Geotechnical Investigation
Proposed Addition to Residential Building
68 Sweetland Avenue
Ottawa, Ontario

Client:
Smart Living Properties
226 Argyle Avenue
Ottawa, Ontario K2P 1B9

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Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed addition to the existing residential building at the address of 68 Sweetland Avenue, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal number: OTT-22005690-A0 dated February 28, 2022. Authorization to proceed with this investigation was provided by Smart Living Properties via the EXP work authorization signed April 22, 2022. In conjunction with this geotechnical investigation, EXP completed a Phase One Environmental Site Assessment of the property and the results are reported under separate cover.

It is our understanding that the residential addition will be an approximate 8.9 m by 15.8 m rectangular shaped structure with a basement extending westward from the west exterior wall of the existing building at 68 Sweetland Avenue. Based on available design plans and profiles, the design elevation of the ground floor will be at Elevation 69.70 m and the basement floor will be at design elevation of Elevation 66.75 m. The design elevation of the final site grades was not available at the time of this geotechnical investigation. However, it is expected that the final site grades will generally match the existing grades and minimum grade raise will be required at the site as part of the proposed development.

The geotechnical investigation for this project consists of two (2) boreholes (Borehole Nos. 1 and 2) drilled to termination and cone refusal depths of 6.7 m and 15.8 m respectively. A monitoring well was installed in Borehole No. 2 for the purpose of monitoring the groundwater level over time.

The borehole information indicates the subsurface conditions consist of fill to a 1.4 m depth (Elevation 67.0 m) underlain by firm to hard native clay and clayey silt to a 13.7 m depth (Elevation 54.7 m) followed by compact glacial till. Boulders or bedrock are inferred at a 15.8 m depth (Elevation 52.6 m). The groundwater level is at a 5.4 m depth (Elevation 63.0 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 D.** The subsurface soils are not susceptible to liquefaction during a seismic event. A higher site class may be obtained by conducting a shear wave velocity soundings survey of the site.

Since the site is located in a well-established developed area of the city of Ottawa, raising the grades at the site is not anticipated as part of the proposed development. However, for purposes of this geotechnical investigation, a maximum grade raise of 0.5 m has been assumed for this project.

Based on a review of the borehole information and design plans and profiles, 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 clay to a maximum depth of 2.5 m below existing grade (Elevation 66.0 m and Elevation 65.9 m). The existing fill is not considered suitable to support the footings for the proposed building addition. For strip footings having a maximum width of 1.0 m and square pad footings having a maximum width and length of 3.0 m founded on the native clay to a maximum depth of 2.5 m below existing grade (Elevation 66.0 m and Elevation 65.9 m), the footings may be designed for a bearing pressure at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 225 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 very stiff to hard 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 would be

greater than 0.5 m, EXP should be contacted to review and provide updated SLS and factored ULS values for the footings.

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 basement floor slab and footings for the new building addition be placed at the same depth as the existing lowest floor slab and the existing footings. This is valid for the footings, provided the native clay exposed at the same level as the bottom of the existing footings is capable of supporting the bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) recommended above for the footings.

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 basement floor may be designed as a slab-on-grade set on the native very stiff to hard clay or on a minimum 300 mm thick engineered fill pad placed on the native clay and should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II compacted to 98 percent standard Proctor maximum dry density (SPMDD). The existing fill is not considered suitable to support the slab-on-grade and should be excavated and removed down to the native clay from 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 or native clay. 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. An underfloor drainage system is not required for the proposed building addition.

The subsurface basement walls of the building should be backfilled with free draining material, such as OPSS Granular B Type II compacted to 95 percent SPMDD and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The walls should be designed to resist lateral earth pressure (force) for the static and seismic conditions.

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. If side slopes noted above 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 addition construction would have to be undertaken within the confines of an engineered support system (shoring system).

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.

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.

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 existing residential building at the address of 68 Sweetland Avenue, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal number: OTT-22005690-A0 dated February 28, 2022. Authorization to proceed with this investigation was provided by Smart Living Properties via the EXP work authorization signed April 22, 2022. In conjunction with this geotechnical investigation, EXP completed a Phase One Environmental Site Assessment of the property and the results are reported under separate cover.

It is our understanding that the residential addition will be an approximate 8.9 m by 15.8 m rectangular shaped structure with a basement extending westward from the west exterior wall of the existing building at 68 Sweetland Avenue. Based on available design plans and profiles, the design elevation of the ground floor will be at Elevation 69.70 m and the basement floor will be at design elevation of Elevation 66.75 m. The design elevation of the final site grades was not available at the time of this geotechnical investigation. However, it is expected that the final site grades will generally match the existing grades and minimum grade raise will be required at the site as part of the proposed development.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil conditions and groundwater levels at two (2) boreholes located on the site,

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 the lateral earth pressure (static and seismic conditions) against basement walls,

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

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

i) 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 is located in a well-established, developed area of the City of Ottawa. The site is a rectangular-shaped property bounded along the east side by Sweetland Avenue, and residential properties to the north, south and west. The site is currently occupied by a multiple unit residential building with parking in the rear. A small retaining wall less than 1.0 m in height exists along the south property line.

The proposed building addition is planned to be located in the current parking area on the west side (rear) of the existing building.

The topography of the site is relatively flat, gradually sloping down from west to east from an approximate elevation of Elevation 68.4 m to Elevation 67.2 m based on the topographical survey plan of the site dated November 28,2019 and prepared by Annis, O'Sullivan, Vollebekk Ltd. (AOV).

