patersongroup

Consulting Engineers

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

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Geological Engineering
Materials Testing
Building Science
Noise & Vibration Studies

www.patersongroup.ca

March 2, 2022
PG5917-LET.01

Dolyn Construction Inc.
888 Lady Ellen Place
Ottawa, Ontario
K1Z 5L5

Attention: **Mr. Doug Burnside**

Subject: **Geotechnical Investigation**
Proposed Mid-Rise Residential Building
326 and 330 Wilbrod Street - Ottawa

Dear Sir,

Paterson Group (Paterson) was commissioned by Dolyn Construction Inc. to conduct a geotechnical investigation for the proposed mid-rise apartment building to be located at 326 and 330 Wilbrod Street.

1.0 Background Information

Based on the available drawings, It is understood that the proposed development will consist of a four to five storey residential building with one basement level, a garbage shed, and associated landscaped margins and access pathways. It is anticipated that the proposed development will be municipally serviced.

The field program for the current investigation was completed on February 15, 2022. At that time, a total of three (3) boreholes were advanced to a maximum depth of 8.8 m below the existing ground surface using a track mounted drill rig.

The test hole locations were selected by Paterson to provide general coverage of the subject site, taking into account existing site features and utilities. The test hole locations and ground surface elevations at the test hole locations were surveyed in the field by Paterson with respect to a geodetic datum. The location of the test holes and the elevation at each test hole location are presented on Drawing PG5917-1 - Test Hole Location Plan attached to the current report.

2.0 Field Observations

Surface Conditions

The existing buildings located at the subject site had been demolished prior to the field investigation. The subject site is bordered by Wilbrod Street to the north and by residential dwellings to the east and west and by a mid-rise apartment building to the south. The existing ground surface across the site is relatively flat at an approximate geodetic elevation of 70.5 m. The subject site is relatively at grade with Wilbrod Street.

Subsurface Conditions

Generally, the subsurface profile encountered at the test hole locations consists of a 1.5 to 1.9 m thick layer of fill overlaying a silty clay deposit. The fill was generally observed to consist of silty sand to silty clay with topsoil, gravel, and some construction debris. The silty clay deposit within the subject site consists of a 2.3 to 3.1 m layer of hard to very stiff brown silty clay crust overlaying a very stiff to stiff layer of grey silty clay. Practical refusal to a Dynamic Cone Penetration Test, completed at BH 2-22, was encountered at 18.2 m.

Based on available geological mapping, the bedrock at the subject site consists of interbedded limestone and shale of the Verulam Formation with a drift thickness of 10 to 15 m.

Based on the field observations and measured groundwater levels within the installed monitoring wells , the long-term groundwater table can be expected at an approximate depth of 3.7 to 4.5 m below the ground surface, within grey silty clay layer. Reference should be made to the Soil Profile and Test Data sheets attached to the current report for specific details of the soil profiles encountered at each test hole location.

3.0 Geotechnical Discussion

Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. The proposed mid-rise residential building is recommended to be founded on conventional spread footings placed on an undisturbed hard to stiff silty clay bearing surface.

Due to the presence of a sensitive silty clay deposit, the proposed development will be subjected to permissible grade raise restrictions. Permissible grade raise recommendations have been provided for the subject site.

The above and other considerations are further discussed in the following sections.

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials or construction debris, 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 and within the lateral support zones of the foundations. Under landscaped and paved areas, existing construction remnants, such as foundation walls, should be excavated to a minimum of 1 m below final grade.

Vibration Considerations

Construction operations are the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations caused by construction operations could be the source of detrimental vibrations at the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). The guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to be completed minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading beneath the proposed building should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site.

The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless used in conjunction with a composite drainage membrane.

Foundation Design

Strip footings, up to 4 m wide, and pad footings, up to 8 m wide, founded on an undisturbed, hard to stiff silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **200 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **350 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 above will be subjected to potential post-construction total and differential settlements of 25 and 20 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 above the groundwater table 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 of the same or higher capacity as that of the bearing medium.

