Geotechnical Investigation

Double Deck

560 Hazeldean Road
Ottawa, Ontario

Prepared for Double Deck Regional Inc.
c/o Regional Group

Report PG7472-1 Revision 3 dated Nov. 26, 2025

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Double Deck Regional Inc. (c/o Regional Group) to prepare a Geotechnical Investigation Report for the proposed development to be located at 560 Hazeldean Road in the City of Ottawa (reference should be made to Figure 1 - Key Plan in Appendix 2 of this report for the general site location).

The objectives of the Geotechnical Investigation Report were to:

- ❑ Determine the subsoil and groundwater conditions at this site by means of existing boreholes; and to

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

This 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.

2.0 Proposed Development

Based on the available site plan, it is understood that the central and eastern portions of the proposed development will consist of low-rise residential dwellings with associated asphalt-paved local roads, driveways, and landscaped areas. The western portion of the site, along Hazeldean Road, is currently listed as a “Future Residential Block” with no specific development plans at this time.

From preliminary discussions with the civil engineer, it is understood that proposed grade raises at the site will be in the approximate range of 1.5 to 2 m.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on May 29 and 30, 2025, which consisted of 5 boreholes (BH 1-25 through BH 5-25) advanced to a maximum depth of 12.7 m below the existing ground surface. Additionally, Paterson conducted previous field investigations at the subject site in December 2020 where 8 boreholes (BH 1-20 through BH 8-20) were advanced to a maximum depth of 6.6 m, and in May 2018 where 4 boreholes (BH 1-18 through BH 4-18) were advanced to maximum depth of 6.4 m.

The borehole locations were distributed in a manner to provide general coverage of the subject site, taking into consideration underground utilities and site features. The approximate borehole locations are shown on Drawing PG7472-1 – Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a low-clearance auger drill rig for the 2025 and 2020 investigations, while a track-mounted auger drill was used for the 2018 investigation. The drill rigs were operated by two-person crews and all fieldwork was conducted under the full-time supervision of Paterson personnel and under the direction of a senior engineer. The testing procedure consisted of augering to the required depths at the selected locations, and sampling and testing the overburden soils.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler, 73 mm diameter thin walled (TW) Shelby tubes in conjunction with a piston sampler, or from the auger flights (AU). All soil samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags, and the Shelby tubes were sealed at both ends on site. All samples were transported to our laboratory for further examination and classification. The depths at which the auger, split-spoon, and Shelby tube samples were recovered from the boreholes are shown as AU, SS, and TW, respectively, on the Soil Profile and Test Data sheets presented 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 conducted in cohesive soils using a field vane apparatus.

The thickness of the silty clay layer was evaluated during the course of the investigation by dynamic cone penetration testing (DCPT) completed at boreholes BH 2-25, BH 5-25, and BH 3-18. 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 at the test hole locations were recorded in detail in the field. Our findings are presented in the Soil Profile and Test Data sheets in Appendix 1.

Groundwater

Groundwater monitoring wells were installed in boreholes BH 2-20, BH 6-20, BH 7-20, BH 2-25, and BH 3-25 to permit monitoring of the groundwater levels following the completion of drilling. Additionally, standpipe piezometers were installed in the remaining boreholes. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

3.2 Field Survey

The borehole locations, and ground surface elevation at each borehole location, were surveyed by Paterson using a handheld GPS unit and referenced to a geodetic datum. The locations of the boreholes, and the ground surface elevation at each borehole location, are presented on Drawing PG7472-1 – 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 3 consolidation tests, 6 Atterberg Limits tests, 2 grain size distribution tests, and 1 linear shrinkage test were completed on selected soil samples. The results are summarized in Section 4.2 and are provided in detail in Appendix 1.

3.4 Analytical Testing

Three (3) soil samples were submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The samples weresubmitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

Currently, the subject site is occupied by golf amenities, including a driving range and putting greens. A single-storey commercial building and asphalt-paved parking lot are also located in the northwest corner of the site.

The site is bordered by Hazeldean Road to the north, the Carp River to the east, a stormwater management pond to the south, and a residential development to the west. The ground surface across the site is relatively level at approximate geodetic elevation 95 to 96 m.

4.2 Subsurface Profile

Generally, the subsurface profile at the borehole locations consists of topsoil or asphalt underlain by fill and a clayey silt to silty clay deposit.

The topsoil or asphalt were observed to be 0.8 to 0.35 m in thickness. Along the western portion of subject site, topsoil or asphalt was underlain by an approximate 0.6 m thick layer of fill, which was primarily consisting of brown silty clay with varying amounts of sand, crusted stone and topsoil

The underlying stiff, brown clayey silt with sand was observed to extend to approximate depths of 0.7 to 3 m below the existing ground surface.

Below these depths, a stiff to firm, grey silty clay to clayey silt was encountered to the bottom depths of the boreholes at approximately 12.7 m below existing site grades.

Practical DCPT refusal were encountered in boreholes BH 2-25, BH 5-25, BH 3-18 at a depth of 7.3 m,17.9 m, and 11.6 m, respectively.

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 borehole hole location.

Bedrock

Based on available geological mapping, the bedrock in the majority of the site is part of the Verulam formation, which consists of interbedded limestone and shale. The southwest portion of the site consists of limestone interbedded with dolomite of the Gull River formation. The overburden drift thickness ranges between 5 to 10 m.

Laboratory Testing

Atterberg Limits testing, as well as associated moisture content testing, was completed on a 6 selected silty clay samples. The results of the Atterberg Limits tests are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1. The results of the moisture content testing are presented on the Soil Profile and Test Data Sheets in Appendix 1. The tested silty clay samples classify as inorganic clays of low plasticity (CL), in accordance with the Unified Soil Classification System (USCS).

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 3-18 - SS3	1.80	35	17	18	45.0	CL
BH 4-18 - SS4	2.59	30	15	14	32.0	CL
BH 3-20 - SS4	2.59	28	19	9	39.9	CL
BH 4-20 - SS4	2.59	29	19	10	34.5	CL
BH 5-20 - SS4	2.59	28	18	9	24.0	CL
BH 7-20 - SS4	2.59	28	17	10	35.4	CL

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content;
CH: Inorganic Clay of High Plasticity

Grain size distribution analysis was completed on 2 selected soil samples. The results of the grain size distribution analysis are presented in Table 2 and on the Grain Size Distribution sheet in Appendix 1.

Table 2 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 4-20 - SS4	2.59	0.0	6.0	69.5	24.5
BH 7-20 - SS4	2.59	0.0	5.0	73.0	22.0

Linear shrinkage testing was completed on a sample recovered from 2.59 m depth from borehole BH 4-20, which yielded a shrinkage limit of 17.88 and a shrinkage ratio of 1.830. The results of the shrinkage testing are presented on the Linear Shrinkage sheet in Appendix 1.

Consolidation Testing

A total of 3 consolidation tests were completed from Shelby tubes collected during the 2018 investigation. The results of the consolidation testing are presented in Table 3 below, and on Consolidation Testing Results sheets in Appendix 1.

The value for p'_c is the preconsolidation pressure and p'_o is the effective overburden pressure of the test sample. The difference between the values is the available preconsolidation. The values for C_{cr} and C_c are the recompression and compression indices, respectively. These soil parameters are a measure of the compressibility due to stress increases below and above the preconsolidation pressures.

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Table 3 – Consolidation Test Results

Borehole	Sample	Depth (m)	p'_c (kPa)	p'_o (kPa)	C_{cr}	C_c	Q
BH 1-18	TW5	4.5	119	50	0.025	1.081	G
BH 2-18	TW6	4.2	116	53	0.019	0.980	G
BH 3-18	TW4	5.1	96	54	0.033	0.352	P

Notes:

p'_c: Preconsolidation pressure; p'_o: Effective overburden pressure; C_{cr}: Recompression indice; C_c : Compression indice;

Q: Quality assessment of sample- G: Good ; A: Acceptable; P: Likely disturbed

The values of p'_c, p'_o, C_{cr} and C_c are estimates determined from standard engineering test procedures. Natural variations within the soil deposit will affect the results. The p'_o parameter is directly influenced by the groundwater level. Groundwater levels were measured during the site investigation.

Lowering the groundwater level increases the p'_o and reduces the available preconsolidation. Unacceptable settlements could be induced by a significant lowering of the groundwater level. The p'_o values for the consolidation tests completed for the investigation are based on the long-term groundwater level observed at each borehole location.

4.3 Groundwater

Groundwater levels were measured within the installed piezometers at the time of the investigation. The measured groundwater levels noted at that time are presented in Table 4, below, and are also presented in Appendix 1.

Table 4 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Dated Recorded
		Depth (m)	Elevation (m)	
BH 1-18	95.64	1.8	93.84	May 2018
BH 2-18	95.24	2.4	92.84	
BH 3-18	96.44	2.0	94.44	
BH 4-18	95.32	2.4	92.92	
BH 1-20	94.71	3.87	90.84	January 4, 2021
BH 2-20 *	95.30	Unavailable	-	
BH 3-20	95.09	Blocked	-	
BH 4-20	95.92	Unavailable	-	
BH 5-20	96.14	Unavailable	-	
BH 6-20 *	95.95	0.77	95.18	
BH 7-20 *	96.00	0.55	95.45	
BH 6-20*	95.95	1.39	94.56	
BH 7-20*	96.00	0.55	95.45	
BH 1-25	95.26	5.69	89.57	June 6, 2025
BH 2B-25 *	95.02	0.97	94.05	
BH 3-25 *	95.40	0.61	94.79	
BH 4-25	95.17	Blocked	-	
BH 5-25	95.12	3.35	91.77	

Note: Ground surface elevations at borehole location are referenced to a geodetic datum.
* - Denotes Monitoring well

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 **0.5 to 1.5 m** below ground surface.

However, it should be noted that groundwater levels are subject to seasonal fluctuations. A groundwater monitoring program will be conducted during the detailed design phase to determine the seasonally high groundwater table. Nonetheless, 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. Foundation support for the proposed low-rise buildings is recommended to consist of conventional spread footings bearing on the undisturbed, stiff clayey silt to silty clay.

Where the underside of footing is located above the existing ground surface, engineered fill will be placed and compacted from the undisturbed, stiff clayey silt to silty clay up to the underside of footing elevation.

Due to the presence of a clayey silt to silty clay deposit at the site, the proposed development will be subjected to grade raise restrictions. Our permissible grade raise recommendations are discussed in Section 5.3.

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

5.2 Grading and Preparation

Stripping Depth

Topsoil, building debris, 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. 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 used 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. 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 proposed building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath exterior parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD.

5.3 Foundation Design

Conventional Spread Footings

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, founded on an undisturbed, stiff clayey silt to silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa.** A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

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.

Permissible Grade Raise Recommendations

Based on the consolidation testing results and undrained shear strength values encountered at the borehole locations, the permissible grade raise recommendations for lot grading are provided on the attached Drawing PG7472-2 – Permissible Grade Raise Plan.

Several options could be considered where the proposed grading exceeds our permissible grade raise recommendations, such as the use of lightweight fill, which allows for raising the grade without adding a significant load to the underlying soils. Alternatively, it is possible to preload or surcharge the subject site in localized areas, provided sufficient time is available to achieve the desired settlements.

The options for managing permissible grade raise exceedances are discussed in more detail on next page:

- ❑ **Preloading:** This option consists of raising the ground surface by the full or partial height of the anticipated grade raise. Settlement plates are installed and monitored to determine the settlements associated with the soil load. The start of the construction of the buildings is then determined based on the response of the settlement plates. It is expected that settlement would continue for up to 5 years after initial fill placement.

- **Surcharging:** This option is similar to preloading with the exception of overloading the ground surface with a fill pile higher than the anticipated grade raise. This permits a reduction of the loading time prior to construction. The excess material is then removed at the start of construction.

- **Lightweight Fill (LWF):** The LWF consists of EPS Type 15 or 19 (expanded polystyrene) blocks, or other lightweight materials, which allow for raising the grade without adding a significant load to the underlying soils. However, these materials are expensive, and in the case of the EPS, are more difficult to use under the groundwater level, as they are buoyant, and must be protected against potential hydrocarbon spills.

5.4 Design for Earthquakes

The seismic site designation is **Class X_D** for the foundations at the subject site. Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2024 for a full discussion of the earthquake design requirements.

5.5 Basement Slab / Slab-on-Grade Construction

With the removal of all topsoil and deleterious fill within the footprints of the proposed buildings, the stiff to firm clayey silt to silty clay will be considered an acceptable subgrade upon which to commence backfilling for slab-on-grade or basement slab construction.

For slabs-on-grade, it is recommended that the upper 200 mm of sub-floor fill consists of OPSS Granular A crushed stone. For basement slabs, it is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the proposed buildings with basement walls. 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 drained unit weight of 20 kN/m^3 (effective unit weight 13 kN/m^3).

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 retained material (0.5)
γ = unit weight of fill of the applicable retained material (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 pressure 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 $0.375 \cdot a_c \cdot H^2/g$ where:

$a_c = (1.45 - a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained material (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the subject site area is 0.345g for a Site Class X_D according to OBC 2024. 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 2024.

5.7 Pavement Design

The pavement structures presented in the following tables are recommended for the design of car only parking areas, access lanes and heavy loading parking areas.

Table 5 – Recommended Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE –** OPSS Granular A Crushed Stone
300	**SUBBASE –** OPSS Granular B Type II
Subgrade – Either fill, in-situ soil, or OPSS Granular B Type I or II material placed over in-situ soil, bedrock or concrete fill.	

Table 6 – Recommended Pavement Structure – Local Residential Roadways, Access Lanes and Ramps

Thickness (mm)	Material Description
40	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course –** HL-8 or Superpave 19 Asphaltic Concrete
150	**BASE –** OPSS Granular A Crushed Stone
400	**SUBBASE –** OPSS Granular B Type II
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.

