PATERSON GROUP

Geotechnical Investigation

Proposed Mixed-Use Development

Town Center Phase 7A - Riverside South
Ottawa, Ontario

Prepared for Riverside South Limited Partnership

Report PG4958-6 dated June 20, 2024

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Riverside South Limited Partnership to conduct a geotechnical investigation for the proposed mixed-use development, referred to as Town Center Phase 7A, to be located at the south-west quadrant of Limebank Road and Earl Armstrong Road within the Riverside South development in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

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

Details of the proposed mixed-use development were not known at the time of writing this report. However, based on available zoning information, it is understood that the proposed development will consist of five blocks with high-rise structures up to a maximum height of 30-storeys and 3 blocks with structures up to a maximum height of 9-storeys. Details of proposed underground parking levels are not known at this time. The development will also have a school block and a park block. Further, local roadways are also planned for the proposed development. The development is anticipated to 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 between April 2 to April 8, 2024, and consisted of advancing a total of 19 boreholes to a maximum depth of 11.3 m below the existing ground surface. In addition, a number of previous investigations have been carried out by Paterson and others within the subject site and on adjacent sites in the last several years.

The test hole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and site features. The borehole locations from the current investigation and relevant boreholes from previous investigations are shown on Drawing PG4958-19 - Test Hole Location Plan included in Appendix 2.

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

Sampling and In Situ Testing

Soil samples were collected from the 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, 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 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 overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at boreholes BH 3-24, BH 11-24, and BH 18-24. The DCPT testing 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.

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

Groundwater

Boreholes BH 1-24, BH 7-24, BH 8-24, BH 13-24, and BH 17-24 were fitted with 51 mm diameter PVC groundwater monitoring wells. The other boreholes were fitted with flexible piezometers to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. 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 or less, as needed depending on the soil profile, 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 the 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.

3.2 Field Survey

The borehole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high precision GPS and referenced to a geodetic datum. The location of the boreholes and ground surface elevation at each test hole location are presented on Drawing PG4958-19 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of 12 Atterberg limits tests, 2 linear shrinkage analysis, and 7 hydrometer tests were completed on selected soil samples. Moisture content testing was completed on all recovered soil samples from the current investigation. The results of the testing are presented in Subsection 4.2 and are provided in Appendix 1.

Sample Storage

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

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 collected from BH 1-24 and submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is located on the south-west quadrant of the intersection of Limebank Road and Earl Armstrong Road. The site is currently largely undeveloped and predominately consists of agricultural land with some tree covered areas and an asphalt access lane located on the north-east side of the site. Construction on the future O-Train network extension is currently underway running east-west through the central portion of the site.

The subject site is bordered by Earl Armstrong Road followed by a residential development and a currently under construction commercial development to the north. Further, the site is bordered by Limebank Road followed by agricultural lands to the east, agricultural lands to the south, and by a densely treed area followed by a residential development to the west. The ground surface across the subject site gradually slopes down towards the north at approximate geodetic elevations of 94.0 to 91.5 m. The site is located below grade of surrounding roadways.

4.2 Subsurface Profile

Overburden

The subsurface profile at the test hole locations consists of a thin topsoil layer underlayin by alternating layers of a loose to compact silty sand to sandy silt, silty clay, and clayey silt. Generally, the soil profile consists of an approximately 0.7 to 2.4 m thick silty sand to sandy silt deposit overlaying a silty clay deposit. In some locations a thin layer of silty clay was encountered directly below the topsoil and overlaying the silty sand layer.

The silty clay deposit was encountered at all test hole locations and generally consisted of a very stiff to stiff brown silty clay crust overlaying a stiff to firm grey silty clay deposit. The presence of the brown silty clay crust layer directly overlaying the grey silty clay was absent at the location of boreholes BH 2-24, BH 5-24, BH 6-24, BH 8-24, and BH 9-24. The silty clay deposit was found to extend as deep as over 11.3 m below the existing ground surface and was generally observed to be underlayin by a thin deposit of clayey silt across the majority of the site. At the location of boreholes BH 12-24, BH 12A-24, and BH 12B-24 the silty clay deposit was observed at ground surface and directly overlayed the glacial till deposit at a depth of approximately 2.9 m below the existing ground surface.

A deposit of glacial till was observed at depths of approximately 2.6 to 9.6 m below the existing ground surface in BH 1-24, BH 3-24, BH 6-24, BH 7-24, BH 8-24, BH 12-24, BH 12A-24, and BH 13-24. The glacial till deposit generally consists of compact to dense, grey clayey silt, grey silty sand to sandy silt, or grey silty clay with variable amounts of gravel, cobbles, and boulders.

Practical refusal to augering or DCPT testing was encountered at BH 3-24, BH 11-24, BH 12-24, BH 12A-24, BH 12B-24, and BH 18-24 at depths ranging from 2.9 to 14.3 m below the existing ground surface.

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 local bedrock consists of interbedded sandstone and dolomite of the March Formation. The overburden thickness is generally anticipated to range between approximately 5 to 15 m.

Atterberg Limits Testing

Atterberg limits testing was completed on select silty clay samples recovered from BH 1- 24, BH 3-24, BH 4-24, BH 5-24, BH 6-24, BH 7-24, BH 8-24, BH 11-24, BH 14-24, BH 15-24, BH 17-24, and BH 18-24. The results of the Atterberg limits tests is presented in Table 1 and on the Atterberg Limits Testing Results sheet in Appendix 1.

Table 1 - Atterberg Limits Results						
Sample	**Depth (m)**	**LL (%)**	**PL (%)**	**PI (%)**	**w (%)**	**Classification**
BH 1-24-SS4	2.59	24	13	11	34	CL
BH 3-24-SS4	2.59	63	28	35	56	CH
BH 4-24-SS4	2.59	36	16	20	29	CL
BH 5-24-SS3	2.59	36	18	18	34	CL
BH 6-24-SS4	2.59	33	16	17	32	CL
BH 7-24-SS3	1.83	34	17	17	29	CL
BH 8-24-SS4	2.59	35	17	18	33	CL
BH 11-24-SS4	2.59	30	16	14	35	CL
BH 14-24-SS3	1.83	40	18	22	38	CL
BH 15-24-SS3	1.83	36	14	22	33	CL
BH 17-24-SS4	2.59	37	16	21	33	CL
BH 18-24-SS4	2.59	31	15	16	32	CL

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: Water Content,
CL: Inorganic Clay of Low Plasticity, CH: Inorganic Clay of High Plasticity,
ML: Inorganic Silt of Low Plasticity, MH: Inorganic Silt of High Plasticity

Grain Size Distribution Testing

7 hydrometer tests were completed on selected recovered silty clay samples to classify selected soil samples according to the Unified Soil Classification System (USCS). The results are summarized in Table 2 and presented in Appendix 1.

Table 2 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 3-24-SS4	2.59	0.0	6.1	44.4	49.5
BH 5-24-SS3	2.59	0.0	28.0	48.0	24.0
BH 6-24-SS4	2.59	0.0	30.6	47.4	22.0
BH 8-24-SS4	2.59	0.0	25.4	55.1	19.5
BH 14-24-SS3	1.83	0.0	36.3	35.2	28.5
BH 17-24-SS3	2.59	0.0	17.5	55.5	27.0
BH 19-24-SS4	2.59	0.0	16.8	45.2	38.0

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

Shrinkage Testing

2 linear shrinkage tests were completed on selected recovered Silty clay samples to determine planting setbacks. The results are summarized in Table 3 and presented in Appendix 1.

Table 3 – Shrinkage Testing

Sample	Depth (m)	Shrinkage Limit	Shrinkage Ratio
BH 4-24-SS4	2.59	14.53	1.93
BH 7-24-SS3	1.83	16.64	1.86

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

4.3 Groundwater

Groundwater levels were recorded in the monitoring wells and piezometers installed at the borehole locations on April 18, 2024. The groundwater level readings at that time are presented in Table 4 and are noted on the applicable Soil Profile and Test Data sheets in Appendix 1.

Table 4 – Summary of Groundwater Level Readings

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1-24	93.09	0.43	92.66	April 18, 2024
BH 2-24	92.31	0.08	92.23	
BH 3-24	93.60	0.67	92.93	
BH 4-24	93.12	0.28	92.84	
BH 5-24	92.60	1.03	91.57	
BH 6-24	92.55	1.84	90.71	
BH 7-24	92.31	0.40	91.91	
BH 8-24	92.50	2.18	90.32	
BH 9-24	91.69	0.72	90.97	
BH 10-24	92.32	0.10	92.22	
BH 11-24	92.31	1.05	91.26	
BH 12B-24	93.47	0.30	93.17	
BH 13-24	93.05	1.26	91.79	
BH 14-24	92.32	0.37	91.95	
BH 15-24	92.21	0.41	91.8	
BH 16-24	92.30	1.36	90.94	
BH 17-24	91.89	1.48	90.41	
BH 18-24	91.96	0.35	91.61	
BH 19-24	91.62	0.18	91.44	

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS and are referenced to 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.

The Long-term groundwater levels can also be estimated based on the observed color, consistency, and moisture content of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximately **2.5 to 3.5 m** below the existing ground surface. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. The details of the future development were not known at the time of writing this report. Based on available zoning information, it is anticipated that the future development will generally consist of several low-rise, mid-rise, and high-rise buildings of slab-on-grade construction, or with one or more basement levels. Since design details of the proposed mixed-use buildings are not known at this time, geotechnical design information provided in this report may only be considered preliminary for proposed buildings. Once design details have been developed for the subject site, development-specific recommendations may be provided at that time. Preliminary recommendations have been provided herein for future consideration. Further, due to the size of the subject site and the nature of the proposed buildings, a supplemental geotechnical field investigation will be required to provide specific design details for proposed buildings.

For preliminary design purposes, it is expected that the proposed low-rise and mid-rise buildings may be founded on conventional shallow spread footings placed on an undisturbed compact silty sand to sandy silt, very stiff to firm silty clay, compact clayey silt, compact to dense glacial till, or a surface sounded bedrock bearing surface. The proposed high-rise buildings may be founded on conventional shallow spread footings placed on a surface sounded bedrock bearing surface.

However, for cases where loads exerted by proposed mid-rise buildings founded on an overburden soil bearing surface exceed the bearing resistance values provided herein, or where proposed high rise buildings are expected to be founded within the overburden soils, it is recommended that the proposed buildings be supported on end-bearing piles extending to the bedrock surface or a raft foundation. Foundation design options are further discussed in Subsection 5.3.

Where the silty sand to sandy silt subgrade below buildings and paved areas is found to be in a loose state of compaction, proof rolling using a suitably sized roller should be completed under dry conditions and above freezing temperatures to achieve optimum compaction levels.

Due to the groundwater level within the glacial till layer at some locations throughout the site, a significantly high groundwater in-flux may be observed during the installation of site servicing and construction of basement levels, where excavations extend below the groundwater table. Trench excavations below the water level in non-cohesive soils, such as silty sand, have the potential for basal heave to occur if groundwater is not controlled during the excavation work.

A series of well points may be required to control groundwater in-flow for excavations that extend below the water table. It is assumed that the excavations will be carried out within the confines of a fully braced trench box or other acceptable shoring system designed by a qualified engineer to resist the design lateral earth pressures and potential basal heave issues.

Due to the presence of a silty clay deposit, the proposed grading throughout the subject site will be subjected to a permissible grade restriction. Permissible grade raise recommendations are discussed in Subsection 5.3. 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.

Bedrock removal may be required to complete the excavations for basement levels of proposed high-rise buildings. Line drilling and controlled blasting where large quantities of bedrock need to be removed is recommended. All contractors should be prepared for bedrock and oversized boulder removal. The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations.

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 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 sub-excavation of the disturbed material and the placement of additional suitable fill material.

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 footprints of low to mid-rise buildings, or below the floor slab of high-rise buildings 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).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill and beneath exterior parking 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 at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in a maximum 300 mm thick loose lift to at least 95% 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, connected to a perimeter drainage system.

Bedrock Removal

If required, bedrock removal can be accomplished by hoe ramming where only small quantities of the bedrock need to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing surrounding services, buildings, LRT, and other structures should be addressed. A pre-blast or pre-construction survey of the existing adjacent structures located in the proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries or claims related to the blasting operations. It should be noted that a Vibration Monitoring Control Plan (VMCP) may be required to address vibration monitoring for the LRT.

As a general guideline, peak particle velocities (measured at the structures) should not exceed the below noted vibration limits during the blasting program to reduce the risks of damage to the existing surrounding structures. The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Excavation side slopes in sound bedrock can be carried out using near vertical sidewalls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing of the overburden. The 1 m horizontal ledge setback can be eliminated with a shoring program which has drilled piles extending below the proposed founding elevation.

Vibration Considerations

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

The following construction equipment could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 20 mm/s for frenquicies equal to or less than 40 Hz, and below 50 mm/s above a frequency of 40 Hz. These guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to be completed to minimize the risks of claims during or following the construction of the proposed buildings. It should be noted that lower peak particle velocity limits may be required for construction activities near the LRT.

5.3 Foundation Design

Bearing Resistance Values

Conventional Shallow Foundations

Using continuously applied loads, strip footings, up to 3 m wide, and pad footings, up to 5 m wide for the proposed buildings with shallow foundations can be designed using the bearing resistance values presented in Table 5.

Table 5 - Bearing Resistance Values

Bearing Surface	Bearing Resistance Value at SLS (kPa)	Factored Bearing Resistance Value at ULS (kPa)
Compact brown silty sand to sandy silt	100	150
Very stiff to Stiff brown silty clay	125	200
Stiff to Firm Grey Silty Clay	75	125
Compact Grey Clayey Silt	75	125
Compact to Dense Glacial Till	150	225
Clean, Surface-Sounded Bedrock	-	1,500

Note: A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance values at ULS.

The bearing resistance values are provided on the assumption that the footings will be placed on undisturbed soil bearing surfaces. An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen, or disturbed soil, whether in-situ or not, have been removed, prior to placement of concrete for footings. A clean surface-sounded bedrock bearing surface should be free of loose materials, and have no near or surface seams, voids, fissures, or open joints which can be detected from surface sounding with a rock hammer.

Raft Foundations

Should the proposed bearing resistance values for conventional footings be deemed insufficient for support of the proposed mid to high-rise buildings, consideration may be given to foundation support by a raft slab foundation structure. However, the geotechnical design of a raft slab is dependant on the number of below grade levels that are to be provided for the proposed buildings, the anticipated founding medium, as well as the overburden soils present within the location of the proposed building that will be removed for the excavation of the proposed building. Therefore, details regarding contact pressure and subgrade modulus can be provided when details of the proposed development are known.

As a preliminary recommendation, where a raft slab is utilized, it is recommended that a minimum 50 mm thick lean concrete mud slab be placed on an undisturbed soil subgrade surface shortly after the excavation and preparation of the bearing medium. The main purpose of the mud slab is to reduce the risk of disturbance of the subgrade under the traffic of workers and equipment.

It should be noted that where the subgrade consists of silty clay, the final excavation to the raft slab bearing surface level and the placing of the mud slab should be done in smaller sections to avoid exposing large areas of the silty clay to avoid potential disturbance due to drying.

The raft slab should incorporate a waterproofing membrane system along with the perimeter foundation walls if the basement slab is expected to be below the long term groundwater level.

End Bearing Driven Piled Foundation

A deep foundation method, such as end bearing piles, may be considered for the foundation support of the proposed high-rise buildings should their loading exceed the load bearing capacities provided.

For deep foundations, concrete-filled steel pipe piles are generally utilized in the Ottawa area. Applicable pile resistance at SLS values and factored pile resistance at ULS values are given in Table 6. A resistance factor of 0.4 has been incorporated into the factored ULS values. Note that these are all geotechnical axial resistance values.

The geotechnical pile resistance values were estimated using the Hiley dynamic formula, to be confirmed during pile installation with a program of dynamic monitoring. For this project, the dynamic monitoring of two (2) to four (4) piles would be recommended. This is considered to be the minimum monitoring program, as the piles under shear walls may be required to be driven using the maximum recommended driving energy to achieve the greatest factored resistance at ULS values.

Re-striking of all piles at least once will also be required after at least 48 hours have elapsed since initial driving.

Table 6 - Pile Foundation Design Data

Pile Outside Diameter (mm)	Pile Wall Thickness (mm)	Geotechnical Axial Resistance		Final Set (blows/12 mm)	Transferred Hammer Energy (kJ)
		SLS (kN)	Factored at ULS (kN)		
245	9	940	1130	10	29
245	11	1175	1410	10	35
245	13	1375	1650	10	42

The minimum centre-to-centre pile spacing is 2.5 times the pile diameter. The closer the piles are spaced, however, the more potential that the driving of subsequent piles in a group could have influence on piles in the group that have already been driven. These effects, primarily consisting of uplift of previously driven piles, are checked as part of the field review of the pile driving operations.

Prior to the commencement of production pile driving, a limited number of indicator piles should be installed across the site. It is recommended that each indicator pile be dynamically load tested to evaluate pile stresses, hammer efficiency, pile load transfer, and end-of-driving criteria for end-bearing piles.

Buildings founded on piles driven to refusal in the bedrock will have negligible post-construction settlement.

It should be noted that end-bearing piles are only considered suitable if sufficient space for embedment below the foundation is available for end-fixity and lateral load resistance. Other methods such as rock socketed piles or end-bearing caissons could instead be considered if sufficient embedment cannot be accomplished. Detailed design information may be provided once additional details are known for the proposed development.

Park Structures

The following design parameters may be considered for thickened edge concrete slabs for park structures (if applicable).

Thickened edge concrete slabs for park structures, placed upon an approved engineered fill pad consisting of 450 mm of OPSS Granular A, can be designed using a bearing resistance value at serviceability limit states (SLS) of **75 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **125 kPa**. The engineered fill material should be placed over an undisturbed approved soil subgrade, in maximum 300 mm thick loose lifts and compacted to a minimum of 98% SPMDD with suitable compaction equipment.

An undisturbed soil subgrade 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 granular material.

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. Above the groundwater level, adequate lateral support is provided to the in-situ bearing medium soils or engineered fill 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 or engineered fill of the same or higher capacity as that of the bearing medium.

Adequate lateral support is provided to a bedrock bearing medium when a plane extending down and out from the bottom edges of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A heavily fractured, weathered bedrock and/or overburden bearing medium will require a lateral support zone of 1H:1V (or flatter).

Settlement

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

Footings bearing on an acceptable bedrock bearing surface or buildings founded on end-bearing piles extending to the bedrock surface and designed for the bearing resistance values provided herein will be subjected to negligible potential postconstruction total and differential settlements.

Proof Rolling and Subgrade Improvement for Loose Sand Below Footings

Where the silty sand to sandy silt bearing surface for foundations is considered loose by Paterson at the time of construction, it may be recommended to proof roll the bearing surface using suitable compaction equipment prior to forming for foundations. Improving the bearing surface compaction will provide a suitable bearing medium.

Depending on the looseness and degree of saturation at the time of construction, other measures (additional compaction, dewatering, mud-slab, sub-excavation and reinstatement of crushed stone fill) may be recommended to accommodate site conditions at the time of construction. However, these considerations would be evaluated at the time of construction by Paterson on a footing-specific basis.

Permissible Grade Raise Recommendations

Due to the presence of the silty clay deposit, a permissible grade raise restriction is recommended. The recommended grade raise restrictions are shown on Drawing PG4958-20 – Permissible Grade Raise Plan included in Appendix 2. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise calculations.

It should be noted that a previous test fill pile program was carried out at the site from December 2019 to December 2020. The program consisted of two 30 x 30 m pads each containing two settlement plates, the height of the fill pads ranged from approximately 2.1 to 2.4 m above the existing ground surface. The location of the test fill pads is shown on drawing PG4958-19 – Test Hole Location Plan and the results are presented in Figure 2 – Test Fill Pile Settlement Monitoring Program Area B in Appendix 2.

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

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D** for foundations founded upon a silty sand or silty clay bearing medium and as **Class C** for foundations founded upon a glacial till or bedrock bearing medium for foundations considered at the subject site.