Permissible Grade Raise Recommendations

A permissible grade raise restriction of **2.0 m** is recommended for the subject site.

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed for our calculations.

Design for Earthquakes

The site class for seismic site response can be taken as **Class D**.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

Basement Slab

For the proposed development, the in-situ silty clay, approved at the time of construction by the geotechnical consultant, will be considered an acceptable medium on which to commence backfilling for the basement floor slab. It is recommended that the upper 200 mm of sub-slab fill consist of OPSS Granular A compacted to a minimum of 98% of the SPMDD.

If engineered fill is required to raise the grade for the basement slab an OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the proposed building. However, in our opinion, 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 dry unit weight of 20 kN/m^3.

The applicable effective unit weight of the retained soil can be estimated as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when calculating the effective unit weight.

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

Static Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \gamma H$ 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 basement wall (m)

An additional pressure having a magnitude equal to K_o 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 away 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 Ottawa area is 0.32g according to OBC 2012. 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 OBC 2012.

4.0 Design and Construction Precautions

Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed residential building. 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 which is 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 storm sewer.

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 placement as backfill against the foundation walls unless used in conjunction with a composite drainage system, such as Delta Drain 6000. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be placed for this purpose.

Protection of Footings Against Frost Action

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

Exterior unheated footings, such as those for isolated exterior piers or an unheated building such as a shed, 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.

Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should be either cut back to acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is expected that insufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e unsupported excavations), therefore shoring systems may be required.

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 shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be 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 Paterson in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended 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 required, the design and approval of the temporary 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 system 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.

The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's structural designer prior to implementation.

The temporary shoring system could consist of a soldier pile and lagging system. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. This system could be cantilevered, anchored or braced.

The earth pressures acting on the temporary shoring system may be calculated with the following parameters.

Table 1 - Soil Parameters for Shoring System Design	
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	20
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.

Underpinning of Adjacent Structures

If the excavation for the proposed building is to extend within the lateral support zone of adjacent building foundations, underpinning of these structures would be required. The depth of the underpinning, if required, would be dependent on the depth of the neighboring foundations relative to the founding depth of the proposed building at the subject site.

Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades to prevent disturbance to the founding medium.

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, and EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site mostly 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, 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.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

Precaution must be taken where excavations are carried in proximity to existing structures which may be adversely affected due to the freezing conditions. In particular, it should be recognized that where a shoring system is used, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

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.

5.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design recommendations to be applicable. The following aspects of the program should be performed by Paterson:

❏ Observation of all bearing surfaces prior to the placement of concrete.

❏ Observations of underpinning operations, if applicable.

❏ Sampling and testing of the concrete and fill materials used.

❏ 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 the construction has been conducted in general accordance with Paterson's recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

6.0 Statement of Limitations

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

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

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

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 Dolyn Construction Inc., or their agents, is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

We trust this report meets your present requirements.

Best Regards,

Paterson Group Inc.

Nicole R.L. Patey, B.Eng.

David J. Gilbert, P.Eng.

Attachments

- ❏ Soil Profile and Test Data Sheets
- ❏ Symbols and Terms
- ❏ Analytical Testing Results
- ❏ Figure 1 - Key Plan
- ❏ Drawing PG5917-1 - Test Hole Location Plan

Paterson Group Inc.

