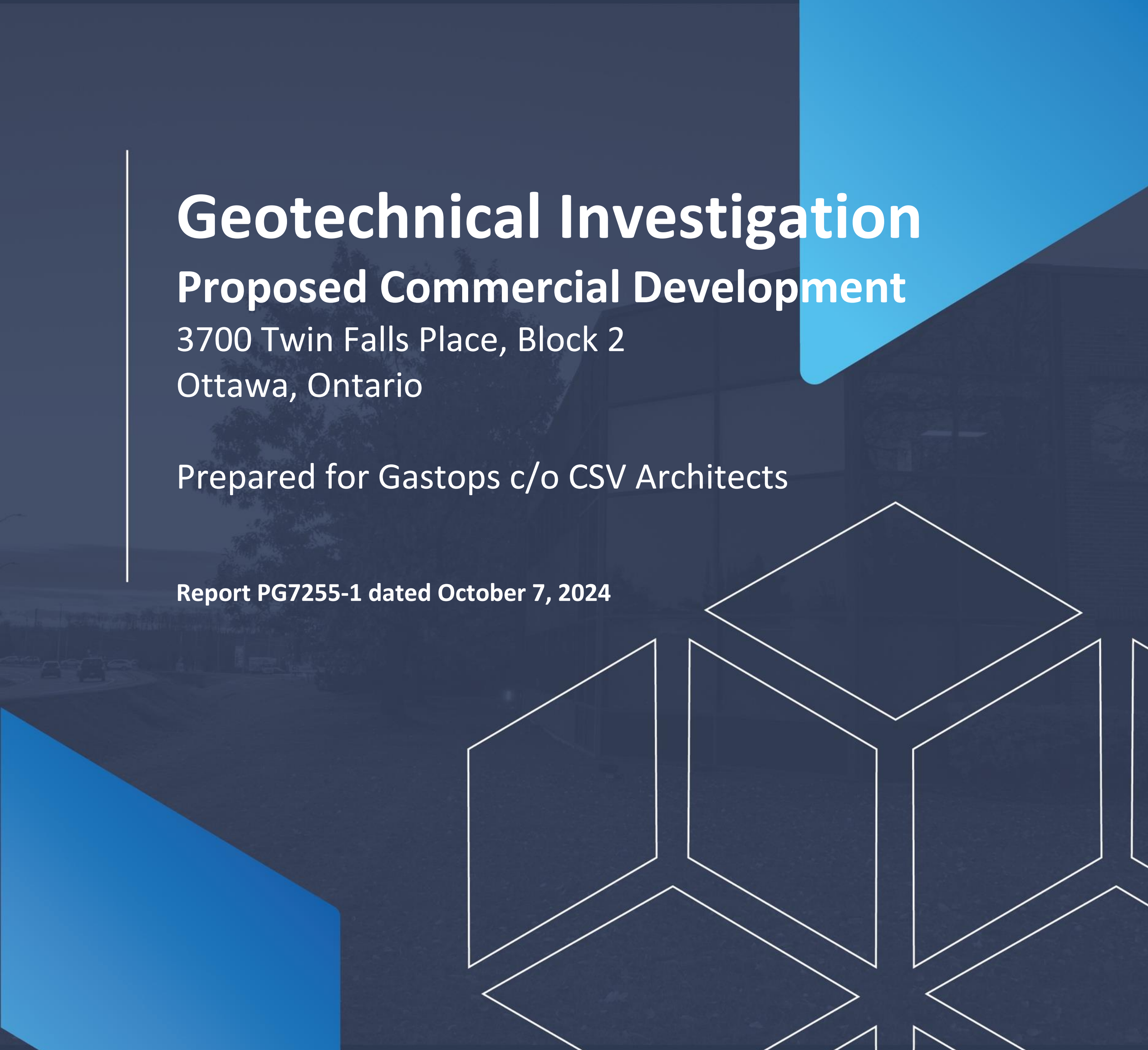


Geotechnical Investigation

Proposed Commercial Development

3700 Twin Falls Place, Block 2
Ottawa, Ontario

Prepared for Gastops c/o CSV Architects

Report PG7255-1 dated October 7, 2024

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Gastops c/o CSV Architects to conduct a geotechnical investigation for the proposed commercial development to be located at Block 2, 3700 Twin Falls Place in the City of Ottawa (reference should be made to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the geotechnical investigation were to:

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

- ☐ Provide geotechnical recommendations pertaining to 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 for 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 plan, it is understood that the proposed development will consist of a slab-on-grade two-storey commercial building occupying the majority of the south portion of the subject site.

Further, it is understood that the remainder of the site will generally be occupied by parking areas, access lanes, loading zones, and landscaped areas. It is also expected that the subject site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on September 10, and 11, 2024 and consisted of advancing a total of 7 boreholes to a maximum depth of 7.3 m below the existing ground surface. In addition, a previous investigation covering the entire area of 3700 Twin Falls Place was completed by Paterson in 2022.

The test hole locations were determined in the field by Paterson personnel and distributed in a manner to provide general coverage of the subject site taking into consideration existing site features and underground utilities. The test hole locations are presented on Drawing PG7255-1 – Test Hole Location Plan included in Appendix 2.

The boreholes were advanced with a low-clearance 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 drilling procedure consisted of augering to the required depth at the selected location, sampling, and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered from the boreholes using a 50 mm diameter split-spoon sampler or from the auger flights or grabbed from the vane apparatus. The split spoon, auger, and grab samples were classified on site and placed in sealed plastic bags. All soil samples were transported to our laboratory for further review. The depths at which the split spoon, auger, or grab samples were recovered from the boreholes are shown as SS, AU, and G, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

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

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus in boreholes.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) at the location of boreholes BH 12-22-EL and BH 13-22-EL, located near Block 2, completed during the previous investigation. Further, site specific seismic shear wave velocity testing was conducted within Block 2 by Paterson in 2023.

The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the 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.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Boreholes BH 11-22-EL and BH 12-22-EL, located near Block 2, from the previous investigation were fitted with 51 mm diameter PVC groundwater monitoring wells. All remaining boreholes were fitted with a flexible polyethylene standpipe to allow groundwater level monitoring. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

Monitoring Well Installation

Typical monitoring well construction details are described below:

- ☐ 1.5 m of slotted 51 mm diameter PVC screen at specified intervals within the borehole column.
- ☐ 51 mm diameter PVC riser pipe from the top of the screen to the ground surface.
- ☐ No.3 silica sand backfill within annular space around screen.
- ☐ 300 mm thick bentonite hole plug directly above PVC slotted screen.
- ☐ Clean backfill from top of bentonite plug to the ground surface.

Refer to the Soil Profile and Test Data sheets in Appendix 1 for specific well construction details.

Sample Storage

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

3.2 Field Survey

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 locations of the test holes, and the ground surface elevation at each test hole location, are presented on Drawing PG7255 - 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. Atterberg Limits, hydrometer and grain size distribution, shrinkage, and moisture content testing were completed on select samples obtained from the current geotechnical investigation.

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 samples were 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 Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site currently consists of undeveloped land, previously used for agricultural purposes, with some mature trees present. Topsoil stripping, road construction and site servicing activities were underway at the time of preparation of this report within 3700 Twin Falls Place, near Block 2. Further, topsoil stripping operations have been completed within some areas of Block 2. The site is generally bordered by undeveloped land, previously used for agricultural purposes, to the north, west, and south, and by Limebank Road followed by undeveloped agricultural land to the east.

The ground surface across the subject site is relatively flat and approximately 1 to 2 m below grade of Limebank Road with approximate geodetic elevations ranging between 91.1 to 91.5 m.

4.2 Subsurface Profile

Generally, the subsurface soil profile encountered at the test hole locations consisted of a deep deposit of silty clay. The silty clay deposit consisted of a hard to stiff brown silty clay crust underlain by a firm to soft grey silty clay. The brown silty clay weathered crust was observed in all boreholes, extending to depths ranging between approximately 2.7 to 3.3 m below the ground surface. Trace sand was observed within the brown silty clay crust layer.

Further, the grey silty clay deposit was observed in all boreholes underlaying the brown silty clay crust. All boreholes were terminated within the grey silty clay deposit. Based on DCPT results from nearby boreholes from the previous investigation and nearby soils data, it is inferred that a deposit of glacial till is present underlaying the silty clay at approximate depths of 15 to 17 m below the ground surface.

Practical refusal to DCPT testing, carried out during the previous investigation near Block 2, was encountered at approximate depths of 21.2 and 17.3 m below the ground surface at boreholes BH 12-22-EL and BH 13-22-EL, 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 in the subject area is part of the March formation, which consists of interbedded sandstone and dolomite with an overburden drift thickness ranging between 15 to 25 m depth.

Atterberg Limits Testing

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples at select borehole locations. Further, Atterberg Limits testing was completed at various borehole locations during the previous field investigation within the vicinity of Block 2. The results of the Atterberg limits test are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1. The tested silty clay samples within Block 2 are classified as inorganic clays of high plasticity (CH) in accordance with the Unified Soil Classification System.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 3-24	2.59	65	28	37	49.44	CH
BH 4-24	2.59	72	28	44	71.48	CH
BH 6-24	1.07	65	32	33	47.57	CH
BH 1-22-EL	1.83	81	38	43	50.00	MH
BH 10-22-EL	1.07	62	29	33	39.00	CH
BH 11-22-EL	1.83	72	34	38	44.68	CH
BH 12-22-EL	1.07	73	34	39	36.46	CH
BH 13-22-EL	1.83	73	35	38	49.95	CH
BH 14-22-EL	1.07	66	30	36	33.11	MH

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

Grain Size Distribution and Hydrometer Testing

Grain size distribution analysis was completed on two selected recovered silty clay deposit samples from the current investigation. Further, grain size distribution analysis was completed at various borehole locations during the previous field investigation within the vicinity of Block 2.

The results of the grain size distribution analysis are presented in Table 2 and on the Grain Size Distribution sheets in Appendix 1.

Table 2 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 3-24 SS3	2.59	0.0	1.7	27.8	70.5
BH 4-24 SS3	2.59	0.0	1.0	29.5	69.5
BH 1-22-EL	1.07	0.0	2.1	30.4	67.5
BH 11-22-EL	1.07	0.0	2.5	38.0	59.5
BH 13-22-EL	1.07	0.0	1.2	32.8	66.0

Shrinkage Testing

Linear shrinkage testing was completed on one sample recovered at a depth of 2.59 from BH 7-24. The shrinkage limit and shrinkage ratio of the tested silty clay sample were found to be 20.12% and 1.68, respectively. Further, linear shrinkage testing was completed at one borehole location during the previous field investigation within the vicinity of Block 2 at a depth of 1.83 m. The results yielded a shrinkage limit of 21.64% and shrinkage ratio if 1.81.

The results of the linear shrinkage testing are presented in Appendix 1.

4.3 Groundwater

Groundwater levels were recorded at each test hole location and are presented in Table 3 below. The groundwater level readings are also presented in the Soil Profile and Test Data sheets in Appendix 1.

Table 3 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1-24	91.31	0.71	90.60	September 17, 2024
BH 2-24	91.23	0.68	90.55	
BH 3-24	91.21	0.63	90.58	
BH 4-24	91.18	3.30	87.88	
BH 5-24	91.48	1.03	90.45	
BH 6-24	91.20	5.78	85.42	
BH 7-24	91.33	1.33	90.00	
BH 1-22-EL	91.61	0.73	90.88	May 12, 2022
BH 10-22-EL	91.44	Dry	N/A	
BH 11-22-EL	91.38	0.81	90.57	
BH 12-22-EL	91.73	0.38	91.35	
BH 13-22-EL	91.57	0.65	90.92	
BH 14-22-EL	91.40	0.64	90.76	

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.

It should be noted that surface water can become trapped within a backfilled borehole that can lead to higher than typical groundwater level observations. Further, it should be noted that groundwater levels are subject to seasonal fluctuations, therefore the groundwater levels could vary at the time of construction.

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 a depth of approximately **2.2 to 3.3 m** below the existing ground surface. The recorded groundwater levels are also provided on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

Hydraulic Conductivity Testing

Slug Testing

Slug testing was completed within monitoring well locations in the vicinity of Block 2 on April 27, 2022. Following the completion of the slug testing, the test data was analyzed as per the method set out by Hvorslev (1951). Assumptions inherent in the Hvorslev method include a homogeneous and isotropic 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 flow 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.

Hvorslev 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.

Based on the above test methods, the grey silty clay yielded field saturated hydraulic conductivity values ranged between **2.7×10^{-8} and 4.7×10^{-8} m/sec** within the vicinity of Block 2. The values measured within the monitoring wells are generally consistent with similar material Paterson has encountered on other sites and typical published values for silty clay. These values typically range from 1×10^{7} to 1×10^{-12} m/sec for silty clay. The range in hydraulic conductivity values is due to the variability in the composition and shear strength of the silty clay. The results of the hydraulic conductivity testing are presented in Appendix 1.

Permeameter Testing

Permeameter testing was completed near surface at depths ranging from 0.3 to 0.6 m below ground surface within the brown silty clay layer adjacent to monitoring well locations within the vicinity of Block 2 on April 29 and May 2, 2022.

Preparation and testing for this investigation was done in accordance with the Canadian Standards Association (CSA) B65-12 - Annex E. The field saturated hydraulic conductivity (K_{fs}) and estimated infiltration values for each test hole location are presented in Table 4 below.

Table 4 - Permeameter Testing Results

BH ID	Depth of Testing (m)	Material	K_{fs} (m/sec)	Unfactored Infiltration Rate (mm/hr)
BH11-22-EL	0.3	Br. Silty Clay	7.5×10^{-7}	40
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH12-22-EL	0.3	Br. Silty Clay	1.1×10^{-6}	49
	0.6	Br. Silty Clay	3.0×10^{-8}	19
BH14-22-EL	0.3	Br. Silty Clay	3.0×10^{-8}	19
	0.6	Br. Silty Clay	1.5×10^{-8}	16

Field saturated hydraulic conductivity values were determined using Engineering Technologies Canada (ETC) Ltd. reference tables provided in the most recent ETC Pask Permeameter User Guide dated March 2016. The field saturated hydraulic conductivity values were used to estimate the infiltration rates based on the approximate relationship between infiltration rate and hydraulic conductivity, as described in the 2010 Low Impact Development Stormwater Management Planning and Design Guide prepared by the CVC and the TRCA. Based on the subsurface profile encountered across the subject site, it is recommended that a minimum correction factor of 2.5 be applied to the chosen infiltration rate at the time of design.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is anticipated that the future commercial building will be founded over conventional shallow footings placed on an undisturbed, hard to stiff, brown silty clay crust or an approved engineered fill placed on an undisturbed silty clay bearing surface.

Due to the presence of the sensitive silty clay deposit, the proposed development will be subjected to grade raise restrictions. Permissible grade raise recommendations have been provided for the subject site. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

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 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 subgrade soils during site preparation activities.

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

Fill Placement

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

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill and for areas where settlement of the ground surface is of minor concern. These materials should be spread in a maximum of 300 mm thick loose lifts and compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in maximum 300 mm thick loose lifts to at least 98% of the material's SPMDD. The placement of subgrade material should be reviewed at the time of placement by Paterson personnel.

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

5.3 Foundation Design

Bearing Resistance Value (Conventional Shallow Foundation)

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed over an undisturbed, hard to stiff silty clay bearing surface or engineered fill over an undisturbed, stiff silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **200 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **300 kPa** incorporating a geotechnical factor of 0.5.

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

Settlement

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

Lateral Support

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

Permissible Grade Raise Restrictions

Based on the undrained shear strength values of the silty clay deposit encountered throughout the subject site and our experience with the local silty clay deposit, **a permissible grade raise restriction of 2.0 m** is recommended in the immediate area of settlement sensitive structures at the subject site. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise restriction calculations.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

Shear wave velocity testing was completed for the subject site in 2023 to accurately determine the applicable seismic site classification for the proposed commercial development in accordance with Table 4.1.8.4.A of the Ontario Building Code 2012 (OBC2012). The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided in Figures 2 and 3 in Appendix 2.

Field Program

The seismic array testing location was placed along the east boundary of the subject site as presented in Drawing PG7255-1 - Test Hole Location Plan in Appendix 2. Paterson field personnel placed 24 horizontal 2.4 Hz. geophones mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 3 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a computer laptop and a hammer trigger switch attached to a 12-pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between four (4) to eight (8) times at each shot location to improve signal to noise ratio.

The shot locations are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were located at 3, 4.5 and 25 m away from the first and last geophone and at the centre of the seismic array.

Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves.

The interpretation is repeated at each shot location to provide an average shear wave velocity, V_{s30}, of the upper 30 m profile, immediately below the foundation of the building. The layer intercept times, velocities from different layers, and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location.

The bedrock velocity was interpreted using the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

Based on our testing results, the average overburden shear wave velocity is **153 m/s**, while the bedrock shear wave velocity is **2,508 m/s**. Through interpretation of the seismic tests results, the bedrock surface is encountered at approximately 19 m below existing ground surface.

Based on this, the Vs30 was calculated using the standard equation for average shear wave velocity calculation from the Ontario Building Code (OBC2012), as presented below.

$$V_{s30} = \frac{Depth_{of\ interest}(m)}{\left(\frac{Depth_{Layer1}(m)}{V_{s_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{s_{Layer2}}(m/s)}\right)}$$

$$V_{s30=} \frac{30\ m}{\left(\frac{19\ m}{153\ m/s} + \frac{11\ m}{2{,}508\ m/s}\right)}$$

$$V_{s30=}\ 233\ \ m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity, V_{s30}, at the subject site is **233 m/s**. Therefore, a **Site Class D** is applicable for the design of the proposed commercial development, as per Table 4.1.8.4.A of the Ontario Building Code 2012 (OBC2012).

