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Geotechnical Engineering

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Building Science

Noise and Vibration Studies

Geotechnical Investigation

Proposed Residential Building
970 & 974 Silver St., 1271 & 1275 Shillington Ave.
Ottawa, Ontario

Prepared For

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Farmhouse Investments Inc. to conduct a geotechnical investigation for the proposed residential Building to be located at 970 & 974 Silver Street and 1271 & 1275 Shillington Avenue in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

- Determine the subsoil and groundwater conditions at this site by means of boreholes.

- Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

Based on the available drawings and correspondence with the client, it is understood that the proposed development will consist of a multi-storey residential building constructed over 1 level of underground parking. The building footprint are anticipated to occupy the majority of the subject site. Associated access lanes, walkways and landscaped areas are also anticipated as part of the development. It is expected that the proposed buildings will be municipally serviced.

Due to the presence of existing dwellings, it is expected that demolition work will be completed as part of the proposed project.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on November 24, 2021 and consisted of advancing a total of 4 boreholes to a maximum depth of 5.9 m below existing ground surface. The test hole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and site features. The borehole locations are shown on Drawing PG6031-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a low-clearance, rubber track-mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of advancing each test hole to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

The soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler. The samples were initially classified on site, placed in sealed plastic bags, and transported to our laboratory. The depths at which the auger, and split-spoon samples were recovered from the boreholes are shown as AU, and SS respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils using a vane apparatus.

The thickness of the overburden was evaluated during the course of the investigation by a dynamic cone penetration test (DCPT) at borehole BH 1-21. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at its tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Flexible polyethylene standpipes were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the proposed development, taking into consideration the existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high precision handheld GPS and referenced to a geodetic datum. The location of the boreholes and ground surface elevation at each test hole location are presented on Drawing PG6031-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of 1 Shrinkage test, 1 Grain Size Distribution and Hydrometer test and 2 Atterberg Limits tests were completed on selected soil samples. The results are presented in Subsection 4.2 and on Shrinkage Test Results, Grain Size Distribution and Hydrometer Testing and Atterberg Limit's Results sheets presented in Appendix 1.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures, one of which was collected from BH3-21. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The ground surface across the subject site is relatively flat and at grade with the surrounding roadways. The subject site consists of four residential lots currently occupied by single-family residential dwellings with associated garages, landscaped areas, fences, and driveways. The site is also covered by several mature trees.

The site is bordered by Alexander Community Centre and Park to the north, Shillington Avenue to the south and Silver Street to the east. The existing ground surface across the site is relatively level with an approximate geodetic elevation of 78 to 78.5 m.

4.2 Subsurface Profile

Generally, the soil profile at the test hole locations consists of topsoil and/or asphalt underlain by fill extending to a maximum depth of 0.8 m. The fill was generally observed to consist of brown silty sand with gravel and trace to some clay.

A hard to very stiff, brown silty clay layer was encountered underlying the fill. The silty clay was observed to transition into a stiff, grey silty clay at 3.0 m depth. Glacial till was encountered between 5.0 and 5.6 m below the existing ground surface and extended to the end of the boreholes. The glacial till was observed to consist of silty clay mixed with sand, gravel, cobbles and boulders. Practical refusal to DCPT was encountered on inferred bedrock at a depth of 10.29 m in BH1-21.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of interbedded limestone and dolomite of the Gull River Formation, with an overburden drift thickness of 10 to 15 m depth.

Atterberg Limit and Shrinkage Tests

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples at selected locations throughout the subject site. The results of the Atterberg limits are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 - Atterberg Limits Results					
Sample	**Depth (m)**	**LL (%)**	**PL (%)**	**PI (%)**	**Classification**
BH 1-21 SS3	1.6 – 2.1	82	37	45	CH
BH 3-21 SS4	2.3 – 2.9	56	25	31	CH
Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; CH: Inorganic Clay of High Plasticity MH: Inorganic Silt of High Plasticity					

The results of the moisture contest test are presented in Table 2 and on the Soil Profile and Test Data Sheet in Appendix 1.

Table 2 – Moisture Content Results			
Borehole	**Sample**	**Depth (m)**	**Water Content (%)**
BH 1-21	AU1	0.3	16.14
BH 1-21	SS2	1.1	43.67
BH 1-21	SS3	1.8	45.48
BH 1-21	SS4	2.6	63.56
BH 1-21	SS5	3.4	58.05
BH 1-21	SS6	4.1	58.07
BH 1-21	SS7	4.7	10.90
BH 1-21	SS8	5.6	11.28
BH 2-21	AU1	0.3	12.40
BH 2-21	SS2	0.9	31.66
BH 2-21	SS2	1.2	44.70
BH 2-21	SS3	5.6	10.19
BH 3-21	AU1	0.3	20.11
BH 3-21	SS2	1.1	36.11
BH 3-21	SS3	1.7	51.17
BH 3-21	SS4	2.6	25.05
BH 3-21	SS5	3.7	48.43
BH 3-21	SS6	4.1	20.16
BH 3-21	SS7	4.9	20.05
BH 3-21	SS8	5.2	16.70

Table 2 (continued) – Moisture Content Results

Borehole	Sample	Depth (m)	Water Content (%)
BH 4-21	AU1	0.3	11.84
BH 4-21	SS2	1.1	44.36
BH 4-21	SS3	5.6	11.80

Grain Size Distribution and Hydrometer Testing

Grain size distribution and hydrometer testing was also completed on one selected soil sample. The results of the grain size analysis are summarized in Table 3 and presented on the Grain-size Distribution and Hydrometer Testing Results sheets in Appendix 1.

Table 3 - Summary of Grain Size Distribution Analysis

Test Hole	Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 3-21	SS4	0.0	5.0	57.0	38.0

Shrinkage Testing

The results of the shrinkage limit test indicate a shrinkage limit of 19.0% and a shrinkage ratio of 1.75.

4.3 Groundwater

Groundwater levels were measured on January 6, 2022 within the installed polytube piezometers. The measured groundwater levels are presented in Table 4 below.

Table 4 – Summary of Groundwater Levels

Test Hole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Dated Recorded
		Depth (m)	Elevation (m)	
BH 1-21	78.56	2.95	75.61	January 6, 2022
BH 2-21	78.49	-	-	
BH 3-21	78.14	-	-	
BH 4-21	78.28	3.33	74.95	

Note: The ground surface elevation at each borehole location was surveyed using a high-precision GPS and referenced to a geodetic datum. The polytube piezometers within boreholes BH 2-21 and BH 3-21 were obstructed and could not be measured.

It should be noted that long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximately 3 to 4 m below ground surface. The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is expected that the proposed building will be founded over conventional shallow foundation placed over an undisturbed brown silty clay bearing medium. Where design loads exceed the bearing resistance values provided for shallow foundations, consideration may be given to a raft foundation.

