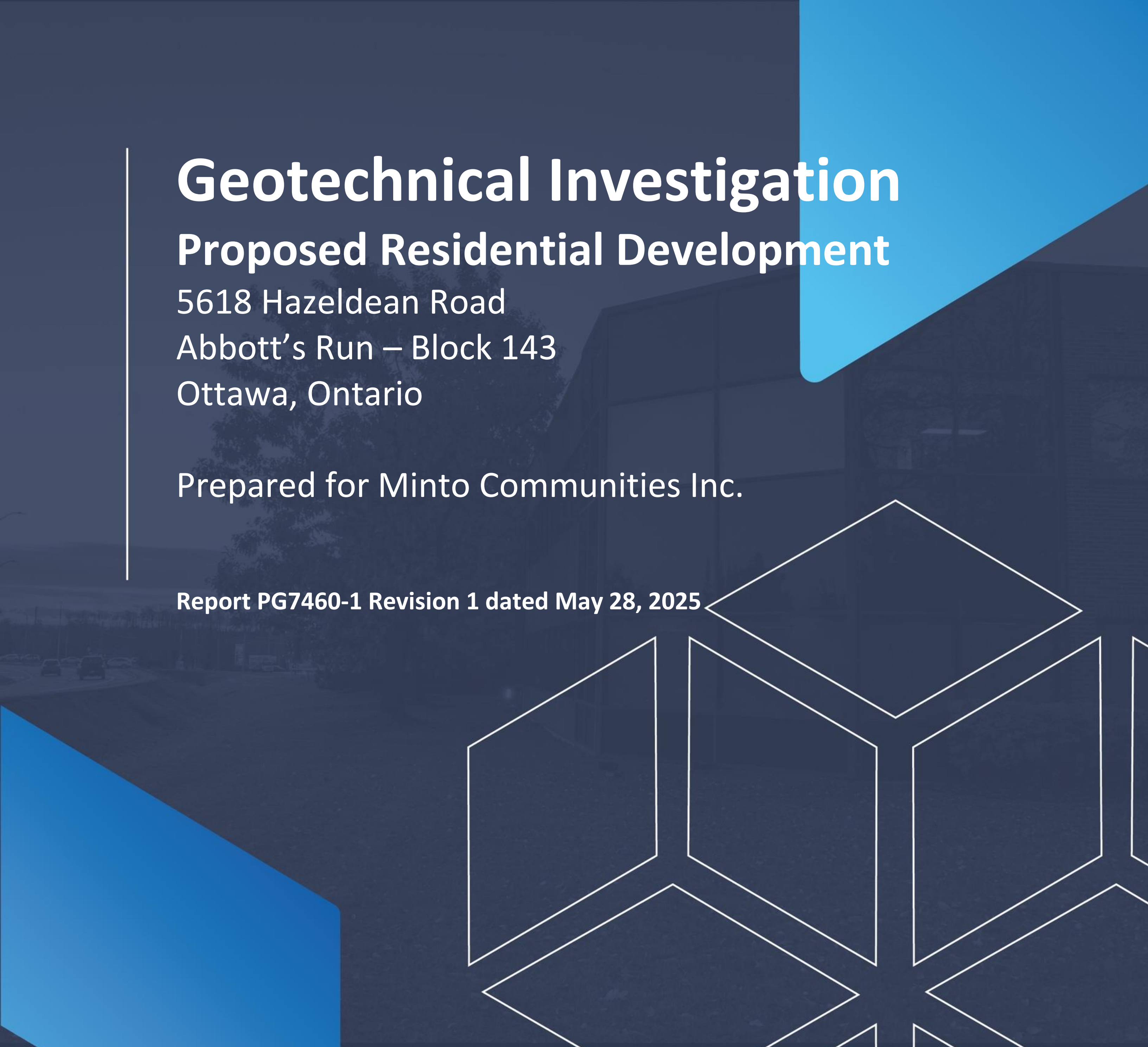


Geotechnical Investigation

Proposed Residential Development

5618 Hazeldean Road
Abbott’s Run – Block 143
Ottawa, Ontario

Prepared for Minto Communities Inc.

Report PG7460-1 Revision 1 dated May 28, 2025

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Minto Group to conduct a geotechnical investigation for Block 143 (formerly referred to as Block 13) of the proposed Abbott's Run residential development to be located within the overall subdivision at 5618 Hazeldean Road in the City of Ottawa (reference should be made to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

- Determine the subsoil and groundwater conditions at this site by means of advancing test pits and considering existing test hole data within or in close proximity to the subject site.

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

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

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

2.0 Proposed Development

Based on the available conceptual drawings, it is expected that the proposed development will consist of six (6) residential low to mid-rise condo-style dwellings. It is anticipated the buildings will be provided with one basement level for residential use.

Associated local access roadways, parking areas, and landscaped areas are also anticipated to form part of the proposed development. It is further understood that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current investigation was carried out on May 7, 2025. At this time, six (6) test pits were advanced to a maximum depth of 3.7 m below the existing ground surface. The test pits were advanced using an excavator provided and operated by the client's earthworks contractor. All fieldwork was conducted under full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The test pitting procedure consisted of advancing to the required depths at the selected locations, sampling and testing the overburden.

A previous field program was carried out by Paterson for the proposed overall Abbott's Run development from March 22 to April 19, 2022, and from July 14 to 18, 2022. At that time, sixty-one (61) boreholes were advanced to a maximum depth of 8.2 m below the existing ground surface. Three (3) of which were advanced within or in close proximity to the subject parcel boundary to a maximum depth of 6.7 m below the existing ground surface.

The boreholes were previously completed using a track mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The testing procedure consisted of augering to the required depths and at the selected locations sampling the overburden.

A previous field program was carried out by others from October 2 to 5, 2015 in support of the sanitary trunk sewer alignment installed throughout the footprint of future Robert Grant Avenue between Hazeldean Road and Abbott Street, located along the western boundary of the subject site. At that time several boreholes were advanced throughout the proposed roadway, three of which were advanced in close proximity to the subject site boundary to a maximum depth of 7.5 m below the existing ground surface.

The test hole locations from the current and previous investigations are presented on Drawing PG7460-1 - Test Hole Location Plan included in Appendix 2.

Sampling and In Situ Testing

Soil samples from the test pits were recovered from the side walls of the open excavation. Grab samples were collected from the test pits at selected intervals. The samples were initially classified on site, placed in sealed plastic bags and transported to our laboratory for further examination and classification. The depths at which the grab samples were recovered from the test pits are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

Soil samples were collected from the previously advanced boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags and transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets 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 carried out in cohesive soils using a field vane apparatus.

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

Groundwater

The boreholes undertaken by Paterson during the 2022 investigation have been previously instrumented with monitoring wells to allow for groundwater level monitoring subsequent to advancing the test holes.

The groundwater level readings were obtained after a suitable stabilization period following the completion of the previous 2022 field investigation. Submersible dataloggers were installed in select monitoring wells to record long-term groundwater level by measuring hydrostatic pressure of the water above the sensor.
The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

3.2 Field Survey

The test hole locations from the current investigation were selected by Paterson to provide general coverage of the subject site. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high precision handheld GPS and referenced to a geodetic datum. The location of the test holes are presented on Drawing PG7460-1 - Test Hole Location Plan included 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. Atterberg Limits, Shrinkage Limits, and moisture content testing were performed on samples recovered from the current investigation. Atterberg Limits and moisture content testing were previously performed on select samples retrieved from boreholes near and within the subject site. Testing results are presented and discussed further in Section 4.2.

3.4 Analytical Testing

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

3.5 Permeameter Testing

In-situ permeameter testing was conducted at one (1) location in close proximity to the subject site using a Pask (Constant Head Well) Permeameter to confirm infiltration rates of the surficial soils at the subject site. At this location, two (2) 83 mm holes, approximately 1.5 m away from each other, were excavated using a Riverside/Bucket auger to a depth of 0.3 to 0.4 and 0.5 to 0.7 m below existing ground surface. All soils from the auger flights were visually inspected and initially classified on-site.

The permeameter reservoir was filled with water and inverted into the hole, ensuring that it was relatively vertical and rested on the bottom of the hole. As the water infiltrated into the soil, the water level of the reservoir was monitored at various time intervals until the rate of fall reached equilibrium, known as *"quasi steady state"* flow rate. Quasi steady state flow can be considered to have been obtained after measuring 3 to 5 consecutive rate of fall readings with identical values. The values for the steady state rate of fall were recorded for each location. The results of testing are further discussed in Subsection 4.4.

3.6 Hydraulic Conductivity (Slug) Testing

Hydraulic conductivity (slug) testing was conducted at one (1) monitoring well location in close proximity to the subject site to assist in confirming anticipated groundwater flow rates within the subsoils at the subject site. The test data was analyzed as per the method set out by Hvorslev (1951). Assumptions inherent in the Hvorslev method include a homogeneous and istropic aquifer of infinite extent with zero-storage assumption, and a screen length significantly greater than the monitoring well diameter. The assumption regarding aquifer storage is considered to be appropriate for groundwater inflow through the overburden aquifer.

The assumption regarding screen length and well diameter is considered to be met based on a screen length of 1.5 m and a diameter of 0.05 m. While the idealized assumptions regarding aquifer extent, homogeneity, and isotropy are not strictly met in this case (or in any real-world situation), it has been our experience that the Hvorslev method produces effective point estimates of hydraulic conductivity in conditions similar to those encountered at the subject site.

The Horslev analysis is based on the line of best fit through the field data (hydraulic head recovery vs. time), plotted on a semi-logarithmic scale. In cases where the initial hydraulic head displacement is known with relative certainty, such as in this case where a physical slug has been introduced, the line of best fit is considered to pass through the origin.

The results of testing and hydrogeological recommendations are further discussed in Subsection 4.5.

4.0 Observations

4.1 Surface Conditions

The subject site consists of undeveloped land currently under construction and stripped of topsoil and organic matter. The subject site is bordered to the north by future Cranesbill Street, to the east by future residential dwellings, to the south by a future residential street, and to the west by future Robert Grant Avenue. The ground surface elevation throughout the subject site was noted to be relatively flat and at level with the surrounding lands to the north, west and south, sloping gently downwards from south to north between geodetic elevations 102.6 m and 101.5 m, respectively. The ground surface was noted to be approximately 1 to 2 m lower than the adjacent future Robert Grant Avenue to the west.

4.2 Subsurface Profile

Generally, the subsurface profile encountered at the majority of the test hole locations consisted of an approximately 0.1 m thick layer of topsoil underlain by a deposit of brown silty clay further underlain by a deposit of grey silty clay.

Generally, throughout the subject site, the silty clay deposit was observed to consist of crust consisting of a hard to stiff brown weathered silty clay with trace amounts of sand and seashells. The weathered (brown) silty clay layer was observed to have a thickness ranging between 2.8 and 3.0 m. Below the crust, unweathered grey silty clay was encountered with trace amounts of sand and seashells.

An approximately 0.6 m thick layer of fill consisting of brown silty clay with variable amounts of gravel and blast rock was encountered at TP 1-25. The fill material was observed to be underlain by an approximately 0.4 m thick layer of sandy silt, followed by the brown and silty clay deposits, 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 test hole location.

Bedrock

Based on available geological mapping, the bedrock throughout the subject site consists of interbedded limestone and dolomite of the Gull River Formation. The drift thickness ranges between 3 to 10 m.

Atterberg Limit Testing

During the previous investigation by Paterson in 2022, two (2) silty clay samples within or in close proximity to the subject site were submitted for Atterberg limits testing. One (1) silty clay sample from the current investigation was submitted for Atterberg limits as well as shrinkage limit testing. The results are summarized in Table 1.