The soils underlying the subject site are not susceptible to liquefaction.

5.5 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the native soil and/or approved fill is considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction.

For slab-on-grade construction, it is recommended that the upper 200 mm of sub-slab fill consist of OPSS Granular A crushed stone compacted to a minimum of 98% of the material's SPMDD.

All backfill material within the footprint of the proposed buildings should be placed in a maximum 300 mm thick loose layers and compacted to a minimum of 98% of the material's SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, is recommended for backfilling below the floor slab.

5.6 Pavement Design

For design purposes, the following pavement structures, presented below, are recommended for the design of car only parking areas, heavy truck parking areas, loading zones, and access at the subject site.

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

Table 6 - Recommended Pavement Structure - Access Lanes, Loading Zones and Heavy Truck Parking Areas

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
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill 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.

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 a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

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.

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.

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed slab-on-grade buildings. The system should consist of a 150 mm diameter perforated, corrugated plastic pipe surrounded on all sides by 150 mm of 19 mm clear crushed stone which is placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection, to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials. The greater part of the site materials will be frost susceptible and, as such, are not recommended for placement as backfill against the foundation walls unless used in conjunction with a composite drainage system, such as Delta Drain 6000 or Miradrain G100N. Imported granular materials, such as clean sand or OPSS Granular B Type I granular materials, should be placed for this purpose.

Concrete Sidewalks Adjacent to Buildings

To avoid differential settlements within the proposed sidewalks adjacent to the proposed buildings, it is recommended that the upper 600 mm of backfill placed below the concrete sidewalks adjacent to the building footprints to consist of non-frost susceptible material such as OPSS Granular A or Granular B Type II. The granular material should be placed in maximum 300 mm loose lifts and compacted to a minimum of 98% of the material’s SPMDD using suitable compaction equipment. The subgrade material should be shaped to promote positive drainage towards the building’s perimeter drainage system. Consideration should be given to placing a layer of rigid insulation below the granular fill layer, however, should be detailed by the geotechnical consultant once design drawings are finalized.

Further, consideration can be given to installing a 150 mm diameter perforated, corrugated plastic pipe surrounded on all sides by 150 mm of 19 mm clear crushed stone at the interface of the soil subgrade and the granular sidewalk base. If a drainage pipe is provided at the top of the soil subgrade layer, the granular backfill thickness below the sidewalk may be reduced to 300 mm.

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

Temporary 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. For the proposed development, 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.

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.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on a soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 98% of the SPMDD.

It should generally be possible to re-use the moist (not wet) site-generated fill above the cover material if the excavation and filling operations are carried out in dry weather conditions. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

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 300 mm thick loose lifts and compacted to a minimum of 95% of the material’s SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding 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. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Groundwater Control for Building Construction

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

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 non-aggressive to slightly 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 soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Table 1 in Subsection 4.2 and in Appendix 1.

Based on the results of our review, two areas were defined within the subject site in which the tree planting restrictions are defined. The two areas are detailed below and are outlined in Drawing PG7255-2 - Tree Planting Setback Recommendations presented in Appendix 2.

Area 1 - Low to Medium Sensitivity Clay Area

A low to medium sensitivity clay soil was encountered between anticipated underside of footing elevations and 3.5 m below preliminary finished grade as per City Guidelines at the areas outlined in Drawing PG7255-2 - Tree Planting Setback Recommendations in Appendix 2. Based on our Atterberg Limits' test results, the modified plasticity limit does not exceed 40% in these areas. The following tree planting setbacks are recommended for the low to medium sensitivity area.

☐ Large trees (mature height over 14 m) can be planted within these areas provided that a tree to foundation setback equal to the full mature height of the tree can be provided.

☐ 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.

Area 2 - High Sensitivity Clay Area

Based on the results of our review, a high sensitivity clay soil was encountered between the anticipated design underside of footing elevation and 3.5 m below finished grade as per City Guidelines. Based on our Atterberg limits test results, the modified plasticity index generally exceeds 40% in these areas. The following tree planting setbacks are recommended for these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided. Tree planting setback limits are 7.5 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 following conditions are met.

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

☐ A small tree must be provided with a minimum of 25 m3 of available soils volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

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

☐ The foundation walls are to be reinforced at least nominally (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 Grading Plan.

7.0 Recommendations

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 of the final design details from a geotechnical perspective.

☐ Review and inspection of the installation of the foundation drainage systems.

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

☐ 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.

☐ Review of the installation of clay seals.

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

8.0 Statement of Limitations

The recommendations provided in this report 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 Gastops c/o CSV Architects, 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.

NPatey

Nicole R. L. Patey, P.Eng.

LICENSED PROFESSIONAL ENGINEER
October 7, 2024
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.

Report Distribution:

☐ Gastops c/o CSV (Email Copy)
☐ Paterson Group (1 Copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMIT TESTING RESULTS

GRAIN SIZE TESTING RESULTS

SHRINKAGE TESTING RESULTS

ANALYTICAL TESTING RESULTS

SLUG TESTING RESULTS

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369408.88 **NORTHING:** 5017536.06 **ELEVATION:** 91.31

PROJECT: Proposed Commercial Development - Gastops Block 2

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

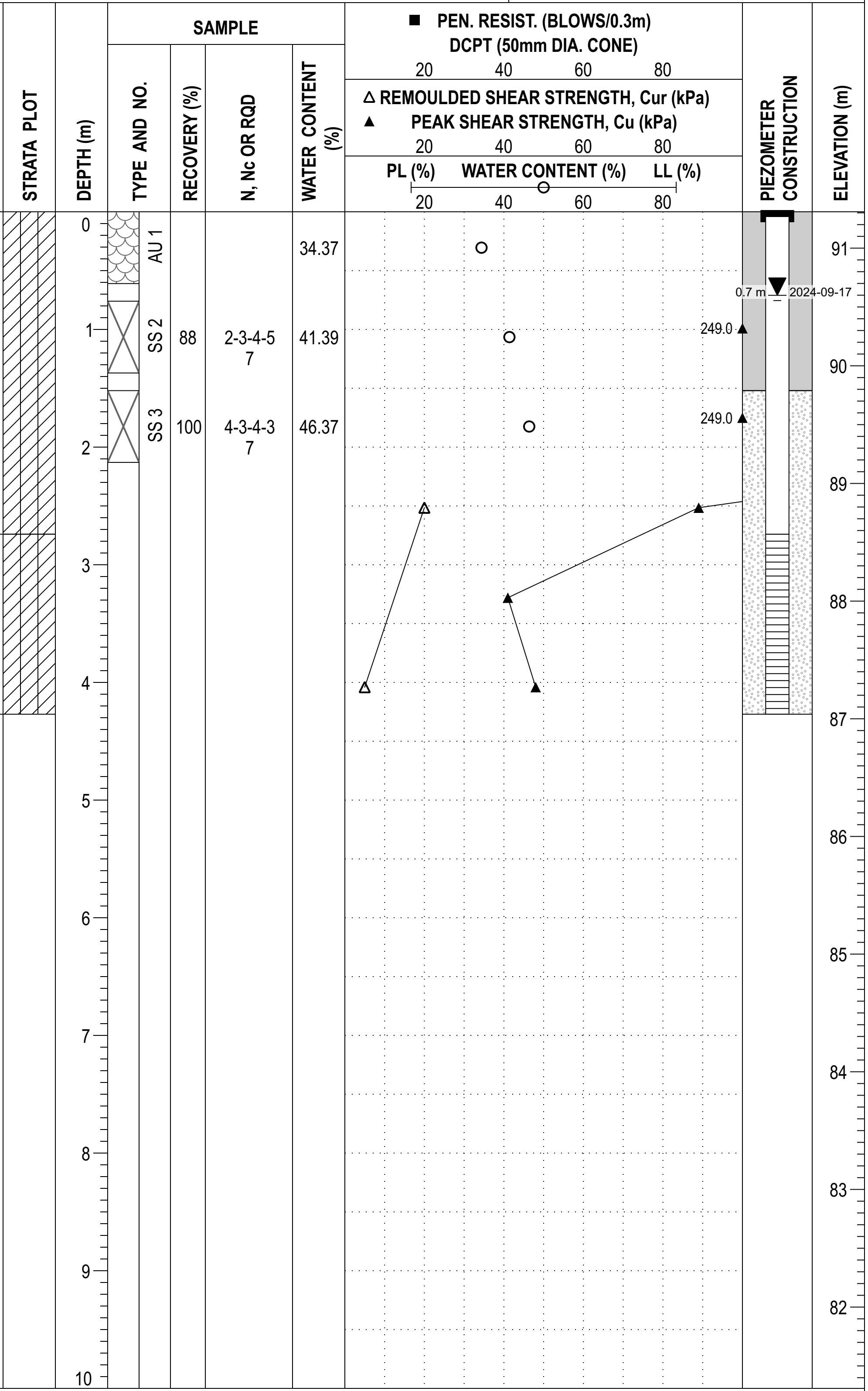
DATE: September 10, 2024

FILE NO. : **PG7255**

HOLE NO. : **BH 1-24**

SAMPLE DESCRIPTION	
GROUND SURFACE	
Hard to stiff, brown **SILTY CLAY**, trace sand	2.74m [88.57m]
Firm, grey **SILTY CLAY**	4.27m [87.04m]
End of Borehole (GWL at 0.71 m - September 17, 2024)	

TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
AU 1			34.37
SS 2	88	2-3-4-5 7	41.39
SS 3	100	4-3-4-3 7	46.37



SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369369.82 **NORTHING:** 5017511.82 **ELEVATION:** 91.23

PROJECT: Proposed Commercial Development - Gastops Block 2

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 11, 2024

FILE NO. : PG7255

HOLE NO. : BH 2-24

SAMPLE DESCRIPTION

GROUND SURFACE

Hard to stiff, brown **SILTY CLAY**, trace sand

2.74m [88.49m]

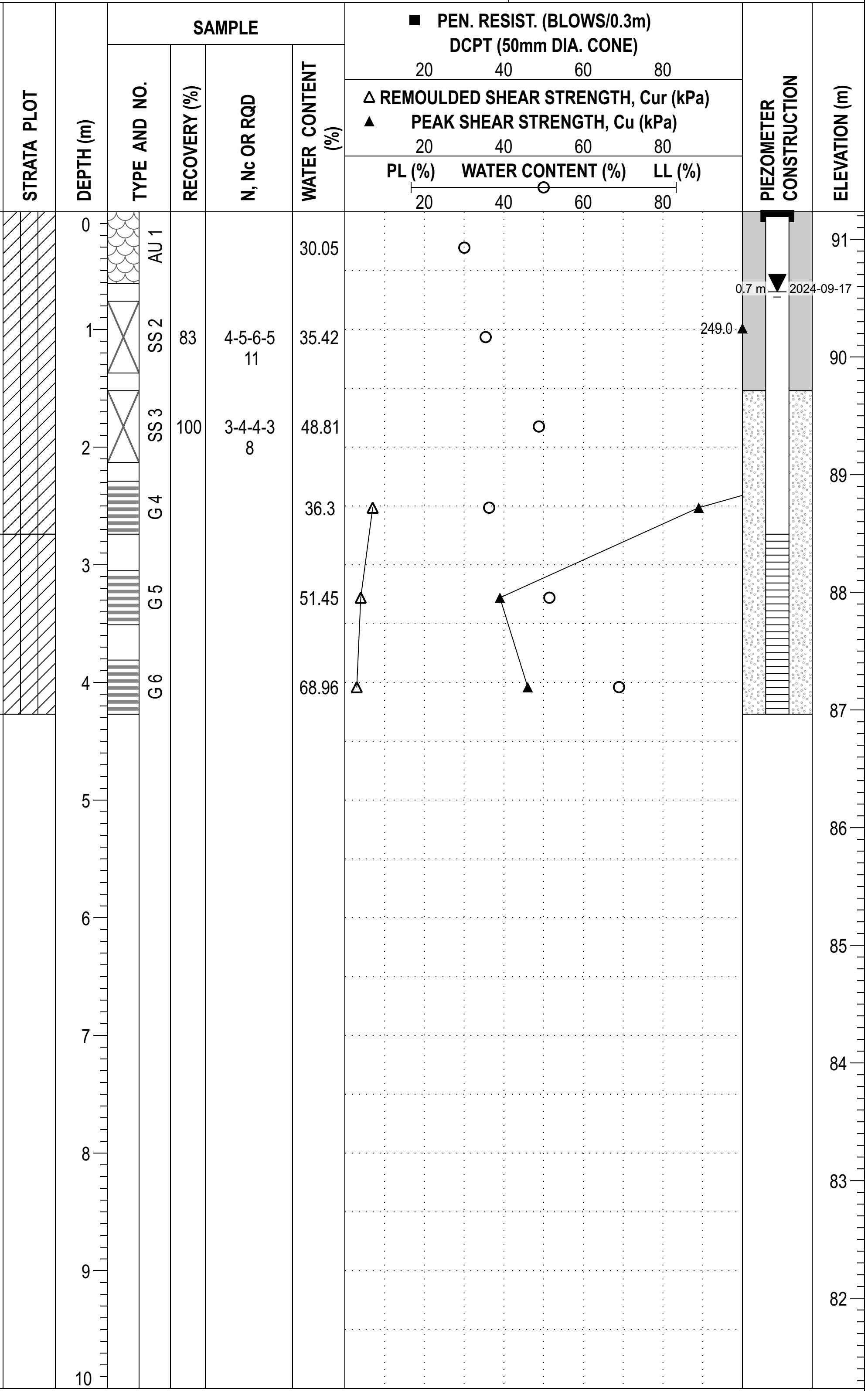
Firm, grey **SILTY CLAY**

4.27m [86.96m]

End of Borehole

(GWL at 0.68 m - September 17, 2024)

TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
AU 1			30.05
SS 2	83	4-5-6-5 11	35.42
SS 3	100	3-4-4-3 8	48.81
G 4			36.3
G 5			51.45
G 6			68.96



PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

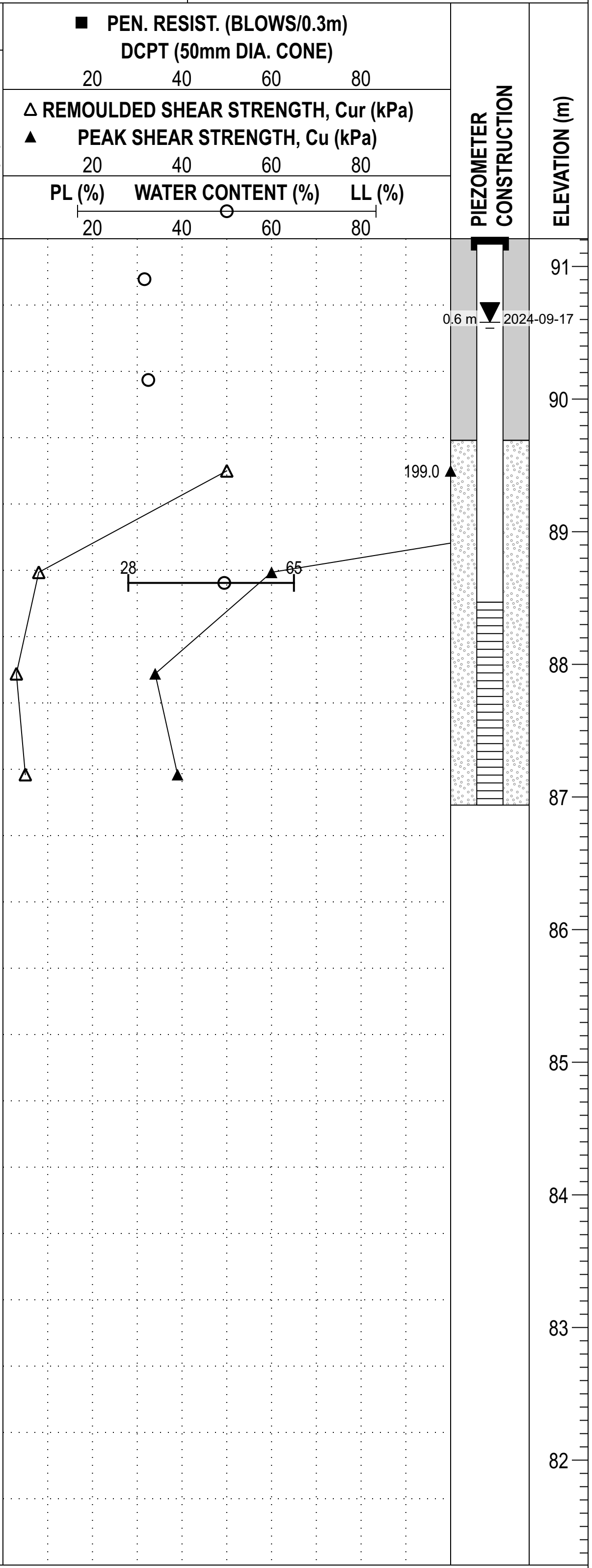
Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369409.65 **NORTHING:** 5017458.38 **ELEVATION:** 91.21

PROJECT: Proposed Commercial Development - Gastops Block 2
BORINGS BY: CME-55 Low Clearance Drill
REMARKS:
DATE: September 11, 2024