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. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable vibratory equipment.

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 clayey silt to silty clay deposit, consideration should be given to installing subdrains during the pavement construction, where the clayey silt to silty clay is anticipated at subgrade level. 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 & Backfill

A perimeter foundation drainage system is recommended for proposed structures with below-grade space. Where required, the system should consist of a 150 mm diameter perforated and corrugated plastic pipe which is surrounded on all sides by 150 mm of 19 mm clear crushed stone, and which is placed at the footing level around the exterior perimeter of each structure. The clear crushed stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

A geocomposite drainage board, such as Delta Drain 6000, should also be installed over the exterior below-grade foundation walls and connected to the perimeter foundation drainage system.

The exterior foundation walls can then be backfilled with the site excavated materials, provided that they are maintained in an unfrozen state and at a suitable moisture content for compaction. Imported granular materials, such as clean sand or OPSS Granular B Type II granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are recommended to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

Exterior unheated footings, such as isolated piers, are more prone to deleterious movement associated with frost action than the exterior walls of the 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 temporary excavation side slopes anticipated should either be excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled. It is expected that sufficient room will be available for the greater part of the excavation to be undertake by open-cut methods (i.e. unsupported excavations).

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 subsurface soil 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 maintain safe working distance 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.

Excavation Base Stability

The base of supported excavations can fail by 3 general modes:

- ❐ Shear failure within the ground caused by inadequate resistance to loads imposed by grade difference inside and outside of the excavation,
- ❐ Piping from water seepage through granular soils, and
- ❐ Heave of layered soils due to water pressures confined by intervening low permeability soils.

Shear failure of excavation bases is typically rare in granular soils if adequate lateral support is provided. Inadequate dewatering can cause instability in excavations made through granular or layered soils. The potential for base heave in cohesive soils should be determined for stability of flexible retaining systems.

The factor of safety with respect to base heave, FS_b, is:

$$FS_b = N_b s_u / \sigma_z$$

where:

Nb - stability factor dependent upon the geometry of the excavation and given in Figure 1
Su - undrained shear strength of the soil below the base level
σz - total overburden and surcharge pressures at the bottom of the excavation

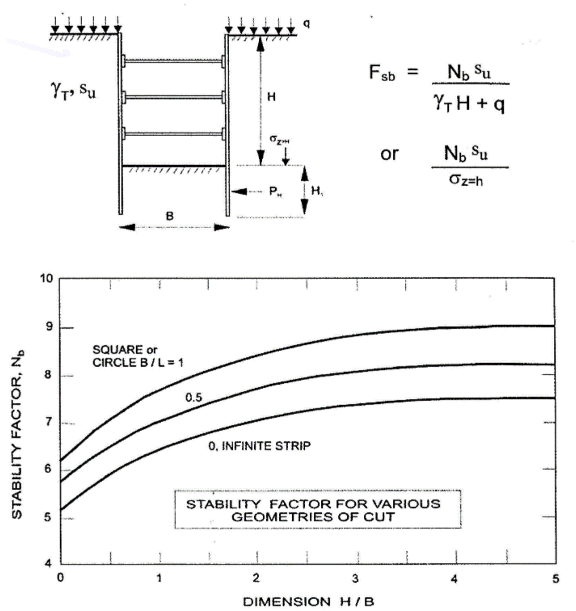


Figure 1 - Stability Factor for Various Geometries of Cut

In the case of soft to firm clays, a factor of safety of 2 is recommended for base stability.

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.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located on the firm, grey clayey silt to silty clay, the thickness of the bedding material should be increased to 300 mm. The bedding should extend to the spring line of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's standard Proctor maximum dry density.

Cover material should extend from the spring line to at least 300 mm above the obvert of the pipe and should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The cover material should be placed in maximum 300 mm thick lifts and 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 surface areas 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 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

Clay Seals

Where clayey silt to silty clay is encountered, 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. Generally, the seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material.

The barriers 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

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. 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.

Groundwater Control for Building Construction

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

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 (GU – General Use cement) would be appropriate for this site. The chloride content and pH of the sample indicate that they are not a significant factor in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a slightly aggressive to moderate corrosive environment.

6.8 Landscaping Considerations

Tree Planting Setbacks

Paterson completed a soils review of the site to determine the applicable tree planting setbacks, in accordance with the City of Ottawa's Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines). Atterberg limits testing was completed for selected silty clay samples. Sieve analysis testing was also completed on selected soil samples. The results of the testing are presented in Tables 1 and 2 in Section 4.2 and also in Appendix 1.

Based on the results of our review, the plasticity index of the silty clay deposit at the subject site does not exceed 40%. Therefore, the following tree planting setbacks are recommended for the silty clay deposit. Large trees (mature height over 14 m) can be planted within the silty clay areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g., in a park or other green space). Tree planting setback limits may be reduced to **4.5 m** for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the conditions noted below are met.

- ❒ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

- ❒ A small tree must be provided with a minimum 25 m^3 of available soil 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 (minimum of two upper and two lower 15M bars in the foundation wall).

- ❒ Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows, and some maples (i.e., Manitoba Maples) and, as such, they should not be considered in the landscaping design.

Swimming Pools

The in-situ soils are considered to be acceptable for swimming pools. Above ground swimming pools must be placed at least 5 m away from the residence foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

Aboveground Hot Tubs

Additional grading around the hot tub should not exceed permissible grade raises. Otherwise, hot tub construction is considered routine, and can be constructed in accordance with the manufacturer's specifications.

Installation of Decks or Additions

Additional grading around proposed deck or addition should not exceed permissible grade raises. Otherwise, standard construction practices are considered acceptable.

7.0 Recommendations

This report should be updated once the development details of the "Future Residential Block" at the western portion of the site are known.

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

- ❑ Observation of all bearing surfaces prior to the placement of concrete.

- ❑ 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 these works have been conducted in general accordance with our recommessndations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

All excess soil must be handled as per ***Ontario Regulation 406/19: On-Site and Excess Soil Management*.**

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 Double Deck Regional Inc. (c/o Regional Group), 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.

LICENSED PROFESSIONAL ENGINEER
Nov. 26, 2025
S. S. DENNIS
100519516
PROVINCE OF ONTARIO

Deepak k Rajendran, E.I.T.

Scott S. Dennis, P.Eng.

Report Distribution:

- ❑ Regional Group (e-mail copy)
- ❑ Paterson Group (1 Copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS RESULTS

CONSOLIDATION TESTING RESULTS

GRAIN SIZE ANALYSIS RESULTS

SHRINKAGE TEST RESULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351878.39 **NORTHING:** 5016725.03 **ELEVATION:** 95.26

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 29, 2025

FILE NO. : PG7472

HOLE NO. : BH 1-25

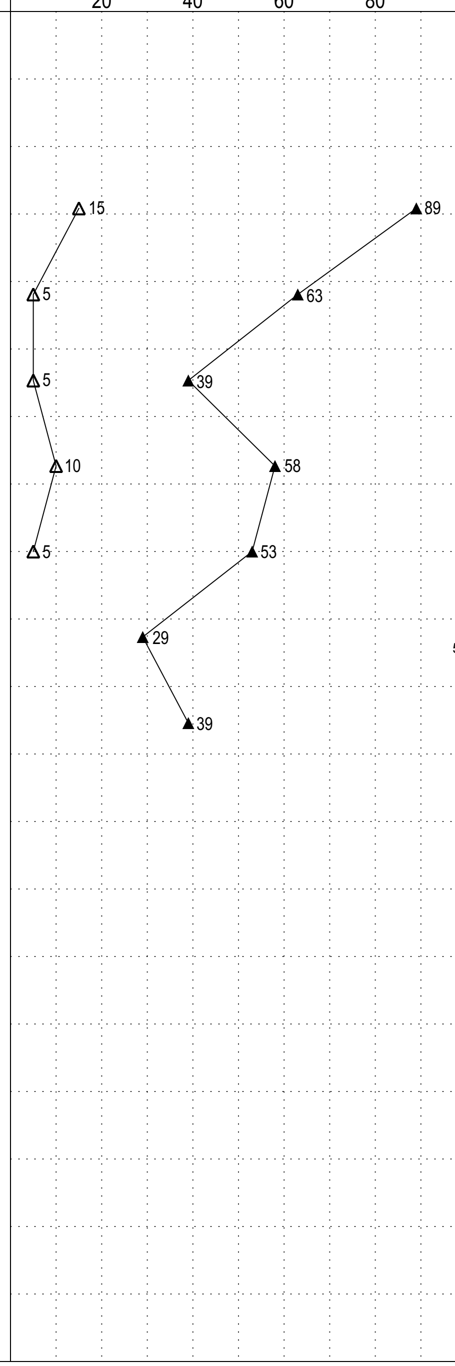
SAMPLE DESCRIPTION	Depth / Elevation	Sample Type and No.	Recovery (%)	N or RQD	Water Content (%)
GROUND SURFACE					
TOPSOIL: with organics	0.05m [95.21m]	AU 1			
FILL: Compact, brown silty clay with some fine sand	0.69m [94.57m]	SS 2	42	1-1-1-2 2	
Stiff, brown **CLAYEY SILT**, trace sand - Sand seams at 1.52 m to 1.63 m depth	2.21m [93.05m]	SS 3	62	P	
Stiff to firm, grey **CLAYEY SILT**, trace sand	6.55m [88.71m]	SS 4	33	P	
		SS 5	75	P	
End of Borehole (GWL at 5.69 m depth - June 6, 2025)					

■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)

△ REMOULDED SHEAR STRENGTH (kPa)

▲ UNDRAINED SHEAR STRENGTH (kPa)

PL (%) WATER CONTENT (%) LL (%)



PIEZOMETER CONSTRUCTION

5.69 m 2025-06-06

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351864.41 **NORTHING:** 5016805.75 **ELEVATION:** 94.90

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 29, 2025

FILE NO. : PG7472

HOLE NO. : BH 2-25

SAMPLE DESCRIPTION (GROUND SURFACE)	DEPTH / ELEVATION
TOPSOIL: with organics	0.05m [94.85m]
FILL: Brown silty fine sand, trace topsoil	0.69m [94.21m]
Stiff, brown **CLAYEY SILT**, some trace to sand	2.97m [91.93m]
Firm, grey **SILTY CLAY** to **CLAYEY SILT**	8.08m [86.82m]
End of Borehole	

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
AU 1			
SS 2	42	3-4-3-2 7	
SS 3		1-2-1-2 3	
SS 4	71	P	
SS 5	50	P	

■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80

△ REMOULDED SHEAR STRENGTH (kPa)

▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80

PL (%) WATER CONTENT (%) LL (%) 20 40 60 80

Remoulded shear strength (kPa): △7, △5, △2

Undrained shear strength (kPa): ▲63, ▲39, ▲34, ▲43, ▲34, ▲39, ▲34, ▲34

PIEZOMETER CONSTRUCTION

DEPTH (m): 1 2 3 4 5 6 7 8 9 10 11 12

ELEVATION (m): 94 93 92 91 90 89 88 87 86 85 84 83

SOIL PROFILE AND TEST DATA

PATERSON GROUP

Geotechnical Investigation
560 Hazeldean Road, Ottawa, ON

COORD. SYS.: MTM ZONE 9 **EASTING:** 351862.44 **NORTHING:** 5016804.41 **ELEVATION:** 95.14

PROJECT:
ADVANCED BY: CME-55 Low Clearance Drill
REMARKS:
DATE: May 29, 2025

FILE NO. : PG7472
HOLE NO. : BH 2A-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE: TYPE AND NO.	SAMPLE: RECOVERY (%)	SAMPLE: N OR RQD	WATER CONTENT (%)	■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80; △ REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80; PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
OVERBURDEN		0							95
		1							94
		2							93
		3							92
		4							91
		5							90
		6							89
		7							88
7.62m [87.52m]									
Dynamic Cone Penetration Test commenced at 7.62 m depth		8							87
		9							86
		10							85
		11							84
		12							

P:/AutoCAD Drawings/Test Hole Data Files/PG74xx/PG7472/data.sqlite 2025-06-11, 13:25 Paterson_Template AA

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351862.44 **NORTHING:** 5016804.41 **ELEVATION:** 95.14

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS: **DATE:** May 29, 2025

FILE NO. : PG7472

HOLE NO. : BH 2A-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE: TYPE AND NO.	SAMPLE: RECOVERY (%)	SAMPLE: N OR RQD	SAMPLE: WATER CONTENT (%)	■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / △ REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
		12							83
		13							82
		14							81
		15							80
		16							79
		17							78
		18							77
		19							76
19.84m [75.30m]							■ 100		
End of Borehole DCPT pushed from 7.62 m to 19.84 m depth Practical refusal to DCPT at 19.84 m depth		20							75
		21							74
		22							73
		23							72
		24							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351863.47 **NORTHING:** 5016805.63 **ELEVATION:** 95.02

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

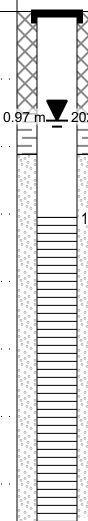
REMARKS:

DATE: May 29, 2025

FILE NO. : PG7472

HOLE NO. : BH 2B-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE: TYPE AND NO.	SAMPLE: RECOVERY (%)	SAMPLE: N OR RQD	SAMPLE: WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) / PL (%) WATER CONTENT (%) LL (%) (20 40 60 80)	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
OVERBURDEN		-							95
		1						0.97 m 2025-06-06	94
		2						1.83m	93
		3							92
		4							91
4.57m [90.45m]								4.57m	
End of Borehole (GWL at 0.97 m depth - June 6, 2025)		5							90
		6							89
		7							88
		8							87
		9							86
		10							85
		11							84
		12							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351805.60 **NORTHING:** 5016758.90 **ELEVATION:** 95.40