Table 1 – Atterberg Limits Results

Test Hole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
PG7460 (Current Investigation)						
TP 3-25	G3	1.6-1.7	31	18	13	CL-Inorganic clays of low plasticity
PG6165 (2022)						
BH 19-22	SS2	1.37	40	20	20	CL-Inorganic clays of low plasticity
BH 34-22	SS3	2.13	32	18	14	CL-Inorganic clays of low plasticity

Note: LL: Liquid Limit; PL: Plastic Limit; PI: Plastic Index.

The results of the shrinkage limit test of the tested silty clay sample (TP 3-25 – G3) indicate a shrinkage limit of 28.5 and a shrinkage ratio of 1.875.

4.3 Groundwater

Groundwater levels were previously recorded at select borehole locations instrumented with a monitoring device subsequent to the completion of their respective previous field program. The previously measured groundwater levels at each borehole in close proximity to the subject site are presented in Table 2 and are presented in the Soil Profile and Test Data sheets in Appendix 1.

Table 2 – Summary of Groundwater Levels

Borehole Number	Observation Method	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
			Depth (m)	Elevation (m)	
Paterson Report No. PG6165 (2022)					
BH 19-22	Monitoring Well	101.66	0.10	102.34	April 22, 2022
			5.7	95.96	July 11, 2022
BH 34-22	Monitoring Well	102.44	0.10	102.34	April 22, 2022
			1.38	101.06	July 11, 2022
By Others (2015)					
MW 15-15	Monitoring Well	101.55	1.38	100.17	October 27, 2015

It should be noted that surface water can become trapped within a backfilled borehole column, which can lead to higher-than-normal groundwater level readings. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, groundwater levels could vary at the time of construction.

4.4 Permeameter Testing Results

During the previous investigation by Paterson in 2022, permeameter tests were conducted at one (1) location in close proximity to the subject site. Preparation and testing of this investigation are in accordance with the Canadian Standards Association (CSA) B65-12-Annex E. Field saturated hydraulic conductivity (K_{fs}) values and estimated infiltration values are presented in Table 3 below.

Field saturated hydraulic conductivity values were determined using the Engineering Technologies Canada (ETC) Ltd. Reference tables provided in the most recent ETC Past Permeameter User Guide dated July 2018. Infiltration rates have been determined based on approximate relationships provided by the Ontario Ministry of Municipal Affairs and Housing – Supplementary Guidelines to the Ontario Building Code, 1997 – SG-6 – Percolation Time and Soil Descriptions.

Table 3 – Summary of field saturated hydraulic conductivity values and infiltration rates.

Test Hole ID	Ground Surface Elevation (m)	Depth of Permeameter Testing (m)	K_{fs} (m/sec)	Infiltration Rate (mm/hr)	Soil Type
BH 34-22	102.44	0.30	7.6×10^{-7}	42.94	Silty Clay
		0.60	5.1×10^{-7}	38.59	
		0.60	3.8×10^{-7}	42.94	
		0.60	1.9×10^{-7}	29.63	

The measured K_{fs} values within the test hole are consistent with similar material Paterson has encountered on other sites and typical published values for silty clay and ranged from approximately 1.0×10^{-6} to 1.0×10^{-7} m/sec. The range in K_{fs} values is generally due to the variability in composition and consistency of the material encountered.

Based on the field saturated hydraulic conductivity values, the infiltration rates were calculated to range from 30 to 43 mm/hr. It is important to note that the infiltration rates derived from the K_{fs} values in the table above are unfactored. Prior to use for design purposes, a safety correction factor will need to be applied to the above infiltration rates to account for a number of factors including variations in soil composition and anticipated accumulation of fine-grained material over time.

4.5 Hydraulic Conductivity (Slug) Testing Results

During the previous investigation, hydraulic conductivity testing was conducted at one (1) location in close proximity to the subject site as shown in Table 4 below.

Table 4 – Summary of hydraulic conductivity values.

Test Hole ID	Ground Surface Elevation (m)	Depth of Testing (m)	K (m/sec)	Test Type	Soil Type
BH 34-22	102.44	5.87	$7.15\text{x}10^{-7}$	Falling Head	Silty Clay

The slug testing completed at the monitoring well location screened in the silty clay identified hydraulic conductivity value of approximately $1\text{x}10^{-7}$ to $1\text{x}10^{-8}$ m/sec. These values are generally consistent with similar material Paterson has encountered on other sites and typical published values for silty clay.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. The proposed buildings may be founded on conventional shallow foundations placed on an undisturbed, very stiff to stiff silty clay or Paterson-reviewed and approved engineered fill bearing surface.

Due to the presence of the silty clay deposit, the subject site is subject to grade raise restrictions. The permissible grade raise recommendations are discussed in Subsection 5.3.

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

5.2 Site Grading and Preparation

Stripping Depth

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

Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

Fill Placement

Fill placed for grading beneath the building footprints should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery to the site. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the buildings should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Site-excavated soil could be placed as general landscaping fill and to build up areas that are to be paved. Workable site-excavated material, free of organics and deleterious materials should be spread in maximum 300 mm thick loose lifts and compacted by several passes of a suitably sized sheepsfoot vibratory roller and reviewed by Paterson personnel at the time of construction.

Frozen material may not be considered for this purpose. This process should be reviewed and approved by Paterson field personnel upon completion of each lift and who are experienced in reviewing the placement of soil fill in this manner.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as CCW MiraDRAIN 2000 or Delta-Teraxx.

5.3 Foundation Design

Conventional Shallow Foundation

Using continuously applied loads, conventional footings can be designed using the bearing resistance values presented in the following table.

Table 5 - Bearing Resistance Values

Bearing Surface	Bearing Resistance Value at SLS (kPa)	Factored Bearing Resistance Value at ULS (kPa)
Stiff to Very Stiff Brown Silty Clay	150	300
Firm Grey Silty Clay	75	110

Note:

- Strip and pad footings, up to 3 and 6 m wide, respectively, can be designed using the bearing resistance values provided for an undisturbed, silty clay bearing surface.
- Bearing resistance values for footing design should be confirmed on a per block basis by the Paterson personnel at the time of construction.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete footings. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance values at ULS. The bearing resistance value at SLS, provided above, will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support Zone

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Above the groundwater level, adequate lateral support is provided to the in-situ bearing medium soils when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil.

Permissible Grade Raise Recommendations

Based on the undrained shear strength testing results and experience with the local silty clay deposit, a permissible grade raise restriction of **2.0 m** is recommended for grading in close proximity to housing within the subject site. A permissible grade raise restriction of **2.3 m** is recommended for roadways.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Site Designation X_D** for foundations constructed at the subject site in accordance with the 2024 Ontario Building Code (OBC 2024). If a higher seismic site class is required, a site-specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed buildings.

The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2024 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Slab-On-Grade and Basement Slab Construction

With the removal of all topsoil and deleterious materials within the footprint of the proposed building, a soil subgrade approved by Paterson personnel at the time of construction, is considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab (outside the zone of influence of the footings).

For structures with basement slabs, it is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone. For any structures with slab-on-grade construction, the upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone compacted to a minimum of 98% of the materials SPMDD.

All grade raise fill used to raise the subgrade to the underside of the slab-on-grade should be placed in maximum 300 mm thick loose lifts. Soil fill reviewed and approved by Paterson during the construction phase would be advised to be compacted using a suitably sized vibratory sheepsfoot roller. Reference should be made to Section 5.2 of this report for additional information pertaining to fill placement.

5.6 Pavement Design

For design purposes, the pavement structures presented in Tables 6 and 7 below are recommended for the design of driveways, local residential roadways, and access lanes. It should be understood the pavement structures provided in Table 6 and Table 7 are not intended for construction truck traffic without requiring additional measures to prepare the base and subbase layers for the placement of asphalt. This is discussed further in this subsection of the report.

Table 6 - Recommended Pavement Structure - Car Only Parking Areas and Driveways

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 in situ soil or OPSS Granular B Type I or II material placed over in situ soil.	

Table 7 - Recommended Pavement Structure - Local Residential Roadways and Access Lanes

Thickness (mm)	Material Description
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil or OPSS Granular B Type I or II material placed over in situ soil.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. For residential driveways and car only parking areas, an Ontario Traffic Category A will be used. For local roadways, an Ontario Traffic Category B should be used for design purposes.

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 II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of geotextile, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program and is discussed further in the following portion of this report.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment, noting that excessive compaction can result in subgrade softening.

Temporary Access Roads and Construction Traffic

Paterson anticipates that the earthworks contractor will require several haul roads, staging areas and other temporary access lanes to facilitate construction traffic. Paterson also anticipates construction traffic will be directed over unpaved access paths constructed using the base and subbase layers identified in the above-noted tables and will be used throughout the duration of the construction phase.

Omitting the asphalt layer, the above-noted pavement designs are not considered suitable to support temporary construction traffic without requiring additional measures to remediate the proposed base and subbase layers to accommodate the placement of asphalt to complete the pavement design.

Therefore, provisions should be carried to either reinstate temporary construction access and haul roads prior to placing asphalt or improve the durability of the temporary unpaved construction access and haul roads to minimize additional efforts for preparing the base course for the placement of asphalt once construction traffic would no longer be required. Examples of scenarios that would require these provisions would consist of areas which construction traffic results in rutting and compromising subgrade soils, placement of subbase layers directly over subgrade shortly following periods of spring thaw, snowmelt and rainfall events or over service trenches that may consist of poorly compacted backfill.

For planning purposes, temporary construction haul roads and working pads should be planned to be 600 mm of crushed stone consisting of a 500 mm of a combination of OPSS Granular B Type I or Type II crushed stone and/or blast-rock covered with a minimum 50 to 100 mm thick layer of OPSS Granular B Type II or OPSS Granular A crushed stone (to provide suitable surface for vehicle tires) over a Paterson-reviewed and -approved subgrade. These types of roads should also be underlain by a non-woven geotextile layer, such as Terraifx 200R, where they would be integrated into the final pavement structure and accommodate the placement of asphalt to minimize pumping of fines into the subbase layer. Cow-pathing site-generated soil may also be considered to provide suitable haul and access roads.

Temporary access roads that will not support heavy truck traffic (i.e., conventional light-duty vehicles only) may be prepared using a minimum of 150 mm of OPSS Granular A and 400 mm of OPSS Granular B Type II crushed stone. However, provisions should be carried to provide a non-woven geotextile separation layer, such as Terrafix 200R, over the subgrade soils to lessen the amount of fines that migrate into the subbase layers in response to a combination of construction traffic and seasonal fluctuations in the subgrades performance.

Provisions should also be carried to scarify and replace the upper 100 to 150 mm of these areas with clean OPSS Granular A crushed stone prior to placing asphalt.

Provisions should also be carried by the earthworks contractor to suitably compact trench backfill placed over services when reinstating servicing trenches below areas proposed to support paved areas.

Since it is anticipated this material would consist of workable brown silty clay or silty sand fill (and not wet, non-workable grey silty clay) it would be recommended to place this material in maximum 400 mm thick loose lifts compacted using a suitably sized vibratory sheepsfoot roller making several passes under the supervision of Paterson field personnel.

The subgrade surface is also recommended to be provided with a layer of bi-axial geogrid, such as Terrafix TBX2500, to improve the stiffness of the reinstated trench backfill subgrade for supporting the final pavement structures.

These efforts would be reviewed, approved and advised upon by Paterson field staff during the construction program. Further, Paterson should review design, tender and construction documents associated with temporary and permanent pavement design throughout those phases of the project.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on 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 load carrying capacity.