FILE NO. : PG7255
HOLE NO. : BH 3-24

SAMPLE DESCRIPTION GROUND SURFACE	DEPTH (m)	TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
Hard to stiff, brown **SILTY CLAY**, trace sand	0	AU 1			31.62
	1	SS 2	100	2-3-4-4 7	32.47
	2	SS 3	100	P	49.44
2.90m [88.31m]					
Firm, grey **SILTY CLAY**	3				
4.27m [86.94m]	4				
End of Borehole (GWL at 0.63 m - September 17, 2024)	5				
	6				
	7				
	8				
	9				
	10				



PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369434.29 **NORTHING:** 5017417.67 **ELEVATION:** 91.18

PROJECT: Proposed Commercial Development - Gastops Block 2
BORINGS BY: CME-55 Low Clearance Drill
REMARKS:
DATE: September 11, 2024

FILE NO. : **PG7255**
HOLE NO. : **BH 4-24**

SAMPLE DESCRIPTION

GROUND SURFACE

Hard to stiff, brown **SILTY CLAY**, trace sand

2.90m [88.28m]

Firm to stiff, grey **SILTY CLAY**

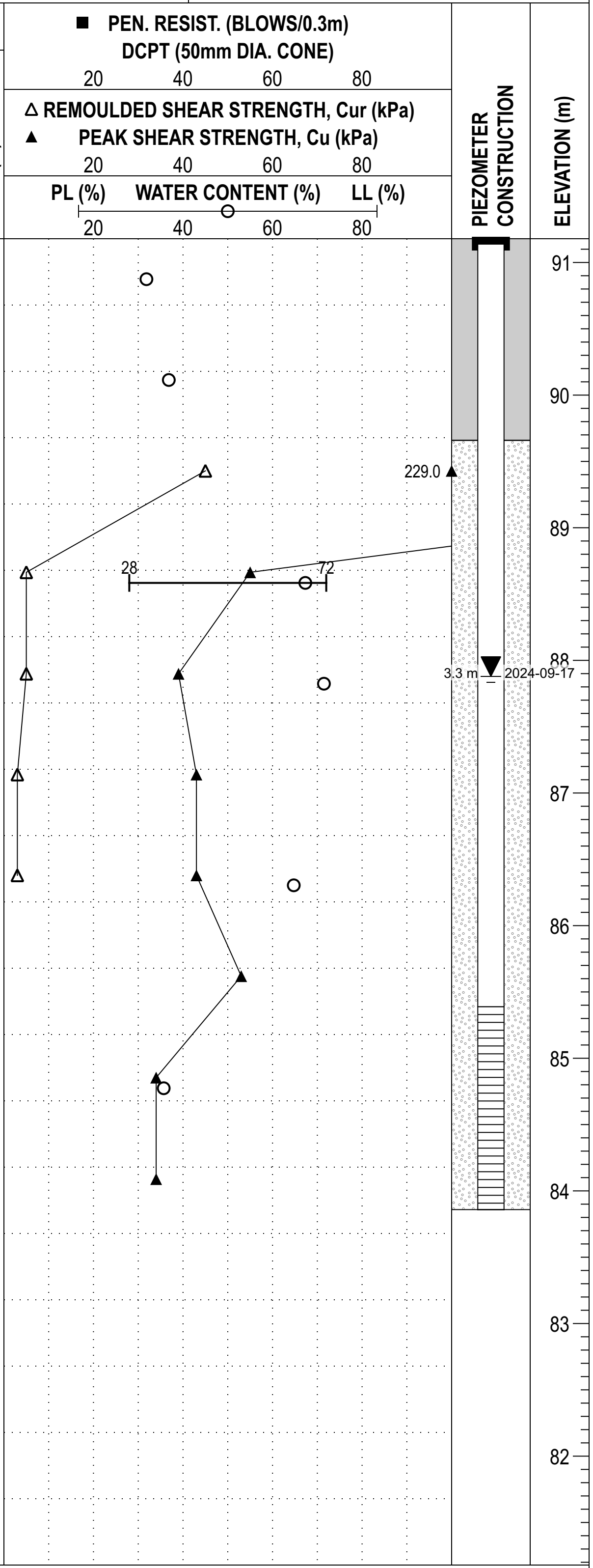
7.32m [83.86m]

End of Borehole

(GWL at 3.30 m - September 17, 2024)

TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
AU 1			31.83
SS 2	100	2-4-3-3 7	36.83
SS 3	100	P	67.32
SS 4	100	P	71.48
SS 5	100	P	64.74
SS 6	100	P	35.69

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



PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369468.41 **NORTHING:** 5017359.51 **ELEVATION:** 91.48

PROJECT: Proposed Commercial Development - Gastops Block 2

BORINGS BY: CME-55 Low Clearance Drill

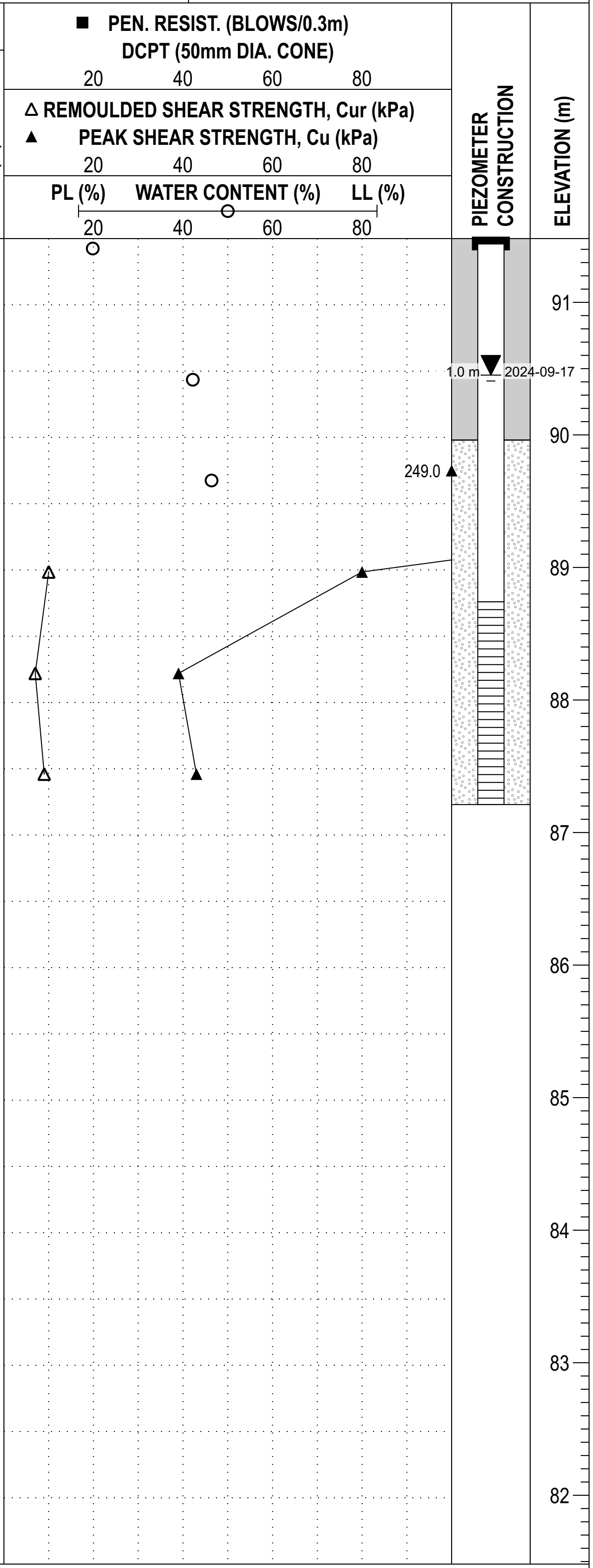
REMARKS:

DATE: September 11, 2024

FILE NO. : PG7255

HOLE NO. : BH 5-24

SAMPLE DESCRIPTION	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
GROUND SURFACE	0	AU 1			19.84
FILL: Brown silty clay, trace gravel and sand 0.15m [91.33m]					
Hard to stiff, brown **SILTY CLAY**, trace sand	1	SS 2	75	4-3-3-4 6	42.19
	2	SS 3	100	3-3-3-3 6	46.38
2.97m [88.51m]					
Firm, grey **SILTY CLAY**	3				
4.27m [87.21m]	4				
End of Borehole					
(GWL at 1.03 m - September 17, 2024)	5				



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

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369489.09 **NORTHING:** 5017397.74 **ELEVATION:** 91.20

PROJECT: Proposed Commercial Development - Gastops Block 2

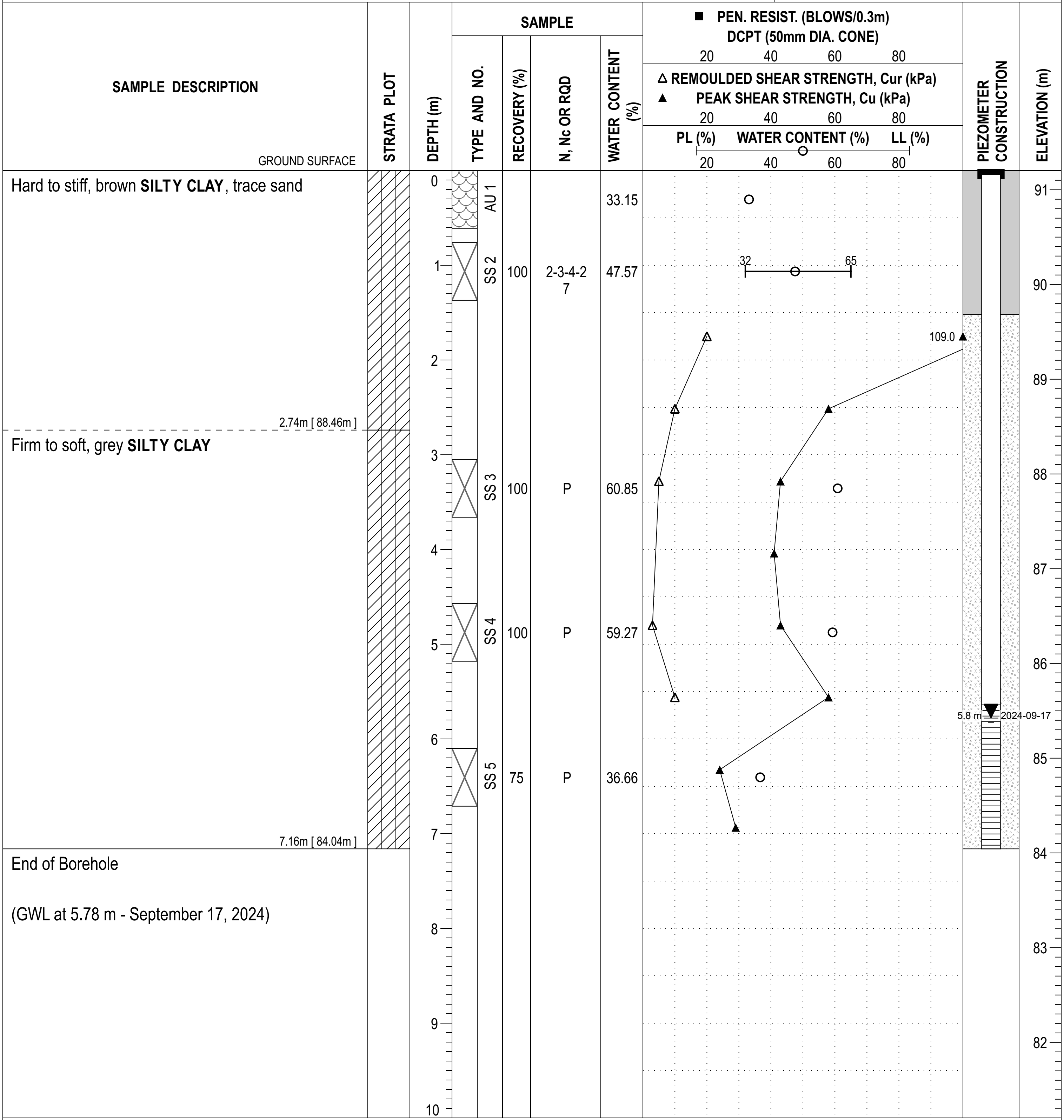
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 11, 2024

FILE NO. : PG7255

HOLE NO. : BH 6-24



SAMPLE DESCRIPTION	Depth
Hard to stiff, brown **SILTY CLAY**, trace sand	0 - 2.74m [88.46m]
Firm to soft, grey **SILTY CLAY**	2.74 - 7.16m [84.04m]
End of Borehole (GWL at 5.78 m - September 17, 2024)	

TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
AU 1			33.15
SS 2	100	2-3-4-2 7	47.57
SS 3	100	P	60.85
SS 4	100	P	59.27
SS 5	75	P	36.66

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

Riverside South Buisness Park - 3700 Twin Falls Place, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 369457.13 **NORTHING:** 5017438.71 **ELEVATION:** 91.33

PROJECT: Proposed Commercial Development - Gastops Block 2

BORINGS BY: CME-55 Low Clearance Drill

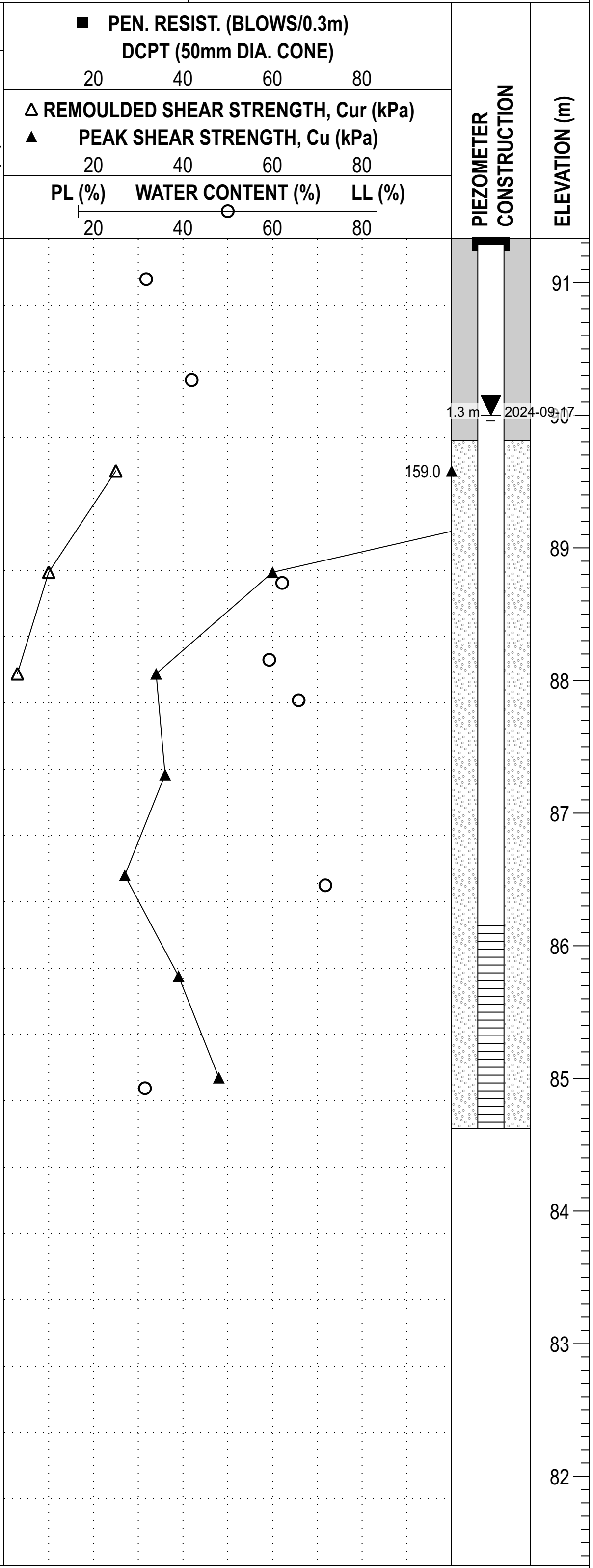
REMARKS:

DATE: September 11, 2024

FILE NO. : PG7255

HOLE NO. : BH 7-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
GROUND SURFACE		0				
Hard to stiff, brown **SILTY CLAY**, trace sand			AU 1			31.78
		1	SS 2	100	3-4-3-4 7	41.94
		2				
			SS 3	83	P	62.15
3.30m [88.03m]		3	SS 4	100	P	59.27 65.84
Firm, grey **SILTY CLAY**		4				
		5	SS 5	100	P	71.8
		6	SS 6	83	P	31.5
6.71m [84.62m]						
End of Borehole (GWL at 1.33 m - September 17, 2024)		7				
		8				
		9				
		10				



