GROUPE MACH INC.
GEOTECHNICAL SUBSOIL INVESTIGATION REPORT

Property located at 77 Metcalfe Street,
Ottawa, Ontario
Lots No. 52 and west part of 53

Prepared by:

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M. Mohamed Kheir Hassoun
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RE: Geotechnical subsoil investigation of the property corresponding to lots no. 52 and west part of 53 located at 77 Metcalfe Street in Ottawa, Ontario.

Dear Sir,

In accordance with your request, we have carried out a subsoil investigation on the property corresponding to lots no. 52 and west part of 53 located at 77 Metcalfe Street, in Ottawa, Ontario, and are pleased to present our report.

We trust that this document contains all the information required to assess the subsoil conditions of the site. We would be pleased to answer any questions which may arise from this study and look forward to being of continued assistance.

Yours very truly,

SOLROC INC.

GEOTECHNICAL SUBSOIL INVESTIGATION REPORT
Property located at 77 Metcalfe Street,
Ottawa, Ontario
Lots no. 52 and west part of 53

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APPENDIX

1. INTRODUCTION

1.1 Presentation of Our Mandate

The services of SOLROC INC. were retained by Mr. Mohamed Kheir Hassoun, representative of GROUPE MACH INC. to carry out a geotechnical study on the property corresponding to parts of lots nº 52 and west part of 53 located at 77 Metcalfe Street in Ottawa, Ontario.

No plans of the future project were currently available. According to the information provided by the client, on this property, it is proposed to demolish the existing twelve (12) storey building with two (2) basement levels and construct a new high-rise building in its place. The new building will reportedly also be two (2) basement levels, however, no information of the basement foundation walls will be reused at this time.

The purpose of this geotechnical study, as defined in our proposal n° SQ.GT01.24.11.013 version 1 dated November 15th 2024 and sent on December 3rd, 2024, is to determine the nature and the geotechnical parameters of the underlying soils, the depth and quality of the bedrock, as well as the underground water conditions to guide the structural engineer with the design criteria for the foundations.

The purpose of this geotechnical investigation is therefore to determine:

- The nature and properties of the in-situ subsoils relevant to the foundations design,
- Geotechnical hypotheses to consider for the foundations design,
- Types of feasible foundation systems,
- The bearing capacity at the ultimate limit state (ULS) and the serviceability limit state (SLS) of the foundations,
- The water table depth at the time of the geotechnical field investigation,
- The seismic classification of the site, and liquefaction potential based upon the SPT's "N" counts and laboratory tests results,
- The frost depth,
- General recommendations regarding excavation stability (retaining walls, excavation slopes, etc.),
- General groundwater drainage recommendations,
- General recommendations and commentaries regarding the site preparation, excavation and construction works.

This study was carried out concurrently with a hydrogeological study (Project nº: PR.HY01.24.0062) which is developed in a separate report.

This report contains a description of the work methods used to obtain the outlined results as well as the conclusions and recommendations relative to the geotechnical needs for the proposed project.

1.1 Presentation of Our Mandate

The following document was provided by the client for consultation for the purpose of this study:

- The excerpts of the structural plans of the existing buildings by the firm J. STUART HALL AND ASSOCIATES, dated May 1991 (Project: 9026).
- An untitled document (probably a feasibility presentation) for the project *Corner of Metcalfe and Albert Street, Ottawa* prepared by the firm NEUF ARCHITECTES, dated July 2024 (Project: 13466).

2. FIELD INVESTIGATION PROCEDURES

The nature and properties of the soils and bedrock were determined from our field investigations and laboratory work.

The fieldwork was carried out between December 6th and 16th, 2024 and included the following:

- Two (2) geotechnical SPT boreholes with sampling identified as BH-1 and BH-2, including bedrock coring, carried out in the first basement level.
- Four (4) geotechnical SPT boreholes with sampling identified as BH-3 to BH-6, including bedrock coring, carried out in the second basement level.

Table 1: Depth of boreholes

Basement	Sounding n°	Depths Reached	
		Soil (m)	Bedrock (m)
1st	BH-1	0 – 1,47	1,47 – 4,72
1st	BH-2	0 – 1,09	1,09 – 6,43
2nd	BH-3	0 – 0,52	0,52 – 3,96
2nd	BH-4	0 – 0,57	0,57 – 3,53
2nd	BH-5	0 – 0,44	0,44 – 4,17
2nd	BH-6	0 – 1,22	1,22 – 7,54

It is important to note that no borehole was carried out on the outside of the property because of the lack of space. No information was available from the surface of the surrounding terrain down to the bedrock.

The preliminary description of the soils in the boreholes was carried out by our geotechnical staff on site during the fieldwork.

The details of the boreholes are shown on individual logs in Annex B.

In this report, refusal means the level where the split-spoon sampler can no longer be advanced due to a local obstacle (cobble, boulder, etc.) or due to very dense soil or the probable bedrock.

All the recovered soil and bedrock samples from the boreholes were forwarded to our laboratory where they were visually examined and tested if needed and logged for presentation purposes in this report. The samples will be stored for a period of three months from the date of the report; after this period, they will be discarded, unless other arrangements are made with the client.

2.1 Boreholes BH-1 to BH-6

Boreholes BH-1 to BH-6 were carried out in the 1st and 2nd basement levels by the company FUSION DRILLING by means of portable equipment for soil and rock sampling. The slab at the locations of each borehole was cored using an electric lever-operated corer fitted with a nominal diameter 101 mm diamond drill bit.

Soil samples were recovered in a continuous manner using a 51 mm I.D. split-spoon sampler, driven into the soil by dropping a weight of 31,8 kg from a height of 760 mm. This method allowed us to simultaneously measure the number of blows required for each 300 mm of penetration, or "N-values”. The N-values have been converted to standard N-index values according to the ratio of driven energies in order to satisfy the normalized procedure for the standard penetration test (SPT).

The bedrock was intercepted in the boreholes between the depths of 0,52 m and 1,47 m below the surface of their respective slab on grade. It was sampled with a 63,5 mm diameter HQ diamond core.

After completion of the boreholes and before the removal of the casings, observation wells were installed within boreholes BH-1, BH-2, BH-3, BH-5 and BH-6 for monitoring the groundwater level. The installation details of the observation wells are shown in the borehole logs in Annex B.

2.2 Surveying

No survey was carried out as part of this mandate. The borehole depths are all considered below the surface of their respective slab on grade. According to the document from NEUF ARCHITECTES, the elevation of the slab for the 1st basement level is at ± 64,5 m whereas the elevation of the slab on grade of the 2nd basement level is at ± 61,5 m

The sounding locations are shown on the « Location of Soundings » drawings in Annex D

3. LABORATORY WORK

All soil and bedrock samples recovered in the boreholes were sent to our laboratory for identification, classification and further testing if needed.

