Geotechnical Investigation
Proposed Additions to Residential Building
253 York Street
Ottawa, Ontario

Client:
Smart Living Properties
Attn.: Mr. Jeremy Silburt
100 Argyle Avenue, Suite 200
Ottawa, Ontario K2P 1B6
Jeremy@smartlivingproperties.ca

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Prepared By:
Athir Nader, M.A.Sc., P.Eng.
Senior Project Manager/Geotechnical Engineer, Geotechnical Services

Reviewed / Approved By:
Susan M. Potyondy, P.Eng.
Senior Project Manager, Geotechnical Services
Earth and Environment

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

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Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation recently completed for the proposed additions to the residential building located at 253 York Street, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: P839606EN dated October 8, 2020. This work was authorized by the Smart Living Properties (the client) on October 15, 2020.

It is our understanding that plans call for the design and construction of two (2) additions to be located on the north and east sides of the existing residential building. The building additions will be four (4) storeys with one (1) basement level. The design elevation of the basement slab was not available at the time of this investigation but is assumed to match that of the existing building. Design details regarding final grades of the site were also not available at the time of this geotechnical investigation. Since the site is located in a well-established developed area of Ottawa, changes to the grades at the site are not anticipated for this proposed development.

Further, we understand that the foundations of the existing residential building were recently underpinned to allow for a below grade basement beneath the existing building. The floor of the basement is located approximately 2.4 m below existing grade. Details regarding the underpinning are shown on the drawing titled, "Underpinning Plan Details and Notes -253, 255, 257 York Street, Ottawa, Ontario", Drawing No. S00.1 dated 19.12.18 and prepared by Trevitech Consulting Ltd.

The fieldwork for the geotechnical investigation was completed on November 17, 18 and 25, 2020 and consists of three (3) boreholes; Borehole Nos. 1 to 3. The boreholes were advanced to auger and dynamic cone refusal depths ranging between 11.3 m and 12.3 m below the existing ground surface. The boreholes were drilled using a truck-mounted drill rig operated by a drilling specialist subcontracted to EXP. The borehole fieldwork was supervised on a full-time basis by a representative from EXP.

The subsurface soil conditions consist of fill contacted at ground surface and extending to depths ranging from 1.7 m to 2.6 m below existing grade (Elevation 57.3 m to Elevation 56.3 m). The fill is underlain by silty clay which extends to an 8.1 m depth below ground surface (Elevation 50.9 m) in Borehole No. 1. The silty clay in Borehole No. 1 is underlain by glacial till contacted at an 8.1 m depth (Elevation 50.9 m). Auger refusal was met in Borehole No. 1 at a 12.3 m depth (Elevation 46.7 m) and cone refusal was met at 12.0 m and 11.3 m depths (Elevation 46.7 m and 47.6 m) in Borehole Nos. 2 and 3, respectively. Auger and cone refusal may have occurred on possible cobbles and/or boulders within the glacial till or on possible bedrock. The groundwater is at 5.5 m and 5.6 m depths below the existing ground surface (Elevation 53.4 m).

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.**

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

Since the site is located in a well-established developed area of Ottawa, raising the grades at the site is not anticipated as part of the proposed development. Therefore, the geotechnical engineering comments and recommendations provided in this report are based on the assumption that the proposed development will not have a site grade raise. Should this assumption be 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 additions in view of the acceptable grade raise.

The proposed building additions may be supported by a strip footing having a maximum width of 1.5 m and square pad footings having a maximum width of 2.5 m and length of 2.5 m founded on the native silty clay to a maximum depth of 3.0 m below existing grade (Elevation 56.0 m to Elevation 55.7 m). The footings may be designed for a bearing pressure at serviceability limit state (SLS) of 125 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 200 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5.

The settlement of footings designed for the above SLS bearing pressures are expected to be within the tolerable limits of 25 mm total and 19 mm differential.

The footings of the proposed new additions located immediately adjacent to the underpinned footings of the existing residential building should be located at the same elevation as the bottom of the underpinned section of the footing to eliminate the need for additional underpinning of the existing footing. This is subject to confirmation that the founding soil at the same level as the bottom of the underpinned section of the footing is capable of supporting the design SLS and factored ULS values noted above. If deeper excavation is required for the new footings located adjacent to existing underpinned footings, additional underpinning of the existing footings may be required. EXP can provide additional recommendations regarding the additional underpinning of the existing footings.

The basement floor of the proposed building additions may be designed as a slab-on-grade set on the native silty clay or on well compacted engineered fill set on the native silty clay. The existing fill is not considered suitable to support the slab-on-grade.

The engineered fill should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II to the underside of the clear stone layer and each lift compacted to 98 percent standard Proctor maximum dry density (SPMDD). The floor slab should be set on a bed of well-packed 19 mm clear stone at least 300 mm thick placed on the engineered fill or on the native silty clay subgrade. The clear stone would prevent the capillary rise of moisture from the sub-soil to the floor slab. Adequate saw cuts should be provided in the floor slabs to control cracking.

It is recommended that a perimeter drainage system be provided for the proposed building additions. Underfloor drains are not required for a basement slab located 2.4 m below existing grade.

The subsurface basement walls of the proposed building additions should be backfilled with free draining material, such as OPSS 1010 Granular B Type II and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The subsurface walls should be designed to resist lateral static and dynamic (seismic) earth forces.

It is anticipated that excavations may be undertaken using conventional equipment capable of removing construction debris within the fill (such as brick pieces). All excavation work should 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 at the site are considered to be Type 3 soil. As per OHSA, the sidewalls of open cut excavations undertaken within Type 3 soil, must be sloped back at 1H:1V from the bottom of the excavation. Within zones of persistent seepage, the excavation side slopes are expected to slough and eventually stabilize at 2H:1V to 3H:1V from the bottom of the excavation.

If the above side slopes cannot be achieved due to space restrictions on site, the proposed building additions 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).

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

- Engineered fill under the slab-on-grade area - 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 inside and outside the building – 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.

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 recently completed for the proposed additions to the residential building located at 253 York Street, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: P839606EN dated October 8, 2020. This work was authorized by the Smart Living Properties (the client) on October 15, 2020.

It is our understanding that plans call for the design and construction of two (2) additions to be located on the north and east sides of the existing residential building. The building additions will be four (4) storeys with one (1) basement level. The design elevation of the basement slab was not available at the time of this investigation but is assumed to match that of the existing building. Further, details regarding final grades of the site were also not available at the time of this geotechnical investigation. Since the site is located in a well-established developed area of Ottawa, changes to the grades at the site are not anticipated for this proposed development.

Further we understand that the foundations of the existing residential building were recently underpinned to allow for a below grade basement beneath the existing building. The floor of the basement is located approximately 2.4 m below existing grade. Details regarding the underpinning are shown on the drawing titled, "Underpinning Plan Details and Notes -253, 255, 257 York Street, Ottawa, Ontario", Drawing No. S00.1 dated 19.12.18 and prepared by Trevitech Consulting Ltd.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at the three (3) borehole locations on 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 in 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 additions, as well as anticipated total and differential settlements;

e) Discuss lateral earth pressure against subsurface walls;

f) Comment on slab-on-grade construction and permanent drainage requirements;

g) Discuss excavation conditions and dewatering requirements during construction of the foundations for the proposed building additions;

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

i) Comment on 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 residential property is located in the northwest corner of the York Street and Nelson Street intersection (Figure 1). The existing residential building occupies the majority of the site (Figure 2).