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

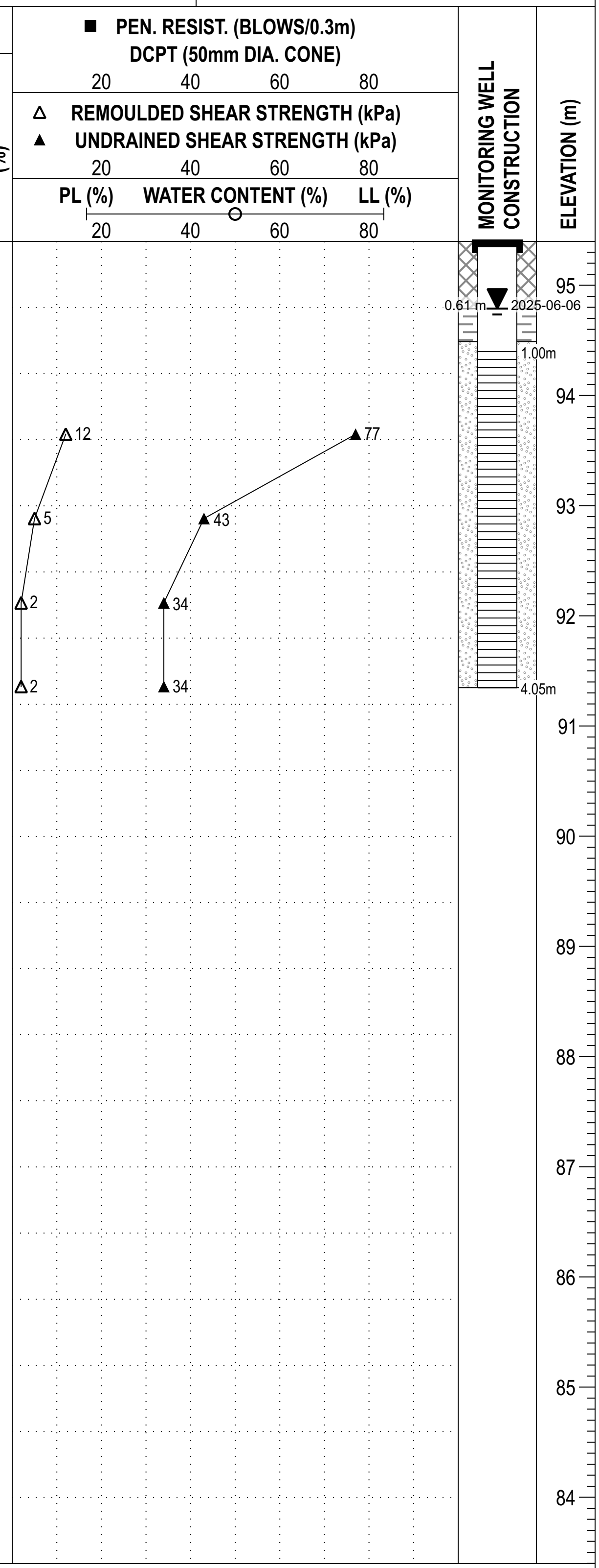
REMARKS:

DATE: May 29, 2025

FILE NO. : PG7472

HOLE NO. : BH 3-25

SAMPLE DESCRIPTION	DEPTH (m)	TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
GROUND SURFACE					
ASPHALT 0.08m [95.32m]		AU 1			
FILL: Brown silty sand with crushed stone and some clay 0.46m [94.94m]	1	SS 2	67	1-1-1-1 2	
Stiff to firm, brown **CLAYEY SILT**, trace sand	2	SS 3	62	P	
		SS 4	42	P	
2.97m [92.43m]					
Firm, grey **SILTY CLAY**	3	SS 5	100	P	
4.42m [90.98m]	4	SS 6	100	P	
End of Borehole					
(GWL at 0.61 m depth - June 6, 2025)					



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

COORD. SYS.: MTM ZONE 9 **EASTING:** 351860.36 **NORTHING:** 5016759.52 **ELEVATION:** 95.17

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

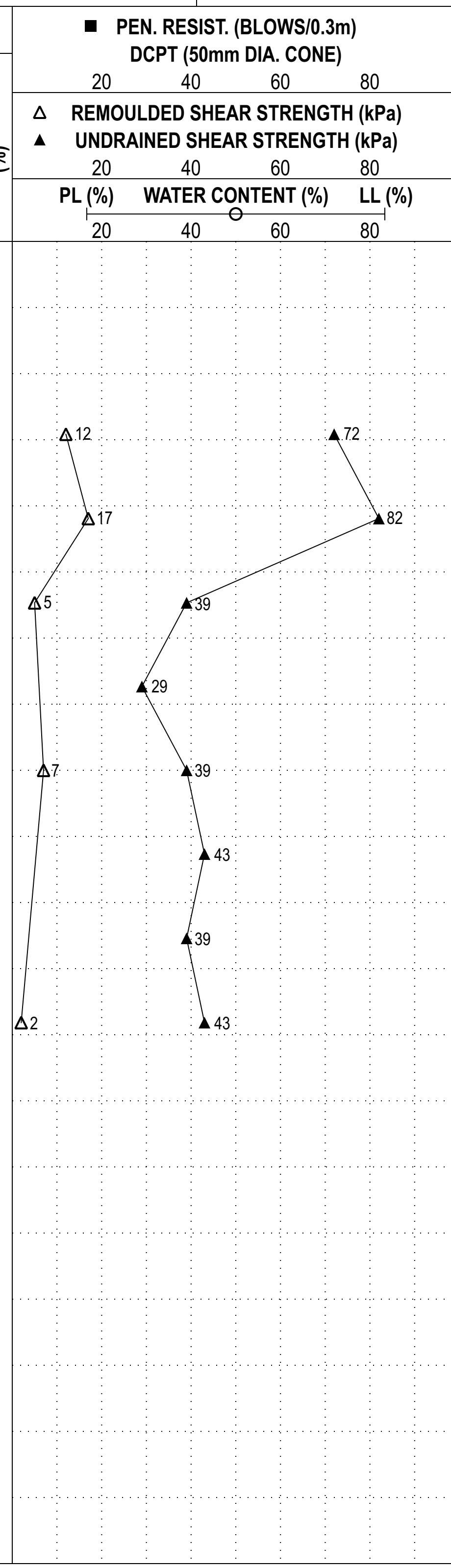
REMARKS:

DATE: May 30, 2025

FILE NO. : PG7472

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
GROUND SURFACE					
TOPSOIL: with organics 0.05m [95.12m]		AU 1			
FILL: Brown silty clay, trace organics and sand 0.69m [94.48m]					
Stiff, brown **CLAYEY SILT**, trace sand	1	SS 2	67	3-2-3-2 5	
	2	SS 3	37	P	
2.97m [92.20m]		SS 4	62	P	
Firm, grey **SILTY CLAY** to **CLAYEY SILT**	3	SS 5		P	
7.32m [87.84m]					
End of Borehole (BH blocked on - June 6, 2025)					



PIEZOMETER CONSTRUCTION

ELEVATION (m): 95, 94, 93, 92, 91, 90, 89, 88, 87, 86, 85, 84

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
560 Hazeldean Road, Ottawa, ON

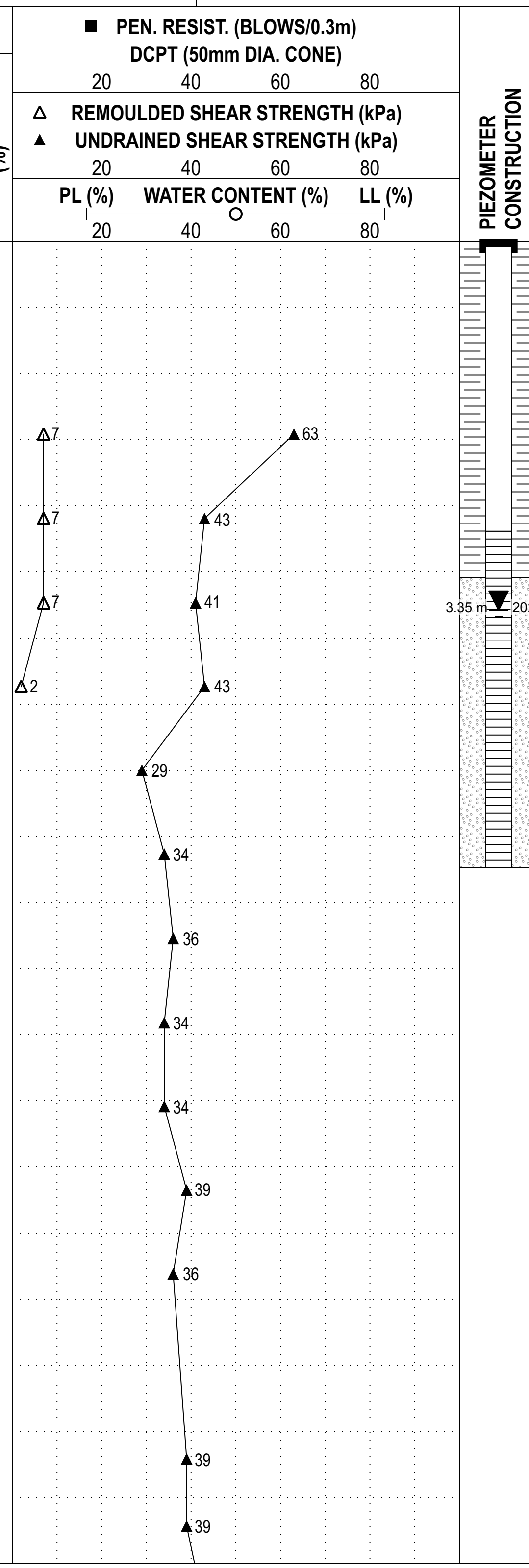
PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351785.78 **NORTHING:** 5016793.36 **ELEVATION:** 95.12

PROJECT:
ADVANCED BY: CME-55 Low Clearance Drill
REMARKS:
DATE: May 30, 2025

FILE NO. : PG7472
HOLE NO. : BH 5-25

SAMPLE DESCRIPTION	DEPTH (m)	TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)	ELEVATION (m)
GROUND SURFACE						
ASPHALT 0.08m [95.04m]		AU 1				95
FILL: Crushed stone and some sand, trace clay 0.69m [94.43m]	1	SS 2	8	1-2-2-1 4		94
Stiff, brown **CLAYEY SILT**, trace sand	2	SS 3	42	P		93
2.97m [92.15m]		SS 4	50	P		92
Firm, grey **SILTY CLAY** to **CLAYEY SILT**	3	SS 5	37	P		91
	4–9					90–86
	10	SS 6	135	P		85
	11–12					84



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

560 Hazeldean Road, Ottawa, ON

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 351785.78 **NORTHING:** 5016793.36 **ELEVATION:** 95.12

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 30, 2025

FILE NO. : PG7472

HOLE NO. : BH 5-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80; △ REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80; PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
12.65m [82.47m]		12					▲ 43		83
Dynamic Cone Penetration Test commenced at 7.62 m depth		13							82
		14							81
		15							80
		16							79
		17							78
17.88m [77.24m]		18					■ 100		77
End of Borehole		19							76
DCPT pushed from 12.65 m to 17.88 m depth		20							75
Practical refusal to DCPT at 17.88 m depth		21							74
(GWL at 3.35 m depth - June 6, 2025)		22							73
		23							72
		24							

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic

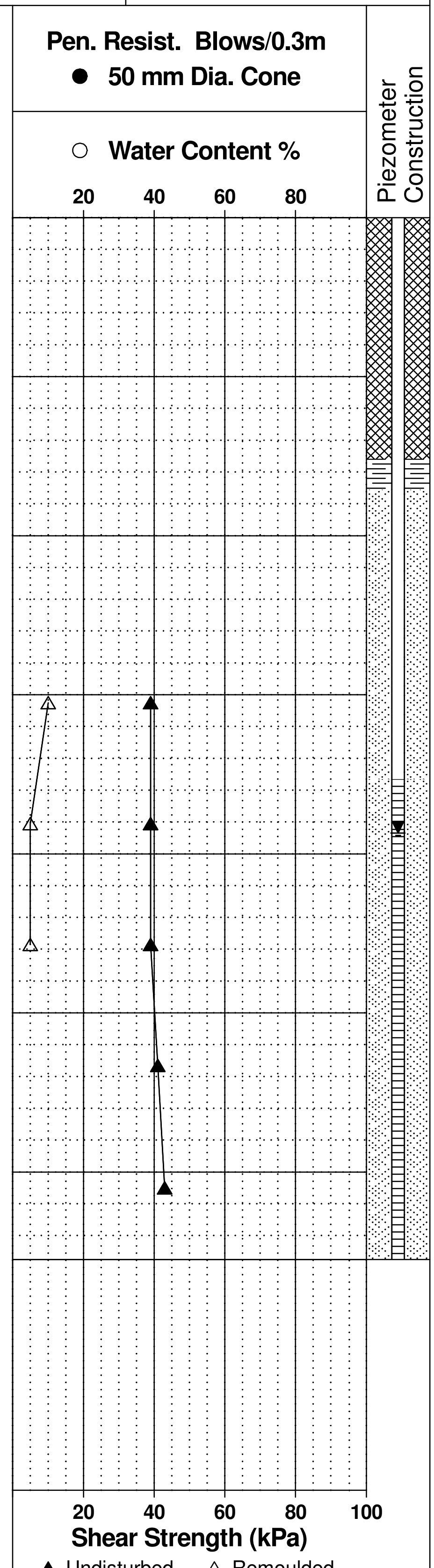
REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** 2020 December 21