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

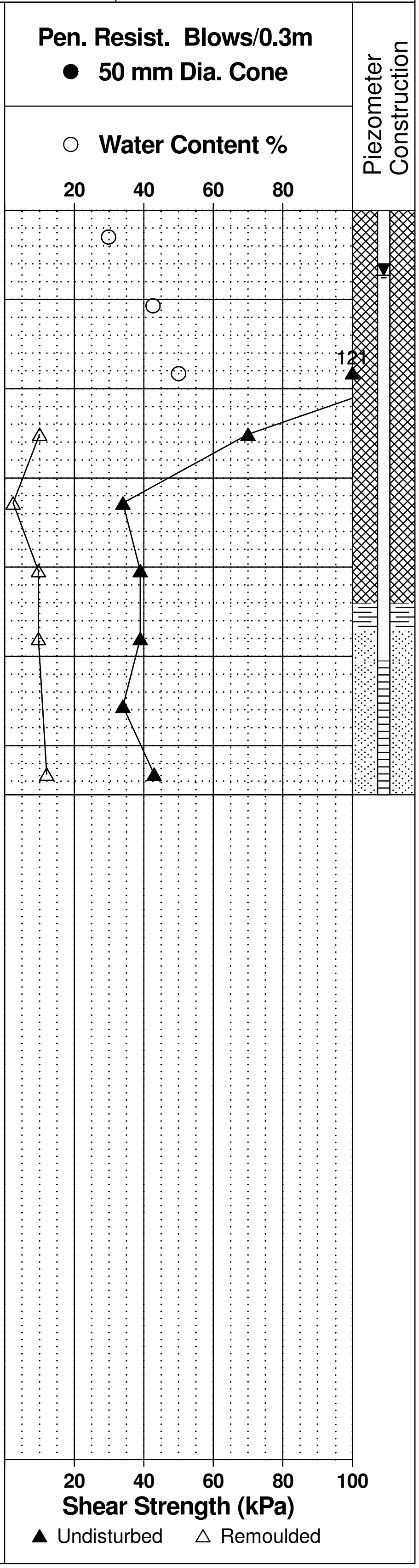
BORINGS BY Track-Mount Power Auger

DATE March 22, 2022

FILE NO. **PG4958**

HOLE NO. **BH 1-22-EL**

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	91.61
TOPSOIL 0.25	SS	1	100	11		
	SS	2	100	6	1	90.61
	SS	3	100	P		
Hard to stiff, brown **SILTY CLAY**					2	89.61
- firm and grey by 2.9m depth					3	88.61
					4	87.61
					5	86.61
					6	85.61
6.55						
End of Borehole (GWL @ 0.73m - May 12, 2022)						



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

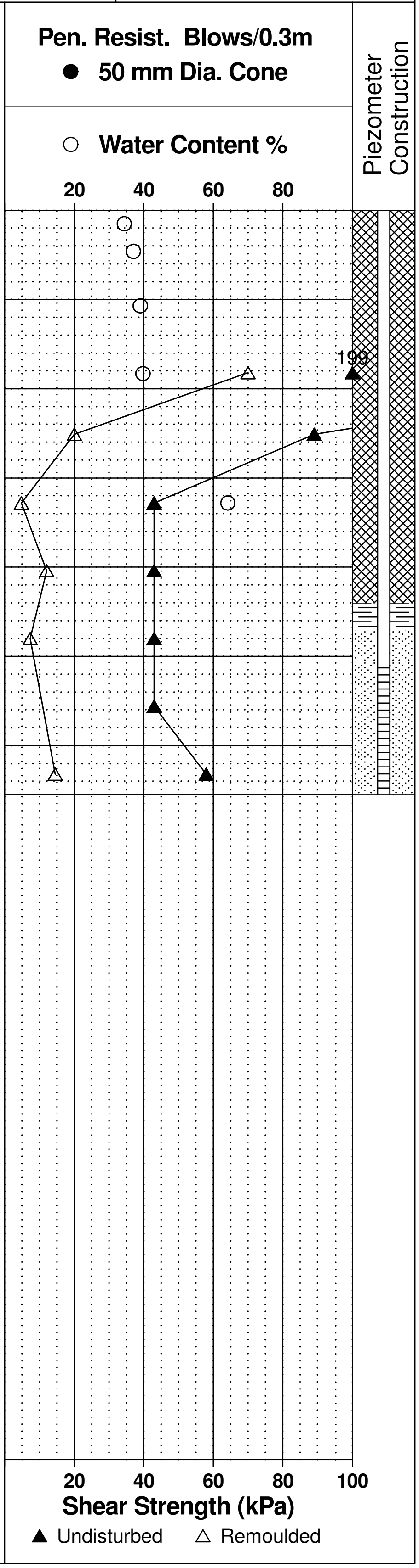
BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. PG4958

HOLE NO. BH10-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.25		SS	1	100	7	0	91.44
		SS	2	83	6	1	90.44
		SS	3	75	P	2	89.44
Very stiff to stiff, brown **SILTY CLAY**							
- firm to stiff and grey by 3.0m depth						3	88.44
						4	87.44
						5	86.44
						6	85.44
6.55							
End of Borehole (Piezometer blocked/dry - May 12, 2022)							



patersongroup Consulting Engineers
9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

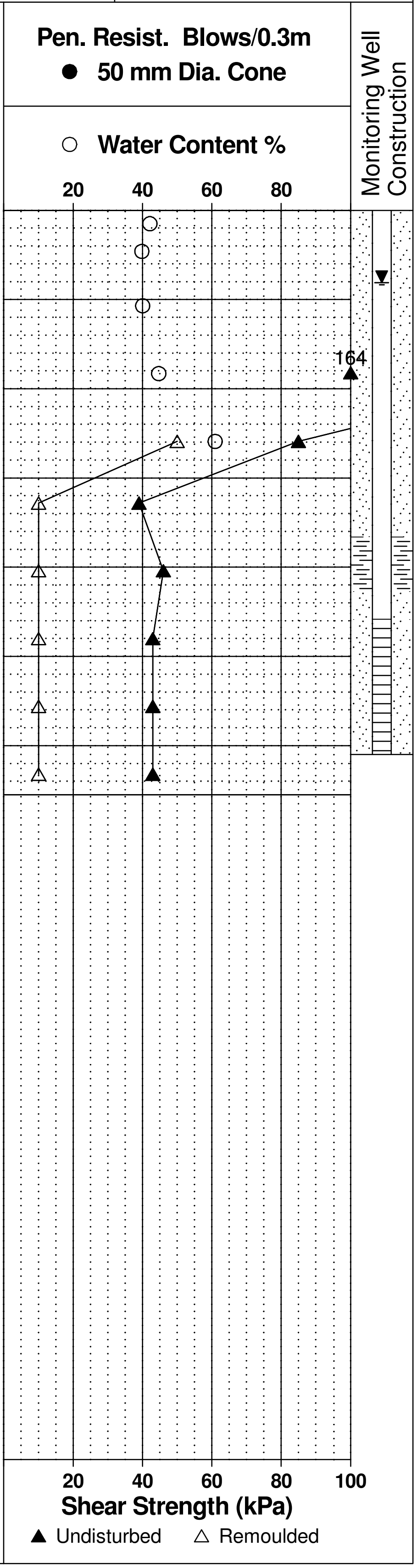
BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. **PG4958**

HOLE NO. **BH11-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	91.38
TOPSOIL 0.23		SS	1	50	9		
		SS	2	83	8	1	90.38
Very stiff to stiff, brown **SILTY CLAY**		SS	3	92	P	2	89.38
- firm and grey by 3.0m depth		SS	4	100	P		
						3	88.38
						4	87.38
						5	86.38
						6	85.38
6.55							
End of Borehole							
(GWL @ 0.81m - May 12, 2022)							



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

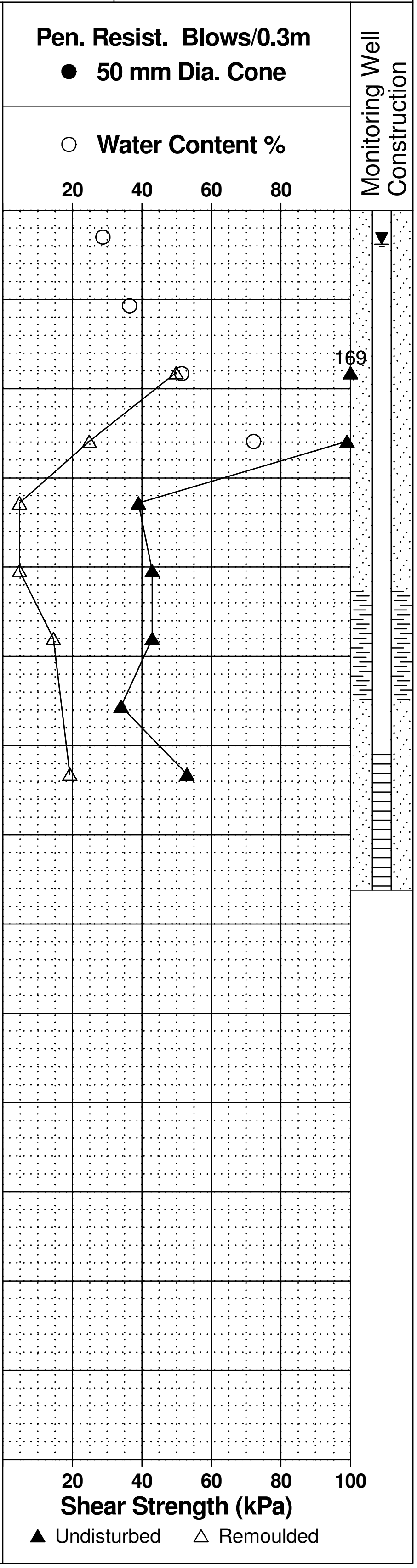
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. **PG4958**

HOLE NO. **BH12-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.73
TOPSOIL 0.23		SS	1	42	7		
		SS	2	50	7	1	90.73
		SS	3	83	P	2	89.73
Very stiff to stiff, brown **SILTY CLAY**		SS	4	100	P		
- firm to stiff and grey by 3.0m depth						3	88.73
						4	87.73
						5	86.73
6.55						6	85.73
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 16.8m depth.						7	84.73
						8	83.73
						9	82.73
						10	81.73
						11	80.73
						12	79.73
						13	78.73
						14	77.73



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

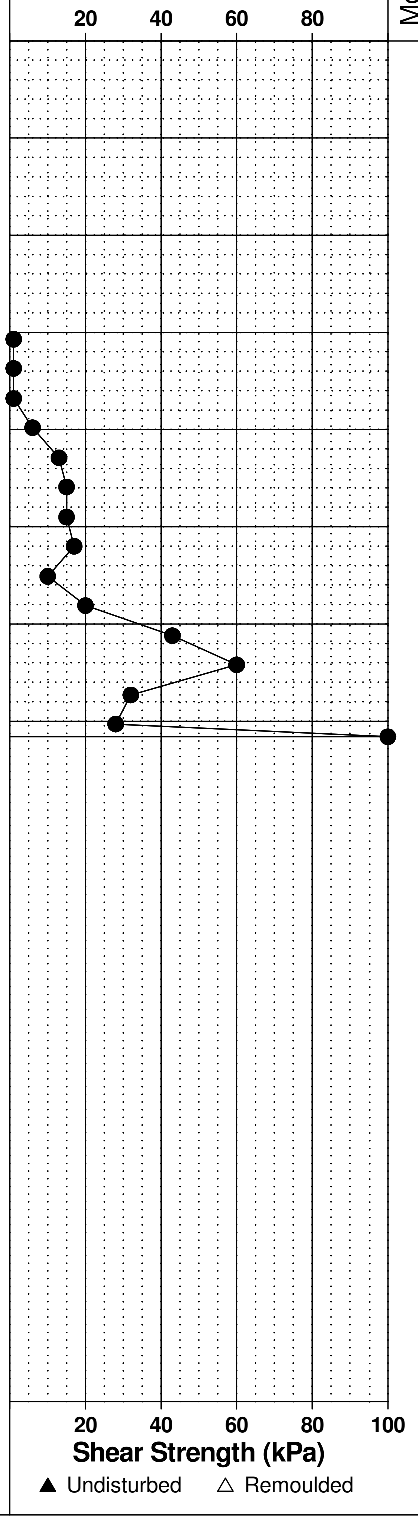
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. PG4958

HOLE NO. BH12-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Monitoring Well Construction
GROUND SURFACE									
						14	77.73		
						15	76.73		
						16	75.73		
						17	74.73		
						18	73.73		
						19	72.73		
						20	71.73		
21.16						21	70.73		



End of Borehole

Practical DCPT refusal at 21.16m depth.

(GWL @ 0.38m - May 12, 2022)

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

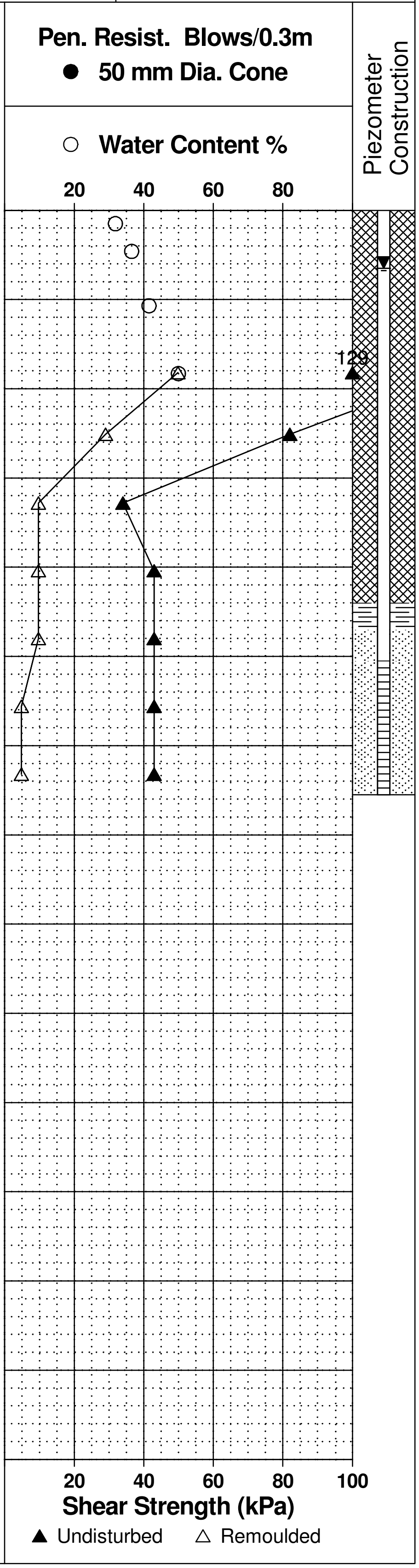
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. **PG4958**

HOLE NO. **BH13-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.57
TOPSOIL 0.25		SS	1	58	7		
		SS	2		6	1	90.57
		SS	3	100	P		
Very stiff to stiff, brown **SILTY CLAY**						2	89.57
- firm and grey by 3.0m depth						3	88.57
						4	87.57
						5	86.57
						6	85.57
6.55							
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 14.3m depth.						7	84.57
						8	83.57
						9	82.57
						10	81.57
						11	80.57
						12	79.57
						13	78.57
						14	77.57



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

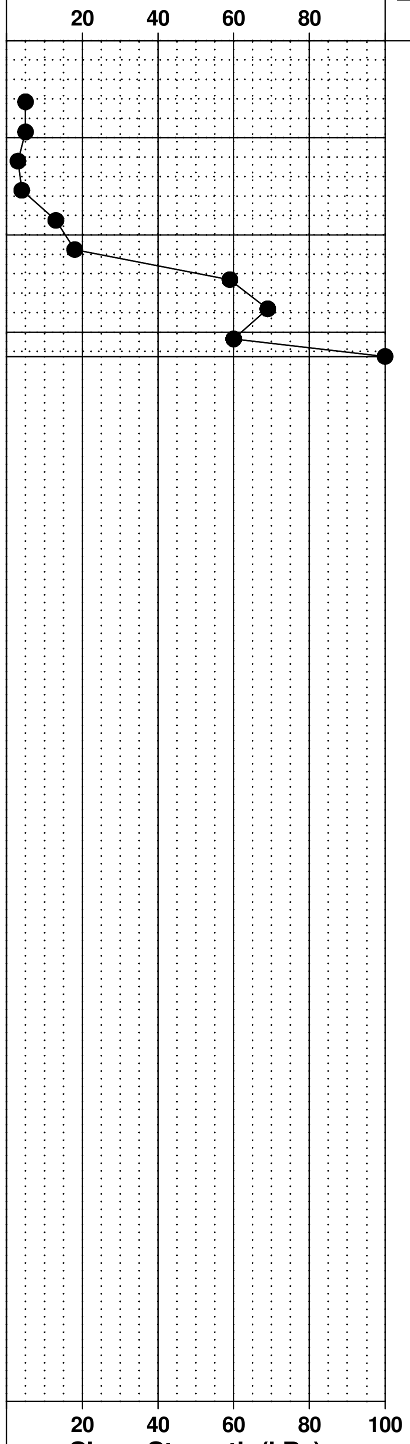
FILE NO. PG4958

HOLE NO. BH13-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						14	77.57	
						15	76.57	
						16	75.57	
						17	74.57	
17.25								
End of Borehole Practical DCPT refusal at 17.25m depth. (GWL @ 0.65m - May 12, 2022)								

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

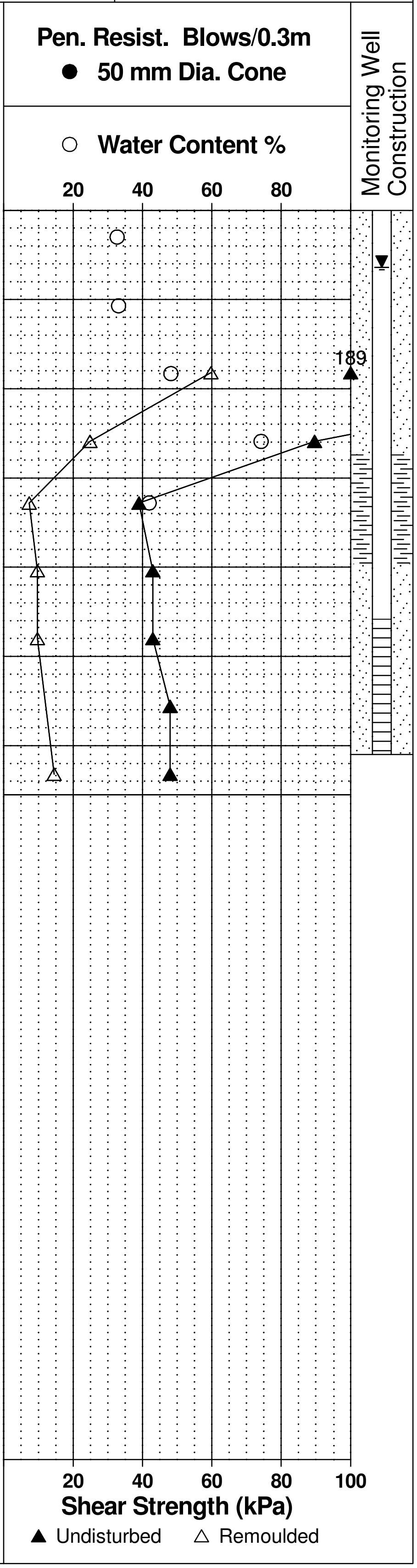
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. PG4958