The proposed building additions will be constructed in the current gravel areas of the property on the north and east sides of the existing residential building.

The property is relatively flat with approximate ground surface elevations ranging between Elevation 59.0 m and Elevation 58.7 m at the borehole locations.

3. Procedure

The fieldwork for the geotechnical investigation was completed on November 17, 18 and 25, 2020 and consists of three (3) boreholes; Borehole Nos. 1 to 3. The boreholes were advanced to auger and dynamic cone refusal depths ranging between 11.3 m and 12.3 m below the existing ground surface. The boreholes were drilled using a truck-mounted drill rig operated by a drilling specialist subcontracted to EXP. The borehole fieldwork was supervised on a full-time basis by a representative from EXP.

The borehole locations were identified on site by EXP. The geodetic elevations of the ground surface at the borehole locations were estimated from the plan titled, "Draft Surveyor's Real Property Report – Part 1 Plan of Part of Lots 11 and 12 (south Clarence Street)Registered Plan 43586 City of Ottawa dated May 3, 2019 and prepared by Annis, O'Sullivan, Vollebekk Ltd. Therefore, the elevations indicated on the borehole logs and in this report should be considered approximate. The location and approximate geodetic elevation of the boreholes are shown on Figure 2.

Prior to the fieldwork, the locations of the boreholes were cleared of any public and private underground services. Auger samples were obtained from the ground surface to a 0.7 m depth in the three (3) boreholes. Standard penetration tests (SPTs) were performed in the boreholes at 0.75 m and 1.5 m depth intervals and the soil samples were retrieved by the split-barrel sampler. The undrained shear strength of the silty clay soil was measured by conducting penetrometer and in-situ vane tests. Dynamic cone penetration test (DCPT) was conducted in Borehole Nos. 2 and 3 from a 7.3 m depth to cone refusal depths at 11.3 m and 12.0 m below existing grade.

A 19 mm diameter standpipe with slotted section was installed in Borehole Nos. 1 and 3 for long-term monitoring of the groundwater level. The standpipe 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 the 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. On completion of the fieldwork, all the soil samples were transported to the EXP laboratory in Ottawa where they were visually examined by a geotechnical engineer and the borehole logs was prepared. The engineer also assigned the laboratory testing which consisted of performing the following tests on the soil samples:

Natural Moisture Content.....27 Tests
Natural Unit Weights.....4 Tests
Grain Size Analysis.....3 Tests
Atterberg Limits.....2 Tests
Chemical Analysis (pH, sulphate, chloride and resistivity) .....1 Test

4. Subsurface Soil and Groundwater Conditions

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

Fill was contacted at ground surface in all three (3) boreholes and extends to depths ranging from 1.7 m to 2.6 m below existing grade (Elevation 57.3 m to Elevation 56.3 m). The fill material comprises of a mixture of gravel and silty sand with some portions of the fill consisting of silt and clay. The fill contains topsoil and brick pieces in Borehole No. 1. The fill material is in a loose to compact state as indicated by the SPT N-values of 4 to 13. It has a natural moisture content ranging from 10 percent to 40 percent.

Grain size analysis was conducted on one (1) sample of the fill and the grain size distribution curve is shown in Figure 6 and the test results are summarized in Table I.

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

Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)				Soil Classification (USCS)
		Gravel	Sand	Silt	Clay	
BH-3 – SS3	1.5 – 2.1	4	28	42	26	Sandy Silt (ML) to Sandy Clay (CL)

Based on the results of the grain size analysis, the fill may be classified as a sandy silt (ML) to sandy clay (CL) in accordance with the Unified Soil Classification System (USCS).

4.2 Silty Clay (CL)

The fill in all boreholes is underlain by silty clay which extends to an 8.1 m depth below ground surface (Elevation 50.9 m) in Borehole No. 1. The silty clay has a stiff to very stiff consistency as indicated by the undrained shear strength measurements of 74 kPa to greater than 180 kPa. The silty clay is medium sensitive to sensitive based on

sensitivity values of 3.4 to 7.0, as indicated by the in-situ vane test results. The silty clay has a natural moisture content ranging from 25 percent to 60 percent.

Grain size analysis and Atterberg Limits were conducted on one (1) sample of the silty clay and the grain size distribution curve is shown in Figure 7 and the test results are summarized in Tables II and III.

Table II: Summary of Grain-size Analysis Results – Silty Clay Sample

Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)				Soil Classification (USCS)
		Gravel	Sand	Silt	Clay	
BH-1 – SS5	3.0 – 3.6	0	7	52	41	Silty Clay (CL)

Table III: Summary of Atterberg Limits Results – Silty Clay Sample

Borehole No. – Sample No.	Depth (m)	Atterberg Limits Results					Soil Classification (USCS)
		W_c (%)	LL (%)	PL (%)	PI (%)	LI	
BH-1 – SS5	3.0 – 3.6	33	36	17	19	0.9	Medium plasticity

w_c: Moisture Content, **LL**: Limit Liquid; **PL:** Plastic Limit; **PI**: Plasticity Index; **LI**: Liquidity Index; [(1)]: Refer to Casagrande Plasticity Chart (1932)

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

4.3 Glacial Till

The silty clay in Borehole No. 1 is underlain by glacial till contacted at an 8.1 m depth (Elevation 50.9 m). The glacial till consists of a silty sand with gravel and some clay. Portions of the glacial till are slightly cohesive. The glacial till may contain cobbles and boulders. The cohesionless sandy portion of the glacial till is in a loose to compact state and the cohesive clayey portion of the glacial till has a firm to stiff consistency as indicated by the SPT N-values of 4 and 13. The glacial till has a natural moisture content ranging from 8 percent to 22 percent.

Grain size analysis and Atterberg Limits were conducted on one (1) sample of the glacial till and the grain size distribution curve is shown in Figure 8 and the test results are summarized in Tables IV and V.

Table IV: Summary of Grain-size Analysis Results – Glacial Till Sample						
Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)				Soil Classification (USCS)
		Gravel	Sand	Silt	Clay	
BH-1 – SS10	9.1 – 9.7	15	42	31	12	Silty Sand with Gravel (SM)

Table V: Summary of Atterberg Limits Results – Glacial Till Sample							
Borehole No. – Sample No.	Depth (m)	Atterberg Limits Results					Soil Classification (USCS)
		W_c (%)	LL (%)	PL (%)	PI (%)	LI	
BH-1 – SS10	9.1 – 9.7	9	13	10	3	<0	Fines portion has a low plasticity
w_c: Moisture Content, **LL**: Limit Liquid; **PL:** Plastic Limit; **PI**: Plasticity Index; **LI**: Liquidity Index; (1): Refer to Casagrande Plasticity Chart (1932)							

Based on the results of the grain size analysis and Atterberg Limits, the glacial till may be classified as silty sand with gravel (SM) in accordance with the Unified Soil Classification System (USCS). The fine portion (silt and clay) of the glacial till soil matrix has a low plasticity.

4.4 Inferred Boulders or Bedrock

Auger refusal was met in Borehole No. 1 at a 12.3 m depth (Elevation 46.7 m) and dynamic cone refusal was met at 12.0 m and 11.3 m depths (Elevation 46.7 m and Elevation 47.6 m) in Borehole Nos. 2 and 3, respectively. Auger and cone refusal may have occurred on possible cobbles and/or boulders within the glacial till or on possible bedrock.