Due to the presence of a silty clay deposit, a permissible grade raise restriction is required for the subject site. The above and other considerations are discussed in the following paragraphs.

The above and other design considerations are summarized in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Existing foundation walls and other construction debris should be entirely removed from within the building footprint. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 99% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids.

If excavated brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, under dry conditions, should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD using a sheepsfoot roller under dry conditions and above freezing temperature under the supervision and approval of Paterson personnel.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000, connected to a perimeter drainage system is provided.

Protection of Subgrade

Due to the presence of silty clay within the subgrade level of the proposed building, it is recommended to prevent construction traffic along the subgrade level. Alternatively, it is recommended that a minimum 50 mm thick lean concrete mudslab be placed on the undisturbed subgrade shortly after the completion of the excavation. The main purpose of the mud slab is to reduce the risk of disturbance of the subgrade under the traffic of workers and equipment.

5.3 Foundation Design

Spread Footing Foundation

Pad footings, up to 3 m wide, and strip footings, up to 6 m wide, founded on an undisturbed, hard to very stiff brown silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa** incorporating a geotechnical factor of 0.5.

Pad footings, up to 3 m wide, and strip footings, up to 6 m wide, founded on an undisturbed, stiff grey silty clay bearing surface can be designed using a bearing resistance value at SLS of **125 kPa** and a factored bearing resistance value at ULS of **175 kPa** incorporating a geotechnical factor of 0.5.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed, in the dry, prior to the placement of concrete footings.

Footings bearing on an undisturbed soil bearing surface and designed using the bearing resistance values provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Raft Foundation

If the proposed building requires higher bearing resistance values than the above noted values, the building may be founded on a raft foundation placed on hard to very stiff brown silty clay bearing surface.

The amount of settlement of the raft slab will be dependent on the sustained raft contact pressure. The design should allow for the use of no more than 80% of the overconsolidation of the silty clay and account for a potential 0.5 m post-development groundwater lowering. Based on the available soils information, a bearing resistance value at serviceability limit states (SLS - contact pressure) of **200 kPa** can be used for the hard to very stiff, brown silty clay bearing medium. The loading conditions for the contact pressure are based on sustained loads, that are generally taken to be 100% Dead Load and 50% Live Load. The factored bearing resistance at ultimate limit states (ULS) can be taken to be 300 kPa. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

The modulus of subgrade reaction was calculated to be **8 MPa/m** for a contact pressure of **200 kPa**. The design of the raft foundation is required to consider the relative stiffness of the reinforced concrete slab and the supporting bearing medium. A common method of modeling the soil structure interaction is to consider the bearing medium to be elastic and to assign a subgrade modulus. However, sensitive silty clay is not elastic and limits have to be placed on the stress ranges of a particular modulus. This value can be re-evaluated once detail of the structural design becomes available.

Based on the above assumptions for the raft foundation, the proposed building can be designed using the above parameters and a total and differential settlement of 25 and 15 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to silty clay and engineered fill bearing media when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as that of the bearing medium.

Permissible Grade Raise

A permissible grade raise restriction of **2 m** is recommended for the subject site. If greater permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations constructed at the subject site. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and deleterious fill within the footprint of the proposed building, the native silty clay will be considered an acceptable subgrade upon which to commence backfilling for basement slab construction. It is anticipated that the basement area for the proposed building will be mostly parking and the recommended pavement structures noted in Subsection 5.7 will be applicable. However, if storage or other uses of the lower level will involve the construction of a concrete floor slab, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

All backfill material within the footprint of the proposed buildings (but outside the zones of influence of the footings) should be placed in maximum 300 mm thick loose layers and compacted to at least 95% of its SPMDD. Within the zones of influence of the footings, the backfill material should be compacted to a minimum of 98% of its SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material. A clear crushed stone fill is recommended for backfilling below the floor slab for limited span slab-on-grade areas, such as front porch or garage footprints. It is recommended that the upper 200 mm of sub-slab fill consist of 19 mm clear crushed stone below basement floor slabs.

In consideration of the groundwater conditions at the site, a sub-slab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the subfloor fill under the lower basement floor. This is discussed further in Subsection 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m3.

However, undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight. On the other hand, if a full drainage system is being implemented and approved by Paterson at the time of construction, hydrostatic pressure can be omitted in the structural design.

Lateral Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall, should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Gatineau area is 0.27 g according to the NBCC. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per the NBCC.

5.7 Pavement Design

For design purposes, it is recommended that the rigid pavement structure for the underground parking level consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is further presented in Table 4. The flexible pavement structure presented in Table 5 on next page should be used for at grade access lanes and heavy loading parking areas.

Table 4 - Recommended Rigid Pavement Structure - Lower Parking Level

Thickness (mm)	Material Description
150	**Exposure Class C2 - 32 MPa Concrete** (5 to 8% Air Entrainment)
300	**BASE** – MG 20 Crushed Stone
SUBGRADE – Either fill, in-situ soil, or OPSS Granular B type I or II material placed over in-situ soil, bedrock or concrete fill.	

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the underground parking level. The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hour after the concrete has been poured during warm temperatures and up to 12 hours during cooler temperatures.

Table 5 - Recommended Pavement Structure - Access Lanes	
Thickness (mm)	**Material Description**
40	**Wear Course** - EB-10S Asphaltic Concrete
50	**Binder Course** - EB-20 Asphaltic Concrete
150	**BASE** – OPSS Granular A Crushed Stone
450	**SUBBASE** – OPSS Granular B Type IIe
SUBGRADE - Either fill, in-situ soil, or OPSS Granular B type I or II material placed over in-situ soil, bedrock or concrete fill.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the silty clay deposit, where silty clay is anticipated at subgrade level, consideration should be given to installing subdrains during the pavement construction. The subdrain inverts should be approximately 300 mm below subgrade level and run longitudinal along the curb lines. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed footing structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the catch basins storm sewer.

Sub-slab Drainage

Sub-slab drainage may be required to control water underlying the floor slab in areas where footings are utilized. For design purposes, it is recommended that a series of 150 mm diameter perforated pipes be placed below the floor slab and be mechanically connected a positive outlet such as the building sump system. It is recommended that the underfloor drainage pipes be spaced a minimum 6 m center to center. The spacing of the sub-slab drainage system should be confirmed at the time of backfilling the floor, following completion of the excavation when water infiltration can be better assessed.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m thick soil cover should be provided for adequate frost protection of heated structured, or an equivalent combination of soil cover and foundation insulation.

Exterior unheated footings, such as those for isolated exterior piers and unheated parking structures, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is anticipated that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

Unsupported Side Slopes

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides. Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

Temporary Shoring

Where space restrictions exist, temporary shoring may be required. The design and approval of the shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures and include dewatering control measures.