The results of the laboratory tests are shown in the report in Annex C.

Table 2: List of Laboratory Tests

Standard	Quantity
Compression tests of the bedrock ASTM D7012-13	7

4. GENERAL SITE DESCRIPTION

The subject property, legally described as parts of lots nº 52 and west part of 53, is located at 77 Metcalfe Street, in a commercial sector of Ottawa.

The subject lots are currently occupied by a twelve (12) storey commercial building with two (2) basement levels occupying the entirety of the property.

Aerial photographs 1965, 1980 and 1991 were consulted to observe any possible physical changes that may have occurred in the subject property and its immediate surrounding sector through time. The aerial photograph from 1965 showed the existing building occupying the property.

Considering Metcalfe Street as a north-south axis, the property is bordered to the north by Albert Street, to the south and to the east by properties occupied by commercial buildings and to the west by Metcalfe Street.

Figure 1: Aerial view dated of 2018 (extract of Google Earth)

The location of the property is shown on the general location plan found at the end of this report (*Annex A)*.

5. GEOTECHNICAL DATA

5.1 Subsoil Conditions

The stratigraphic profile identified in the boreholes and test pits is summarized below. However, we must refer to the individual borehole and test pit logs in Annex B for a more detailed description of the soil strata encountered.

It should be noted that the classification presented below as well as the borehole and test pit logs in Annex B is only guaranteed at the location where the soundings were carried out. Therefore, any conclusions and recommendations on this information are subjected to this limitation. Consequently, Solroc Inc must be notified of any discrepancy detected between the materials described in this report and those encountered during the excavation.

In general, we find the following:

Table 3: Summary of the stratigraphy

Soundings	Depth, m		
	Concrete slab	Fill[1]	Bedrock[2]
BH-1	0 – 0,25	0,25 – 1,47	1,47 – 4,72
BH-2	0 – 0,15	0,15 – 1,09	1,09 – 6,43
BH-3	0 – 0,08	0,08 – 0,52	0,52 – 3,96
BH-4	0 – 0,08	0,08 – 0,57	0,57 – 3,53
BH-5	0 – 0,11	0,11 – 0,78	0,78 – 4,17
BH-6	0 – 0,13	0,13 – 1,22	1,22 – 7,54

1. <u>Fill:</u> The fill material consists of either crushed stone or a mixture of humid, silt, sand and gravel, in variable proportions, with traces to a lot of clay and the presence of rock fragments. Loose to dense. N values varying between 5 and 36 including several refusals of the soil sampler.
2. <u>Rock</u>: Bedrock consists of a dark grey shale with some submillimetre quartz veins. Recoveries varying between de 0% and 100%, with RQD values of 83% to 100%. Based on RQD, bedrock is of very poor to excellent quality.

Note: The description does not take into account the presence of pebbles and gravels not sampled by the spoon. The Rock Quality Designation (R. Q. D.) is an indirect assessment of the degree of fracturing (section 4.4.3.10 Canadian Foundation Engineering Manual 2023).

5.2 Groundwater

After completion of the boreholes and before the removal of the casings, observation wells were installed within boreholes BH-1, BH-2, BH-3, BH-5 and BH-6 for monitoring the groundwater level.

The water levels measured on January 27th 2025 in the observation wells are indicated in the following table nº4:

Table 4: Groundwater level

Location	Borehole	Water level	Elevation of the level of water
1st basement	BH-1	2,29	± 62,1
1st basement	BH-2	2,43	± 62,0
2nd basement	BH-3	2,15	± 59,3
2nd basement	BH-5	0,23	± 61,2
2nd basement	BH-6	2,55	± 58,9

It is important to note that a punctual groundwater level reading does not provide sufficient hydrological information. The obtained level corresponds to a reading at a specific moment in time and does not include the inevitable variations of water tables and of the groundwater movements which depend, namely, on meteorological conditions. It is important to note that the water level in the subsoil fluctuates depending on the seasonal, climatic and environmental conditions and precipitations.

For more details on hydrogeological conditions, refer to the hydrogeological report by Solroc. (PR.HY01.24.0062).

5.3 Laboratory Testing

The preliminary description of the soils in the boreholes was carried out by our geotechnical staff on site during the fieldwork. Thereafter, all samples recovered in the boreholes were sent to our laboratory for identification and classification and testing if needed.

The soils were described by the geotechnical ASTM D2488 method according to "Description of soils (Visual-Manual Procedure)". The rock cores have been described by our geologists.

The results are detailed in Annex C and are summarized in the following table:

Six (6) selected rock samples recovered from the boreholes were tested in our laboratory for uni-axial compressive strength according to the ASTM D7012-07 standard. The results are summarized and presented in the following table no. 5:

Table 5: Compressive Strength results

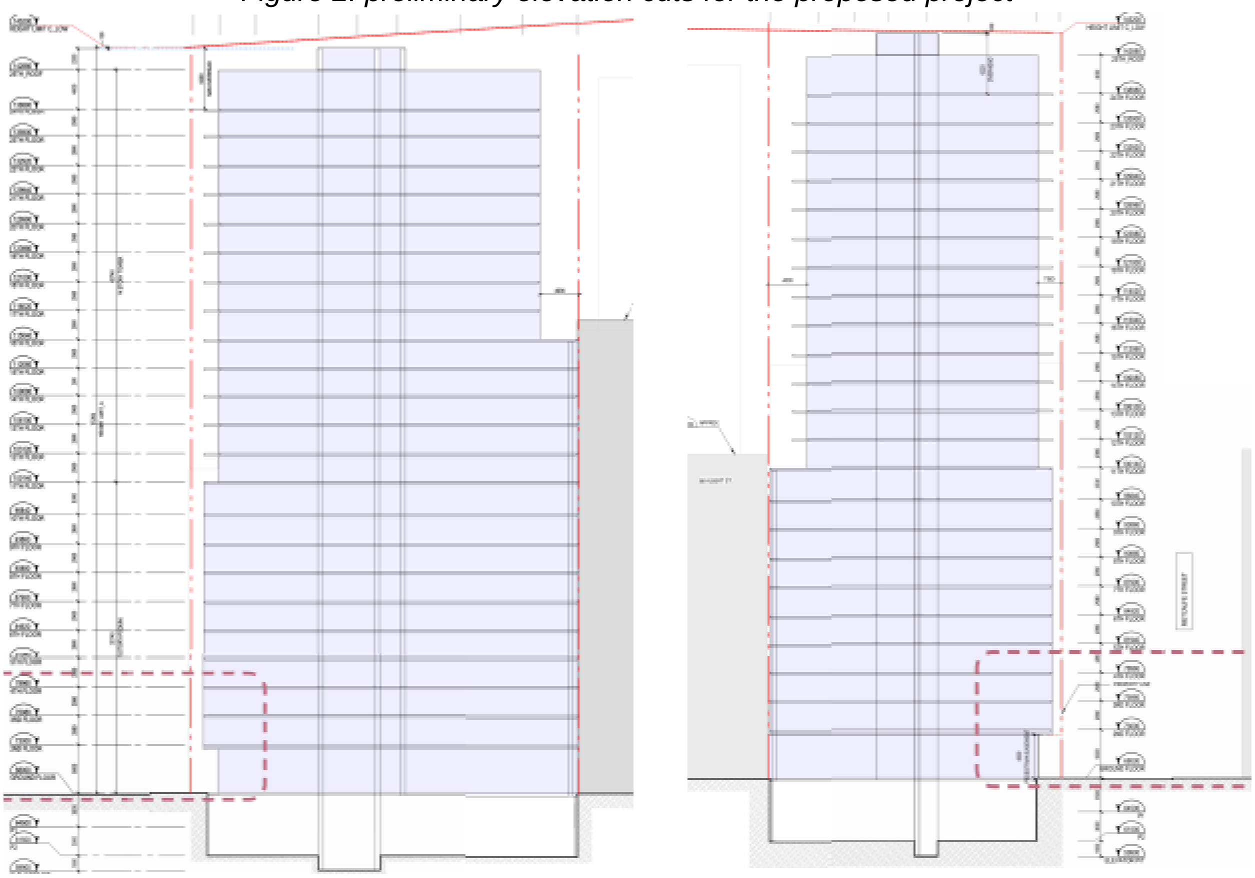
Bedrock sample	Sample depth (m)	Total unit weight (kN/ m³)	Compressive strength (MPa)	Grade*
BH1-RC5	4,55 – 4,71	25,3	50	R4 (strong)
BH2-RC4	2,72 – 2,88	24,8	34	R3 (Medium strong)
BH2-RC8	5,95 – 6,11	24,4	36	R3 (Medium strong)
BH3-RC4	3,29 – 3,48	24,9	40	R3 (Medium strong)
BH4-RC3	3,38 – 3,53	24,4	43	R3 (Medium strong)
BH5-RC4	3,24 – 3,48	25,0	44	R3 (Medium strong)
BH5-RC8	6,69 – 7,11	24,6	40	R3 (Medium strong)
Average		24,8	41	

* According to ISRM (1981) table 4.21 of the CFEM (2023)

6. CONCLUSIONS AND RECOMMENDATIONS

According to the available information, on the property corresponding to parts of lots nº 52 and west part of 53 at 77 Metcalfe Street in Ottawa, Ontario, it is proposed to demolish the existing twelve (12) storey building with a partial one (1) and two (2) basement levels and construct a new high-rise building in its place. The new building will reportedly also be two (2) basement levels, however, no information of the basement foundation walls will be reused at this time.

Figure 2: preliminary elevation cuts for the proposed project



The existing building has an irregular basement configuration. The first basement level footprint is bigger along Albert Street than the second basement level

Figures 3 and 4: Plans of the existing basements

No structural plans of the future project were currently available. For discussion purposes, we assume that floor live loads for the building will not exceed 5 kPa at maximum.

Considering the limitations of space to carry out the fieldwork outside, based on the results of our soundings and assuming that they are representative of the projected zone of the future building, the following elements need to be considered for the project:

- With pre-existing basement levels and the new construction also being two (2) basement levels, the new foundations are assumed to be placed at approximately the same elevation of the bedrock intercepted in the boreholes at the 2nd basement level. According to the document from NEUF ARCHITECTES, the elevation of the slab of the 2nd basement level is at ± 61,5 m, therefore, the foundations are presumed to be at elevation ± 61,0 m.
- With the existing building being demolished, the foundation walls could be used as part of the new project or as temporary retaining walls. If not, temporary shoring should be anticipated for this project.
- For this project, external drilling was not possible and Solroc Inc is unable to provide geotechnical parameters based on in situ data to define the lateral earth pressures. In this case, very conservative parameters could be taken in order to obtain good safety margins for the design of the temporary supports and shoring for the basement levels during the construction works as well as in the final design of the foundation walls (see sub-section 6.4).

Based on the results obtained from the boreholes and assuming that the results obtained from tested areas are representative of the subsoil conditions across the entire area, the following recommendations are offered:

6.1 Foundation design

According to the document from NEUF ARCHITECTES, the elevation of the slab of the 2nd basement level is at ± 61,5 m, therefore, the new foundations are presumed to be placed at elevation ± 61,0 m. At this elevation, the subsoil consists of the bedrock with RQD values ranging between 0% to 96%.

The loads of the new building could be founded on conventional strip and spread footings placed upon the acceptable bedrock.

Based on the examination of rock cores and considering some variability of the RQD values in the soundings as well as assuming that the soil conditions at the test locations are the same at the location of the existing building, we recommend an allowable bearing capacity or at serviceability limit states (SLS) of **1000 kPa** for the foundations placed on acceptable bedrock.

Under these constraints, the settlement under the new foundations should be negligible.

This bearing capacity value must be validated on site by a geologist before the foundations are set in place (see section 11.1 of the report).

The bearing capacity at the ultimate limit states (ULS) is 3000 kPa. At this bearing capacity a geotechnical resistance factor Φ of 0.5 should be applied to obtain the factored geotechnical resistance at the ULS (based on table 6.2 of the CFEM 2023).

The bearing surfaces at the foundation level must be clean and free of any loose or friable fragments and must not have an inclination greater than 10%. All areas of altered or very friable rock deemed unacceptable must be excavated to place the foundations on acceptable rock meeting the above-defined bearing capacity.

All backfilling from acceptable bedrock to reach the level of the new foundations must be done using concrete of at least 20 MPa at 28 days. The concrete must comply with the latest CSA-A23.1 / A23.2 standard.

If the foundation walls are poured against the rock, a membrane and a separation drain such as Miradrain must be installed to prevent the formation of cracks during concrete shrinkage and to allow drainage of water flowing through the rock with the foundation wall.

6.1.1 Shale protection

Because of the presence of shale bedrock, steps should be taken to limit the exposure of the bedrock to the air around the foundations for more than 24 hours by means of a layer of bituminous coating, a layer of granular cushion or a layer of C1 concrete in order to avoid reactivity of the shale rock. The C1 concrete will also help protect the new foundations.

If the water table is found at the level of the foundations, a floor drainage system should also be considered to drain the groundwater and avoid potential sulphatic reactions or other contamination from the bedrock that may be spread from the water into the existing concrete foundations and all other concrete structural elements if these concrete elements are susceptible to such contamination. Alternatively, the foundation footings could be constructed with C1 concrete.