HOLE NO. BH14-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.40
TOPSOIL 0.25		SS	1	50	8		
		SS	2	67	11	1	90.40
Very stiff to stiff, brown **SILTY CLAY**		SS	3	75	P		
						2	89.40
		SS	4	83	P		
- firm and grey by 3.0m depth						3	88.40
						4	87.40
						5	86.40
						6	85.40
6.55							
End of Borehole							
(GWL @ 0.64m - May 12, 2022)							



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC% - Natural moisture content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic limit, % (water content above which soil behaves plastically)
PI - Plasticity index, % (difference between LL and PL)

Dxx - Grain size which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu - Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth
p'_c - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below p'_c)
Cc - Compression index (in effect at pressures above p'_c)

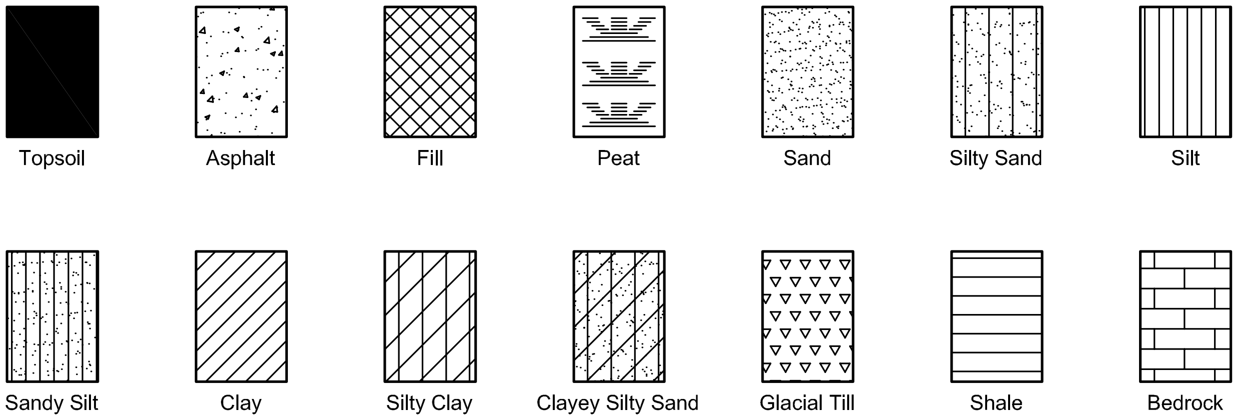
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

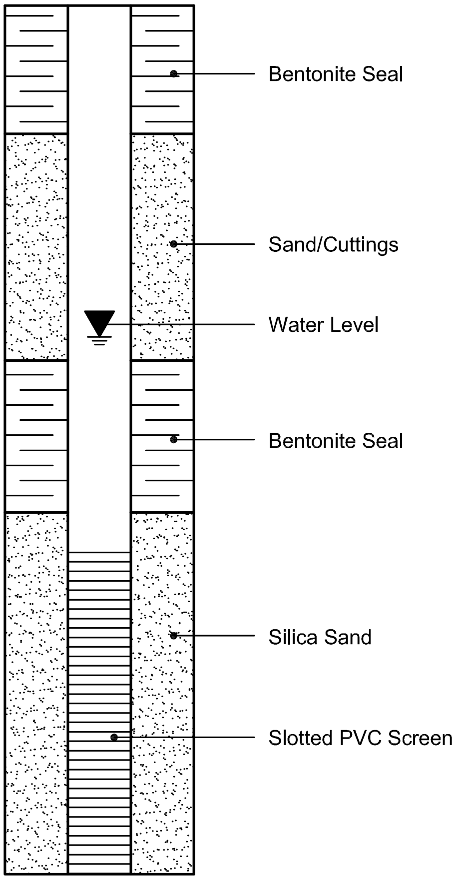
SYMBOLS AND TERMS (continued)

STRATA PLOT

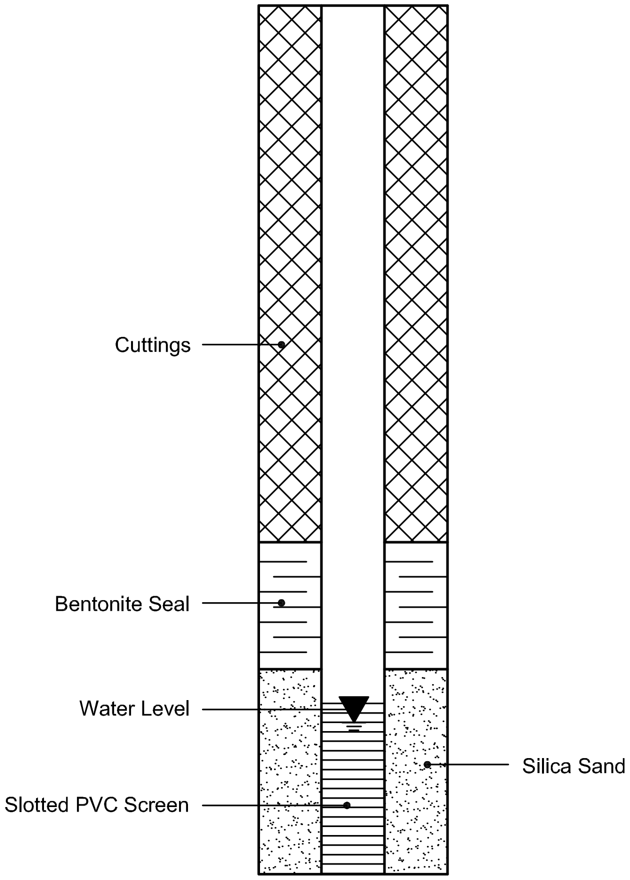


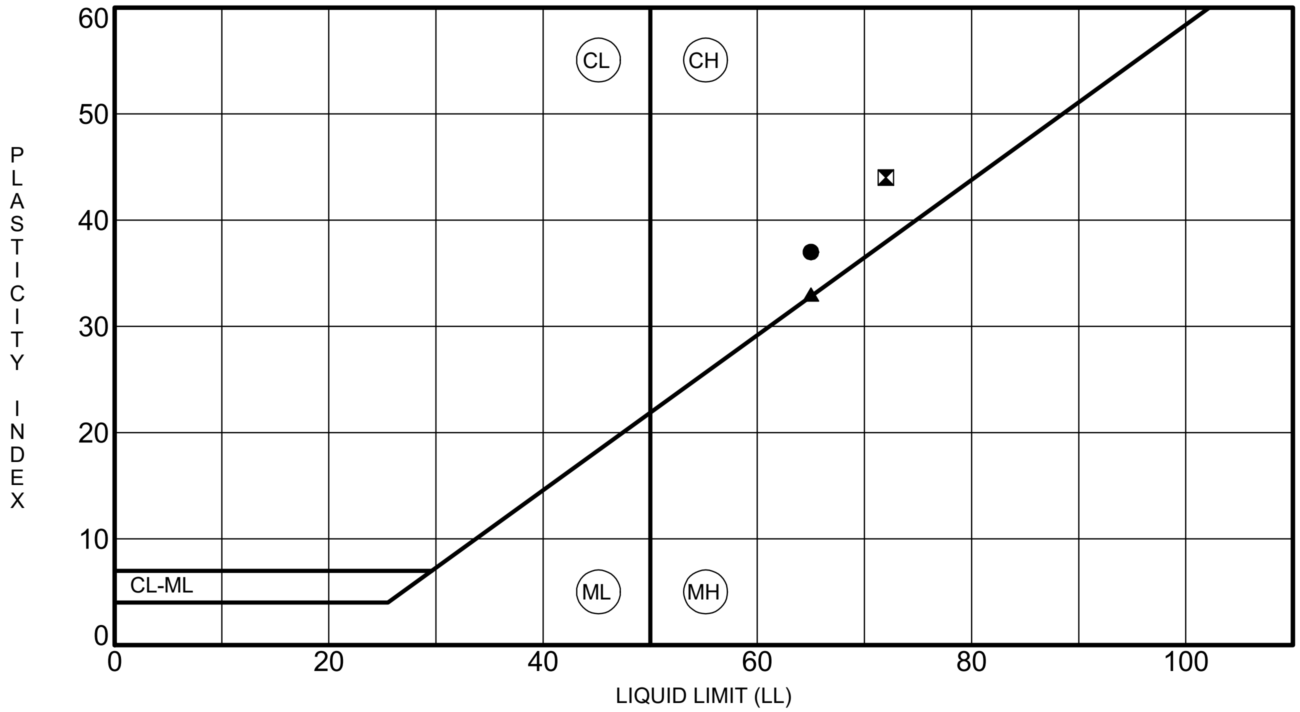
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 3-24** **SS3**	**65**	**28**	**37**		**CH - Inorganics clays of high plasticity**
☒	**BH 4-24** **SS3**	**72**	**28**	**44**		**CH - Inorganics clays of high plasticity**
▲	**BH 6-24** **SS2**	**65**	**32**	**33**		**CH - Inorganics clays of high plasticity**

CLIENT **Gastops c.o. CSV**

PROJECT **Geotechnical Investigation - Riverside South**
Buisness Park - 3700 Twin Falls Place

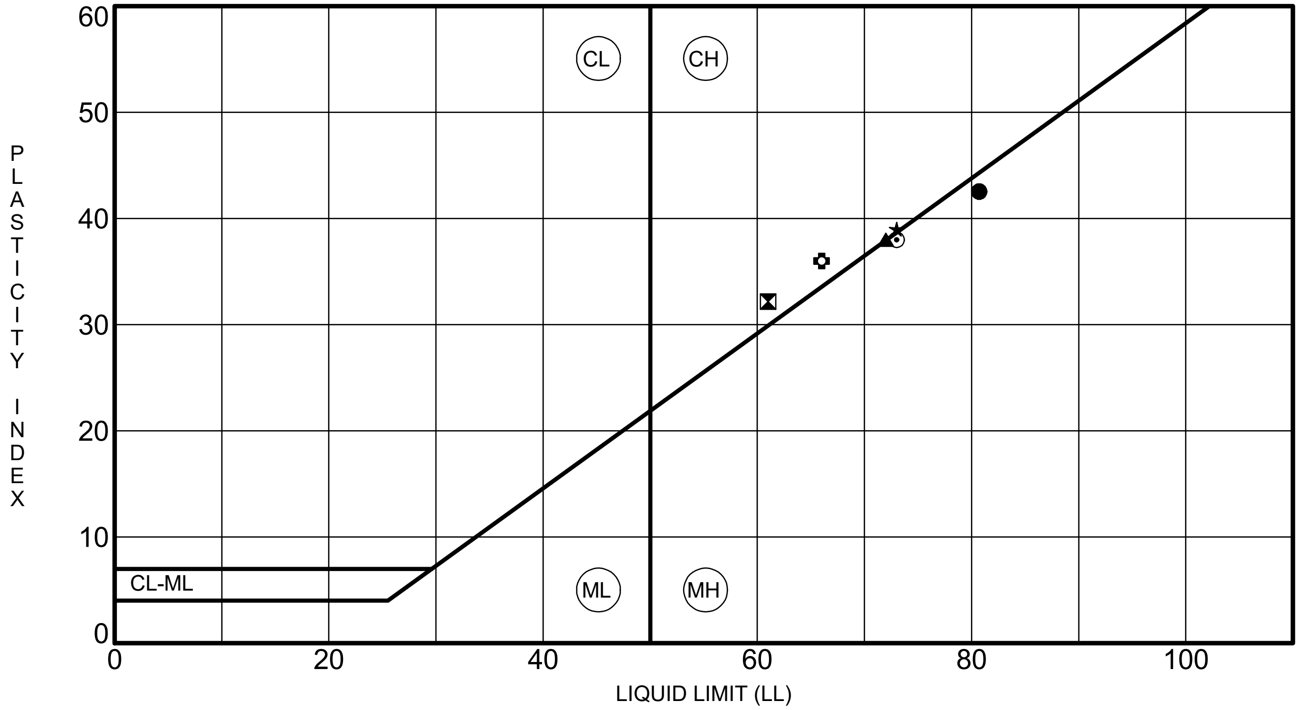
FILE NO. **PG7255**

DATE **11 Sep 24**

PATERSON GROUP

9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

ATTERBERG LIMITS' RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-22-EL**	**SS3**	**81**	**38**	**43**		**MH - Inorganic silts of high plasticity**
⧗	**BH10-22-EL**	**SS2**	**61**	**29**	**32**		**CH - Inorganic clays of high plasticity**
▲	**BH11-22-EL**	**SS3**	**72**	**34**	**38**		**CH - Inorganic clays of high plasticity**
★	**BH12-22-EL**	**SS2**	**73**	**34**	**39**		**CH - Inorganic clays of high plasticity**
⊙	**BH13-22-EL**	**SS3**	**73**	**35**	**38**		**MH - Inorganic silts of high plasticity**
✿	**BH14-22-EL**	**SS2**	**66**	**30**	**36**		**CH - Inorganic clays of high plasticity**

CLIENT **Riverside South Limited Partnership**

PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**

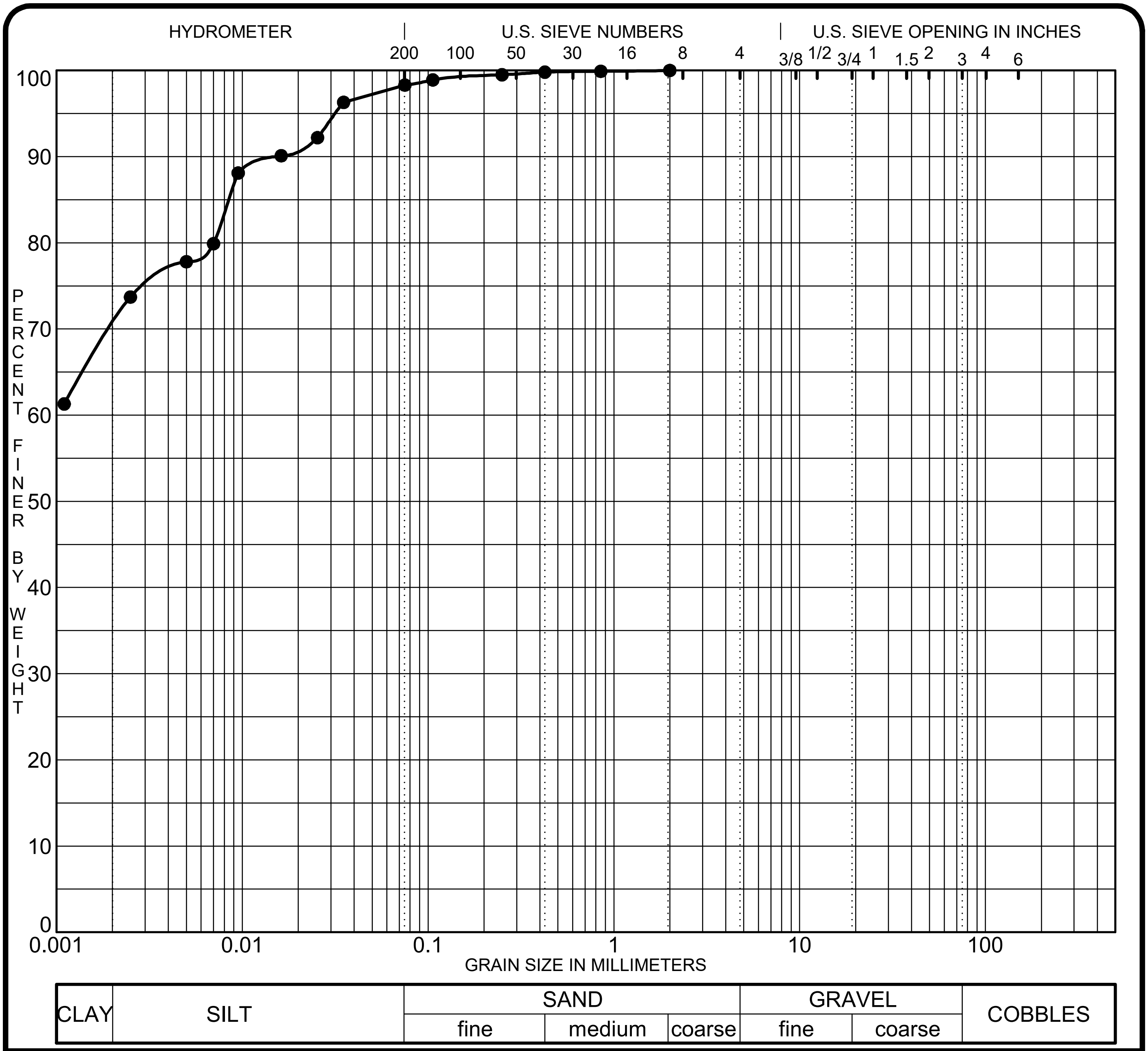
FILE NO. **PG4958**

DATE **1 Apr 22**

PATERSON GROUP

9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

ATTERBERG LIMITS' RESULTS



Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 3-24**	**SS3**	**CH - Inorganics clays of high plasticity**	**50.5**	**65**	**28**	**37**		
☒									
▲									
★									