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

Northern Office and Laboratory
63 Gibson Street
North Bay - Ontario - P1B 8Z4
Tel: (705) 472-5331 Fax: (705) 472-2334

Ottawa Laboratory
28 Concourse Gate - Unit 6
Ottawa - Ontario - K2E 7T7
Tel: (613) 226-7381

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building
326 and 330 Wilbrod Street - Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5917

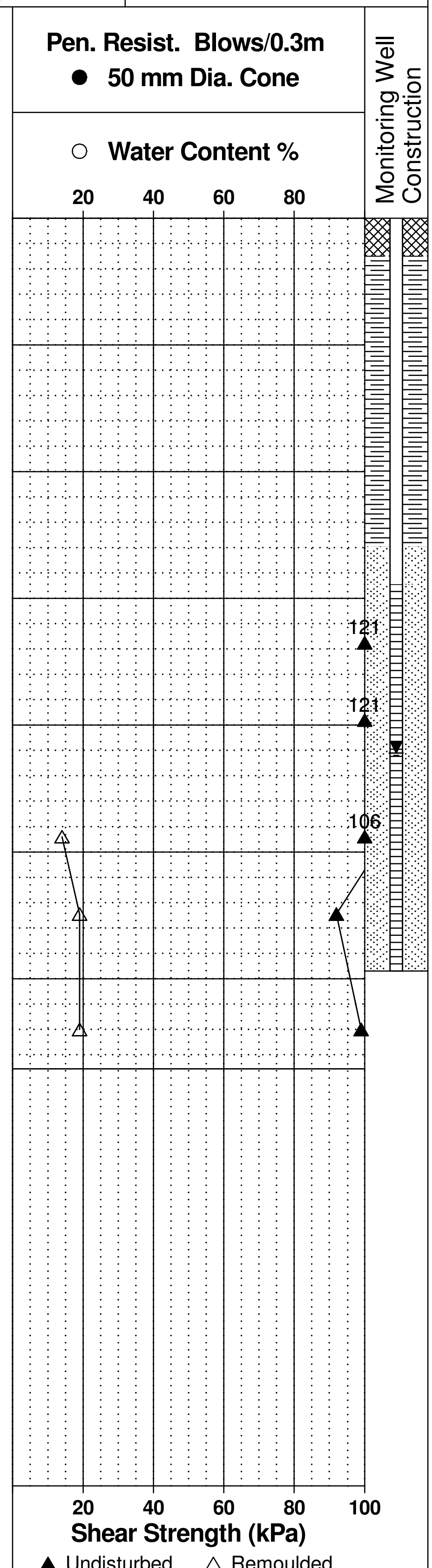
REMARKS

HOLE NO. BH 1-22

BORINGS BY CME-55 Low Clearance Drill **DATE** 2022 February 15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Brown silty sand with crushed stone, gravel, trace construction debris (to 0.76)		AU	1		
FILL: Brown silty sand trace gravel (to 1.45)		SS	2	75	15
Very stiff brown **SILTY CLAY**		SS	3	83	18
		SS	4	100	7
(to 3.73)		SS	5	83	P
Very stiff to stiff grey **SILTY CLAY**		SS	6	100	P
		SS	7	100	P
		SS	8	92	P
(to 6.71)		SS	9	83	P
End of Borehole					
(GWL at 4.22 m depth - Feb 24, 2022)					

DEPTH (m)	ELEV. (m)
0	70.59
1	69.59
2	68.59
3	67.59
4	66.59
5	65.59
6	64.59



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building
326 and 330 Wilbrod Street - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE 2022 February 15