Where silty clay is anticipated at the pavement subgrade level, consideration should be given to installing subdrains during the pavement construction. The subdrain inverts should be approximately 300 mm below subgrade level, and the subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Basement and Partial Basement Structures

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed structures provided with a basement level. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The clear 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 or sump pump pit. The foundation walls are recommended to be covered with a drainage geocomposite, such as CCW MiraDRAIN 2000 or Delta-Teraxx, connected to the perimeter foundation drainage system.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free draining non-frost susceptible granular materials (such as clean sand or OPSS Granular B Type I granular material) or site-generated workable soils placed in maximum 400 mm thick loose lifts and compacted using suitably sized compaction equipment. If consideration is given to backfilling the structures with crushed stone, Paterson should be advised of this during the tendering stage to review and advise on impacts to grade raise restrictions.

Slab-on-Grade Structures

Foundation Drainage

The perimeter foundation drainage system identified for basement structures is considered optional for slab-on-grade structures. Consideration should be given to implementing it below areas supporting hardscaping/settlement sensitive structures (i.e., driveways and pathways) to maintain the service life of these structures.

In areas where hard-scaping or pavement structures will abut the building footprint, the system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe wrapped in a geosock and surrounded by 150 mm of 10 mm clear crushed stone. The clear 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.

The perimeter drainage pipe may be placed against the structure and with the invert placed a minimum of 600 mm below proposed finished grade (i.e., within the subgrade fill and below the crushed stone fill for the hardscaping) and against the building footprint upon Paterson-reviewed and-approved compacted soil backfill to ensure adequate drainage of the overlying granular fill layer is provided from precipitation events and/or spring meltwater.

In this configuration, provided the backfill overlying the pipe consists of crushed stone fill associated with the hardscaping, a composite foundation drainage board will not be required. The installation of the perimeter drainage system should be reviewed by Paterson personnel at the time of construction.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free draining non-frost susceptible granular materials (such as clean sand or OPSS Granular B Type I granular material) or site-generated workable soils placed in maximum 400 mm thick loose lifts and compacted using suitably sized compaction equipment. If consideration is given to backfilling the structures with crushed stone, Paterson should be advised of this during the tendering stage to review and advise on impacts to grade raise restrictions.

6.2 Protection of Footings Against Frost Action

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

Other exterior unheated footings, such as those for isolated exterior piers and retaining walls, are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for excavation to be undertaken 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 to 1H:1V or flatter. The flatter slope is required for excavations below groundwater level. The brown and grey clay subsoils at this site are considered to be mainly a Type 2 and Type 3 soil, respectively, according to the Occupational Health and Safety Act and Regulations for Construction Projects.

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

Excavation side slopes around the building excavation should be protected from erosion by surface water and rainfall events by the use of secured tarpaulins spanning the length of the side slopes, or other means of erosion protection along their footprint. Efforts should also be made to maintain dry surfaces at the bottom of the excavation footprints and along the bottom of side slopes. Additional measures may be recommended at the time of construction by Paterson.

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.

6.4 Pipe Bedding and Backfill

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

The pipe bedding for the sewer and water pipes placed on a relatively dry, undisturbed soil subgrade surface should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm.

The material should be placed in a maximum 225 mm thick loose lifts and compacted to a minimum of 99% of its SPMDD. The bedding material should extend at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 225 mm thick lifts and compacted to a minimum of 95% of its SPMDD.

It should generally be possible to re-use the workable (not wet, grey silty clay) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet site-generated fill will be difficult to re-use, as the high-water contents make compacting impractical without an extensive drying period. Due to its high natural water content, the wet grey silty clay will be difficult, if not impractical, to compact without an extensive drying period and is not recommended for this purpose where site services are located below future roadways.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 400 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

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 (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, sub bedding and cover material.

The clay seals should consist of relatively dry and compactable silty clay placed in maximum 225 mm thick loose layers and compacted using suitably sized vibratory compaction equipment and inspected by Paterson field personnel at the time of placement. 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.

The location of the clay seals should be advised by Paterson during the servicing plan review and associated design stage.

6.5 Groundwater Control

Groundwater Control for Building Construction

Due to the relatively impervious nature of the silty clay and existing groundwater level, it is anticipated that groundwater infiltration into the excavations should be low to medium and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

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

Long-term Groundwater Control

Provided recommendations such as clay seals and landscaping are followed during the design and construction stages, it is not anticipated the proposed development will negatively impact the groundwater table surrounding the area of the subject site and associated structures and infrastructure from a geotechnical perspective.

6.6 Winter Construction

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/pile caps/grade beams are protected with sufficient soil cover to prevent freezing at founding level. Trench excavations and pavement construction are difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms and in spring thaw conditions. Precautions should be considered if such activities are to be completed during freezing conditions. Additional information could be provided, if required.

The trench excavations should be carried out in a manner that will avoid the introduction of frozen materials into the trenches. Also, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

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

6.8 Landscaping Considerations

Tree Planting Considerations

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for the recovered silty clay samples at selected locations throughout the subject site. The results of our testing are presented in Table 1 in Subsection 4.2.

Based on the results of the Atterberg limit testing mentioned above, the plasticity index was found not exceed 40% for all the tested clay samples. Based on this, the silty clay across the subject site is considered to be a clay of low to medium potential for soil volume change. The following tree planting setbacks are recommended for this area.

Large trees (mature height over 14 m) can be planted within these 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 tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the conditions noted below are met.

- ☐ The foundations are founded upon or are underlain by clayey soils. If they are not, as is anticipated for a portion of the subject site, there is no applicable setback.

- ☐ A small tree must be provided with a minimum of 25 m^3 of available soils volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally uncompacted 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 for sidewalls of structure facing the tree 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), as noted on the subdivision Grading Plan.

Above-Ground Swimming Pools, Hot Tubs, Decks and Additions

The in-situ soils are considered acceptable for in-ground 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.

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

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

6.9 Low-Impact Development (LID) Considerations

As outlined in the City of Ottawa Technical Bulletin IWSTB-2024-04, clay and silt soils have poor hydraulic properties, making infiltration-based LID practices unsuitable for such soils. As summarized in Subsection 4.2, the subject site is predominantly underlain by a silty clay deposit, and as such, infiltration-type LID practices are not considered suitable for this site from a geotechnical perspective.

7.0 Recommendations

It is recommended that the following be carried out by Paterson once preliminary and future details of the proposed development have been prepared:

- Review preliminary and detailed grading, servicing plan(s) from a geotechnical perspective.

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

- Review and inspection of the installation of the foundation drainage systems.
- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling and placement of mud slabs.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

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

All excess soils generated by construction activities should 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 Minto Communities Inc. or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

N Versolato

Nicholas F. R. Versolato, CPI, B.Eng.

Drew Petahtegoose, P.Eng.

LICENSED PROFESSIONAL ENGINEER
May 28, 2025
D. J. PETAHTEGOOSE
100568013
PROVINCE OF ONTARIO

Report Distribution:

- Minto Group (1 digital copy)
- Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SOIL PROFILE AND TEST DATA SHEETS BY OTHERS

SYMBOLS AND TERMS

ATTERBERG LIMITS AND SHRINKAGE TESTING RESULTS

ANALYTICAL TESTING RESULTS

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Interim Geotechnical Investigation

5618 Hazeldean Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 351690.20 **NORTHING:** 5015808.89 **ELEVATION:** 101.74

PROJECT: Proposed Residential Development - Abbott's Run - Block 13

ADVANCED BY: Back Hoe / Excavator

REMARKS:

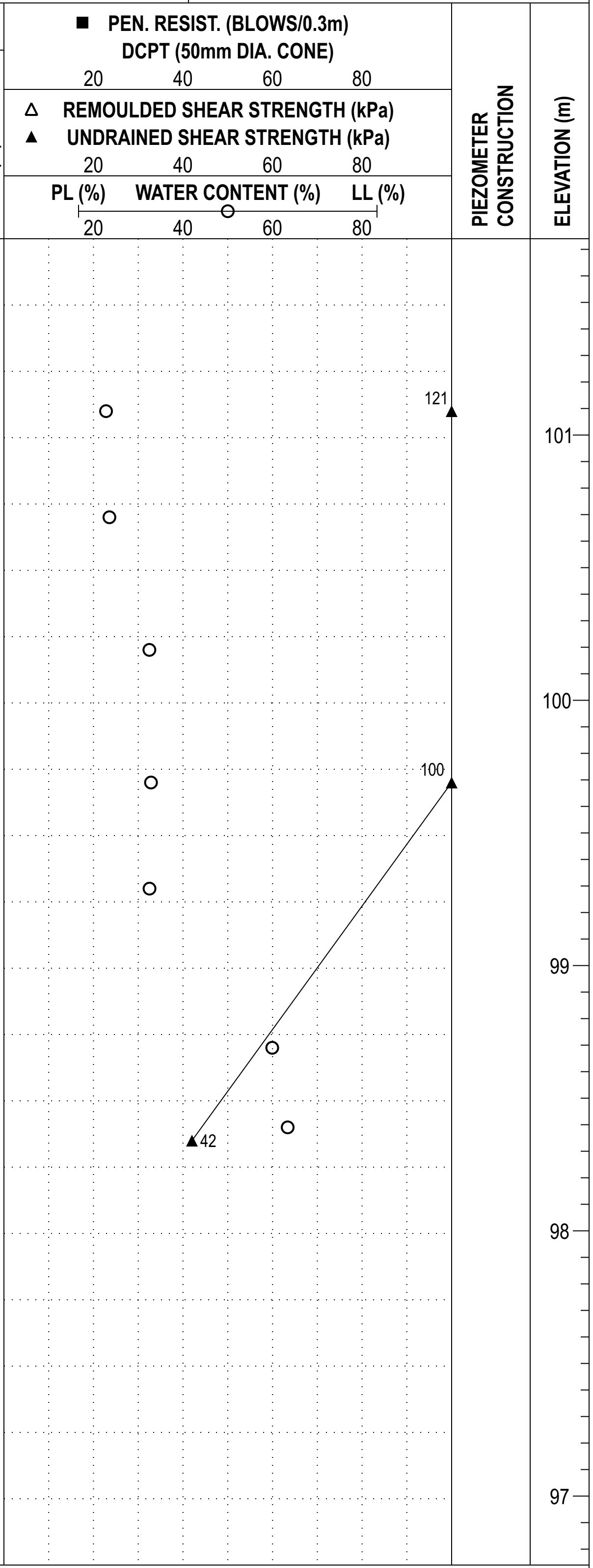
DATE: May 7, 2025

FILE NO. : PG7460

HOLE NO. : TP 1-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)
GROUND SURFACE		
FILL: Brown silty clay, with gravel, some blast rock	▨	
0.60m [101.14m]		
Very stiff, brown **SILTY CLAY**, some sand	▨	
0.80m [100.94m]		
Compact, brown **SANDY SILT**, trace clay and sea shells	▨	1
1.20m [100.54m]		
Very stiff, brown **SILTY CLAY**, trace sand - Trace sea shells at 2.3 m depth	▨	2
3.10m [98.64m]		3
Firm, grey **SILTY CLAY**	▨	
3.60m [98.14m]		
End of Test Pit Groundwater infiltration observed at 1.50 m depth		4 5

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
G 1			23
G 2			24
G 3			32
G 4			33
G 5			33
G 6			60
G 7			63



DISCLAIMER: THE DATA PRESENTED IN THIS SHEET IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHOM IT WAS PRODUCED. THIS SHEET SHOULD BE READ IN CONJUNCTION WITH ITS CORRESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.