FILE NO. PG5642

HOLE NO. BH 1 - 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.71
TOPSOIL 0.20		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	75	6	1	93.71
		SS	3	71	5	2	92.71
2.28							
Firm, grey **SILTY CLAY** to **CLAYEY SILT**		SS	4	100	2		
						3	91.71
						4	90.71
						5	89.71
						6	88.71
6.55							
End of Borehole (GWL @ 3.87 m depth - January 4, 2021)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY CME-55 Low Clearance Drill
DATE 2020 December 21
FILE NO. PG5642
HOLE NO. BH 2 - 20

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.30
TOPSOIL	0.15						
Stiff, brown **CLAYEY SILT** with sand		AU	1				
		SS	2	79	4	1	94.30
		SS	3	63	2	2	93.30
	2.89	SS	4	83	2		
Firm grey **SILTY CLAY** to **CLAYEY SILT**	3.65	SS	5	17	2	3	92.30
End of Borehole							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Monitoring Well Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

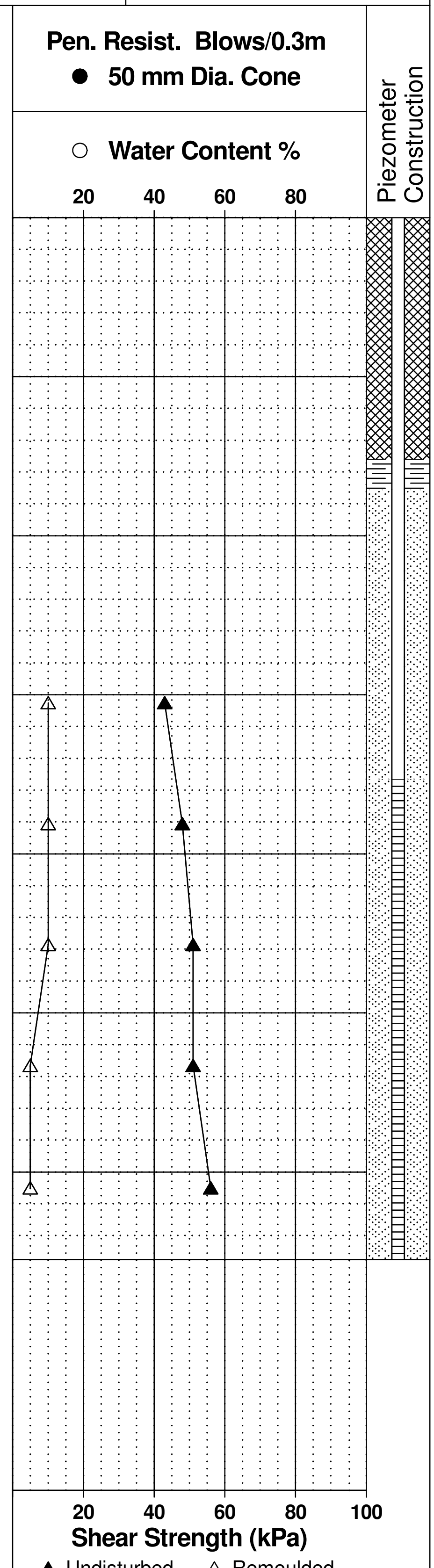
BORINGS BY CME-55 Low Clearance Drill

DATE 2020 December 21

FILE NO. PG5642

HOLE NO. BH 3 - 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.09
TOPSOIL 0.17		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	79	4	1	94.09
		SS	3	83	2	2	93.09
2.84		SS	4	75	2		
Firm to stiff, grey **SILTY CLAY** to **CLAYEY SILT**						3	92.09
						4	91.09
						5	90.09
6.55						6	89.09
End of Borehole							
(Piezometer dry/blocked at 5.94 m depth - January 4, 2021)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

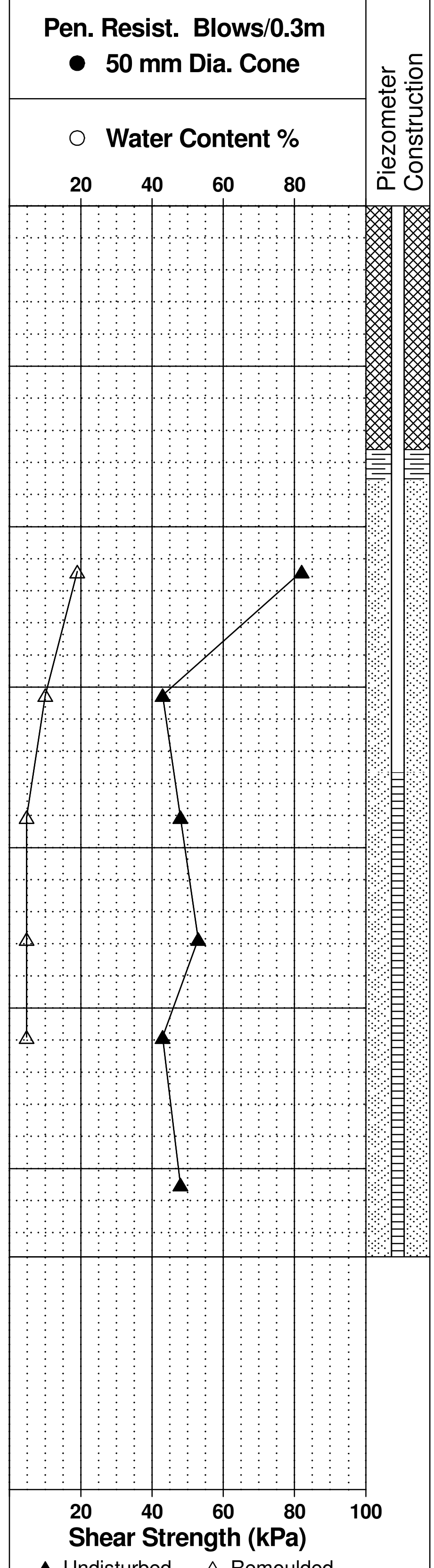
BORINGS BY CME-55 Low Clearance Drill

DATE 2020 December 21

FILE NO. PG5642

HOLE NO. BH 4 - 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.92
TOPSOIL 0.25		AU	1				
Stiff, brown **SILT** to **CLAYEY SILT** with sand		SS	2	50	5	1	94.92
		SS	3	58	2	2	93.92
3.04						3	92.92
Firm, grey **SILTY CLAY** to **CLAYEY SILT**						4	91.92
						5	90.92
						6	89.92
6.55 End of Borehole							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

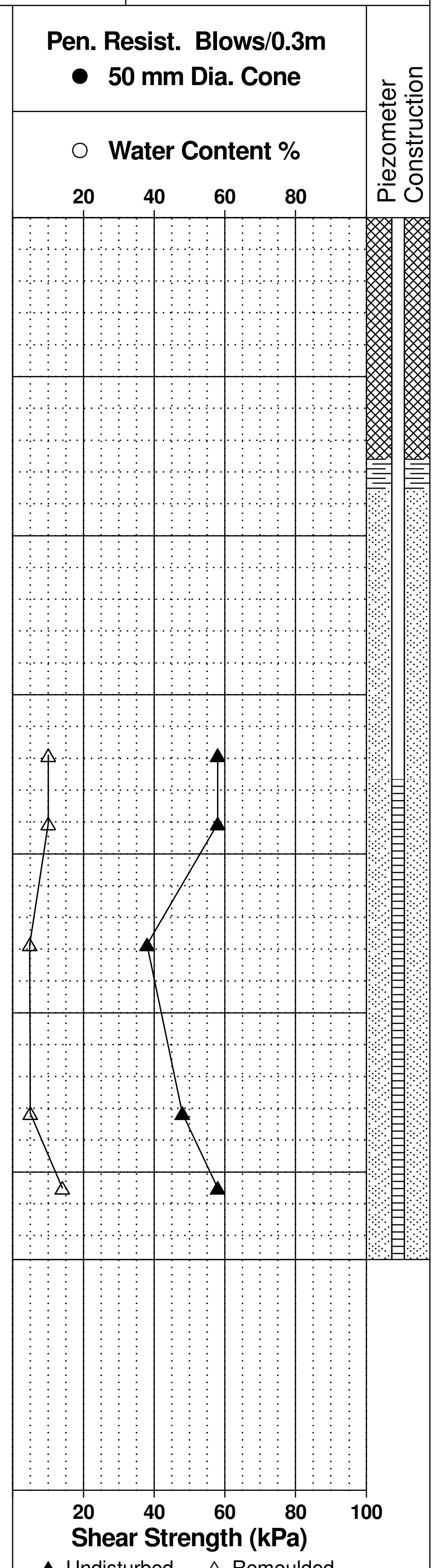
BORINGS BY CME-55 Low Clearance Drill

DATE 2020 December 21

FILE NO. PG5642

HOLE NO. BH 5 - 20

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.14
TOPSOIL	0.13						
Stiff, brown **CLAYEY SILT** with sand		AU	1				
		SS	2	71	3	1	95.14
		SS	3	58	2	2	94.14
	3.05	SS	4	83	3	3	93.14
Stiff grey **SILTY CLAY** to **CLAYEY SILT**		SS	5	21	P	4	92.14
						5	91.14
	6.55	SS	6	100	P	6	90.14
End of Borehole							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE 2020 December 21

FILE NO. PG5642

HOLE NO. BH 6 - 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Monitoring Well Construction
GROUND SURFACE						0	95.95		
TOPSOIL 0.13									
Stiff, brown **SILT** to **CLAYEY SILT** with sand		AU	1						
		SS	2	46	5	1	94.95		
		SS	3	79	2	2	93.95		
		SS	4	66	1				
3.05						3	92.95		
Firm, grey **SILTY CLAY** to **CLAYEY SILT**		SS	5	100	P				
3.65									
End of Borehole (GWL @ 0.77 m depth - January 4, 2021)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazledean Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

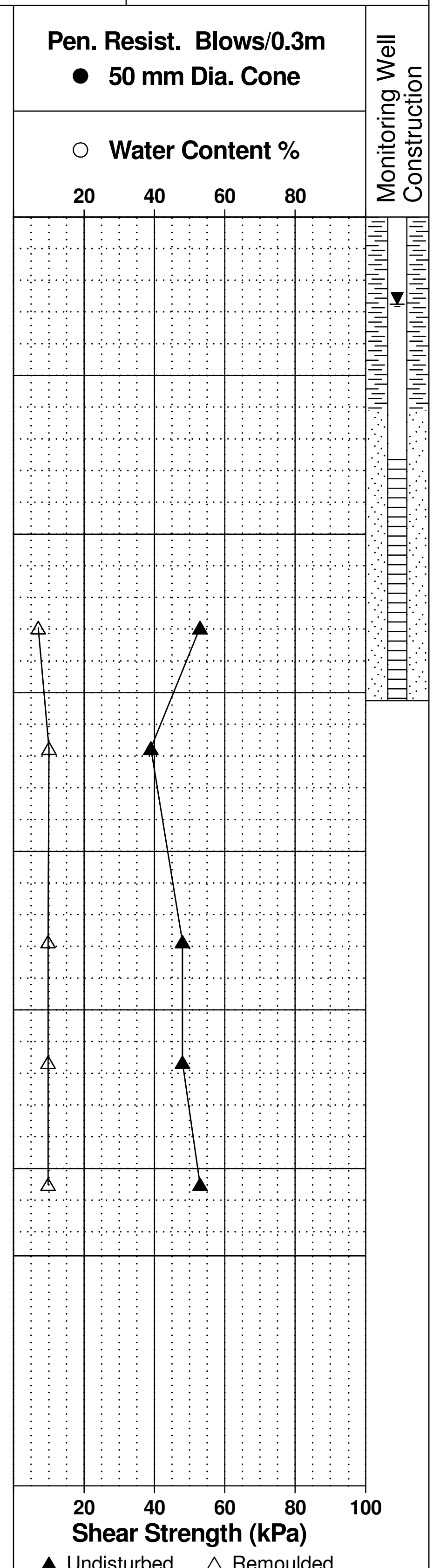
BORINGS BY CME-55 Low Clearance Drill

DATE 2020 December 21

FILE NO. PG5642

HOLE NO. BH 7 - 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.00
TOPSOIL 0.18		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	46	4	1	95.00
		SS	3	79	5	2	94.00
2.81		SS	4	66	2		
Firm to stiff, grey **SILTY CLAY** to **CLAYEY SILT**		SS	5	46	P	3	93.00
						4	92.00
						5	91.00
6.55						6	90.00
End of Borehole							
(GWL @ 0.55 m depth - January 4, 2021)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Limited.

