Preliminary Geotechnical Investigation
Proposed Residential Development
133 Forward Avenue, Ottawa, Ontario

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1. Table of Contents

List of Figures

List of Tables

List of Appendices

Executive Summary

Introduction

EXP Services Inc. (EXP) is pleased to present the results of the preliminary geotechnical investigation completed for the proposed residential development to be located at the property registered by the street address of 133 Forward Avenue, Ottawa, Ontario. (Figure 1). Terms and conditions of this project were outlined in EXP's proposal dated August 6, 2025. Authorization to proceed with the work was provided by Marc-Alexander Shank on behalf of In Harmony Developments Inc. via exp signed work authorization dated August 6, 2025

Proposed Development

It is our understanding that it is proposed to develop the subject site with a 4-storey residential apartment building with one basement level. Design drawings showing elevation of underside of footing, finished floor level, and exterior site grades were not available at the time of this geotechnical investigation.

EXP completed Phase One and Two Environmental Site Assessments (ESAs) at this site in conjunction with this geotechnical investigation and the reports are provided under separate covers.

Fieldwork Program

The fieldwork for the geotechnical investigation was undertaken on September 2, 2025 and comprised the drilling of four (4) boreholes (Borehole Nos. 25-01 to 25-04) to termination and auger refusal depths of 0.2 m to 4.8 m below existing grade (i.e Elevation 62.3 m to 57.7 m). The fieldwork was supervised on a full-time basis by a representative from EXP. A 50 mm diameter monitoring well was installed in Borehole Nos. 25-01 and 25-02 for long-term monitoring and sampling of the groundwater.

Subsurface Conditions

The borehole information indicates the subsurface conditions at the site to consist of asphalt or topsoil overlying shallow deposit of silty sand and gravel fill that extends to 0.2 m to 0.9 m depths (Elevation 62.5 m to Elevation 61.5 m). The shallow overburden is underlain by limestone bedrock contacted at 0.3 m and 0.9 m depths (Elevation 62.5 m and Elevation 61.5 m). The groundwater level was measured at depths of 3.2 m and 3.0 m depths (Elevation 59.21 m to Elevation 59.82 m), 17 days following the completion of drilling, on September 19, 2025.

Geotechnical Engineering Comments and Recommendations

Site Grade Raise

Since compressible clay was not encountered on the site, there is no restriction to raising the grades at the site from a geotechnical perspective.

Site Classification

Based on the above assumptions and currently available information, the Site Class for the proposed structure is "C" as per Table 4.1.8.4.-A and Table 4.1.8.4.-B, OBC 2024. According to Section A-4.1.8.4 of OBC 2024, the in-situ measurements of shear wave velocity can be utilized to lower the demand in the seismic design. Therefore, field shear wave velocity measurements are recommended to be performed through non-intrusive (e.g. multichannel analysis of surface waves) and / or intrusive (e.g. downhole / cross hole techniques, or SCPT) geophysical tests. The subsurface soils are not considered to be liquefiable during a seismic event.

Foundations

The geotechnical investigation has revealed that the subsurface conditions at the site are well suited to supporting the proposed building by strip and spread footings set on the competent sound limestone bedrock below any weathered or fractured zones and designed for a factored geotechnical resistance at ultimate limit state (ULS) of 1500 kPa. Settlements of footing designed for the above recommended factored geotechnical resistance at ULS and properly constructed are expected to be less than 10 mm. Any sub-excavation of the weathered bedrock can be backfilled to the underside of footing using 15 MPa lean mix concrete.

Floor Slab and Drainage Requirements

The basement floor slab of the proposed building may be designed as a slab-on-grade provided it is set on a bed of well compacted 19 mm clear stone at least 200 mm thick placed directly on the competent sound bedrock. The clear stone would prevent the capillary rise of moisture to the floor slab. Alternatively, the clear stone layer may be replaced with Ontario Provincial Standard Specification (OPSS) Granular A compacted to 98 percent standard Proctor maximum dry density (SPMDD) and overlain by a vapour barrier. Adequate saw cuts should be provided in the floor slab to control cracking.

A perimeter drainage system is recommended to be installed around the proposed building and should be suitably outletted. The need for an underfloor drainage system should be assessed once the design elevation of the basement floor is known and compared with the groundwater level.

Excavations

Excavation of the fill may be undertaken using conventional equipment. All excavation work should be completed in accordance with the Occupational health and Safety Act (OHSA). Excavations within the fill soil may be undertaken as open cut provided the sidewalls of the excavation are cut back at 1H:1V from the bottom of the excavation.

Excavation of the limestone bedrock may be undertaken using a hoe ram for removal of small quantities of the bedrock; however, this process is expected to be very slow. Alternatively, the bedrock may be excavated by line drilling and blasting technique. Contractors bidding on this project should decide on their own the most preferred rock removal method; hoe ramming or line drilling and blasting. The sound bedrock may be excavated at near vertical slope, subject to examination by a geotechnical engineer.

Excavations may be dewatered by conventional sump pumping method.

Pre-condition survey of surrounding structures as well as vibration monitoring are recommended to be completed prior and during the blasting operation and/or bedrock removal.

Suitability of On-Site Soils for Backfilling

It is anticipated that the majority of the material required for backfilling purposes in the interior and exterior of the proposed building and in the service trenches will need to be imported and should preferably conform to the specifications provided in the attached geotechnical report.

Closure

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

Consideration should be given to excavate some test pits to collect additional data on the depth of the bedrock in other areas of the site.

This executive summary is a brief synopsis of the report and should not be read in lieu of reading the attached geotechnical report in its entirety.

1.0 Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed residential development to be located at the property registered by the street address of 133 Forward Avenue, Ottawa, Ontario. (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal dated August 6, 2025. Authorization to proceed with the work was provided given by Marc-Alexander Shank on behalf of In Harmony Developments Inc. via exp signed work authorization dated August 6, 2025.

It is our understanding that the residential development will consist of a 4-storey residential apartment building with one basement level. Design drawings showing elevation of underside of footing, finished floor level, and exterior site grades were not available at the time of this geotechnical investigation.

EXP completed Phase One and Two Environmental Site Assessments (ESAs) at this site in conjunction with this geotechnical investigation and the reports are provided under separate covers.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil, bedrock and groundwater conditions at four (4) boreholes located on site,
b) Classify the site for seismic site response in accordance with the requirements of the 2024 Ontario Building Code (OBC) and assess the potential for liquefaction of the subsurface soils during a seismic event,
c) Comment on grade-raise restrictions for the site,
d) Make recommendations on the most suitable type of foundations, founding depth and bearing pressure at Serviceability Limit State (SLS) and factored geotechnical resistance at Ultimate Limit State (ULS) of the founding strata and comment on the anticipated total and differential settlements of the recommended foundation type for the proposed building,
e) Comment on slab-on-grade construction and permanent drainage requirements,
f) Provide lateral earth pressure parameters (for static and seismic conditions) for the subsurface basement walls of the proposed building,
g) Discuss excavation conditions and dewatering requirements during construction,
h) Comment on backfilling requirements and suitability of the on-site soils for backfilling purposes, and;
i) Comment on subsurface concrete requirements and corrosion potential of subsurface soil and bedrock to buried metal structures/members.