The bedrock geology map (Map 1508A – Generalized Bedrock geology, Ottawa-Hull, Ontario and Quebec, Geological Survey of Canada, printed by the Surveys and Mapping Branch, 1979) indicates the site is underlain by limestone bedrock (with some shaley partings) of the Ottawa formation.

4.5 Groundwater Level

Groundwater level measurements taken 11 and 12 days after drilling in the standpipes installed in Borehole Nos. 1 and 3 indicate the groundwater level is at 5.5 m and 5.6 m depths below the existing ground surface (Elevation 53.4 m).

Groundwater levels were determined in the boreholes at the times and under the conditions 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 susceptible to liquefaction during a seismic event.

6. Grade Raise Restrictions

Since the site is located in a well-established developed area of Ottawa, raising the grades at the site is not anticipated as part of the proposed development. Therefore, the geotechnical engineering comments and recommendations provided in this report are based on the assumption that the proposed development will not have a site grade raise. Should this assumption be 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 additions in view of the acceptable grade raise.

7. Foundation Considerations

The proposed building additions may be supported by a strip footing having a maximum width of 1.5 m and square pad footings having a maximum width of 2.5 m and length of 2.5 m founded on the native silty clay to a maximum depth of 3.0 m below existing grade (Elevation 56.0 m to Elevation 55.7 m). The footings may be designed for a bearing pressure at serviceability limit state (SLS) of 125 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 200 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5.

The settlement of footings designed for the above SLS bearing pressures are expected to be within the tolerable limits of 25 mm total and 19 mm differential.

The footings of the proposed new additions located immediately adjacent to the underpinned footings of the existing residential building should be located at the same elevation as the bottom of the underpinned section of the footing to eliminate the need for additional underpinning of the existing footing. This is subject to confirmation that the founding soil at the same level as the bottom of the underpinned section of the footing is capable of supporting the design SLS and factored ULS values noted above. If deeper excavation is required for the new footings located adjacent to existing underpinned footings, additional underpinning of the existing footings may be required. EXP can provide additional recommendations regarding the additional underpinning of the existing footings.

Footings placed at different elevations should be located such that the higher footing is set below a line drawn up at 10H:7V from the near edge of the lower footing. The lower footing should be constructed before the upper footing to prevent the latter from being undermined during subsequent construction.

It should be noted that the exposed surface of the silty clay is susceptible to disturbance due to movement of workers and construction equipment. To prevent disturbance of the founding silty clay, 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

The basement floor of the proposed building additions may be designed as a slab-on-grade set on a bed of clear stone placed on the native silty clay or on well compacted engineered fill set on the native silty clay. The existing fill is not considered suitable to support the slab-on-grade.

The engineered fill should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II to the underside of the clear stone layer and each lift compacted to 98 percent standard Proctor maximum dry density (SPMDD). The floor slab should be set on a bed of well-packed 19 mm clear stone at least 300 mm thick placed on the engineered fill or on the native silty clay subgrade. The clear stone would prevent the capillary rise of moisture from the sub-soil to the floor slab. Adequate saw cuts should be provided in the floor slabs to control cracking.

It is recommended that a perimeter drainage system be provided for the proposed building additions. Underfloor drains are not required for a basement slab located at a 2.4 m depth below existing grade.

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

9. Lateral Earth Pressure to Subsurface Walls

The subsurface basement walls of the proposed building additions should be backfilled with free draining material, such as OPSS 1010 Granular B Type II 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.

The perimeter drainage system for the proposed additions are anticipated to be above the prevailing groundwater level and as such the drainage system is not anticipated to alter (raise or lower) the prevailing groundwater level over the long-term. Therefore, the perimeter drainage system is not anticipated to adversely impact neighboring structures and infrastructure from a groundwater level perspective.

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 coefficient for 'at rest' condition for Granular B Type II backfill material = 0.50

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 seismic 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

$\frac{a_h}{g}$ = seismic coefficient = 0.32

F_b = thrust factor = 1.0

The dynamic thrust does not take into account the surcharge load. The resultant force 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 made under the Environmental Protection Act (November 28, 2019) is scheduled to be implemented on January 1, 2021. The new regulation will dictate the testing protocol that will be required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols will need to be implemented and followed based on the volume of soil to be managed. 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

The excavations for the building additions are expected to extend to a maximum depth of 3.0 m below the existing ground surface. These excavations will extend through the fill and into the native silty clay. The excavations are anticipated to be approximately 2.5 m above the groundwater level.

It is anticipated that excavations may be undertaken using conventional equipment capable of removing construction debris within the fill (such as brick pieces). All excavation work should 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 at the site are considered to be Type 3 soil. As per OHSA, the sidewalls of open cut excavations undertaken within Type 3 soil, must be sloped back at 1H:1V from the bottom of the excavation. Within zones of persistent seepage, the excavation side slopes are expected to slough and eventually stabilize at 2H:1V to 3H:1V from the bottom of the excavation.

If the above side slopes cannot be achieved due to space restrictions on site, the proposed building additions 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 survey of buildings and infrastructure within the influence zone of the construction should be undertaken prior to start of construction activities including shoring installation activity.

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 proposed building additions to ensure the existing structures and infrastructure are not damaged as a result of the construction activities and shoring installation.

Base heave type failure in the excavation is not anticipated in excavations that extend to a 3.0 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 travel on the excavated surface, such as a gradall or mechanical shovel.

Extra care should be exercised during excavation close to the existing building to prevent the undermining of existing foundations and infrastructure.

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 and Impact on Surrounding Structures and Infrastructure

Seepage of the surface and subsurface water into these excavations is anticipated. However, it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated. Therefore, the need of high capacity pumps to keep the excavation dry should not be ignored.

The excavations are anticipated to be above the groundwater level and as such the removal of groundwater from the excavation is anticipated to be minimal or not at all. Therefore, groundwater removal from the site during he short-term construction activities is not anticipated to adversely impact existing neighboring structures and infrastructure.

It has been assumed that the maximum excavation depth at the site will be approximately 3.0 m and groundwater removal is anticipated to be minimal or not at all. However, it is noteworthy to mention that new legislation came into force in Ontario on March 29, 2016 to regulate groundwater takings for construction dewatering purposes. Prior to March 29, 2016, a Category 2 Permit to Take Water (PTTW) was required from the Ontario Ministry of the Environment and Climate Change (MOECC) for groundwater takings related to construction dewatering, where taking volumes in excess of 50 m3/day, but less than 400 m3/day, and the taking duration was no more than 30 consecutive days. The new legislation replaces the Category 2 PTTW for construction dewatering with a new process under the Environmental Activity and Sector Registry (EASR). The EASR is an on-line registry, which allows persons engaged in prescribed activities, such as water takings, to register with the MOECC instead of applying for a PTTW.

To be eligible for the new EASR process, the construction dewatering taking must be less than 400 m3/day under normal conditions. The water taking can be groundwater, storm water, or a combination of both. It should be noted that the 30-consecutive day limit on the water taking under the old Category 2 PTTW process has been removed in the new EASR process. Also, it should be noted that the EASR process requires two technical studies be prepared by a Qualified Person, prior to any water taking. These studies include a Water Taking Report, which provides assurance that the taking will not cause any unacceptable impacts, and a Discharge Plan, which provides assurance that the discharge will not result in any adverse impacts to the environment. EXP has qualified persons who can prepare these types of reports, if required. A significant advantage of the new EASR process over the former Category 2 PTTW process, is that the groundwater taking may begin immediately after completing the on-line registration of the taking and paying the applicable fee, assuming the accompanying technical studies have been completed. The former PTTW process typically took more than 90 days, which had the potential to impact construction schedules.

