1 Site Classification for Seismic Site Response 9
5.2 Liquefaction Potential of Soils 9

6. Grade Raise Restrictions **10**

7. Foundation Considerations **11**

8. Slab-on-Grade Construction and Permanent Drainage Systems **13**

9. Excavation and De-Watering Requirements **14**

9.1 Excess Soil Management 14
9.2 Excavations 14
9.3 De-Watering Requirements 14

10. Pipe Bedding Requirements **16**

11. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes **17**

12. Access Roads and Parking Lots **18**

13. Subsurface Concrete Requirements **20**

14. General Comments **21**

Appendices:

Appendix A: Laboratory Certificate of Analysis

Appendix B: Legal Notification

Figures:

Figure 1 – Site Location Plan

Figure 2 – Borehole Location Plan

Figures 3 to 5 – Borehole Logs

Figures 6 to 8 – Grain Size Distribution Curves

List of Tables:

Table I: Summary of Results from Grain-Size Analysis and Atterberg Limit Determination - Clay Samples 7

Table II: Summary of Grain-size Analysis Results – Glacial Till Sample 7

Table III: Summary of Groundwater Level Measurements 8

Table IV: Recommended Pavement Structure Thicknesses 18

Table V: Results of pH, Sulphate, and Resistivity Tests on Soil Samples 20

Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed addition to the Haven Baptist church building situated at the civic address 4000 Strandherd Drive, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal number: OTT-22013837-A0 dated May 19, 2022. Authorization to proceed with this investigation was provided by Haven Baptist Church via the EXP work authorization signed August 31, 2022.

It is our understanding that the building addition will be a slab on grade 279 square meter (3000 square feet) rectangular shaped structure extending on the south side of the existing church building. The design finished floor of the proposed addition and final site grades were not available at the time of this geotechnical investigation, however, it is expected that the finished floor of the proposed addition will match that of the existing building and minimum grade raise will be required as part of the proposed development.

The fieldwork for this investigation was completed on October 11, 2022 and consists of three (3) boreholes (Borehole Nos. 1, 2, and 3) drilled to termination and cone refusal depths of 6.7 m and 15.3 m respectively. A 19 mm diameter standpipe (with 1.5 m slotted section) was installed in Borehole Nos. 1 and 3 for long-term monitoring of the groundwater level.

The borehole information revealed the subsurface conditions to consist of topsoil over fill to roughly 1.5 m depth underlain by firm to very stiff native clay to depths ranging between 4.6 to 7.9 m. The clay is underlain by loose to compact glacial till containing boulders and cobbles to refusal depth contacted at 15.3 m depth (Elevation 79.2 m) in Borehole No. 2. The groundwater level was established at depths of 2.7 to 3.4 m below existing ground (Elevation 91.3 m to 91.1 m).

Based on the borehole information and Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC) as amended May 2, 2019, the site classification for seismic site response is estimated to be **Class C.** The subsurface soils are not susceptible to liquefaction during a seismic event.

As indicated above, minimal grade raise is expected to be required at the site as part of the proposed addition. However, for design purposes, a maximum grade raise of 0.5 m is considered acceptable for the site. If higher grade raise is required, this office must be contacted for additional information.

Based on a review of the borehole information, it is considered feasible to support the proposed building addition by strip and spread footings founded in the upper 1.0 m of the native brown clay to a maximum depth of 2.5 m below existing grade (Elevation 92.0 m to Elevation 91.5 m). For strip footings having a maximum width of 0.9 m and square pad footings having a maximum width and length of 3.0 m founded on the native brown clay to a maximum depth of 2.5 m below existing grade (Elevation 92.0 m and Elevation 91.5 m), the footings may be designed for a bearing pressure at serviceability limit state (SLS) of 120 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 180 kPa. The factored ULS value includes a geotechnical resistance factor of 0.5. The recommended SLS and factored ULS values are valid for the maximum footing founding depth of 2.5 m below existing grade on the native brown clay and for a maximum site grade raise of 0.5 m. Should the footings extend to greater depths below the maximum depth of 2.5 m below existing grade and/or the site grade raise will be greater than 0.5 m, EXP should be contacted to review and provide updated SLS and factored ULS values for the footings.

It is recommended that the footing of the proposed addition be placed at the same level as the existing footing.

A minimum of 1.5 m of earth cover should be provided to the exterior foundations of heated structures 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 and to 2.4 m if snow will be removed from the vicinity of the structure. When earth cover is less than the minimum required, an equivalent thermal combination of earth cover and rigid insulation or rigid insulation alone should be provided. EXP can provide additional comments in this regard, if required.

The floor slab of the proposed structure with no basement can be constructed as slab on grade placed on engineered fill over native silty clay. For this purpose, all the fill from the proposed building envelope must be removed to the native soils and replaced with engineered fill as per recommendation of this report.

A perimeter drainage system should be installed for the proposed new building addition. If the perimeter drainage system of the existing building is encountered during the construction of the new building addition, it should be reinstated following construction of the new building addition. The perimeter drainage system may comprise of 150 mm diameter perforated pipe or equivalent covered at the top, sides and bottom with a minimum 150 mm thick layer of clear stone that is completely wrapped or covered with a non-woven geotextile such as Terrafix 270R or equivalent. The perimeter drainage system should be connected to a sump to provide positive drainage. An underfloor drainage system is not required for the proposed building addition.

The excavations may be undertaken by conventional excavation and shall be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils on site are considered to be Type 3 and for open cut excavations, the side slopes of the excavation must be cut back at 1H:1V from the bottom of the excavation

Seepage of the surface and subsurface water into the excavations above the groundwater level is anticipated and it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques.

The pipe subgrade material is anticipated to consist of firm to very stiff silty clay. In this case, it is recommended the pipe bedding consist of 300 mm thick of OPSS 1010 Granular A bedding material. The bedding material should be compacted to at least 98 percent SPMDD.

If the backfill for the service trenches will consist of granular fill, clay seals should be installed in the service trenches at select intervals as required. The seals should be 1 m wide, extend over the entire trench width and from the bottom of the trench to the underside of the pavement structure. The clay should be compacted to 95 percent SPMDD. The purpose of the clay seals is to prevent the permanent lowering of the groundwater level. Reference is made to the City of Ottawa Drawing No. S8 regarding clay seals for pipe trenches.

It is anticipated that the majority of the material required for engineered fill and for backfilling purposes for this project would have to be imported and should preferably conform to the specifications provided in the attached report.

Based on a review of the borehole information at the location of the proposed church addition, the subgrade for new parking and driveways is anticipated to consist of silty sand with gravel fill or stiff silty clay. The pavement structure thicknesses required for the proposed driveways and parking areas for soil subgrades were computed and are shown in this report.

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

1. Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed addition to the Haven Baptist Church situated at Civic address of 4000 Strandherd Drive, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal number: OTT-22013837-A0 dated May 19, 2022. Authorization to proceed with this investigation was provided by Haven Baptist Church via the signed EXP work authorization form dated August 31, 2022.