The comments and recommendations given in this report are based on the assumption 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.

2.0 Site Description

The subject site is located at 133 Forward Avenue, Ottawa, Ontario and is currently occupied by a 2-storey detached residential building and separate garage at the back of the property (east end of site) which will be demolished to allow the construction of the proposed building. The remainder of the lot is occupied by asphalt driveways and landscaped areas. The site borders on Forward Avenue to the west, and residential properties to the north, east, and south. The parking garage of the residential property to the north abuts the north property line of the subject site. An automotive repair garage exists adjacent to the site, to the southeast.

The site is generally flat with ground surface elevations ranging from Elevation 62.41 m to Elevation 62.82 m as surveyed by EXP at the borehole locations. The site gently slopes in a westerly direction towards Forward Avenue.

3.0 Procedure

The fieldwork for the geotechnical investigation was undertaken on September 2, 2025 and comprised the drilling of four (4) boreholes (Borehole Nos. 25-01 to 25-04) to termination and auger refusal depths of 0.2 m to 4.8 m below existing grade. The fieldwork was supervised on a full-time basis by a representative from EXP.

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

Prior to drilling the boreholes, the borehole locations were cleared of public and private underground services.

The boreholes were drilled using a CME-55LC rubber track mounted drill rig equipped with continuous flight hollow stem augers and conventional rock coring capabilities. Standard penetration tests (SPTs) were performed in all the boreholes at the ground surface and at 0.75 m depth intervals and soil samples retrieved by the B-sized split-barrel sampler. An N-Size sampler was occasionally used for greater sample recovery. The bedrock was cored in two (2) boreholes using the H-size core barrel and conventional coring techniques. A field record of the wash water return, colour of wash water and any sudden drops of the core barrel were kept during rock coring operations.

The subsurface soil conditions in each borehole were logged and each soil sample placed in labelled plastic bags. Similarly, the bedrock cores were visually examined, placed in core boxes, identified and logged.

A 50 mm diameter monitoring well was installed in Borehole Nos. 25-01 and 25-02 for long-term monitoring and sampling of the groundwater at the site. The monitoring wells were installed in accordance with EXP standard practice and the installation configuration is documented on the respective borehole log. The boreholes were backfilled upon completion of drilling and the installation of the monitoring wells.

On completion of the fieldwork, all the soil samples and rock cores were transported to the EXP laboratory located in Ottawa, Ontario. The soil samples were classified by their main constituents using soil group name and symbol in accordance with the Unified Soil Classification System (USCS) and by the modified Burmister soil classification method for the classification of the minor constituents of the soil using adjectives and modifiers such as trace and some.

The bedrock cores were visually examined by the geotechnical engineer and logged in general accordance with the 2023 Canadian Foundation Engineering Manual (CFEM) Fifth Edition. Photographs were taken of the bedrock cores.

The laboratory testing program for the soil samples and rock cores is shown in Table I.

Table I: Summary of Laboratory Testing Program

Type of Test	Number of Tests Completed
Soil Samples	
Moisture Content Determination	5
Grain Size Analysis	1
Bedrock Cores	
Unit Weight Determination	6
Unconfined Compressive Strength Test	6
Corrosion Analyses (pH, sulphate, chloride and resistivity)	1

4.0 Subsurface Conditions and Groundwater Levels

A detailed description of the subsurface conditions encountered in the four (4) boreholes is given on the borehole logs, Figure Nos. 3 to 6. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time also may result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

Boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of potential environmental conditions. Reference is made to the Phase One and Two ESAs regarding the environmental condition of the subsurface soils and groundwater.

It should be noted that the soil and bedrock boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling operations. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Descriptions" preceding the borehole logs form an integral part of this report and should be read in conjunction with this report.

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

Asphalt

At Borehole Nos. 25-1 and 25-3, an asphalt layer of 25 mm to 75 mm thickness is present at the surface.

Topsoil

At Borehole Nos. 25-2 and 25-4, topsoil is present at the surface with a thickness of 50 mm.

Fill

Underlying the asphalt or topsoil at all boreholes is silty sand and gravel fill containing rock fragments, roots and rootlets, and construction debris such as nails and wood pieces. The depth of the fill extends to auger refusal depths of 0.2 m to 1.0 m (Elevation 62.4 m to Elevation 61.4 m) below ground surface at all boreholes. The fill is in a compact state based on SPT N-value of 12. Instances where the sampler met refusal may have occurred on bedrock or possible large debris within the fill. The SPT N-values indicated on the borehole logs are the corrected values for the standard ('B') split-spoon size. The moisture content of the fill is 1 percent to 12 percent.

Grain size analysis was conducted on one (1) composite sample of the fill which was combined from all four (4) boreholes. The grain size curve is shown in Figure 7 and the results are summarized in Table II.

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

Borehole/Monitoring Well No. (BH/MW) - Sample No.	Depth (m)	Grain-size Analysis (%)				Soil Classification
		Gravel	Sand	Silt	Clay	
All BHs (Composite Sample)	0.1 – 1.0	50	37	13	0	Silty Gravel and Sand

Based on a review of the results from the grain size analysis, the fill may be classified as a silty gravel and sand.

Limestone Bedrock

Refusal to augers was met in all boreholes at 0.2 m to 1.0 m depths (Elevation 61.4 m to Elevation 62.4 m) on inferred cobbles, boulders or bedrock. Highly weathered rock may have occurred at shallower depths than auger refusal.

The presence of the bedrock was confirmed in Borehole Nos. 25-01 and 25-02 at 1.0 m and 0.4 m depths, respectively (Elevation 61.4 m and Elevation 62.4 m) by wash-boring and core drilling techniques. A summary of the bedrock depth (elevation) findings is presented in Table III.

Table III: Summary of Bedrock Depths (Elevations)			
Borehole/Monitoring Well No. (BH/MW)	Ground Surface Elevation	Bedrock Depth (Elevation, m)	Proven by Coring (Yes/No)
BH/MW25-01	62.41	1.0 (61.40)	Yes
BH/MW25-02	62.82	0.4 (62.40)	Yes
BH25-03	62.50	0.2 (62.30)	No
BH25-04	62.67	0.9 (61.80)	No

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.

Based on examination of the bedrock cores, the Total Core Recovery (TCR) ranges from 89 percent to 100 percent and the Rock Quality Designation (RQD) ranges from 50 percent to 100 percent indicating the bedrock quality is fair to excellent. Photographs of the rock cores are shown in Appendix A.

Results of the unconfined compressive strength and unit weight determination tests conducted on six (6) selected sections of rock cores are summarized in Table IV.