3. Procedure

The borehole fieldwork for the geotechnical investigation was completed on May 31,2022 and consists of two (2) boreholes (Borehole Nos. 1 and 2) drilled to termination and cone refusal depths of 6.7 m and 15.8 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 November 28, 2019 and prepared by AOV. Therefore, the borehole ground surface elevations and the elevations of the soil boundaries and groundwater level shown in the borehole logs should be considered 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. 1, a dynamic cone penetration test (DCPT) was conducted from auger refusal at 14.9 m to a cone refusal depth of 15.8 m below ground surface.

A 38 mm diameter monitoring well (with 1.5 m slotted section) was installed in Borehole No. 2 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 monitoring well.

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 .....16 tests

Natural Unit Weight Determination.....4 tests

Grain Size Analysis.....3 tests

Atterberg Limits.....1 tests

Chemical Analysis (pH, sulphate and chloride) .....1 test

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 and 4. 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 Granular Fill

A surficial 100 mm and 150 mm thick granular layer was contacted in both boreholes.

The results from the grain-size analysis conducted on one (1) sample of the granular fill is summarized in Table I. The grain-size distribution curve is shown in Figure 5.

Table I: Summary of Grain-size Analysis Results – Granular Fill Sample

Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)			Soil Classification (USCS)
		Gravel	Sand	Silt and Clay	
BH1 – SS1	0.0 – 0.1	26	59	15	Silty Sand with Gravel (SM)

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

4.2 Fill

In both boreholes, the granular fill is underlain by heterogeneous fill that extends to a 1.4 m depth (Elevation 67.0 m) in both boreholes. The fill consists of a silty sand to silty clay to a mixture of silty sand and silty clay with gravel, topsoil inclusions and concrete and wood fragments. The standard penetration test (SPT) N values of the fill range from 3 to 23 indicating the fill is in a very loose to compact state. The moisture content of the fill is 16 percent to 41 percent. The unit weight of the fill is 18.4 kN/m^3.

4.3 Clay

Native clay was encountered beneath the fill in both boreholes at 1.4 m depth (Elevation 67.0 m) and extends to a 7.5 m depth (Elevation 60.9 m) in Borehole No. 1. Borehole No. 2 terminated within the clay at a 6.7 m depth (Elevation 61.7 m). The clay consists of an upper desiccated brown clay crust to approximate 3.7 m and 5.9 m depths (Elevation 64.7 m and Elevation 62.5 m) underlain by an un-desiccated grey clay. The undrained shear strength of the brown clay crust ranges from 120 kPa to 250 kPa indicating the clay has a very stiff to hard consistency. The sensitivity values of the brown clay are 4.0 to 6.0 indicating the clay is sensitive. The lower grey clay has an undrained shear strength of 43 kPa and 72 kPa indicating the grey clay has a firm to stiff consistency. The sensitivity values of the grey clay range from 3.8 to 9.0 indicating the clay is sensitive to extra-sensitive.

The natural moisture content and unit weight of the brown clay crust is 34 percent to 74 percent and 16.8 kN/m^3 to 17.6 kN/m^3 respectively. The natural moisture content of the grey clay is 59 and 68 percent.

The results from the grain-size analysis and Atterberg limit determination conducted on one (1) sample of the brown clay crust is summarized in Table II. The grain-size distribution curve is shown in Figure 6.

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

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	1	99	46	64	31	33	Clay of High Plasticity (CH)

Based on a review of the results of the grain-size analysis and Atterberg limits, the soil may be classified as a clay of high plasticity (CH) in accordance with the USCS.

4.4 Clayey Silt

The clay in Borehole No. 1 is underlain by clayey silt that extends to a 13.7 m depth (Elevation 54.7 m). The clayey silt exhibits slight plasticity. The undrained shear strength of the clayey silt is 62 kPa and 101 kPa indicating the clayey silt has a stiff to very stiff consistency. The sensitivity values of the clayey silt are 3.7 and 4.7 indicating the clayey silt is medium sensitive to sensitive. The natural moisture content of the clayey silt ranges from 28 percent to 42 percent.

The results from the grain-size analysis conducted on one (1) sample of the clayey silt is summarized in Table III. The grain-size distribution curve is shown in Figure 7.

Table III: Summary of Results from Grain-Size Analysis - Clayey Silt Sample					
Borehole (BH) No. – Sample (SS) No.	Depth (m)	Grain-Size Analysis (%)			
		Gravel	Sand	Fines (Silt and Clay)	Soil Classification (USCS)
BH 1 – SS7	7.6 – 8.2	0	15	85	Clayey Silt with Sand (ML)

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

4.5 Glacial Till

Glacial till was contacted in Borehole No.1 below the clayey silt at a 13.7 m depth (Elevation 54.7 m). The glacial till is a silty sand with gravel and possible cobbles and boulders. The SPT N value of the glacial till is 14 indicating the glacial till is in a compact state. The natural moisture content of the glacial till is 8 percent.

4.6 Inferred Boulders or Bedrock

A dynamic cone penetration test (DCPT) was conducted in Borehole No. 1 from a 14.9 m auger refusal depth to cone refusal at a 15.8 m depth (Elevation 52.6 m). Cone refusal may have been met on inferred boulders or bedrock.

4.7 Groundwater Level

The groundwater level was measured in the monitoring well installed in Borehole No. 2 on June 7, 2022 (7 days after drilling) and indicates the groundwater level was at a 5.4 m depth (Elevation 63.0 m).

Groundwater levels were determined in the borehole 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 D**.

A higher site class may be obtained by conducting a shear wave velocity soundings survey of the site.

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.

Since the site is located in a well-established developed area of the city of Ottawa, major grade raise is not anticipated to be required at the site as part of the proposed building addition development. However, for purposes of this geotechnical investigation, a maximum grade raise of 0.5 m has been assumed for this project.

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 available design plans and profiles of the proposed building addition indicate the design elevation of the ground floor will be at Elevation 69.70 m. The basement floor will be at design elevation of Elevation 66.75 m which is approximately 1.6 m and 1.7 m below existing grade.