It is our understanding that the building addition will be an approximately 279 square meter (3000 square feet) rectangular shaped structure with no basement, extending on the south side of the existing church building. The design finished floor of the proposed addition and final site grades were not available at the time of this geotechnical investigation, however, it is expected that the finished floor of the proposed addition will match that of the existing building and minimal grade raise will be required as part of the proposed development.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil conditions and groundwater levels at three (3) boreholes drilled within the area of the proposed addition,

b) Provide classification of the site for seismic design in accordance with requirements of the 2012 Ontario Building Code (OBC) as amended May 2, 2019 and assess the liquefication potential of the subsurface soils during a seismic event,

c) Discuss grade raise restrictions,

d) Provide the bearing pressure at Serviceability Limit State (SLS) and factored geotechnical resistance at Ultimate Limit State (ULS) of the most suitable type of foundation for the proposed building addition, as well as anticipated total and differential settlements,

e) Comment on slab-on-grade construction and permanent drainage requirements,

f) Discuss excavation conditions and dewatering requirements during construction of the foundation for the proposed building addition,

g) Discuss pipe bedding requirements,

h) Comment on backfilling requirements and suitability of the on-site soils for backfilling purposes;

i) Discuss pavement design and construction recommendations for parking lots and driveways, and

j) Discuss the subsurface concrete requirements and the corrosion potential of subsurface soils to buried metal structures/members.

The comments and recommendations given in this report assume that the above-described design concept 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 property, “Haven Baptist Church” is located in a suburban developed residential area of the City of Ottawa. It is rectangular-in shape, bounded by a park on the east and north sides, Nepean Seventh Day Adventist church to the west, and by Strandherd drive to the south.

The proposed building addition is planned to be located in the landscaped grassy area on the south side (rear) of the existing building.

A topographical survey plan prepared by Annis, O’Sullivan, Vollebekk Ltd. (AOV) for the site dated December 10, 2018 was provided to exp as reference material. A review of this plan revealed that the topography of the site is relatively flat, gradually sloping down from north to south. In the area of the building addition, the site slopes down from the existing building to the Strandherd drive roadside ditch from an approximate elevation of Elevation 94.45 m to Elevation 93.71 m.

3. Procedure

The fieldwork for the geotechnical investigation was completed on October 11, 2022 and consists of three (3) boreholes (Borehole Nos. 1, 2, and 3) drilled to termination and cone refusal depths of 6.7 m and 15.3 m respectively. The borehole locations are shown on Figure 2. The fieldwork was supervised on a full-time basis by a representative from EXP.

Prior to the fieldwork, the locations of the boreholes were staked in the field and their locations cleared of any public and private underground services. The geodetic elevation of the ground surface at each borehole location was estimated from the topographical survey plan of the site dated December 10, 2018 and prepared by AOV. Therefore, the borehole ground surface elevations should be considered as approximate.

The boreholes were drilled using a track-mounted drill rig equipped with hollow stem augers and operated by a drilling specialist subcontracted to EXP. Standard penetration tests (SPTs) were performed in all the boreholes at 0.75 m and 1.5 m depth intervals and the soil samples were retrieved by the split-spoon sampler. The undrained shear strength of the cohesive soil was measured by conducting penetrometer and in-situ vane tests. In Borehole No. 2, a dynamic cone penetration test (DCPT) was conducted beside the auger hole from 1.5 m to a cone refusal depth of 15.3 m below ground surface.

A 19 mm diameter standpipe (with 1.5 m slotted section) was installed in Borehole Nos. 1 and 3 for long-term monitoring of the groundwater level. The monitoring well was 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 and the installation of the standpipes.

All soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified accordingly. On completion of the fieldwork, all the soil samples were transported to the EXP laboratory located in the City of Ottawa where they were visually examined by a geotechnical engineer and the borehole logs were prepared. The engineer also assigned the laboratory testing which consisted of performing the following tests on the soil samples:

Natural Moisture Content Determination .....26 tests

Natural Unit Weight Determination.....5 tests

Grain Size Analysis.....3 tests

Atterberg Limits.....3 tests

Chemical Analysis (pH, sulphate and chloride) .....2 tests

4. Subsurface Soil and Groundwater Conditions

A detailed description of the subsurface soil and groundwater conditions encountered in the boreholes is given on the borehole logs, Figures 3, 4, and 5. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time may also result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

The boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of environmental conditions.

It should be noted that the soil boundaries indicated on the borehole logs are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Descriptions" preceding the borehole logs forms an integral part of this report and should be read in conjunction with this report.

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

4.1 Topsoil

A surficial topsoil layer ranging between 200 and 300 mm was contacted at the location of the three boreholes.

4.2 Fill

The topsoil in all three boreholes is underlain by heterogeneous fill that extends to depths of 1.0 to 1.5 m depth (Elevation 92.9 to 93.0 m). The fill consists of silty sand, with gravel, trace clay and topsoil inclusions. It is loose as indicated by the standard penetration test (SPT) N values of 5 to 9 blows for 300 mm penetration of the split spoon sampler. The moisture content and unit weight of the fill ranged from 8 to 18 percent and 18.7 and 19.2 kN/m^3 respectively.

4.3 Clay

The fill in the boreholes is underlain by a native silty clay deposit extending to 4.6 m to 7.9 m in the boreholes (Elevation 89.8 m to 86.6 m). The upper 1.5 m of the clay is desiccated brown and has an undrained shear strength ranging from 110 kPa to 140 kPa indicating a very stiff consistency. The upper clay crust is underlain by lower grey clay with an undrained shear strength of 43 kPa to 77 kPa indicating a firm to stiff consistency. The sensitivity values of the clay deposit ranged from 4.3 to 8.0 indicating a sensitive clay.

The natural moisture content and unit weight of the clay deposit is 27 to 75 percent and 18.7 kN/m^3 to 20.2 kN/m^3 respectively.

The results from the grain-size analysis and Atterberg limit determination conducted on one (1) sample of the brown clay crust (BH2 SS3) and one (1) sample of un-desiccated grey clay (BH2 SS5) is summarized in Table I. The grain-size distribution curves are shown in Figure 6 and Figure 7, respectively.

Table I: Summary of Results from Grain-Size Analysis and Atterberg Limit Determination - Clay Samples									
Borehole (BH) No. – Sample (SS) No.	Depth (m)	Grain-Size Analysis (%)			Atterberg Limits (%)				
		Gravel	Sand	Fines (Silt and Clay)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Soil Classification (USCS)
BH 2 – SS3	1.5 – 2.1	0	6	94	27	37	18	19	Clay of Low Plasticity (CL)
BH 2 – SS5	4.6 - 5.2	0	0	100	65	44	22	22	Clay of Low Plasticity (CL)

Based on a review of the results of the grain-size analysis and Atterberg limits, the clay deposit at the site can be classified as of low plasticity (CL) in accordance with the USCS.

4.4 Glacial Till

The clay deposit is underlain by glacial till extending to the maximum explored/sampled depths in all boreholes of 6.7 m to 15.3 m (Elevation 79.2 m to 87.7 m). The glacial till comprised of silty sand with gravel and clay contains cobbles and boulders. It is very loose to compact and has a natural moisture content of 9 to 47 percent.