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 consist of fill and native silty clay. These soils are not considered suitable for use under structural elements and for backfilling purposes. However, they may be used for general grading purposes in landscaped areas.

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

- Engineered fill under the slab-on-grade area - 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 inside and outside the building – 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.

12. Subsurface Concrete and Steel Requirements

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

Table VI: Chemical Test Results on Soil Sample

Borehole No. (Sample No.)	Soil Type	Depth (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (ohm-cm)
BH-1 (SS3)	Silty Clay	1.5 – 2.1	7.53	0.0782	0.0134	935

The test results indicate the sulphate and chloride content in the silty clay is 0.0782 percent and 0.0134 percent respectively.

The sulphate content is less than 0.1 percent. This concentration in the silty 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.23.1-14. However, the concrete should be dense, well compacted and cured.

Based on a review of the resistivity test result, the silty clay sample is considered corrosive to moderately 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.

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 and groundwater. Should specific information be required, including for example the presence of pollutants, contaminants or other hazards in the soil, additional testing may be required.

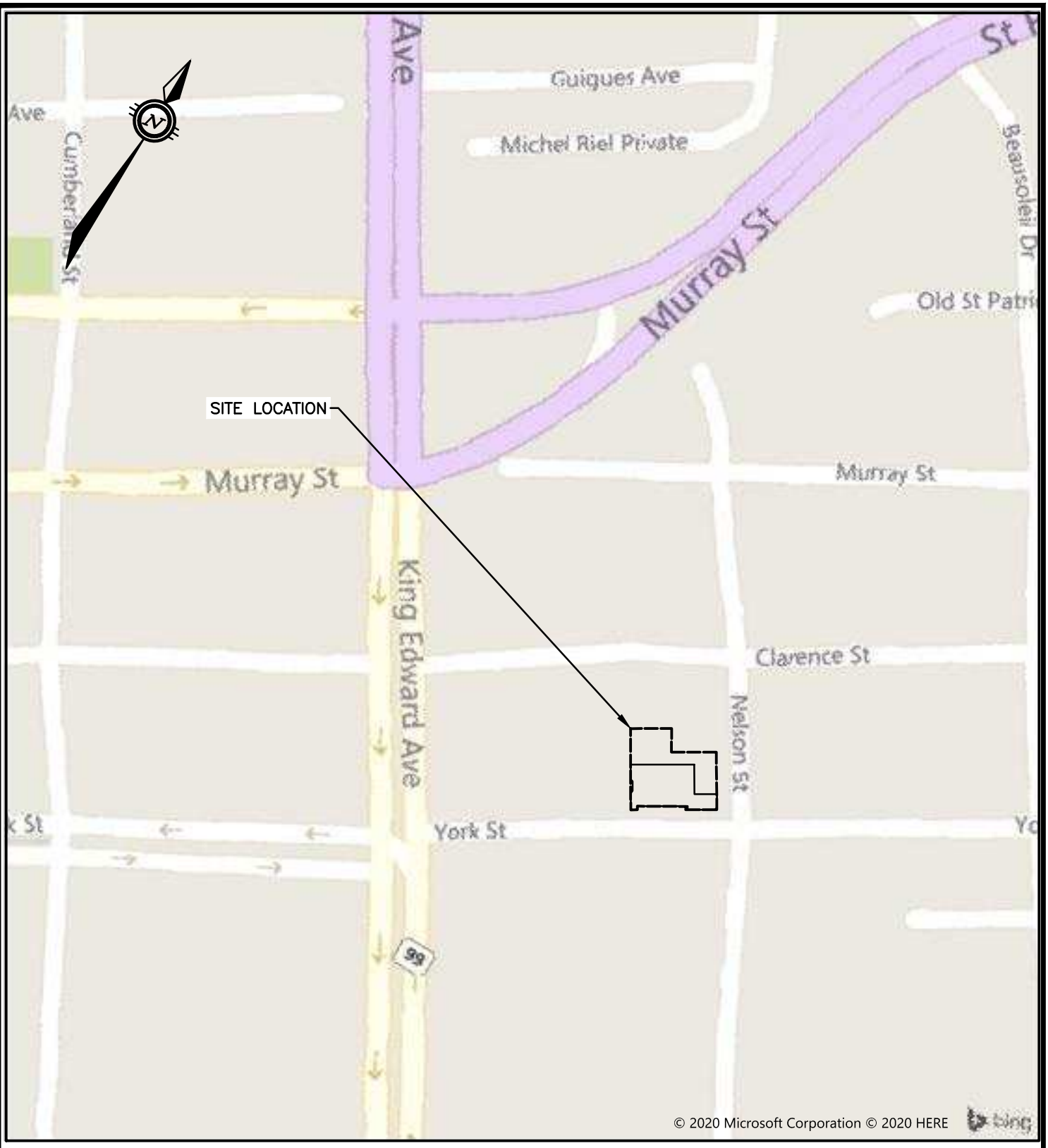
We trust that the information contained in this report is satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely.

Athir Nader, M.A.Sc., P.Eng.
Senior Project Manager, Geotechnical Services
Earth and Environment

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

Figures



0 25m 50m 100m

HORIZONTAL 1:2500

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

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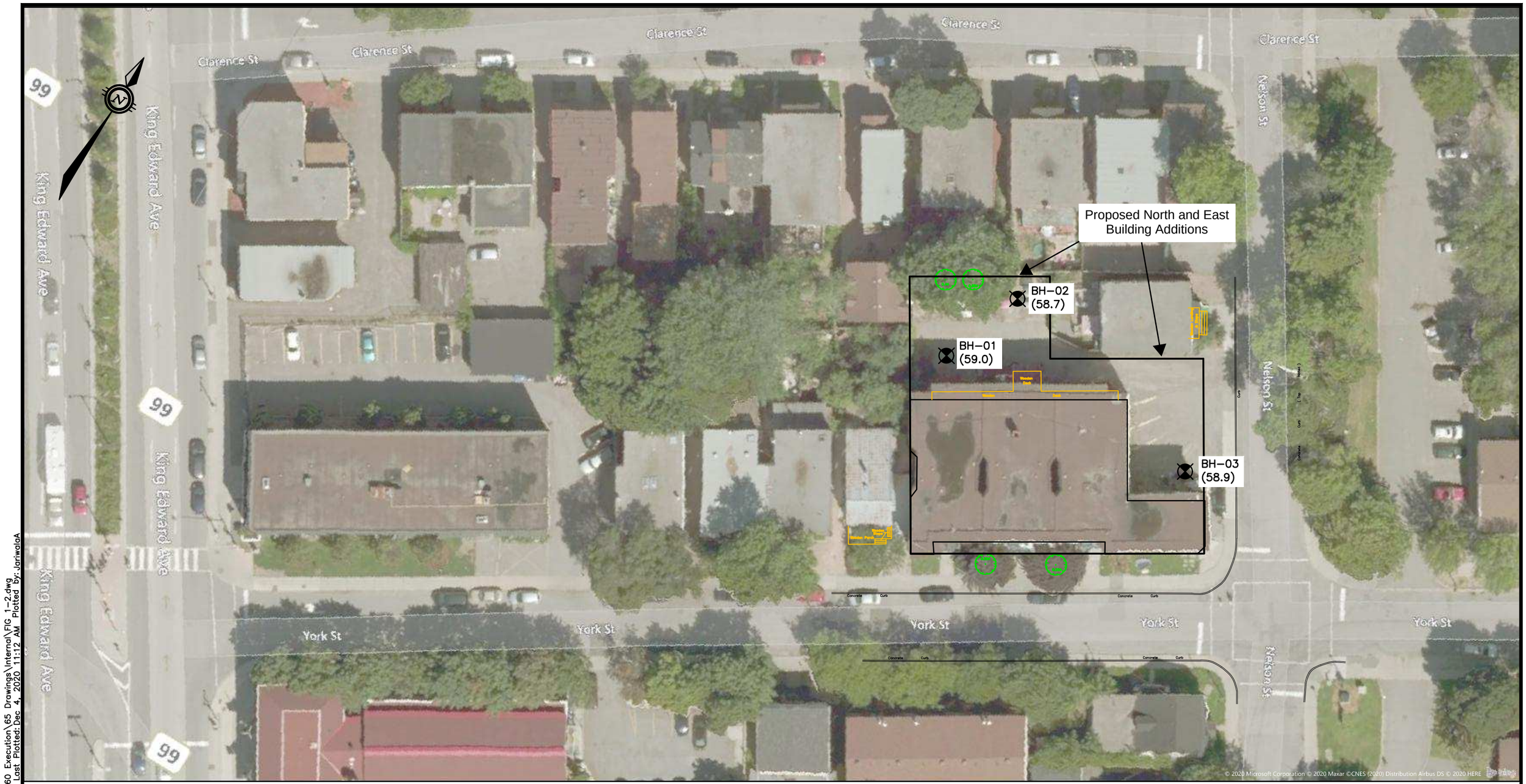
DESIGN	A.N.
DRAWN	A.J.
DATE	DEC. 2020
FILE NO	OTT-00262813-A0