REMARKS

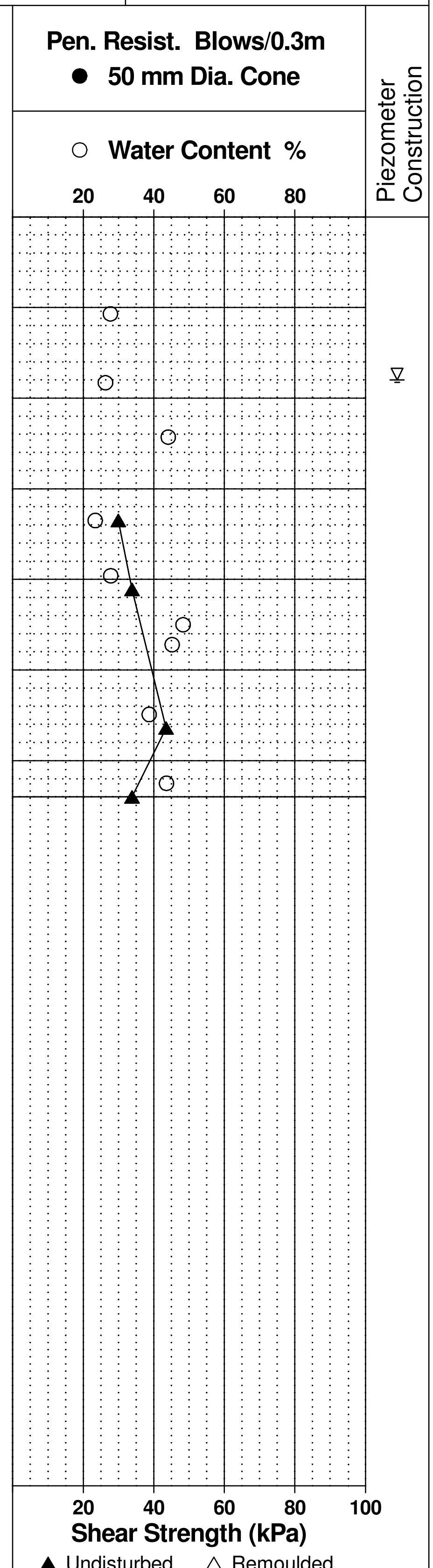
BORINGS BY CME 55 Power Auger

DATE May 16, 2018

FILE NO. PG4508

HOLE NO. BH 1-18

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.64
TOPSOIL with brown clayey silt (0.36)		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	58	5	1	94.64
- sand content decreasing with depth (2.29)		SS	3	12	5	2	93.64
Firm, grey **SILTY CLAY to CLAYEY SILT**		SS	4	42	2	3	92.64
						4	91.64
		TW	5			5	90.64
(6.40)						6	89.64
End of Borehole							
(GWL @ 1.8m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Limited.

REMARKS

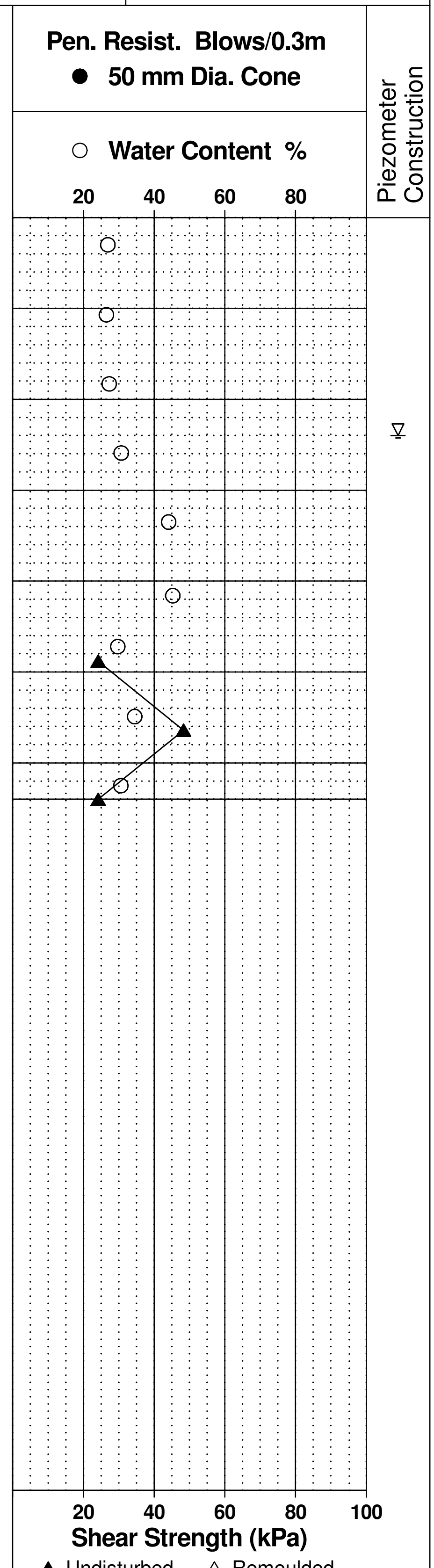
BORINGS BY CME 55 Power Auger

DATE May 16, 2018

FILE NO. PG4508

HOLE NO. BH 2-18

SOIL DESCRIPTION	STRATA PLOT	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.24
TOPSOIL with brown clayey silt — 0.20		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	67	3	1	94.24
- sand content decreasing with depth		SS	3	54	4	2	93.24
— 2.90		SS	4	62	2		
Firm, grey **SILTY CLAY to CLAYEY SILT**		SS	5	92	2	3	92.24
		TW	6	88		4	91.24
						5	90.24
— 6.40						6	89.24
End of Borehole							
(GWL @ 2.4m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE May 17, 2018

FILE NO. PG4508

HOLE NO. BH 3-18

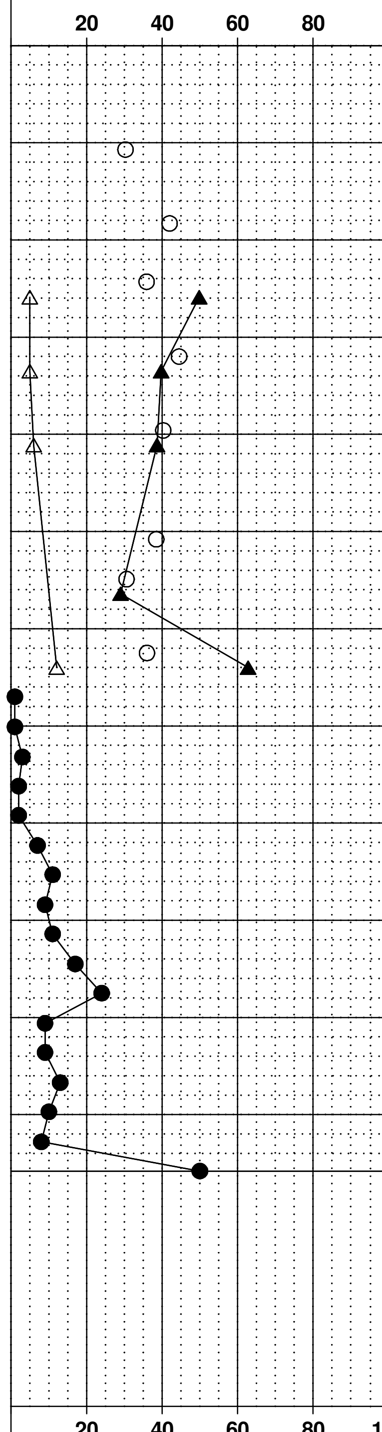
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.44
TOPSOIL with brown clayey silt (0.36)		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	33	3	1	95.44
- sand content decreasing with depth		SS	3	100	3	2	94.44
(2.44)							
Firm, grey **SILTY CLAY to CLAYEY SILT**						3	93.44
						4	92.44
		TW	4			5	91.44
(6.40)						6	90.44
Dynamic Cone Penetration Test commenced at 6.40m depth						7	89.44
						8	88.44
						9	87.44
						10	86.44
						11	85.44
(11.58) End of Borehole							

Practical DCPT refusal at 11.58m depth

(GWL @ 2.0m depth based on field observations)

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

○ Water Content %



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 560 Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Limited.

REMARKS

BORINGS BY CME 55 Power Auger

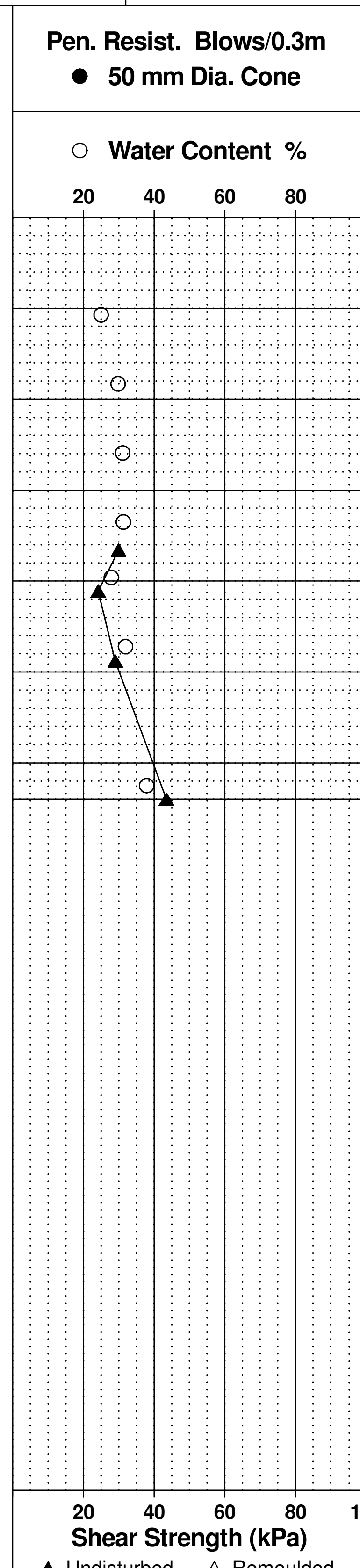
DATE May 17, 2018

FILE NO. PG4508

HOLE NO. BH 4-18

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.32
TOPSOIL with brown clayey silt (0.33)		AU	1				
Stiff, brown **CLAYEY SILT** with sand		SS	2	62	2	1	94.32
- sand content decreasing with depth		SS	3	67	3	2	93.32
(2.90)		SS	4	100	2	3	92.32
Firm, grey **SILTY CLAY to CLAYEY SILT**						4	91.32
						5	90.32
		TW	5			6	89.32
(6.40) End of Borehole							

(GWL @ 2.4m depth based on field observations)



Piezometer Construction

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

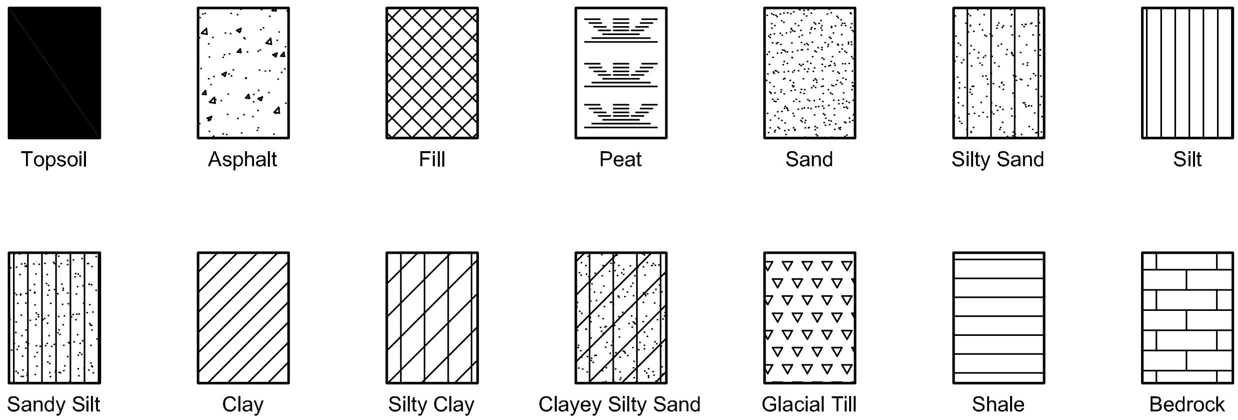
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

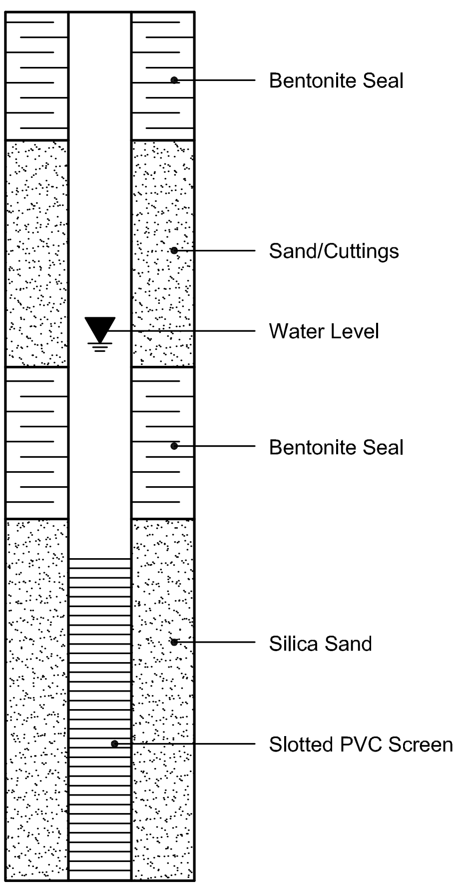
SYMBOLS AND TERMS (continued)