The results from the grain-size analysis conducted on one (1) sample of the glacial till is summarized in Table II. The grain-size distribution curve is shown in Figure 8

Table II: Summary of Grain-size Analysis Results – Glacial Till Sample						
Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)			Atterberg Limits (%)	Soil Classification (USCS)
		Gravel	Sand	Silt and Clay		
BH2 – SS8	9.2 – 9.8	13	48	39	Non-plastic	Silty Sand (SM)

Based on a review of the results of the grain-size analysis, the glacial till may be classified as silty sand in accordance with the Unified Soil Classification System (USCS).

4.5 Inferred Boulders or Bedrock

Auger refusal was met in Borehole No. 2 at 13.9 m below ground surface. Following auger refusal, a dynamic cone penetration test (DCPT) was conducted adjacent to the hole at borehole No. 2 from a 1.5 m depth to cone refusal at a 15.3 m depth (Elevation 79.2 m). It is not known if refusal was met on boulders within the glacial till deposit or on the surface of the bedrock.

4.6 Groundwater Level

Groundwater levels were collected in the open boreholes upon completion as well as in standpipes installed in Borehole Nos. 1, and 3 and results summarized in Table III.

Table III: Summary of Groundwater Level Measurements

Borehole No. (BH)	Ground Surface Elevation (m)	Date of Measurement (Elapsed Time in Days from Date of Installation)	Groundwater Depth Below Ground Surface (Elevation), m
BH 1	94.41	October 27, 2022 (16 days)	3.2 (91.2)
BH 2	94.50	October 11, 2022 (0 days)	3.4 (91.1)
BH 3	94.00	October 27, 2022 (16 days)	2.7 (91.3)

A review of Table III indicates the groundwater table at the site ranges from 2.7 m to 3.4 m (Elevation 91.3 m to Elevation 91.1 m).

Groundwater levels were determined in the boreholes at the time and under the condition stated in the scope of services. 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.

5. Seismic Site Classification and Liquefaction Potential of Soils

5.1 Site Classification for Seismic Site Response

Based on the borehole information and Table 4.1.8.4.A in the 2012 Ontario Building Code (as amended May 2, 2019), the site classification for seismic site response is **Class C**.

5.2 Liquefaction Potential of Soils

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

6. Grade Raise Restrictions

The site is underlain by a clay deposit that is prone to consolidation settlement if overstressed by loads imposed on it by site grade raise, foundations and by the permanent lowering of the groundwater level following construction. Overstressing of the clay will result in its consolidation and subsequent settlement of foundations, which may exceed tolerable limits of the structure resulting in cracking of the structure.

Major grade raise is not anticipated as part of the proposed construction, however for the purpose of this geotechnical investigation, a maximum grade raise of 0.5 m has been assumed.

If the above assumption is incorrect, EXP should be contacted to review the acceptability of the proposed grade raise from a geotechnical point of view and provide updated bearing pressure value at serviceability limit state (SLS) and factored geotechnical resistance value at ultimate limit state (ULS) for the footings of the proposed new building addition.

7. Foundation Considerations

The finished floor level of the proposed addition with no basement, as well as the finished exterior grades were not available at time of preparation of this report. However, it is expected that the floor of the proposed addition will match that of the existing building. Also, the exterior grades are expected to generally match the existing grades and therefore minimum grade raise to be required at the site as part of the proposed addition. It is also assumed that the footing of the proposed addition will match that of the existing building.

The investigation has revealed that the site is suitable to found the proposed addition on the upper levels of the native silty clay contacted at depths of 1.0 m to 1.5 m below grade. The existing fill is not considered suitable to support the footings for the proposed building addition

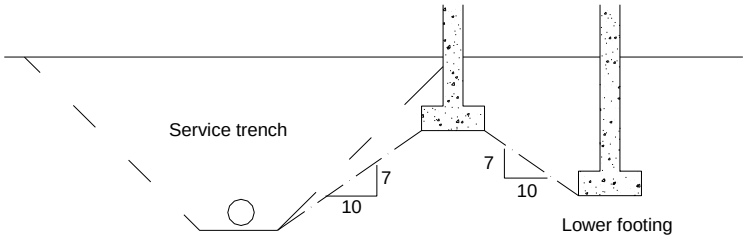
Strip and spread footings founded in the upper 1.0 m of the native brown clay to a maximum depth of 2.5 m below existing grade (Elevation 92.0 m to Elevation 91.5 m) with a maximum width of 0.9 m and 3 m respectively may be designed for a bearing pressure at serviceability limit state (SLS) of 120 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 180 kPa. The factored ULS value includes a geotechnical resistance factor of 0.5. The recommended SLS and factored ULS values are valid for a maximum site grade raise of 0.5 m. If this is different, EXP should be contacted to review and provide updated SLS and factored ULS values for the footings.

The total and differential settlements of footings designed in accordance with the recommendations of this report and with careful attention to construction detail are expected to be less than 25 mm and 19 mm respectively.

To minimize the need to underpin the existing footings along the west wall of the existing building where the proposed new building addition will be located, it is recommended that the footings for the new building addition be placed at the same depth as the existing footings.

If deeper excavation is required for the new footings located adjacent to existing footings, underpinning of the existing footings may be required. EXP can provide additional recommendations regarding the underpinning of the existing footings.

Footings at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical (10H:7V) from the near edge of the lower footing. This concept should also be applied to service excavation, etc. to ensure that undermining is not a problem.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footing beds should be examined by a geotechnical engineer to ensure that the founding soil is capable of supporting the bearing pressure at SLS and that the footings have been properly prepared.

It should be noted that the exposed clay subgrade surface is susceptible to disturbance due to movement of workers and construction traffic and the prevailing weather conditions during construction. To prevent disturbance to the clay subgrade, the approved footing beds should be covered or protected with a 50 mm thick concrete mud slab.

A minimum of 1.5 m of earth cover should be provided to the exterior foundations of heated structures 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 and to 2.4 m if snow will be removed from the vicinity of the structure. When earth cover is less than the minimum required, an equivalent thermal combination of earth cover and rigid insulation or rigid insulation alone should be provided. EXP can provide additional comments in this regard, if required.

The recommended bearing pressure at SLS and factored geotechnical resistances at ULS 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.

8. Slab-on-Grade Construction and Permanent Drainage Systems

The existing soil matching the ground floor of the existing structure is topsoil over silty sand fill. The ground floor may be designed as slab on grade. The existing fill is not considered suitable to support the slab-on-grade and should be excavated and removed down to the native clay within the floor slab footprint. The floor slab should be set on a bed of well-packed 19 mm clear stone at least 200 mm thick placed on the engineered fill pad at least 300 mm thick and should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II which should be placed in 300 mm lifts and each lift compacted to 98 percent standard Proctor maximum dry density (SPMDD). The clear stone would prevent the capillary rise of moisture from the sub-soil to the floor slab. Adequate saw cuts should be provided in the floor slab to control cracking.

A perimeter drainage system should be installed around the proposed new building addition. If the perimeter drainage system of the existing building is encountered during the construction of the new building addition, it should be reinstated following construction of the new building addition. The perimeter drainage system may comprise of 150 mm diameter perforated pipe or equivalent covered at the top, sides and bottom with a minimum 150 mm thick layer of clear stone that is completely wrapped or covered with a non-woven geotextile such as Terrafix 270R or equivalent. The perimeter drainage system should be connected to a sump to provide positive drainage. Underfloor drainage system is not required for the proposed building addition with no basement.