In the event that subsurface conditions differ from the approved design during the actual installation, it is the responsibility of the shoring contractor to commission the required experts to re-assess the design and implement the required changes. Furthermore, the design of the temporary shoring system should take into consideration a full hydrostatic condition which can occur during significant precipitation events.

The temporary shoring system is recommended to consist of a soldier pile and lagging system which could be cantilevered, anchored or braced.

Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. The earth pressures acting on the shoring system may be calculated using the following parameters.

Table 7 - Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Unit Weight (γ), kN/m^3	21
Submerged Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil should be calculated full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the upper portion of the dry to moist (not wet) silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions.
The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Where hard surfaces are considered above the trench backfill, the backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material.

The seals should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Adverse effects on Neighbouring Properties

It is anticipated that the proposed multi-storey building will be founded on conventional shallow footings above the long-term groundwater table. Therefore, lowering of the long-term groundwater table is not expected. Temporary dewatering of the site during construction is expected to be minimal within the immediate area of the site and should have no adverse effects to the surrounding buildings or structures.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non-aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. A shrinkage limit test and sieve analysis testing was also completed on selected soil samples. The shrinkage limit testing indicates a shrinkage limit of 19.0% and a shrinkage ratio of 1.75. The results of our atterberg limit and sieve testing are presented in Appendix 1.

Based on the results of our testing, two areas have been outlined in Drawing PG6031-2 - Tree Planting Setback Areas presented in Appendix 2. Area 1 defines areas of low to medium plasticity silty clay (Plasticity index < 40%) and area 2 defines areas of high plasticity silty clay (Plasticity index > 40%). In accordance with the city of Ottawa guidelines, the tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) in Area 1. As per the guideline, trees in area 2 shall be planted with a minimum setback equal to the mature height of the tree.

- ❑ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade for footings within 10 m from the tree, as measured from the center of the tree trunk and verified by means of the Grading Plan.

- A small tree must be provided with a minimum of 25 m^3 of available soils volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

- The foundation walls are to be reinforced at least nominally.

- Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the subdivision Grading Plan.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ Grading plan review from a geotechnical perspective, once the final grading plan is available.
- ❑ Review of the contractor's design of the temporary shoring system, if applicable.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Inspection of all foundation drainage systems
- ❑ Sampling and testing of the concrete and fill materials.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Farmhouse Investments Inc. or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Owen Canton, E.I.T.

Faisal I. Abou-Seido., P.Eng

Report Distribution:

- ❑ Farmhouse Investments Inc.
- ❑ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN-SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
970-971 Silver Street & 1271, 1275 Shillington Ave.
Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG6031**

REMARKS

HOLE NO. **BH 1-21**

BORINGS BY CME-55 Low Clearance Drill **DATE** November 24, 2021

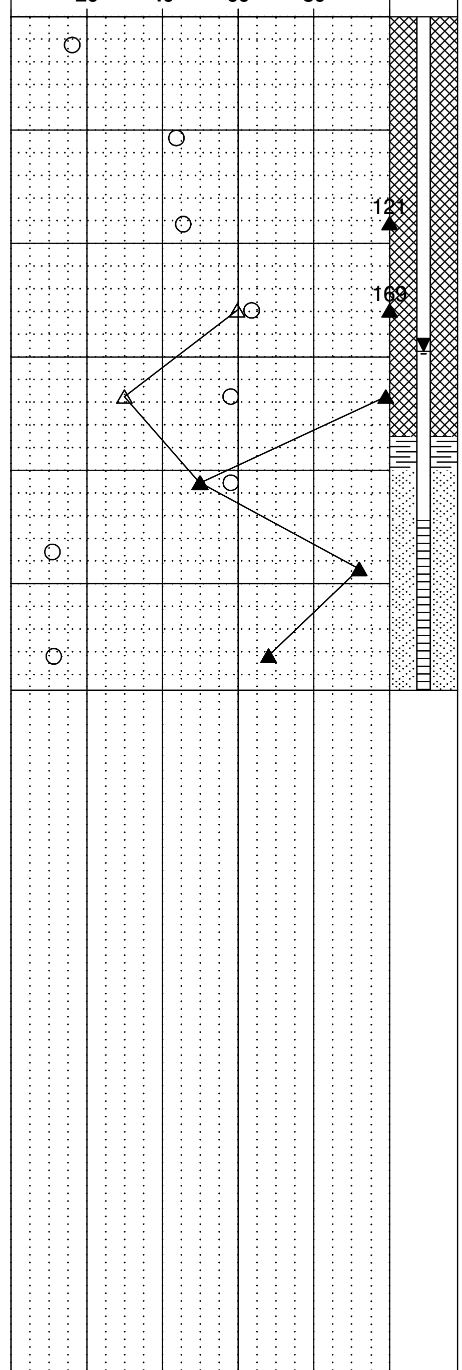
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.56
Asphaltic concrete 0.05		AU	1				
FILL: Brown silty sand, some clay, trace gravel 0.46							
		SS	2	50	8	1	77.56
Hard to very stiff, brown **SILTY CLAY** with sand to 1.2m.		SS	3	75	P		
		SS	4	50	P	2	76.56
- stiff and grey by 3.0m depth		SS	5	75	P	3	75.56
		SS	6	50	P	4	74.56
		SS	7	50	P	5	73.56
5.64		SS	8	50	10		
GLACIAL TILL: Very stiff to hard, grey silty clay with sand, gravel, cobbles and boulders 5.94							
End of Borehole							
(GWL @ 2.95m - January 6, 2022)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
970-971 Silver Street & 1271, 1275 Shillington Ave.
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG6031