Higher site classes such as Class A or Class B may be provided for buildings founded upon or within 3 m of the bedrock surface. However, they would have to be confirmed by site specific shear wave velocity testing. Such testing may be considered once more detailed plans are available for the proposed development. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest version of the Ontario Building Code (OBC) 2012 for a full discussion of the earthquake design requirements.

5.5 Basement Floor Slab/Slab on Grade Construction

With the removal of all topsoil and deleterious materials within the footprint of the proposed buildings, 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 basement floor slab or slab on grade construction. Where the subgrade consists of silty sand in a loose state of compaction a vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program, reviewed and approved by Paterson at the time of construction. Any poor performing areas under proof rolling or soft areas should be removed and reinstated with an engineered fill, such as OPSS Granular A or Granular B Type II placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the material's SPMDD.

It is recommended that the upper 200 mm of sub-slab fill below a basement floor slab or slab-on-grade for buildings founded on shallow foundations or piles consist of OPSS Granular A crushed stone compacted to a minimum of 98% of the material's SPMDD.

Where a raft slab is utilized, a granular layer consisting of OPSS Granular A will be required to allow for the installation of sub-floor services above the raft slab foundation. The thickness of the OPSS Granular A crushed stone will be dependent on the piping requirements.

A subfloor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear stone backfill under the lowest basement floor. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed. This is discussed further in Section 6.1 of this report.

5.6 Basement Wall

Where the soil is to be retained, there are several combinations of backfill materials and retained soils that could be applicable to the basement walls of the subject structures. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a dry unit weight of 20 kN/m^3. The applicable effective unit weight of the retained soil can be estimated as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when calculating the effective unit weight.

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

Lateral Earth Pressures

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

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

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

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

Seismic Earth Pressures

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

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

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

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32 g according to the OBC 2012. Note that the vertical seismic coefficient is assumed to be zero. The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5 K_o \gamma H^2$, where $K_o = 0.5$ for the soil conditions noted above.

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

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

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per the OBC 2012.

5.7 Pavement Design

For design purposes, the pavement structures presented in the following tables could be used for the design of driveways, local residential streets, and roadways with bus traffic.

It should be noted that for residential driveways and car only parking areas, an Ontario Traffic Category A is applicable. For local roadways, an Ontario Traffic Category B should be used for design purposes.

Table 7 - Recommended Pavement Structure - 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 over in-situ soil.	

Table 8 - Recommended Pavement Structure - Local Residential Roadways	
Thickness (mm)	**Material Description**
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Wear Course** - 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 over in-situ soil.	

Table 9 - Recommended Pavement Structure - Arterial Roadways with Bus Traffic	
Thickness (mm)	**Material Description**
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course** - Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
600	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in-situ soil, or OPSS Granular B Type I or II material over in-situ soil.	

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, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

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. 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 remaining 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 subgrade level, 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, and the subgrade surface should be crowned to promote water flow to drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be designed for the future structures. The system should consist of a 150 mm diameter, geotextile wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, 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.

Buildings proposed throughout the development of the subject site whose basement levels are founded below the long-term groundwater table should be provided a groundwater suppression system. The groundwater suppression system would consist of installing a waterproofing membrane over a drainage geocomposite installed on the exterior portion of the foundation wall. The waterproofing membrane is recommended to extend between the bottom of the foundation and up to a minimum of 1 m above the long-term groundwater level. A groundwater suppression system would also be recommended for structures located below the buildings foundations (i.e.- elevator shafts, sump pits, etc).

Due to the preliminary nature of the development, the requirement for groundwater suppression systems will be assessed once the number of proposed basement levels for the future mid and high-rise buildings is known. Details pertaining to the groundwater suppression system may also be provided at that time.

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

Backfill material below sidewalk or asphalt paved subgrade areas or other settlement sensitive structures should consist of free draining, non-frost susceptible material placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD under dry and above freezing conditions.

6.2 Protection of Footings Against Frost Action

Perimeter footings, raft slabs, pile caps, and grade beams of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover (or insulation equivalent) should be provided in this regard.

Other exterior unheated footings 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).

Where footings are founded directly on clean, surface-sounded bedrock with no near-surface cracks or fissures and is approved by Paterson personnel at the time of the excavation, the minimum soil cover, listed above, is not required.

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 structures are backfilled.

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 Type 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 a safe working distance from the excavation sides.

Excavation side slopes carried out for the building footprint are recommended to be provided surface protection from erosion by rain and surface water runoff where shoring is not anticipated to be implemented. This can be accomplished by covering the entire surface of the excavation side-slopes with tarps secured between the top and bottom of the excavation and approved by Paterson personnel at the time of construction. It is further recommended to maintain a relatively dry surface along the bottom of the excavation footprint to mitigate the potential for sloughing of side-slopes.

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.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements designed by a structural engineer specializing in those works will depend on the depth of the excavation, the proximity of the adjacent structures, and the elevation of the adjacent building foundations and underground services. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team.

Inspections and approval of the temporary system will also be the responsibility of the designer. Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation event will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner’s structural designer prior to implementation.

The temporary system could consist of a soldier pile and lagging system or an interlocking steel sheet piling system. Any additional loading due to street traffic, construction equipment, adjacent structures, and facilities, etc., should be added to the earth pressures described below. These systems could be cantilevered, anchored, or braced.

Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure their stability. The shoring system is recommended to be adequately supported to resist toe failure and inspected to ensure that the sheet piles extend well below the excavation base. It should be noted if consideration is being given to utilizing a raker style support for the shoring system that lateral movements can occur and the structural engineer should ensure that the design selected minimizes these movements to tolerable levels.

The earth pressures acting on the shoring system may be calculated using the parameters provided in Table 10.

Table 10 - Soil Parameters for Calculating Earth Pressures Acting on Shoring System

Parameter	Value
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Unit Weight (γ), kN/m^3	20
Submerged Unit Weight (γ'), kN/m^3	13

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

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

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

Excavation Base Stability

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

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

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

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

$$FS_b = N_b s_u / \sigma_z$$

where:

N_b - stability factor dependent upon the geometry of the excavation and given in Figure 1 on the following page.
s_u - undrained shear strength of the soil below the base level
σ_z - total overburden and surcharge pressures at the bottom of the excavation

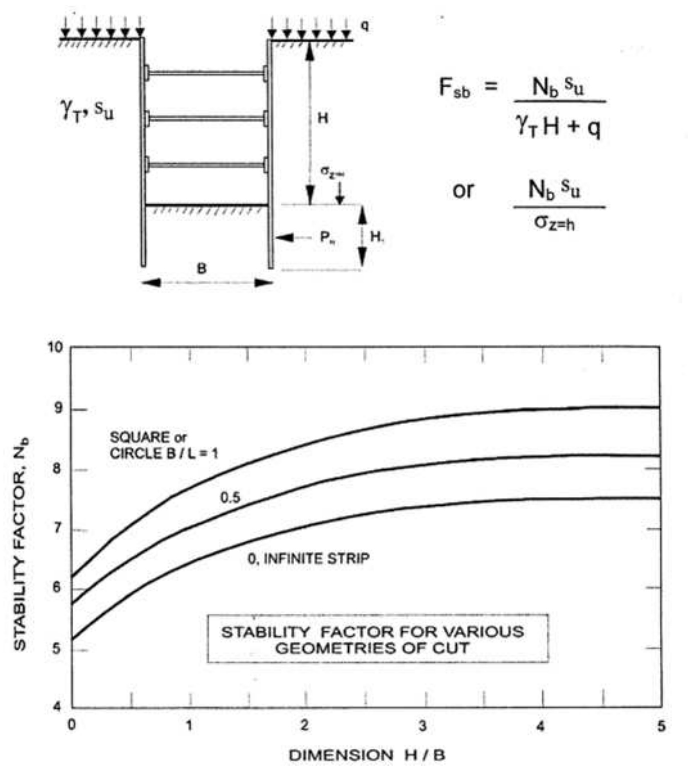


Figure 1 – Stability Factor for Various Geometries of Cut

A safety factor of 2 is generally recommended to be considered for excavation base stability.

6.4 Pipe Bedding and Backfill

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

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

It should generally be possible to re-use the upper portion of the dry to moist (not wet) silty clay above the cover material if the excavation and backfilling operations are carried out in dry weather conditions. Any stones greater than 200 mm in their longest dimension should be removed from these materials prior to placement.

The backfill material within the frost zone (about 1.5 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. 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 using a sheepsfoot roller. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

Due to the relatively impervious nature of the silty clay materials, 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 disturbances to the founding medium.

Due to the permeable glacial till deposit encountered within the groundwater table at the subject site, it is anticipated that conventional pumping with open sumps may be difficult to control the groundwater influx through servicing trench and deep basement excavations. If excavations well below groundwater level and within the permeable sand or glacial till deposits are considered, dewatering from outside the excavations using deep wells, well points or other means may be required.

Above the permeable sand and glacial till deposit, it is anticipated that groundwater infiltration into the excavations should be low to moderate, if encountered, and controllable using open sumps. Similar conditions may arise where excavations are undertaken below the depth of a silty clay deposit and into more permeable soils.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

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

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

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 using 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.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non-aggressive to moderately 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 review of the soils at the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. The results of our Atterberg limits, shrinkage, and hydrometer testing are presented in Appendix 1.

Based on the results of the Atterberg limit testing mentioned above, the plasticity index was found to be less than 40% for all the tested silty clay samples. In addition, based on the moisture levels and consistency of the encountered clay, the silty clay deposit encountered across the subject site is considered to be a low to medium sensitivity sily clay deposit.

The following tree planting setbacks are recommended for low to medium sensitivity silty clay deposits throughout the subject site.

Large trees (mature tree height over 14 m) can be planted at the subject site provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g., in a park or other green space). Tree planting setback limits may be reduced to 4.5 m for small (mature height up to 7.5 m) and medium size trees (mature height 7.5 to 14 m), provided that the conditions noted below are met:

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

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

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

- The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15 mm 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).

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 foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer’s requirements.

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

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

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, landscaping, and structural plan(s) from a geotechnical perspective.
- ❑ Review of the geotechnical aspects of the excavation contractor's shoring designs, if not designed by Paterson, prior to construction, if applicable.
- ❑ Review of architectural plans pertaining to the groundwater suppression system, underfloor drainage systems and waterproofing details for elevator shafts, if not designed by Paterson.

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.
- ❑ Observation of driving and re-striking of all pile foundations.
- ❑ 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 follow-up field density tests to determine the level of compaction achieved.
- ❑ 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, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site 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 Riverside South Limited Partnership or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
June 20, 2024
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Nicole Patey, B.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Riverside South Limited Partnership (e-mail copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

BOREHOLE LOGS BY OTHERS

ATTERBERG LIMIT TESTING RESULTS

HYDROMETER TESTING RESULTS

SHRINKAGE ANALYSIS RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369844.1 **NORTHING:** 5015184.184 **ELEVATION:** 93.09

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 2, 2024

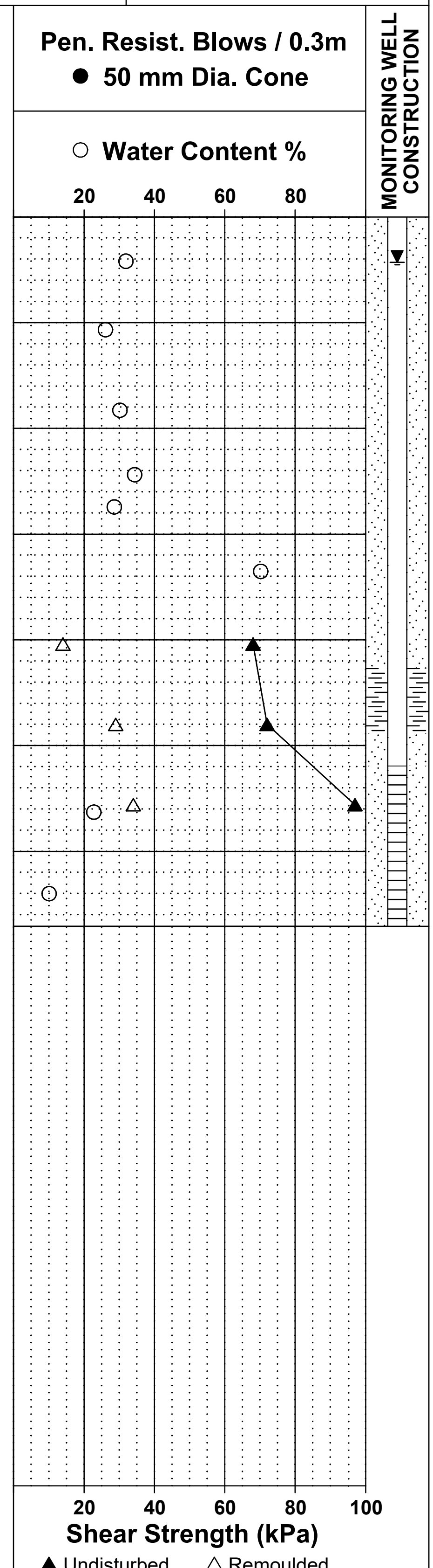
FILE NO. PG4958

HOLE NO. BH 1-24

SAMPLE DESCRIPTION	Strata bottom depth (m)
GROUND SURFACE	
TOPSOIL	0.23
Very stiff, brown **SILTY CLAY**, trace sand	0.61
Loose, brown **SILTY SAND** to **SANDY SILT**, trace to some clay - clay content increases with depth	2.21
Stiff, brown **SILTY CLAY** with sand	2.74
Stiff, grey **SILTY CLAY**	5.18
Very stiff, grey **CLAYEY SILT** with silt seams, trace sand and gravel	6.02
GLACIAL TILL: Compact, grey clayey silt to sandy silt with gravel, cobbles and boulders	6.71
End of Borehole (GWL @ 0.43m - April 18, 2024)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	7
SS	3	100	4
SS	4	100	3
SS	5	100	P
SS	6	100	P
SS	7	75	13

DEPTH (m)	ELEV. (m)
0	93.09
1	92.09
2	91.09
3	90.09
4	89.09
5	88.09
6	87.09



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369715.112 **NORTHING:** 5015296.377 **ELEVATION:** 92.31

DATUM: Geodetic

REMARKS:

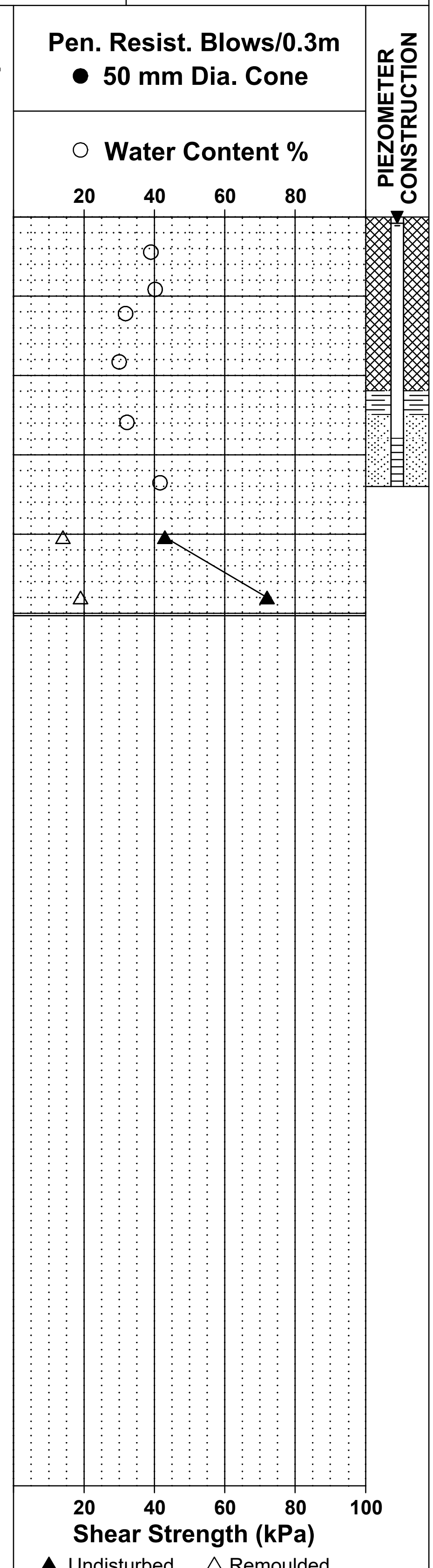
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 2, 2024

FILE NO. PG4958

HOLE NO. BH 2-24

SAMPLE DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
Ground Surface					
TOPSOIL	0.33				
Very stiff, brown **SILTY CLAY**, trace sand	1.02	AU	1		
Loose to very loose, brown **SILTY SAND** to **SANDY SILT**, trace clay - clay content increases by 2.2m depth	2.97	SS	2	100	8
		SS	3	100	3
		SS	4	100	3
Firm to stiff, grey **SILTY CLAY** with intermittent silt seams	5.03	SS	5	100	P
End of Borehole (GWL @ 0.08m - April 18, 2024)					

DEPTH (m)	ELEV. (m)
0	92.31
1	91.31
2	90.31
3	89.31
4	88.31
5	87.31



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369983.836 **NORTHING:** 5015063.857 **ELEVATION:** 93.60

DATUM: Geodetic

REMARKS:

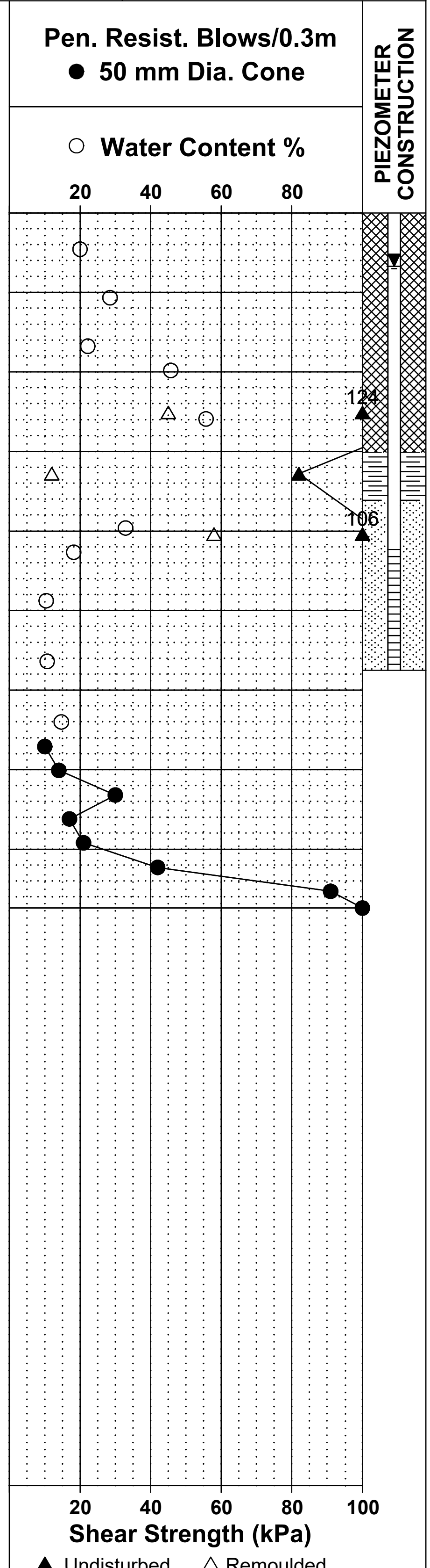
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 2, 2024

FILE NO. PG4958

HOLE NO. BH 3-24

SAMPLE DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
Ground Surface					
TOPSOIL	0.30				
Loose, brown **SILTY SAND** to **SANDY SILT** - trace clay by 1.4m depth	1.83	AU	1		
		SS	2	100	3
		SS	3	100	8
Very stiff, brown **SILTY CLAY**, some sand	2.97	SS	4	100	P
Stiff, grey **SILTY CLAY**	3.73				
Very stiff, grey **CLAYEY SILT** with sand - some gravel by 4.0m depth	4.50	SS	5	75	7
GLACIAL TILL: Compact, grey silty sand to sandy silt with gravel, cobbles and boulders	6.71	SS	6	50	14
		SS	7	67	9
		SS	8	83	16
Dynamic Cone Penetration Test commenced at 6.71m depth.	9.04				
End of Borehole Practical DCPT refusal at 9.04m depth (GWL @ 0.67m - April 18, 2024)					