The ground floor slab should be set at least 150 mm above the surrounding exterior grades and the finished exterior grade should be sloped away from the building to prevent ponding of surface water close to the exterior walls of the proposed building addition.

9. Excavation and De-Watering Requirements

9.1 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.

9.2 Excavations

Excavations for the construction of the proposed building addition foundations are anticipated to extend a maximum of 2.0 m depth below existing ground surface. These excavations will extend through the fill and into the native clay and will be above the groundwater level.

The excavations may be undertaken by conventional excavation equipment.

All excavations must be undertaken in accordance with the Occupational Health and Safety Act (OHSA), Ontario Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils on site are considered to be Type 3 and for open cut excavations, the side slopes of the excavation must be cut back at 1H:1V from the bottom of the excavation. For zones along the sidewalls of the excavation of persistent water seepage, the excavation side slopes are expected to slough and eventually stabilize at a slope of 2H:1V from the bottom of the excavation.

Base heave type failure is not expected in excavations that extend into the native clay to a maximum 2.5 m depth below existing grade.

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

Extra care should be exercised during the excavation close to the existing building to prevent the undermining of the existing footings. Reference is made to Section 7 of this report regarding measures to prevent the undermining of existing footings.

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.

9.3 De-Watering Requirements

Seepage of the surface and subsurface water into the excavations is anticipated and it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. High-capacity

pumps may be required to keep the excavation dry in zones of persistent seepage where more permeable soil may exist along the side walls of the excavation.

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.

10. Pipe Bedding Requirements

It is recommended that 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).

The pipe subgrade material is anticipated to consist of firm to very stiff silty clay. In this case, it is recommended the pipe bedding consist of 300 mm thick of OPSS 1010 Granular A bedding material. The bedding material should be compacted to at least 98 percent SPMDD.

The bedding thickness may be further increased in areas where the silty clay subgrade becomes disturbed or below the water table. Trench base stabilization techniques, such as removal of loose/soft material, placement of crushed stone sub-bedding (Granular B Type II) that is completely wrapped in a non-woven geotextile, may also be used if trench base disturbance becomes a problem in wet or soft areas.

It is anticipated that paved surfaces may be located over service trenches. In this case, it is recommended that the trench backfill material within the frost zone up to 1.8 m below finished grade, should match the existing material in the paved roadway, provided the material is determined to be suitable for re-use as backfill material. The matching of materials minimizes differential frost heave of the subgrade material. If the trench backfill material is different than the material in the sidewalls of the trench, a 3H:1V frost taper should be provided to minimize differential frost heave. The trench backfill should be placed in 300 mm thick lifts and each lift compacted to 95 percent SPMDD.

If the backfill for the service trenches will consist of granular fill, clay seals should be installed in the service trenches at select intervals as required. The seals should be 1 m wide, extend over the entire trench width and from the bottom of the trench to the underside of the pavement structure. The clay should be compacted to 95 percent SPMDD. The purpose of the clay seals is to prevent the permanent lowering of the groundwater level. Reference is made to the City of Ottawa Drawing No. S8 regarding clay seals for pipe trenches.

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

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

The material to be excavated from the site will comprise of topsoil, fill, and native clay. Portions of the fill may be re-used as backfill material in the landscaped areas. The excavated soils are not considered suitable for use under structural elements and for backfilling purposes and therefore must be disposed off-site or used in landscaped areas.

It is anticipated that the majority of the material required for engineered fill and for backfilling purposes for this project would have to be imported and should preferably conform to the following specification:

- Engineered fill under slab-on-grade - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent SPMDD.
- Backfill in footing trenches and against foundation walls – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent of the SPMDD inside the building and 95 percent SPMDD outside the building respectively.
- Bedding for pipes and site services – OPSS 1010 Granular A placed in 150 to 300 mm thick lifts and each lift compacted to 98 percent SPMDD
- Trench backfill and subgrade fill in parking areas, access roadways – OPSS Select Subgrade Material (SSM) or approved on-site material excavated above the water table placed in 300 mm thick lifts and each lift compacted to 95 percent SPMDD.

12. Access Roads and Parking Lots

At the time of the fieldwork for this investigation, there were no proposed pavement upgrades at the site, and therefore the subsurface conditions were not investigated at the location of the now proposed new parking areas and driveways. Based on a review of the borehole information at the location of the proposed church addition, the subgrade for new parking and driveways is anticipated to consist of silty sand with gravel fill or stiff silty clay. The pavement structure thicknesses required for the proposed driveways and parking areas for soil subgrades were computed and are shown on Table IV.

The thicknesses are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples collected at the proposed addition location and pavement functional design life of ten (10) to fifteen (15) years. The proposed functional design life represents the number of years to the first rehabilitation, assuming regular maintenance is carried out.

Table IV: Recommended Pavement Structure Thicknesses

Pavement Layer	Compaction Requirements	Light Duty Traffic (Cars)	Heavy Duty Traffic (Fire Trucks/Garbage Trucks)
Asphaltic Concrete (PG 58-34)	92 percent to 97 percent MRD*	65 mm HL3/SP12.5 Cat C	50 mm HL3/SP12.5 Cat C 60 mm HL8 SP19.0 Cat C
OPSS 1010 Granular A Base	100 percent SPMDD**	150 mm	150 mm
OPSS 1010 Granular B Sub-Base Type II	100 percent SPMDD**	300 mm	450 mm

**Denotes maximum relative density.*
*** Denotes standard Proctor maximum dry density, ASTM-D698-12e2.*

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 and/or geotextile may be required.

Additional comments on the construction of proposed new parking lots and access roads are as follows:

1. As part of the subgrade preparation, the proposed new pavement areas should be stripped of topsoil, organic stained soil and other obviously unsuitable material. The subgrade should be properly shaped, crowned, then proof-rolled with a non-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 OPSS Granular B Type II compacted to 95 percent SPMDD.

2. The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. The need for adequate drainage cannot be over-emphasized. Subdrains 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 sub drainage 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.

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 catchbasins. 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 of granular sub-base (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 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 maximum relative density (MRD). Asphalt placement should be in accordance with OPSS 310 and OPSS 313.

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

13. Subsurface Concrete Requirements

Chemical tests limited to pH, sulphate, and resistivity determination were performed on two (2) samples of the native clay soil. The laboratory certificate of analysis is attached in Appendix A and the results are summarized in Table V below.

Table V: Results of pH, Sulphate, and Resistivity Tests on Soil Samples

Borehole No. (Sample No.)	Depth (m)	Soil Type	pH	Sulphate (%)	Resistivity (Ohm*cm)
BH 1 – SS3	1.5 - 2.1	Native Brown Clay	7.06	0.0005	6060
BH 3 – SS4	3.0 – 3.6	Native Grey Clay	7.28	0.0185	2270

The test results indicate the native brown and grey clays have a sulphate content of less than 0.1 percent. This concentration of sulphate in the native clays would have a negligible potential of sulphate attack on subsurface concrete. The concrete should be designed in accordance with Table Nos. 3 and 6 of CSA A.23.1-19. However, the concrete should be dense, well compacted and cured.