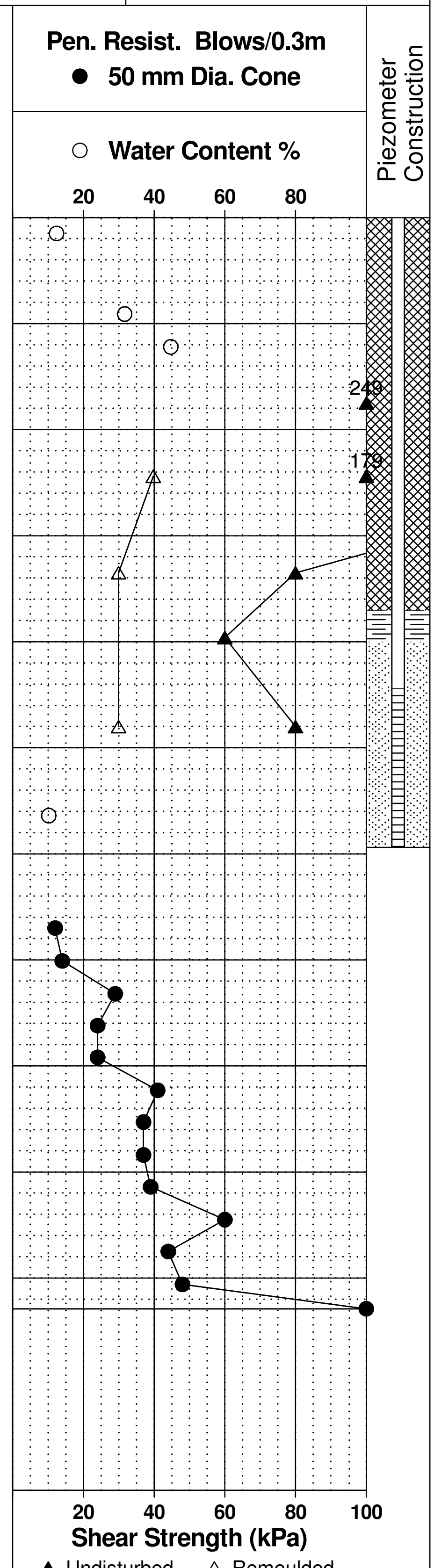
REMARKS

HOLE NO. BH 2-21

BORINGS BY CME-55 Low Clearance Drill **DATE** November 24, 2021

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
Asphaltic concrete	0.05	AU	1		
FILL: Brown silty sand with gravel, trace clay	0.51				
FILL: Brown silty sand	0.84	SS	2	50	15
Hard to very stiff, brown **SILTY CLAY** - stiff and grey by 3.0m depth	5.03				
GLACIAL TILL: Very stiff, grey silty clay with sand, gravel, cobbles and boulders	5.94	SS	3		11
Dynamic Cone Penetration Test commenced at 5.94m depth.	10.29				
End of Borehole Practical DCPT refusal at 10.29m depth					

DEPTH (m)	ELEV. (m)
0	78.49
1	77.49
2	76.49
3	75.49
4	74.49
5	73.49
6	72.49
7	71.49
8	70.49
9	69.49
10	68.49



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
970-971 Silver Street & 1271, 1275 Shillington Ave.
Ottawa, Ontario

DATUM Geodetic

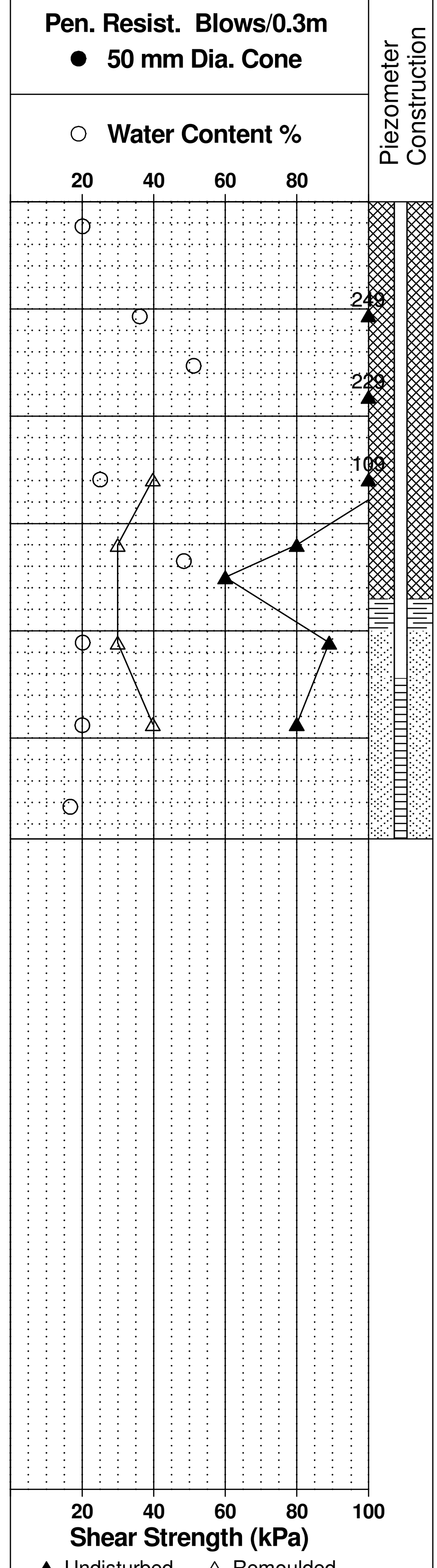
FILE NO. PG6031

REMARKS

HOLE NO. BH 3-21

BORINGS BY CME-55 Low Clearance Drill **DATE** November 24, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.14
Asphaltic concrete 0.08		AU	1				
FILL: Brown silty sand with gravel, trace clay 0.46							
		SS	2	33	P	1	77.14
		SS	3	75	P		
Hard to very stiff, brown **SILTY CLAY** with sand to 1.2m.						2	76.14
		SS	4	75	P		
- stiff and grey by 3.0m depth						3	75.14
		SS	5	25	P		
		SS	6	100	P	4	74.14
		SS	7	75	P	5	73.14
5.41							
GLACIAL TILL: Very stiff, grey silty clay with sand, gravel, cobbles and boulders 5.94		SS	8	21	12		
End of Borehole							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
970-971 Silver Street & 1271, 1275 Shillington Ave.
Ottawa, Ontario