P:/Autocad Drawings/Test Hole Data Files/PG74xx/PG7460/data.sqlite 2025-05-28, 11:07 Paterson_Template AE

SOIL PROFILE AND TEST DATA

Interim Geotechnical Investigation

5618 Hazeldean Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 351743.71 **NORTHING:** 5015820.19 **ELEVATION:** 101.53

PROJECT: Proposed Residential Development - Abbott's Run - Block 13

ADVANCED BY: Back Hoe / Excavator

REMARKS:

DATE: May 7, 2025

FILE NO. : PG7460

HOLE NO. : TP 2-25

SAMPLE DESCRIPTION

GROUND SURFACE

Brown **SILTY CLAY**, trace topsoil — 0.10m [101.43m]

Very stiff, brown **SILTY CLAY**

- Trace sea shells at 2.0 m depth

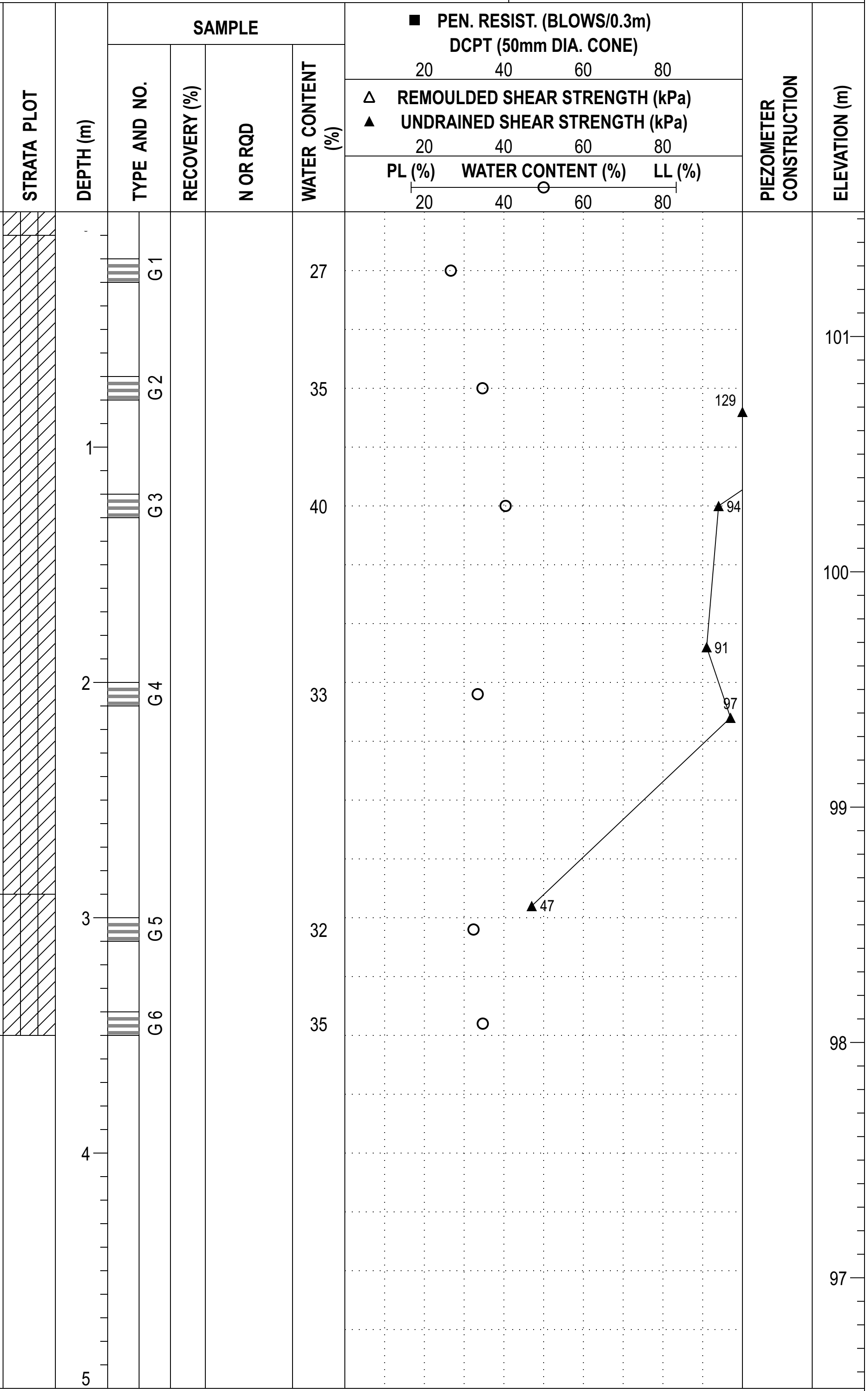
2.90m [98.63m]

Firm, grey **SILTY CLAY**, trace sand and sea shells

3.50m [98.03m]

End of Test Pit

Groundwater infiltration observed at 2.90 m depth



TYPE AND NO.	WATER CONTENT (%)
G 1	27
G 2	35
G 3	40
G 4	33
G 5	32
G 6	35

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Interim Geotechnical Investigation

5618 Hazeldean Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 351759.95 **NORTHING:** 5015780.63 **ELEVATION:** 101.84

PROJECT: Proposed Residential Development - Abbott's Run - Block 13

ADVANCED BY: Back Hoe / Excavator

REMARKS:

DATE: May 7, 2025

FILE NO. : PG7460

HOLE NO. : TP 3-25

SAMPLE DESCRIPTION

GROUND SURFACE

Very stiff, brown **SILTY CLAY**

- Trace sea shells at 1.6 m depth

3.00m [98.84m]

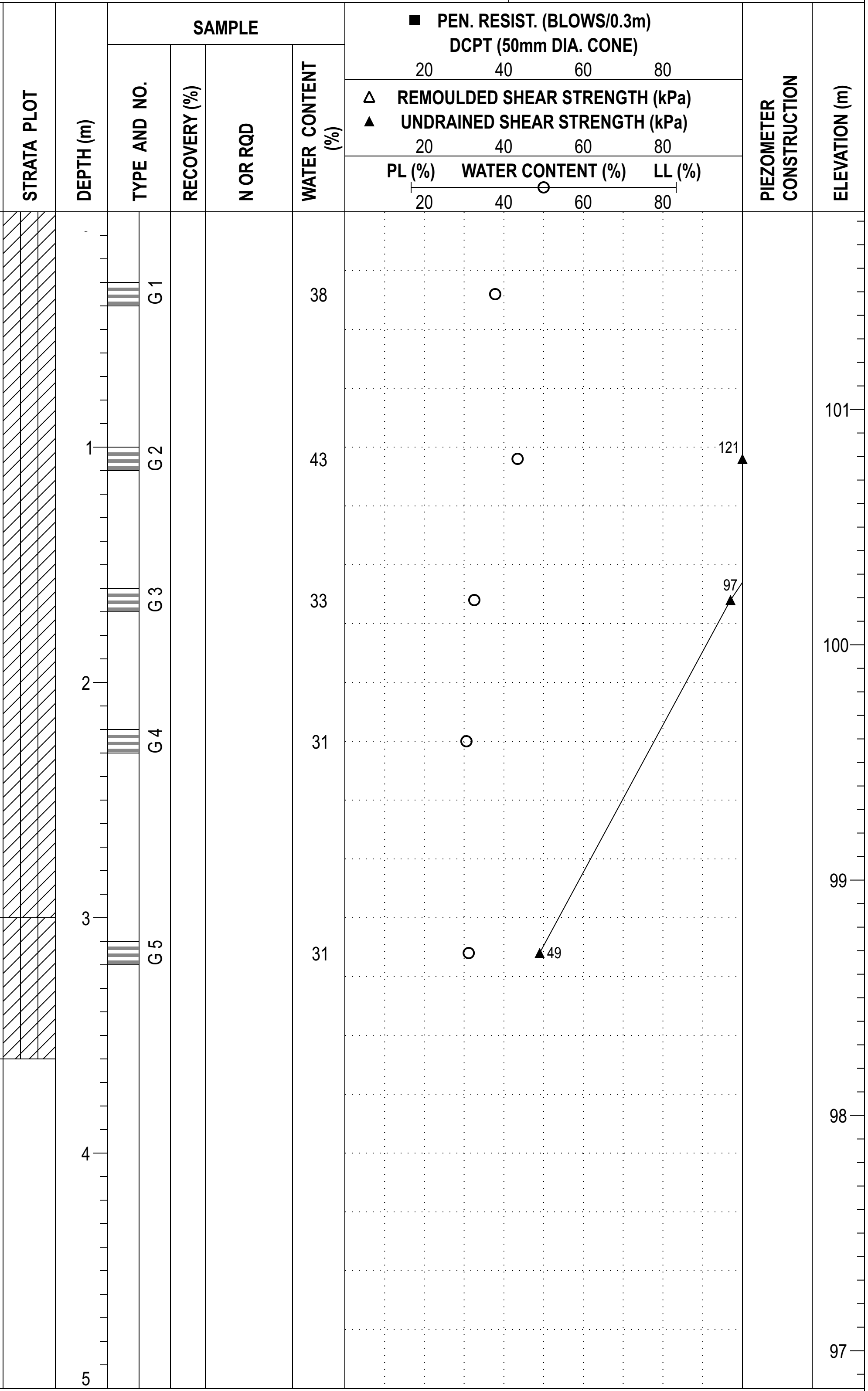
Firm, grey **SILTY CLAY**

3.60m [98.24m]

End of Test Pit

Groundwater infiltration observed at 2.00 m depth

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
G 1			38
G 2			43
G 3			33
G 4			31
G 5			31



SOIL PROFILE AND TEST DATA

Interim Geotechnical Investigation

5618 Hazeldean Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 351726.95 **NORTHING:** 5015774.07 **ELEVATION:** 101.79

PROJECT: Proposed Residential Development - Abbott's Run - Block 13

ADVANCED BY: Back Hoe / Excavator

REMARKS:

DATE: May 7, 2025

FILE NO. : **PG7460**

HOLE NO. : **TP 4-25**

SAMPLE DESCRIPTION

GROUND SURFACE

FILL: Brown silty clay, trace gravel and topsoil

0.10m [101.69m]

Very stiff, brown **SILTY CLAY**, trace sand

- Trace sea shells at 2.4 m depth

3.00m [98.79m]

Grey **SILTY CLAY**, trace sand and sea shells

3.60m [98.19m]

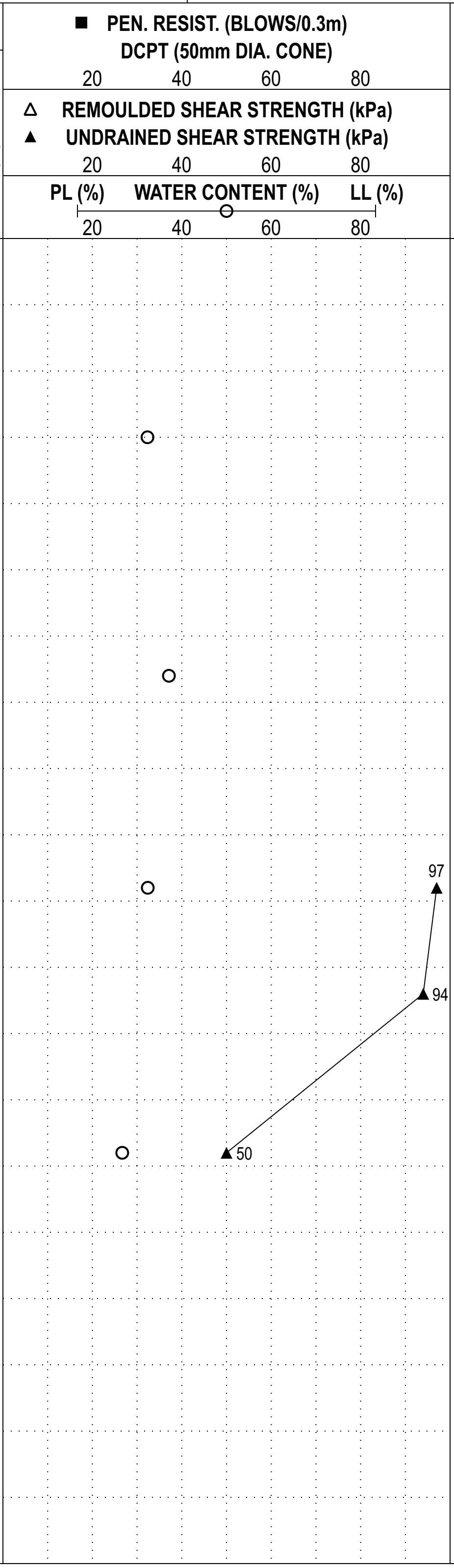
End of Test Pit

Groundwater infiltration observed at 2.00 m depth

SAMPLE TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
G 1			32
G 2			37
G 3			32
G 4			27

DEPTH (m): 1, 2, 3, 4, 5

ELEVATION (m): 101, 100, 99, 98, 97



PIEZOMETER CONSTRUCTION

DISCLAIMER: THE DATA PRESENTED IN THIS SHEET IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHOM IT WAS PRODUCED. THIS SHEET SHOULD BE READ IN CONJUNCTION WITH ITS CORRESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.