FILE NO. PG5917

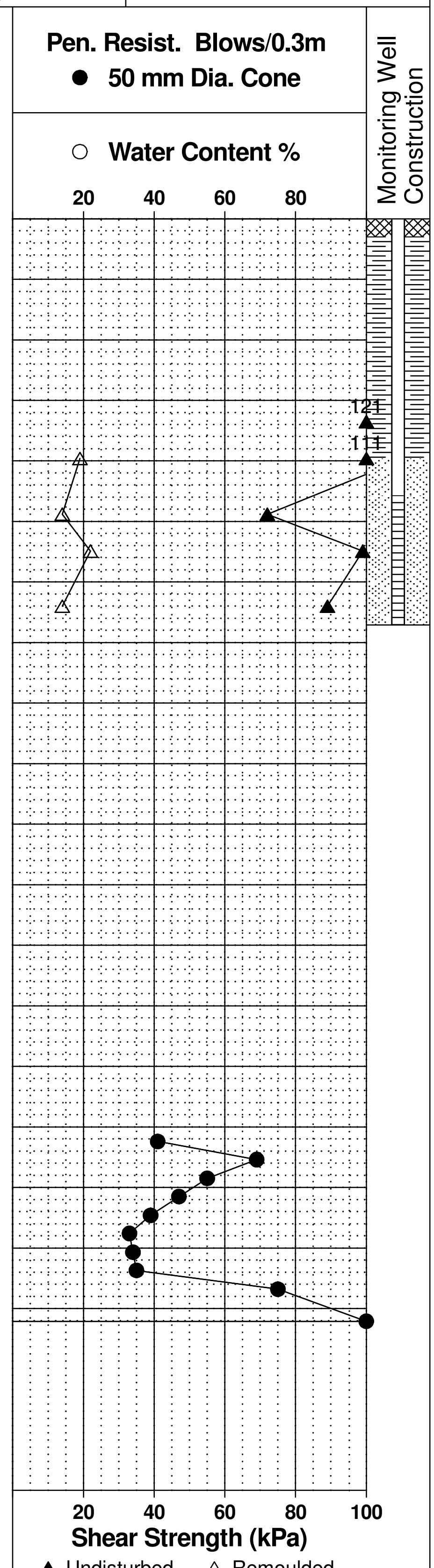
HOLE NO. BH 2-22

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Topsoil with brown silty clay, sand and gravel	0.69	AU	1		
FILL: Brown silty sand with gravel, trace clay and rock fragments	1.93	SS	2	50	50+
		SS	3	58	40
Hard to very stiff brown **SILTY CLAY**	4.50	SS	4	79	8
		SS	5	83	P
		SS	6	0	P
Stiff grey **SILTY CLAY**	6.71	SS	7	100	P
		SS	8	100	P
		SS	9	100	P
Dynamic Cone Penetration Test commenced at 6.71 m depth. Cone pushed to 15.3 m depth.	18.21				
End of Borehole					

Practical refusal to DCPT at 18.21 m depth

(Monitoring Well dry - Feb 24, 2022)

DEPTH (m)	ELEV. (m)
0	70.52
1	69.52
2	68.52
3	67.52
4	66.52
5	65.52
6	64.52
7	63.52
8	62.52
9	61.52
10	60.52
11	59.52
12	58.52
13	57.52
14	56.52
15	55.52
16	54.52
17	53.52
18	52.52



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building
326 and 330 Wilbrod Street - Ottawa, Ontario