DATUM Geodetic

REMARKS

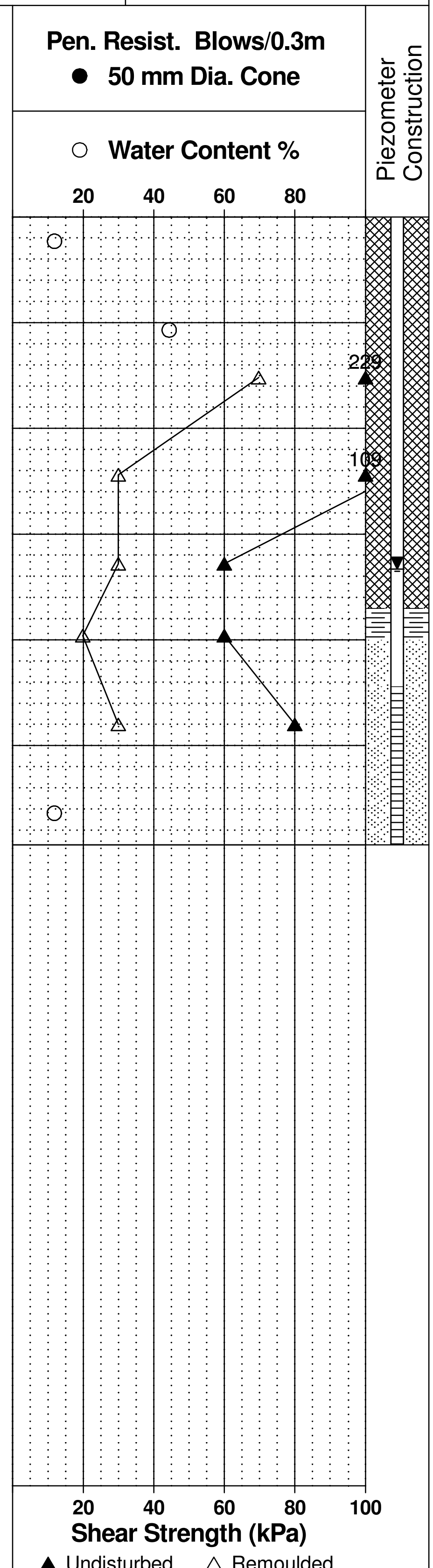
BORINGS BY CME-55 Low Clearance Drill

DATE November 24, 2021

FILE NO. PG6031

HOLE NO. BH 4-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.28
Asphaltic concrete 0.05							
FILL: Brown silty sand wtih gravel, clay and crushed stone, trace clay 0.46		AU	1				
		SS	2	58	9	1	77.28
Hard to very stiff, brown **SILTY CLAY,** trace sand						2	76.28
- stiff and grey by 3.0m depth						3	75.28
						4	74.28
5.18						5	73.28
GLACIAL TILL: Very stiff, grey silty clay with sand, gravel, cobbles and boulders 5.94		SS	3	83	10		
End of Borehole							
(GWL @ 3.33m - January 6, 2022)							



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

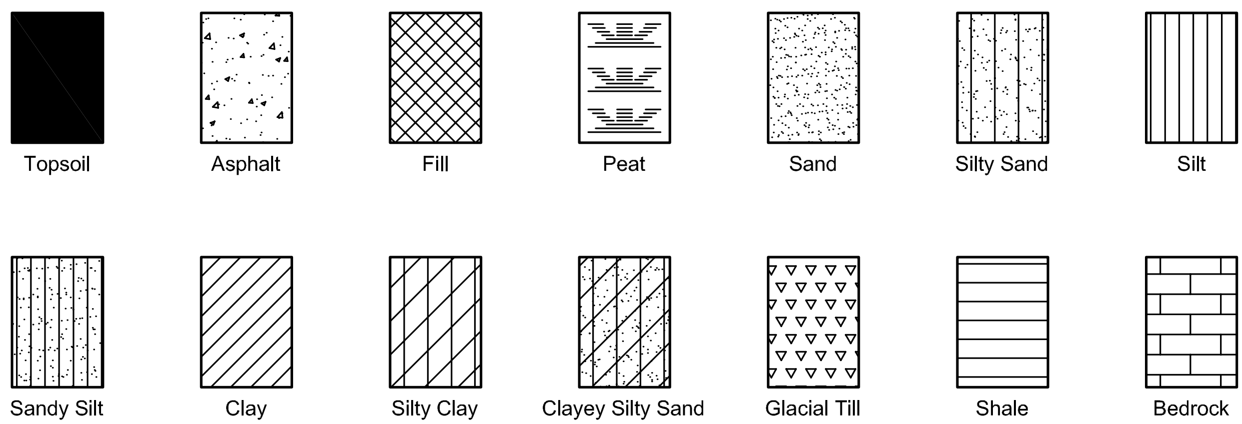
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

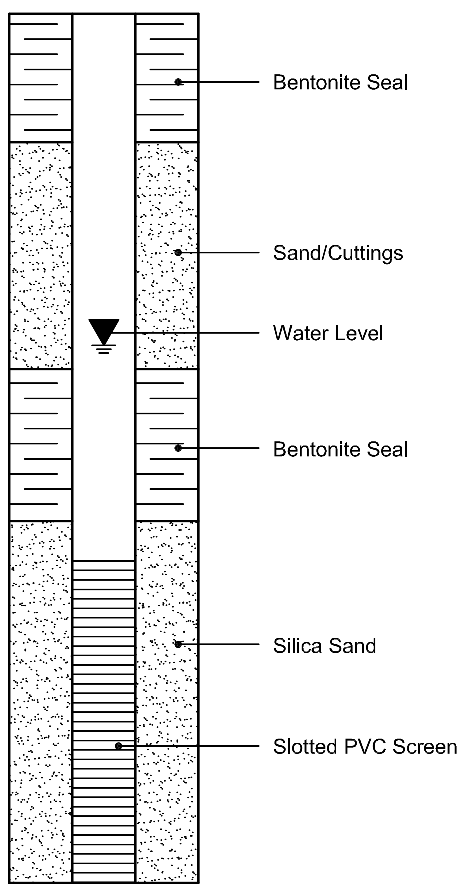
SYMBOLS AND TERMS (continued)