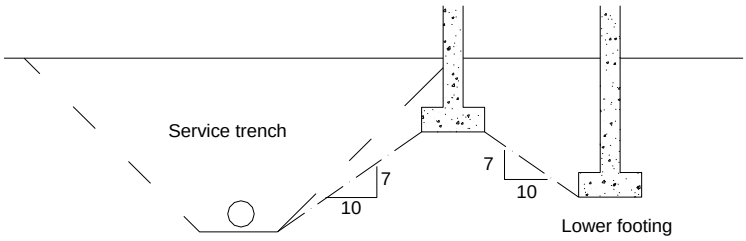
Based on a review of the borehole information, it is considered feasible to support the proposed building addition by strip and spread footings founded in the upper 1.0 m of the native brown clay to a maximum depth of 2.5 m below existing grade (Elevation 66.0 m and Elevation 65.9 m). The existing fill is not considered suitable to support the footings for the proposed building addition. For strip footings having a maximum width of 1.0 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 66.0 m and Elevation 65.9 m), the footings may be designed for a bearing pressure at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 225 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.

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 basement floor slab and footings for the new building addition be placed at the same depth as the existing lowest floor slab and the existing footings. This is valid for the footings, provided the native clay exposed at the same level as the bottom of the existing footings is capable of supporting the bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) recommended above for the 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 basement floor will be set at Elevation 66.75 m and based on the borehole information, the subgrade at this elevation will consist of the native very stiff to hard clay. The basement floor may be designed as a slab-on-grade set on the native very stiff to hard clay or on a minimum 300 mm thick engineered fill pad placed on the native clay and should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II compacted to 98 percent standard Proctor maximum dry density (SPMDD). 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 or native clay. 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.

The groundwater level is at a 5.4 m depth (Elevation 63.0 m) and is approximately 3.8 m below the basement floor of the proposed building addition. Since the perimeter drainage system for the new building addition will be above the groundwater level, the perimeter drainage system is not anticipated to lower the groundwater level over the long-term. Therefore, the perimeter drainage system is not anticipated to induce settlement of neighboring structures and infrastructure from a groundwater level perspective.

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. Lateral Earth Pressure on Subsurface Walls

The subsurface basement walls of the building addition should be backfilled with free draining material, such as OPSS Granular B Type II compacted to 95 percent SPMDD and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The walls will be subjected to lateral static and dynamic (seismic) earth forces. The expressions below assume free draining backfill material, a perimeter drainage system, level backfill surface behind the wall and vertical face on the back side of the wall.

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

$$P = K_0\, h\, (½\, \gamma h + q)$$

where P = lateral earth thrust acting on the subsurface wall, kN/m

K_0 = lateral earth pressure at rest coefficient, assumed to be 0.5 for Granular B Type II backfill material

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

h = depth of point of interest below top of backfill, m

q = surcharge load stress, kPa

The lateral dynamic thrust may be computed from the equation given below:

$$\Delta_{Pe} = \gamma H^2 \frac{a_h}{g} F_b$$

where Δ_{Pe} = dynamic thrust in kN/m of wall

H = height of wall, m

γ = unit weight of backfill material = 22 kN/m^3

$\frac{a_h}{g}$ = earth pressure coefficient = 0.32 for Ottawa area

F_b = thrust factor = 1.0

The dynamic thrust does not take into account the surcharge load. The resultant force of the lateral dynamic thrust acts approximately at 0.63H above the base of the wall.

All subsurface walls should be properly waterproofed.

10. Excavation and De-Watering Requirements

10.1 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.

10.2 Excavations

Excavations for the construction of the proposed building addition foundations are anticipated to extend a maximum of 2.5 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 heavy equipment capable of removing any construction debris within the fill (such as wood and concrete pieces).

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 3H:1V to 2H:1V from the bottom of the excavation.

If side slopes noted above 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 addition construction would have to be undertaken within the confines of an engineered support system (shoring system).

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

A pre-construction condition survey of buildings and infrastructure within the influence zone of the construction should be undertaken prior to start of construction activities.

It is recommended that vibration monitoring be conducted at the site and at adjacent existing buildings and infrastructure during the installation of the shoring system and during construction of the new building addition to ensure the existing structures and infrastructure are not damaged as a result of the construction activities.

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.

10.3 De-Watering Requirements

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. 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.

Since the excavations are anticipated to be above the groundwater level, the dewatering of excavations on site during the short-term construction operations is not expected to induce settlement adjacent existing structures and infrastructure.

If less than 50 m^3 of water are to be pumped per day, no permits are required. If between 50 m^3 and 400 m^3 of water is to be pumped per day, then the activity should be registered on the Environmental Activity and Sector Registry (EASR), an online registry maintained by the Ministry of the Environment, Conservation and Parks (MECP). If more than 400 m^3 of water is to be pumped per day, then a Category 3 Permit to Take Water (PTTW) is required.

Since water taking can be groundwater, storm water, or a combination of both, the most likely potential for significant volumes of water requiring removal from an excavation at the site is storm water. If a major rain event occurs while a large excavation is open, then it is possible that the total accumulation of water within the excavation will exceed 50 m^3. If that occurs, then it may be removed without a permit by pumping over several days during which no single-day water-taking is more than 50 m^3. Alternatively, a maximum of 400 m^3 of water may be pumped per day once the online EASR application form is filled out and the fee is paid. The EASR application may be completed by the property owner or their delegate. EXP would be pleased to assist with the EASR, should it be deemed necessary. Per the terms of the EASR, the total quantities of water actually removed from the excavation must be reported to the MECP.

A scenario whereby a Category 3 PTTW would be required is not anticipated for this project. 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.