DEPTH (m)	ELEV. (m)
0	93.60
1	92.60
2	91.60
3	90.60
4	89.60
5	88.60
6	87.60
7	86.60
8	85.60



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

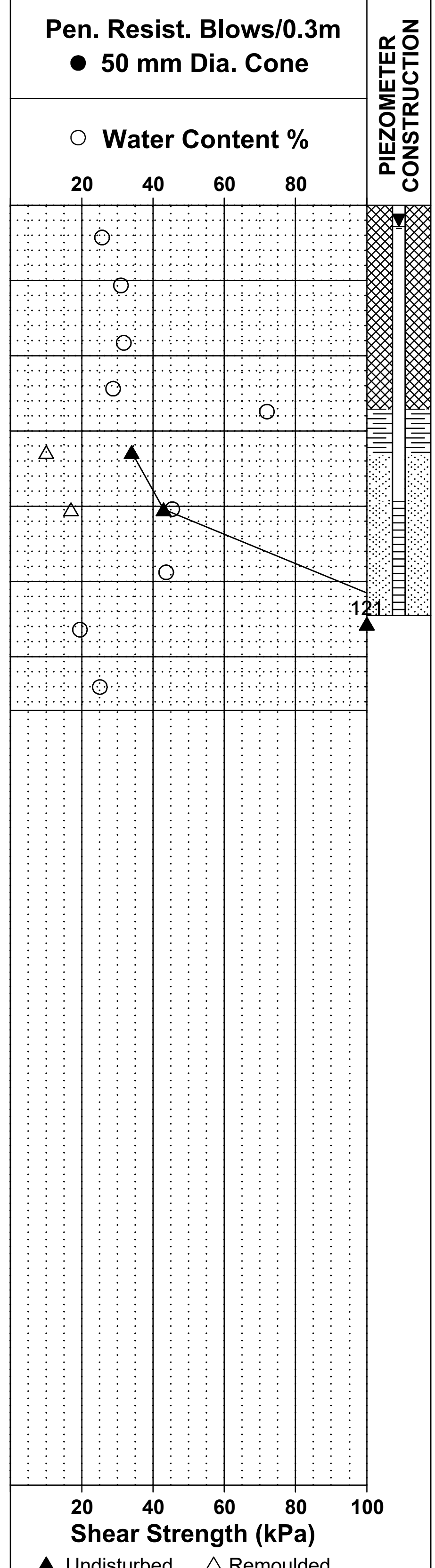
EASTING: 370046.251 **NORTHING:** 5015300.037 **ELEVATION:** 93.12
DATUM: Geodetic
REMARKS:
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 2, 2024

FILE NO. PG4958
HOLE NO. BH 4-24

SAMPLE DESCRIPTION	Depth to base (m)
Ground Surface	
TOPSOIL	0.25
Loose to very loose, brown **SILTY SAND** to **SANDY SILT**, trace to some clay - clay content increases with depth	2.59
Stiff, brown **SILTY CLAY**, some sand	2.97
Firm, grey **SILTY CLAY**	3.66
Firm to stiff, grey **SILTY CLAY** to **CLAYEY SILT** with silt seams	5.26
Very stiff, grey **SILTY CLAY** to **CLAYEY SILT** with sand, trace gravel	5.87
Loose, grey **CLAYEY SILT**, trace gravel	6.71
End of Borehole	
(GWL @ 0.28m - April 18, 2024)	

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	4
SS	3	100	2
SS	4	92	2
G	5		
SS	6	100	2
SS	7	75	
SS	8	100	4

DEPTH (m)	ELEV. (m)
0	93.12
1	92.12
2	91.12
3	90.12
4	89.12
5	88.12
6	87.12



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370025.02 **NORTHING:** 5015417.232 **ELEVATION:** 92.60

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 3, 2024

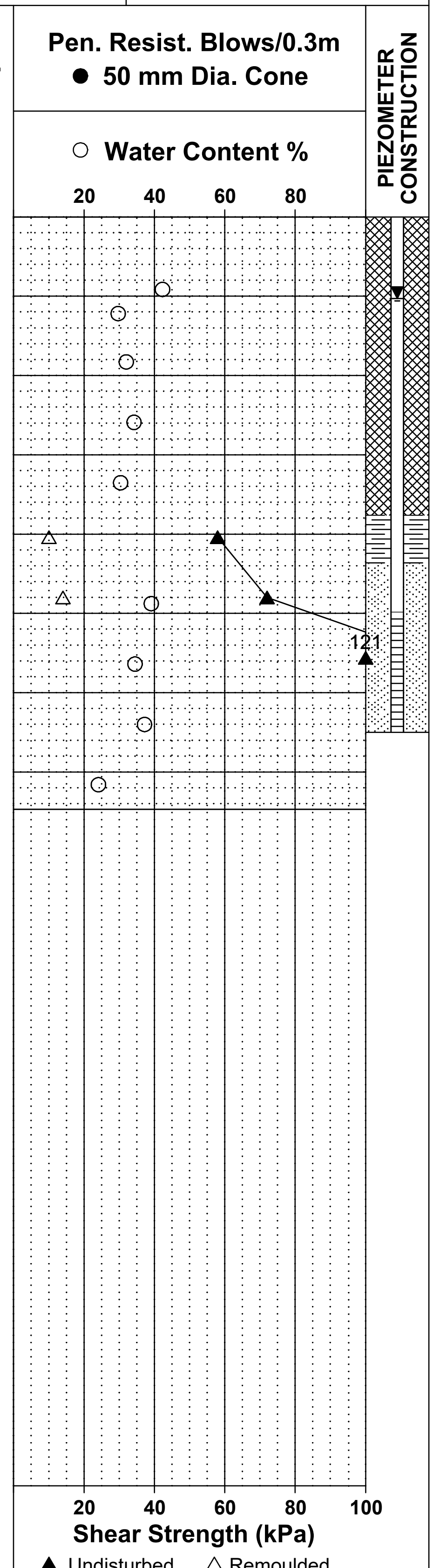
FILE NO. PG4958

HOLE NO. BH 5-24

SAMPLE DESCRIPTION	Depth to base (m)
Ground Surface	
TOPSOIL	0.20
Hard to very stiff, brown **SILTY CLAY**	0.97
Loose, brown **SILTY SAND** to **SANDY SILT**, with clay - clay content increases with depth	2.97
Stiff, grey **SILTY CLAY** with intermittent silt seams throughout	5.26
Very stiff to hard, grey **SILTY CLAY** to **CLAYEY SILT**, trace gravel, with intermittent silt seams	7.47
End of Borehole (GWL @ 1.03m - April 18, 2024)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
SS	1	100	7
SS	2	100	4
SS	3	100	3
SS	4	100	2
SS	5	100	P
SS	6	100	9
SS	7	100	6
SS	8		8

DEPTH (m)	ELEV. (m)
0	92.60
1	91.60
2	90.60
3	89.60
4	88.60
5	87.60
6	86.60
7	85.60



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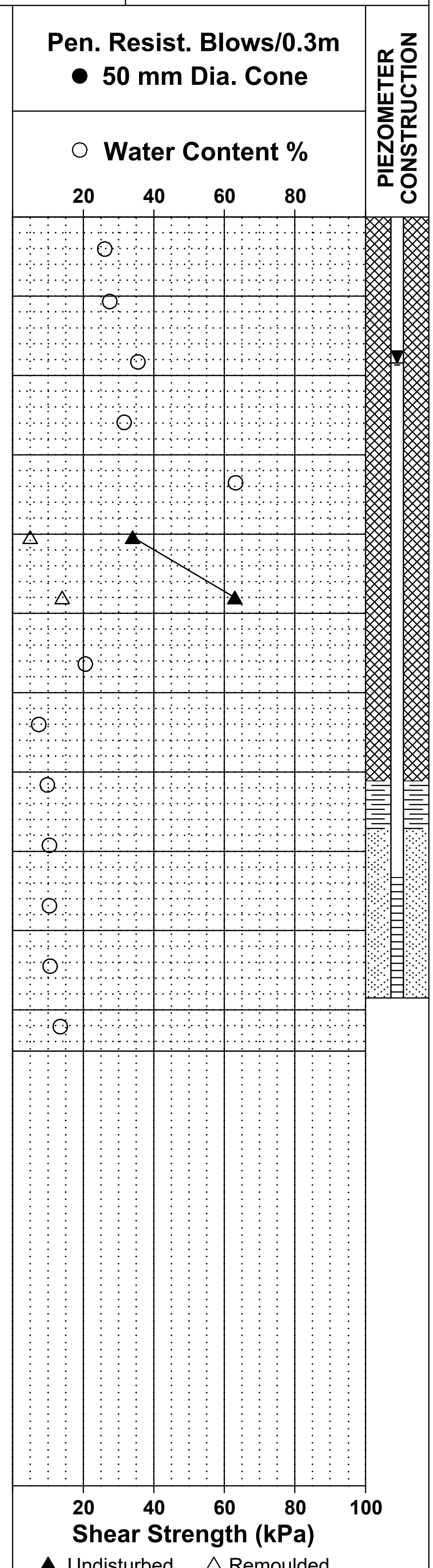
SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370206.233 **NORTHING:** 5015555.894 **ELEVATION:** 92.55
DATUM: Geodetic
REMARKS:
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 3, 2024

FILE NO. PG4958
HOLE NO. BH 6-24

SAMPLE DESCRIPTION	Depth to base (m)	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	92.55
TOPSOIL	0.20	AU	1				
Compact, brown **SILTY SAND** to **SANDY SILT**, with clay		SS	2	100	10	1	91.55
- clay content increases with depth		SS	3	100	2	2	90.55
	2.97	SS	4	100	2		
Firm to stiff, grey **SILTY CLAY** with intermittent silt seams		SS	5	100	P	3	89.55
						4	88.55
	5.18					5	87.55
GLACIAL TILL: Compact, grey silty clay to clayey silt, some sand and gravel	5.79	SS	6	100	28	6	86.55
GLACIAL TILL: Compact to dense, grey silty sand to sandy silt with gravel, cobbles and boulders, trace clay		SS	7	92	43	7	85.55
		SS	8	33	29	8	84.55
		SS	9	42	24		
		SS	10	58	14	9	83.55
- very dense by 9.1m depth		SS	11	100	+50		
	10.52	SS	12		39	10	82.55
End of Borehole							
(GWL @ 1.84m - April 18, 2024)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369812.91 **NORTHING:** 5015509.209 **ELEVATION:** 92.31

DATUM: Geodetic

REMARKS:

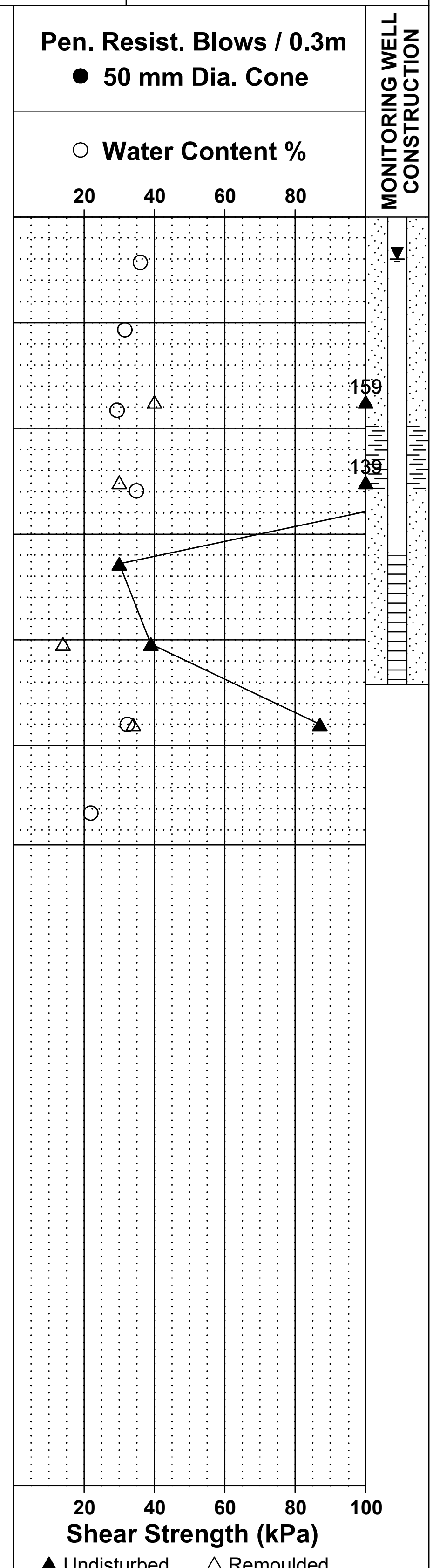
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 3, 2024

FILE NO. PG4958

HOLE NO. BH 7-24

SAMPLE DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.31
TOPSOIL	0.25						
Very stiff, brown **SILTY CLAY**, trace sand	0.61	AU	1				
Loose, brown **SILTY SAND** to **SANDY SILT**, some clay, with intermittent sand seams throughout	1.45	SS	2	100	5	1	91.31
Very stiff to stiff, brown **SILTY CLAY**	2.97	SS	3	100	P	2	90.31
		SS	4	100	P		
Firm, grey **SILTY CLAY** with intermittent silt seams	4.42					3	89.31
						4	88.31
Stiff, grey **SILTY CLAY** to **CLAYEY SILT**, trace sand and gravel	5.18	G	5			5	87.31
GLACIAL TILL: Compact, grey clayey silt to sandy silt with sand and gravel, cobbles and boulders	5.94	SS	6		26		
End of Borehole							

(GWL @ 0.40m - April 18, 2024)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

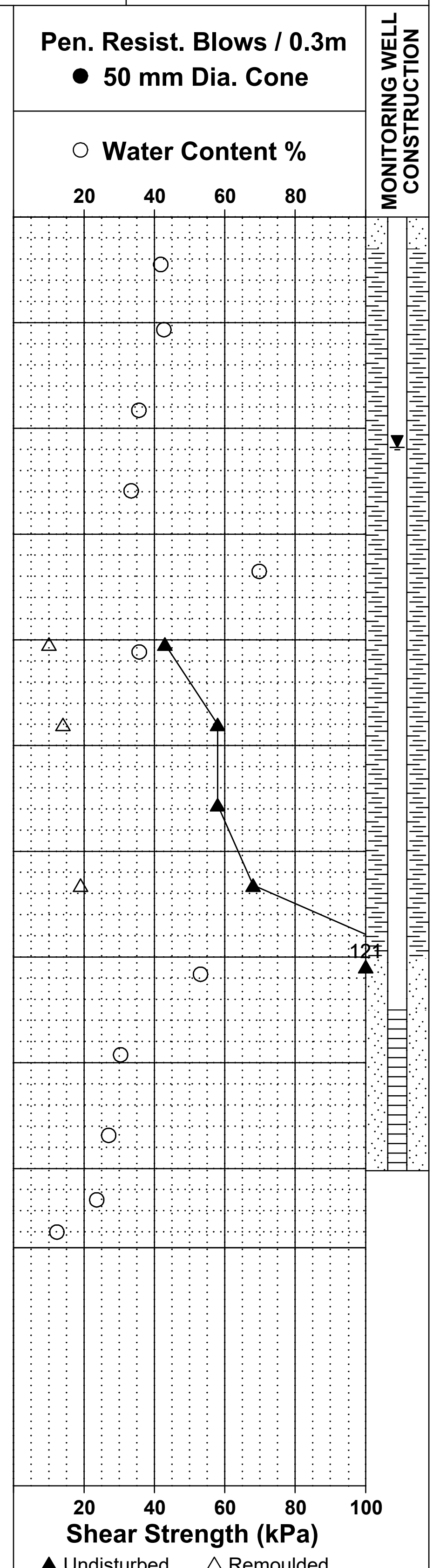
EASTING: 370183.895 **NORTHING:** 5015703.54 **ELEVATION:** 92.50
DATUM: Geodetic
REMARKS:
BORINGS BY: CME 55 Low Clearance Power Auger **DATE:** April 4, 2024

FILE NO. PG4958
HOLE NO. BH 8-24

SAMPLE DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.28				
Hard to very stiff, brown **SILTY CLAY**, trace sand	1.45	AU	1		
		SS	2	100	8
Loose, brown **SILTY SAND** to **SANDY SILT**, with clay - Clay content increasing with depth	2.97	SS	3	100	P
		SS	4	100	3
Firm to stiff, grey **SILTY CLAY**, with intermittent silt seams throughout - silt seam decreases with depth	6.71	SS	5	58	<1
		SS	6	100	P
Very stiff, grey **SILTY CLAY** to **CLAYEY SILT**, occasional silt seams	7.54	SS	7	100	P
Compact, grey **CLAYEY SILT** to **SANDY SILT**, trace sand and gravel - clay content decreases with depth	9.60	SS	8	83	12
		SS	9	50	11
		SS	10	83	12
GLACIAL TILL: Compact, grey silty clay with sand, some gravel, cobbles and boulders	9.75				
End of Borehole					

(GWL @ 2.18m - April 18, 2024)

DEPTH (m)	ELEV. (m)
0	92.50
1	91.50
2	90.50
3	89.50
4	88.50
5	87.50
6	86.50
7	85.50
8	84.50
9	83.50



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369974.319 **NORTHING:** 5015814.475 **ELEVATION:** 91.69

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Low Clearance Power Auger **DATE:** April 4, 2024

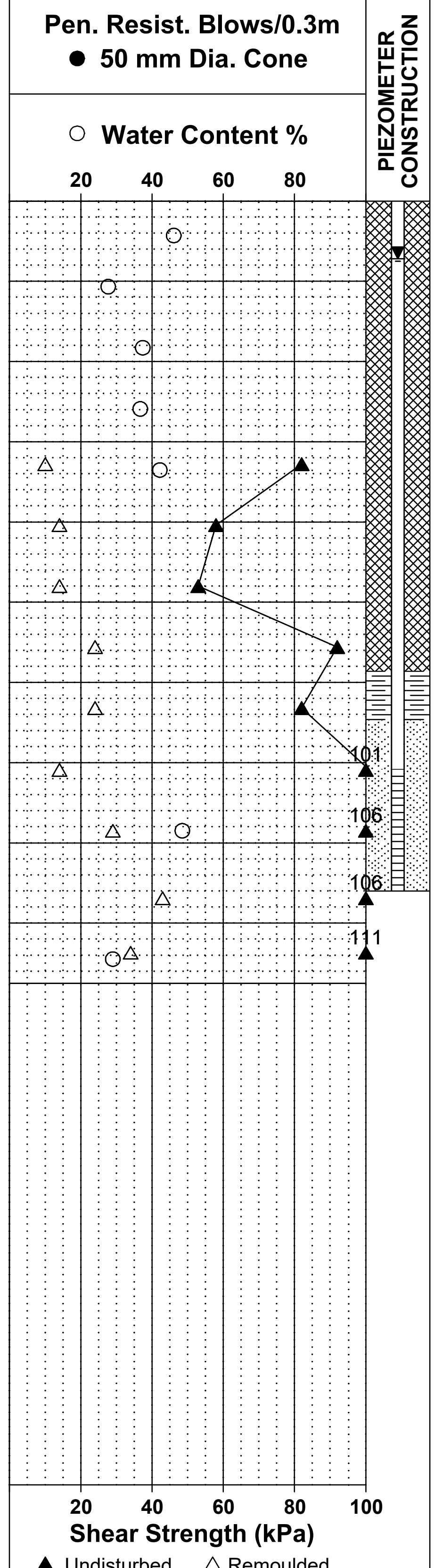
FILE NO. PG4958

HOLE NO. BH 9-24

SAMPLE DESCRIPTION	Depth to base (m)
Ground Surface	
TOPSOIL	0.25
Hard to very stiff, brown **SILTY CLAY**, trace sand	0.91
Loose to compact, brown **SILTY SAND** to **SANDY SILT** with clay - clay content increases with depth	2.97
Stiff, grey **SILTY CLAY**, some intermittent silt seams	6.71
Very stiff, grey **SILTY CLAY** to **CLAYEY SILT**	9.75
End of Borehole	
(GWL @ 0.72m - April 18, 2024)	