STRATA PLOT

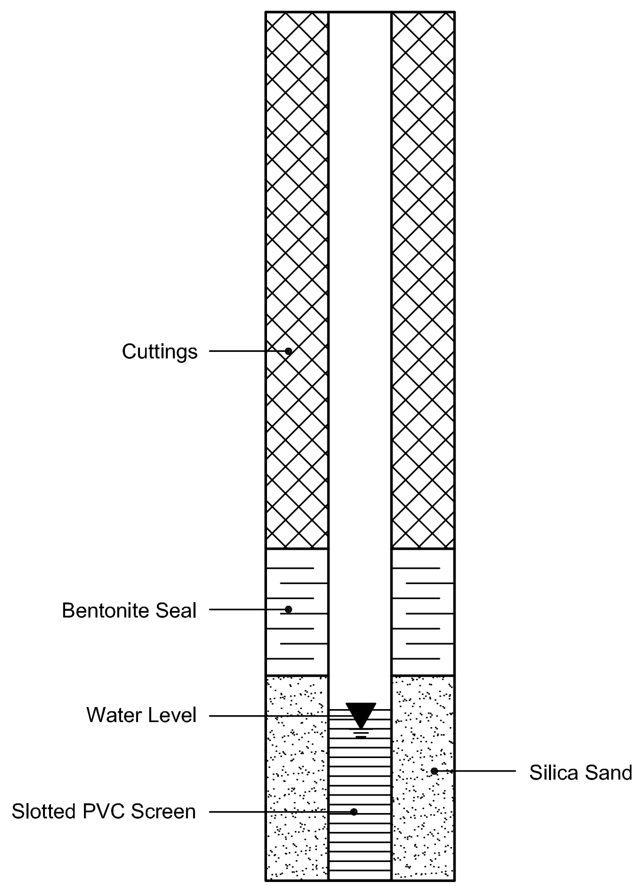


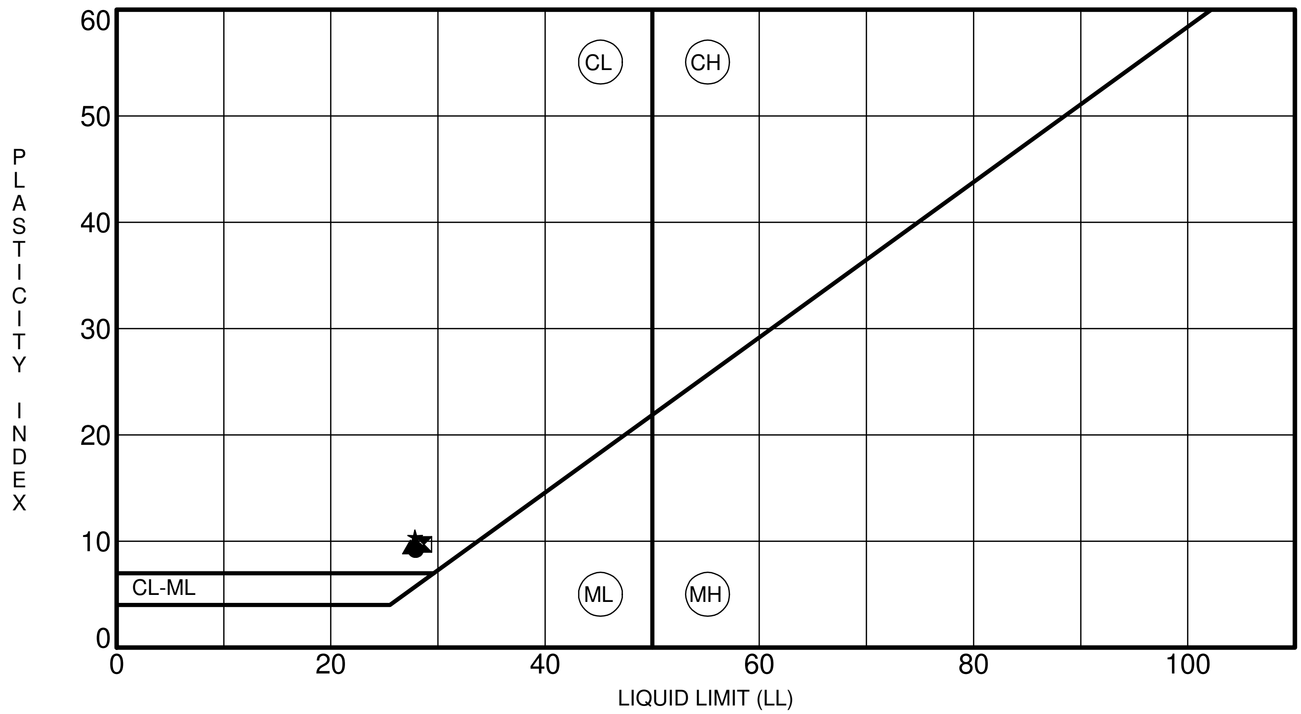
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





	Specimen Identification	LL	PL	PI	Fines	Classification
●	**BH 3 - 20**	**28**	**19**	**9**		**CL - Inorganic clays of low plasticity**
⊠	**BH 4 - 20**	**29**	**19**	**10**	**94.0**	**CL - Inorganic clays of low plasticity**
▲	**BH 5 - 20**	**27**	**18**	**9**		**CL - Inorganic clays of low plasticity**
★	**BH 7 - 20**	**28**	**17**	**10**	**95.0**	**CL - Inorganic clays of low plasticity**

CLIENT **Caivan Communities**

PROJECT **Geotechnical Investigation - Proposed Development - 560 Hazledean Road**

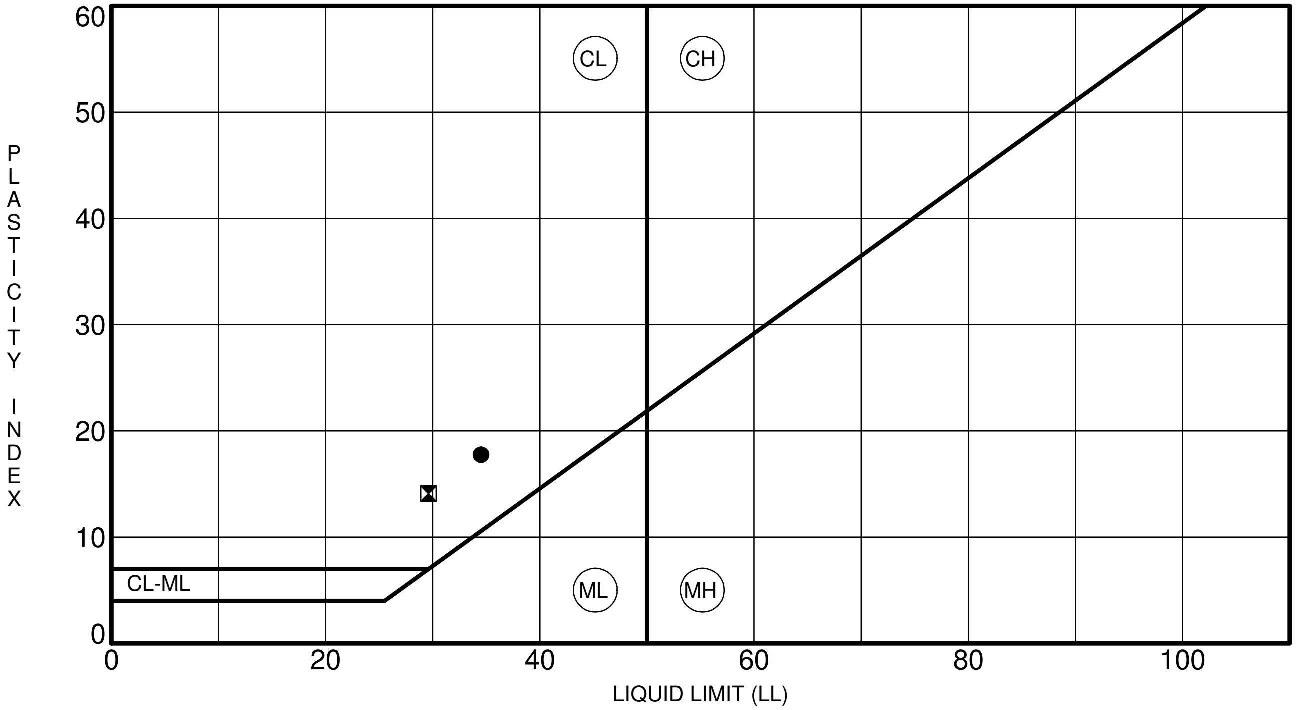
FILE NO. **PG5642**

DATE **21 Dec 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 3-18**	**SS 3**	**35**	**17**	**18**		**CL - Inorganic clays of low plasticity**
⊠	**BH 4-18**	**SS 4**	**30**	**15**	**14**		**CL - Inorganic clays of low plasticity**

CLIENT **Novatech Engineering Consultants Ltd.**

PROJECT **Geotechnical Investigation - Proposed Development - 560 Hazeldean Road**

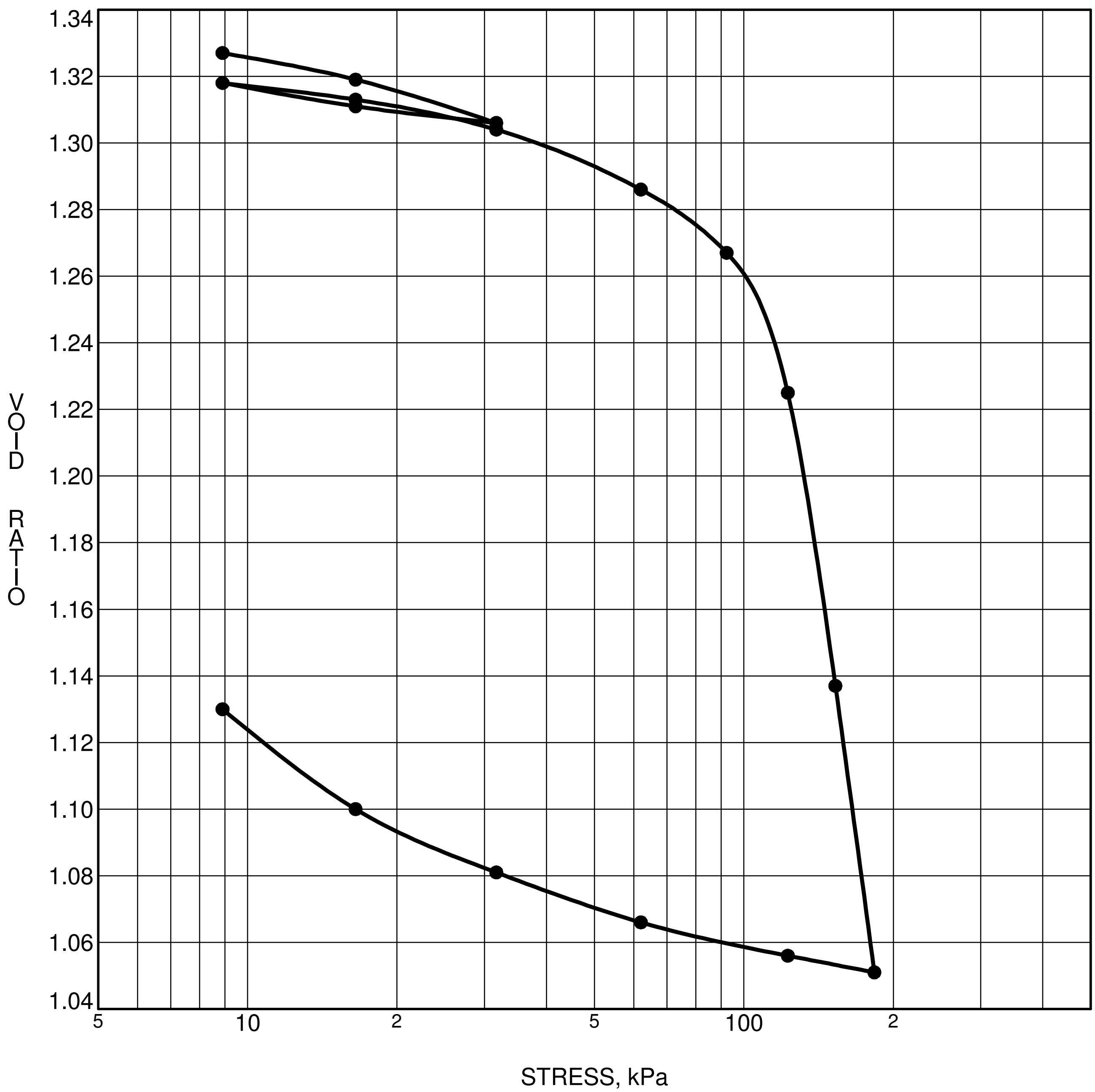
FILE NO. **PG4508**

DATE **17 May 18**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



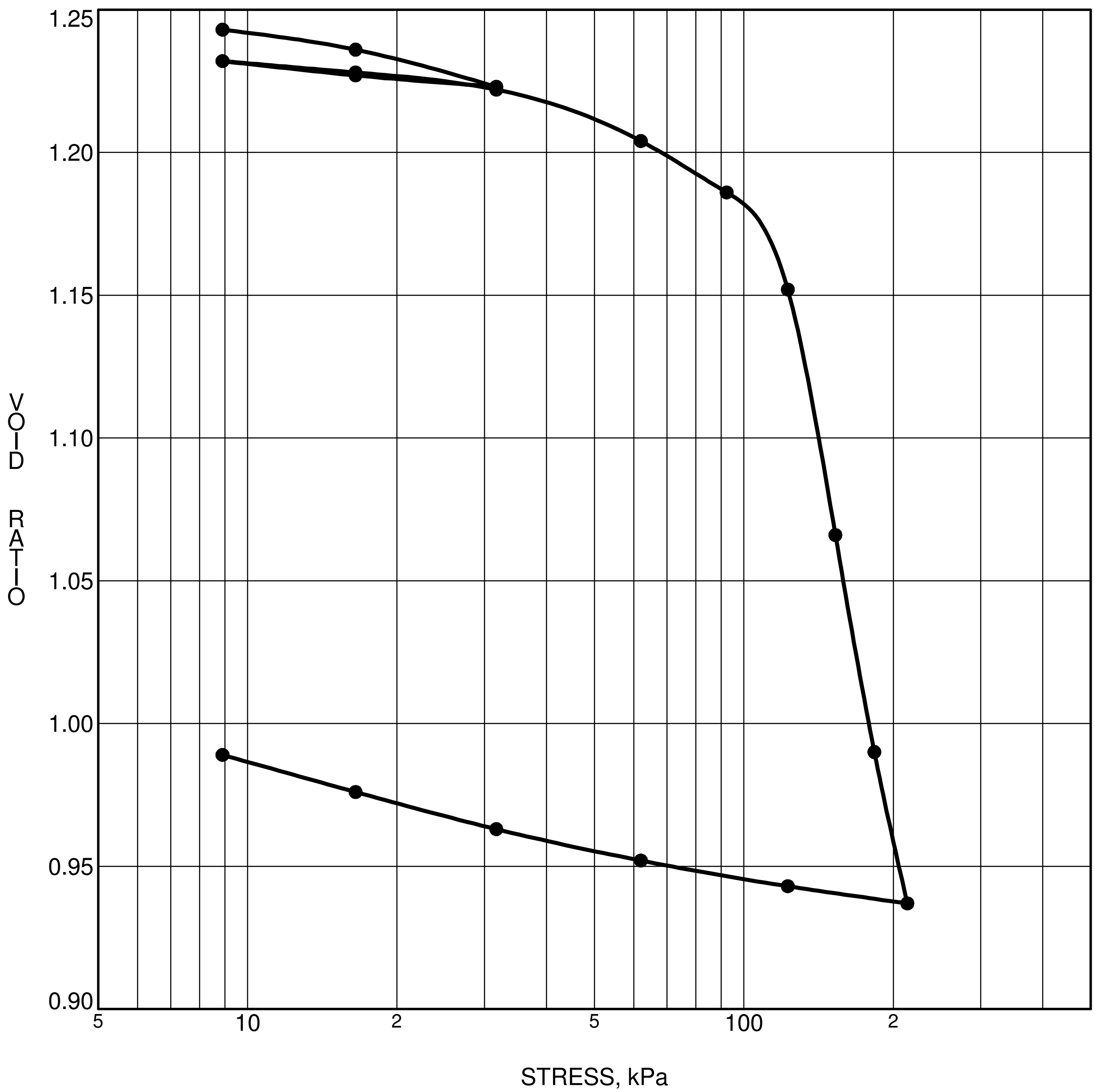
CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 1-18**	p'o	**50.29** kPa	Ccr	**0.025**
Sample No.	**TW 5**	p'c	**119.12** kPa	Cc	**1.081**
Sample Depth	**4.50** m	OC Ratio	**2.4**	Wo	**48.3** %
Sample Elev.	**91.14** m	Void Ratio	**1.329**	Unit Wt.	**17.2** kN/m ^{3}