6.2 Seismic Parameters

6.2.1 Liquefaction potential

Given the bedrock encountered in the boreholes, the subsoil is not liquefiable.

6.2.1 Site evaluation for seismic classification

According to Table 4.1.8.4.A. of the 2015 National Building Code of Canada, it is necessary to obtain information from the base of the foundations or pile caps until a depth of 30,0 m, to determine the seismic classification of the site from the standard penetration resistance N_{60}, or the intact shear resistance S_u.

The bedrock was intercepted in boreholes BH-3 to BH-6 between the depths of 0,47 m and 1,22 m.

According to the results of the boreholes and in reference to the table 4.1.8.4.A of 2015

National Building Code of Canada, for foundations placed on acceptable bedrock, the site under study is classified as **category C** with an average shear wave velocity interval between 360 m/s < V_s < 760 m/s.

According to the client, a Multichannel Analysis of Surface Waves MASW geophysical survey will be carried out for this site. Depending on the results, the site classification can probably be improved from the C indicated above.

6.3 Slab-on-Grade

To ensure a proper installation for the slab-on-grade and assuming that the floor live loads will be in the order of 10 kPa, the following precautions must be taken:

- The bearing surface should be free of deleterious materials, organic matter if encountered, and/or remoulded soils down to the bedrock under control by geotechnical personnel.
- The exposed surface should then be verified by qualified soil personnel to detect any inadequate zones. If encountered these zones should be excavated and replaced by a controlled granular material, which will then be compacted.
- The area should then be brought up until the base of the slab-on-grade using 0-20 mm DB or granular A crushed stone conforming to BNQ or OPSS specifications and to appropriate local procedures for slab installation. The crushed stone of at least 300 mm in thickness should be compacted to at least 95% of the modified Proctor maximum dry density of the material.

  Ensure that there is at least one layer of granular cushion at the base of the slab on grade consisting of crushed stone of MG-20 or granular A caliber at least 300 mm thick, free of pyrite and certified DB according to the CTQ-M100 protocol.
- The base should be covered with a polyethylene film as a vapour barrier to protect the slab against humidity.
- All the above operations should be carried out under the supervision of qualified soils personnel.
- The slab-on-grade should be structurally separated from the foundation walls and any columns.

6.4 Excavation stability and shoring

All the excavation works should be carried out in accordance with the security code in effect for excavation works by the WSIB or equivalent norms. Considering that the work method that will be used is currently unknown, the stability of the short-term excavation slopes and the security of workers and structures to be constructed are under the contractor's responsibility.

For temporary excavations, a slope of 2H: 1V could be used in the fill materials. A slope of 1H: 1V could be used for the fractured bedrock. For the sound bedrock, sub-vertical excavations can be considered for this project. It is recommended to allow for a shelf on the surface of the bedrock by recessing the excavated soil, if present, by at least 0,60 m from the edge of the bedrock excavation.

We recommend that the excavation line in the bedrock should be prepared using the line-drilling method to promote a clean cut and to avoid any fracturing or deterioration of the bedrock, where the foundations will be placed, before any fracturing and excavation work on the bedrock. Fractured and weathered bedrock can probably be removed with a hydraulic excavator and/or hydraulic hammer.

The excavation walls in the rock must be inspected by an experienced geologist during the excavation work to identify areas of weakness or shattered/crushed zones and then adopt appropriate support or reinforcing solutions.

Because of the lack of space, temporary supports will be required for the excavation walls. The existing foundation walls could probably act as the shoring walls for the project. An alternative would be creating shoring walls behind the walls to independently support the existing foundation walls and earth pressures during the demolition process and construction of the structure. According to information from the client, using the existing walls as shoring walls is currently being considered. The retaining structures, whatever the case, should be designed by a structural engineering firm and are under the contractor’s responsibility. They can be adapted during excavation according to the geology encountered and under the direction and control of an engineer.

The lateral pressures exerted by the soils on the retaining structure depend on the type of soils to be supported, the type of retaining structure used, and the installation method.

Additionally, the depth to reach the acceptable bedrock stratum may be deeper than what was encountered in the soundings. The retaining structures will need to be adequately dimensioned in case deeper excavations are required relative to the initial level to reach an acceptable rock.

In any case, strict control must be imposed to limit the speed of vibration waves in the work area using seismographs.

In the case of this project, external drilling is not possible and Solroc Inc. is unable to provide geotechnical parameters based on in situ data to define the lateral earth pressures. A decision was made during a meeting on November 5th 2024 between the client, the structural engineer and Solroc, to use very conservative parameters in order to obtain a good safety margins for the design of the temporary supports and shoring for the basement levels during the construction works as well as in the final design of the foundation walls. The client is aware of the higher construction cost with these designs, has understood and has accepted them.

The data in Table 6 of section 6.5 is the aforementioned estimated conservative geotechnical properties that can be used, as an indication, for the design of the retaining structure, assuming that the site is well-drained and the soil is horizontal at the rear of the wall. It is also recommended that a geotextile membrane be placed behind the lagging to prevent the migration of fine particles.

The lateral pressures to be supported by the retaining structures must be increased by surcharges at the ground level. The surcharges to consider must include the load of construction equipment, neighboring buildings, and any other load that could be transferred to the retaining structures during the duration of the work

The new building will be located near two nearby buildings to the south and east sides. At the time of writing this report, no exact information was available regarding the basement levels or foundation levels of the neighboring buildings.

If the excavation level or existing basement levels are deeper than the foundations of the neighboring existing structures, the loads must be taken into consideration in the design of the temporary and/or permanent retaining structures. In order to determine the design parameters, it will be necessary to obtain precise information about the foundations of the neighboring building before any excavation work or assume a conservative case for the designs.

6.5 Geotechnical parameters of the soil for the design of structures

The following tables define the geotechnical parameters of soils for the design of structures to be implemented in the construction of the building as well as for the design of temporary retaining structures

Table 6: Geotechnical parameters of the soils

Parameters / Soil	Soils (conservative estimate)	Bedrock
Total humid unit weight density, γ (kN/m^3)	18,0	24,8
Total saturated unit weight density, γ (kN/m^3)	20,0	-
Internal friction angle, ϕ, degrees	25	42,0
Coefficient of active earth pressure (Ka)	0,41	0,20
Coefficient of passive earth pressure (Kp)	2,46	5,04
Coefficient of lateral earth pressure at rest (K_o)	0,58	0,33
Coefficient of dynamic active earth pressure (Kae)	0,57	0,27
Coefficient of dynamic passive earth pressure (Kpe)	2,07	4,69
Coefficient of soil concrete friction	0,25	0,55

The lateral pressures to be supported by the temporary shoring must be increased by the overload at ground level. Overload to be considered must include the loads of construction equipment and any other load that could be transferred to the retaining walls for the duration of the work. For the distribution of lateral pressures, it will be necessary to refer to chapter 20 of the CFEM (2023)

To limit the movement of soil behind the shoring (existing foundation walls or otherwise), the calculation should be done using the coefficient of lateral earth pressure at rest, Ko. The recommended value for the ultimate grout/rock bond should be 0,5 MPa.