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	7
SS	3	100	3
SS	4	100	2
SS	5		P
G	6		
SS	7	58	P

DEPTH (m)	ELEV. (m)
0	91.69
1	90.69
2	89.69
3	88.69
4	87.69
5	86.69
6	85.69
7	84.69
8	83.69
9	82.69



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370080.262 **NORTHING:** 5015747.142 **ELEVATION:** 92.32

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Low Clearance Power Auger **DATE:** April 5, 2024

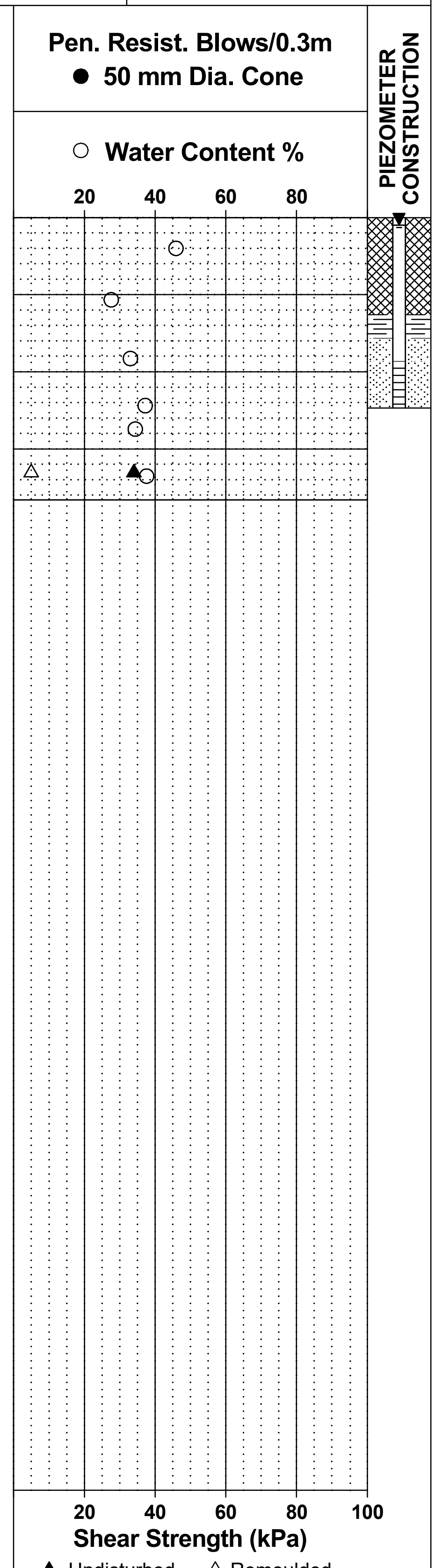
FILE NO. PG4958

HOLE NO. BH10-24

SAMPLE DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	92.32
TOPSOIL	0.20	AU	1				
Stiff, brown **SILTY CLAY** with sand	0.69	SS	2	75	P	1	91.32
Loose, brown **SILTY SAND** to **SANDY SILT** with clay - clay content increases with depth	2.36	SS	3	100	2	2	90.32
Very stiff to stiff, brown **SILTY CLAY**, some to trace sand	2.97	SS	4	100	2	3	89.32
Firm, grey **SILTY CLAY** with intermittent silt seams throughout	3.66	SS	5	100	P		

End of Borehole

(GWL @ 0.10m - April 18, 2024)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370129.049 **NORTHING:** 5015829.169 **ELEVATION:** 92.31

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Low Clearance Power Auger **DATE:** April 5, 2024

FILE NO. PG4958

HOLE NO. BH11-24

SAMPLE DESCRIPTION

Ground Surface

Sample Description	Depth to base (m)
TOPSOIL	0.30
Stiff, brown **SILTY CLAY** with silty sand	0.91
Loose to compact, brown **SILTY SAND** to **SANDY SILT** with clay - clay content increases with depth	2.21 / 2.90
Very stiff, brown **SILTY CLAY** with intermittent sand seams throughout	
Firm to stiff, grey **SILTY CLAY** - some intermittent silt seams	7.47
Loose to compact, grey **CLAYEY SILT**, trace sand and gravel	9.75
Dynamic Cone Penetration Test commenced at 9.75m depth.	14.30

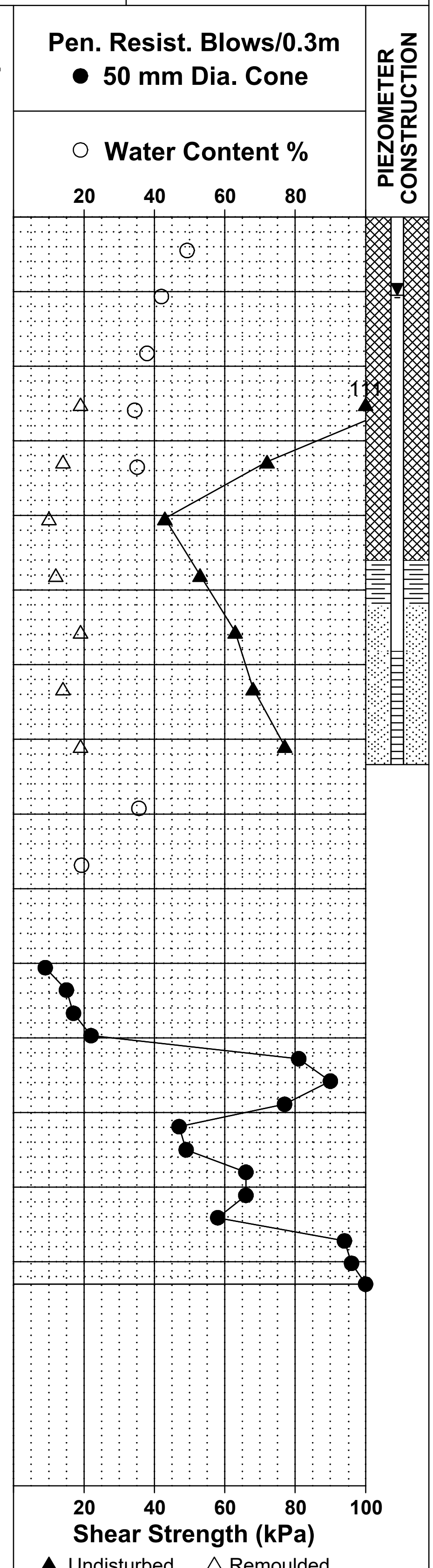
End of Borehole

Practical DCPT refusal at 14.30m depth

(GWL @ 1.05m - April 18, 2024)

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	6
SS	3	100	3
SS	4	83	P
SS	5	100	P
SS	6	100	4
SS	7	75	7
SS	8	83	20

DEPTH (m)	ELEV. (m)
0	92.31
1	91.31
2	90.31
3	89.31
4	88.31
5	87.31
6	86.31
7	85.31
8	84.31
9	83.31
10	82.31
11	81.31
12	80.31
13	79.31
14	78.31



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370193.438 **NORTHING:** 5015339.177 **ELEVATION:** 93.47

DATUM: Geodetic

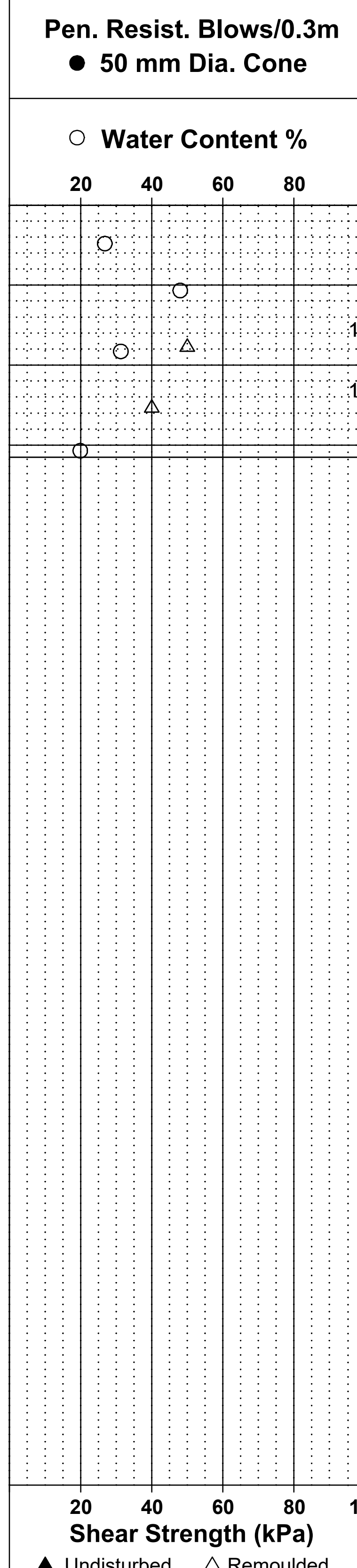
REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 4, 2024

FILE NO. PG4958

HOLE NO. BH12-24

SAMPLE DESCRIPTION	Strata depth (m)	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	93.47
TOPSOIL	0.36	AU	1				
Hard to very stiff, brown **SILTY CLAY** with intermittent silt seams throughout		SS	2	42	8	1	92.47
		SS	3	100	P	2	91.47
	2.90						
GLACIAL TILL: Very dense, grey silty clay to clayey silt with sand, some gravel, cobbles and boulders	3.15	SS	4	100	+50	3	90.47
End of Borehole Practical refusal to augering at 3.15m depth							



PIEZOMETER CONSTRUCTION

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370191.455 **NORTHING:** 5015338.503 **ELEVATION:** 93.38

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 4, 2024

FILE NO. PG4958

HOLE NO. BH12A-24

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	PIEZOMETER CONSTRUCTION
Ground Surface						0	93.38		
TOPSOIL 0.36									
Hard to very stiff, brown **SILTY CLAY** with intermittent silt seams throughout 2.60						1	92.38		
						2	91.38		
GLACIAL TILL: Very dense, grey silty clay to clayey silt with sand, some gravel, cobbles and boulders 2.92									
End of Borehole Practical refusal to augering at 2.92m depth									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370196.978 **NORTHING:** 5015342.481 **ELEVATION:** 93.40

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 4, 2024

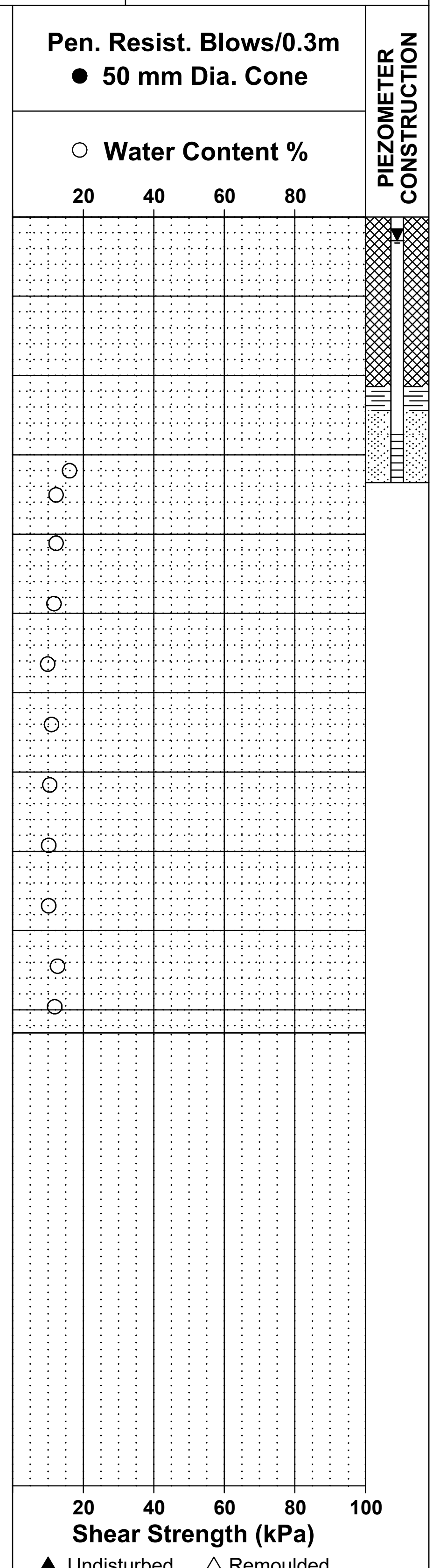
FILE NO. PG4958

HOLE NO. BH12B-24

SAMPLE DESCRIPTION	Depth of strata change (m)	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	93.40
TOPSOIL	0.36						
Hard to very stiff, brown **SILTY CLAY** with intermittent silt seams throughout						1	92.40
						2	91.40
GLACIAL TILL: Compact, grey silty clay to clayey silt with sand, some gravel, cobbles and boulders	2.90					3	90.40
	3.30	SS	1	100	11		
		SS	2	67	18	4	89.40
GLACIAL TILL: Compact, grey silty sand to sandy silt with gravel, cobbles and boulders, trace clay		SS	3	58	17	5	88.40
		SS	4	83	14	6	87.40
		SS	5	58	19		
		SS	6	67	16	7	86.40
- dense to very dense by 7.9m depth		SS	7	83	48	8	85.40
		SS	8	100	+50		
		SS	9	100	+50	9	84.40
		SS	10		+50	10	83.40
End of Borehole	10.29						

Practical refusal to augering at 10.29m depth

(GWL @ 0.30m - April 18, 2024)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 370233.153 **NORTHING:** 5015473.477 **ELEVATION:** 93.05

DATUM: Geodetic

REMARKS:

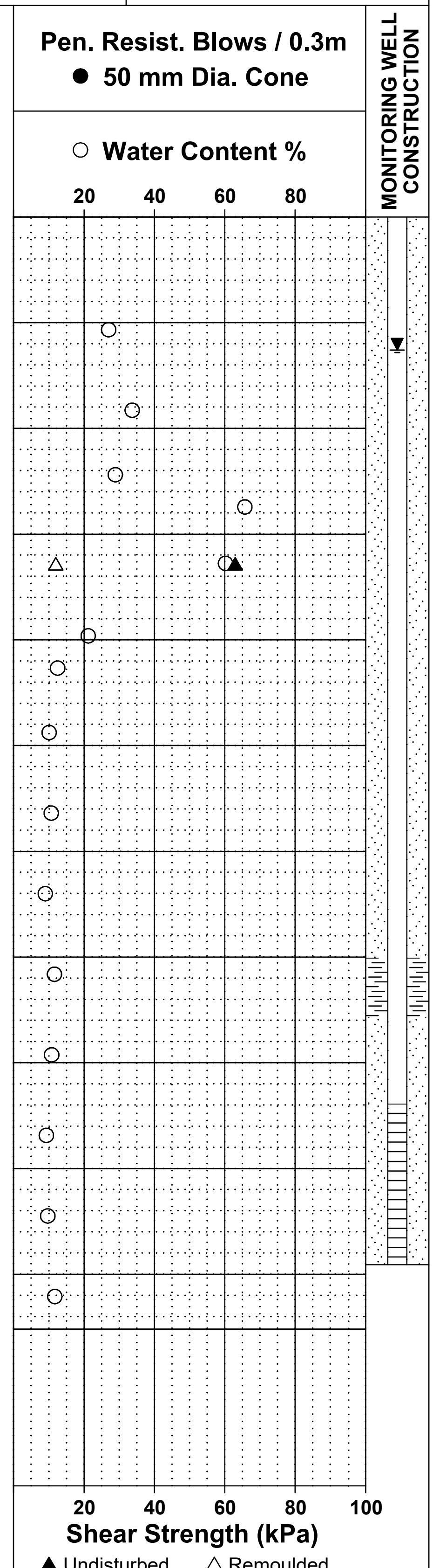
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 5, 2024

FILE NO. PG4958

HOLE NO. BH13-24

SAMPLE DESCRIPTION	Depth to base (m)	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.30				
Loose brown **SILTY SAND** to **SANDY SILT**, trace clay		AU	1		
		SS	2	100	5
- clay content increases with depth		SS	3	100	3
	2.69	SS	4	100	3
Very stiff to stiff, brown **SILTY CLAY**, trace sand	2.97				
Stiff, grey **SILTY CLAY** with intermittent silt seams throughout	3.66	G	5		
Compact, grey **CLAYEY SILT**, trace sand, clay and gravel	3.96	SS	6	100	20
GLACIAL TILL: Compact to dense, grey silty sand to sandy silt, with gravel, cobbles and boulders, trace clay		SS	7	13	44
		SS	8	50	+50
		SS	9	100	33
		SS	10	75	38
		SS	11	67	33
		SS	12	58	33
		SS	13	75	22
	10.52	SS	14	58	45
End of Borehole					
(GWL @ 1.26m - April 18, 2024)					

DEPTH (m)	ELEV. (m)
0	93.05
1	92.05
2	91.05
3	90.05
4	89.05
5	88.05
6	87.05
7	86.05
8	85.05
9	84.05
10	83.05



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369818.482 **NORTHING:** 5015600.331 **ELEVATION:** 92.32

DATUM: Geodetic

REMARKS:

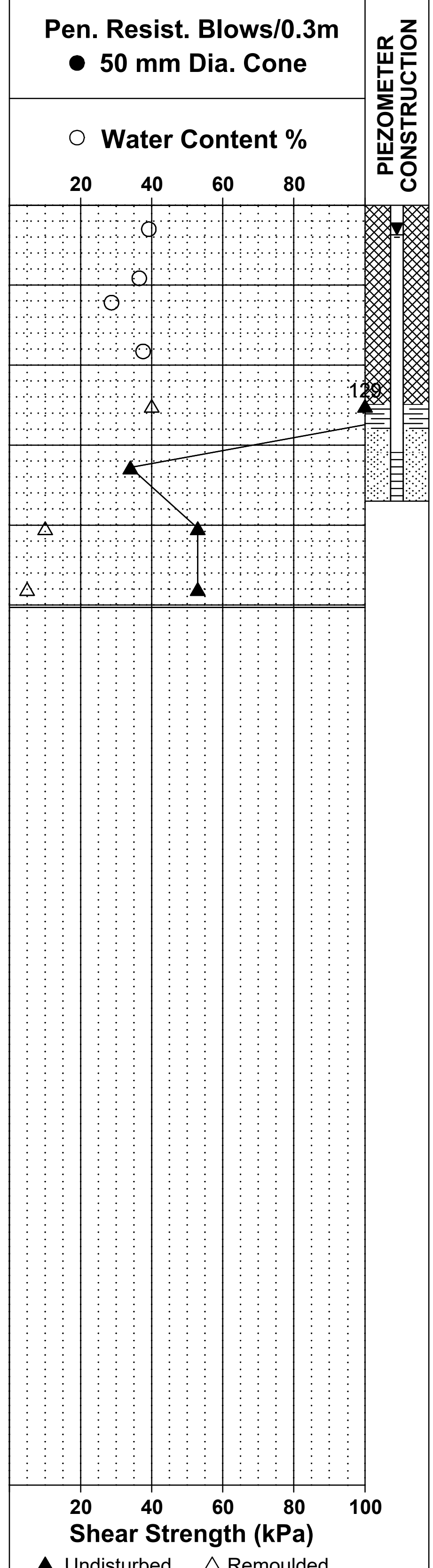
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 5, 2024

FILE NO. PG4958

HOLE NO. BH14-24

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	92.32
Hard to very stiff, brown **SILTY CLAY**, trace sand (to 0.97)		AU	1				
- organics at surface		SS	2	100	5	1	91.32
Loose, brown **SILTY SAND** to **SANDY SILT**, with clay (to 2.13)		SS	3	100	3	2	90.32
- Clay content increasing with depth (to 2.90)							
Very stiff, brown **SILTY CLAY** with sand and intermittent silt seams throughout						3	89.32
Firm to stiff, grey **SILTY CLAY**, some intermittent silt seams (to 5.03)						4	88.32
End of Borehole						5	87.32

(GWL @ 0.37m - April 18, 2024)



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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369936.703 **NORTHING:** 5015582.347 **ELEVATION:** 92.21