CLIENT	**Novatech Engineering Consultants Ltd.**	FILE NO.	**PG4508**
PROJECT	**Geotechnical Investigation - Proposed Development - 560 Hazeldean Road**	DATE	**16/06/2018**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 2-18**	p'_o	**53.2** kPa	Ccr	**0.019**
Sample No.	**TW 6**	p'_c	**115.9** kPa	Cc	**0.980**
Sample Depth	**4.16** m	OC Ratio	**2.2**	Wo	**45.3** %
Sample Elev.	**91.08** m	Void Ratio	**1.245**	Unit Wt.	**17.5** kN/m^3

CLIENT **Novatech Engineering Consultants Ltd.**

FILE NO. **PG4508**

PROJECT **Geotechnical Investigation - Proposed Development - 560 Hazeldean Road**

DATE **02/06/2018**

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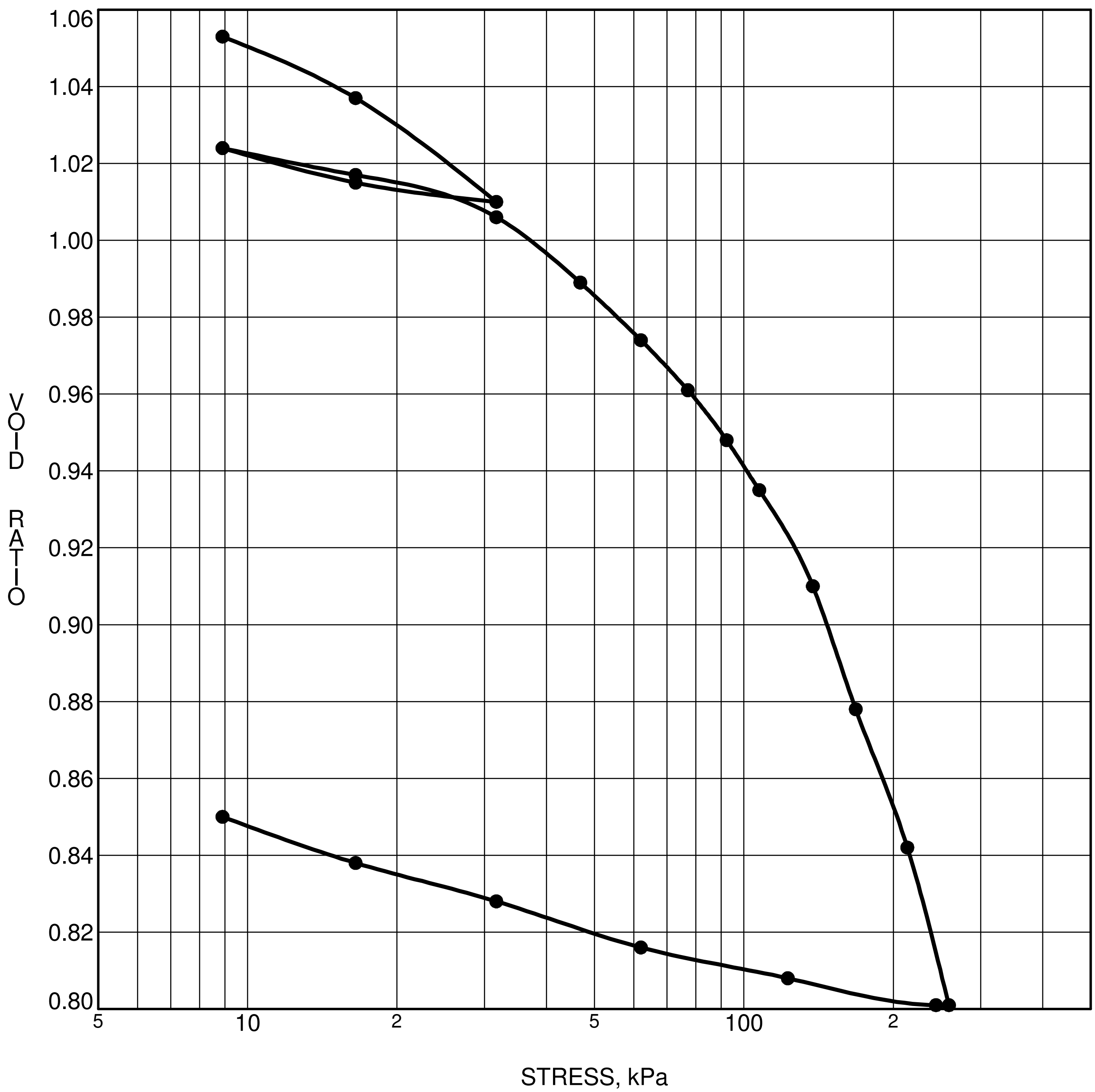
CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 3-18**	p'o	**53.5** kPa	Ccr	**0.033**
Sample No.	**TW 4**	p'c	**95.5** kPa	Cc	**0.352**
Sample Depth	**5.08** m	OC Ratio	**1.8**	Wo	**38.5** %
Sample Elev.	**91.36** m	Void Ratio	**1.057**	Unit Wt.	**18.2** kN/m 3

CLIENT	**Novatech Engineering Consultants Ltd.**	FILE NO.	**PG4508**
PROJECT	**Geotechnical Investigation - Proposed Development - 560 Hazeldean Road**	DATE	**10/06/2018**

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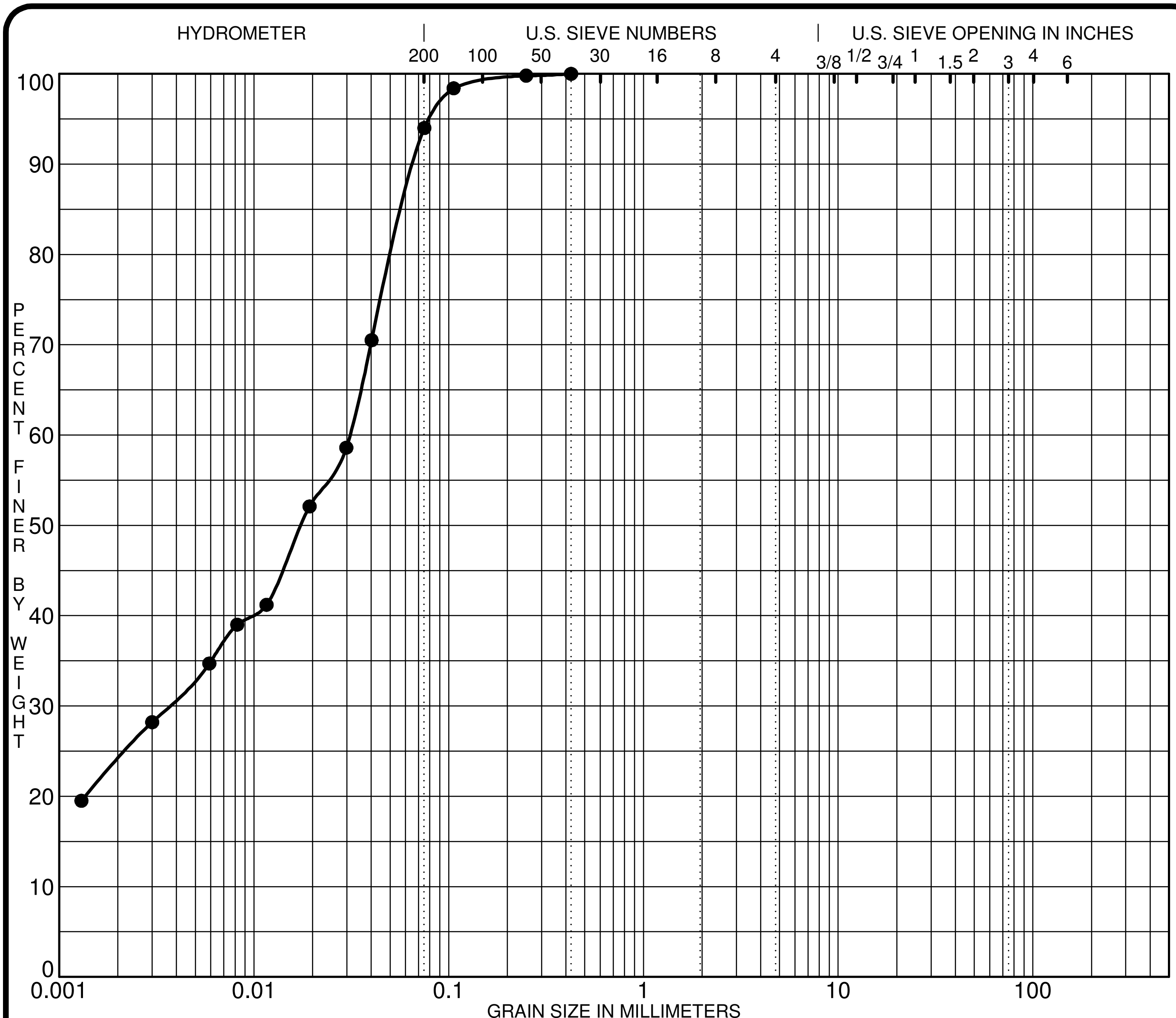
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 4 - 20**	**CL - Inorganic clays of low plasticity**		**29**	**19**	**10**		

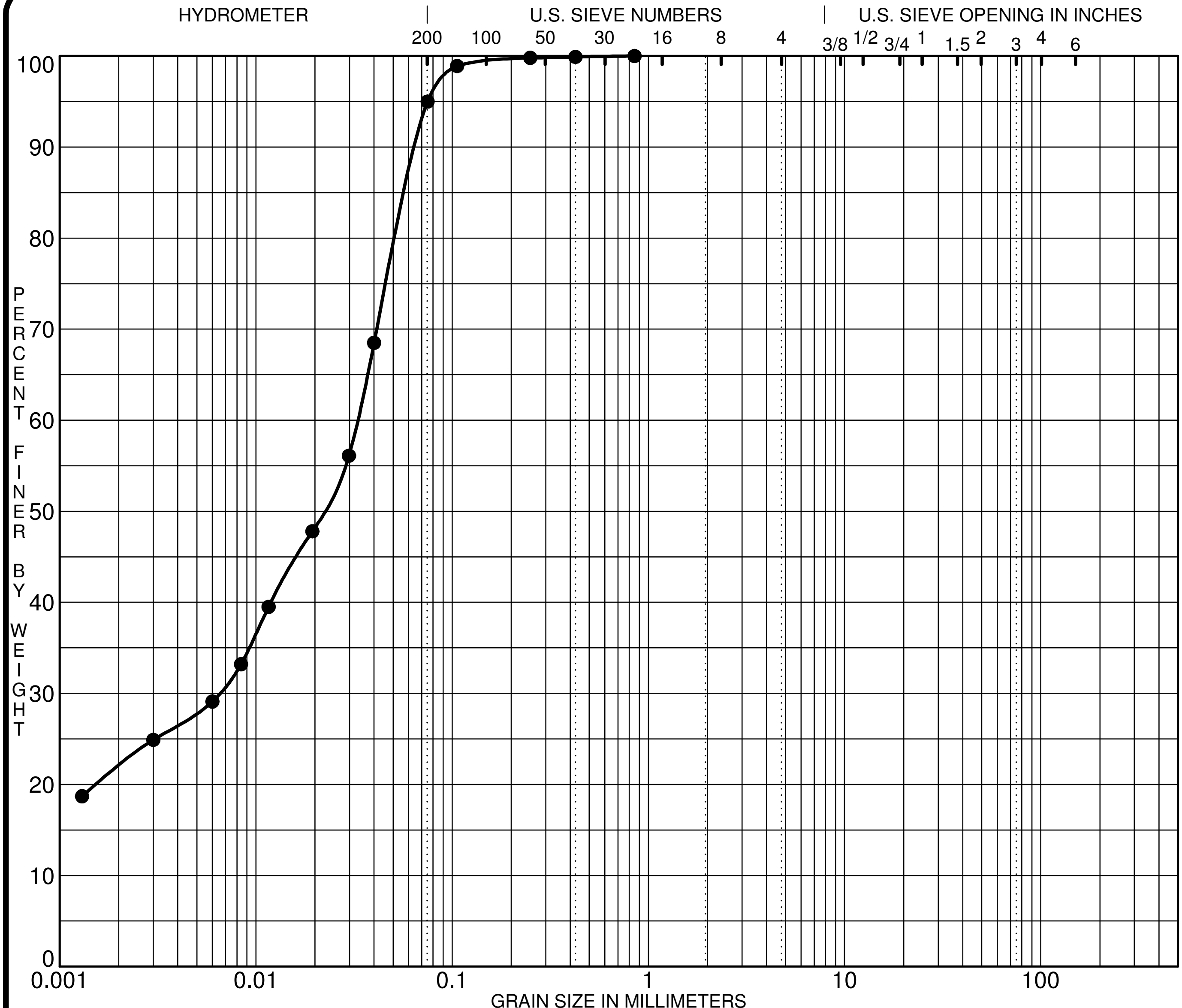
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 4 - 20**	**0.43**	**0.03**	**0.004**		**0.0**	**6.0**	**94.0**	