Table IV: Unconfined Compressive Strength and Unit Weight of Rock Core Sections			
Borehole/Monitoring Well No. (BH/MW) RUN No.	Depth (m)	Unconfined Compressive Strength (MPa)	Unit Weight (kN/m^3)
BH25-01 – Run 1	1.0 – 1.1	86.2	26.6
BH25-01 – Run 2	1.7 – 1.9	102.1	26.6
BH25-01 – Run 3	3.2 – 3.3	128.1	26.7
BH25-02 – Run 1	1.0 – 1.1	104.3	26.2
BH25-02 – Run 2	1.9 – 2.1	99.8	26.3
BH25-02 – Run 3	3.5 – 3.7	115.1	26.7

The unconfined compressive strength test results range from 86 MPa to 128 MPa and the rock may be classified as strong (R4) to very strong (R5) in accordance with the 2023 Fifth Edition of the Canadian Foundation Engineering Manual (CFEM).

Groundwater Levels

Groundwater level measurements in monitoring wells installed in two (2) boreholes were taken 17 days following installation on September 19, 2025, and are summarized in Table V.

Table V: Summary of Groundwater Level Measurements			
Borehole/Monitoring Well No. (BH/MW)	Ground Surface Elevation (m)	Date of Measurement (Elapsed Time in Days from Date of Installation)	Groundwater Depth Below Ground Surface (Elevation), m
BH/MW25-01	62.41	September 19, 2025 (17 days)	3.2 (59.21)
BH/MW25-02	62.82	September 19, 2025 (17 days)	3.0 (59.82)

Based on a review of the groundwater level measurements, the groundwater level is at 3.2 m and 3.0 m depths (Elevation 59.21 m to 59.82 m) on September 19, 2025. The monitoring wells were both purged dry on September 4, 2025.

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

5.0 Grade Raise Restrictions

Since compressible clays were not encountered at the site, there is no restriction to raising the grades at the site from a geotechnical perspective.

6.0 Seismic Site Classification and Liquefaction Potential of Subsurface Soils

The recommendations for the geotechnical aspects to determine the earthquake loading for design in accordance with Section 4.1.8 Earthquake Load and Effects in the Ontario Building Code (OBC) 2024, are presented below.

6.1 Subsoil Conditions

The strata and groundwater information at this site have been examined in relation to Section 4.1.8.4 of the OBC (2024). The strata generally consist of fill and limestone bedrock with minor shale. It is anticipated that the proposed building with one level of basement will be supported on conventional spread and strip footings founded on the bedrock surface.

6.2 Borehole Depth and In Situ Measurements

Table 4.1.8.4.-A Exceptions for Site Designation Using Vs30 Calculated from In Situ Measurements and Table 4.1.8.4.-B Site Classes, S, for Site Designation Xs in OBC (2024) indicated that to determine the site classification, the average properties in the top 30 m (below the lowest basement level) are to be used. Site Classification can be determined using the average shear wave velocity (Vs30) as per the classifications stated in Table 4.1.8.4.-A and Table 4.1.8.4.-B. If in-situ shear wave velocity measurements are not available, the site designation Xs shall be determined based on the energy-corrected average standard penetration resistance (SPT) $\bar{N}60$ or the average undrained shear strength Su in accordance with Table 4.1.8.4.-B.

There are no shear wave measurements carried out at this site and therefore, the Site Designation will be determined based on the energy-corrected average SPT. The boreholes advanced at this site terminated at depths of 0.2 m to 4.8 m below existing grade. Therefore, the recommended site classification would be based on the available information as well as our interpretation of conditions below the boreholes based on our knowledge of the soil conditions in the subject area.

6.3 Site Classification and Liquefaction Potential of Soils

Based on the above assumptions and currently available information, the Site Class for the proposed structure is “C” as per Table 4.1.8.4.-A and Table 4.1.8.4.-B, OBC 2024. According to Section A-4.1.8.4 of OBC 2024, the in-situ measurements of shear wave velocity can be utilized to lower the demand in the seismic design. Therefore, field shear wave velocity measurements are recommended to be performed through non-intrusive (e.g. multichannel analysis of surface waves) and / or intrusive (e.g. downhole / cross hole techniques, or SCPT) geophysical tests.

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

7.0 Foundation Considerations

The geotechnical investigation revealed that the subsurface conditions at the site are well suited to support the proposed building by strip and spread footings set on the competent sound limestone bedrock below any weathered and fractured zones confirmed in the boreholes at 0.4 m and 1.0 m depths (Elevation 62.4 m and Elevation 61.4 m).

Strip and spread footings founded on the competent sound limestone bedrock may be designed for a factored geotechnical resistance at ultimate limit state (ULS) of 1500 kPa. The factored geotechnical resistance value at ULS includes a resistance factor of 0.5. The Serviceability Limit State (SLS) bearing pressure of the bedrock, required to produce 25 mm settlement of the structure will be much larger than the recommended value for factored geotechnical resistance at ULS. Therefore, the factored geotechnical resistance at ULS will govern the design. Any sub-excavation of the weathered bedrock can be backfilled to the underside of footing using 15 MPa lean mix concrete.

Settlements of footings designed for the above recommended factored geotechnical resistance at ULS and properly constructed are expected to be less than 10 mm.

All the footing beds should be examined by a geotechnical engineer to ensure that the founding surfaces are capable of supporting the recommended factored ULS value and that the footing beds have been properly prepared.

A minimum of 1.0 m of earth cover for heated /unheated structures should be provided to the footings founded on sound bedrock to protect them from damage due to frost penetration. Equivalent rigid insulation may be used instead of the required soil cover or a combination of rigid insulation and soil cover may be used to achieve the required frost protection.

8.0 Floor Slab and Drainage Requirements

The basement floor slab of the proposed building may be designed as a slab-on-grade provided it is set on a bed of well compacted 19 mm clear stone at least 200 mm thick placed directly on the competent sound bedrock. The clear stone would prevent the capillary rise of moisture to the floor slab. Alternatively, the clear stone layer may be replaced with Ontario Provincial Standard Specification (OPSS) Granular A compacted to 98 percent standard Proctor maximum dry density (SPMDD) and overlain by a vapour barrier. Adequate saw cuts should be provided in the floor slab to control cracking.

A perimeter drainage system is recommended to be installed around the proposed building and should be suitably outletted. The need for underfloor drainage should be assessed once the design elevation of the basement floor is known and compared with the groundwater level.

The finished ground floor should be set at least 150 mm higher than the finished exterior grade.

The finished exterior grade should be sloped away from the building to prevent ponding of surface water close to the exterior walls of the building.

9.0 Lateral Earth Pressure Against Subsurface Walls

The subsurface basement walls should be backfilled with free-draining granular material, such as OPSS Granular B Type II material and equipped with a perimeter drainage system.

If the space between the subsurface basement walls and the rock face is to be backfilled, the subsurface walls will be subjected to lateral static earth pressure as well as lateral dynamic earth pressure during a seismic event. The lateral static earth pressure that the subsurface walls would be subjected to may be computed from equations (i) and (ii) below and the lateral dynamic earth force from equation (iii) given below.