DATUM: Geodetic

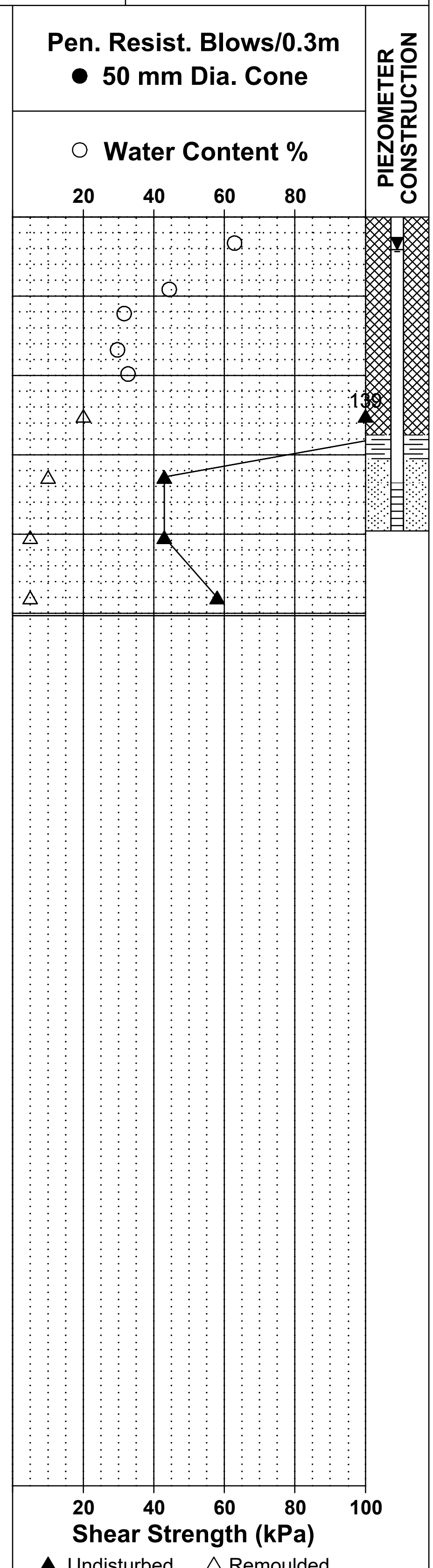
REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 5, 2024

FILE NO. PG4958

HOLE NO. BH15-24

SAMPLE DESCRIPTION	Layer depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	92.21
Hard to very stiff, brown **SILTY CLAY**, trace to some sand - organics at surface	1.12	AU	1			1	91.21
Loose, brown **SILTY SAND** to **SANDY SILT**, trace clay	1.83	SS	2	100	7	2	90.21
- clay content increases with depth	2.90	SS	3	100	5	3	89.21
Very stiff, brown **SILTY CLAY**, some sand and intermittent silt seams throughout						4	88.21
Firm to stiff, grey **SILTY CLAY**, some intermittent silt seams	5.03					5	87.21
End of Borehole (GWL @ 0.41m - April 18, 2024)							



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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369653.612 **NORTHING:** 5015426.957 **ELEVATION:** 92.30

DATUM: Geodetic

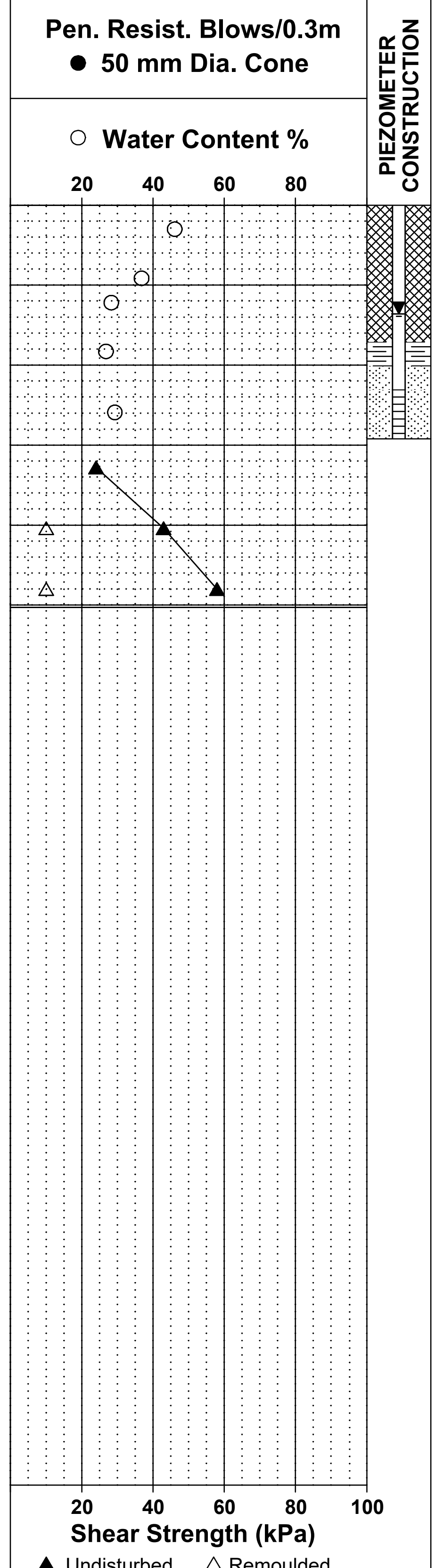
REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 5, 2024

FILE NO. PG4958

HOLE NO. BH16-24

SAMPLE DESCRIPTION	Layer bottom depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	92.30
TOPSOIL	0.20	AU	1				
Hard to very stiff, brown **SILTY CLAY**, some sand	1.02					1	91.30
Loose, brown **SILTY SAND** to **SANDY SILT**, trace clay - clay content increases with depth	2.21	SS	2	100	7		
		SS	3	100	8	2	90.30
Very stiff, brown **SILTY CLAY**, some sand and intermittent silt seams throughout	2.97	SS	4	100	4		
Firm to stiff, grey **SILTY CLAY**, some intermittent silt seams	5.03					3	89.30
						4	88.30
						5	87.30
End of Borehole							
(GWL @ 1.36m - April 18, 2024)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369817.403 **NORTHING:** 5015745.327 **ELEVATION:** 91.89

DATUM: Geodetic

REMARKS:

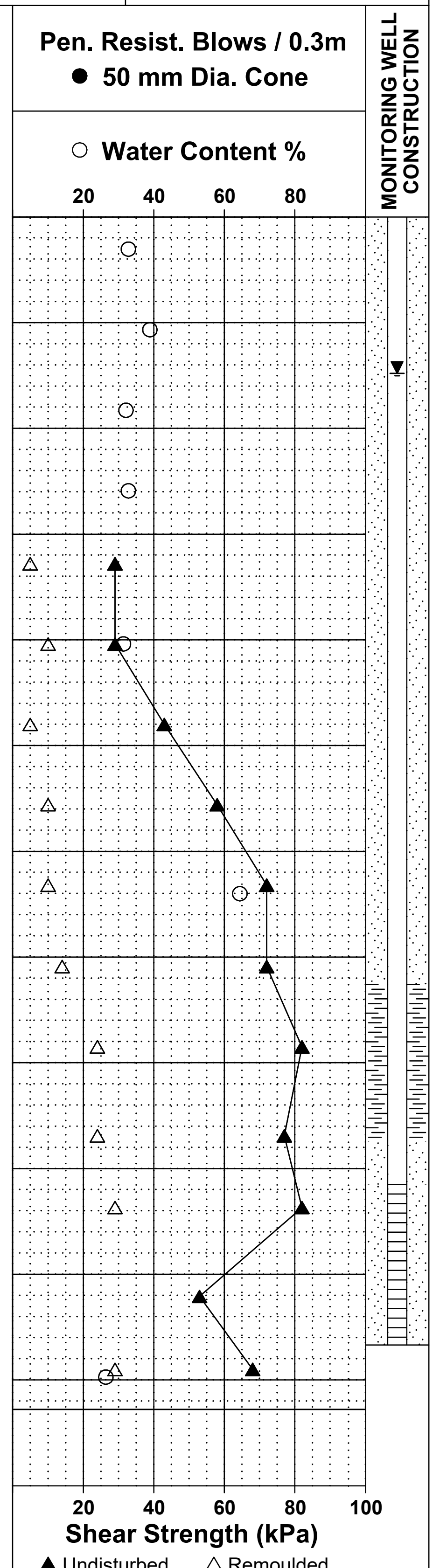
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 8, 2024

FILE NO. PG4958

HOLE NO. BH17-24

SAMPLE DESCRIPTION	Bottom depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.89
Hard to very stiff, brown **SILTY CLAY** with intermittent silt seams, trace sand	1.37	AU	1				
		SS	2	100	10	1	90.89
Loose, brown **SILTY SAND** to **SANDY SILT**, some clay - clay content increases with depth	2.21	SS	3	100	P	2	89.89
Stiff, brown **SILTY CLAY** to **CLAYEY SILT**, some sand and intermittent silt seams	2.97	SS	4	100	4	3	88.89
Firm to stiff, grey **SILTY CLAY** with intermittent silt seams	11.28	G	5			4	87.89
						5	86.89
						6	85.89
		SS	6	100	2	7	84.89
						8	83.89
						9	82.89
						10	81.89
		SS	7	100	2	11	80.89
End of Borehole							

(GWL @ 1.48m - April 18, 2024)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369637.104 **NORTHING:** 5015645.767 **ELEVATION:** 91.96

DATUM: Geodetic

REMARKS:

BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 8, 2024

FILE NO. PG4958

HOLE NO. BH18-24

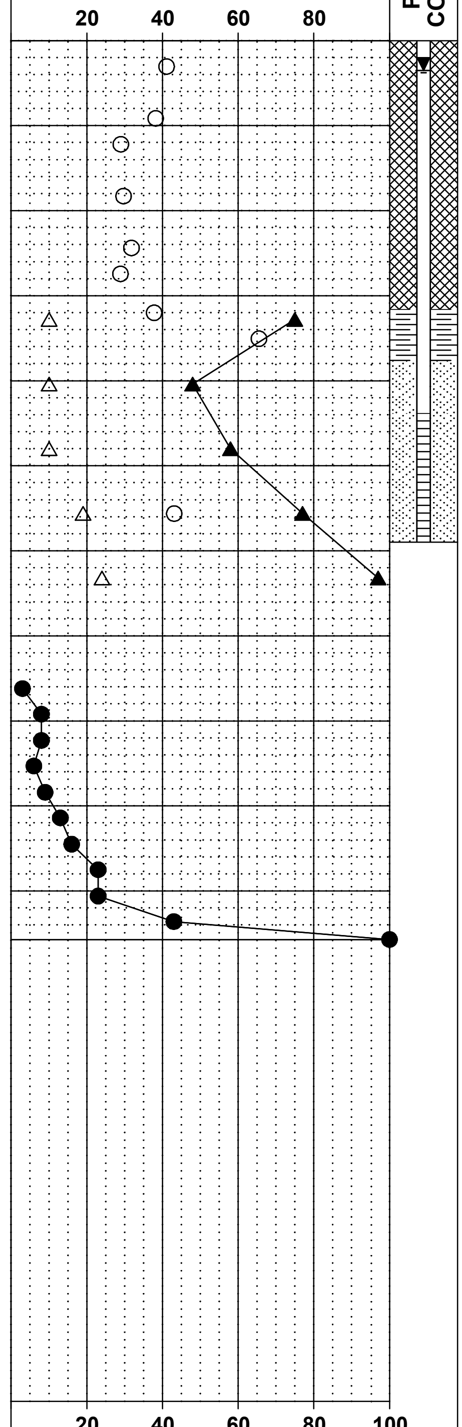
SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	91.96
Hard to very stiff, brown **SILTY CLAY** with intermittent silt seams, trace sand (0.97) - organics at surface		AU	1				
		SS	2	100	7	1	90.96
Loose, brown **SILTY SAND** to **SANDY SILT**, some clay - clay content increases with depth (2.49)		SS	3	100	5	2	89.96
Stiff, brown **SILTY CLAY**, some sand, with intermittent silt seams (3.30)		SS	4	100	4	3	88.96
Firm to stiff, grey **SILTY CLAY** with intermittent silt seams (6.55)		SS	5	100	P	4	87.96
						5	86.96
		G	6			6	85.96
Dynamic Cone Penetration Test commenced at 6.55m depth. The cone was pushed to 7.62m depth. (10.57)						7	84.96
						8	83.96
						9	82.96
						10	81.96
End of Borehole							

Practical DCPT refusal at 10.57m depth

(GWL @ 0.35m - April 18, 2024)

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation - Prop. Mixed-Use Dev.
Riverside South - Town Center Phase 7A
Ottawa, Ontario

EASTING: 369510.502 **NORTHING:** 5015631.116 **ELEVATION:** 91.62

DATUM: Geodetic

REMARKS:

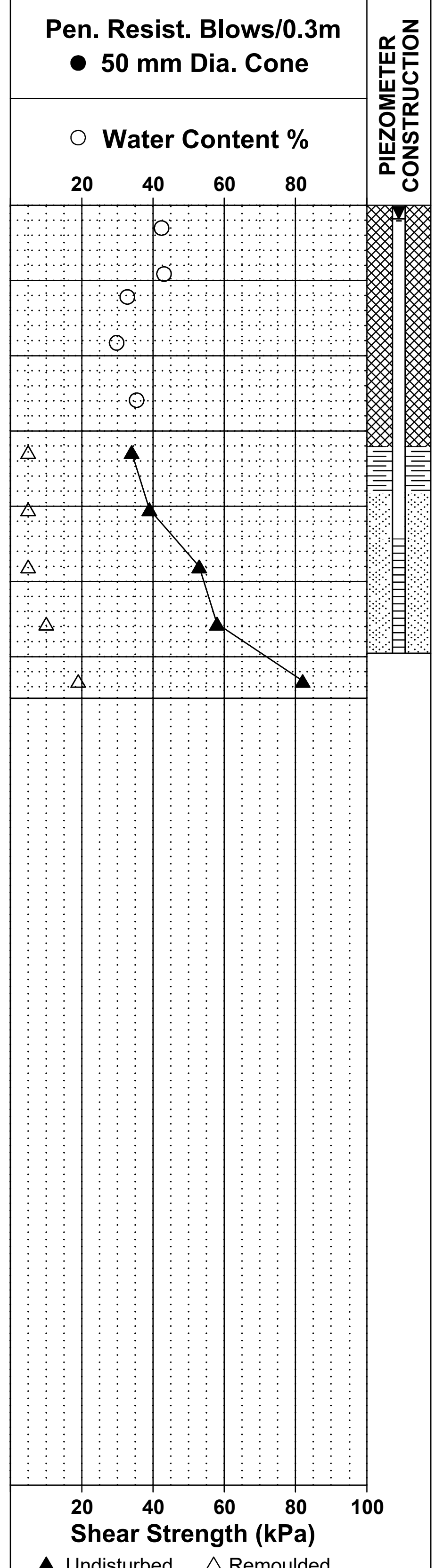
BORINGS BY: CME 55 Track-Mounted Auger **DATE:** April 8, 2024

FILE NO. PG4958

HOLE NO. BH19-24

SAMPLE DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
Ground Surface					
Hard to very stiff, brown **SILTY CLAY**, trace sand - organics at surface	1.07	AU	1		
Loose, brown **SILTY SAND** to **SANDY SILT**, some clay - clay content increases with depth	2.97	SS	2	100	8
	2.21	SS	3	100	4
		SS	4	100	3
Stiff, brown **SILTY CLAY** to **CLAYEY SILT** with intermittent silt seams and sand					
Firm to stiff, grey **SILTY CLAY** with intermittent silt seams	6.55				
End of Borehole (GWL @ 0.18m - April 18, 2024)					

DEPTH (m)	ELEV. (m)
0	91.62
1	90.62
2	89.62
3	88.62
4	87.62
5	86.62
6	85.62



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

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

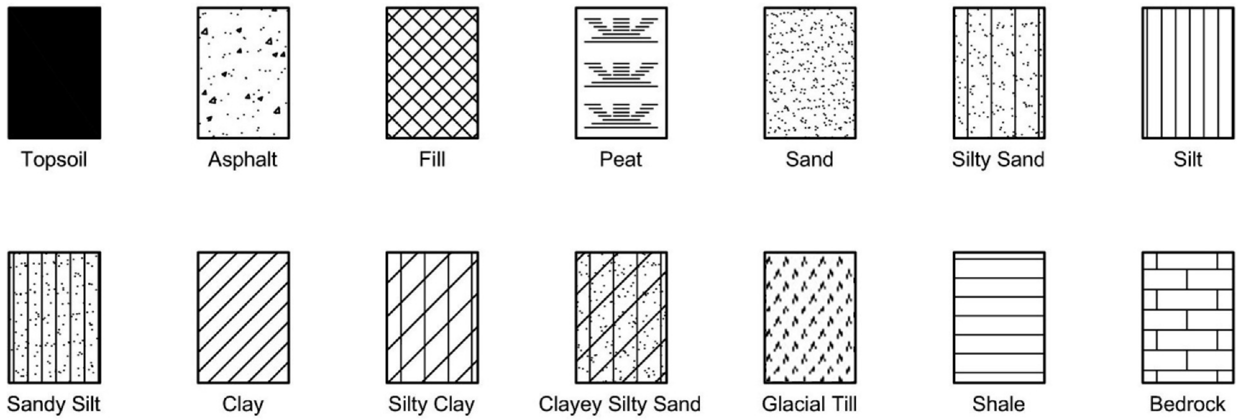
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

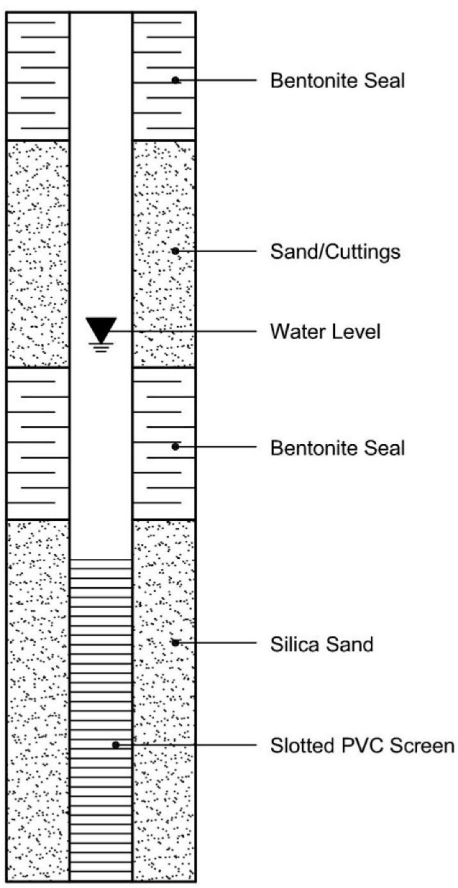
SYMBOLS AND TERMS (continued)

STRATA PLOT

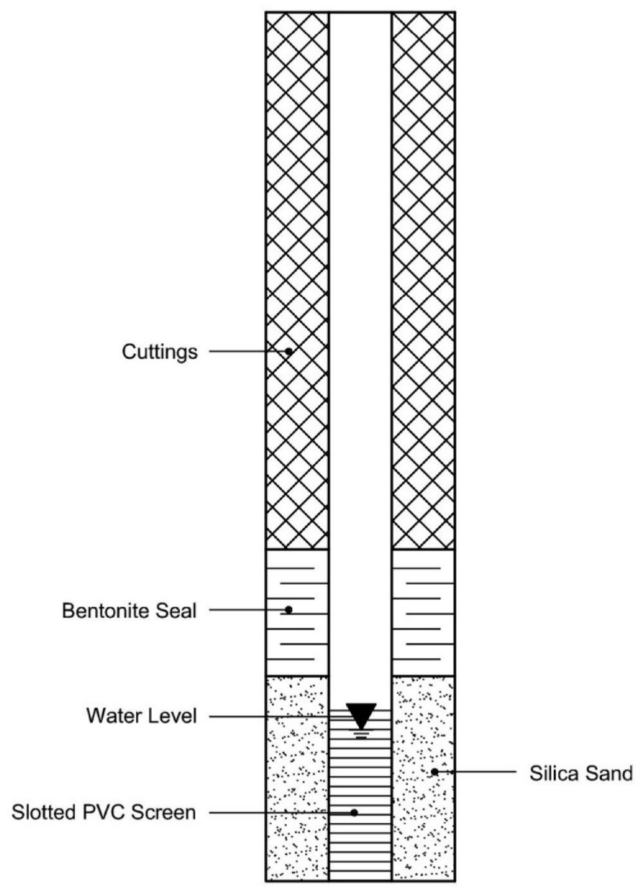


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PROJECT: 11-1121-0293

RECORD OF BOREHOLE: 12-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 24, 2012

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES: 0 – 10

BORING METHOD: Rotary Drill, 200mm Dia. (Hollow Stem)

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20, 40, 60, 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20, 40, 60, 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 20, 40, 60, 80

ADDITIONAL LAB. TESTING

SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	93.82
Dark brown to black clayey silt, some sand and organic matter (TOPSOIL)	0.00
Very stiff to stiff grey brown SILTY CLAY, occasional silty fine sand seams (Weathered Crust)	93.46 / 0.36
Loose to very dense grey brown to grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	91.38 / 2.44
End of Borehole	84.98 / 8.84

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	50 DO	5
2	50 DO	3
3	50 DO	57
4	50 DO	20
5	50 DO	17
6	50 DO	9
7	50 DO	24
8	50 DO	26
9	50 DO	37
10	50 DO	55
11	50 DO	46

PIEZOMETER OR STANDPIPE INSTALLATION

Native Backfill

Bentonite Seal

Standpipe

Cave

WL in Standpipe at Elev. 93.67m on Mar. 13, 2012

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: C.K.