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

The material to be excavated from the site will comprise of fill and native clay. Portions of the fill (free of topsoil and debris) may be re-used as backfill material in the landscaped areas, subject to additional geotechnical evaluation and testing at the time of construction. 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.

12. Subsurface Concrete Requirements

Chemical tests limited to pH, chloride and sulphate determination were performed on one (1) sample of the brown clay soil sample. The laboratory certificate of analysis is attached in Appendix A and the results are summarized in Table IV below.

Table IV: Results of pH, Chloride and Sulphate Tests on Soil Sample

Borehole No. (Sample No.)	Depth (m)	Soil Type	pH	Sulphate (%)	Chloride (%)
BH 2 – SS4	3.0 -3.6	Native Brown Clay	7.36	0.0048	0.0072

The test results indicate the native brown clay has a sulphate content of less than 0.1 percent. This concentration of sulphate in the native brown clay 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.

13. 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.

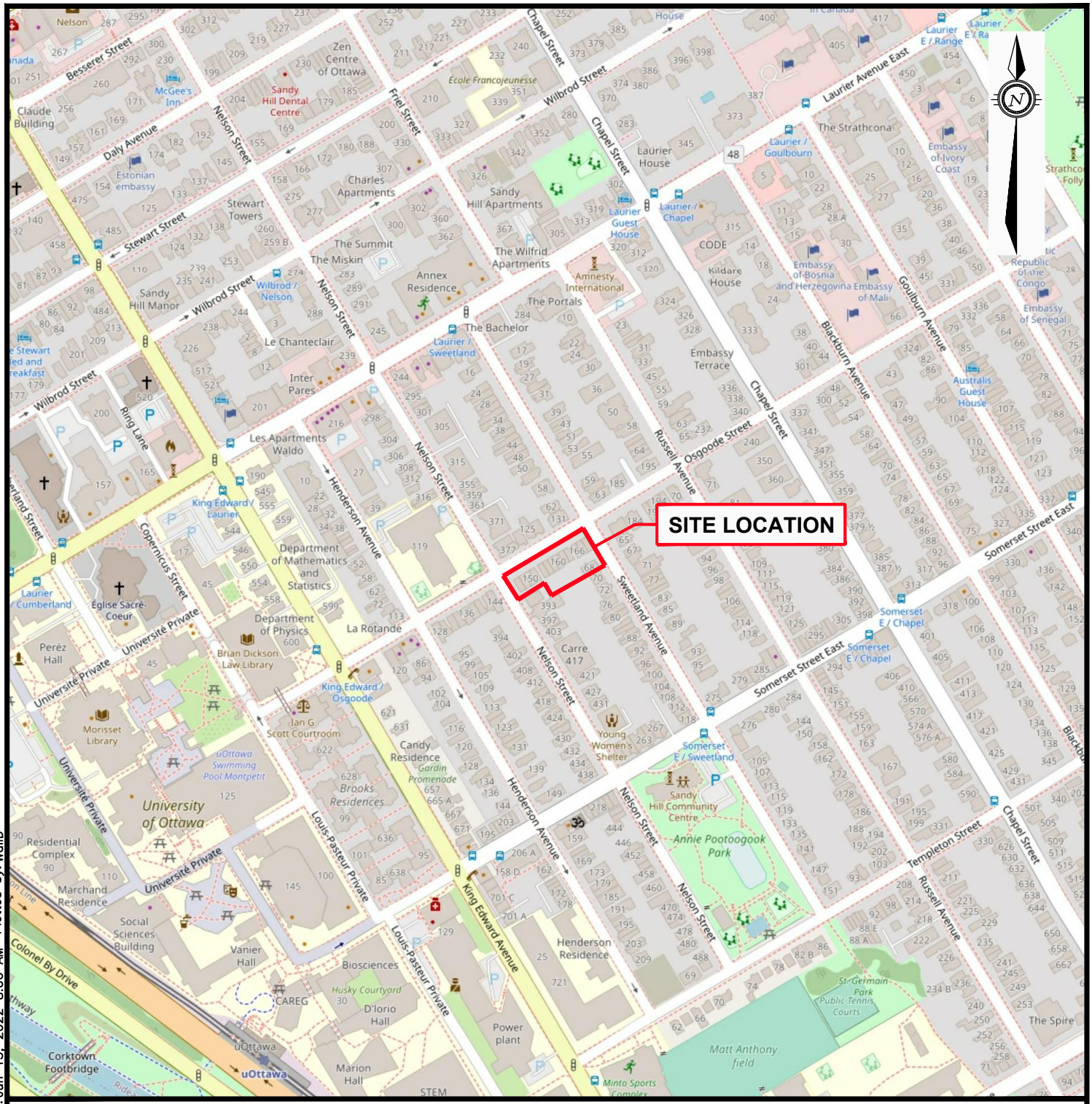
We trust that the information contained in this report is satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely,

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

Susan M. Potyondy P.Eng.
Senior Project Manager
Earth and Environment

Figures



EXP Services Inc. **www.exp.com**
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2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE: JUNE 2022	CLIENT: SMART LIVING PROPERTIES	project no.: OTT-22005690-A0
DESIGN: MZ / CHECKED: IT	GEOTECHNICAL INVESTIGATION	scale: 1:7,500
DRAWN BY: AS	TITLE: SITE LOCATION PLAN 68 SWEETLAND AVENUE, OTTAWA, ON	FIG 1

Filename: E:\OTT\OTT-22005690-A0\60 Execution\65 Drawings_Geot\22005690-A0_Geo.dwg
Last Saved: Jun 1, 2022 10:39 AM Last Plotted: Jun 15, 2022 8:06 AM Plotted by: WallD

rue Osgoode St.

av. Sweetland Ave.

rue Nelson St.