Based on a review of the resistivity test result, the native clay samples are considered to be mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be undertaken to protect buried steel elements from corrosion.

14. General Comments

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

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

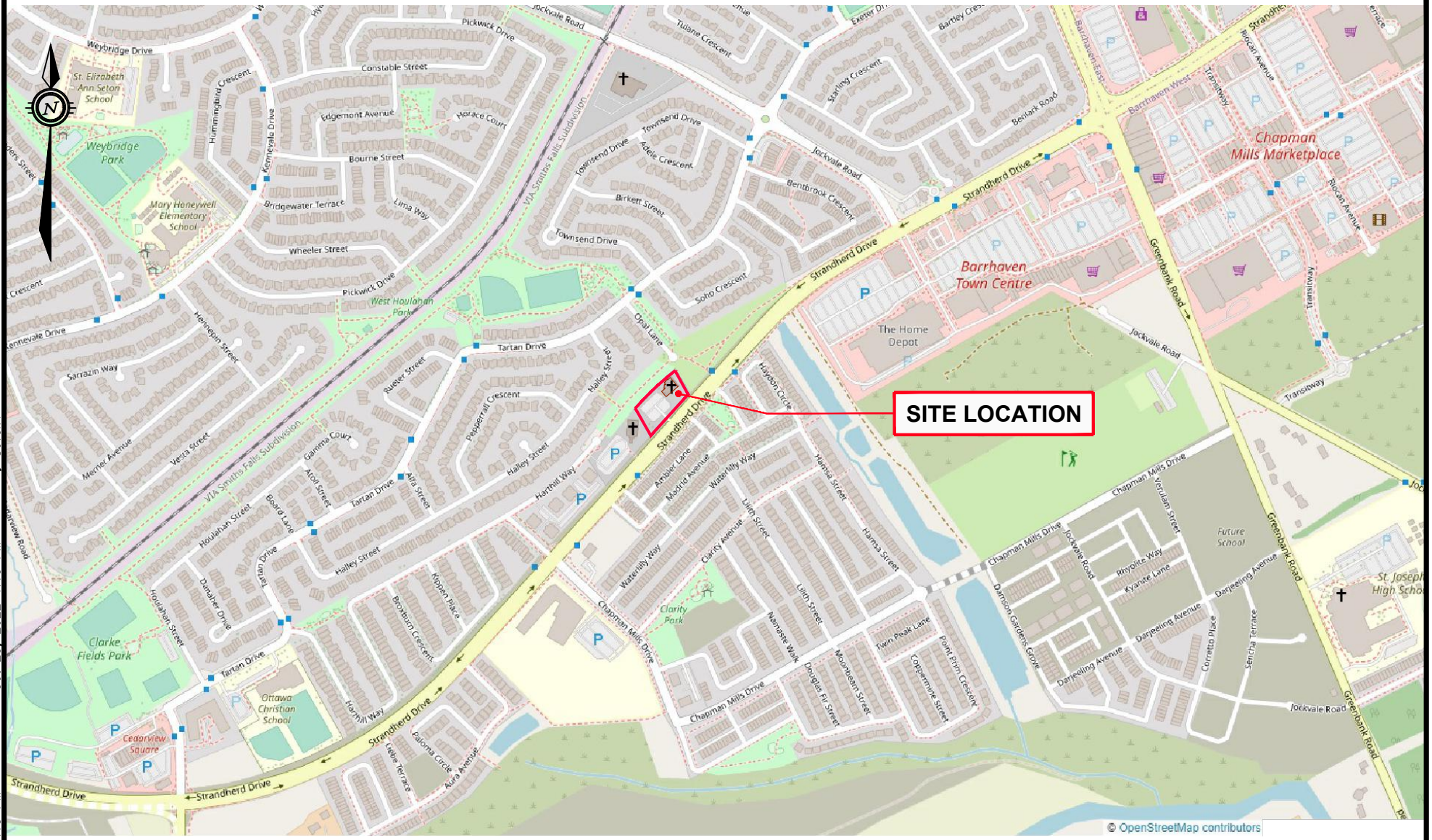
We trust that the information contained in this report is satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely,

Matthew Zammit, M.A.Sc., P.Eng.
Geotechnical Engineer
Earth and Environment

Ismail Taki, M.Eng, P.Eng.
Senior Manager
Earth and Environment

Figures



0 100m 200m 400m

HORIZONTAL 1:10,000

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

DESIGN	MZ
DRAWN	AS
DATE	OCTOBER 2022
FILE NO	OTT-22013837-A0

GEOTECHNICAL INVESTIGATION
HAVEN BAPTIST CHURCH
4000 STRANDHERD DRIVE, OTTAWA, ON

SITE PLAN

SCALE 1:10,000

SKETCH NO FIG 1

Filename: E:\OTT\OTT-22013837-A0\60 Execution\65 Drawings\22013837-A0_Geo.dwg
Last Saved: Oct 25, 2022 1:15 PM Last Plotted: Oct 25, 2022 1:15 PM Plotted by: SeverA

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 ANGELO MATTIA SPADOLA ARCHITECT, DRAWING/SHEET NO.: A0.0, DATED MAY 10, 2022.

LEGEND

PROPERTY LINE

EXISTING CHURCH BUILDING

NEW BUILDING ADDITION

BH-1 (94.4 m) — BOREHOLE NO. & LOCATION (XX.X) – APPROXIMATE GROUND SURFACE ELEVATION (m)

0 4m 8m 16m

HORIZONTAL 1:400

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

DESIGN	MZ
DRAWN	AS
DATE	OCTOBER 2022
FILE NO	OTT-22013837-A0

GEOTECHNICAL INVESTIGATION
HAVEN BAPTIST CHURCH
4000 STRANDHERD DRIVE, OTTAWA, ON

BOREHOLE LOCATION PLAN

SCALE 1:400

SKETCH NO FIG 2

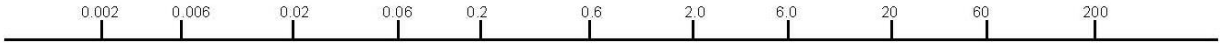
Filename: E:\OTT\OTT-22013837-A0\60 Execution\65 Drawings\22013837-A0_Geo.dwg
Last Saved: Oct 28, 2022 9:24 AM Last Plotted: Oct 28, 2022 9:25 AM Plotted by: SeverA

Notes On Sample Descriptions

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

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

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-22013837-A0

Project: Proposed Addition to Haven Baptist Church

Location: 4000 Strandherd Drive, Ottawa, Ontario

Figure No. 3

Page. 1 of 1

Date Drilled: 'Oct. 11, 2022

Drill Type: CME-75 Track Mounted Drill Rig

Datum: Approximate Elevation

Logged by: M.Z. Checked by: I.T.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Approximate 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 ~300 mm thick	94.41	0	6		SS1	18.7
			94.1					
		FILL Silty sand, with gravel, topsoil inclusions, brown, moist (loose)		1	9		SS2	
			92.9					
		SILTY CLAY Light brown to grey, moist to wet (stiff to very stiff)		2	6		SS3	18.7
					120 kPa s = 8			
▽		wet, grey below 3 m depth		3	9 Hammer Weight		SS4	
				4	77 kPa s = 7.7			
			89.8					
		GLACIAL TILL Silty sand with gravel, some clay, wet (very loose to loose)		5	1		SS5	
				6	7		SS6	
			87.7					
		Borehole Terminated at 6.7 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe was 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-22013837-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Oct 27, 2022	3.2	