6.5.1 Underpinning work

Should any excavations reach below the level of the existing foundations, the need for underpinning work should be verified based on the condition and quality of the bedrock the foundations are resting upon. We also recommend carrying out the work after the demolition of the existing building and before the construction of the new building (if applicable) for the purpose of limiting the loads while doing the underpinning work.

6.6 Anchors

Anchorage design in rock is based on an allowable grout-to-rock bond stress acting over the fixed anchorage length. The allowable bond stress should be smaller than 1 / 30 times the unconfined compressive strength of the grout used. It should not exceed 1300 kPa. Whenever possible, the capacity of an anchor in rock should be established by means of a pull-out test, as recommended in article 20.8.6.1 of the CFEM (2023).

As for the number and size of the anchors, it will be necessary to refer to the structural engineer of the project.

6.7 Groundwater drainage

The groundwater level was measured on January 27th, 2025, in the boreholes at the depths of 0,23 and 2,55 m below the slabs (elevations ± 59,3 m to ± 62,1 m).

Infiltration caused by runoff or occluded water within the upper soil layers may occur during the excavations, depending on the weather conditions or the time of the year in which the work will be completed. These infiltrations should be able to be removed by wells with pumps placed on the perimeter of the excavation near the sources of infiltration.

Adequate pumping and drainage will be required to reduce and maintain the water level below the bottom of the excavation and construction during the works. The groundwater level must be kept to a minimum depth of 0,6 m under the level of all excavations.

For all information on the discharge capacity, the French drains and the need for under the slab drainage, refer to the hydrogeological study report prepared by SOLROC INC. (Project n^{o}: PR.HY01.24.0062).

Due to space restrictions, the French drains could be installed along the interior perimeter of the foundation walls. Weep holes may be installed or retrofitted to collect any lateral water infiltrations towards the French drains.

If not already waterproofed from the outside, the buried portions of the new foundation walls should be waterproofed against moisture and humidity with a waterproofing coating with appropriate concrete adhesion or self-sealing or thermally fused waterproofing membrane.

All products must be submitted to the project architect for approval.

We recommend waterproofing the elevator shaft and installing a water stopper for any new elevator shafts, if present.

7. RECOMMENDATIONS FOR CONSTRUCTION PROCEDURES

7.1 Placement of foundations and site inspection

The bottom of any excavation must be inspected and approved by qualified geotechnical personnel or geologists to ensure that subsurface conditions correspond to those encountered in the soundings and that the foundation is placed within the acceptable bedrock, and to confirm the bearing capacity.

It is also recommended to establish sumps at strategic areas of the construction site to drain all surfaces or groundwater running at the surface of the footing trenches.

In altered and fractured bedrock, we recommend the use of mechanical equipment or hydraulic impact hammers for rock excavation at the bearing surface of the foundations. We also recommend carrying out line drilling before the excavation works begins.

Any anomalies (fissures, joints, etc.) or any gaps in the bedrock surface must be reported to the designer so that the dimensions of the foundations are adjusted to the actual bearing capacity obtained after inspection (depending on the actual nature of the bedrock).

It is recommended to carry out a pre-construction survey of neighbouring buildings before any excavation or demolition work and to verify the vibrations generated by the excavation, demolishing or blasting, if used, by means of seismographs.

Steps should be taken to limit the exposure of the bedrock (shale) to the air for more than 24 hours by means of a layer of bituminous coating, a layer of granular cushion or a layer of C1 concrete.

7.2 Winter conditions

During construction, all exposed surfaces to support the new foundations must be protected against freezing by means of loose straw, tarpaulins, heating, etc.

The action of freezing and thawing can be disastrous for the bearing capacity of the bedrock, and, in this context, it is important to protect the bedrock beneath the foundations of the action of freezing and thawing during construction.

7.3 Backfilling

The interior trenches surrounding the foundation walls if any and the excavations around any interior columns should be backfilled using class A material (0-20 mm DB crushed stone or granular A material) compacted in successive thin layers (300 mm) to at least 95 % of the modified Proctor maximum dry density of the granular material. The shale rock should not be used as a backfilling material.

Backfilling and compaction operations should be supervised in order to ensure that proper materials are employed, and that full compaction is achieved.

The crushed stone material used must comply with the standard OPSS 1010 or similar local standards.

8. LIMITATIONS OF OUR INVESTIGATION

This report is carried out in accordance with current standards and practices of geotechnical consultation for the use of the company Groupe Mach inc., as part of a demolition and reconstruction project of a building at the property corresponding to lots n° 52 and west part of 53 located at 77 Metcalfe Street in Ottawa, Ontario. We consider that the information presented and obtained from the boreholes provide a reasonable representation of site conditions.

The conclusions and recommendations given in this report are based upon the information determined at the tested locations and on the data supplied to us at this time regarding the project to be built. Typically, geological subsurface and groundwater conditions across the site may differ from those encountered at the SOLROC INC. tested locations.

Consequently, should the project outlined in our hypothesis differ from the one which will be built, and should any soil and groundwater conditions exposed across the site differ from those found at the tested locations, we request that we be notified immediately to permit a reassessment of our recommendations.

It is stressed that this report is intended only for the guidance of the construction designer. Bidding contractors or contractors undertaking the works are warned that many more tests and analyses are required to determine the localised underground conditions affecting constructing costs, technique, sequencing, equipment, scheduling, etc. SOLROC INC disclaims any liability to any part, including contractors that interprets or relies upon this report to determine localized underground conditions.

The information contained in this report has no bearing on the environmental aspects of the soil.