DATUM Geodetic

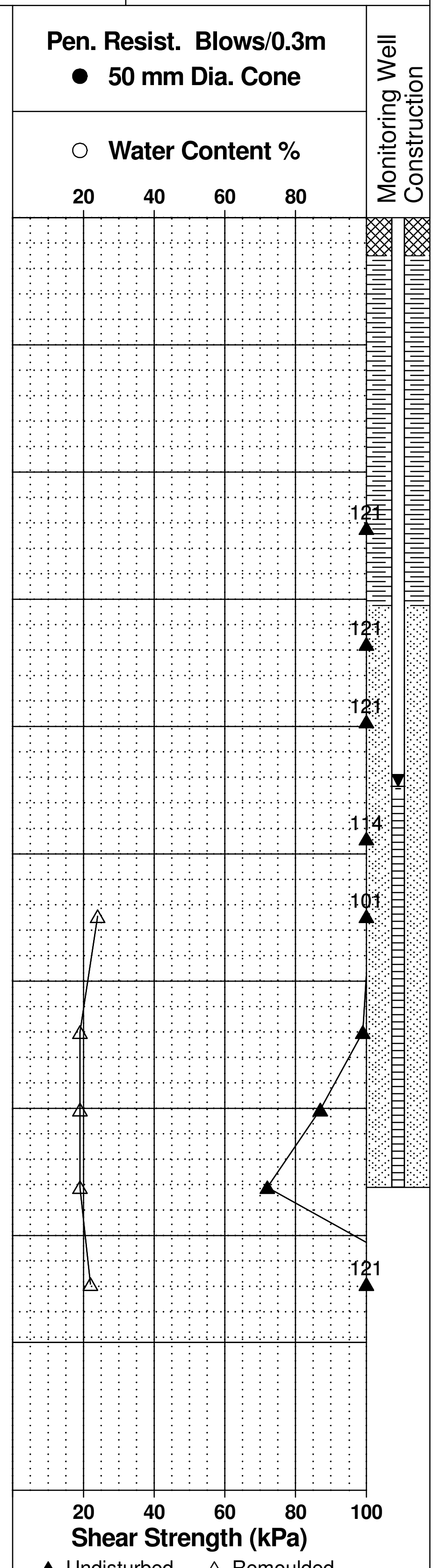
FILE NO. PG5917

REMARKS

HOLE NO. BH 3-22

BORINGS BY CME-55 Low Clearance Drill **DATE** 2022 February 15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.49
FILL: Brown silty clay with sand, gravel and topsoil		AU	1				
		SS	2	42	8	1	69.49
1.45							
Very stiff brown **SILTY CLAY**		SS	3	42	5		
						2	68.49
		SS	4	92	P		
		SS	5	75	P	3	67.49
		SS	6	83	P	4	66.49
4.50							
Very stiff to stiff grey **SILTY CLAY**		SS	7	100	P	5	65.49
		SS	8	100	P		
						6	64.49
		SS	9	100	P		
		SS	10	100	P	7	63.49
						8	62.49
8.84							
End of Borehole (GWL at 4.47 m depth - Feb 24, 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 strength of cohesionless soils is the relative density, 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.

Relative Density	‘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 vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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 is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

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 NXL size core. However, it can be used on smaller core sizes, such as BX, 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
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture 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 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 x 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

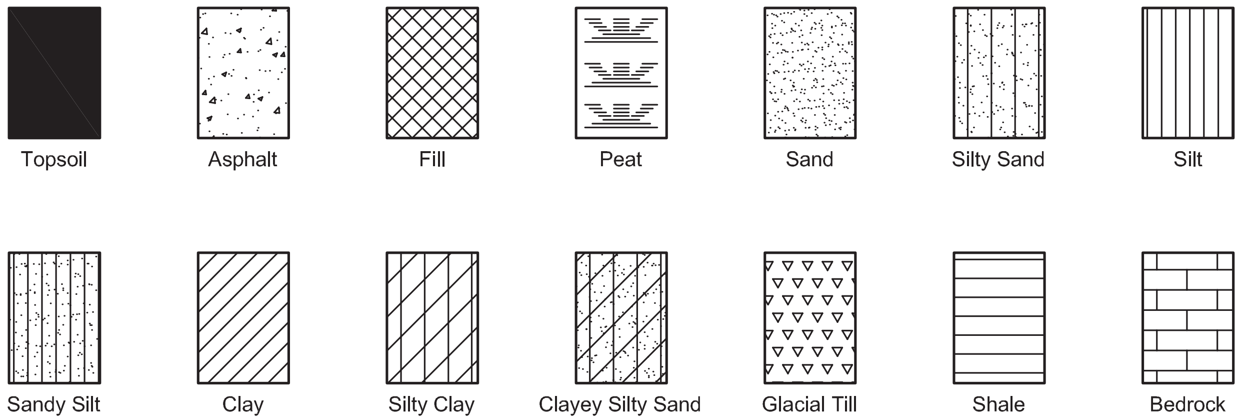
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