146 Osgoode

156-160 Osgoode

162 Osgoode

166 Osgoode

389 Nelson Street

68 Sweetland

3200

5200

2600

2600

16617

148 sq m

100 sq m

A110

BIKE RACK

36 BIKES

BH-2/MW
(68.36)

BH-1
(68.43)

8900

35121

1500

EXISTING BUILDING

PROPOSED BUILDING ADDITION

LEGEND

PROPERTY LINE

BH-1 (68.43) — BOREHOLE LOCATION, NUMBER
APPROXIMATE ELEVATION IN METRES

BH-2/MW (68.36) — BOREHOLE + MONITORING WELL
APPROXIMATE ELEVATION IN METRES

NOTES:

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TEST HOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
4. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
5. BASE PLAN INFORMATION OBTAINED FROM W.J. JOHNSTON SURVEYING LTD DATED APRIL 28, 2020.

0 2m 4m 10m
HORIZONTAL 1:250

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2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE: JUNE 2022	CLIENT: SMART LIVING PROPERTIES		project no. OTT-22005690-A0
DESIGN: MZ / CHECKED: IT		GEOTECHNICAL INVESTIGATION	scale 1:250
DRAWN BY: AS	TITLE: BOREHOLE LOCATION PLAN	68 SWEETLAND AVENUE, OTTAWA, ON	FIG 2

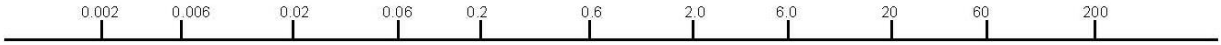
Filename: E:\OTT\OTT-22005690-A0\60 Execution\65 Drawings_Geot\22005690-A0_Geo.dwg
Last Saved: Jun 1, 2022 10:39 AM Last Plotted: Jun 15, 2022 8:05 AM Plotted by: WallD

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-22005690-A0

Project: Proposed Addition to Residential Building

Location: 68 Sweetland Avenue, Ottawa, Ontario

Figure No. 3

Page. 1 of 2

Date Drilled: 'May 31, 2022

Drill Type: CME-45 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
			68.43	0
		GRANULAR FILL ~ 100 mm thick Silty sand with gravel, brown, moist	68.3	
		FILL Silty sand, with gravel, trace clay, topsoil inclusions, brown, moist, (loose)	67.7	1
		FILL Silty clay, trace of gravel, brown, moist, (loose)	67.0	
		CLAY Brown, moist to wet, (very stiff to hard)		2
			64.7	3
		CLAY Grey, moist to wet, (firm to stiff)		4
				5
				6
				7
		CLAYEY SILT With sand, exhibits slight plasticity, grey, wet, (stiff to very stiff)	60.9	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)

SAMPLES	Natural Unit Wt. kN/m³	Standard Penetration Test N Value	Shear Strength	Combustible Vapour Reading (ppm)	Natural Moisture Content % Atterberg Limits (% Dry Weight)
SS1		6		×	
SS2	18.4	9		×	
SS3	17.6	8	150 kPa ▲	×	
			210 kPa + s=4.2		
SS4		2		×	
			43 kPa + s=9.0		
SS5		2		×	
			72 kPa + s=3.8		
SS6		2		×	
			72 kPa + s=4.3		
SS7		Hammer Weight		×	
			62 kPa + s=3.7		
SS8		Hammer Weight		×	

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-22005690-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	9.8	13.7

CORE DRILLING RECORD

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

LOG OF BOREHOLE OTT-22005690 - 68 SWEETLAND AVE AND 146 OSGOODE ST BH LOGS.GPJ TROW OTTAWA.GDT 6/16/22

Log of Borehole BH-01

Project No: OTT-22005690-A0

Project: Proposed Addition to Residential Building

Figure No. 3

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Elevation m	Depth
		CLAYEY SILT With sand, exhibits slight plasticity, grey, wet, (stiff to very stiff) *(continued)*	58.43	10
		With sand seams below a 12.0 m depth		11 12 13
		GLACIAL TILL Silty sand with gravel, some clay, possible cobbles and boulders, brown, wet, (compact)	54.7	14
		Dynamic Cone Penetration Test (DCPT) conducted from 14.9 m to cone refusal at 15.8 m depth	53.5	15
		Cone Refusal at 15.8 m Depth	52.6	

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

101 kPa
s=4.7

1

14

Combustible Vapour Reading (ppm): 250 500 750

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

SAMPLES: SS9, SS10

Natural Unit Wt. kN/m³

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-22005690-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	9.8	13.7

CORE DRILLING RECORD

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

Log of Borehole BH-02

Project No: OTT-22005690-A0

Project: Proposed Addition to Residential Building

Location: 68 Sweetland Avenue, Ottawa, Ontario

Figure No. 4

Page. 1 of 1

Date Drilled: 'May 31, 2022

Drill Type: CME-45 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
		GRANULAR FILL ~ 150 mm thick Silty sand and crushed gravel, grey, moist	68.36 68.2	0
		FILL Silty sand with gravel, trace clay, topsoil inclusions, wood fragments, brown, moist, (compact)	67.7	1
		FILL Mixture of sitly sand and silty clay, some gravel, concrete fragments, brown, moist, (very loose)	67.0	2
		CLAY High plasticity, brown, moist to wet, (stiff to hard)		3
				4
			62.96	5
		CLAY Grey, moist to wet	62.5	6
			61.7	
		Borehole Terminated at 6.7 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

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	17.4
SS4	16.8
SS5	
SS6	

23 (SS1)
3 (SS2)
8 (SS3)
250 kPa
240 kPa
s=4.0
4 (SS4)
120 kPa
s=6.0
2 (SS5)
96 kPa
s=4.4
2 (SS6)