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 3-24**	**SS3**	**2.00**				**0.0**	**1.7**	**27.8**	**70.5**
☒										
▲										
★										

CLIENT **Gastops c.o. CSV**

PROJECT **Geotechnical Investigation - Riverside South**
Buisness Park - 3700 Twin Falls Place

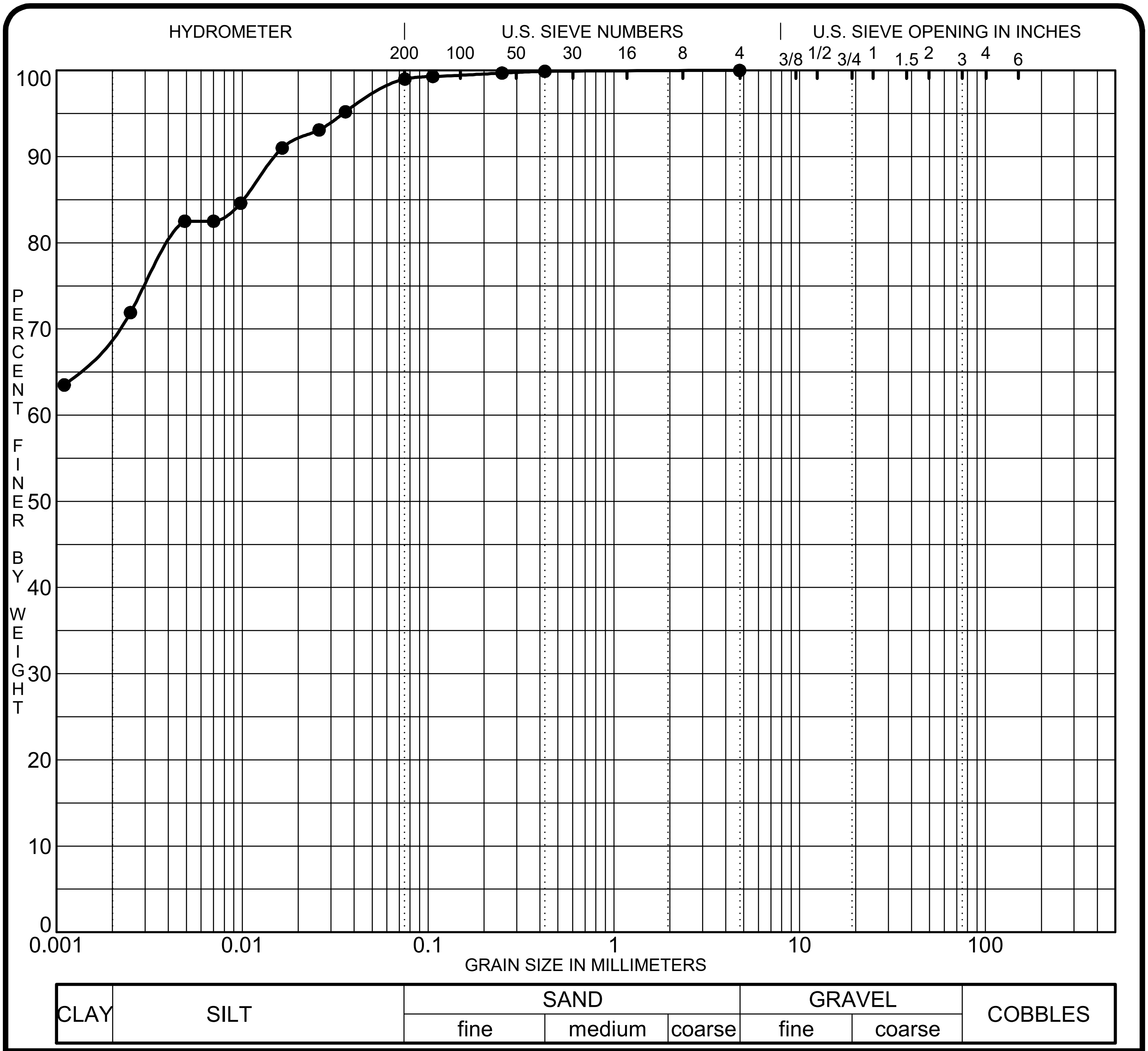
FILE NO. **PG7255**

DATE **11 Sep 24**

PATERSON GROUP

9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 4-24**	**SS3**	**CH - Inorganics clays of high plasticity**	**57.6**	**72**	**28**	**44**		
☒									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 4-24**	**SS3**	**4.75**				**0.0**	**1.0**	**29.5**	**69.5**
☒										
▲										
★										

CLIENT **Gastops c.o. CSV**

PROJECT **Geotechnical Investigation - Riverside South**
Buisness Park - 3700 Twin Falls Place

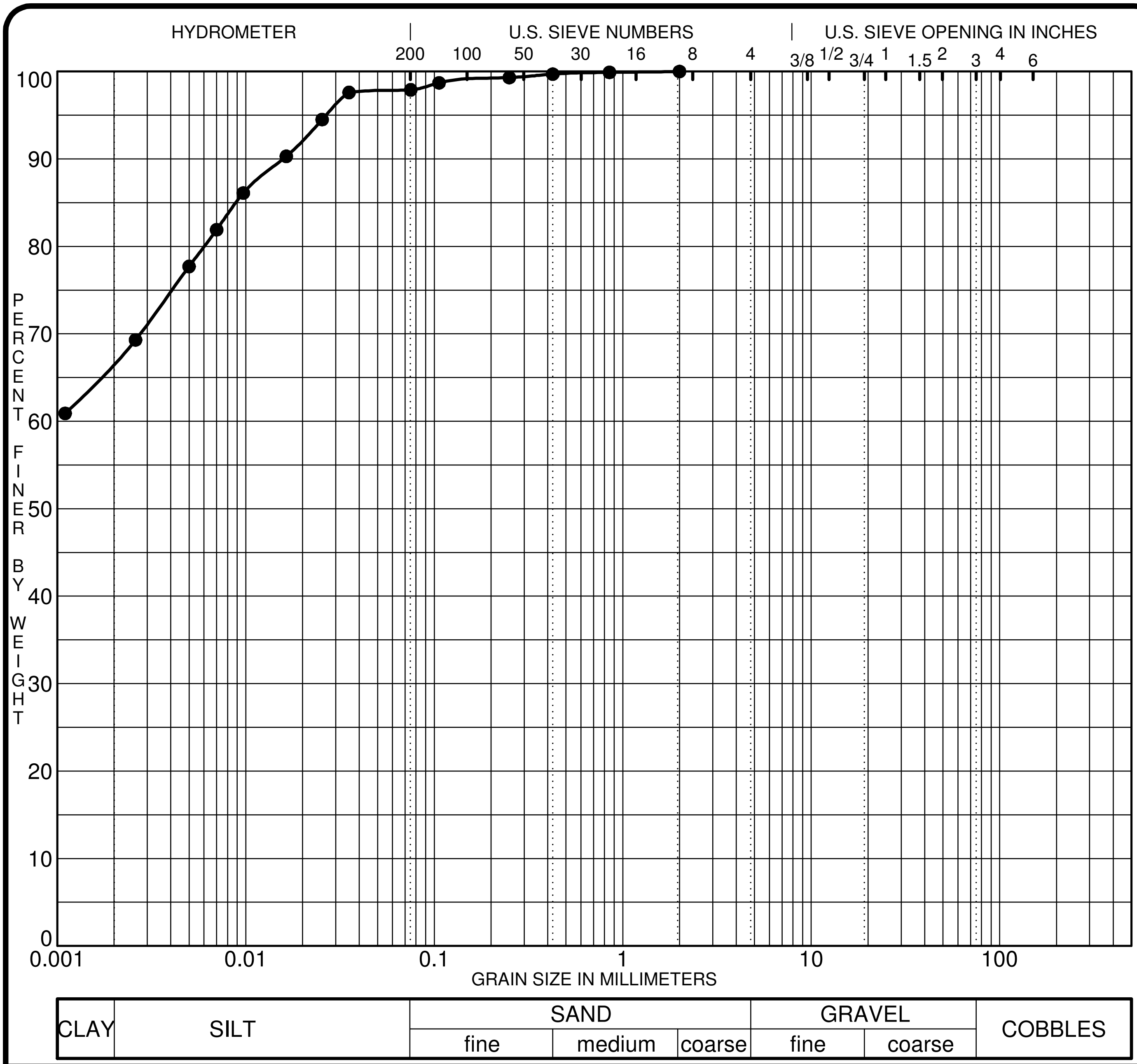
FILE NO. **PG7255**

DATE **11 Sep 24**

PATERSON GROUP

9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

GRAIN SIZE DISTRIBUTION



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **BH 1-22-EL SS2**		**41.2**					
⌧							
▲							
★							

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH 1-22-EL SS2**	**2.00**				**0.0**	**2.1**	**30.4**	**67.5**
⌧								
▲								
★								

CLIENT **Riverside South Development Corp.**

FILE NO. **PG4958**

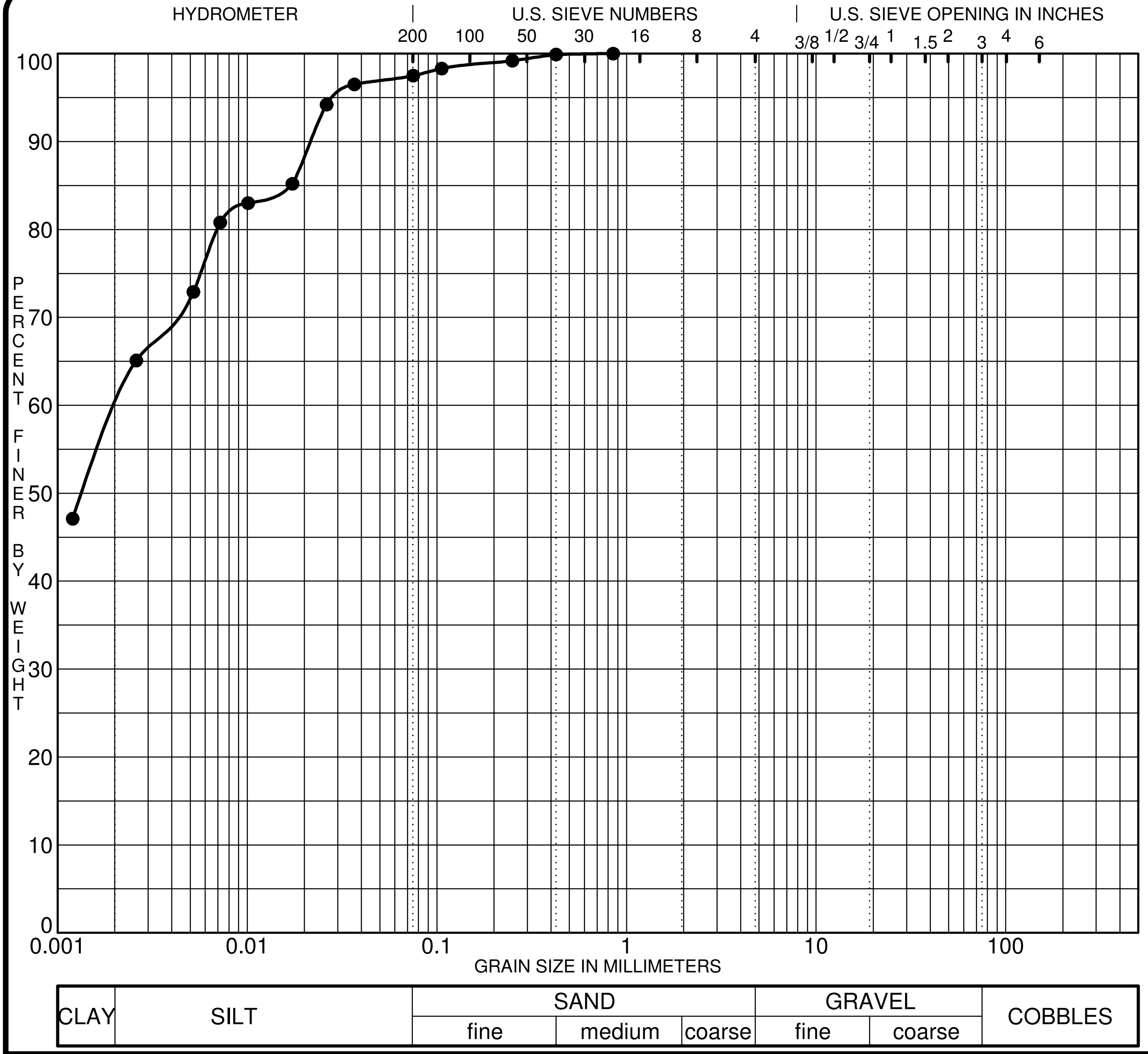
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**

DATE **22 Mar 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH11-22-EL**	**SS2**		**32.9**					
⌧									
▲									
★									

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH11-22-EL**	**SS2**	**0.85**	**0.00**			**0.0**	**2.5**	**38.0**	**59.5**
⌧										
▲										
★										

CLIENT **Riverside South Development Corp.**

FILE NO. **PG4958**

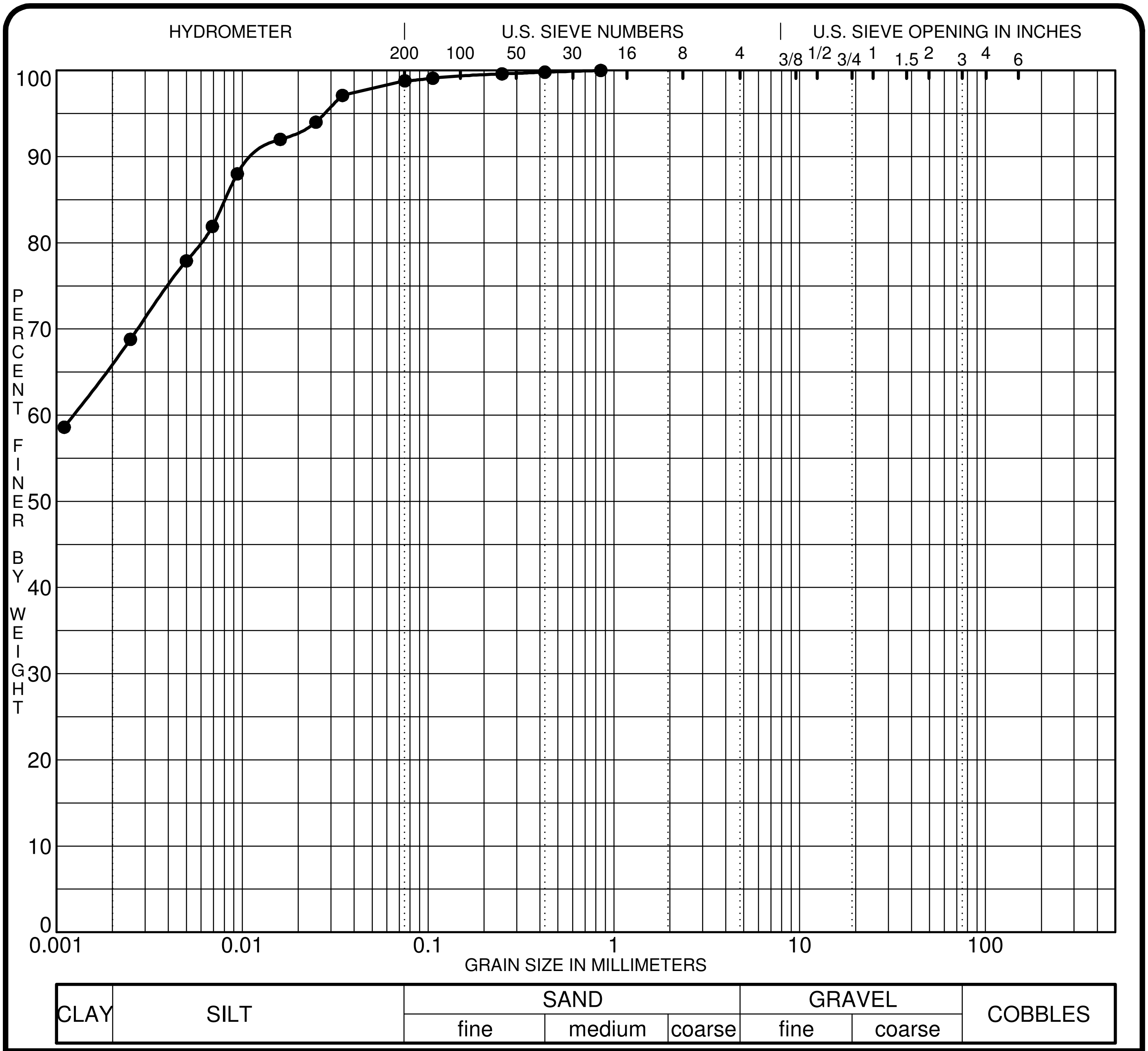
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**

DATE **31 Mar 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● **BH13-22-EL**	**SS2**		**46.7**					
☒								
▲								
★								

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH13-22-EL**	**SS2**	**0.85**	**0.00**			**0.0**	**1.2**	**32.8**	**66.0**
☒									
▲									
★									