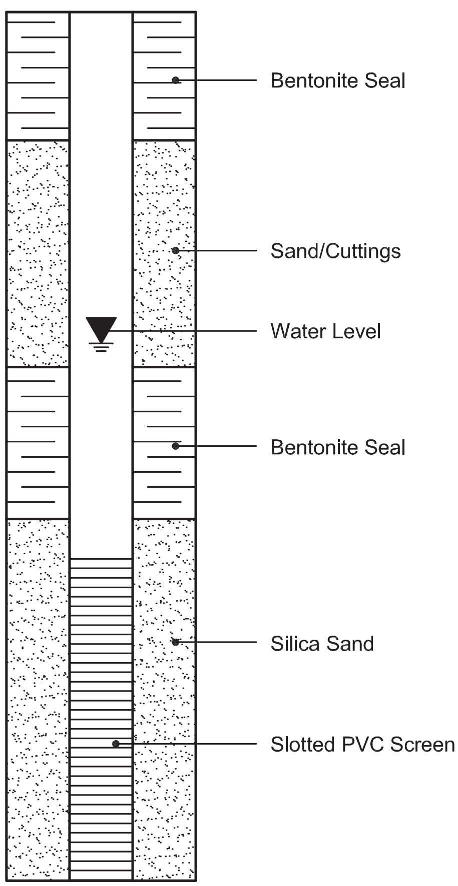
SYMBOLS AND TERMS (continued)

STRATA PLOT

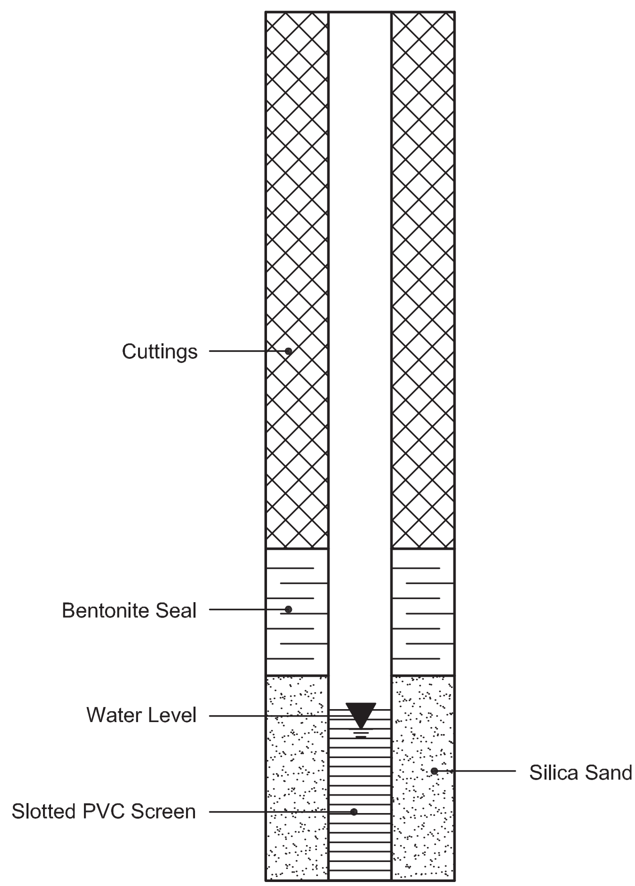


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	18-Feb-22	18-Feb-22
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	17-Feb-22	18-Feb-22
Resistivity	EPA 120.1 - probe, water extraction	18-Feb-22	18-Feb-22
Solids, %	Gravimetric, calculation	17-Feb-22	17-Feb-22