The equations given below assume that the backfill against the subsurface walls will be free-draining granular material and that a perimeter drainage system will be provided to prevent build-up of hydrostatic pressure. Equation (i) will be applicable to the portion of the subsurface wall in the overburden (soil). Equation (ii) will be applicable to the portion of the subsurface wall in the bedrock where the earth pressure will be considerably reduced due to the narrow backfill between the subsurface wall and the rock face resulting in an arching effect (Spangler & Handy, 1984). The weight of the overburden (soil) and any surcharge applied at the ground surface should be considered as surcharge when computing lateral pressure using equation (ii).

Lateral static earth pressure, p:

p = k (γh + q) ---------- (i)

where:

k = lateral earth pressure coefficient for 'at rest' condition = 0.50

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

h = depth of interest below ground surface (m)

q = any surcharge acting at ground surface (kPa)

Lateral static earth pressure due to narrow earth backfill between subsurface wall and rock face at depth z; σ_n:

$$\sigma_n = \frac{\gamma B}{2\tan\delta}\left(1 - e^{-2k\frac{z}{B}\tan\delta}\right) + kq \text{ ---------- (ii)}$$

where:

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

B = backfill width (m)

z = depth from top of wall (m)

δ = friction angle between the backfill and wall and rock (assumed to be equal) = 17 degrees

k = lateral earth pressure coefficient for 'at rest' condition = 0.50

q = surcharge pressure including pressures from overburden (soil), traffic at ground surface and foundations from existing adjacent buildings (kPa)

The lateral dynamic earth force (dynamic thrust) due to seismic loading may be computed from the equation given below:

$$\Delta_{Pe} = \gamma h^2 \frac{a_h}{g} F_b \quad \text{----------} \quad \text{(iii)}$$

where:

Δ_{Pe}	=	dynamic thrust in kN/m of wall
h	=	height of basement wall against soil above the bedrock surface (m)
γ	=	unit weight of soil = 22 kN/m^3
$\frac{a_h}{g}$	=	seismic coefficient = 0.347 (2020 NBC Seismic Hazard Tool)
F_b	=	thrust factor = 1.0

The dynamic thrust acts approximately at 0.63h.

For basement walls cast directly against the bedrock, a vertical drainage membrane or board such as Terrain 200 or equivalent should be installed on the face of the bedrock and connected to the perimeter drainage system. The top of the drainage board should be covered with a filter fabric to prevent the loss of overlying soil into the drainage board.

All subsurface walls should be damp-proofed.

10.0 Excavations and Dewatering Requirements

10.1 Excess Soil Management

Ontario Regulation 406/19 specifies protocols that are required for the management and disposal of excess soils which is expected to be of minimal volume. 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.

For the environmental aspects of the subsurface soils, reference is made to the EXP Phase Two ESA report.

10.2 Excavations

Excavations for the construction of the proposed building are anticipated to extend through the fill and into the limestone bedrock and may or may not be above the groundwater level.

Following the demolition of the existing building on site, excavations should include the removal of existing items such as foundations, foundation walls and floor slabs that may be reinforced from the existing building and underground piping.

The excavation of the granular fill may be undertaken using conventional heavy equipment capable of removing cobbles and boulders and debris within the fill.

All excavation work should be completed in accordance with the Occupational Health and Safety Act (OHSA). Excavations within the fill soil may be undertaken as open cut provided the sidewalls of the excavation are cut back at 1H:1V from the bottom of the excavation.

It is recommended to excavate a test pit along the parking garage structure situated at the north boundary of the property to establish the founding level of existing footings.

Excavation of the limestone bedrock may be undertaken using a hoe ram for removal of small quantities of the bedrock; however, this process is expected to be very slow. Alternatively, the bedrock may be excavated by line drilling and blasting technique. Contractors bidding on this project must review the available data and decide on their own the most preferred rock removal method; hoe ramming or line drilling and blasting.

The sound bedrock may be excavated at near vertical sides, subject to examination by a geotechnical engineer.

To prevent damage to adjacent surrounding structures and infrastructure, the hoe ramming and blasting operations should be carefully planned and closely monitored. For blasting, it is recommended that the blasting contractor should retain the services of a blasting specialist to provide a blasting plan. The contractor should have a licensed blaster on site at all times during the blasting operations and a vibration engineer on retainer.

Vibration monitoring during the blasting operations should be carried out in the adjacent surrounding structures and infrastructure to ensure that the blasting meets the limiting vibration criteria at all times. Blasting operations should be carried out in accordance with City of Ottawa Special Provisions (S.P.) No. F-1201, which also provides limiting vibration criteria. A pre-construction and pre-blast condition survey of all adjacent surrounding structures and infrastructure should be conducted prior to start of construction and blasting operations. If adjacent structures are deemed to be heritage buildings, special limiting vibration criteria is required.

10.3 Dewatering Requirements

Seepage of surface water and subsurface water into the excavations are anticipated. It should be possible to collect water entering the excavations at low points and to remove it by conventional sump pumping techniques. In areas of high infiltration

or in areas where more permeable soils may exist, a higher seepage rate should be anticipated. Therefore, high-capacity pumps to keep the excavation dry may be required.

For construction dewatering, an Environmental Activity and Sector Registry (EASR) approval shall be obtained for water takings greater than 50 m^3 per day. Since July of 2025, any volume of pumping at greater than 50 m^3/day will require to be registered as EASR. A hydrogeological assessment report, water taking and discharge plans are required for EASR registration. If the long-term foundation drainage pumping is required at rates more than 379 m^3/day then a Category 3 Permit to Take Water (PTTW) would be required from the Ministry of Environment Conservation and Parks (MECP) for the long-term dewatering operation.

Although this geotechnical 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. A detailed hydrogeological study is required to assess the hydrogeological conditions which will provide better dewatering pumping volume estimates.

Depending on where the discharge is routed, a separate discharge agreement/permit may be required before discharge can be released. For example, the City of Ottawa sewer service now requires a discharge permit to release water into city sewers.

11.0 Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

The material to be excavated from the site is anticipated to consist of asphalt, topsoil, fill and limestone bedrock. Portions of the on-site fill may be re-used as backfill outside the building pending additional testing during construction. Otherwise, the existing fill may be used for landscaping purposes provided it is free of organics, cobbles, boulders and debris. Excavated bedrock is not suitable for use as backfill and should be discarded.

Therefore, it is anticipated that the majority of the material required for backfilling purposes in the interior and exterior of the proposed building and in the service trenches will need to be imported and should preferably conform to the following specifications:

- Engineered fill, subbase or pavements, and underfloor fill including backfilling in service trenches inside the building – OPSS 1010 for Granular B Type II (50 mm minus) placed in 300 mm thick lifts with each lift compacted to 98 percent SPMDD beneath the floor slab,
- Granular base for pavements, and underfloor fill within the top 200 mm of the slab - OPSS 1010 Granular A placed in 200 mm thick lifts and each lift compacted to 100 percent SPMDD,
- Backfill against exterior subsurface walls - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and compacted to 95 percent SPMDD,
- Trench backfill outside building area and fill placement to subgrade level for pavement – Approved on-site material or imported OPSS 1010 Select Subgrade Material (SSM), free of organics, debris and with a natural moisture content within 2 percent of the optimum moisture content. It should be placed in 300 mm thick lifts compacted to minimum 95 percent SPMDD; and
- Landscaped areas - Clean fill that is free of organics and deleterious material and is placed in 300 mm thick lifts with each lift compacted to 92 percent of the SPMDD.