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. A 38 mm diameter monitoring well installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-22005690-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	6.7
June 7, 2022	5.4	

CORE DRILLING RECORD

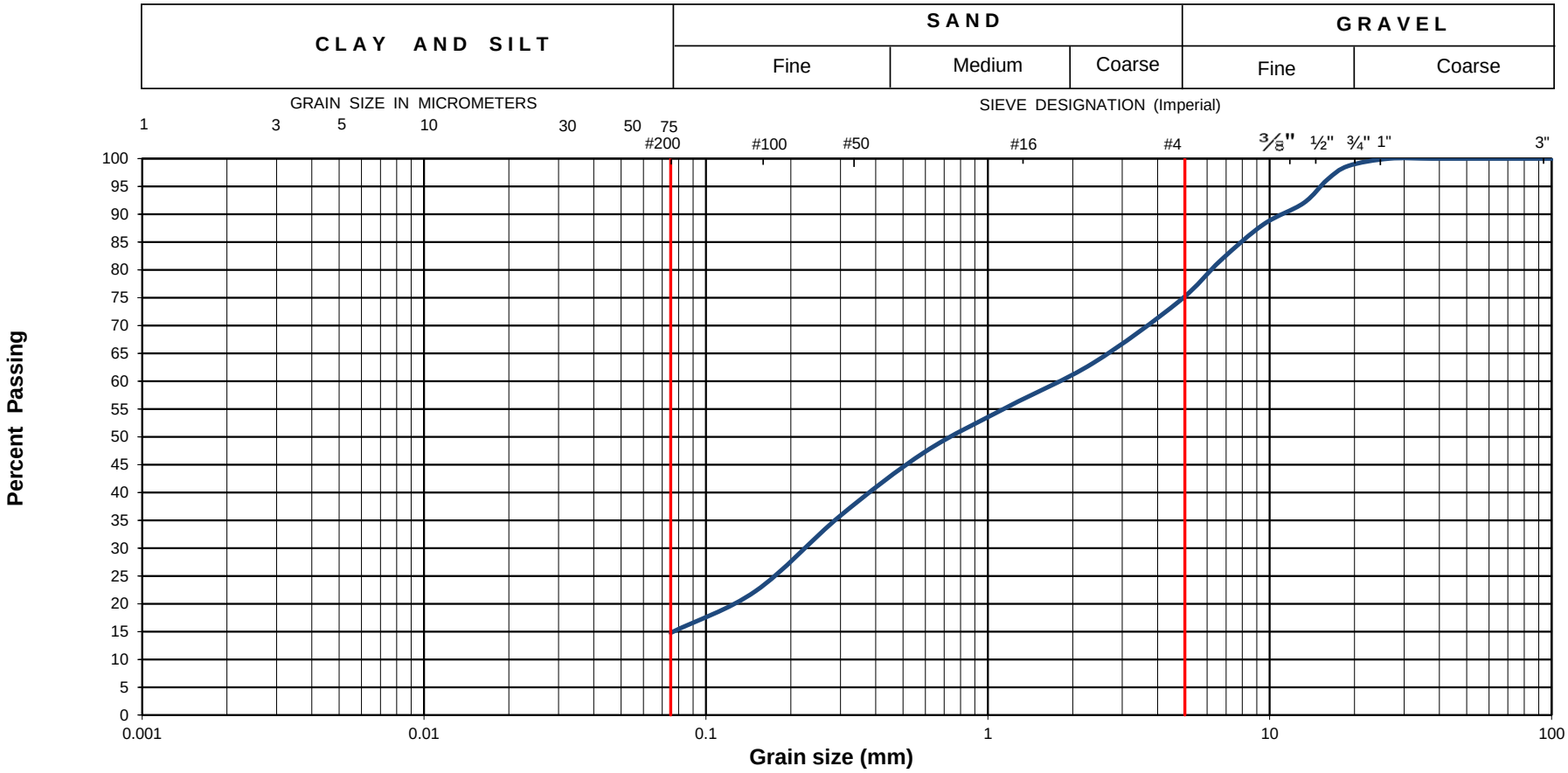
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-22005690 - 68 SWEETLAND AVE AND 146 OSGOODE ST BH LOGS.GPJ TROW OTTAWA.GDT 6/16/22