SOLROC INC

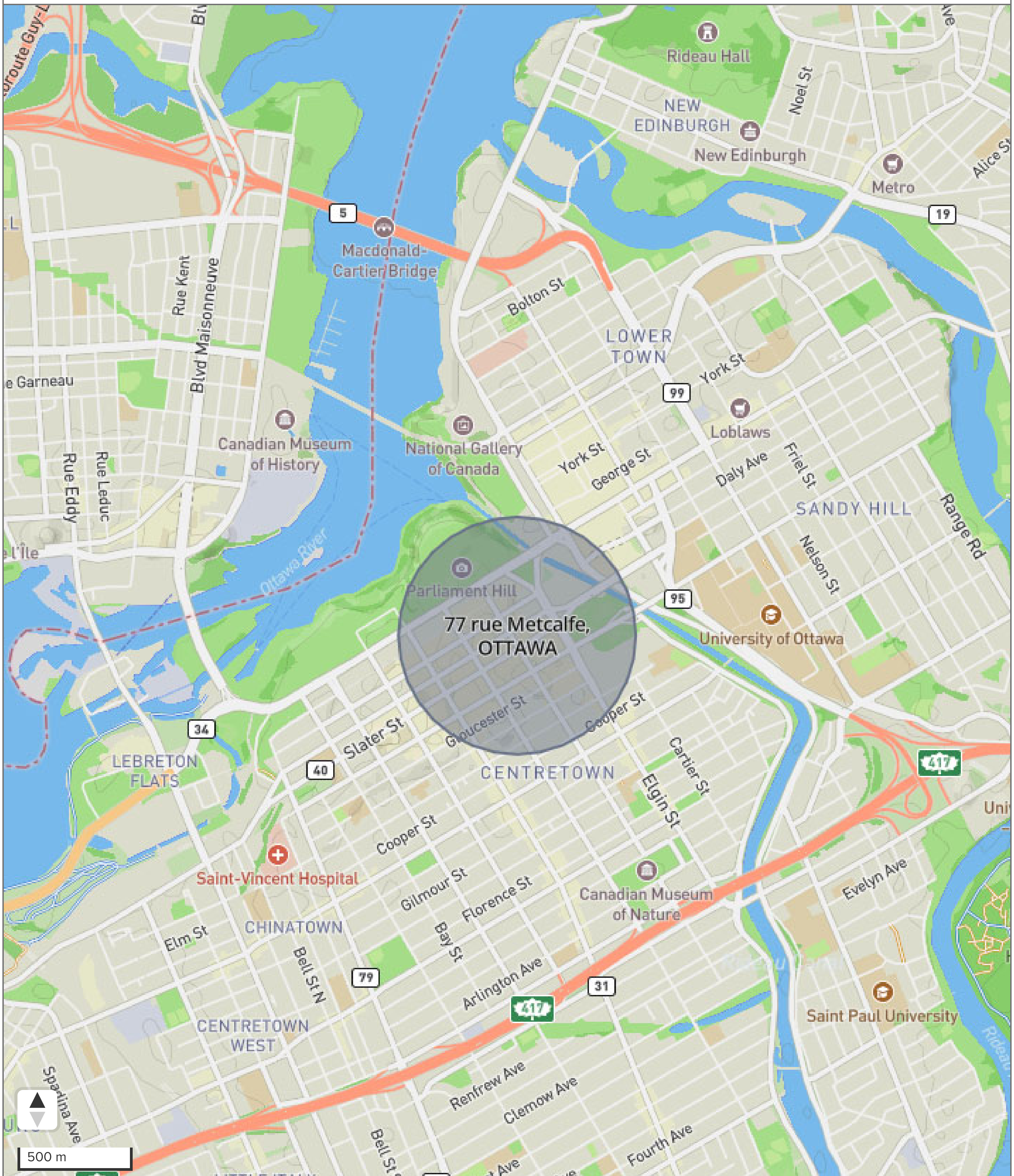
Annex A

GENERAL LOCATION PLAN

No. Project : **PR.GT01.24.0115**

CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**
PROJECT	**77 rue Metcalfe, OTTAWA**
LOCATION	**77 rue Metcalfe, OTTAWA**

LOCATION MAP



Annex B

BOREHOLE LOGS

No. Project : **PR.GT01.24.0115**	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**	Borehole n° **F1**
	PROJECT	**77 rue Metcalfe, OTTAWA**	
	LOCATION	**77 rue Metcalfe, OTTAWA**	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-06**	X	**132,955.11**	Z	**+64.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,651.71**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
- **CF** Cuillère fendue
- **CR** Carotte

ORGANOLEPTIC SIGNS
- **N** Nuls
- **F** Faibles

Water depth

Depth	Elevation	Descriptions	Samples	Recovery rate	RQD	SPT Reported	N_{spt}	Water depth	OS (N / F)	Well
0	64.5	Concrete slab. 0.25 m	0.25 m	0.25 m	0.25 m					Class B
	64.25	Fill: Humid dark brown silty sand and gravel. 0.86 m	SS-1 0.86 m	50.0% 0.86 m	0.86 m	2-4-5-5	9		N	
1	63.64	Becoming humid dark brown silty coarse sand and gravel. 1.47 m	SS-2 1.47 m	25.0% 1.47 m	1.47 m	3-2-2-1	4		N	Bentonite
2	63.03	Dark gray shale rock, locally submillimeter veinlets of quartz and carbonates. Mechanical fracturing.	RC-3 2.18 m	100.0% 2.18 m	62.0% 2.18 m			1	F	
3			RC-4 3.48 m	100.0% 3.48 m	94.0% 3.48 m				F	
4		4.72 m	RC-5 4.72 m	100.0% 4.72 m	67.0% 4.72 m				F	Sable silice
	59.78									

1 2.29m

solroc No. Project : **PR.GT01.24.0115**	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**	Borehole n° **F2**
	PROJECT	**77 rue Metcalfe, OTTAWA**	
	LOCATION	**77 rue Metcalfe, OTTAWA**	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-13**	X	**132,937.87**	Z	**+64.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,643.65**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
- **CF** Cuillère fendue
- **CR** Carotte

ORGANOLEPTIC SIGNS
- **N** Nuls

Water depth

Depth	Elevation	Descriptions	Samples	Recovery rate	RQD	SPT Reported	Nspt	Water depth	OS N	Well
0	64.5	Concrete slab. 0.15 m	0.15 m	0.15 m	0.15 m				✳	Class B
	64.35	Crushed stone 0-20mm. 0.3 m							✳	
	64.2	Fill: Fine beige humid sand with some silt. 0.43 m	SS-1	58.0%		3-10-4-2	14		✳	
	64.07	Becoming fine gray-brown humide sand with some gravel and traces of silt. 0.76 m	0.76 m	0.76 m	0.76 m					
	63.74	Becoming grey-brown humid sandy, silty, clay with some gravel and rock fragments. 1.09 m	SS-2 1.09 m	100.0% 1.09 m	1.09 m	2-7-50/25mm	> 50		✳	Bentonite
1	63.41	Dark gray shale rock, mechanical fracturing. 1.93 m	RC-3 1.93 m	90.0% 1.93 m	62.0% 1.93 m					
2	62.57	Becoming oblique natural fracturing at 40-50. 3.2 m	RC-4 3.2 m	100.0% 3.2 m	81.0% 3.2 m			1		
3	61.3	Becoming horizontal fracturing from 3.30 to 4.12 m. Mixture of mechanical and natural fractures. 3.43 m	RC-5 3.43 m	100.0% 3.43 m	11.0% 3.43 m					Sable silice
4	61.07	Dark gray shale rock. Local submillimeter quartz veins. Mechanical fracturing. 4.93 m	RC-6 4.93 m	100.0% 4.93 m	96.0% 4.93 m					
5	59.5	Becoming rock fracture.	RC-7 5.05 m	100.0% 5.05 m	5.05 m					