P:/Autocad Drawings/Test Hole Data Files/PG74xx/PG7460/data.sqlite 2025-05-28, 11:07 Paterson_Template AE

SOIL PROFILE AND TEST DATA

Interim Geotechnical Investigation

5618 Hazeldean Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 351761.10 **NORTHING:** 5015718.50 **ELEVATION:** 102.29

PROJECT: Proposed Residential Development - Abbott's Run - Block 13

ADVANCED BY: Back Hoe / Excavator

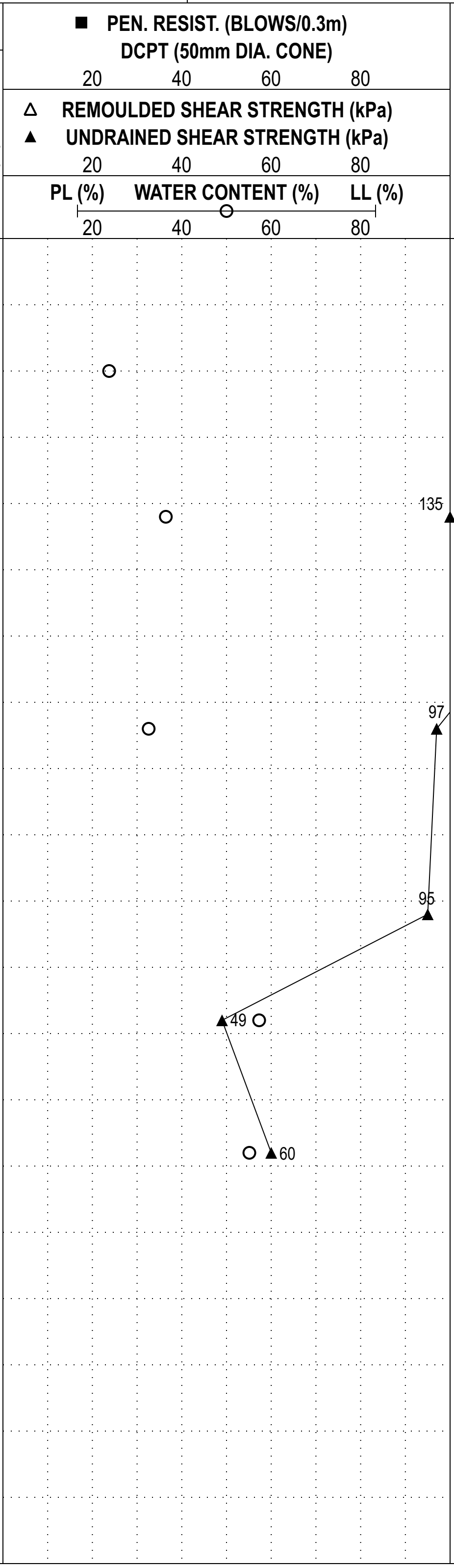
REMARKS:

DATE: May 7, 2025

FILE NO. : PG7460

HOLE NO. : TP 5-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0						102.29
Brown **SILTY CLAY**, with topsoil 0.10m [102.19m]								
Very stiff, brown **SILTY CLAY**, trace sand			G 1			24		102
		1	G 2			36		101
- Trace sea shells at 1.8 m depth			G 3			33		
		2						100
3.00m [99.29m]		3	G 4			57		
Firm, grey **SILTY CLAY**			G 5			55		99
3.70m [98.59m]								
End of Test Pit Groundwater infiltration observed at 2.00 m depth		4						98
		5						



PATERSON GROUP

SOIL PROFILE AND TEST DATA

Interim Geotechnical Investigation

5618 Hazeldean Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 351816.20 **NORTHING:** 5015715.33 **ELEVATION:** 102.62

PROJECT: Proposed Residential Development - Abbott's Run - Block 13

ADVANCED BY: Back Hoe / Excavator

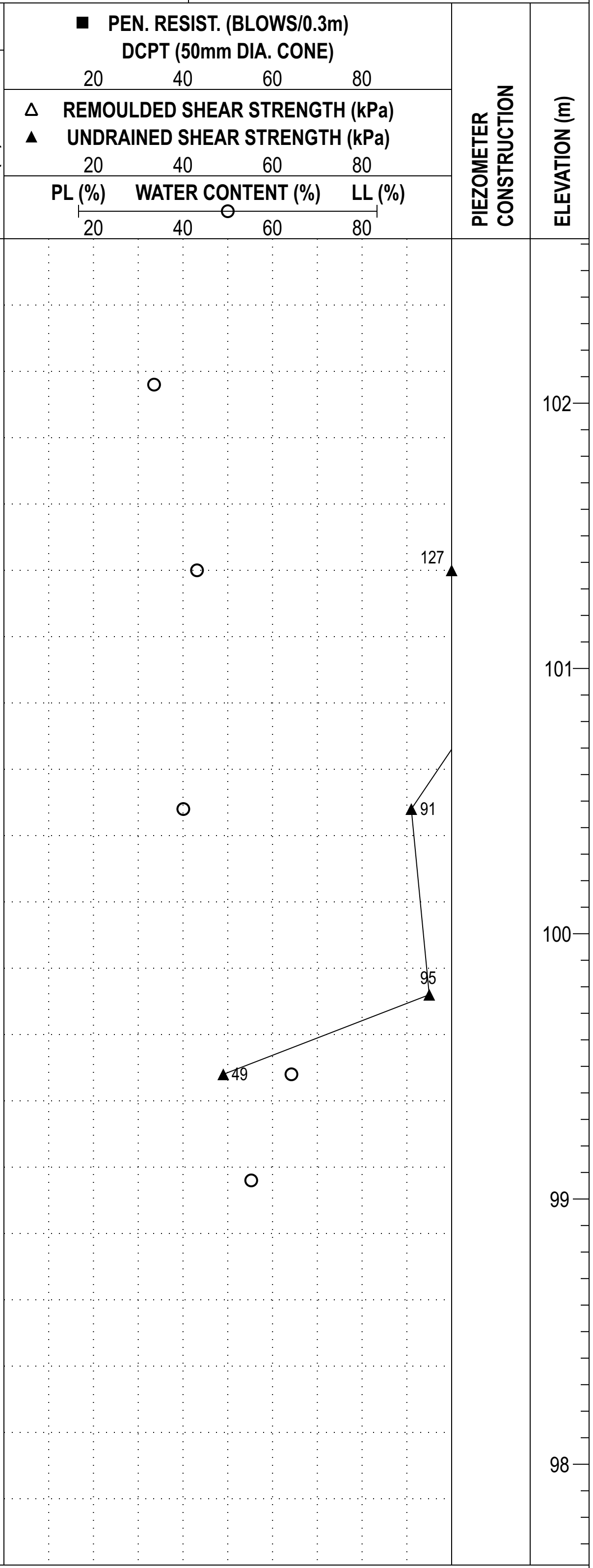
REMARKS:

DATE: May 7, 2025

FILE NO. : **PG7460**

HOLE NO. : **TP 6-25**

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)
GROUND SURFACE						
Very stiff, brown **SILTY CLAY**	▨		G 1			34
	▨	1	G 2			43
	▨	2	G 3			40
3.00m [99.62m]	▨	3				
Firm, grey **SILTY CLAY** - Trace sand and sea shells at 3.4 m depth	▨		G 4			64
	▨		G 5			55
3.70m [98.92m]						
End of Test Pit Groundwater infiltration observed at 2.00 m depth		4				
		5				



P:/Autocad Drawings/Test Hole Data Files/PG74xx/PG7460/data.sqlite 2025-05-28, 11:07 Paterson_Template AE

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
5618 Hazeldean Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE March 30, 2022

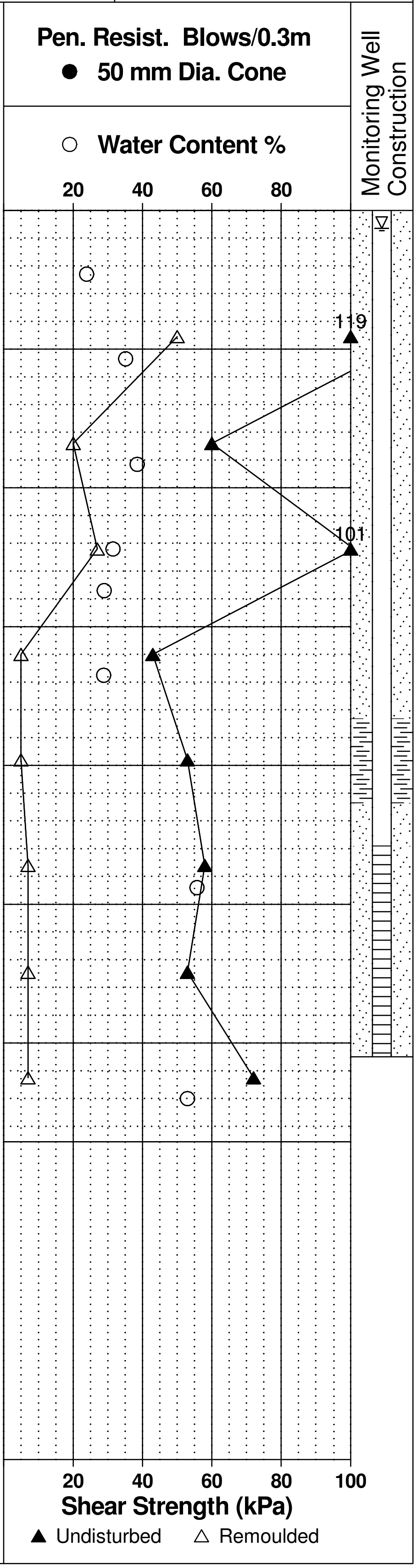
FILE NO. PG6165

HOLE NO. BH19-22

SOIL DESCRIPTION	Depth (m)
GROUND SURFACE	
TOPSOIL	0.30
Very stiff to stiff, brown **SILTY CLAY,** some sand - sand content decreasing with depth - firm to stiff and grey by 2.8m depth	6.71
End of Borehole (GWL @ 0.13m - April 1, 2022)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	25	P
SS	3	25	P
SS	4	33	P
SS	5	33	P
SS	6	83	P
SS	7	83	P
SS	8	83	P

DEPTH (m)	ELEV. (m)
0	101.66
1	100.66
2	99.66
3	98.66
4	97.66
5	96.66
6	95.66



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
5618 Hazeldean Road, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG6165