Proposed Additions to Residential Building
253 York Street, Ottawa, Ontario

SITE LOCATION PLAN

SCALE 1:2500

SKETCH NO FIG 1



LEGEND

BH–01 (69.0) — BOREHOLE NO. (Approx. Ground Elevation)

NOTES

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. THEY ARE ASSUMED BETWEEN BOREHOLES 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. BOREHOLE 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.

0 5m 10m 20m
HORIZONTAL 1:500

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DESIGN	A.N.
DRAWN	A.J.
DATE	DEC. 2020
FILE NO	OTT–00262813–A0

Proposed Additions to Residential Building
253 York Street, Ottawa, Ontario

BOREHOLE LOCATION PLAN

SCALE 1:500
SKETCH NO FIG 2

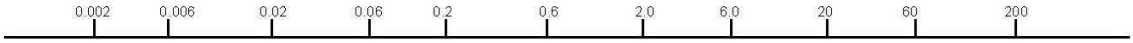
Filename: E:\OTT\OTT-00262813-A0\60 Execution\65 Drawings\Internal\FIG 1-2.dwg
Last Saved: Dec 4, 2020 11:07 AM Last Plotted: Dec 4, 2020 11:12 AM Plotted by: JariwalaA

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-1

Project No: OTT-00262813-A0

Project: Proposed Additions To Residential Building

Location: 253 York Street, Ottawa, Ontario

Figure No. 3

Page. 1 of 1

Date Drilled: 'November 17, 2020

Drill Type: Truck-Mounted Drill-Rig

Datum: Approximate Elevation

Logged by: A.Neguss Checked by: A.Nader

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

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

GWL	SYMBOL	SOIL DESCRIPTION	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
		FILL Mixture of crushed gravel and silty sand with some clay, grey, moist	59	0			AS1	
		FILL Silty sand with gravel, some topsoil and brick pieces, brown (compact)	58.2	1	13		SS2	16.3
		SILTY CLAY (CL) Medium plasticity, grey to dark grey, moist to wet, (stiff to very stiff)	57.3	2	9		SS3	17.4
				3	7; 96; 108; s=4.5		SS4	
				4	3; 90; s=3.8		SS5	
		with sand seams from 4.6 m to 8.1 m depths		5	114; s=5.3		SS6	
			53.4	6	4; >180		SS7	
		GLACIAL TILL Silty sand with gravel (SM), some clay, low plasticity, slightly cohesive, possible cobbles and boulders, light grey, wet, (loose to compact/firm to stiff)	50.9	7	2; 84; s=3.9		SS8	
				8	8		SS9	
				9	4		SS10	
				10				
				11	13		SS11	
			46.7	12	50 for 100 mm		SS12	
		Auger Refusal at 12.3 m Depth						

LOG OF BOREHOLE BH LOGS - 262813.GPJ TROW OTTAWA.GDT 1/6/21

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. 19 mm standpipe installed upon completion of the drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00262813-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion	3.0	12.2
11 Days	5.6	

CORE DRILLING RECORD

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

Log of Borehole BH-2

Project No: OTT-00262813-A0

Project: Proposed Additions To Residential Building

Location: 253 York Street, Ottawa, Ontario

Figure No. 4

Page. 1 of 1

Date Drilled: 'November 25, 2020

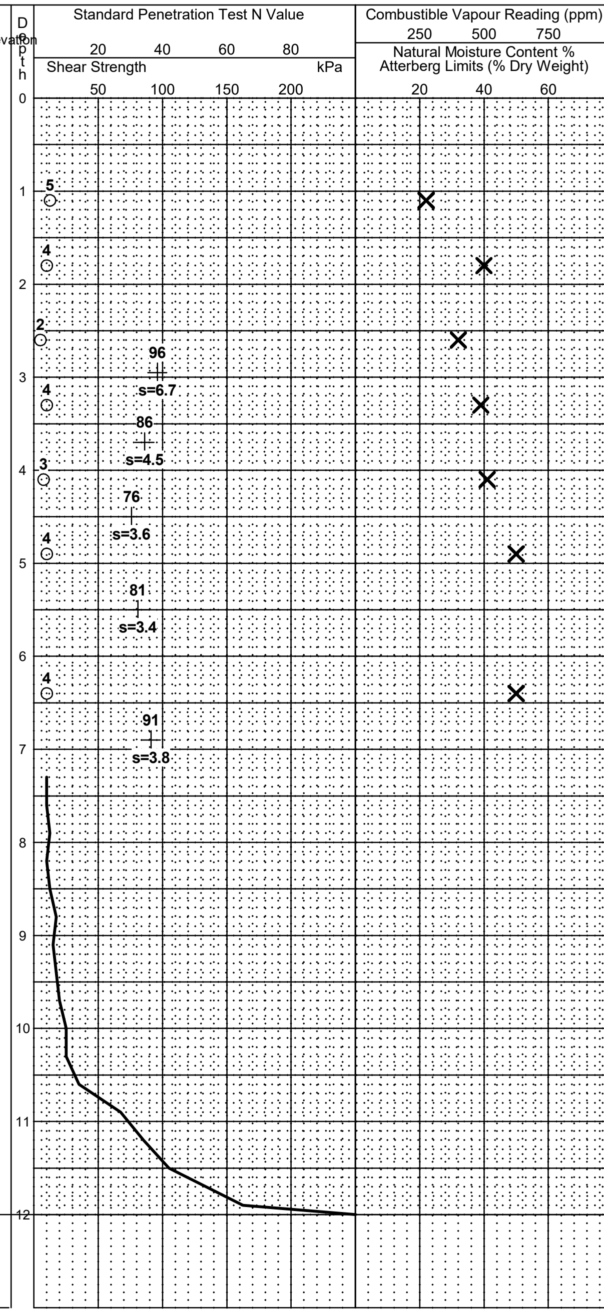
Drill Type: Truck-Mounted Drill-Rig

Datum: Approximate Elevation

Logged by: M.Leroux Checked by: A.Nader

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

SOIL DESCRIPTION	Approximate Elevation m	Depth (m)	Samples	Natural Unit Wt. kN/m³
	58.7	0		
FILL Mixture of crushed gravel and silty sand with some clay, grey, moist	57.9		AS1	
FILL Silty sand, some clay, brown, moist (loose)	57.2		SS2	
FILL Sandy silt (ML) to sandy clay (CL), grey, moist (loose)	56.4		SS3	17.4
SILTY CLAY (CL) With sand seams, grey, moist to wet, (stiff)	51.7		SS4, SS5, SS6, SS7, SS8	
Borehole advanced by conducting dynamic cone penetration test (DCPT) from 7.3 m to cone refusal at 12.0 m depth.	46.7	12		
Cone Refusal at 12.0 m Depth				



NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Borehole backfilled upon completion of the drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00262813-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion	Dry	6.1

CORE DRILLING RECORD

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

Log of Borehole BH-3

Project No: OTT-00262813-A0

Project: Proposed Additions To Residential Building

Location: 253 York Street, Ottawa, Ontario

Figure No. 5

Page. 1 of 1

Date Drilled: 'November 18, 2020

Drill Type: Truck-Mounted Drill-Rig

Datum: Approximate Elevation

Logged by: A.Neguss Checked by: A.Nader

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
		FILL Mixture of crushed gravel and silty sand with some clay, grey, moist	58.9	0			AS1	
		FILL Silty sand with gravel to silty sand, dark grey to black (loose)	58.1	1	6		SS2	
		FILL Sandy silt (ML) to sandy clay (CL), brown, moist to wet, (loose)	57.2	2	6		SS3	18.8
		SILTY CLAY (CL) Grey to dark grey, moist to wet, (stiff to very stiff)	56.3	3	3; 96; 74; s=6.2		SS4	
		with sand seams from 3.8 m to 5.2 m depths		4	2; 84; s=7.0		SS5	
				5	3; 102; s=5.7		SS6	
			53.4	6	4; 144		SS7	
				7	3; 90; s=3.8		SS8	
		Borehole advanced by conducting dynamic cone penetration test (DCPT) from 7.3 m to cone refusal at 11.3 m depth.	51.9	8				
				9				
				10				
			47.6	11				
		Cone Refusal at 11.3 m Depth						

LOG OF BOREHOLE BH LOGS - 262813.GPJ TROW OTTAWA.GDT 1/6/21

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. 19 mm standpipe installed upon completion of the drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00262813-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion		6.1
12 Days	5.5	

CORE DRILLING RECORD

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

EXP Services Inc.
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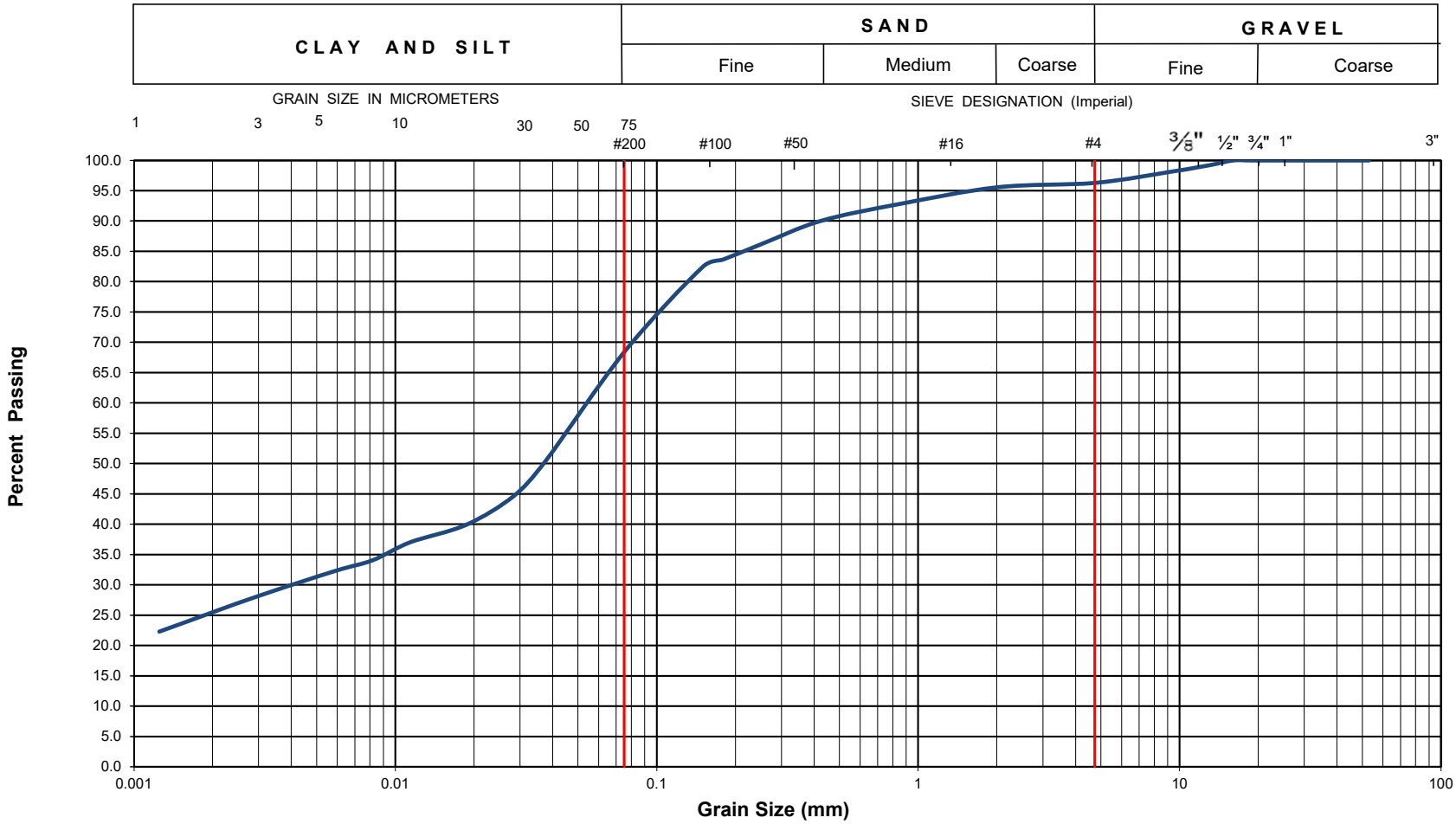
Ottawa, ON K2B 8H6

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

Unified Soil Classification System



EXP Project No.:	**OTT-00262813-A0**	**Project Name :**	**Proposed Additions To Residential Building**						
Client :	**Smart Living Properties**	**Project Location :**	**253 York Street, Ottawa, Ontario**						
Date Sampled :	**November 18, 2020**	**Borehole No:**	**BH-3**		**Sample No.:**	**SS3**		**Depth (m) :**	**1.5-2.1**
Sample Description :		**% Silt and Clay**	**68**	**% Sand**	**28**	**% Gravel**	**4**	**Figure :**	**6**
Sample Description :		**FILL: Sandy Silt (ML) to Sandy Clay (CL)**							