1 2.43m

solroc No. Project : **PR.GT01.24.0115**	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**	Borehole n° **F2**
	PROJECT	**77 rue Metcalfe, OTTAWA**	
	LOCATION	**77 rue Metcalfe, OTTAWA**	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-13**	X	**132,937.87**	Z	**+64.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,643.65**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
CF Cuillère fendue
CR Carotte

ORGANOLEPTIC SIGNS
N Nuls

Water depth

Depth	Elevation	Descriptions	Lithology	State	Samples	Recovery rate	RQD	SPT Reported	N_{spt}	Water depth	OS N	Well
5	59.5				RC-7 5.05 m	5.05 m	5.05 m					
		Becoming rock fracture.			RC-8	100.0%	72.0%					
6		6.43 m			6.43 m	6.43 m	6.43 m					
	58.07											

No. Project : **PR.GT01.24.0115**	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**	Borehole n° **F3**
	PROJECT	**77 rue Metcalfe, OTTAWA**	
	LOCATION	**77 rue Metcalfe, OTTAWA**	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-10**	X	**132,949.83**	Z	**+61.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,645.03**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
- **CF** Cuillère fendue
- **CR** Carotte

ORGANOLEPTIC SIGNS
- **N** Nuls
- **F** Faibles

Water depth

Depth	Elevation	Descriptions	Lithology	State	Samples	Recovery rate	RQD	SPT Reported	N_{spt}	Water depth	OS (N / F)	Well
0		Dalle de béton. 0.08 m				0.08 m	0.08 m				F	Class B
	61.42	Pierre concassé 0-20mm. fragment de roc. 0.52 m			SS-1 (0.08 m – 0.52 m)	94.0%	0.52 m	4-5-8-1	13			
	60.98	Dark grey shale blocks. 0.84 m			RC-2 (0.52 m – 0.83 m)	100.0%	0.83 m				N	
1 – 2	60.66	Dark gray shale rock. Rare submillimeter quartz veins. 2.24 m			RC-3 (0.83 m – 2.23 m)	100.0%	91.0%			1	N	Bentonite
3	59.26	Becoming mechanical fracturing.			RC-4 (2.23 m – 3.47 m)	100.0%	100.0%				N	Bentonite
		3.96 m			RC-5 (3.47 m – 3.96 m)	100.0%	100.0%				N	Sable silice
	57.54											

1 2.15m

No. Project : **PR.GT01.24.0115**	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**	Borehole n° **F4**
	PROJECT	**77 rue Metcalfe, OTTAWA**	
	LOCATION	**77 rue Metcalfe, OTTAWA**	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-11**	X	**132,941.32**	Z	**+61.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,630.90**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
CF Cuillère fendue
CR Carotte

ORGANOLEPTIC SIGNS
N Nuls

Water depth

Depth	Elevation	Descriptions	Lithology	State	Samples	Recovery rate	RQD	SPT Reported	N_{spt}	Water depth	OS N	Well
0		Concrete slab. 0.08 m				0.08 m	0.08 m				✳	
	61.42	Crushed stone 0-20mm. 0.21 m			0.08 m						✳	
	61.29	Fill:Uncultivated rock. Mixing with backfill. 0.57 m			SS-1 0.57 m	68.0% 0.57 m	0.57 m	2-5-6-6	11			
1	60.93	Dark gray shale rock. Some submillimeter quartz veins. Blocks at the start of the race between 0.33 - 0.79 m. 2.21 m			RC-2 2.21 m	83.0% 2.21 m	72.0% 2.21 m					
2, 3	59.29	Dark gray shale rock. Some submillimeter quartz veins. Mechanical fracturing. 3.53 m			RC-3 3.53 m	100.0% 3.53 m	100.0% 3.53 m					
	57.97											

solroc	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**	Borehole n°
	PROJECT	**77 rue Metcalfe, OTTAWA**	**F5**
No. Project : **PR.GT01.24.0115**	LOCATION	**77 rue Metcalfe, OTTAWA**	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-10**	X	**132,963.65**	Z	**+61.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,635.91**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
- **CF** Cuillère fendue
- **CR** Carotte

ORGANOLEPTIC SIGNS
- **N** Nuls
- **F** Faibles

Water depth

Depth	Elevation	Descriptions	Lithology	State	Samples	Recovery rate	RQD	SPT Reported	N_{spt}	Water depth	OS (N / F)	Well
0	61.5	Concrete slab. 0.11 m		Disturbed		0.11 m	0.11 m					Class B
	61.39	Crushed stone 0-20mm. 0.26 m		Disturbed	SS-1 (0.11 m – 0.44 m)	77.0% (0.44 m)	0.44 m	2-4-1-1	5	1	F	Class B
	61.24	Rock fragment. 0.44 m		Disturbed							F	Class B
	61.06	Dark gray shale rock blocks. 0.78 m			RC-2 (0.78 m)	100.0% (0.78 m)	0.78 m				N	Class B
1 – 4	60.72	Dark gray shale rock. Submillimeter quartz veins. Mechanical fracturing. 4.16 m			RC-3 (2.18 m)	100.0% (2.18 m)	78.0% (2.18 m)				N	Bentonite
					RC-4 (3.48 m)	100.0% (3.48 m)	89.0% (3.48 m)				N	Bentonite
					RC-5 (4.16 m)	100.0% (4.16 m)	93.0% (4.16 m)				N	Sable silice
	57.34											

1 0.23m

solroc	CLIENT	Edifice 77 Metcalfe inc, Groupe Mach	Borehole n°
	PROJECT	77 rue Metcalfe, OTTAWA	**F6**
No. Project : **PR.GT01.24.0115**	LOCATION	77 rue Metcalfe, OTTAWA	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-10**	X	**132,958.09**	Z	**+61.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,619.61**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
- **CF** Cuillère fendue
- **CR** Carotte