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22013837 - 4000 STRANDHERD DRIVE BH LOGS.GPJ TROW OTTAWA.GDT 11/1/22

Log of Borehole BH-02

Project No: OTT-22013837-A0

Project: Proposed Addition to Haven Baptist Church

Location: 4000 Strandherd Drive, Ottawa, Ontario

Figure No. 4

Page. 1 of 2

Date Drilled: 'Oct. 11, 2022

Drill Type: CME-75 Track Mounted Drill Rig

Datum: Approximate Elevation

Logged by: M.Z. Checked by: I.T.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Approx. Elevation m	Depth
		TOPSOIL ~250 mm thick	94.5 / 94.3	0
		FILL Silty sand, with gravel, topsoil inclusions, brown, moist (loose)		1
			93.0	2
		SILTY CLAY Light brown to grey, moist to wet (firm to very stiff)		3
▼		wet, grey below 3 m depth	91.1	4
				5
				6
			86.6	7
		GLACIAL TILL Silty sand with gravel, cobbles, boulders, some clay, wet (very loose to compact)		8
				9
				10

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

SPT values: 5, 6, 5, 1, Hammer Weight, Hammer Weight, 1, 6

Shear strength: 140 kPa, s = 4.7; 48 kPa, s = 6.9; 43 kPa, s = 4.3; 43 kPa, s = 6.1

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	20.2
SS4	
SS5	
SS6	
SS7	
SS8	

Continued Next Page

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-22013837-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	3.4	12.5

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22013837 - 4000 STRANDHERD DRIVE BH LOGS.GPJ TROW OTTAWA.GDT 11/1/22

Log of Borehole BH-02

Project No: OTT-22013837-A0

Project: Proposed Addition to Haven Baptist Church

Figure No. 4

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Approximate 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
		GLACIAL TILL Silty sand with gravel, cobbles, boulders, some clay, wet (very loose to compact) *(continued)*	84.5	10				
				11	3		SS9	
				12	11		SS10	
				13				
		Auger refusal met boulders or bedrock at 13.9 m depth	80.6	14	20 / 150 mm then bouncing		SS11	
		Dynamic Cone Penetration Test (DCPT) conducted beside auger hole from 1.5 m to cone refusal at 15.3 m depth		15				
			79.2					
		Cone Refusal at 15.3 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22013837-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Upon Completion	3.4	12.5

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

LOG OF BOREHOLE OTT-22013837 - 4000 STRANDHERD DRIVE BH LOGS.GPJ TROW OTTAWA.GDT 11/1/22

Log of Borehole BH-03

Project No: OTT-22013837-A0

Project: Proposed Addition to Haven Baptist Church

Location: 4000 Strandherd Drive, Ottawa, Ontario

Figure No. 5

Page. 1 of 1

Date Drilled: 'Oct. 11, 2022

Drill Type: CME-75 Track Mounted Drill Rig

Datum: Approximate Elevation

Logged by: M.Z. Checked by: I.T.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Approx. 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 ~200 mm thick	94 / 93.8	0	7	×	SS1	19.2
		FILL Silty sand, with gravel, topsoil inclusions, brown, moist (loose)	93.0	1	9	×	SS2	
		SILTY CLAY Light brown to grey, moist to wet (firm to very stiff)		2	6	×	SS3	19.3
					110 kPa; s = 5.5			
▽		wet, grey below 3 m depth	91.3	3	Hammer Weight	×	SS4	
				4	48 kPa; s = 6.9			
		GLACIAL TILL Silty sand with gravel, some clay, wet (very loose to loose)	89.4		Hammer Weight	×	SS5	
				5	6	×	SS6	
				6	3	×	SS7	
		Borehole Terminated at 6.7 m Depth	87.3					

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe was 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-22013837-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Oct 27, 2022	2.7	

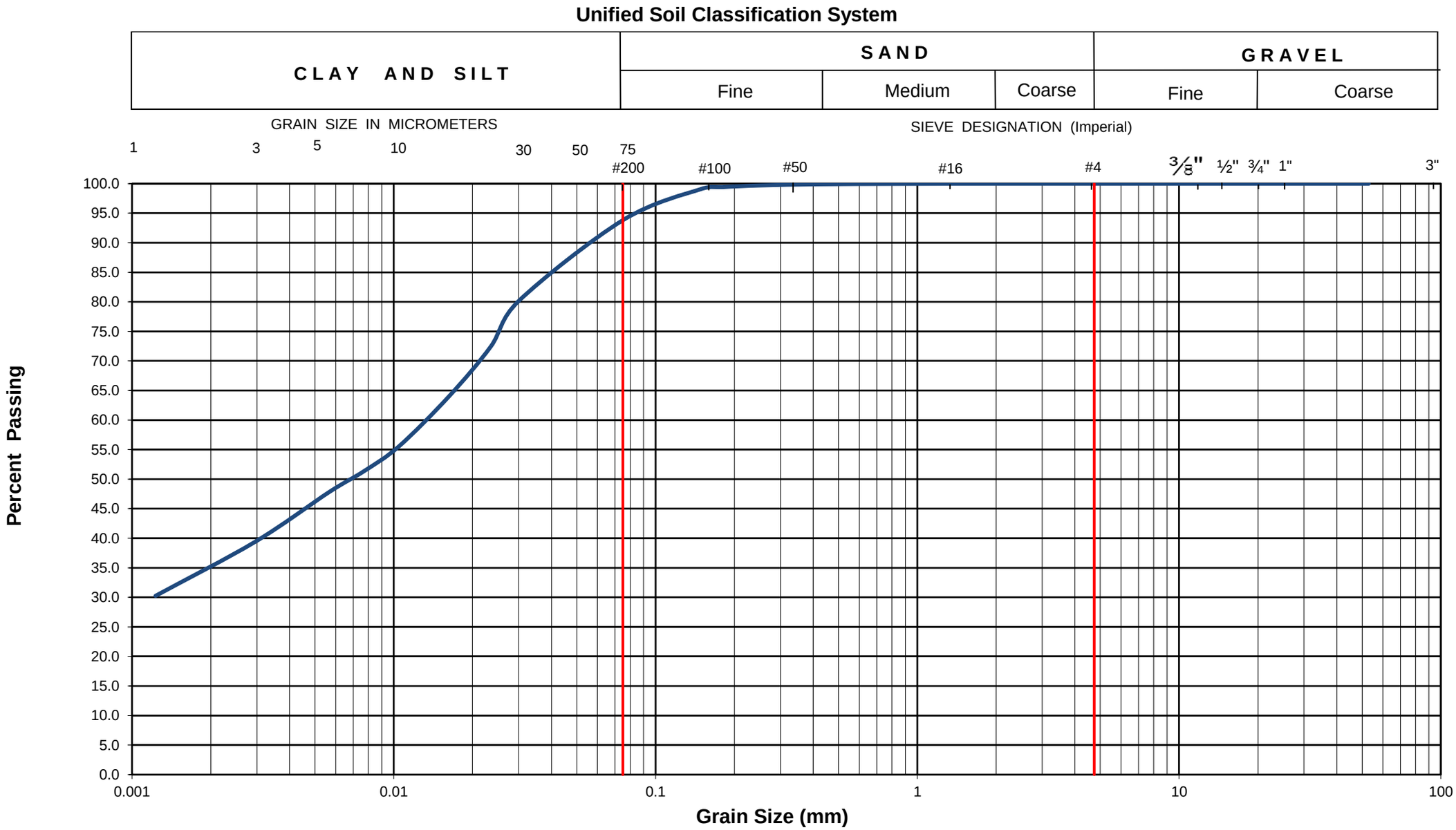
CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22013837 - 4000 STRANDHERD DRIVE BH LOGS.GPJ TROW OTTAWA.GDT 11/1/22