CLIENT	**Caivan Communities**	FILE NO.	**PG5642**
PROJECT	**Geotechnical Investigation - Proposed Development - 560 Hazledean Road**	DATE	**21 Dec 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 7 - 20**	**CL - Inorganic clays of low plasticity**		**28**	**17**	**10**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 7 - 20**	**0.85**	**0.03**	**0.006**		**0.0**	**5.0**	**95.0**	

CLIENT **Caivan Communities** FILE NO. **PG5642**

PROJECT **Geotechnical Investigation - Proposed Development - 560 Hazledean Road** DATE **21 Dec 20**

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Caivan	DEPTH	7'6" - 9'6"	FILE NO.:	PG5642
PROJECT:	560 Hazeldean	BH OR TO No:	BH4 SS4	DATE SAMPLED	21-Dec
LAB No:	23263	TESTED BY:	DJ / DB	DATE RECEIVED	02-Dec
SAMPLED BY:		DATE REPORTED:		DATE TESTED	05-Jan

LABORATORY INFORMATION & TEST RESULTS

Moisture		Calibration (Two Trials)		
Tare	4.8	Tin	4.8	4.8
Soil Pat Wet + Tare	76.16	Tin + Grease	4.97	4.91
Soil Pat Wet	71.36	Glass	48.97	48.97
Soil Pat Dry + Tare	58.83	Tin + Glass + Water	91.09	91.11
Soil Pat Dry	54.03	Volume	37.15	37.23
Moisture	**32.07**	**Average Volume**	**37.19**	

Soil Pat + String	54.05
Soil Pat + Wax + String in Air	55.76
Soil Pat + Wax + String in Water	24.32
Volume Of Pat (Vdx)	31.44

RESULTS:

Shrinkage Limit	**17.88**
Shrinkage Ratio	**1.830**
Volumetric Shrinkage	**25.988**
Linear Shrinkage	**7.411**

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**

	Client ID:	BH2-25-SS3	-	-	-		
	Sample Date:	29-May-25 09:00	-	-	-	-	-
	Sample ID:	2523175-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	75.9	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.28	-	-	-	-	-
Resistivity	0.1 Ohm.m	40.4	-	-	-	-	-
Anions							
Chloride	10 ug/g	22	-	-	-	-	-
Sulphate	10 ug/g	55	-	-	-	-	-

PARACEL LABORATORIES LTD.

Order #: 2052256

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO:

Report Date: 31-Dec-2020

Order Date: 23-Dec-2020

Project Description: PG5642

	Client ID:	BH3-SS3	-	-	-
	Sample Date:	22-Dec-20 13:00	-	-	-
	Sample ID:	2052256-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	73.2	-	-	-
General Inorganics					
pH	0.05 pH Units	7.48	-	-	-
Resistivity	0.10 Ohm.m	63.9	-	-	-
Anions					
Chloride	5 ug/g dry	15	-	-	-
Sulphate	5 ug/g dry	16	-	-	-

PARACEL
LABORATORIES LTD.

Order #: 1824406

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24159

Report Date: 18-Jun-2018

Order Date: 13-Jun-2018

Project Description: PG4508

	Client ID:	BH2-18 - SS3	-	-	-
	Sample Date:	05/16/2018 09:00	-	-	-
	Sample ID:	1824406-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	77.7	-	-	-
General Inorganics					
pH	0.05 pH Units	7.76	-	-	-
Resistivity	0.10 Ohm.m	82.5	-	-	-
Anions					
Chloride	5 ug/g dry	11	-	-	-
Sulphate	5 ug/g dry	22	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

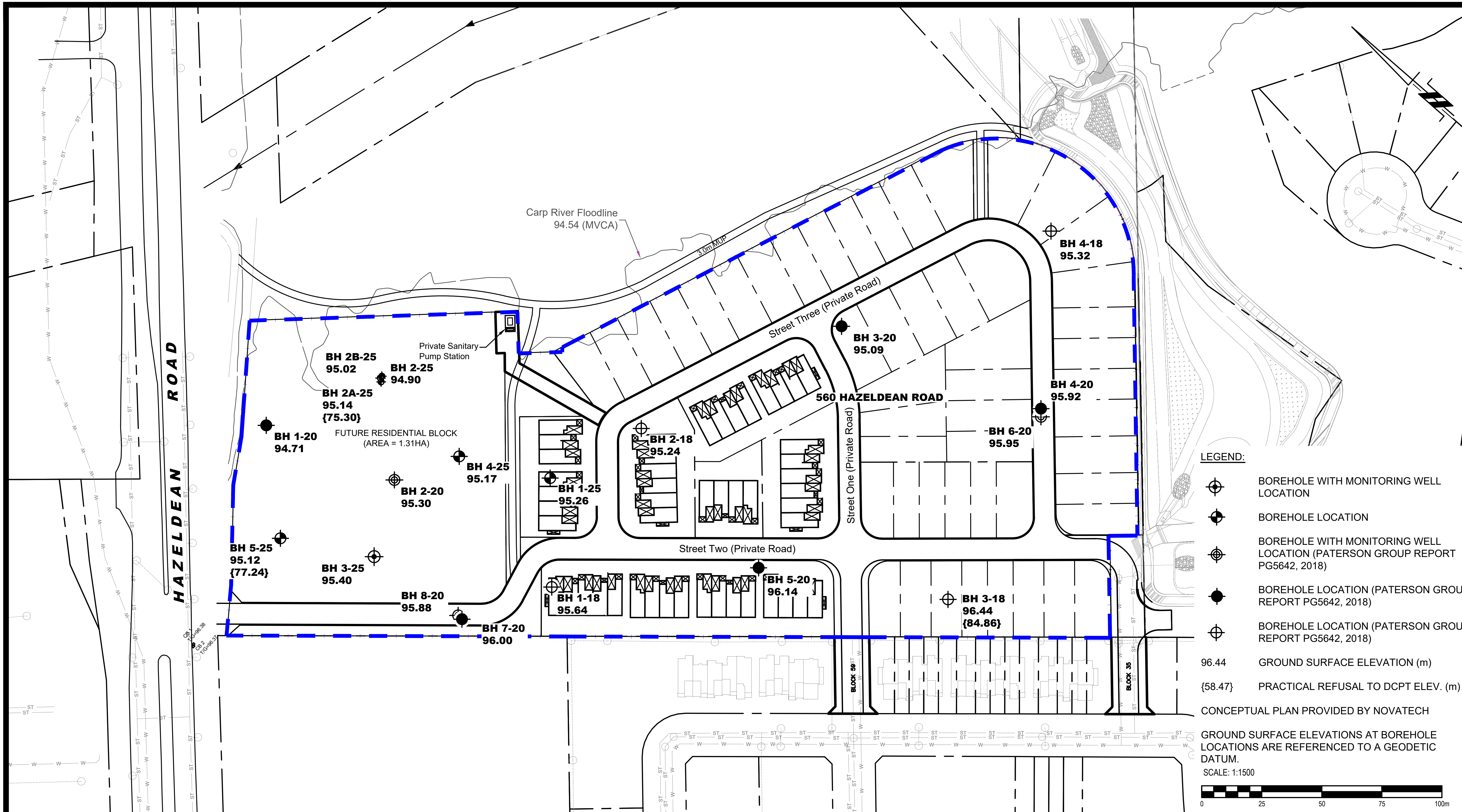
DRAWING PG7472-1 – TEST HOLE LOCATION PLAN

DRAWING PG7472-2 – PERMISSIBLE GRADE RAISE PLAN

FIGURE 1

KEY PLAN

PATERSON GROUP



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PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	ADDED 2025 BOREHOLE LOCATION BH 1-25 TO BH 5-25 AND UPDATED CONCEPTUAL PLAN	11/06/2025	DR

REGIONAL GROUP
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
560 HAZELDEAN ROAD

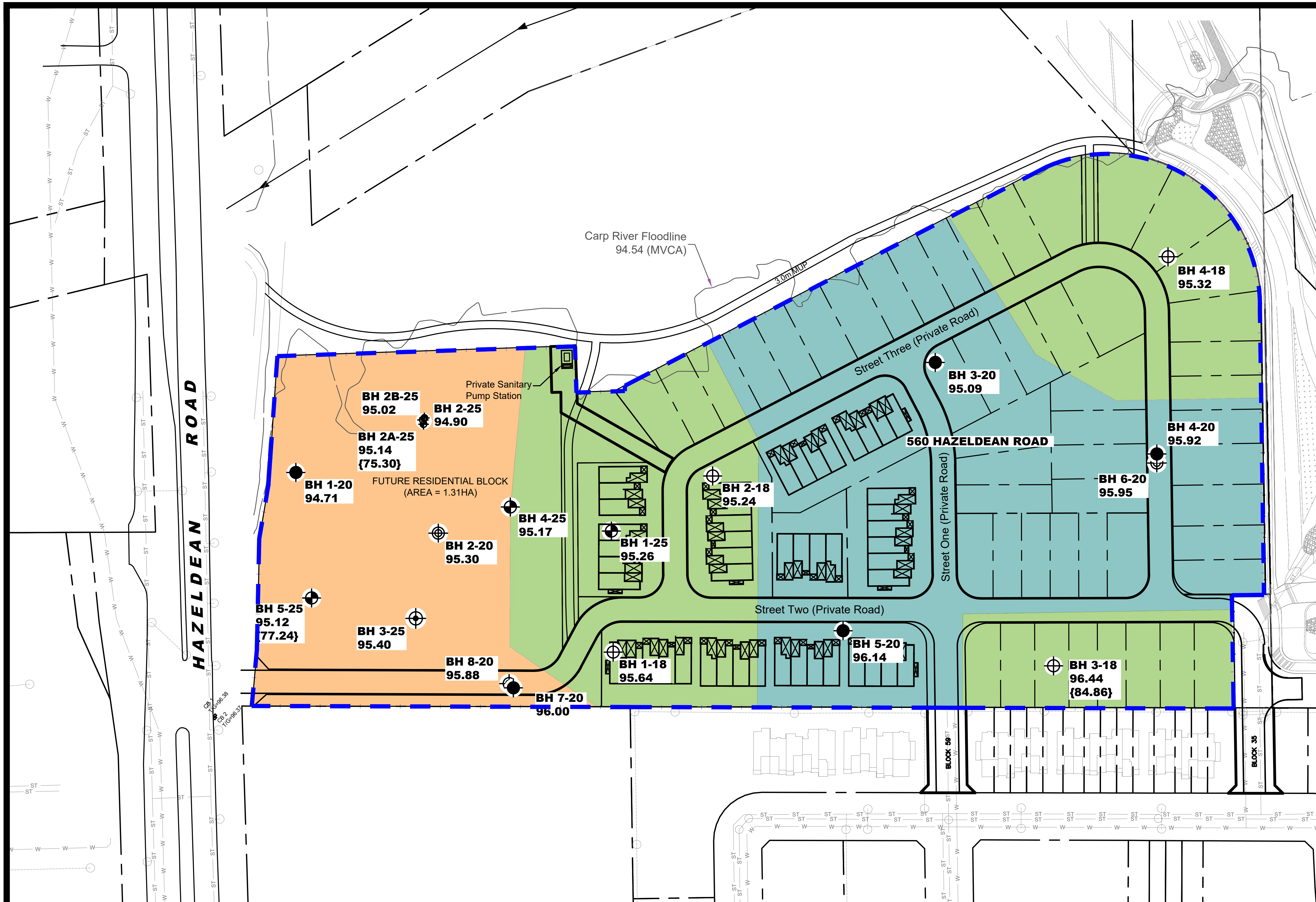
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 04/2025
Drawn by: GK	Report No.: PG7472-1
Checked by: DR	Dwg. No.: PG7472-1
Approved by: SD	Revision No.: 1

11x17



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT PG5642, 2018)
- BOREHOLE LOCATION (PATERSON GROUP REPORT PG5642, 2018)
- BOREHOLE LOCATION (PATERSON GROUP REPORT PG5642, 2018)

96.44 GROUND SURFACE ELEVATION (m)

{58.47} PRACTICAL REFUSAL TO DCPT ELEV. (m)

CONCEPTUAL PLAN PROVIDED BY NOVATECH

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

PERMISSIBLE GRADE RAISE RESTRICTION

- 1.8 m FOR BUILDINGS, 2.2 m FOR ROADS
- 1.5 m FOR BUILDINGS, 2.0 m FOR ROADS
- 1.2 m FOR BUILDINGS, 1.6 m FOR ROADS

SCALE: 1:1500

0 25 50 75 100m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

REGIONAL GROUP
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
560 HAZELDEAN ROAD

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:1500	Date: 06/2025
Drawn by: GK	Report No.: PG7472-1
Checked by: DR	Dwg. No.: PG7472-2
Approved by: SD	Revision No.:

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11x17