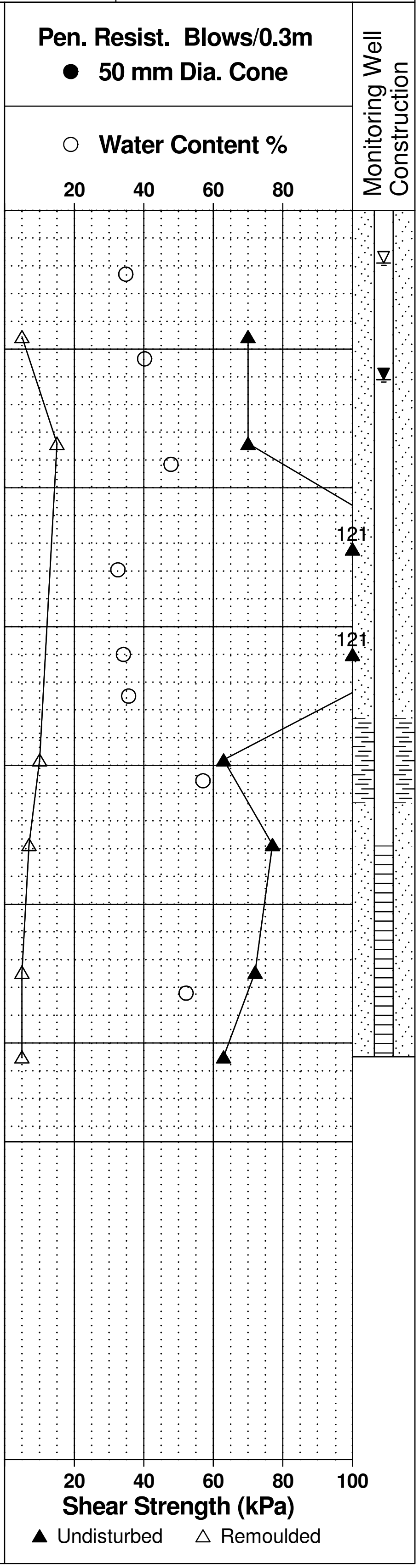
REMARKS

HOLE NO. BH20-22

BORINGS BY CME 55 Power Auger

DATE March 31, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.30						0	101.86
		AU	1				
		SS	2	83	P	1	100.86
		SS	3	83	P	2	99.86
Stiff to very stiff, brown **SILTY CLAY,** some sand		SS	4	83	P	3	98.86
- stiff and grey by 3.5m depth		SS	5	83	P	4	97.86
		SS	6	83	P	5	96.86
6.71		SS	7	83	P	6	95.86
End of Borehole							
(GWL @ 0.38m - April 8, 2022)							
(GWL @ 1.22m - July 11, 2022)							



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
5618 Hazeldean Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

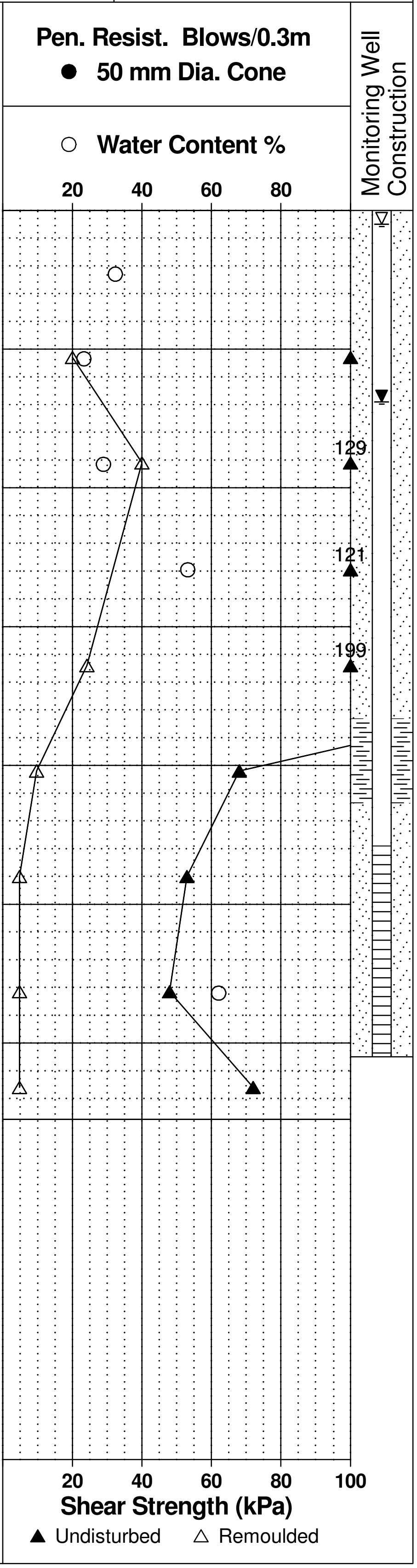
BORINGS BY CME 55 Power Auger

DATE April 9, 2022

FILE NO. PG6165

HOLE NO. BH34-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.44
TOPSOIL 0.30							
		AU	1				
						1	101.44
		SS	2	25	P		
		SS	3	83	P		
						2	100.44
Very stiff to stiff, brown **SILTY CLAY,** some sand - sand content decreasing with depth - grey by 3.7m depth		SS	4	83	P		
						3	99.44
						4	98.44
						5	97.44
		SS	5	83	P		
						6	96.44
6.55							
End of Borehole (GWL @ 0.10m - April 22, 2022) (GWL @ 1.38m - July 11, 2022)							



Stantec

BOREHOLE RECORD

N: 5 014 390 E: 429 291

BH-15-13

CLIENT City of Ottawa

LOCATION Stittsville Diversion Trunk Sewer - Abbott Street to Maple Grove Road

DATES: BORING October 5, 2015 WATER LEVEL

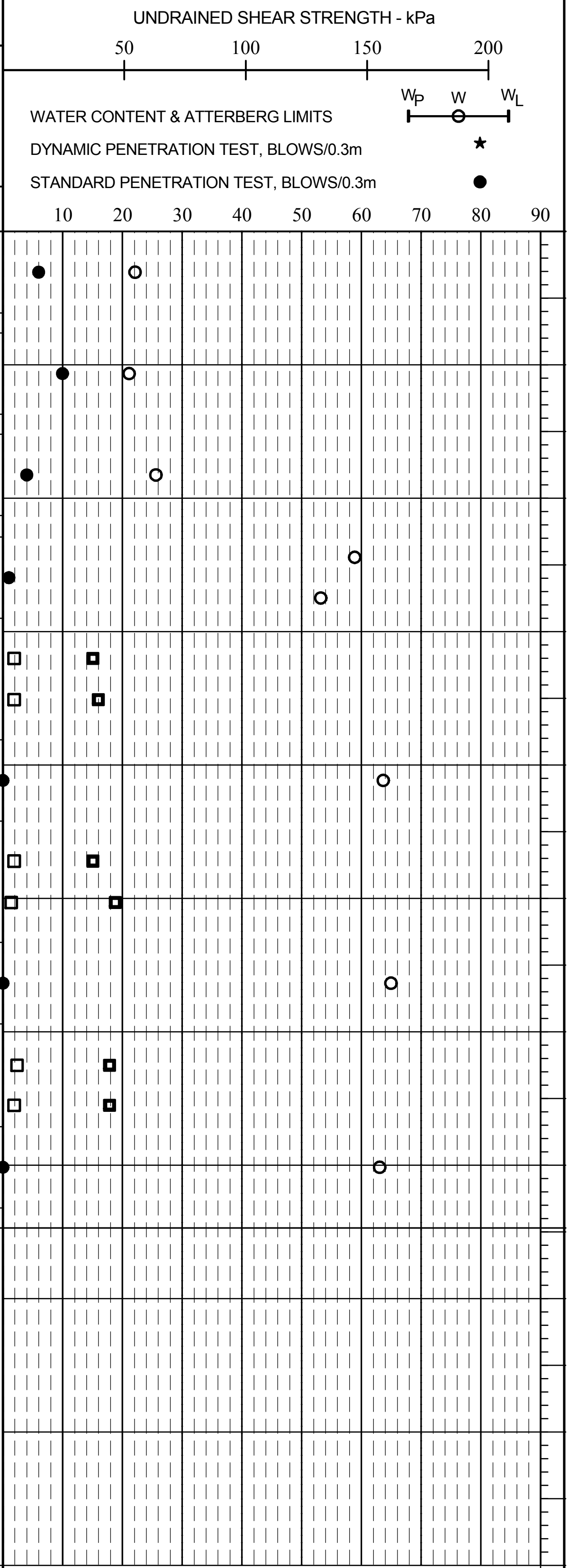
BOREHOLE No. BH-15-13

PROJECT No. 163401299

DATUM Geodetic

ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
102.33							
	TOPSOIL (610 mm)			SS	1	210	6
101.7	Firm to stiff brown lean CLAY with sand (CL)			SS	2	330	10
				SS	3	600	4
99.7	Firm grey lean CLAY (CL)			SS	4	600	1
				SS	5	600	0
				SS	6	600	0
				SS	7	600	0
94.9	End of Borehole						

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa

☐ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd ________

Date ________

Stantec

BOREHOLE RECORD

N: 5 014 441 E: 429 252

BH-15-14

CLIENT City of Ottawa

LOCATION Stittsville Diversion Trunk Sewer - Abbott Street to Maple Grove Road

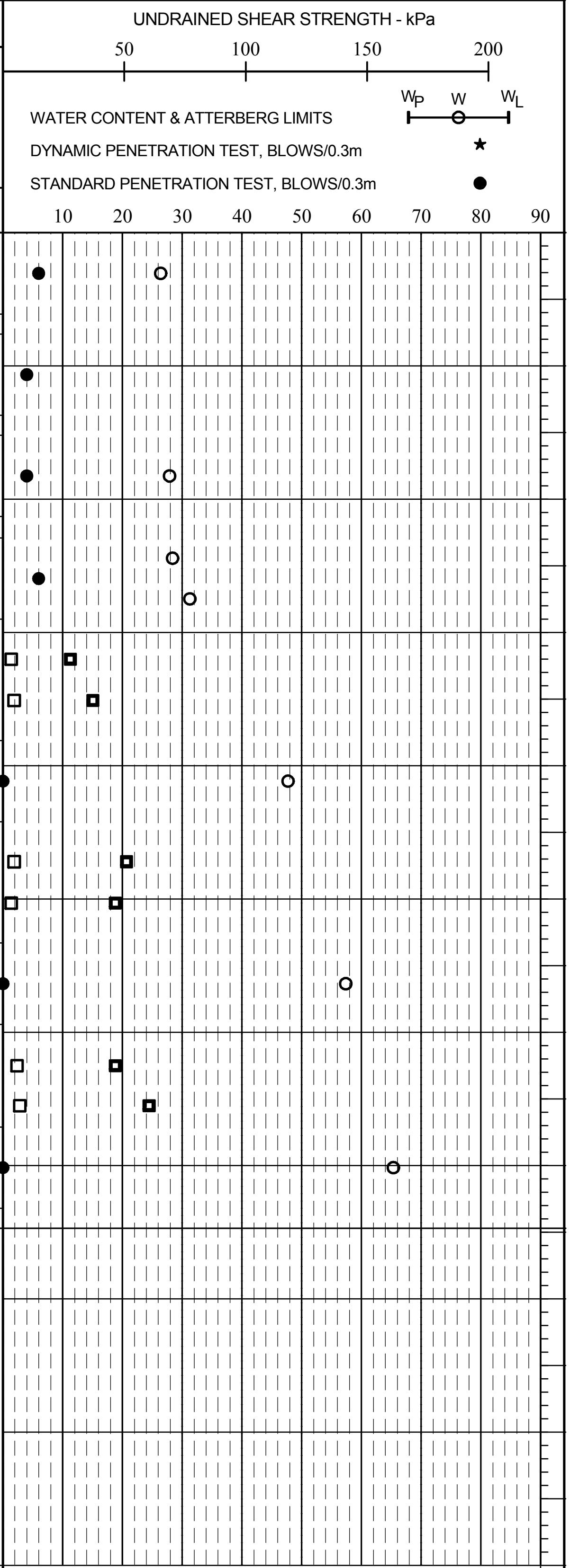
DATES: BORING October 5, 2015 WATER LEVEL