12.0 Subsurface Concrete Requirements and Corrosion Potential of Subsurface Soils

Chemical tests limited to pH, sulphate, chloride and resistivity were undertaken on a selected section of the bedrock cores and the results are shown in Table VI. The laboratory certificate of analysis report is provided in Appendix B.

Table VI: Results of Corrosion Analyses on Section of Rock Core					
Borehole/Monitoring Well No. – Run Number	Depth (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (ohm-cm)
BH25-01 – Run 2	1.9 - 2.0	8.72	0.0018	0.0063	6580

The results indicate the limestone bedrock core section has a negligible sulphate attack on subsurface concrete. The concrete mix design should be in accordance with CSA A.23.1-19.

Based on a review of the resistivity test results, the limestone bedrock core section is considered to be mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be undertaken to protect buried steel elements from corrosion.

13.0 Tree Planting Restrictions

Since sensitive marine clay soils were not encountered on the site, the 2017 City of Ottawa Guidelines for tree planting do not apply for this site.

14.0 General Comments

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

The information contained in this report is not intended to reflect on environmental aspects of the soils. Reference is made to the EXP Phase One and Two Environmental Site Assessment reports completed for this site by EXP and presented in separate reports.

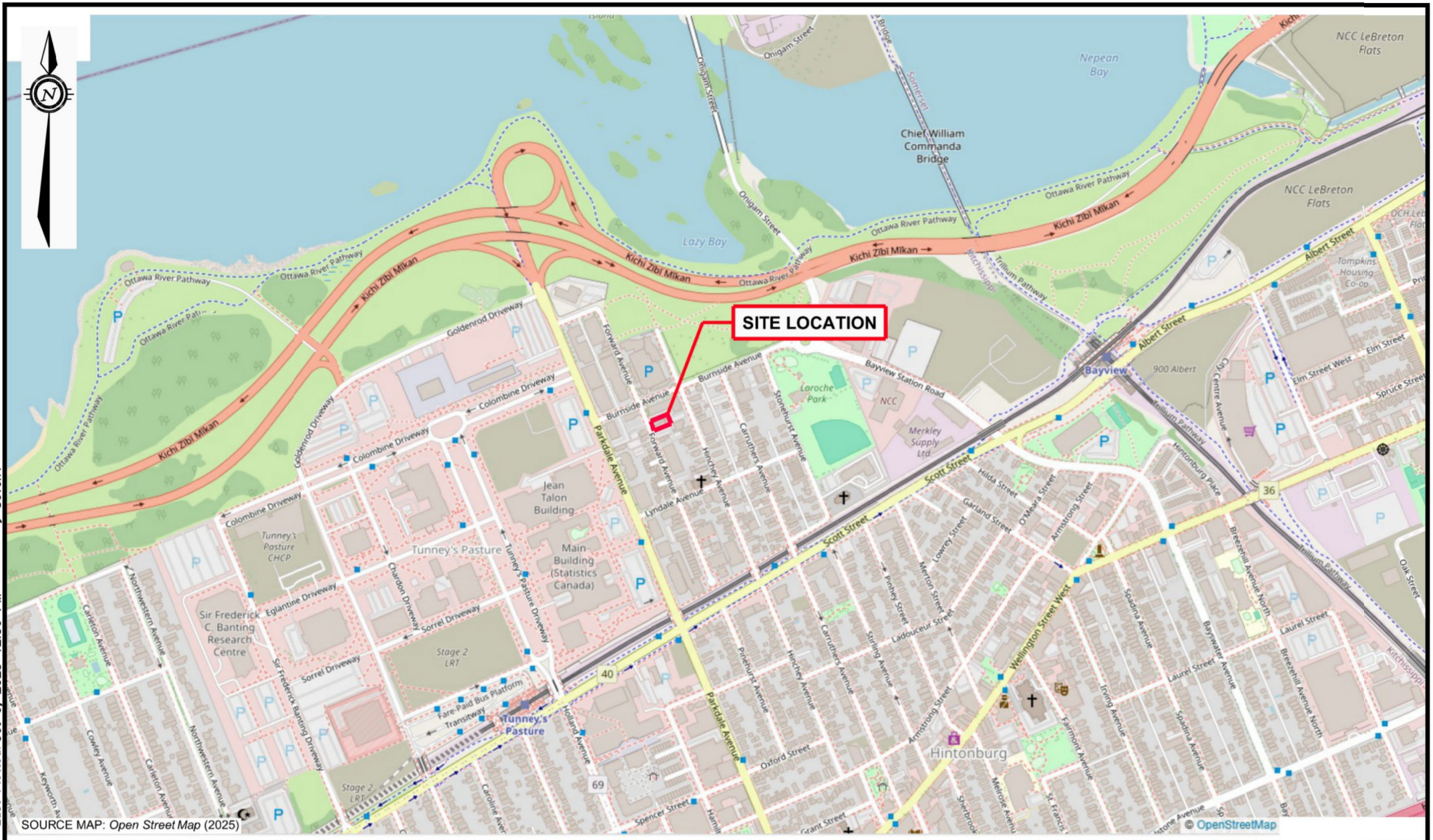
Consideration should be given to excavate some test pits to collect additional data on the depth of the bedrock in other areas of the site.

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

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

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

Figures



LEGEND

APPROXIMATE PROPERTY BOUNDARY

ORIGINAL SHEET SIZE = 11" X 8.5"