CLIENT **Riverside South Development Corp.**
FILE NO. **PG4958**
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**
DATE **1 Apr 22**

patersongroup **Consulting Engineers**
9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION

PATERSON GROUP

Linear Shrinkage
ASTM D4943-02

CLIENT:	Gastops c/o CSV	DEPTH	7'-6" - 9'6	FILE NO.:	PG7255
PROJECT:	3700 Twin Falls Place	BH OR TP No:	BH7-24 SS3	DATE SAMPLED	04-Sep-24
LAB No:	56341	TESTED BY:	C.P	DATE RECEIVED	12-Sep-24
SAMPLED BY:	K.S.	DATE REPORTED:	26-Sep-24	DATE TESTED	13-Sep-24

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(7)	Calibration (Two Trials)	Tin NO.(x21)	
Tare	4.62	Tin	4.46	4.46
Soil Pat Wet + Tare	59.93	Tin + Grease	4.61	4.62
Soil Pat Wet	55.31	Glass	43.23	43.23
Soil Pat Dry + Tare	34.32	Tin + Glass + Water	85.11	85.11
Soil Pat Dry	29.7	Volume	37.27	37.26
Moisture	**86.23**	**Average Volume**	**37.27**	

Soil Pat + String	29.8
Soil Pat + Wax + String in Air	34.72
Soil Pat + Wax + String in Water	11.56
Volume Of Pat (Vdx)	23.16

RESULTS:

Shrinkage Limit	**20.12**
Shrinkage Ratio	**1.684**
Volumetric Shrinkage	**111.350**
Linear Shrinkage	**22.075**

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

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Riverside S Dev Co	DEPTH	5'-0" to 7'-0"	FILE NO.:	PG4958
PROJECT:	Mosquito Creek	BH OR TP No:	BH10-22 SS3	DATE SAMPLED	31-Mar
LAB No:	32302	TESTED BY:	CP/ CS	DATE RECEIVED	1-Apr
SAMPLED BY:	MF	DATE REPORTED:	8-Apr-22	DATE TESTED	6-Apr

LABORATORY INFORMATION & TEST RESULTS

Moisture	**No. of Blows(8)**	**Calibration (Two Trials)**	**Tin NO.(x215)**	
Tare	4.96	Tin	4.83	4.84
Soil Pat Wet + Tare	63.3	Tin + Grease	4.98	5
Soil Pat Wet	58.34	Glass	48.97	48.97
Soil Pat Dry + Tare	36.6	Tin + Glass + Water	91.27	91.36
Soil Pat Dry	31.64	Volume	37.32	37.39
Moisture	**84.39**	**Average Volume**	**37.36**	

Soil Pat + String	31.77
Soil Pat + Wax + String in Air	32.49
Soil Pat + Wax + String in Water	14.18
Volume Of Pat (Vdx)	18.31

RESULTS:

Shrinkage Limit	**21.64**
Shrinkage Ratio	**1.808**
Volumetric Shrinkage	**113.445**
Linear Shrinkage	**22.331**

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

Certificate of Analysis

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

Client PO: 61264

Report Date: 19-Sep-2024

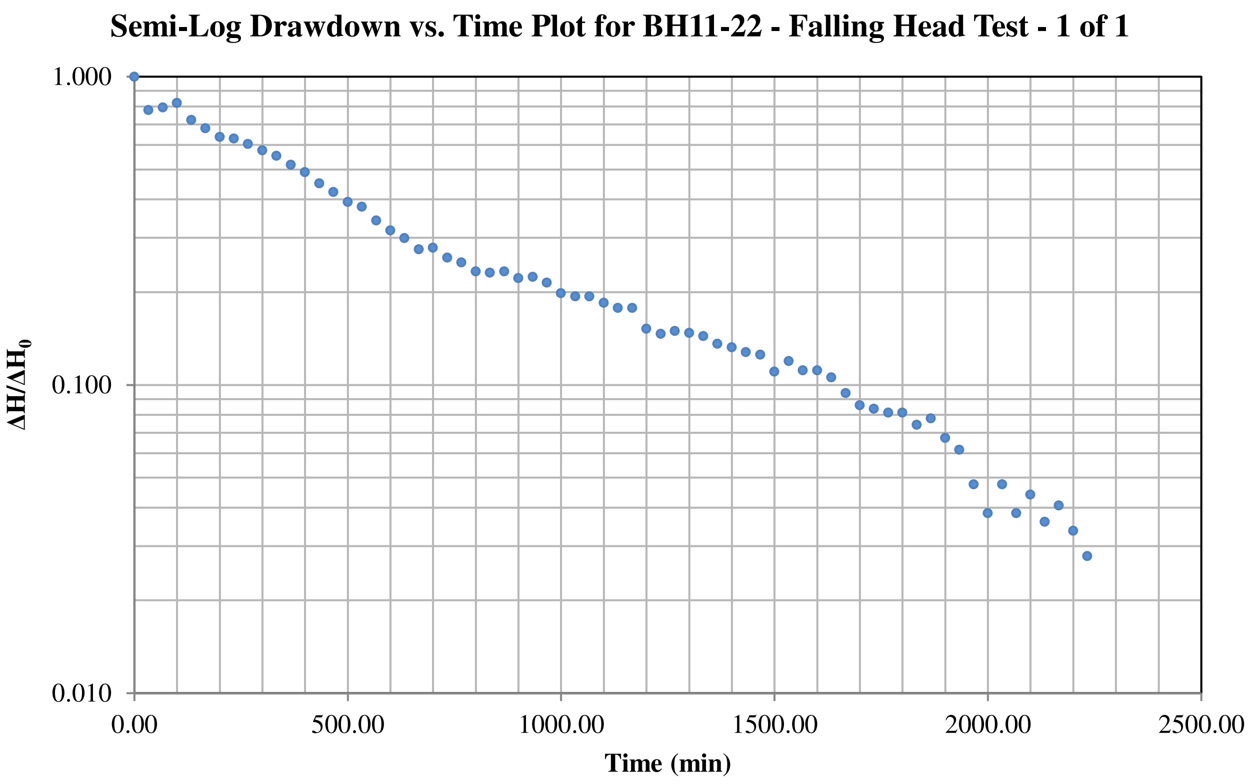
Order Date: 13-Sep-2024

Project Description: PG7255

Client ID:		BH5 -24_SS3	-	-	-	-	-
Sample Date:		11-Sep-24 09:00	-	-	-		
Sample ID:		2438029-01	-	-	-		
Matrix:		Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	82.8	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.18	-	-	-	-	-
Resistivity	0.1 Ohm.m	114	-	-	-	-	-
Anions							
Chloride	10 ug/g	<10	-	-	-	-	-
Sulphate	10 ug/g	20	-	-	-	-	-

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH11-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5 m	Saturated length of screen or open hole
D	0.0508 m	Diameter of well
r_c	0.0254 m	Radius of well

Data Points (from plot):

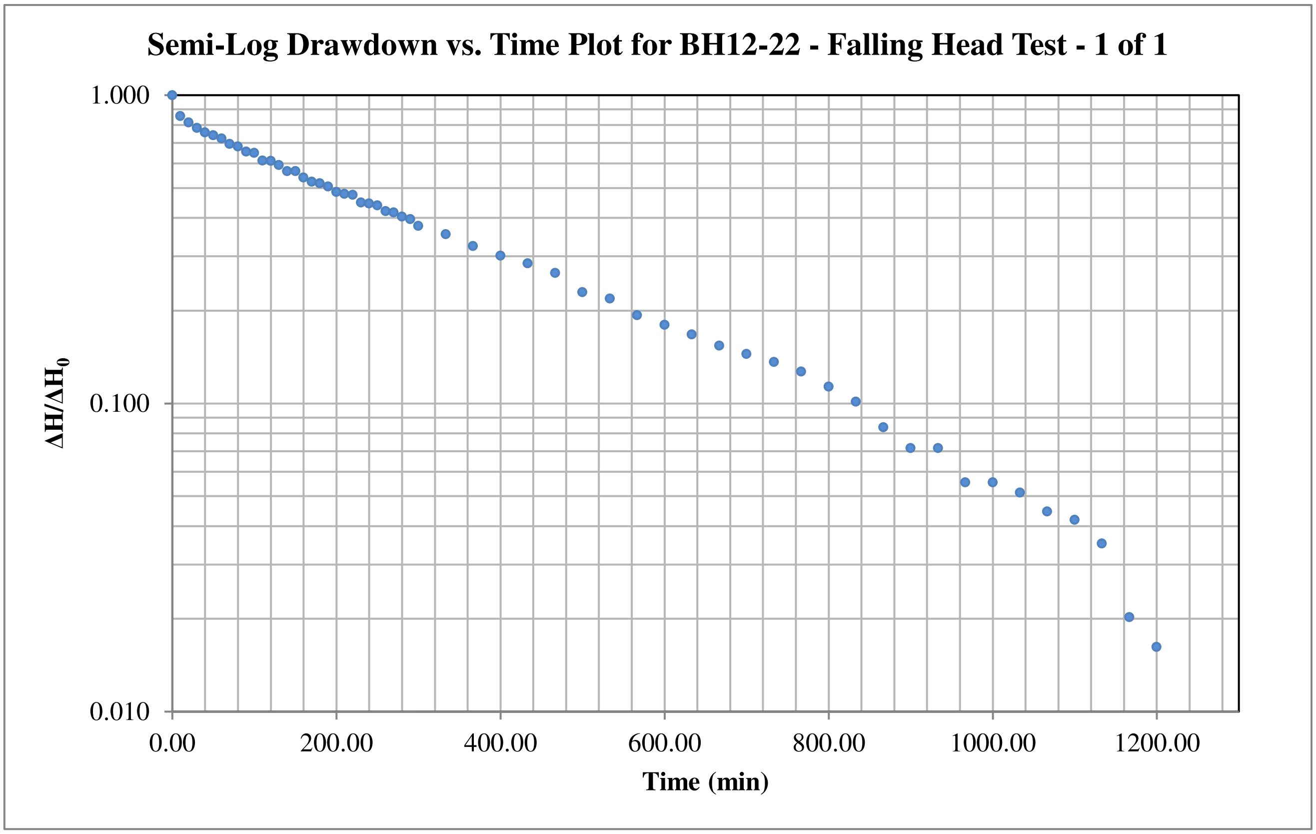
t^*: 541.073 minutes

$\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 2.69E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH12-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5 m	Saturated length of screen or open hole
D	0.0508 m	Diameter of well
r_c	0.0254 m	Radius of well

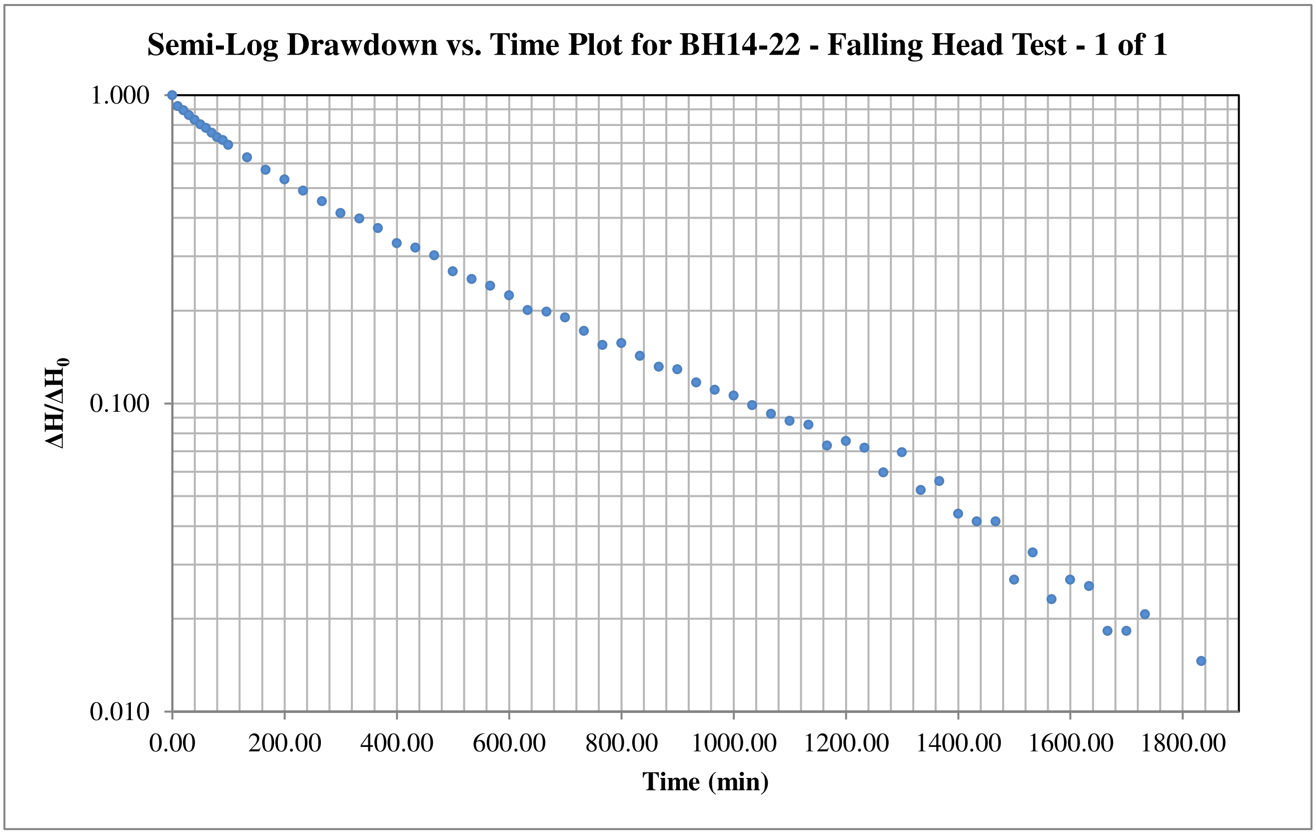
Data Points (from plot):

t*: 310.196 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 4.69E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH14-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t*} \ln\left(\frac{\Delta H *}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

Data Points (from plot):