STRATA PLOT

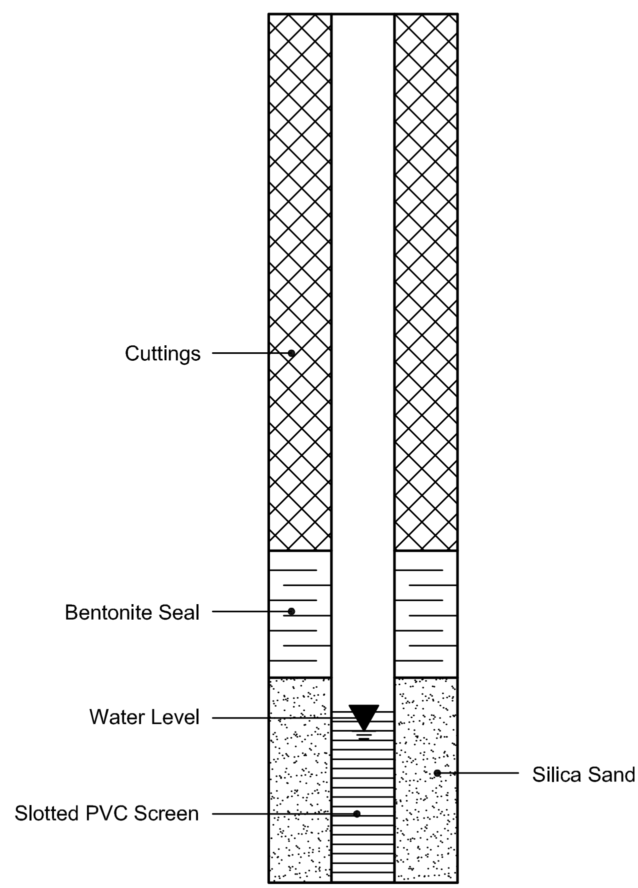


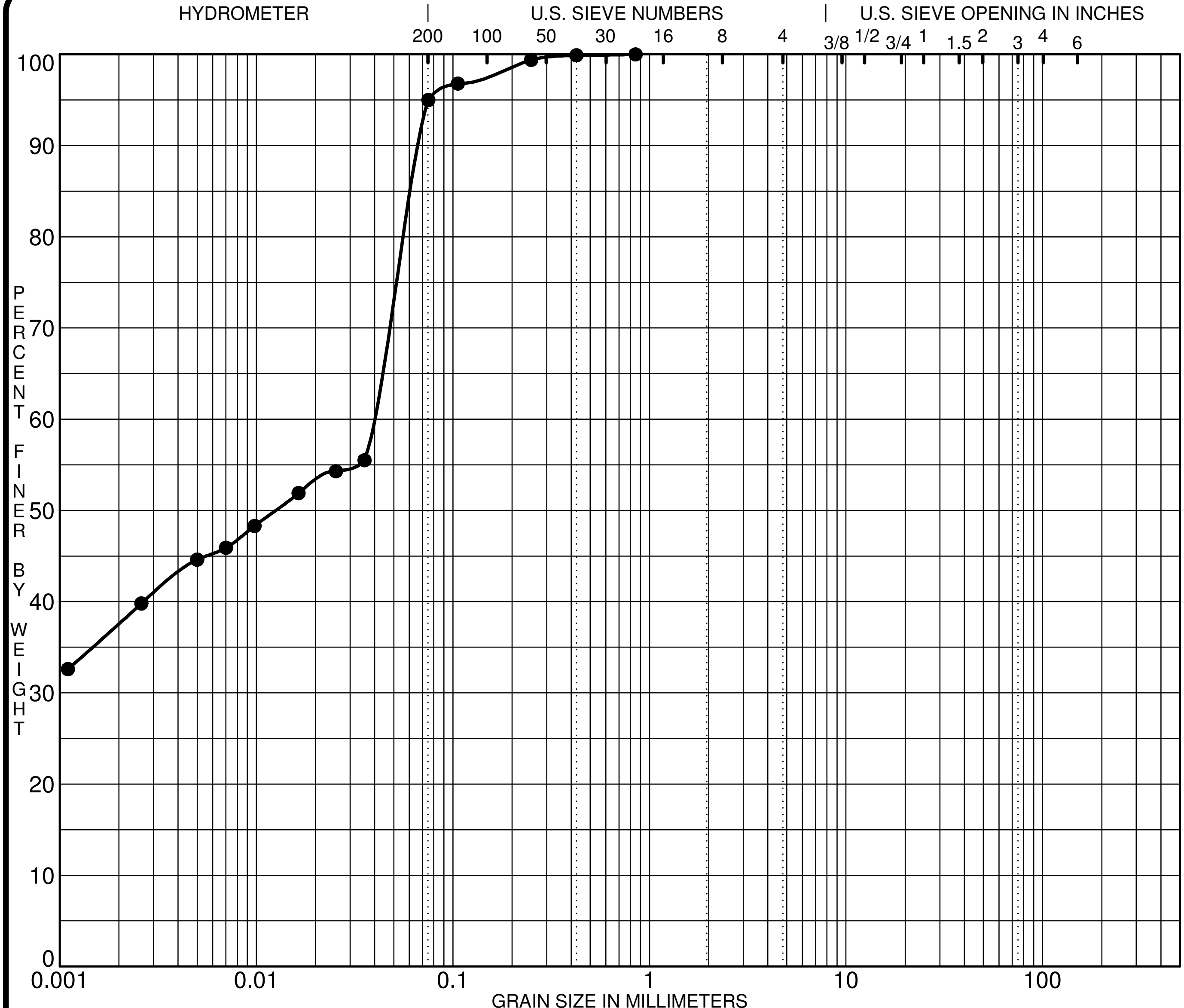
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 3-21**	**SS4**	**CH - Inorganic clays of high plasticity**						
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 3-21**	**SS4**	**0.85**	**0.04**			**0.0**	**5.0**	**95.0**	
⊠										
▲										
★										

CLIENT **Farmhouse Investments Inc.**

FILE NO. **PG6031**

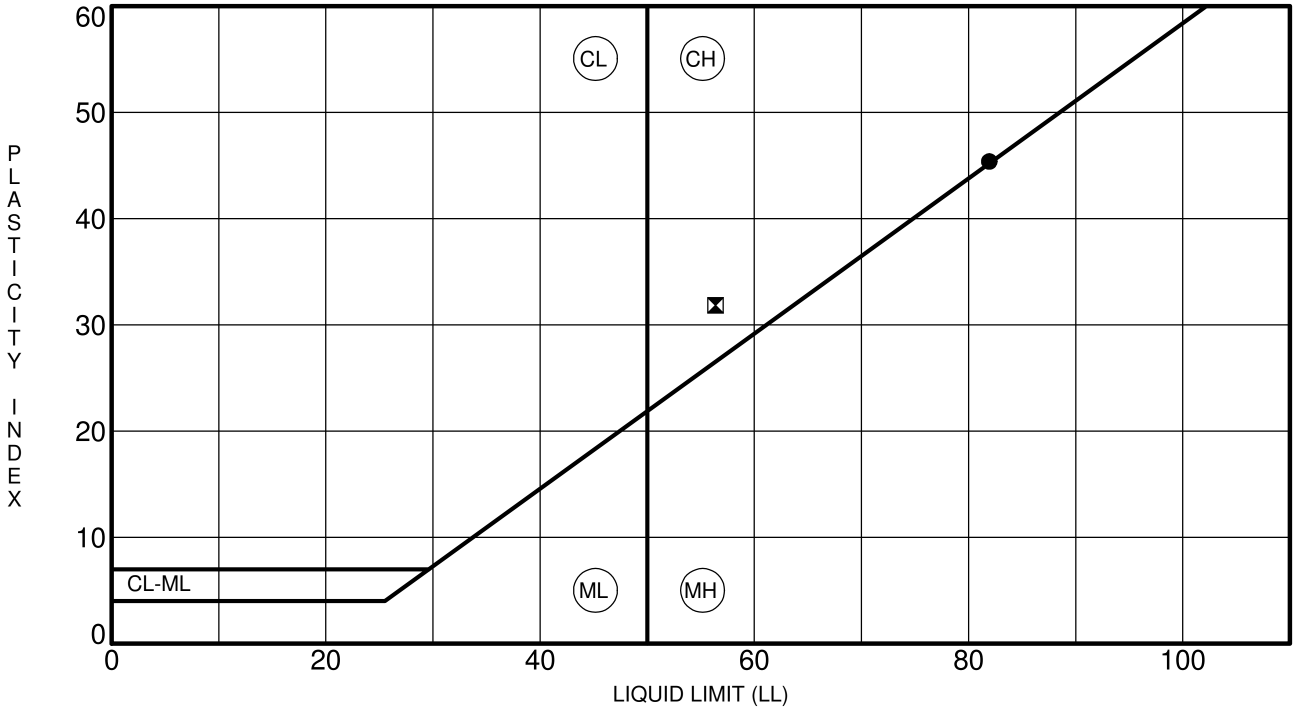
PROJECT **Geotechnical Investigation - 970-971 Silver Street & 1271, 1275 Shillington Ave.**

DATE **24 Nov 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-21**	**SS3**	**82**	**37**	**45**		**CH - Inorganic clays of high plasticity**
⧗	**BH 3-21**	**SS4**	**56**	**25**	**32**		**CH - Inorganic clays of high plasticity**

CLIENT **Farmhouse Investments Inc.**

PROJECT **Geotechnical Investigation - 970-971 Silver Street & 1271, 1275 Shillington Ave.**

FILE NO. **PG6031**

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

PARACEL
LABORATORIES LTD.