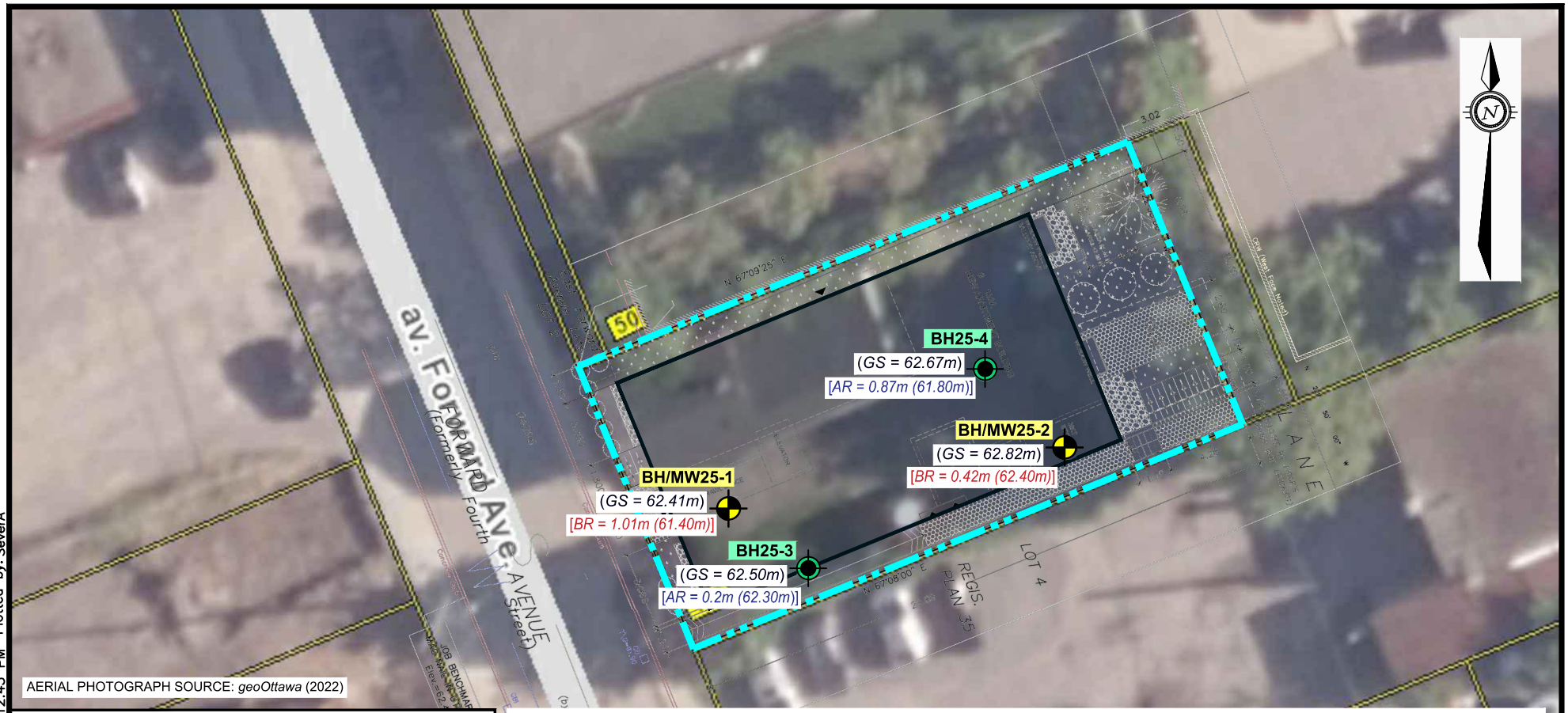
0 100m 200m 400m

HORIZONTAL 1:10,000

EXP Services Inc. www.exp.com
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE: OCTOBER 2025	PROJECT: PRELIMINARY GEOTECHNICAL INVESTIGATION 133 FORWARD AVENUE, OTTAWA, ONTARIO		project no. OTT-25011403-A0
DESIGN: MZ / CHECKED: IT			scale 1:10,000
DRAWN BY: AS	TITLE: SITE LOCATION PLAN		FIG 1

Filename: E:\OTT\OTT-25011403-A0\60 Execution\65 Drawings\OTT-25011403-A0_133-Forward-Ave_Geo.dwg
Last Saved: Oct 6, 2025 12:35 PM Last Plotted: Oct 6, 2025 12:36 PM Plotted by: SeverA



AERIAL PHOTOGRAPH SOURCE: *geoOttawa* (2022)

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- BH/MW25-1 — GEOTECHNICAL + ENVIRONMENTAL BOREHOLE / MONITORING WELL NO. & LOCATION (2025)
- BH25-3 — ENVIRONMENTAL SHALLOW BOREHOLE NO. & LOCATION (2025)
- (GS = 62.41m) — GROUND SURFACE ELEVATION (m)
- [BR = 1.01m (61.40m)] — BEDROCK DEPTH (ELEVATION) (m)
- [AR = 0.2m (62.30m)] — AUGER REFUSAL DEPTH (ELEVATION) (m)
- NEW BUILDING APPROX. FOOTPRINT

ORIGINAL SHEET SIZE = 11" X 8.5"

0 3m 6m 12m

HORIZONTAL 1:300

GENERAL NOTES:

1. THE BOUNDARIES, ROCK 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 AND ROCK CORES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TOPSOIL AND ASPHALT QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE BOREHOLE LOCATIONS.
4. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE SITE PLAN PRODUCED BY *InHarmony DEVELOPMENTS*, DATED: JULY 2025

EXP Services Inc. **www.exp.com**
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE: OCTOBER 2025	PROJECT: PRELIMINARY GEOTECHNICAL INVESTIGATION 133 FORWARD AVENUE, OTTAWA, ONTARIO		project no. OTT-25011403-A0
DESIGN: MZ / CHECKED: IT			scale 1:300
DRAWN BY: AS	TITLE: BOREHOLE LOCATION PLAN		FIG 2

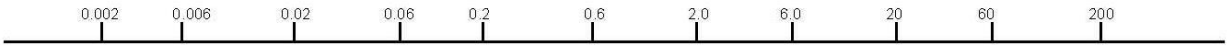
Filename: E:\OTT\OTT-25011403-A0\60 Execution\65 Drawings\OTT-25011403-A0_133-Forward-Ave_Geo.dwg
Last Saved: Oct 6, 2025 12:35 PM Last Plotted: Oct 6, 2025 12:43 PM Plotted by: SeverA

Notes On Sample Descriptions

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

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/MW25-01

Project No: OTT-25011403-A0

Project: Preliminary Geotechnical Investigation - Proposed Residential Development

Location: 133 Forward Avenue, Ottawa, ON

Figure No. 3

Page. 1 of 1

Date Drilled: 'Sept. 2, 2025

Drill Type: CME-55LC Rubber Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: S.A. Checked by: M.Z.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		ASPHALT ~75 mm thick	62.41	0
		FILL Silty sand with gravel, with rock fragments, rootlets, brown and grey, damp, some odours, no stains, (compact)	62.3	
		HIGHLY WEATHERED LIMESTONE BEDROCK	61.5	
		LIMESTONE BEDROCK Grey, fair to excellent quality	61.4	1
			59.21	3
		Borehole Terminated at 4.7 m Depth	57.7	4

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

4, 4, 15 / 75 mm

26, 50 / 75 mm

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
RUN 1	26.6
RUN 2	26.6
RUN 3	26.7

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. A 50 mm diameter monitoring well was installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-25011403-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Sept. 19, 2025	3.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1 - 1.6	95	50
2	1.6 - 3.2	96	91
3	3.2 - 4.7	100	100

LOG OF BOREHOLE BH LOGS-133 FORWARD AVENUE.GPJ TROW OTTAWA.GDT 10/6/25

Log of Borehole BH/MW25-02

Project No: OTT-25011403-A0

Project: Preliminary Geotechnical Investigation - Proposed Residential Development

Location: 133 Forward Avenue, Ottawa, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'Sept. 2, 2025

Drill Type: CME-55LC Rubber Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: S.A. Checked by: M.Z.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~ 50 mm thick	62.82	0
		FILL	62.7	
		Silty sand with gravel, rock fragments, roots, brown and grey, damp, no odours, no stains, (compact)	62.5	
		HIGHLY WEATHERED LIMESTONE BEDROCK	62.4	
		LIMESTONE BEDROCK Grey, fair to excellent quality		1
▼			59.82	3
			58.0	
		Borehole Terminated at 4.8 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
1, 15 / 125 mm