MIS-BHS 001 1111210293.GPJ GAL-MIS.GDT 06/15/12 P.L.G.

RECORD OF BOREHOLE: 12-2

PROJECT: 11-1121-0293
SHEET 1 OF 1

LOCATION: See Site Plan
BORING DATE: February 24, 2012
DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Rotary Drill, 200mm Dia. (Hollow Stem)

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
	GROUND SURFACE	93.79			
0	Dark brown to black clayey silt, some sand and organic matter (TOPSOIL)	0.00			
	Grey brown SILTY SAND to SANDY SILT, some clay	93.36 / 0.43			
	Very stiff grey brown SILTY CLAY, occasional silty fine sand seams (Weathered Crust)	92.95 / 0.84	1	50 DO	7
			2	50 DO	6
2	Loose to compact grey brown to grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	91.88 / 1.91	3	50 DO	15
			4	50 DO	8
			5	50 DO	16
	End of Borehole Auger Refusal	89.39 / 4.40			

Column headings also printed: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa, nat V. + Q - ●, rem V. ⊕ U - ○ (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT, Wp ⊢ ○W ⊣ Wl (20, 40, 60, 80); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION.

Piezometer or standpipe installation: ∇ (water level)

W.L. in open hole at Elev. 92.16 m upon completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.
CHECKED: C.K.

MIS-BHS 001 1111210293.GPJ GAL-MIS.GDT 06/15/12 P.L.G.

RECORD OF BOREHOLE: 12-3

PROJECT: 11-1121-0293
LOCATION: See Site Plan
BORING DATE: February 27, 2012
SHEET 1 OF 1
DATUM: Geodetic
SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Rotary Drill, 200mm Dia. (Hollow Stem)

ELEV. / DEPTH (m)	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS/0.3m
92.86	GROUND SURFACE			
0.00	Dark brown to black silty clay, trace to some sand and organic matter (TOPSOIL)			
92.53 / 0.33	Grey brown SILTY CLAY, some sand (Weathered Crust)			
92.23 / 0.63	Very loose grey brown SILTY SAND to SANDY SILT, some clay	1	50 DO	4
		2	50 DO	3
		3	50 DO	2
90.19 / 2.67	Firm to stiff grey brown to grey SILTY CLAY, with occasional silt seams	4	50 DO	1
		5	50 DO	1
87.37 / 5.49	Stiff grey SILTY CLAY to CLAYEY SILT	6	50 DO	2
86.00 / 6.86	Compact grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	7	50 DO	22
		8	50 DO	17
84.63 / 8.23	End of Borehole			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ ; 20 40 60 80
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
WATER CONTENT PERCENT: Wp — W — Wl ; 20 40 60 80
ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION:
- Native Backfill
- Bentonite Seal
- Standpipe
- WL in Standpipe at Elev. 91.59m on Mar. 13, 2012

DEPTH SCALE 1 : 50
Golder Associates
LOGGED: R.I.
CHECKED: C.K.

PROJECT: 11-1121-0293

RECORD OF BOREHOLE: 12-4

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 23, 2012

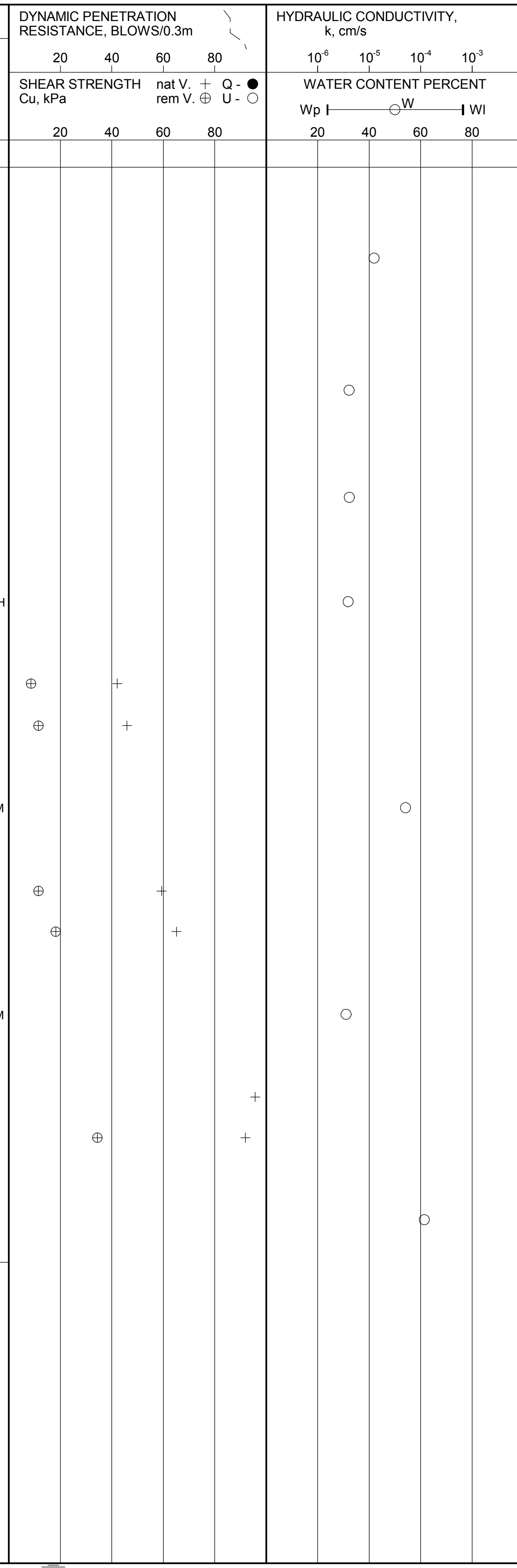
DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Rotary Drill, 200mm Dia. (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	92.58			
Dark brown to black silty clay, trace sand and organic matter (TOPSOIL)	0.00			
Very stiff grey brown SILTY CLAY, trace sand (Weathered Crust)	92.17 / 0.41	1	50 DO	5
Loose to very loose grey brown SILTY SAND to SANDY SILT, some clay	91.64 / 0.94	2	50 DO	2
Firm grey brown to grey CLAYEY SILT, occasional fine sand seams	90.14 / 2.44	3	50 DO	1
		4	50 DO	WH
Stiff grey SILTY CLAY	88.16 / 4.42	5	50 DO	PM
		6	50 DO	PM
Stiff grey CLAYEY SILT, trace sand	85.13 / 7.45	7	50 DO	2
End of Borehole	84.50 / 8.08			



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

W.L. in open hole at Elev. 91.41 m upon completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: C.K.

RECORD OF BOREHOLE: 12-5

PROJECT: 11-1121-0293

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 21, 2012

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Rotary Drill, 200mm Dia. (Hollow Stem)

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 20 40 60 80

Soil Profile

DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	92.22
Dark brown silty clay, trace sand and organic matter (TOPSOIL)	0.00
Very stiff grey brown SILTY CLAY, occasional sand seams (Weathered Crust)	92.04 / 0.18
Very loose grey brown SILTY SAND to SANDY SILT, some clay	90.85 / 1.37
Very loose grey SANDY SILT, some clay	89.02 / 3.20
Stiff grey SILTY CLAY to CLAYEY SILT, trace sand, black organic mottling and shells	88.41 / 3.81
Stiff grey SILTY CLAY, some silt seams, trace sand and black organic mottling	87.80 / 4.42
End of Borehole	83.99 / 8.23

Samples

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	50 DO	8	
2	50 DO	3	
3	50 DO	2	MH
4	50 DO	WH	
5	50 DO	PM	
6	50 DO	PM	
7	50 DO	PM	
8	50 DO	1	

Piezometer or Standpipe Installation

Native Backfill

Bentonite Seal

Silica Sand

Standpipe

WL in Standpipe at Elev. 90.76m on Mar. 13, 2012

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: C.K.

PROJECT: 11-1121-0293

RECORD OF BOREHOLE: 12-6

LOCATION: See Site Plan

BORING DATE: February 27, 2012

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Rotary Drill, 200mm Dia. (Hollow Stem)

ELEV. / DEPTH (m)	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
93.62	GROUND SURFACE					
0.00	Dark brown to black silty clay, trace to some sand and organic matter (TOPSOIL)					
93.29 / 0.33	Grey brown SILTY CLAY, some sand (Weathered Crust)					
93.01 / 0.61	Loose grey brown SILTY SAND to SANDY SILT, some clay, trace gravel	1	50 DO	6		
		2	50 DO	5		
91.33 / 2.29	Stiff grey brown SILTY CLAY, trace sand (Weathered Crust)	3	50 DO	2		
90.57 / 3.05	Stiff grey brown to grey SILTY CLAY, with silt seams	4	50 DO	1		Native Backfill
89.05 / 4.57	Very stiff grey CLAYEY SILT, trace to some sand, trace gravel	5	50 DO	4		
		6	50 DO	5		
87.52 / 6.10	Compact grey SILTY SAND, trace to some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	7	50 DO	15		Bentonite Seal
		8	50 DO	13	MH	Standpipe
86.00 / 7.62	End of Borehole					WL in Standpipe at Elev. 93.10m on Mar. 13, 2012

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● ; rem V. ⊕ U - ○ ; 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢ W ⊣ Wl ; 20 40 60 80

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: C.K.

RECORD OF BOREHOLE: 12-7

PROJECT: 11-1121-0293

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 28, 2012

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Rotary Drill, 200mm Dia. (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	93.48			
Dark brown to black silty clay, trace sand and organic matter (TOPSOIL)	0.00			
Grey brown SILTY CLAY to CLAYEY SILT, some sand (Weathered Crust)	93.12 / 0.36			
Loose to very loose grey brown SILTY SAND, some clay	92.92 / 0.56	1	50 DO	6
		2	50 DO	2
		3	50 DO	1
Stiff grey SILTY CLAY	90.43 / 3.05	4	50 DO	WH
Stiff grey SILTY CLAY to CLAYEY SILT, some silt seams, trace sand	88.91 / 4.57	5	50 DO	2
Very stiff grey CLAYEY SILT, some silt seams, trace sand, trace gravel	87.38 / 6.10	6	50 DO	6
Dense grey SILTY SAND to SANDY SILT, some gravel, trace clay (GLACIAL TILL)	86.62 / 6.86	7	50 DO	36
Very stiff grey CLAYEY SILT, some silt seams, trace fine sand	86.01 / 7.47	8	50 DO	6
Loose grey SILTY SAND to SANDY SILT, some gravel (GLACIAL TILL)	85.32 / 8.23			
End of Borehole				

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢ ○W ⊣ Wl (20 40 60 80)

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

W.L. in open hole at Elev. 90.74 m upon completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: C.K.

MIS-BHS 001 1111210293.GPJ GAL-MIS.GDT 06/15/12 P.L.G.

RECORD OF BOREHOLE: 12-8

PROJECT: 11-1121-0293
LOCATION: See Site Plan
SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: February 23, 2012

SHEET 1 OF 1
DATUM: Geodetic
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	92.93				
0	Rotary Drill, 200mm Dia. (Hollow Stem)	Dark brown to black silty clay, trace to some sand and organic matter (TOPSOIL)	0.00				
		Grey brown SILTY CLAY, trace to some sand, with occasional sand seams (Weathered Crust)	92.50 / 0.43				
1		Grey brown SILTY SAND to SANDY SILT, some clay	92.32 / 0.61				
		Loose grey brown SILTY SAND to SANDY SILT, some clay	91.41 / 1.52				
2		Firm grey brown SILTY CLAY, trace sand (Weathered Crust)	90.64 / 2.29				Native Backfill
3		Firm grey SILTY CLAY, trace sand, occasional sand seam	90.03 / 2.90				
4		Compact to dense grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	88.66 / 4.27				
5				1	50 DO	21	
				2	50 DO	17	Bentonite Seal
6							Silica Sand
				3	50 DO	41	Standpipe
		End of Borehole	86.22 / 6.71				
7		Note: Soil stratigraphy between 1.52m and 4.27m inferred from borehole 09-6.					WL in Standpipe at Elev. 92.71m on Mar. 13, 2012
8							
9							
10							

Column headings also include: STRATA PLOT; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (20, 40, 60, 80); ADDITIONAL LAB. TESTING.

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: R.I.
CHECKED: C.K.

PROJECT: 11-1121-0293

RECORD OF BOREHOLE: 12-9

LOCATION: See Site Plan

BORING DATE: February 22, 2012

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Rotary Drill, 200mm Dia. (Hollow Stem)

SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	92.64					
Dark brown silty clay, trace sand and organic matter (TOPSOIL)	0.00					
Very stiff grey brown SILTY CLAY, occasional silt and sand seam (Weathered Crust)	92.36 / 0.28					
Very loose to loose grey brown SILTY SAND to SANDY SILT, occasional silty clay seams, trace shells	91.88 / 0.76	1	50 DO	9		
		2	50 DO	2		
		3	50 DO	4	MH	∇
Very stiff grey brown SILTY CLAY to CLAYEY SILT, some fine sand and silt seams, trace gravel	89.74 / 2.90	4	50 DO	4		
Compact to very dense SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	88.68 / 3.96	5	50 DO	12		
		6	50 DO	31		
		7	50 DO	67		
		8	50 DO	24		
		9	50 DO	14		
End of Borehole	85.32 / 7.32					W.L. in open hole at Elev. 90.20 m upon completion of drilling

Chart columns: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp ⊢ ○W ⊣ Wl) (20, 40, 60, 80)

DEPTH SCALE METRES: 0–10

DEPTH SCALE 1 : 50

LOGGED: R.I.

CHECKED: C.K.

PROJECT: 11-1121-0293

RECORD OF BOREHOLE: 12-10

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 22, 2012

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Rotary Drill, 200mm Dia. (Hollow Stem)

DEPTH (m)	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
	GROUND SURFACE	92.32				
0.00	Dark brown to black silty clay, trace sand and organic matter (TOPSOIL)	0.00				Native Backfill
0.23	Very stiff grey brown SILTY CLAY, trace sand (Weathered Crust)	92.09 / 0.23	1	50 DO	7	
1.20	Loose to very loose grey brown SILTY SAND to SANDY SILT, some clay, trace gravel	91.12 / 1.20	2	50 DO	5	
			3	50 DO	3	
3.20	Stiff grey brown to grey SILTY CLAY to CLAYEY SILT, trace sand	89.12 / 3.20	4	50 DO	1	
3.66	Stiff grey SILTY CLAY, occasional silt seams	88.66 / 3.66	5	50 DO	WH	
			6	50 DO	WH	Bentonite Seal
5.64	Very dense grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)	86.68 / 5.64	7	50 DO	>50	Standpipe
6.40	End of Borehole Auger Refusal	85.92 / 6.40				

Shear strength (nat V.) plotted at approx. 5.6 m depth.

WL in Standpipe at Elev. 89.92m on Mar. 13, 2012

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: C.K.

RECORD OF BOREHOLE: 12-11

PROJECT: 11-1121-0293 SHEET 1 OF 1

LOCATION: See Site Plan BORING DATE: February 21, 2012 DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Rotary Drill, 200mm Dia. (Hollow Stem)

Depth (m)	Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m
	GROUND SURFACE	92.20			
0.00	Black silty clay, trace sand and organic matter (TOPSOIL)	0.00			
0.08	Very stiff grey brown SILTY CLAY, trace sand (Weathered Crust)	0.08	1	50 DO	8
1.37	Loose to very loose grey brown SILTY SAND to SANDY SILT, some clay, trace shells	90.83 / 1.37	2	50 DO	4
			3	50 DO	2
			4	50 DO	1
3.81	Firm grey SILTY CLAY to CLAYEY SILT, trace sand, trace gravel	88.39 / 3.81	5	50 DO	WH
4.42	Firm to stiff grey SILTY CLAY, some black organic mottling	87.78 / 4.42	6	50 DO	PM
			7	50 DO	PM
			8	50 DO	PM
8.84	End of Borehole	83.36 / 8.84			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl — 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

W.L. in open hole at Elev. 88.85 m upon completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

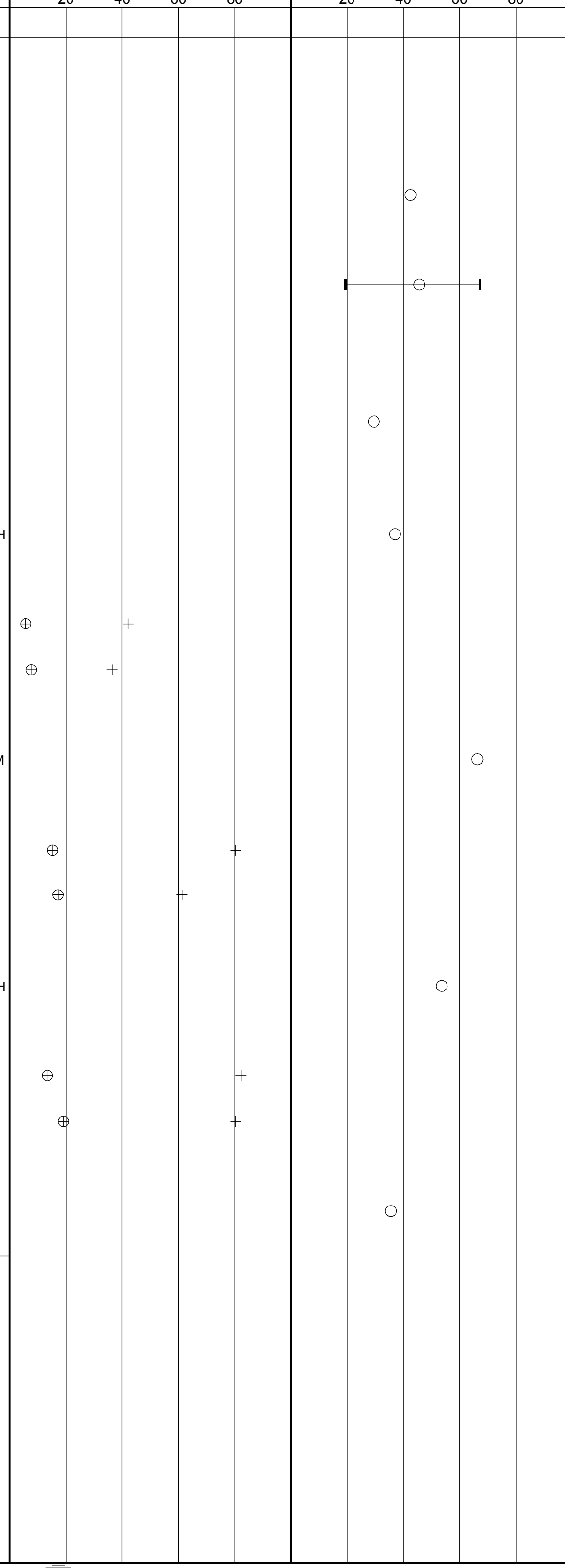
CHECKED: C.K.