BOREHOLE No. BH-15-14

PROJECT No. 163401299

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	102.14	TOPSOIL (610 mm)			SS	1	200	6
	101.5	Stiff brown to grey lean CLAY (CL) with sand						
1					SS	2	0	4
2					SS	3	350	4
					SS	4	600	6
	99.4	- Sand seam						
3	99.2	Firm to stiff grey lean CLAY (CL)						
4					SS	5	600	0
5								
6					SS	6	600	0
7					SS	7	600	0
	94.7	End of Borehole						
8								
9								
10								



∇ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd ______

Date ______

Stantec

MONITORING WELL RECORD

N: 5 014 494 E: 429 212

MW-15-15

CLIENT City of Ottawa

LOCATION Stittsville Diversion Trunk Sewer - Abbott Street to Maple Grove Road

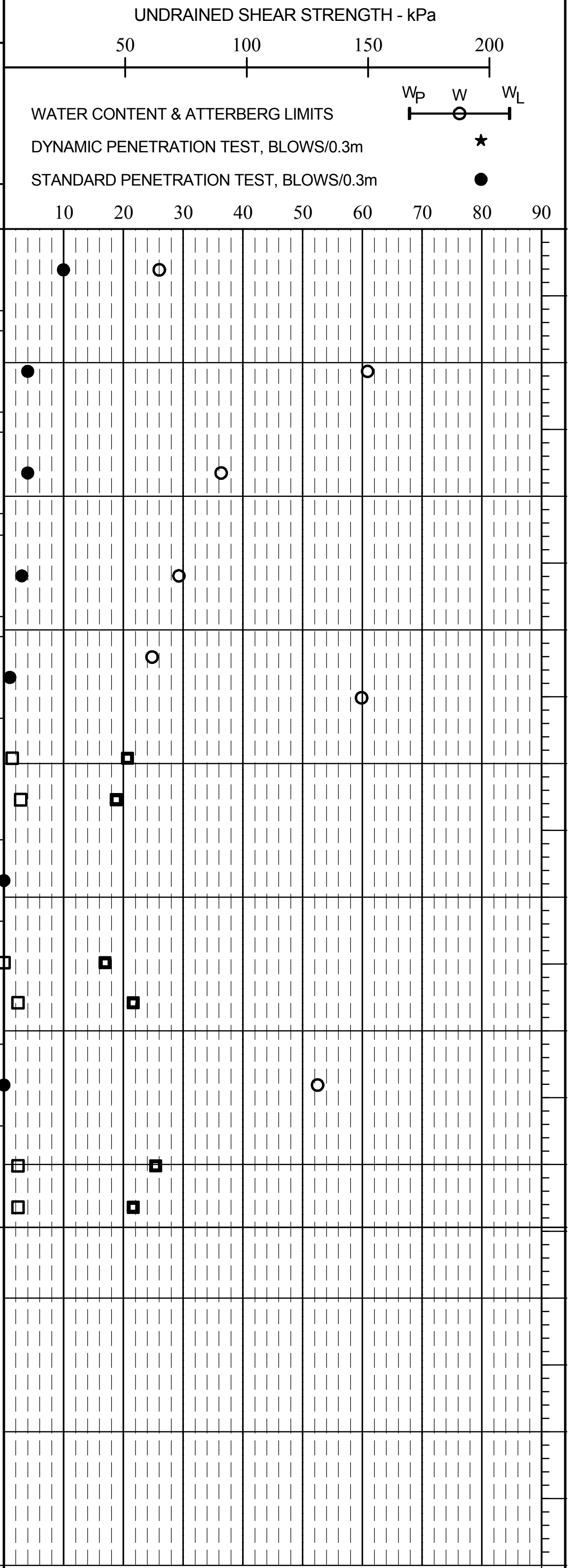
DATES: BORING October 5, 2015 WATER LEVEL October 27, 2015

BOREHOLE No. MW-15-15

PROJECT No. 163401299

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	101.55	TOPSOIL (610 mm)		SS	1	150	10
	100.9	Firm to stiff brown to grey lean CLAY (CL) with sand - moist to wet		SS	2	0	4
			▼	SS	3	400	4
				SS	4	600	3
3	98.4	Firm to stiff grey lean CLAY (CL)		SS	5	600	1
				SS	6	600	0
				SS	7	600	0
	94.1	End of Borehole Monitoring well installed Screen from 3.9 m to 5.4 m					



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd ________

Date ________

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 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)

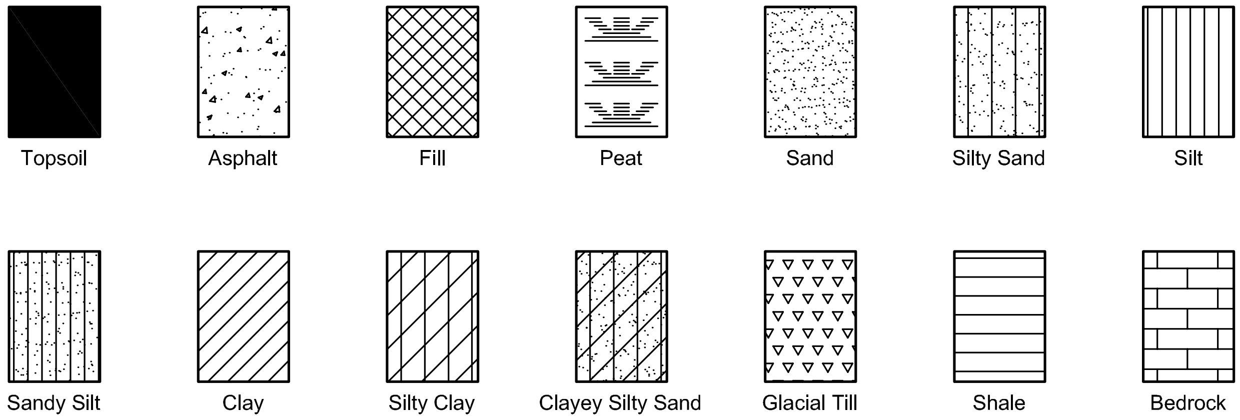
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

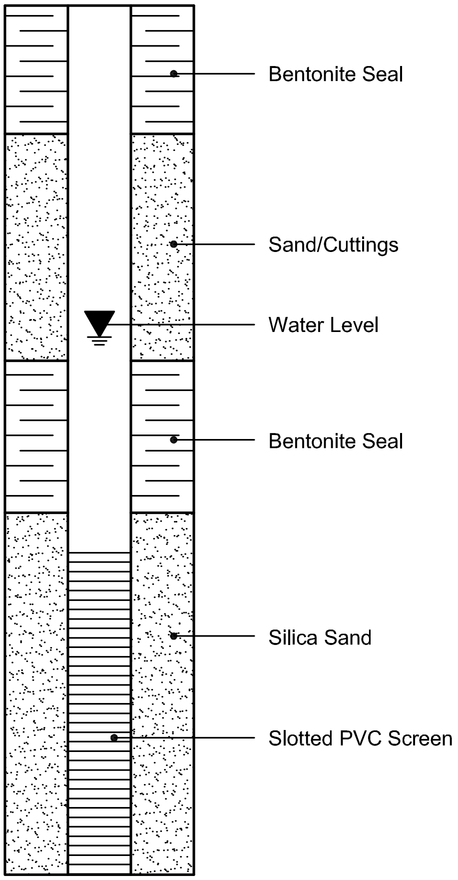
SYMBOLS AND TERMS (continued)

STRATA PLOT

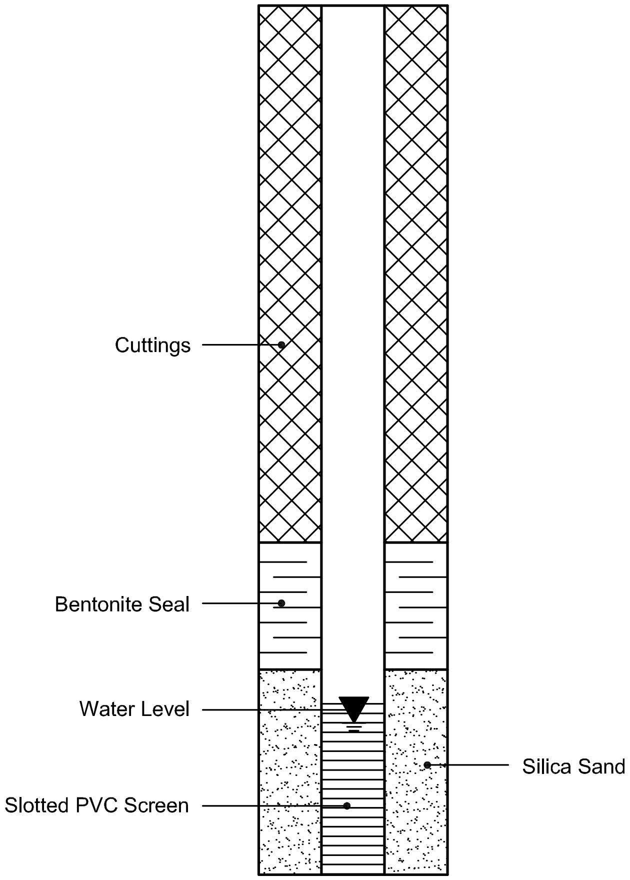


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PATERSON GROUP

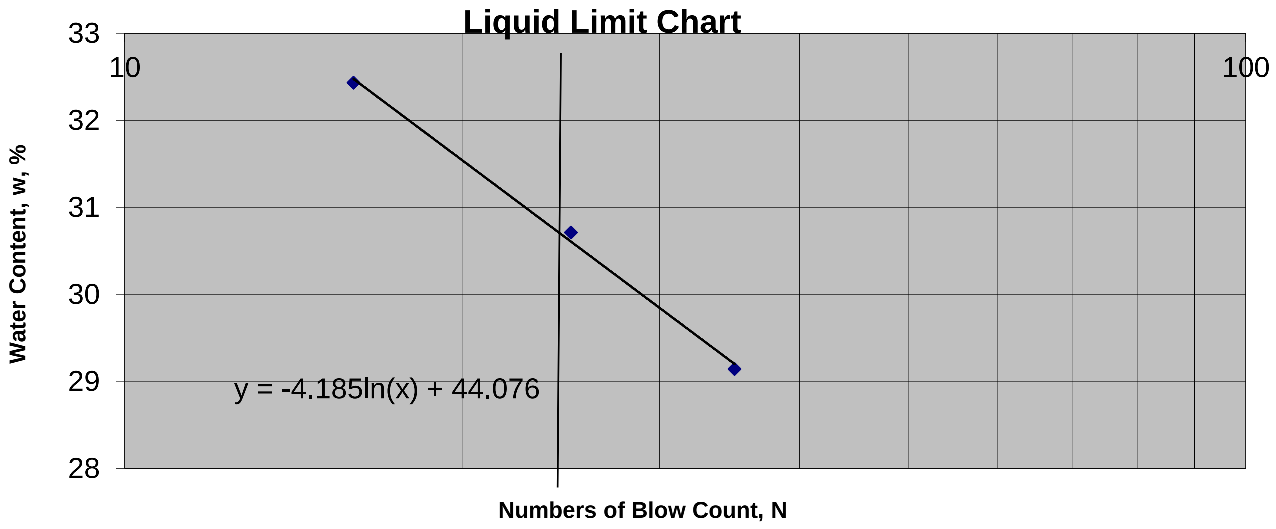
ATTERBERG LIMITS
LS-703/704

CLIENT:	Minto	FILE NO.:	PG7460
PROJECT:	Abbott's Run - Phase 2 - Block 13	DATE SAMPLED:	7-May
LOCATION:	TP4-25 G3	DATE REPORTED:	16-May