t*: 349.547 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 4.16E-08 m/sec

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURES 2 AND 3 – SEISMIC SHEAR WAVE VELOCITY PROFILES

DRAWING PG7255-1 - TEST HOLE LOCATION PLAN

DRAWING PG7255-2 – TREE PLANTING SETBACK PLAN

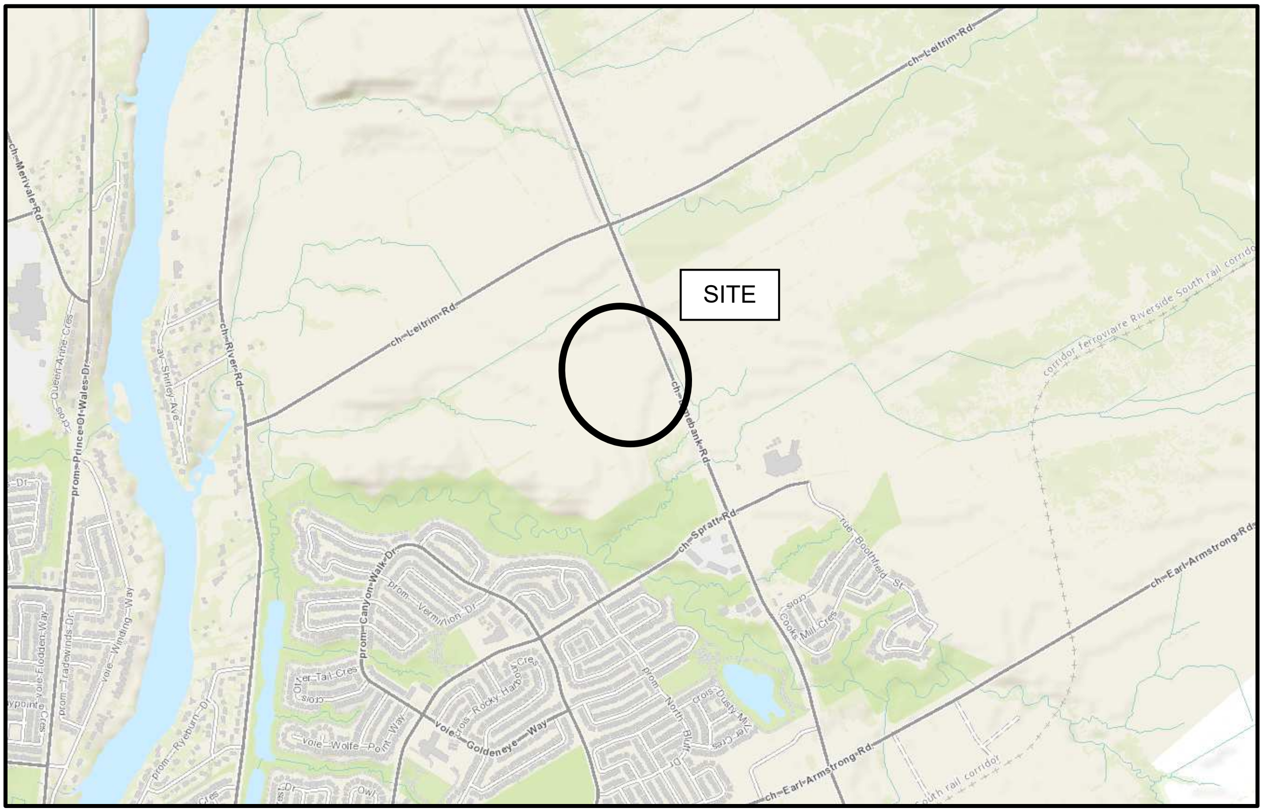


FIGURE 1

KEY PLAN

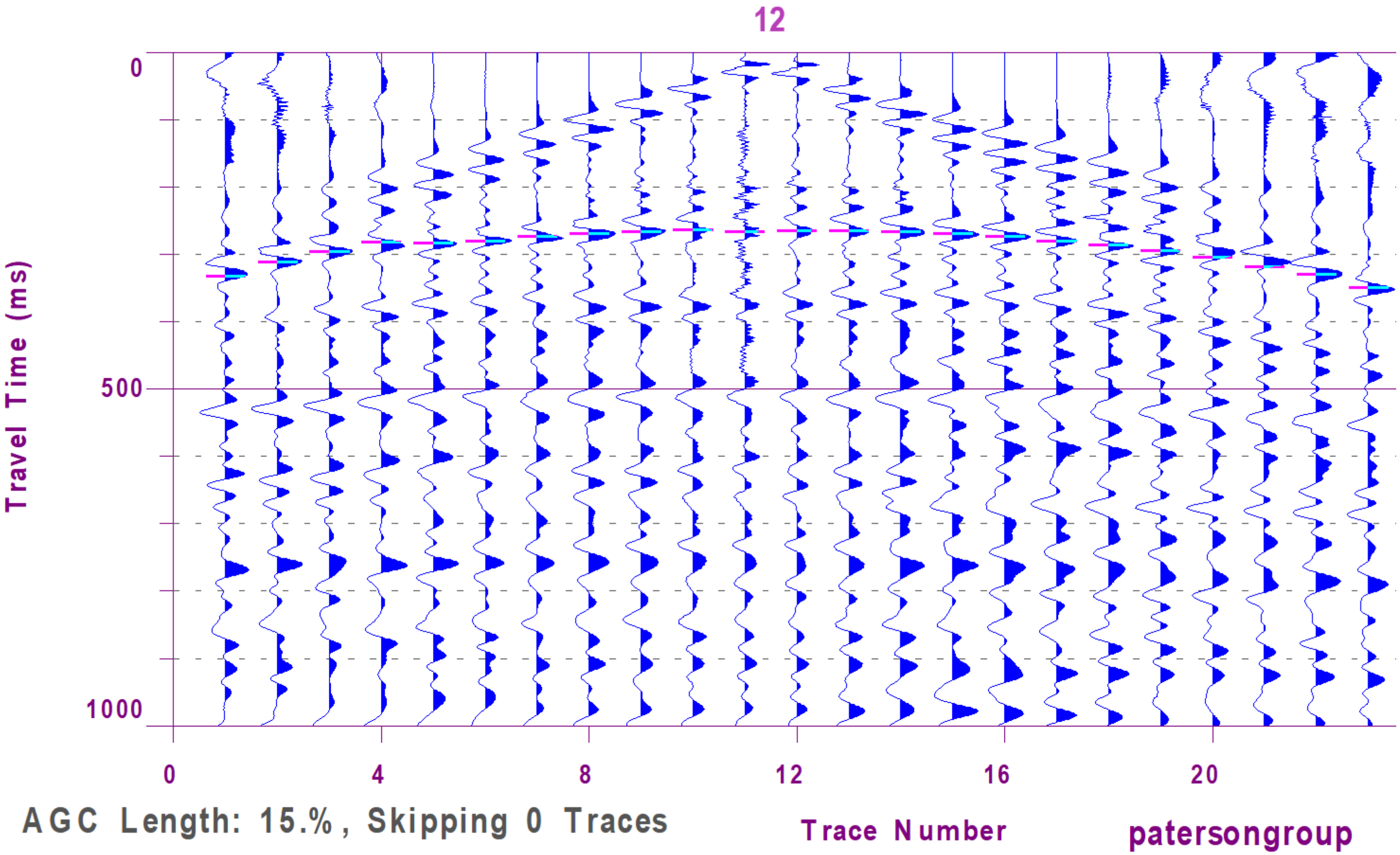


Figure 2 – Shear Wave Velocity Profile at Shot Location 34.5 m

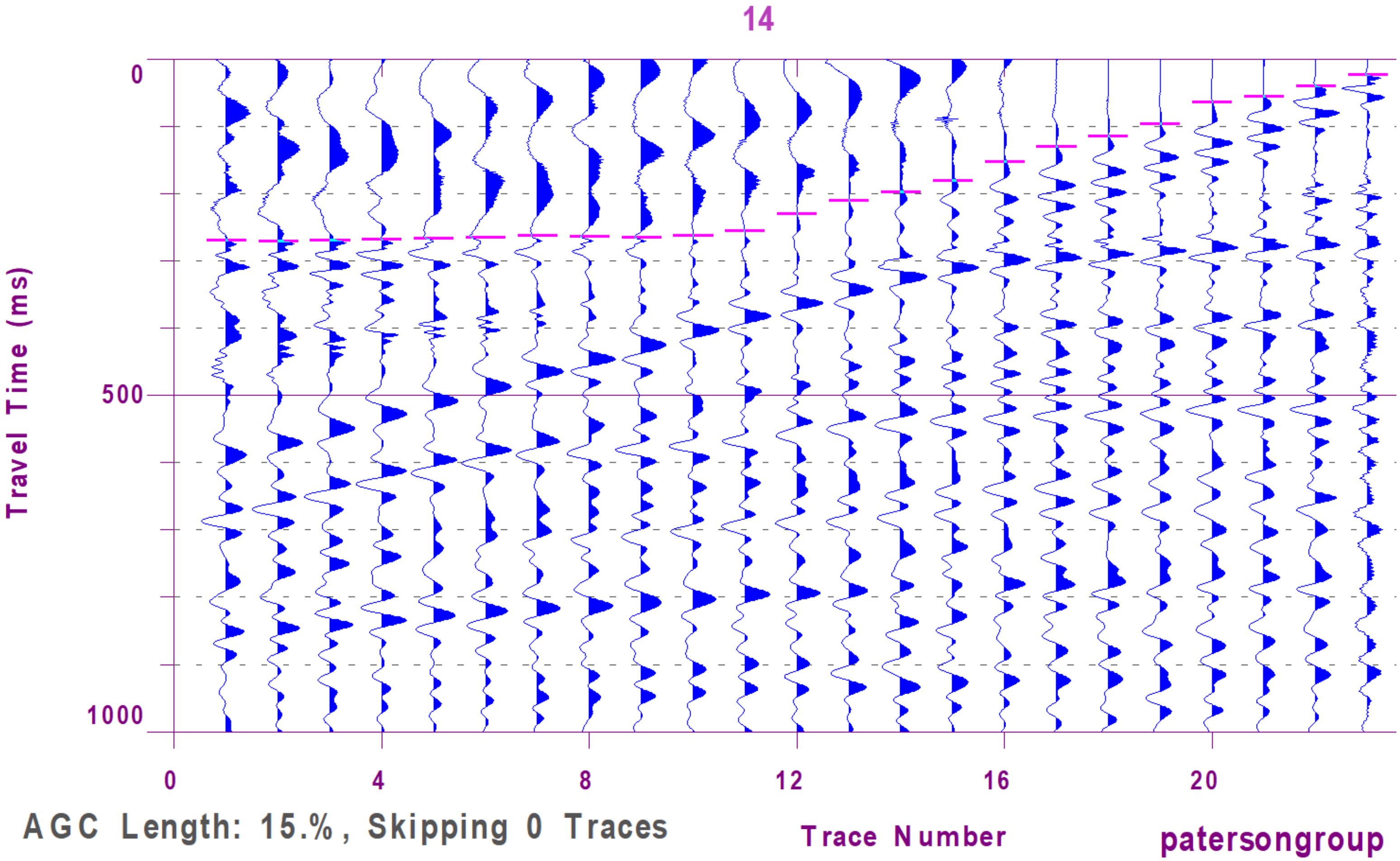
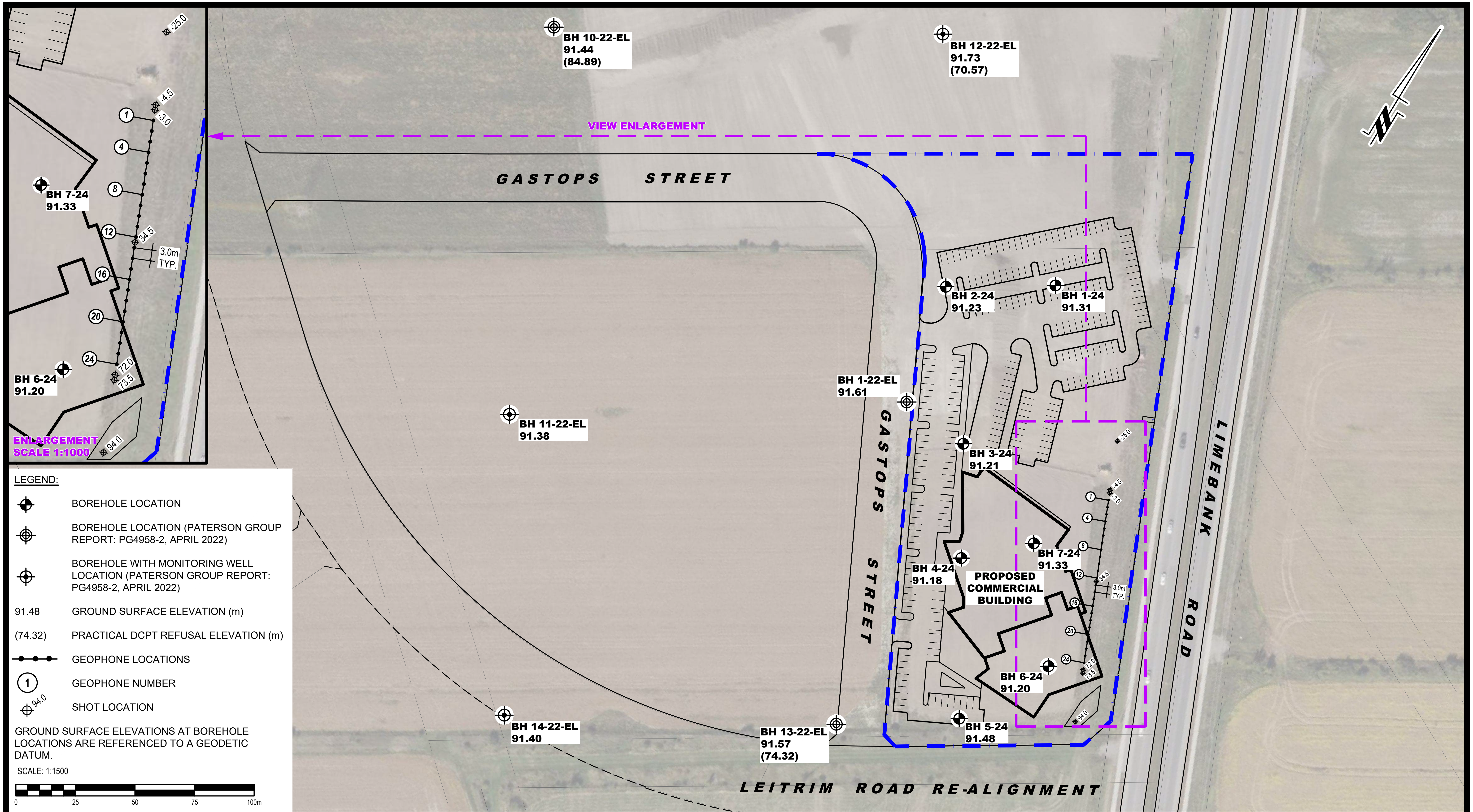


Figure 3 – Shear Wave Velocity Profile at Shot Location 72 m



LEGEND:

⊕	BOREHOLE LOCATION
⊕	BOREHOLE LOCATION (PATERSON GROUP REPORT: PG4958-2, APRIL 2022)
⊕	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT: PG4958-2, APRIL 2022)
91.48	GROUND SURFACE ELEVATION (m)
(74.32)	PRACTICAL DCPT REFUSAL ELEVATION (m)
●—●—●	GEOPHONE LOCATIONS
①	GEOPHONE NUMBER
⊠ 94.0	SHOT LOCATION

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

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

GASTOPS C.O. CSV
GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3700 TWIN FALLS PLACE - BLOCK 2

OTTAWA, ONTARIO

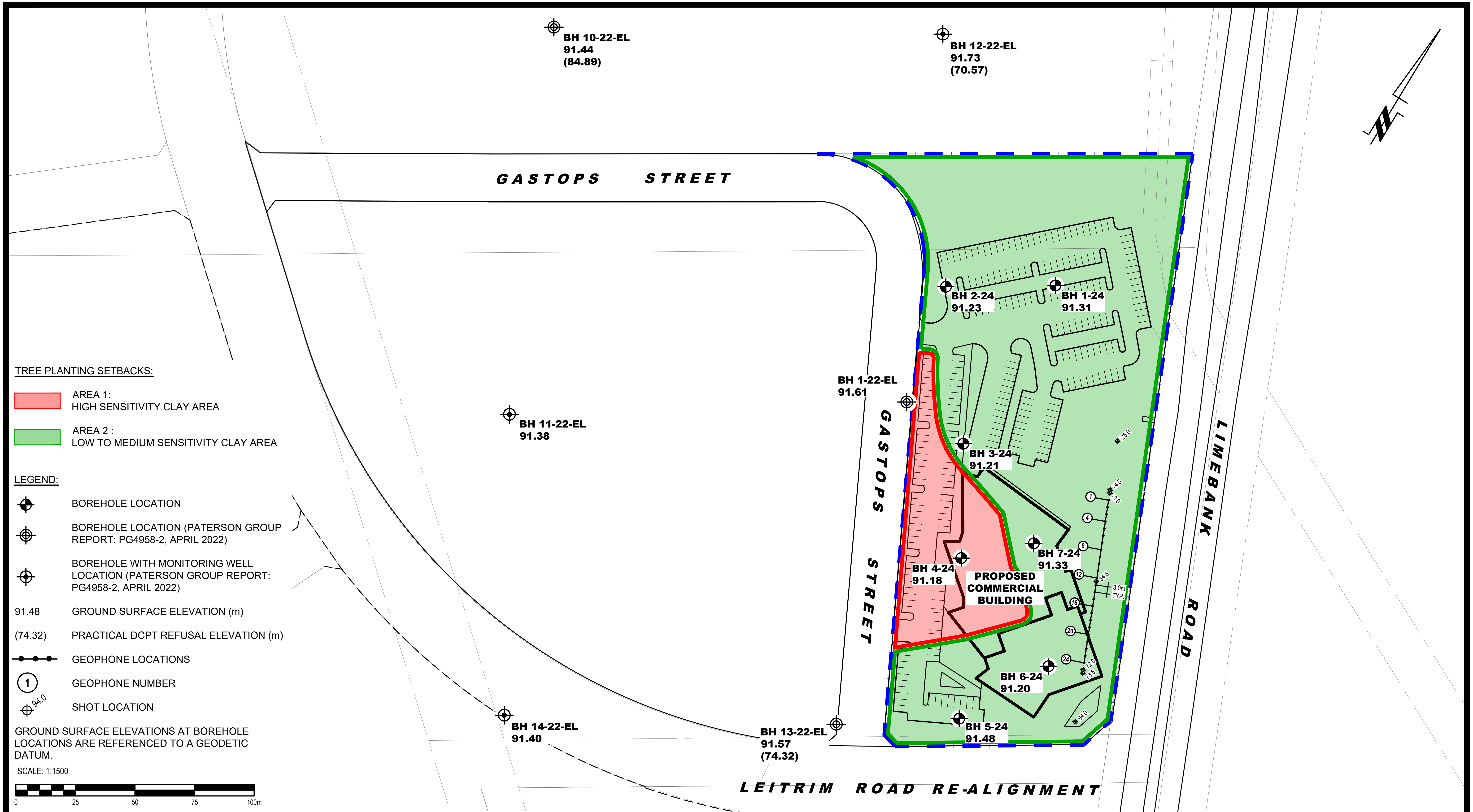
Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500
Date: 10/2024
Drawn by: ZS
Report No.: PG7255-1
Checked by: NP
Dwg. No.: PG7255-1
Approved by: DJG
Revision No.:

p:\autocad drawings\geotechnical\pg72xx\pg7255\pg7255-1-test hole location plan.dwg

11x17



TREE PLANTING SETBACKS:

🟥 AREA 1:
HIGH SENSITIVITY CLAY AREA

🟩 AREA 2 :
LOW TO MEDIUM SENSITIVITY CLAY AREA

LEGEND:

⊕	BOREHOLE LOCATION
⊕	BOREHOLE LOCATION (PATERSON GROUP REPORT: PG4958-2, APRIL 2022)
⊕	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT: PG4958-2, APRIL 2022)
91.48	GROUND SURFACE ELEVATION (m)
(74.32)	PRACTICAL DCPT REFUSAL ELEVATION (m)
●–●–●	GEOPHONE LOCATIONS
①	GEOPHONE NUMBER
⊕ 94.0	SHOT LOCATION

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

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

GASTOPS C.O. CSV
GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3700 TWIN FALLS PLACE - BLOCK 2

OTTAWA, ONTARIO

Title:

TREE PLANTING SETBACK PLAN

Scale: 1:1500	Date: 10/2024
Drawn by: ZS	Report No.: PG7255-1
Checked by: NP	Dwg. No.: PG7255-2
Approved by: DJG	Revision No.:

11x17

p:\autocad drawings\geotechnical\pg72xx\pg7255\pg7255-1-test hole location plan.dwg