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

SAMPLES: SS1; RUN 1 26.2; RUN 2 26.3; RUN 3 26.7

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. A 50 mm diameter monitoring well was installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-25011403-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Sept. 19, 2025	3.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	0.4 - 1.8	89	54
2	1.8 - 3.3	100	87
3	3.3 - 4.8	100	79

LOG OF BOREHOLE BH LOGS-133 FORWARD AVENUE.GPJ TROW OTTAWA.GDT 10/6/25

Log of Borehole BH25-03

Project No: OTT-25011403-A0

Project: Preliminary Geotechnical Investigation - Proposed Residential Development

Location: 133 Forward Avenue, Ottawa, ON

Figure No. 5

Page. 1 of 1

Date Drilled: 'Sept. 2, 2025

Drill Type: CME-55LC Rubber Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: S.A. Checked by: M.Z.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 25 mm thick	62.5	0	15 / 50 mm ○	×	SS1	
		FILL Sand and gravel with construction debris such as nails, rock fragments, wood pieces, brown, damp, no odours, no stains	62.4					
		Auger Refusal at 0.2 m Depth	62.3					

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. The borehole was backfilled upon completion.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-25011403-A0

WATER LEVEL RECORDS

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

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH LOGS-133 FORWARD AVENUE.GPJ TROW OTTAWA.GDT 10/6/25

Log of Borehole BH25-04

Project No: OTT-25011403-A0

Project: Preliminary Geotechnical Investigation - Proposed Residential Development

Location: 133 Forward Avenue, Ottawa, ON

Figure No. 6

Page. 1 of 1

Date Drilled: 'Sept. 2, 2025

Drill Type: CME-55LC Rubber Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: S.A. Checked by: M.Z.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~50 mm thick	62.67	0				
		FILL Silty sand with gravel, rock fragments, roots and rootlets, wood pieces, brown and grey, damp, no odours, no stains, (compact)	62.6		12	✕	SS1	
		Augers grinding from 0.8 m depth to auger refusal depth	61.8					
		Auger Refusal at 0.9 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. The borehole was backfilled upon completion.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-25011403-A0

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

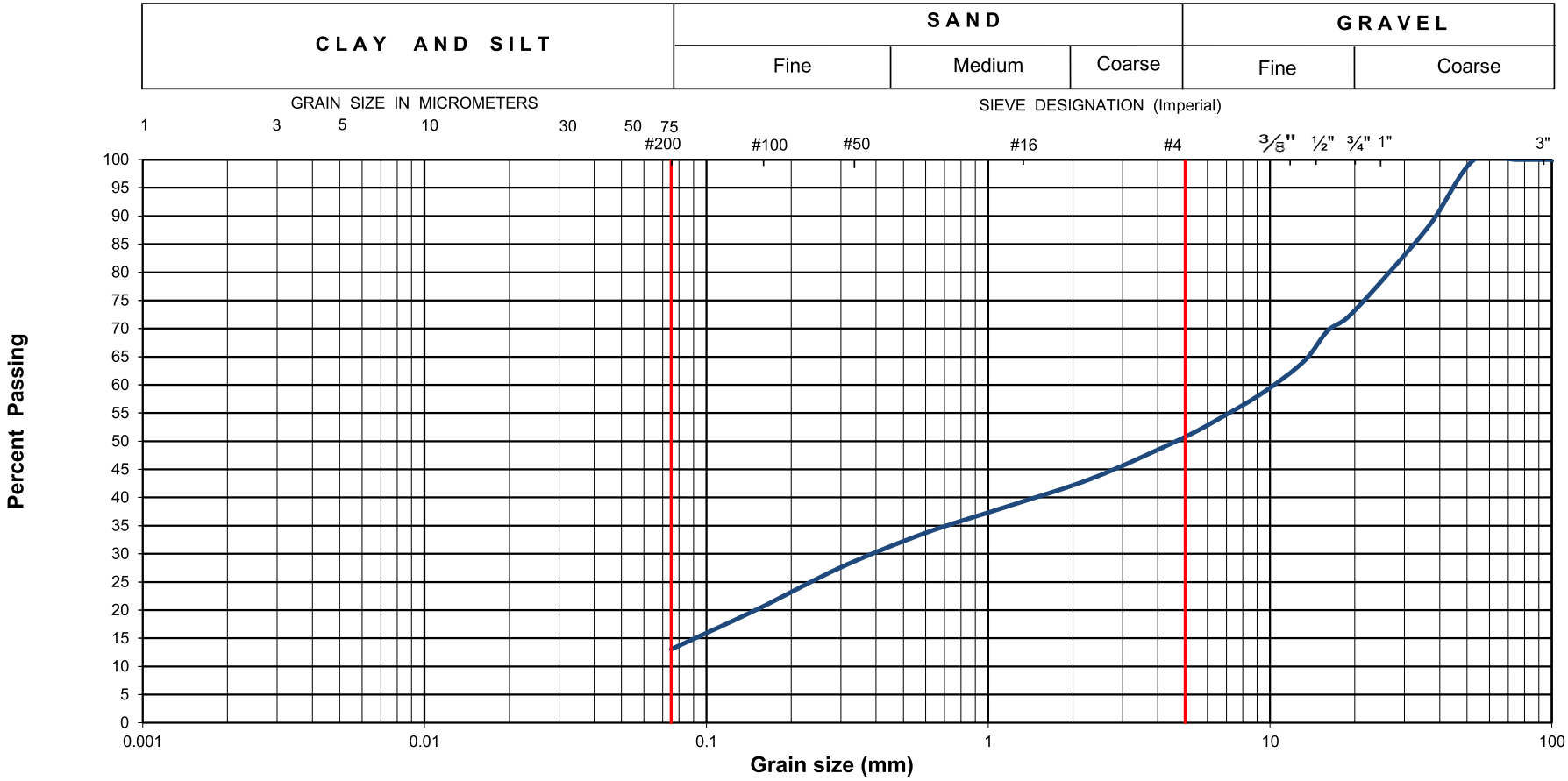
CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS-133 FORWARD AVENUE.GPJ TROW OTTAWA.GDT 10/6/25