Order #: 2148595

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33442

Report Date: 02-Dec-2021

Order Date: 26-Nov-2021

Project Description: PG6031

	Client ID:	BH3-21 SS3	-	-	-
	Sample Date:	24-Nov-21 09:00	-	-	-
	Sample ID:	2148595-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	67.0	-	-	-
General Inorganics					
pH	0.05 pH Units	7.36	-	-	-
Resistivity	0.10 Ohm.m	20.8	-	-	-
Anions					
Chloride	5 ug/g dry	202	-	-	-
Sulphate	5 ug/g dry	86	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG6031-1 Revision 1 – TEST HOLE LOCATION PLAN

DRAWING PG6031-2 Revision 1 – TREE PLANTING SETBACK PLAN

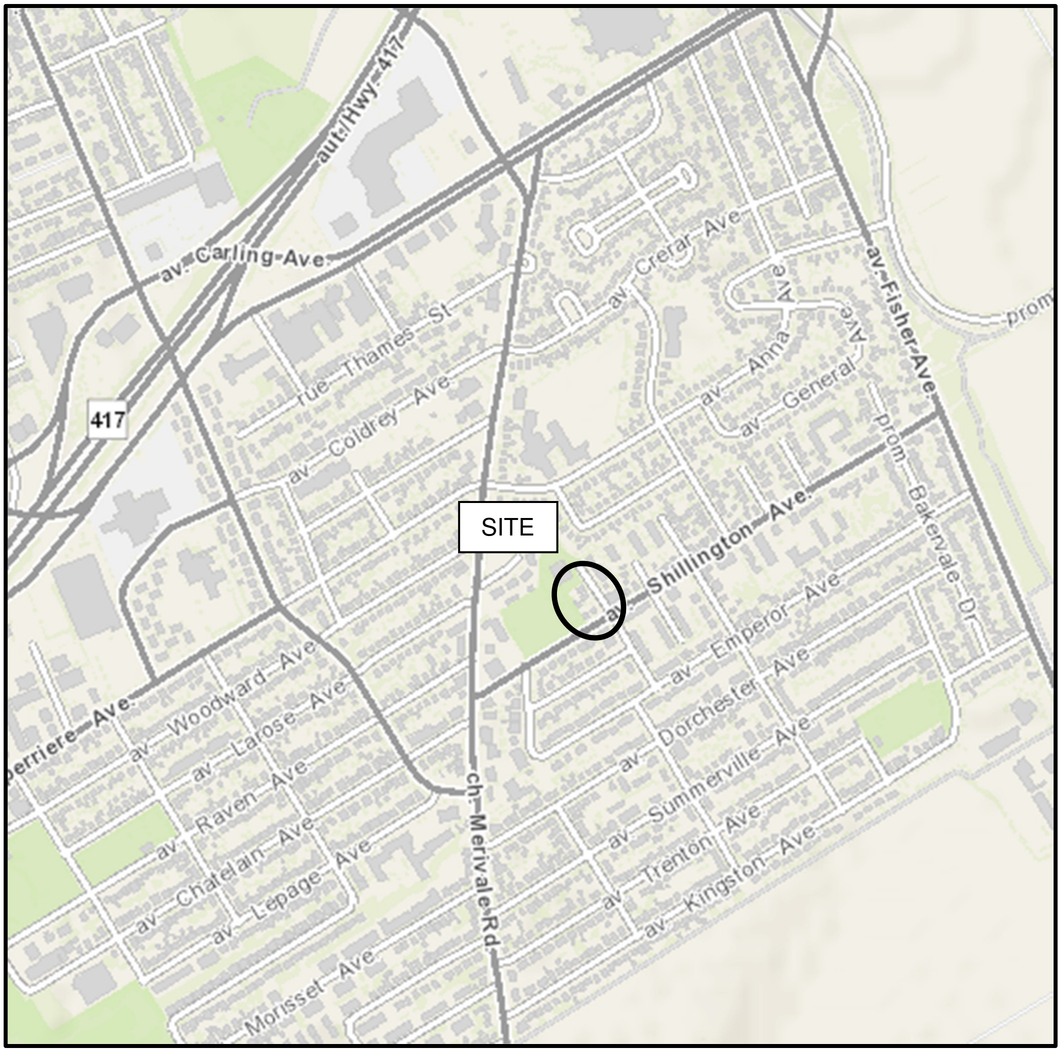
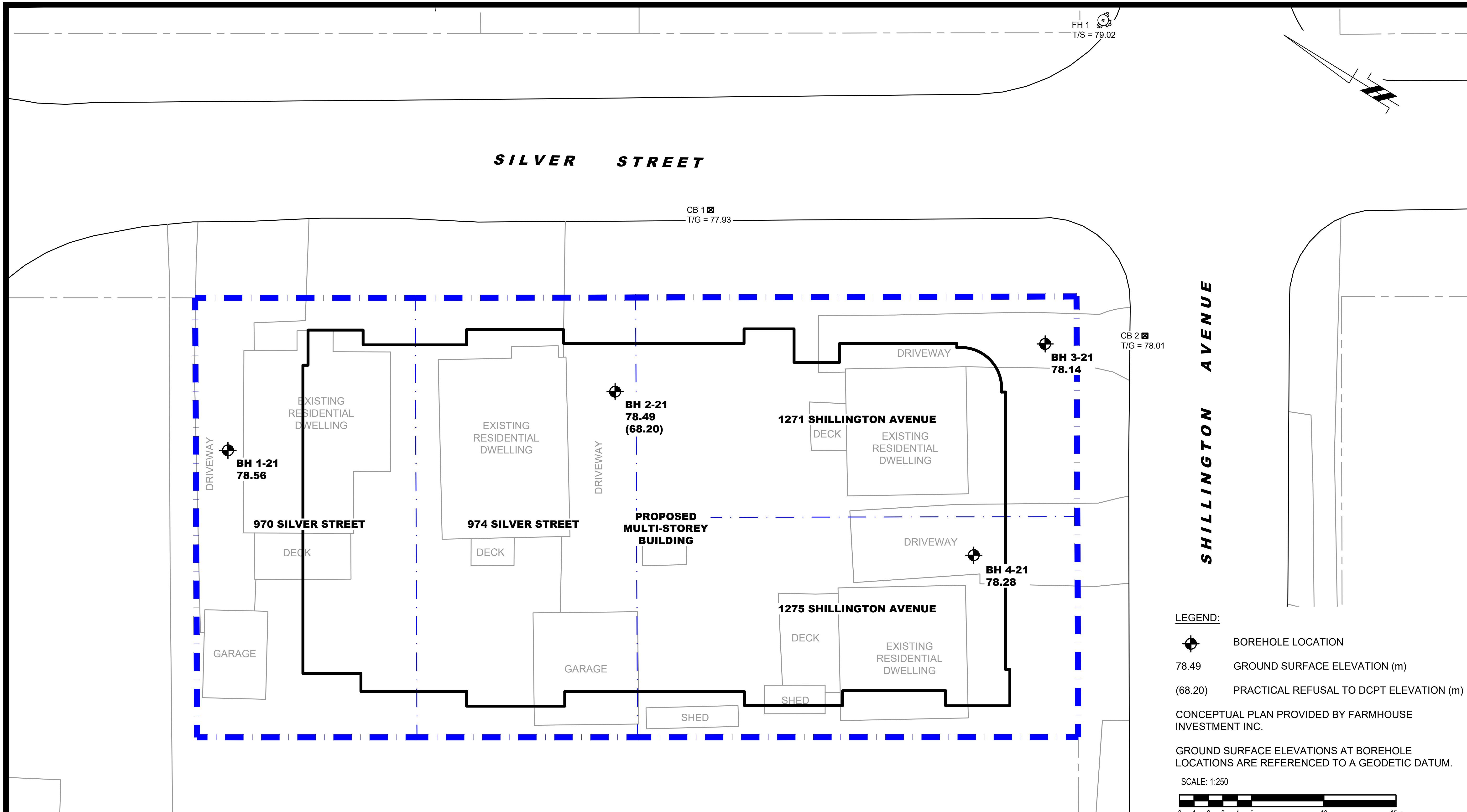