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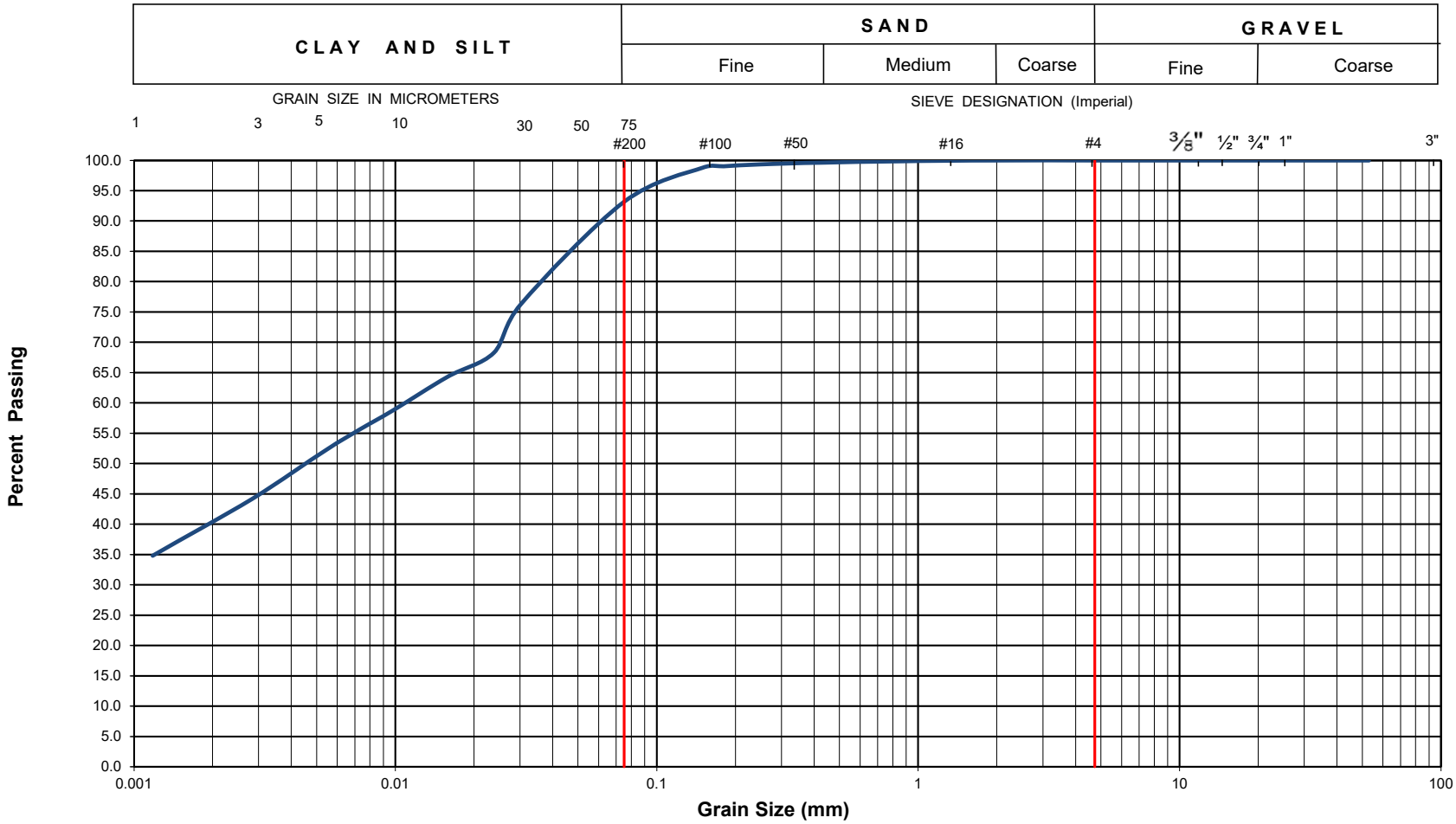
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-00262813-A0**	**Project Name :**	**Proposed Additions To Residential Building**						
Client :	**Smart Living Properties**	**Project Location :**	**253 York Street, Ottawa, Ontario**						
Date Sampled :	**November 17, 2020**	**Borehole No:**	**BH-1**		**Sample No.:**	**SS5**		**Depth (m) :**	**3.0-3.6**
Sample Description :		**% Silt and Clay**	**93**	**% Sand**	**7**	**% Gravel**	**0**	**Figure :**	**7**
Sample Description :		**Silty CLAY (CL) of Medium Plasticity**							

EXP Services Inc.
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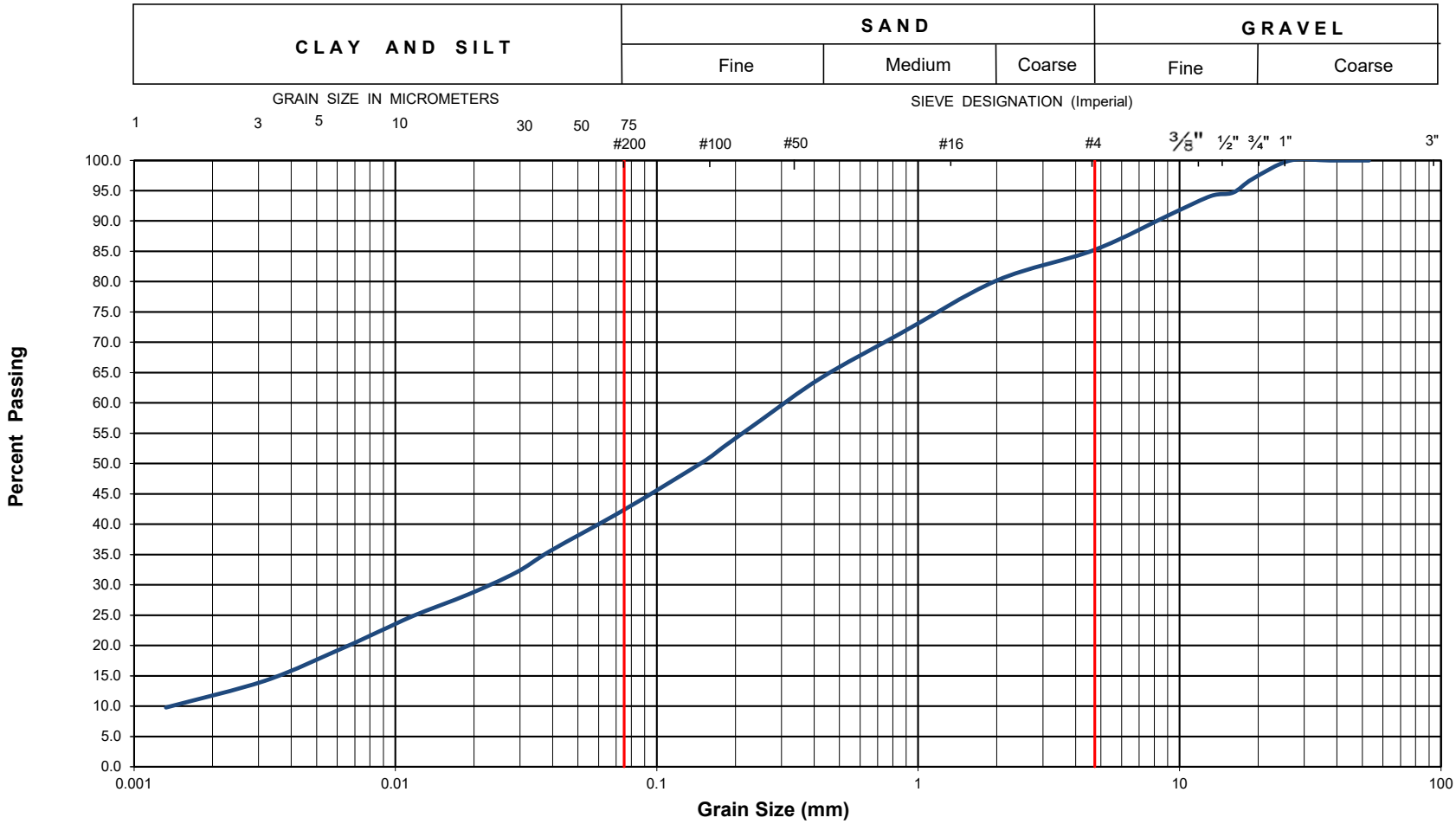
Ottawa, ON K2B 8H6