RECORD OF BOREHOLE: 12-12

PROJECT: 11-1121-0293
LOCATION: See Site Plan
BORING DATE: February 22, 2012
SHEET 1 OF 1
DATUM: Geodetic
SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	91.90				
0	Rotary Drill, 200mm Dia. (Hollow Stem)	Dark brown silty clay, trace sand and organic matter (TOPSOIL)	0.00				
		Very stiff grey brown SILTY CLAY, trace sand (Weathered Crust)	91.52 / 0.38				
1				1	50 DO	7	
				2	50 DO	4	
2		Very loose grey brown SILTY SAND to SANDY SILT, trace clay, trace gravel	90.07 / 1.83				
				3	50 DO	4	
3		Firm grey CLAYEY SILT, some fine sand seams	88.85 / 3.05				
				4	50 DO	WH	
4							
		Stiff grey SILTY CLAY	87.33 / 4.57				
5				5	50 DO	PM	
6				6	50 DO	WH	
7							
		Very stiff to stiff grey SILTY CLAY to CLAYEY SILT, some silt seams	84.28 / 7.62				
8				7	50 DO	2	Borehole dry upon completion of drilling
		End of Borehole	83.67 / 8.23				
9							
10							

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
WATER CONTENT PERCENT: Wp ⊢ W ⊣ Wl (20 40 60 80)
ADDITIONAL LAB. TESTING



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: R.I.
CHECKED: C.K.

PROJECT: 09-1121-0120

RECORD OF BOREHOLE: 09-4

LOCATION: See Site Plan

BORING DATE: Aug. 19, 2009

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200mm Diam. (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	93.37			
Dark brown sandy silt, some clay and organic matter (TOPSOIL)	0.00			
Loose grey brown SILTY SAND to SANDY SILT, trace to some clay, trace gravel	93.07 / 0.30	1	50 DO	8
Stiff grey brown SILTY CLAY, some sand (Weathered Crust)	91.85 / 1.52	2	50 DO	1
Stiff grey brown to grey CLAYEY SILT	90.47 / 2.90	3	50 DO	9
		4	50 DO	2
Loose grey SILT, some sand, trace gravel and clay	89.10 / 4.27			
Compact to very dense grey SILTY SAND to SANDY SILT, some gravel, trace clay, cobbles and boulders (GLACIAL TILL)	88.80 / 4.57	5	50 DO	23
		6	50 DO	16
		7	50 DO	14
		8	50 DO	21
		9	50 DO	54
		10	50 DO	53
End of Borehole	84.53 / 8.84			

Column headings: DEPTH SCALE METRES; BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp, W, Wl) (20, 40, 60, 80); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

W.L. in open hole at 1.37m depth below ground surface upon completion of drilling

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: SK

PROJECT: 09-1121-0120

RECORD OF BOREHOLE: 09-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Aug. 17, 2009

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200mm Diam. (Hollow Stem)

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	GROUND SURFACE	92.37				
	Dark brown silty clay, some sand and organic matter (TOPSOIL)	0.00				Native Backfill
	Loose to very loose grey brown SANDY SILT, some clay, trace gravel and shells	92.04 / 0.33				Bentonite Seal
1			1	50 DO	7	
2			2	50 DO	3	
			3	50 DO	WH	
3	Firm to stiff grey SILTY CLAY, trace sand, occasional sand seam and shells	89.47 / 2.90				
			4	50 DO	WH	Native Backfill
5			5	50 DO	WH	
6	Stiff grey SILTY CLAY to CLAYEY SILT, trace sand, occasional sand seam	86.27 / 6.10	6	50 DO	WH	Bentonite Seal
7						Silica Sand / Standpipe
	Stiff grey CLAYEY SILT to SILTY CLAY, trace gravel and sand, occasional sand seam	84.75 / 7.62				
8			7	50 DO	6	Cave
			8	50 DO	5	
9	End of Borehole	83.53 / 8.84				
10						

Graph columns: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (20, 40, 60, 80) nat V. + Q - ● rem V. ⊕ U - ○; HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (20, 40, 60, 80); ADDITIONAL LAB. TESTING

W.L. in standpipe at Elev. 90.49m on Sept. 8, 2009

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: SK

MIS-BHS 001 09112101201-1000.GPJ GAL-MIS.GDT 9/24/09 JM

PROJECT: 09-1121-0120

RECORD OF BOREHOLE: 09-6

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Aug. 18, 2009

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200mm Diam. (Hollow Stem)

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa (nat V. + / rem V. ⊕)	WATER CONTENT PERCENT	PIEZOMETER OR STANDPIPE INSTALLATION
0	GROUND SURFACE	92.80						
	Dark brown silty clay, some sand and organic matter (TOPSOIL)	0.00						
	Grey brown SILTY CLAY, some sand (Weathered Crust)	92.55 / 0.25						
	Loose grey brown SILTY SAND to SANDY SILT, some clay	92.14 / 0.66						
1	Loose grey brown SILTY SAND to SANDY SILT, trace to some clay	91.89 / 0.91	1	50 DO	6			
								∇ (W.L. at 1.52m)
2			2	50 DO	3		○	
	Firm grey brown SILTY CLAY, trace sand (Weathered Crust)	90.51 / 2.29	3	50 DO	WH		○	
3	Firm grey SILTY CLAY, trace sand, occasional sand seam	89.90 / 2.90	4	50 DO	WH		○	
4						⊕, +		
						⊕, +		
5			5	50 DO	WH		○	
	Compact grey SILTY SAND, some gravel, trace clay, cobbles and boulders (GLACIAL TILL)	87.31 / 5.49	6	50 DO	>50	⊕, +		
6	End of Borehole	86.70 / 6.10						

W.L. in open hole at 1.52m depth below ground surface upon completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: R.I.

CHECKED: ________

PROJECT: 09-1121-0120

RECORD OF BOREHOLE: 09-7

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Aug. 14, 2009

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200mm Diam. (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	92.23			
Dark brown silty clay, some sand and organic matter (TOPSOIL)	0.00			
Stiff grey brown SILTY CLAY, some sand, occasional fine sand seam (Weathered Crust)	0.15	1	50 DO	8
		2	50 DO	4
		3	50 DO	WH
Grey SILTY CLAY, occasional clayey silt seam with depth	89.33 / 2.90	4	50 DO	WH
		5	50 DO	WH
		6	50 DO	WH
Stiff grey SILTY CLAY, trace sand	86.59 / 5.64	7	50 DO	4
		8	50 DO	5
		9	50 DO	5
End of Borehole	84.91 / 7.32			

Chart columns: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa — nat V. + Q - ●, rem V. ⊕ U - ○ (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (20, 40, 60, 80); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: J.C.

CHECKED: SK

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 13-2
Ottawa, Ontario

DATUM Geodetic

REMARKS

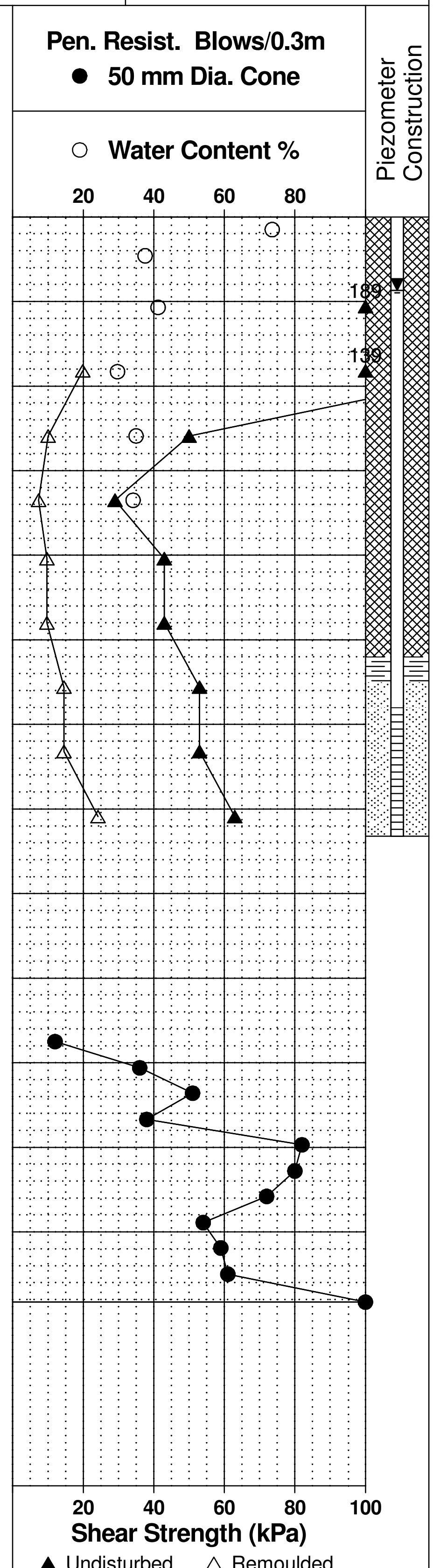
BORINGS BY Track-Mount Power Auger

DATE May 5, 2022

FILE NO. PG4958

HOLE NO. BH1-22-PH13-2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.29
TOPSOIL 0.23		SS	1	92	4		
Very stiff, brown **SILTY CLAY,** trace to some sand		SS	2	58		1	91.29
- sand content increasing with depth 2.30		SS	3	92		2	90.29
Firm to stiff, grey **SILTY CLAY**		SS	4	58			
		SS	5	100		3	89.29
						4	88.29
						5	87.29
						6	86.29
7.32						7	85.29
Dynamic Cone Penetration Test commenced at 7.32m depth. Cone pushed to 9.4m depth.						8	84.29
						9	83.29
						10	82.29
						11	81.29
12.83						12	80.29
End of Borehole Practical DCPT refusal at 12.83m depth. (GWL @ 0.87m - May 18, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 13-2
Ottawa, Ontario

DATUM Geodetic

REMARKS

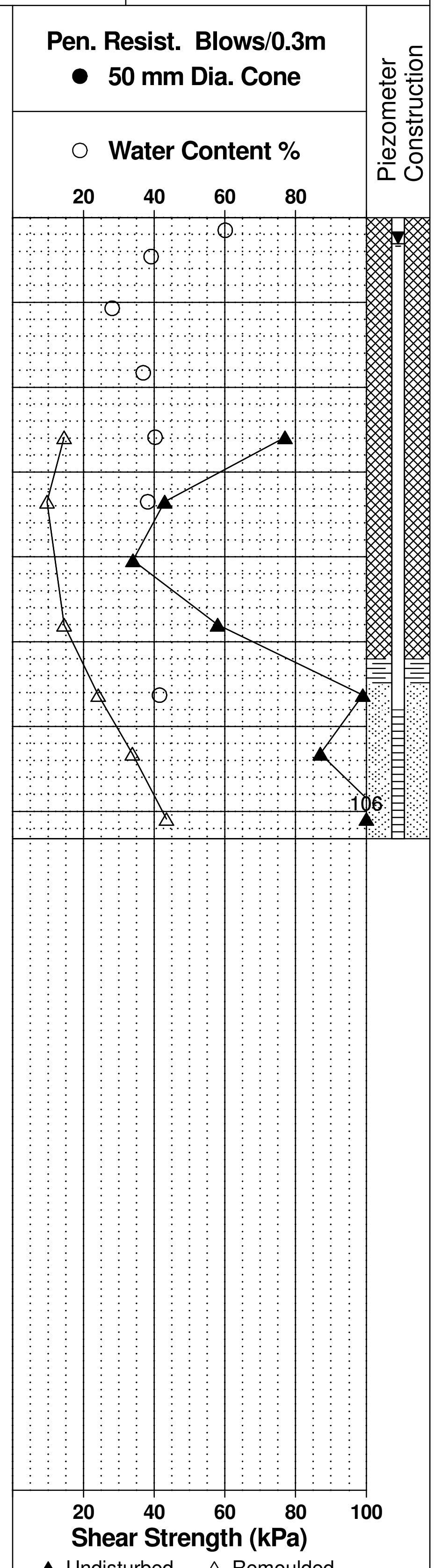
BORINGS BY Track-Mount Power Auger

DATE May 5, 2022

FILE NO. PG4958

HOLE NO. BH2-22-PH13-2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.15
TOPSOIL 0.25							
Very stiff, brown **SILTY CLAY** 0.69		SS	1	25	3		
Loose, brown **SILTY SAND** with clay 1.45		SS	2	83		1	92.15
Very stiff to stiff, brown **SILTY CLAY** with sand		SS	3	100	3	2	91.15
- sand content decreasing with depth 3.00		SS	4	100			
		SS	5	75		3	90.15
						4	89.15
Firm to very stiff, grey **SILTY CLAY**						5	88.15
		SS	6	100			
						6	87.15
7.32						7	86.15
End of Borehole							
(GWL @ 0.31m - May 18, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 13-2
Ottawa, Ontario

DATUM Geodetic

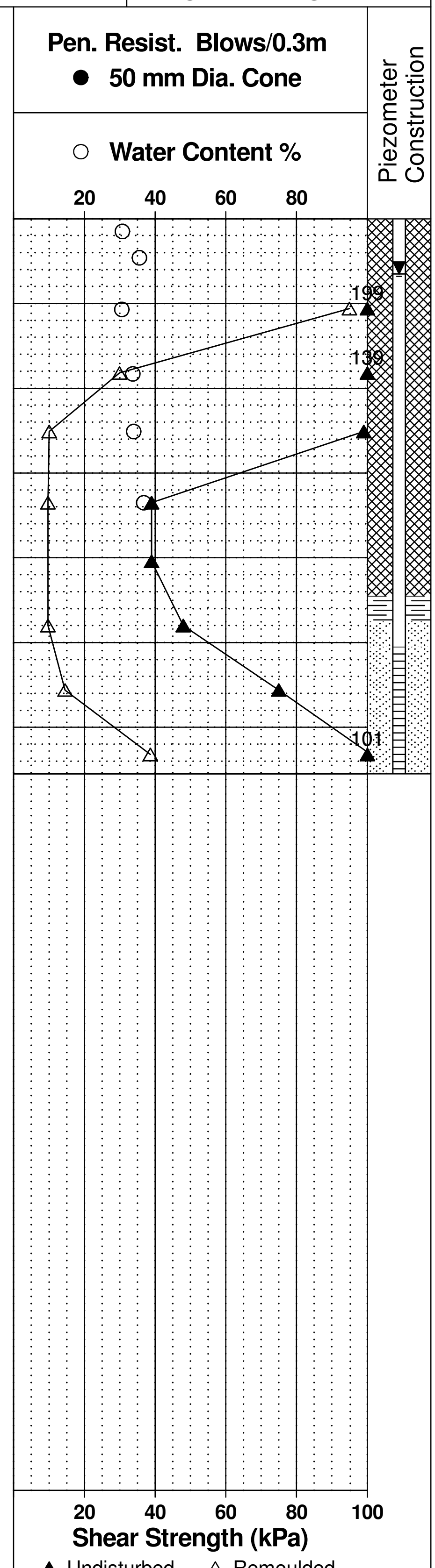
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** May 5, 2022

FILE NO. PG4958

HOLE NO. BH3-22-PH13-2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.76
TOPSOIL 0.23		SS	1	75	7		
Very stiff, brown **SILTY CLAY,** trace to some sand		SS	2	100		1	91.76
- sand content increasing with depth		SS	3	100		2	90.76
2.90						3	89.76
Firm to very stiff, grey **SILTY CLAY**		SS	4	100		4	88.76
						5	87.76
6.55						6	86.76
End of Borehole							
(GWL @ 0.65m - May 18, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 13-2
Ottawa, Ontario

DATUM Geodetic

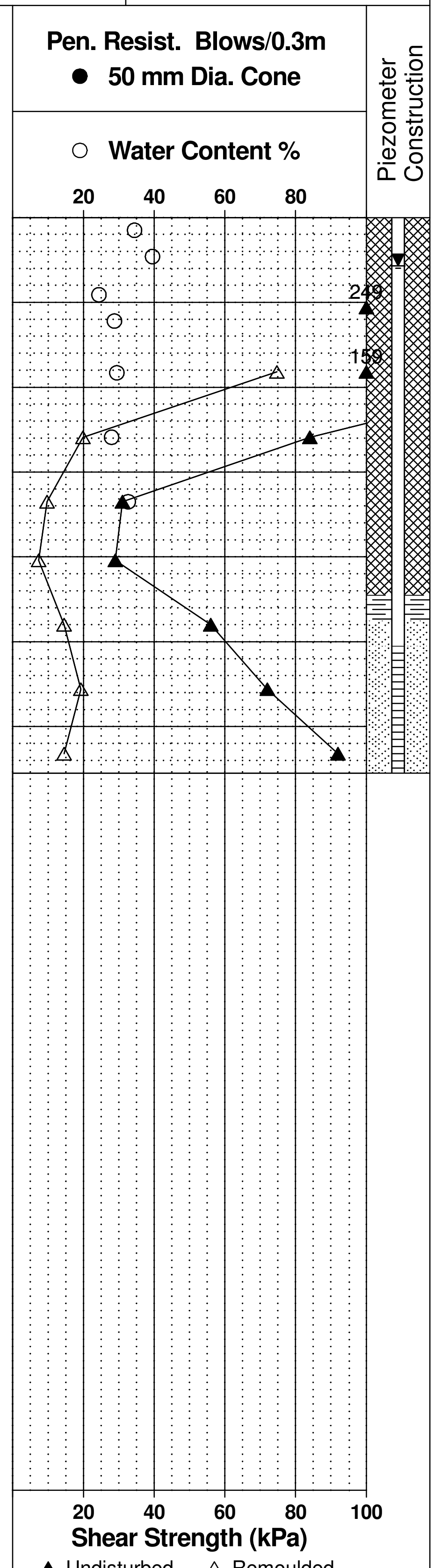
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** May 6, 2022

FILE NO. PG4958

HOLE NO. BH4-22-PH13-2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.55
TOPSOIL 0.30		SS	1	50	4		
Hard, reddish brown to brown **SILTY CLAY,** trace sand 1.04		SS	2	92		1	91.55
Very stiff to stiff, brown **SILTY CLAY** with silty sand to sandy silt 3.00		SS	3	100		2	90.55
		SS	4	17			
Firm to stiff, grey **SILTY CLAY** 6.55		SS	5	100		3	89.55
						4	88.55
						5	87.55
						6	86.55
End of Borehole							
(GWL @ 0.57m - May 18, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 13-2
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

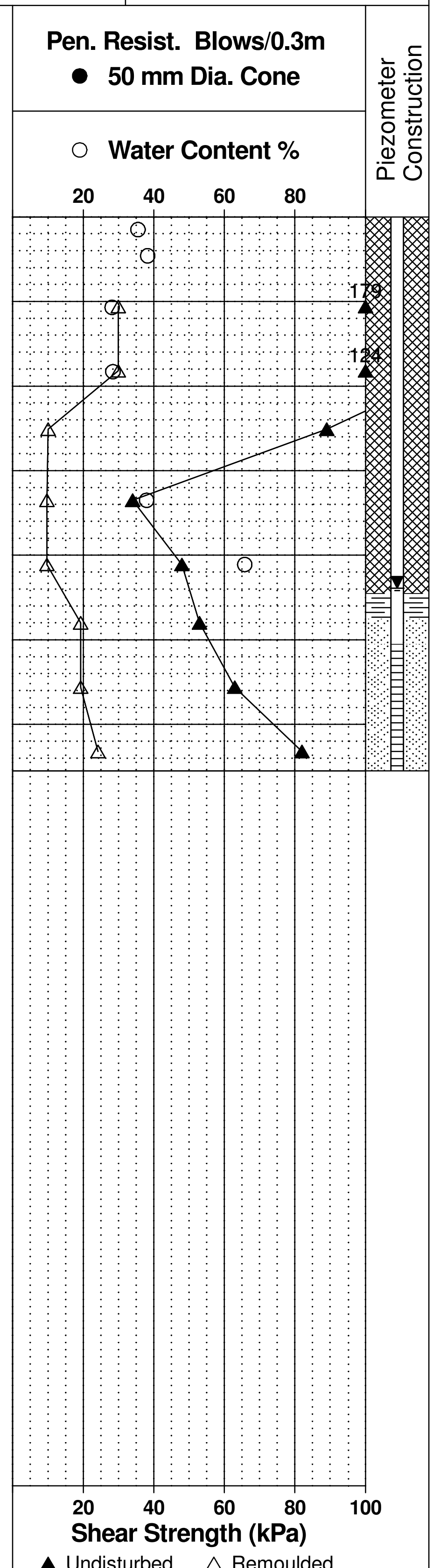
DATE May 6, 2022

FILE NO. PG4958

HOLE NO. BH5-22-PH13-2

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.28	SS	1	33	4
Very stiff, brown **SILTY CLAY,** trace sand	0.69				
Very stiff to stiff, brown **SILTY CLAY** with silty sand to sandy silt	2.90	SS	2	100	
		SS	3	100	
Firm to stiff, grey **SILTY CLAY**	6.55	SS	4	17	
		SS	5	100	
End of Borehole					
(GWL @ 4.39m - May 18, 2022)					