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

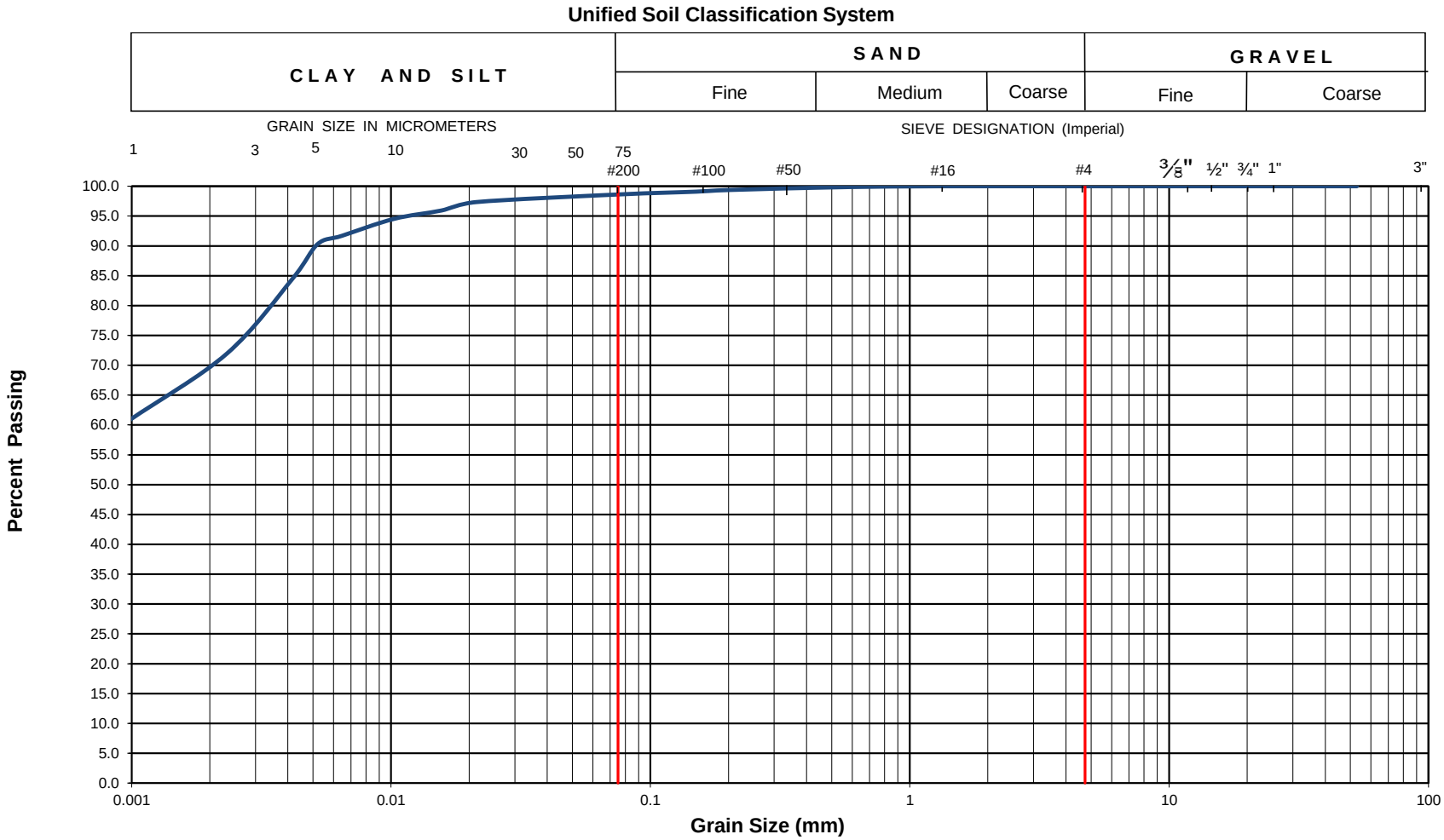
Unified Soil Classification System



EXP Project No.:	**OTT-22005690-A0**	**Project Name :**	**Proposed Addition to Residential Building**						
Client :	**Smart Living Properties**	**Project Location :**	**68 Sweetland Avenue, Ottawa, Ontario**						
Date Sampled :	**May 31, 2022**	**Borehole No:**	**BH1**	**Sample:**	**SS1**	**Depth (m) :**	**0-0.1**		
Sample Composition :		**Gravel (%)**	**26**	**Sand (%)**	**59**	**Silt & Clay (%)**	**15**	**Figure :**	**5**
Sample Description :	**GRANULAR FILL: Silty Sand with Gravel (SM)**								

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

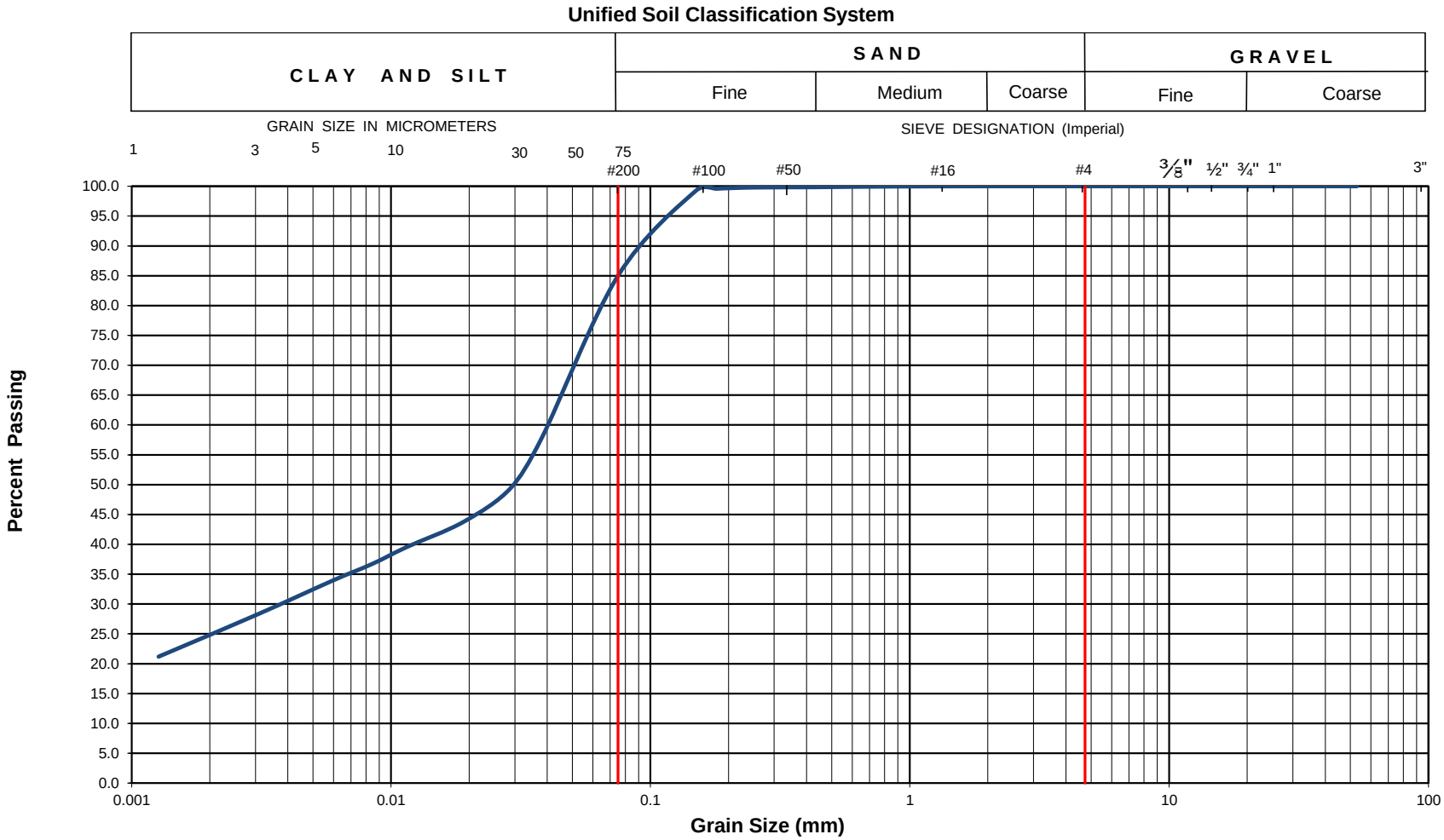
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-22005690-A0**	**Project Name :**	**Proposed Addition to Residential Building**						
Client :	**Smart Living Properties**	**Project Location :**	**68 Sweetland Avenue, Ottawa, Ontario**						
Date Sampled :	**May 31, 2022**	**Borehole No:**	**BH 2**		**Sample No.:**	**SS3**		**Depth (m) :**	**1.5-2.1**
Sample Description :		**% Silt and Clay**	**99**	**% Sand**	**1**	**% Gravel**	**0**	**Figure :**	**6**
Sample Description :		**CLAY of High Plasticity (CH)**							