CAN NO.	**11**	**67**	**87**				
WT. OF CAN	8.64	7.22	7.23				
WT. OF SOIL & CAN	14.52	14.37	14.10				
WT. OF DRY SOIL & CAN	13.08	12.69	12.55				
WT. OF MOISTURE	1.44	1.68	1.55				
WT. OF DRY SOIL & CAN	4.44	5.47	5.32				
WATER CONTENT, w, %	**32.43**	**30.71**	**29.14**				
NO. OF BLOWS, N	16	25	35				

CAN NO.	**12**	**18**
WT. OF CAN	16.71	20.01
WT. OF SOIL & CAN	24.96	28.40
WT. OF DRY SOIL & CAN	23.70	27.14
WT. OF MOISTURE	1.26	1.26
WT. OF DRY SOIL & CAN	6.99	7.13
WATER CONTENT, w, %	**18.03**	**17.67**

RESULTS	
LIQUID LIMIT	**31**
PLASTIC LIMIT	**18**
PLASTICITY INDEX	**13**



TECHNICIAN: CP	**REVIEWED BY:**	**C. Beadow**	**J. Forsyth, P. Eng.**

PATERSON GROUP

Linear Shrinkage
ASTM D4943-02

CLIENT:	Minto	DEPTH	-	FILE NO.:	PG7460
PROJECT:	Abbott's Run - Phase 2 - Block 13	BH OR TP No:	TP4-25 G3	DATE SAMPLED	7-May-25
LAB No:	59448	TESTED BY:	CP	DATE RECEIVED	8-May-25
SAMPLED BY:	N.V.	DATE REPORTED:	16-May-25	DATE TESTED	12-May-25

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(6)	Calibration (Two Trials)	Tin NO.(P1)	
Tare	4.94	Tin	4.77	4.77
Soil Pat Wet + Tare	76.7	Tin + Grease	4.96	4.95
Soil Pat Wet	71.76	Glass	48.97	48.97
Soil Pat Dry + Tare	58.19	Tin + Glass + Water	85.67	85.66
Soil Pat Dry	53.25	Volume	31.74	31.74
Moisture	**34.76**	**Average Volume**	**31.74**	

Soil Pat + String	53.42
Soil Pat + Wax + String in Air	60.17
Soil Pat + Wax + String in Water	24.18
Volume Of Pat (Vdx)	35.99

RESULTS:

Shrinkage Limit	**28.50**
Shrinkage Ratio	**1.875**
Volumetric Shrinkage	**11.738**
Linear Shrinkage	**3.632**

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

Certificate of Analysis

Report Date: 13-May-2025

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 8-May-2025

Client PO: 63057

Project Description: PG7460

Client ID:		TP 3-25 (G3)	-	-	-		
Sample Date:		07-May-25 14:00	-	-	-	-	-
Sample ID:		2519422-01	-	-	-		
Matrix:		Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	75.8	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.56	-	-	-	-	-
Resistivity	0.1 Ohm.m	62.0	-	-	-	-	-
Anions							
Chloride	10 ug/g	10	-	-	-	-	-
Sulphate	10 ug/g	13	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG7460-1 – TEST HOLE LOCATION PLAN

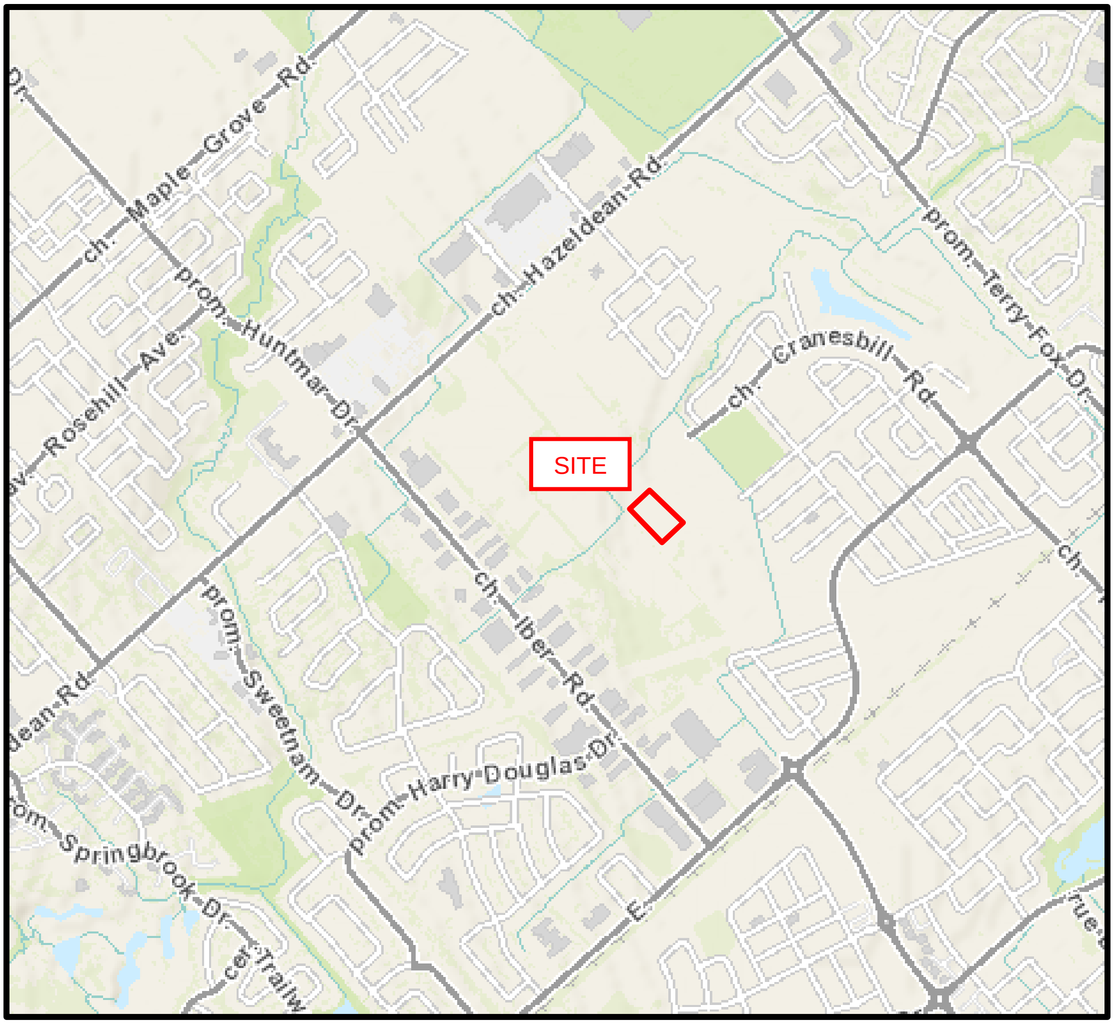
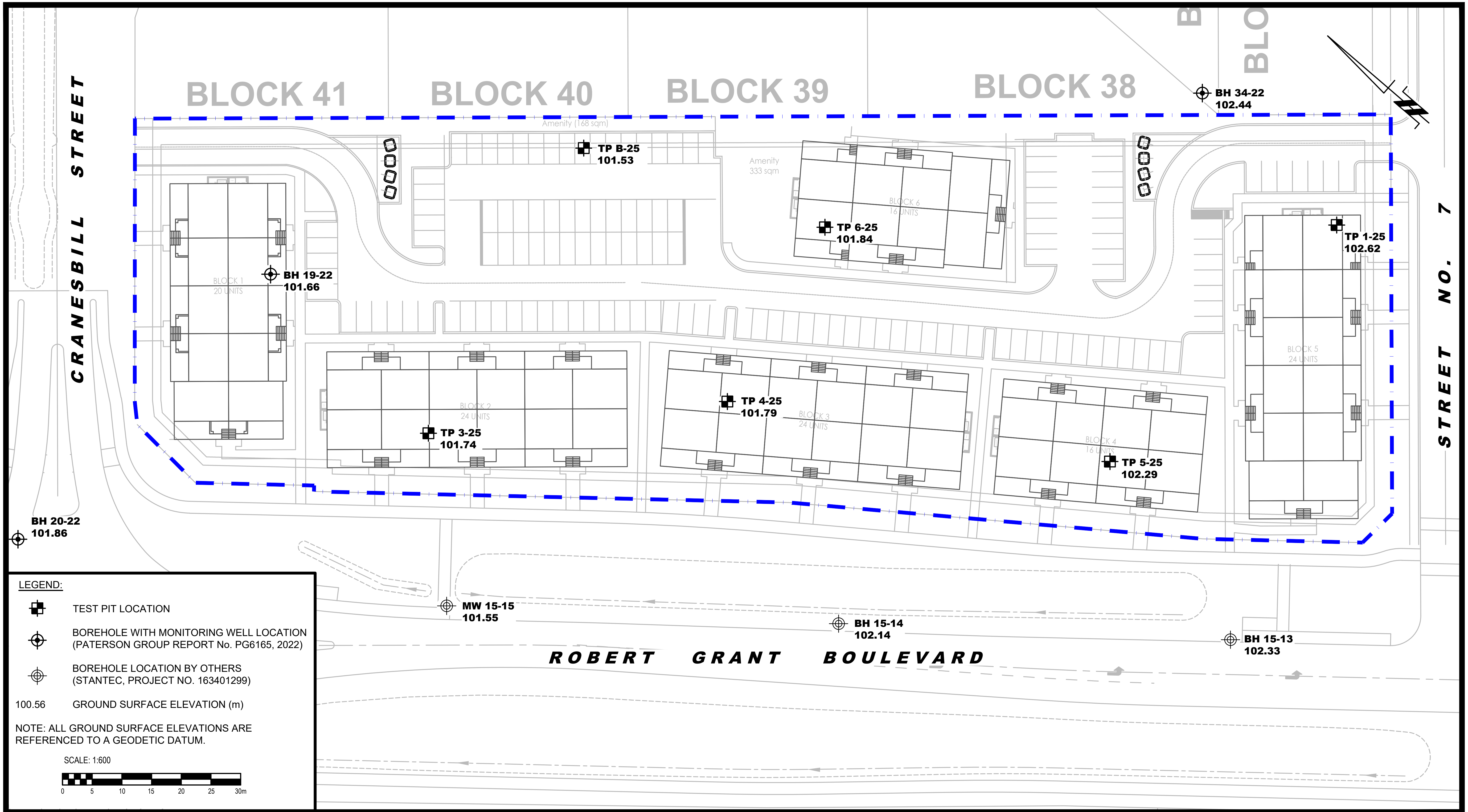


FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

■	TEST PIT LOCATION
⊕	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT No. PG6165, 2022)
⊕	BOREHOLE LOCATION BY OTHERS (STANTEC, PROJECT NO. 163401299)
100.56	GROUND SURFACE ELEVATION (m)

NOTE: ALL GROUND SURFACE ELEVATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:600

PATERSON GROUP

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

NO.	REVISIONS	DATE	INITIAL
1	TEST PITS TP 1-25 TO TP 6-25 ADDED	08/05/2025	NFRV

MINTO GROUP
INTERIM GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT - ABBOTT'S RUN - BLOCK 13
5618 HAZELDEAN ROAD
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:600	Date: 04/2025
Drawn by: NFRV	Report No.: PG7460-1
Checked by: NFRV	Dwg. No.: PG7460-1
Approved by: DP	Revision No.: 1

11x17

p:\autocad drawings\geotechnical\pg74xx\pg7460\pg7460-1 thlp (rev.1).dwg