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

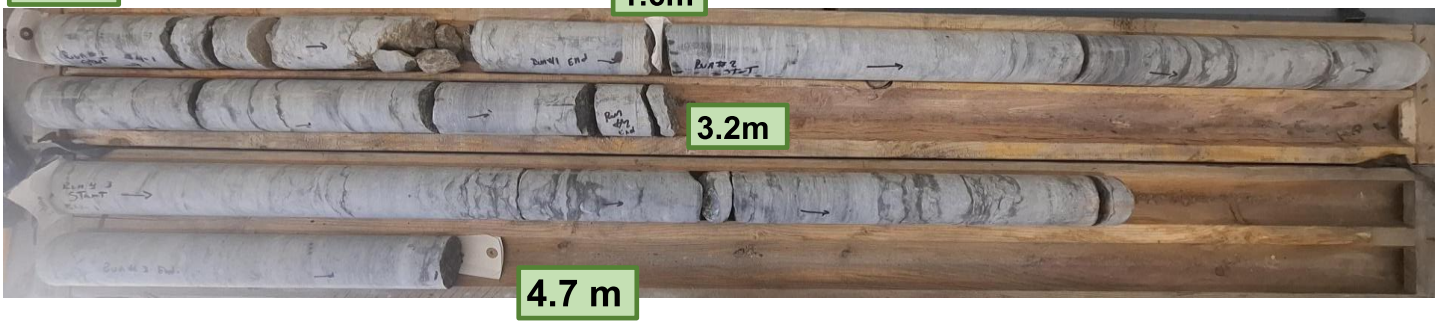
Unified Soil Classification System



EXP Project No.:	**OTT-25011403-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**In Harmony Developments Inc.**	**Project Location :**	**133 Forward Avenue, Ottawa**						
Date Sampled :	**September 2, 2025**	**Borehole No:**	**BH1 to 4**		**Sample:**	**Composite**		**Depth (m) :**	**0.1 - 1.0**
Sample Composition :		**Gravel (%)**	**50**	**Sand (%)**	**37**	**Silt & Clay (%)**	**13**	**Figure :**	**7**
Sample Description :		**FILL: Silty Gravel and Sand (GM/SM)**							

Appendix A: Bedrock Core Photographs

DRY BEDROCK CORES



WET BEDROCK CORES

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

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

borehole no.	core runs	PROJECT		project no.
BH25-1	Run 1: 1.0m - 1.6m Run 2: 1.6m - 3.2m Run 3: 3.2m - 4.7m End of Borehole		Proposed 4-Storey Residential Building 133 Forward Avenue, Ottawa, Ontario	OTT-25011403-A0
date cored Sep 02, 2025			ROCK CORE PHOTOGRAPHS	FIG A1

DRY BEDROCK CORES

0.4m

WET BEDROCK CORES

0.4m

exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
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borehole no.	core runs	PROJECT		project no.
BH25-2	Run 1: 0.4m - 1.8m Run 2: 1.8m - 3.3m Run 3: 3.3m - 4.8m End of Borehole		Proposed 4-Storey Residential Building 133 Forward Avenue, Ottawa, Ontario	OTT-25011403-A0
date cored Sep 02, 2025			ROCK CORE PHOTOGRAPHS	FIG A2

Appendix B: Laboratory Certificate of Analysis Report

AGAT Laboratories

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

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

ATTENTION TO: **Matthew Zammit**

PROJECT: **OTT-25011403-A0**

AGAT WORK ORDER: **25Z340473**

SOIL ANALYSIS REVIEWED BY: **Sukhwinder Randhawa, Inorganic Team Lead**

DATE REPORTED: **Sep 11, 2025**

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 is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.*
- *This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

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: 25Z340473

PROJECT: OTT-25011403-A0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Matthew Zammit

SAMPLING SITE:

SAMPLED BY:

(Soil) Inorganic Chemistry

DATE RECEIVED: 2025-09-03 **DATE REPORTED: 2025-09-11**

				BH1 Run2
		SAMPLE DESCRIPTION:		6'2-6'6"
		SAMPLE TYPE:		Rock
		DATE SAMPLED:		2025-09-02
Parameter	Unit	G / S	RDL	7028339
Chloride (2:1)	µg/g		2	63
Sulphate (2:1)	µg/g		2	18
pH (2:1)	pH Units		NA	8.72
Resistivity (2:1) (Calculated)	ohm.cm		1	6580

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

7028339 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:

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: 25Z340473

PROJECT: OTT-25011403-A0

ATTENTION TO: Matthew Zammit

SAMPLING SITE:

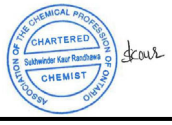
SAMPLED BY:

Soil Analysis

RPT Date: Sep 11, 2025			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)	7028350		63	63	0.0%	< 2	98%	70%	130%	102%	80%	120%	102%	70%	130%
Sulphate (2:1)	7028350		59	59	0.0%	< 2	98%	70%	130%	102%	80%	120%	101%	70%	130%
pH (2:1)	7028339	7028339	8.72	8.49	2.7%	NA	88%	80%	120%						

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

Certified By:



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Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 25Z340473

PROJECT: OTT-25011403-A0

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SAMPLING SITE:

SAMPLED BY:

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

AGAT Laboratories

Have feedback? Scan here for a quick survey!

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
Contact: Matthew Zammit
Address: 2650 Queensview Drive, Suite 100
Ottawa, Ontario, K2B 8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: matthew.zammit@exp.com
2. Email: ryan.digiuseppe@exp.com

Project Information:

Project: OTT-25011403-A0
Site Location: 133 Forward Avenue
Sampled By: EXP
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

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

Regulatory Requirements:

(Please check all applicable boxes)

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

☐ Regulation 406
Table ___ (Indicate One)
☐ Ind/Com ☐ Res/Park ☐ Agriculture
☐ 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 (RSC)**? ☐ Yes ☐ No

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

Legal Sample ☐

Sample Matrix Legend

GW	Ground Water	**SD**	Sediment
O	Oil	**SW**	Surface Water
P	Paint	**R**	Rock/Shale
S	Soil		

Laboratory Use Only

Work Order #: 25Z340473

Cooler Quantity: n/a - no ice packs
Arrival Temperatures: 24.0 | 23.7 | 23.5
~~Depot~~ Temperatures: 9.2 | 9.5 | 9.0
Custody Seal Intact: ☐ Yes ☐ No ☑ N/A
Notes:

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 CSR

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	VOC	PAHs	PCBs: Arochlors ☐	O. Reg 406: Regulation 406 Characterization Package	O. Reg 406: pH, Metals, BTEX, F1-F4	O. Reg 406: EC, SAR	O. Reg 406: Regulation 406 SPLP Rainwater Leach mSPLP: ☐ Metals ☐ VOCs ☐ SVOCs ☐ OC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Corrosivity: ☐ Moisture ☐ Sulphide	pH	Sulphates	Chlorides	Resistivity			Potentially Hazardous or High Concentration (Y/N)
1. BH1 Run2 6'2-6'6"	Sept 2	AM PM	1																☑	☑	☑	☑			
2.		AM PM																							
3.		AM PM																							
4.		AM PM																							
5.		AM PM																							
6.		AM PM																							
7.		AM PM																							
8.		AM PM																							
9.		AM PM																							
10.		AM PM																							
11.		AM PM																							

	Date	Time		Date	Time
Samples Relinquished By (Print Name and Sign):			Samples Received By (Print Name and Sign): C. Griffiths	09/03/25	16h02
Samples Relinquished By (Print Name and Sign): CP to Dino	09/04/25	15h00	Samples Received By (Print Name and Sign):	Sept 5	9AM
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page ___ of ___

N°:

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

Legal Notification

This report was prepared by EXP Services Inc. for the account of **In Harmony Developments Inc.**.

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

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