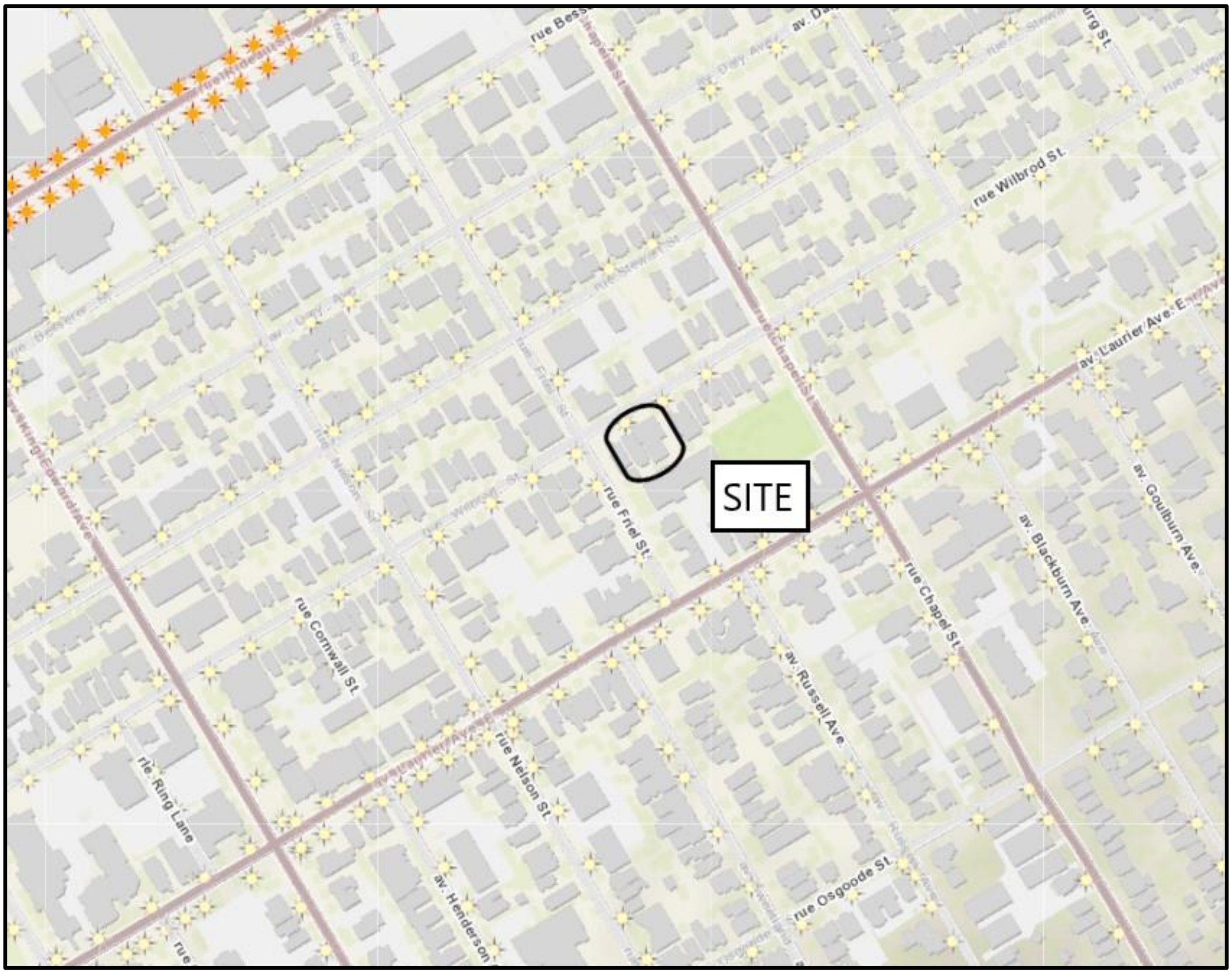


FIGURE 1

KEY PLAN

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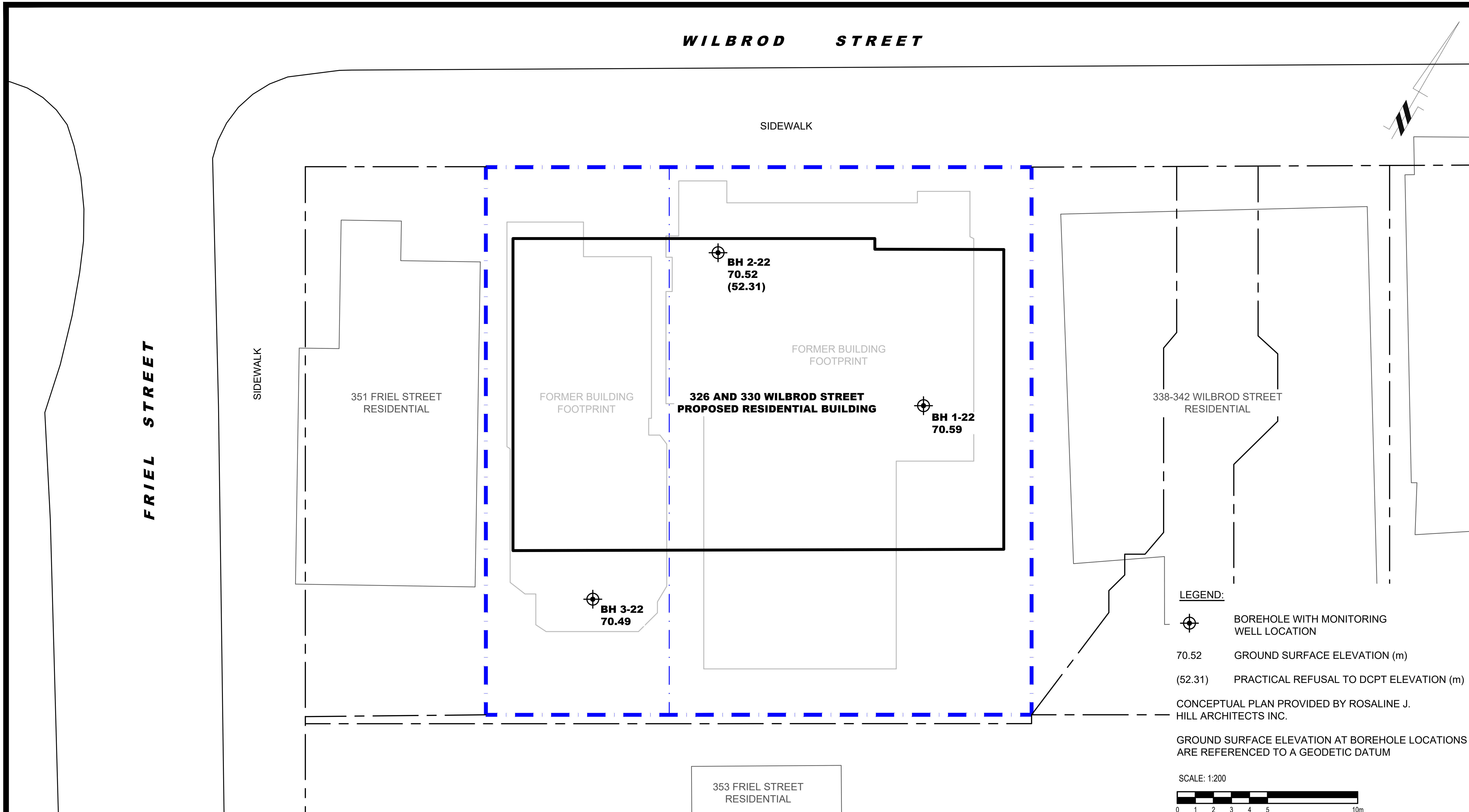

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL

DOLYN CONSTRUCTION INC.
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDING
326 AND 330 WILBROD STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:200	Date: 02/2022
Drawn by: YA	Report No.: PG5917-1
Checked by: NP	Dwg. No.: PG5917-1
Approved by: DJG	Revision No.:

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