ORGANOLEPTIC SIGNS
- **N** Nuls
- **F** Faibles

Water depth

Depth	Elevation	Descriptions	Samples	Recovery rate	RQD	SPT Reported	Nspt	Water depth	OS (N / F)	Well
0	61.5	Concrete slab. 0.13 m	0.13 m	0.15 m	0.15 m					Class B
	61.37	Crushed stone 0-20mm. 0.61 m	SS-1 (0.15 m – 0.61 m)	61.0% (0.61 m)	0.61 m	2-1-1	2		F	Class B
	60.89	Mix with stone. 1.22 m	SS-2 (0.61 m – 1.22 m)	50.0% (1.22 m)	1.22 m	1-2-2-10	4		F	Class B
1	60.28	Dark gray shale rock. Some submillimeter veins of quartz. Blocks at the start of the race between 1.22 and 1.49 m. 2.18 m	RC-3 (2.18 m)	100.0% (2.18 m)	70.0% (2.18 m)				N	Class B
2	59.32	Dark gray shale rock. Some submillimeter veins of quartz. Some pyrite crystals. 3.23 m	RC-4 (3.23 m)	100.0% (3.23 m)	97.0% (3.23 m)			1	N	Bentonite
3	58.27	Dark gray shale rock. Some submillimeter quartz veins. Mechanical fracturing.	RC-5 (4.04 m)	100.0% (4.04 m)	95.0% (4.04 m)				N	Sable silice
4			RC-6 (4.65 m)	100.0% (4.65 m)	96.0% (4.65 m)					Sable silice
5	56.5		RC-7	100.0%	100.0%					Sable silice

1 2.55m

solroc	CLIENT	Edifice 77 Metcalfe inc, Groupe Mach	Borehole n°
	PROJECT	77 rue Metcalfe, OTTAWA	**F6**
No. Project : **PR.GT01.24.0115**	LOCATION	77 rue Metcalfe, OTTAWA	

REALIZED BY	**M.D.**	WORKS DATE	**2024-12-10**	X	**132,958.09**	Z	**+61.5 m**
CHECK BY	**G.G.**	CONTRACTOR	**Solroc**	Y	**5,033,619.61**		
APPROVED BY	**G.G.**	DRILL TYPE	**M-1**	CRS	**NAD83 / MTM zone 8**	LVL.	**Elevation**
				ACCURACY	**Not specified**	ACCURACY	**Not specified**

SAMPLE STATUS
- UNDISTURBED SAMPLE
- DISTURBED SAMPLE
- LOST OR NOT SAMPLED

SAMPLE TYPE
- **CF** Cuillère fendue
- **CR** Carotte

ORGANOLEPTIC SIGNS
- **N** Nuls
- **F** Faibles

Water depth

Depth	Elevation	Descriptions	Lithology	State	Samples	Recovery rate	RQD	SPT Reported	N_{spt}	Water depth	OS (N / F)	Well
5	56.5	Dark gray shale rock. Some submillimeter quartz veins. Mechanical fracturing.			RC-7 6.02 m	100.0% 6.02 m	100.0% 6.02 m					Sable silice
6					RC-8 7.54 m	100.0% 7.54 m	100.0% 7.54 m					Bentonite
7	53.96	7.54 m										

Annex C

RESULTS OF LABORATORY TESTING

SOLROC Inc.

ROCK CORE
COMPRESSIVE STRENGTH DETERMINATION

CLIENT :	**Edifice 77 Metcalfe inc.**	SAMPLING DATE :	**02/12/2025**
SITE :	**77 rue Metcalfe, QC**	COMPRESSION DATE :	**15/01/2025**
PROJECT MANAGER :	**George Giannis**	MEMO No :	**N/A**
PROJECT No :	**PR.GT01.24.0115**	LABORATORY No :	**25-LG-006**

GENERAL INFORMATIONS

ROCK DESCRIPTION : **Shale**

ROCK DESCRIPTION BY : **Mathieu Nouazi**

SAMPLED BY : **S.P.**

RESULTS

Number / Reference	**Depth (m) Top Bottom**	Average diameter (mm)	Core height (mm)	Height with capping (mm)	Ratio H/D	Mass (g)	**Unit weight (kN/m^3)**	Force (kN)	**MPa**
BH1-CR5	55.82 55.70	55.76	118.65	122.09	2.19	748.2	**2582.3**	122.48	**50.2**
BH2-CR4	55.59 55.81	55.70	114.86	116.85	2.10	708.5	**2531.6**	82.62	**33.9**
BH2-CR8	56.10 56.72	56.41	112.37	118.21	2.10	697.1	**2482.2**	91.01	**36.4**
BH3-CR4	55.86 56.01	55.94	114.54	117.13	2.09	713.5	**2535.0**	98.39	**40.0**
BH4-CR3	55.85 55.87	55.86	115.86	119.21	2.13	706.9	**2489.5**	105.70	**43.1**
BH5-CR4	55.81 55.88	55.85	117.60	121.27	2.17	734.5	**2549.9**	107.71	**44.0**
BH6-CR8	56.22 56.25	56.24	112.54	117.62	2.09	702.0	**2511.4**	98.84	**39.8**

* Diameter : 2 readings half sample (Precision 0,5mm)
** Height : With capping, Ø < 2,0 , apply correction factor (Precision 1mm)
*** Flatness : <0,05mm
**** Perpendicularity : <2mm for 200mm (0,5°)

REMARKS

Compressive section BH1-CR5 : 4.55 - 4.71 m

Compressive section BH2-CR4 : 2.72 - 2.88 m

Compressive section BH2-CR8 : 5.95 - 6.11 m

Compressive section BH3-CR4 : 3.29 - 3.48 m

Compressive section BH4-CR3 : 3.38 - 3.53 m

Compressive section BH5-CR4 : 3.24 - 3.48 m

Compressive section BH6-CR8 : 6.94 - 7.11 m

Realised by: Mathieu Nouazi Date: 16-01-2025 Verified by: George Giannis Date: 16-01-2025

Annex D

LOCATION OF BOREHOLES

	CLIENT	Edifice 77 Metcalfe inc, Groupe Mach
	PROJECT	77 rue Metcalfe, OTTAWA
No. Project : **PR.GT01.24.0115**	LOCATION	77 rue Metcalfe, OTTAWA

LAYOUT MAP

Surveys accuracy (X / Y)	Carried out by surveyor
Not specified	No
Coordinate Reference System of the project	**Leveling**
NAD83 / MTM zone 8	Not specified

	WGS 84		NAD83 / MTM zone 8		
Name	**Longitude**	**Latitude**	**X**	**Y**	**Elevation** [m]
F1	-75.695868968	45.421685284	132,955	5,033,652	64.5
F2	-75.696086279	45.421608579	132,938	5,033,644	64.5
F3	-75.695934127	45.42162393	132,950	5,033,645	61.5
F4	-75.696037859	45.421494714	132,941	5,033,631	61.5
F5	-75.695754417	45.421545275	132,964	5,033,636	61.5
F6	-75.695819714	45.421397374	132,958	5,033,620	61.5

solroc	CLIENT	**Edifice 77 Metcalfe inc, Groupe Mach**
	PROJECT	**77 rue Metcalfe, OTTAWA**
No. Project : **PR.GT01.24.0115**	LOCATION	**77 rue Metcalfe, OTTAWA**

LAYOUT MAP