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

Unified Soil Classification System



EXP Project No.:	**OTT-00262813-A0**	**Project Name :**	**Proposed Additions To Residential Building**						
Client :	**Smart Living Properties**	**Project Location :**	**253 York Street, Ottawa, Ontario**						
Date Sampled :	**November 17, 2020**	**Borehole No:**	**BH-1**		**Sample No.:**	**SS10**		**Depth (m) :**	**9.1-9.7**
Sample Description :		**% Silt and Clay**	**43**	**% Sand**	**42**	**% Gravel**	**15**	**Figure :**	**8**
Sample Description :	**GLACIAL TILL: Silty Sand with Gravel (SM) - trace Clay; low plasticity (fine portion)**								

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: **Athir Nader**
PROJECT: **OTT-00262813-AO**
AGAT WORK ORDER: **20Z682967**
SOIL ANALYSIS REVIEWED BY: **Nivine Basily, Inorganics Report Writer**
DATE REPORTED: **Dec 03, 2020**
PAGES (INCLUDING COVER): **6**
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 following analysis, unless expressly agreed otherwise in writing. Please contact your Client Project Manager if you require additional sample storage time.*
- *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: 20Z682967

PROJECT: OTT-00262813-AO

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Athir Nader

SAMPLING SITE:York St., Ottawa

SAMPLED BY:EXP

Inorganic Chemistry (Soil)

DATE RECEIVED: 2020-11-25 **DATE REPORTED: 2020-12-03**

		SAMPLE DESCRIPTION:		BH#1 SS3 5'-7'
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2020-11-17
Parameter	Unit	G / S	RDL	1744876
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.53
Chloride (2:1)	µg/g		4	134
Sulphate (2:1)	µg/g		4	782
Resistivity (2:1) (Calculated)	ohm.cm		1	935

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

1744876 pH was determined on the 0.01M CaCl2 extract obtained from 2:1 leaching procedure (2 parts extraction fluid:1 part wet soil).

Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Dilution required, RDL has been increased accordingly.

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

Certificate of Analysis

AGAT WORK ORDER: 20Z682967

PROJECT: OTT-00262813-AO

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Athir Nader

SAMPLING SITE:York St., Ottawa

SAMPLED BY:EXP

Inorganic Chemistry (Soil) %

DATE RECEIVED: 2020-11-25 **DATE REPORTED: 2020-12-03**

		SAMPLE DESCRIPTION:		BH#1 SS3 5'-7'
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2020-11-17
Parameter	Unit	G / S	RDL	1744876
Chloride (2:1)	%		0.0004	0.0134
Sulphate (2:1)	%		0.0004	0.0782

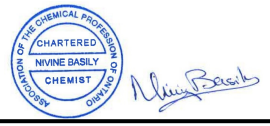
Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1744876 Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Dilution required, RDL has been increased accordingly.

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: 20Z682967

PROJECT: OTT-00262813-AO

ATTENTION TO: Athir Nader

SAMPLING SITE:York St., Ottawa

SAMPLED BY:EXP

Soil Analysis

RPT Date: Dec 03, 2020			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
Inorganic Chemistry (Soil)															
pH, 2:1 CaCl2 Extraction	1741040		7.50	7.60	1.3%	NA	100%	80%	120%						
Chloride (2:1)	1742166		96	96	0.4%	< 2	98%	70%	130%	108%	80%	120%	105%	70%	130%
Sulphate (2:1)	1742166		1410	1410	0.1%	< 2	102%	70%	130%	103%	80%	120%	NA	70%	130%
Inorganic Chemistry (Soil) %															
Chloride (2:1)	1742166		0.0096	0.0096	NA	<0.0002	98%	70%	130%	108%	80%	120%	105%	70%	130%
Sulphate (2:1)	1742166		0.141	0.141	NA	<0.0002	102%	70%	130%	103%	80%	120%	NA	70%	130%

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

Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.

Certified By:

AGAT Laboratories

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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 20Z682967

PROJECT: OTT-00262813-AO

ATTENTION TO: Athir Nader

SAMPLING SITE:York St., Ottawa

SAMPLED BY:EXP

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
pH, 2:1 CaCl2 Extraction	INOR-93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
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
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	EC METER

(medium blue ice-packs) -4.6

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)

Laboratory Use Only

Work Order #: 20Z682967

Cooler Quantity: 1

Arrival Temperatures: 20.0 | 20.0 | 20.1

Custody Seal Intact: ☐ Yes ☐ No ☑ N/A

Notes: No Coolant

Report Information:

Company: EXP Services Inc. Ottawa
Contact: Athir Nader
Address: 2650 Queensview dr. Unit 100, Ottawa, ON, K2B 8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: athir.nader@exp.com
2. Email:

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

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

☐ Sewer Use
☐ Sanitary
☐ Storm
Region ____ Indicate One
☐ MISA

☐ Regulation 558
☐ CCME
☐ 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

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

Project Information:

Project: OTT-00262813-A0
Site Location: York st., 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:

Sample Matrix Legend

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

Analysis columns: Field Filtered - Metals, Hg, CrVI (Y/N); O. Reg 153: Metals and Inorganics; ☐ All Metals ☐ 153 Metals (excl. Hydrides); ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides); ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR; Full Metals Scan; Regulation/Custom Metals; Nutrients: ☐ TP ☐ NH3 ☐ TKN ☐ NO2 ☐ NO3 ☐ NO3+NO2; Volatiles: ☐ VOC ☐ BTEX ☐ THM; PHCs F1 - F4; ABNs; PAHs; PCBs: ☐ Total ☐ Aroclors; Organochlorine Pesticides; TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs; Sewer Use; pH; sulphate; chlorides; Resistivity; Potentially Hazardous or High Concentration (Y/N)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	pH	sulphate	chlorides	Resistivity
BH #1 SS3 5'-7'	Nov.17		1	S		✓	✓	✓	✓

Samples Relinquished By (Print Name and Sign): Jeff MacMillan [signature]	Date: Nov.25/20	Time: 4:45	Samples Received By (Print Name and Sign): Jeff Jones [signature]	Date: 25Nov20	Time: 1650		
Samples Relinquished By (Print Name and Sign): VB/DHOFedEx	Date: 2020/11/26	Time: 16h00	Samples Received By (Print Name and Sign): SIMRAN [signature]	Date: Nov 27/20	Time: 11:12 am	Page 1 of 1	
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time	Nº: T101288	

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

Jeremy Silburt, Smart Living Properties; Jeremy@smartlivingproperties.ca

Jason Weatherall Smart Living Properties; jasonw@smartlivingproperties.ca