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

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

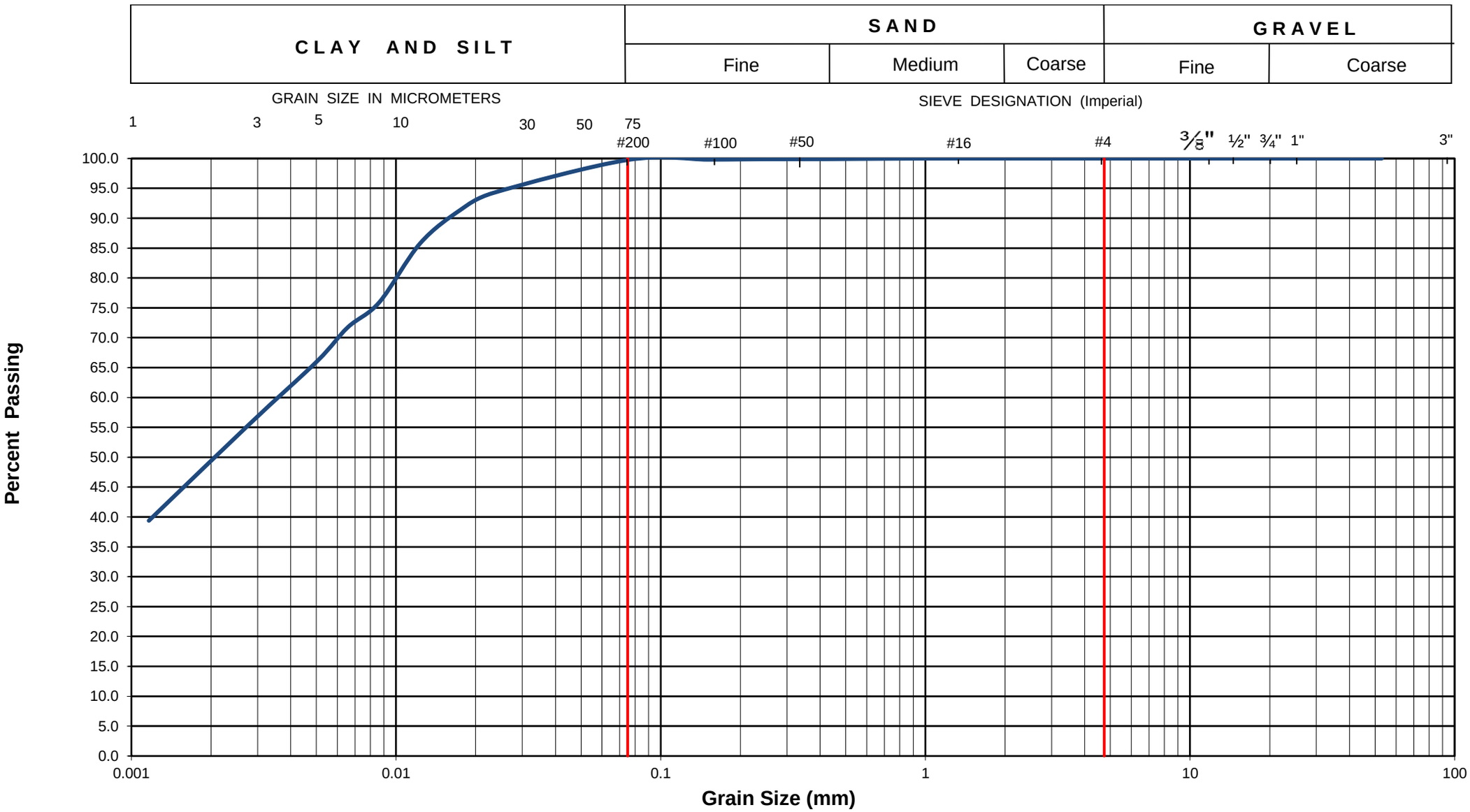


EXP Project No.:	**OTT-22013837-A0**	**Project Name :**	**Geotechnical Investigation - Proposed Addition to Haven Baptist Church**						
Client :	**Haven Baptist Church**	**Project Location :**	**4000 Strandherd Drive, Ottawa, ON**						
Date Sampled :	**October 11, 2022**	**Borehole No:**	**2**		**Sample No.:**	**SS3**		**Depth (m) :**	**1.5-2.1**
Sample Description :		**% Silt and Clay**	**94**	**% Sand**	**6**	**% Gravel**	**0**	**Figure :**	**6**
Sample Description :		**Clay of Low Plasticity (CL)**							