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-22005690-A0**	**Project Name :**	**Proposed Addition to Residential Building**						
Client :	**Smart Living Properties**	**Project Location :**	**68 Sweetland Avenue, Ottawa, Ontario**						
Date Sampled :	**May 31, 2022**	**Borehole No:**	**BH 1**		**Sample No.:**	**SS7**		**Depth (m) :**	**7.6-8.2**
Sample Description :		**% Silt and Clay**	**85**	**% Sand**	**15**	**% Gravel**	**0**	**Figure :**	**7**
Sample Description :		**CLAYEY SILT with Sand (ML)**							

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: Matthew Zammit
PROJECT: OTT-22005690-A0
AGAT WORK ORDER: 22Z903265
SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Lab Manager
DATE REPORTED: Jun 10, 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

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

Certificate of Analysis

AGAT WORK ORDER: 22Z903265

PROJECT: OTT-22005690-A0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Matthew Zammit

SAMPLING SITE:146 Osgoode Street

SAMPLED BY:EXP

(Soil) Inorganic Chemistry

DATE RECEIVED: 2022-06-02 **DATE REPORTED: 2022-06-10**

			SAMPLE DESCRIPTION:	BH#2 SS4
			SAMPLE TYPE:	10'-12'
			DATE SAMPLED:	Soil
				2022-05-31
Parameter	**Unit**	**G / S**	**RDL**	**3938610**
Chloride (2:1)	µg/g		2	72
Sulphate (2:1)	µg/g		2	48
pH (2:1)	pH Units		NA	7.36

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

3938610 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: 22Z903265

PROJECT: OTT-22005690-A0

ATTENTION TO: Matthew Zammit

SAMPLING SITE:146 Osgoode Street

SAMPLED BY:EXP

Soil Analysis

RPT Date: Jun 10, 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															
Chloride (2:1)	3935532		85	86	1.2%	< 2	91%	70%	130%	99%	80%	120%	103%	70%	130%
Sulphate (2:1)	3935532		106	102	3.8%	< 2	98%	70%	130%	104%	80%	120%	99%	70%	130%
pH (2:1)	3935532		7.53	8.06	6.8%	NA	100%	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
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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 22Z903265

PROJECT: OTT-22005690-A0

ATTENTION TO: Matthew Zammit

SAMPLING SITE:146 Osgoode Street

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

1 Large

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: Matthew Zammit
Address: 2650 Queensview dr Unit 100
Ottawa, ON, K2B 8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: matthew.zammit@exp.com
2. 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

Laboratory Use Only

Work Order #: 22790326 5

Cooler Quantity: n/a - 1 bag
Arrival Temperatures: 23.6 | 23.5 | 23.5
LT: 2.8 | |
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

Project Information:

Project: OTT-22005690-A0
Site Location: 146 Osgoode street
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:

Sample Matrix Legend

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

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: Total PCBs ☐ Aroclor	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 ✓	Chloride ✓	Resistivity ✓	Potentially Hazardous or High Concentration (Y/N)
BH # 2 SS4 10'-12'	May 31/22	✓ AM PM	1	S																
		AM PM																		
		AM PM																		
		AM PM																		
		AM PM																		
		AM PM																		
		AM PM																		
		AM PM																		
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		AM PM																		
		AM PM																		

Samples Relinquished By (Print Name and Sign): Jeff MacMillan	Date: June 2/22	Time: 4:40	Samples Received By (Print Name and Sign): C. Cui	Date: JUN 02 2022	Time: 16h50
Samples Relinquished By (Print Name and Sign): C.C to Purolator	Date: JUN 03 2022	Time: 16h00	Samples Received By (Print Name and Sign): Avneet Minhas AM	Date: June 4/22	Time: 10:35am
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:

Page 1 of 1

N°: T 122952

Appendix B:
Legal Notification

Legal Notification

This report was prepared by EXP Services Inc. (EXP) for the account of Smart Living Properties.

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

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