FIGURE 1

KEY PLAN



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154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
1	AS PER REVISED CONCEPTUAL PLAN	17/02/2022	BN

FARMHOUSE INVESTMENT INC.

GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT

OTTAWA, 970, 974 SILVER STREET & 1271, 1275 SHILLINGTON AVENUE ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 02/2022
Drawn by: JM	Report No.: PG6031-1
Checked by: OC	Dwg. No.: PG6031-1
Approved by: FA	Revision No.: 1

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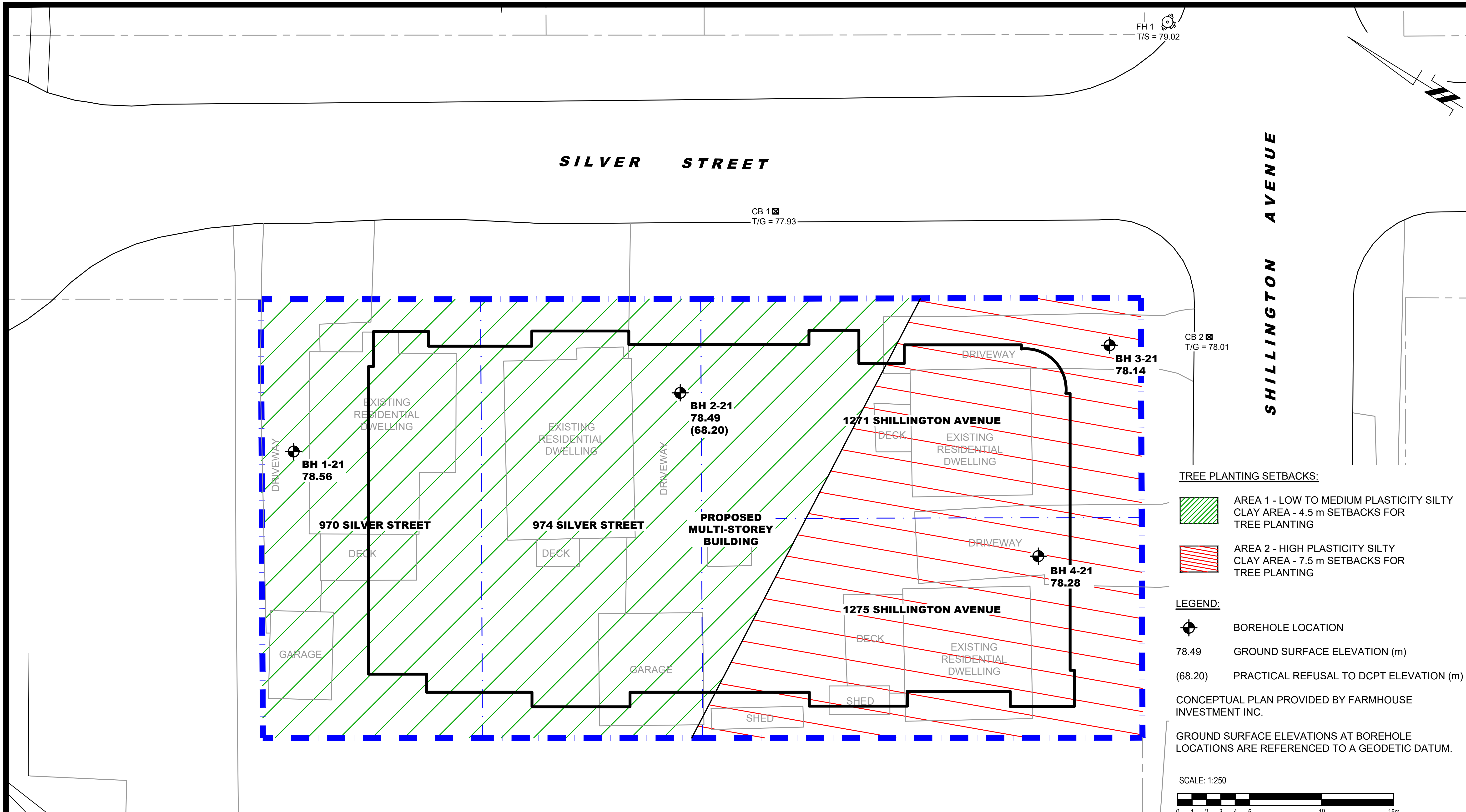

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NO.	REVISIONS	DATE	INITIAL
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FARMHOUSE INVESTMENT INC.

GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT

OTTAWA, 970, 974 SILVER STREET & 1271, 1275 SHILLINGTON AVENUE ONTARIO

Title:

TREE PLANTING SETBACK PLAN

Scale: 1:250	Date: 02/2022
Drawn by: JM	Report No.: PG6031-1
Checked by: OC	Dwg. No.: PG6031-2
Approved by: FA	Revision No.: 1

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