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

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

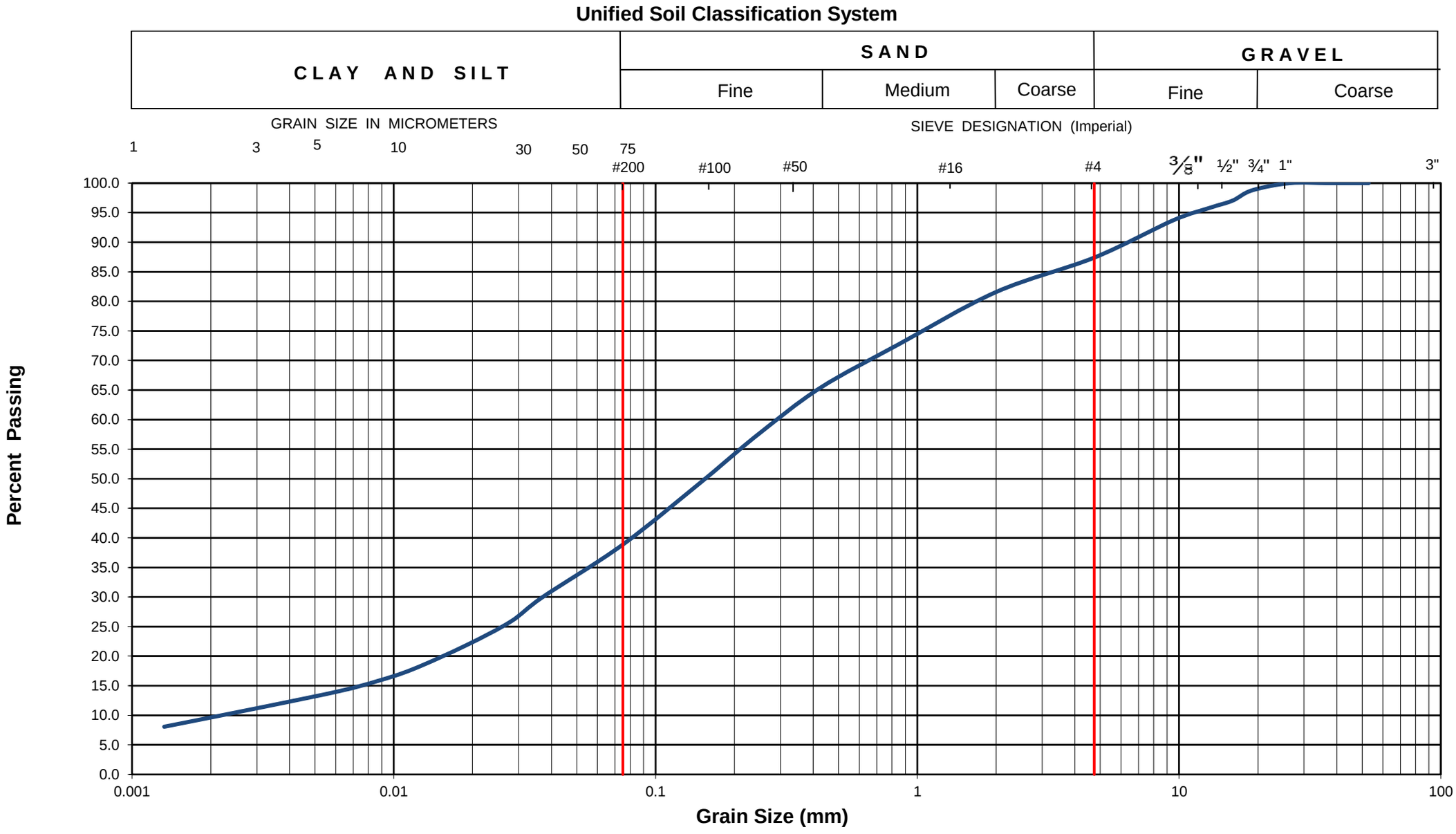
Unified Soil Classification System



EXP Project No.:	**OTT-22013837-A0**	**Project Name :**	**Geotechnical Investigation - Proposed Addition to Haven Baptist Church**						
Client :	**Haven Baptist Church**	**Project Location :**	**4000 Strandherd Drive, Ottawa, ON**						
Date Sampled :	**October 11, 2022**	**Borehole No:**	**2**		**Sample No.:**	**SS5**		**Depth (m) :**	**4.6-5.2**
Sample Description :		**% Silt and Clay**	**100**	**% Sand**	**0**	**% Gravel**	**0**	**Figure :**	**7**
Sample Description :		**Clay of Low Plasticity (CL)**							

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

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



EXP Project No.:	**OTT-22013837-A0**	**Project Name :**	**Geotechnical Investigation - Proposed Addition to Haven Baptist Church**						
Client :	**Haven Baptist Church**	**Project Location :**	**4000 Strandherd Drive, Ottawa, ON**						
Date Sampled :	**October 11, 2022**	**Borehole No:**	**2**		**Sample No.:**	**SS8**		**Depth (m) :**	**9.2-9.8**
Sample Description :		**% Silt and Clay**	**39**	**% Sand**	**48**	**% Gravel**	**13**	**Figure :**	**8**
Sample Description :		**GLACIAL TILL: Silty Sand (SM)**							

Appendix A:
Laboratory Certificate of Analysis

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: **Ismail M. Taki**

PROJECT: **OTT-22013837-AO**

AGAT WORK ORDER: **22Z958177**

SOIL ANALYSIS REVIEWED BY: **Nivine Basily, Inorganics Report Writer**

DATE REPORTED: **Oct 24, 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.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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: 22Z958177

PROJECT: OTT-22013837-AO

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Ismail M. Taki

SAMPLING SITE:400 Strandherd Dr., Ottawa

SAMPLED BY:EXP

(Soil) Inorganic Chemistry

DATE RECEIVED: 2022-10-17 **DATE REPORTED: 2022-10-24**

			SAMPLE DESCRIPTION:	BH#1 SS3 5'-7'	BH#3 SS4 10'-12'
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2022-10-11	2022-10-11
Parameter	Unit	G / S	RDL	4427042	4427044
Sulphate (2:1)	µg/g		2	5	185
pH (2:1)	pH Units		NA	7.06	7.28
Resistivity (2:1) (Calculated)	ohm.cm		1	6060	2270

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

4427042-4427044 Sulphate & pH 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:

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: 22Z958177

PROJECT: OTT-22013837-AO

ATTENTION TO: Ismail M. Taki

SAMPLING SITE:400 Strandherd Dr., Ottawa

SAMPLED BY:EXP

Soil Analysis

RPT Date: Oct 24, 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
(Soil) Inorganic Chemistry															
Sulphate (2:1)	4420293		8	8	NA	< 2	101%	70%	130%	98%	80%	120%	92%	70%	130%
pH (2:1)	4428128		7.07	7.15	1.1%	NA	99%	80%	120%						

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
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22Z958177

PROJECT: OTT-22013837-AO

ATTENTION TO: Ismail M. Taki

SAMPLING SITE:400 Strandherd Dr., Ottawa

SAMPLED BY:EXP

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
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: Ismail Taki
Address: 2650 Queensview dr. Unit 100
Ottawa, ON, K2B 8H6
Phone: 647-688-1895 Fax:
Reports to be sent to:
1. Email: ismail.taki@exp.com
2. Email: jeff.macmillan@exp.com

Project Information:

Project: OTT-22013837-A0
Site Location: 4000 Strandherd dr., Ottawa
Sampled By: EXP
AGAT Quote #: 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 #: 22795817 7
Cooler Quantity: 1 medium n/a-Bag (none/pack)
Arrival Temperatures: 21.7 | 21.5 | 21.7
4°C → 3.4 | 3.9 | 4.3
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: Bagged Ice

Turnaround Time (TAT) Required:

Regular TAT ☑ 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	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	pH	sulphate	resistivity	Potentially Hazardous or High Concentration (Y/N)
BH # 1 SS3 5'-7'	Oct.11	AM PM	1	S													✓	✓	✓	
BH # 3 SS4 10'-12'	Oct.11	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):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Jeff MacMillan	Oct.17/22	3:26 PM	C. Griffith	OCT 17 2022	15h27
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
	OCT 17 2022	16h00			
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

22OCT18 9:45A

Page 1 of 1

N°: T 133548

Document ID: DIV-78-1511-021

Pink Copy - Client | Yellow Copy - AGAT | White Copy: AGAT

Appendix B:
Legal Notification

Legal Notification

This report was prepared by EXP Services Inc. (EXP) for the account of Pastor Greg Johnston of Haven Baptist Church.

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

Report Distribution

Pastor Greg Johnston, Haven Baptist Church - Johnstonsrice@gmail.com