DEPTH (m)	ELEV. (m)
0	93.15
1	92.15
2	91.15
3	90.15
4	89.15
5	88.15
6	87.15



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG4958**

REMARKS

HOLE NO. **BH 2-22-PH18**

BORINGS BY Track-Mount Power Auger **DATE** 2022 April 18

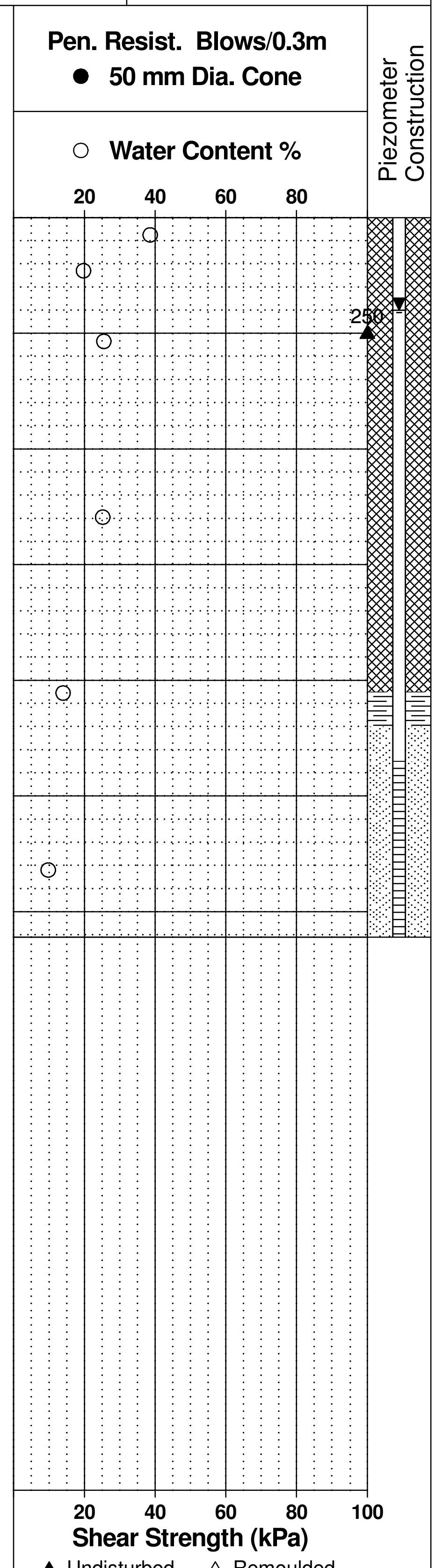
SOIL DESCRIPTION	Bottom depth (m)	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.33	SS	1	75	3
Very loose, brown **SILTY SAND**	0.91				
Very stiff, brown **SILTY CLAY**	1.45	SS	2	92	6
Hard to very stiff, brown **CLAYEY SILT to SANDY SILT**	2.90	SS	3	83	12
Very dense to dense, brown **SILTY SAND** with gravel, occasional cobbles	5.26	SS	4	27	50+
		SS	5	83	19
		SS	6	50	48
GLACIAL TILL: Compact to dense, grey silty sand to sandy silt with gravel, cobbles and boulders	6.22	SS	7	92	32
		SS	8	80	50+

DEPTH (m)	ELEV. (m)
0	94.08
1	93.08
2	92.08
3	91.08
4	90.08
5	89.08
6	88.08

End of Borehole

Practical refusal to augering at 6.22m depth.

(GWL at 0.87m - May 18, 2022)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE 2022 April 20

FILE NO. PG4958

HOLE NO. BH 3B-22-PH18

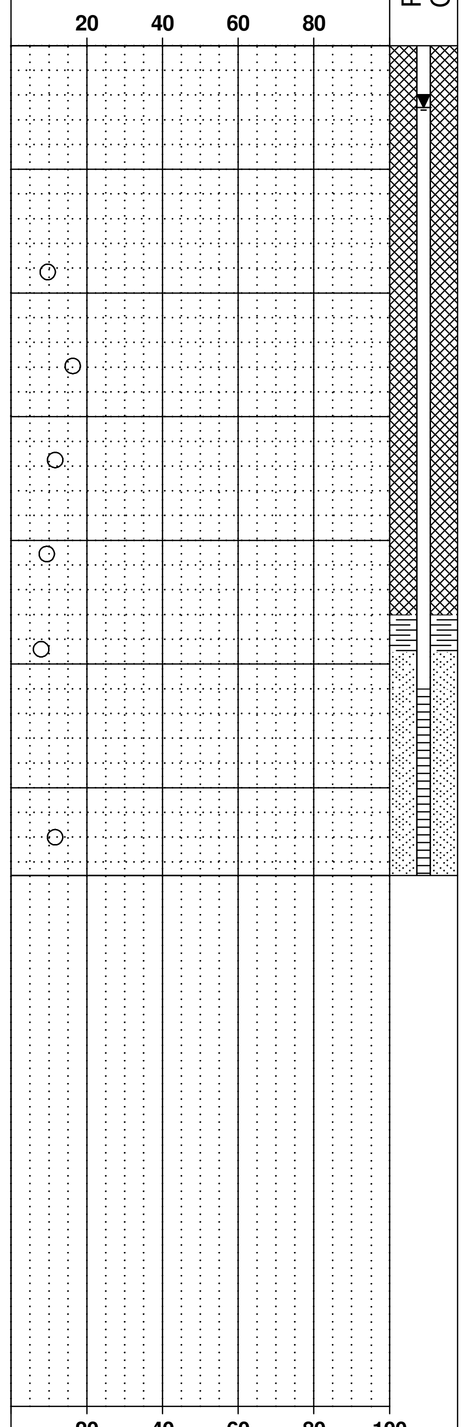
SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOPSOIL	0.28
Very stiff, brown **SILTY CLAY**	0.69
Compact, brown **SILTY SAND,** some clay	0.91
Compact to dense, brown **SILTY SAND to SANDY SILT,** some gravel, occasional cobbles	2.90
GLACIAL TILL: Very dense to compact, brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay - grey by 4.5m depth	6.71
End of Borehole (GWL at 0.50m - May 18, 2022)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
SS	1	67	2
SS	2	17	23
SS	3	83	39
SS	4	100	27
SS	5	100	57
SS	6	83	24
SS	7	25	12
SS	8	0	32
SS	9	67	9

DEPTH (m)	ELEV. (m)
0	94.90
1	93.90
2	92.90
3	91.90
4	90.90
5	89.90
6	88.90

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

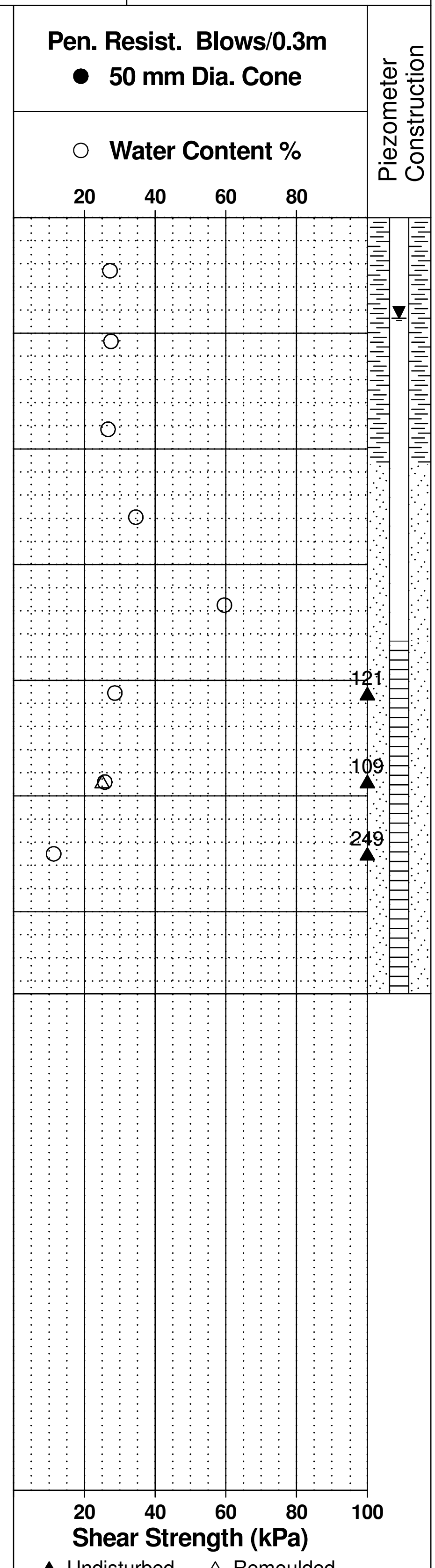
DATE 2022 May 2

FILE NO. PG4958

HOLE NO. BH17-22-PH18

SOIL DESCRIPTION	Strata bottom depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.20				
Loose, brown **SILTY SAND,** some clay	2.21	AU	1		
		SS	2	100	4
		SS	3	100	3
Loose, grey **SILTY SAND** to **SANDY SILT,** some clay	2.97	SS	4	100	2
Very stiff to hard, grey **SILTY CLAY**	5.79	SS	5	100	1
		SS	6	100	P
		SS	7	100	P
GLACIAL TILL: Loose to compact, grey silty sand with gravel, cobbles and boulders	6.71	SS	8	50	18
End of Borehole					
(GWL at 0.87m - May 18, 2022)					

DEPTH (m)	ELEV. (m)
0	93.58
1	92.58
2	91.58
3	90.58
4	89.58
5	88.58
6	87.58



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE 2022 May 2

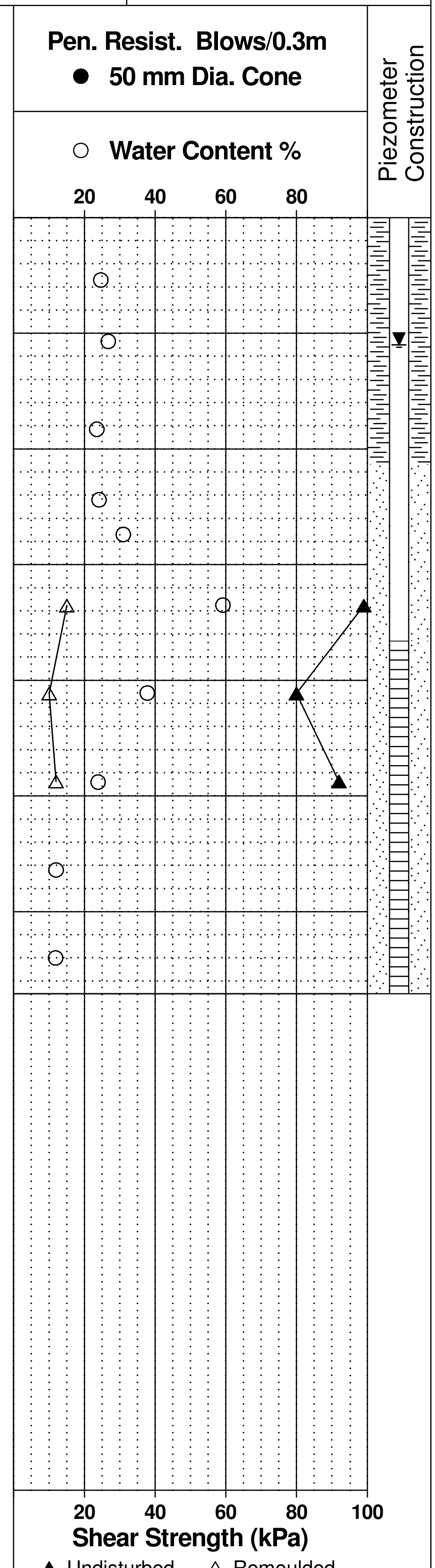
FILE NO. **PG4958**

HOLE NO. **BH18-22-PH18**

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	93.73
TOPSOIL (to 0.41)	AU	1				
Loose to compact, brown **SILTY SAND,** some clay	SS	2	100	4	1	92.73
	SS	3	100	4	2	91.73
(to 2.79)	SS	4	100	8		
Stiff, grey **SILTY CLAY**	SS	5	100	P	3	90.73
	SS	6	0	P	4	89.73
(to 5.03)	SS	7	67	P	5	88.73
GLACIAL TILL: Loose to compact, grey silty sand with gravel, cobbles and boulders	SS	8	75	10	6	87.73
(to 6.71)	SS	9	50	23		

End of Borehole

(GWL at 1.10m - May 18, 2022)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE 2022 May 3

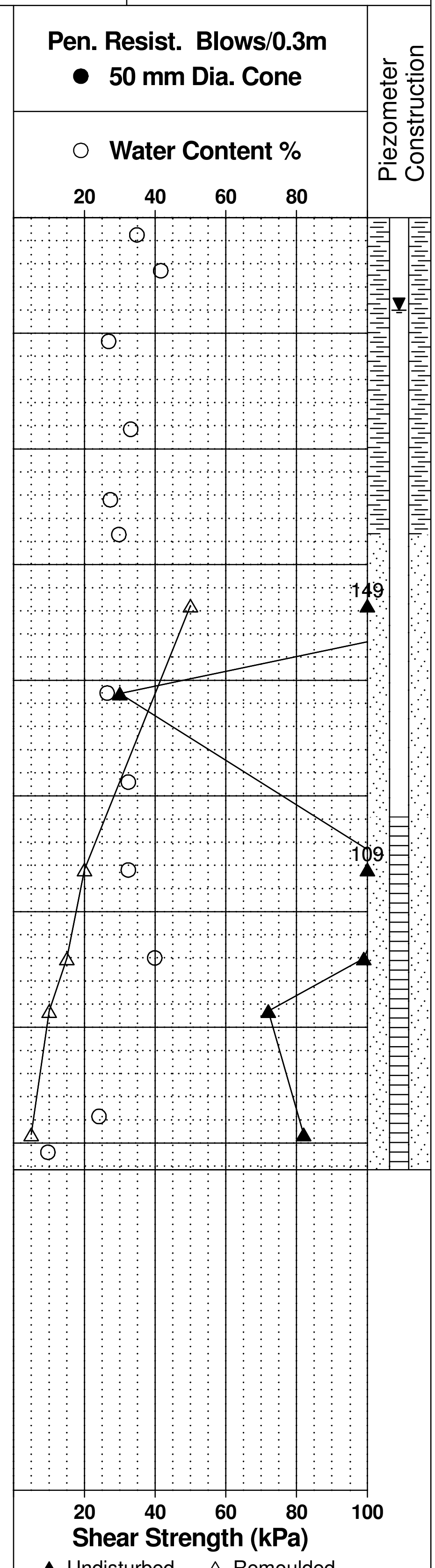
FILE NO. PG4958

HOLE NO. BH19-22-PH18

SOIL DESCRIPTION	Depth to base of layer (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.21
TOPSOIL	0.38	SS	1	50	3		
Hard, brown **SILTY CLAY**	0.69						
Loose to compact, brown **SILTY SAND,** trace to some clay - clay content increasing with depth	2.79	SS	2	75	6	1	92.21
		SS	3	100	5	2	91.21
		SS	4	100	3		
Hard to very stiff, brown **SILTY CLAY**	3.73	SS	5	0	P	3	90.21
Firm, grey **SILTY CLAY** to **CLAYEY SILT,** some sand, trace gravel	4.50	SS	6	100	P	4	89.21
Very stiff to stiff, grey **SILTY CLAY**	7.82	SS	7	100	1	5	88.21
		SS	8	100	P	6	87.21
		SS	9	100	P	7	86.21
GLACIAL TILL: Very stiff to stiff grey silty clay with gravel, cobbles and boulders	8.23	SS	10	100	P	8	85.21

End of Borehole

(GWL at 0.80m - May 18, 2022)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE 2022 May 3

FILE NO. PG4958

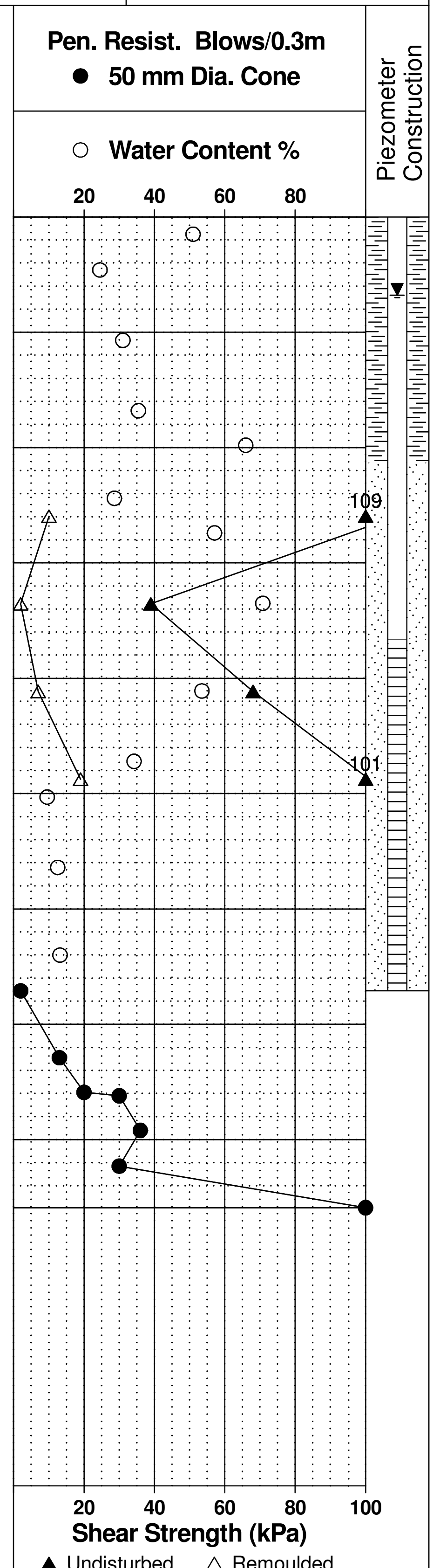
HOLE NO. BH20-22-PH18

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.30				
Loose to compact, brown **SILTY SAND,** trace clay	2.03	SS	1	67	3
		SS	2	100	4
		SS	3	83	2
Hard to very stiff, brown **SILTY CLAY**	2.82	SS	4	100	0
Firm to very stiff, grey **SILTY CLAY**	4.88	SS	5	100	0
		SS	6	100	0
		SS	7	100	0
GLACIAL TILL: Loose to compact, grey silty sand to sandy silt some gravel, cobbles and boulders, trace clay	6.71	SS	8	17	9
		SS	9	8	14
Dynamic Cone Penetration Test commenced at 6.71 m depth.	8.59				
End of Borehole					

Practical refusal to DCPT at 8.59m depth

(GWL at 0.68m - May 18, 2022)

DEPTH (m)	ELEV. (m)
0	93.50
1	92.50
2	91.50
3	90.50
4	89.50
5	88.50
6	87.50
7	86.50
8	85.50



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

REMARKS

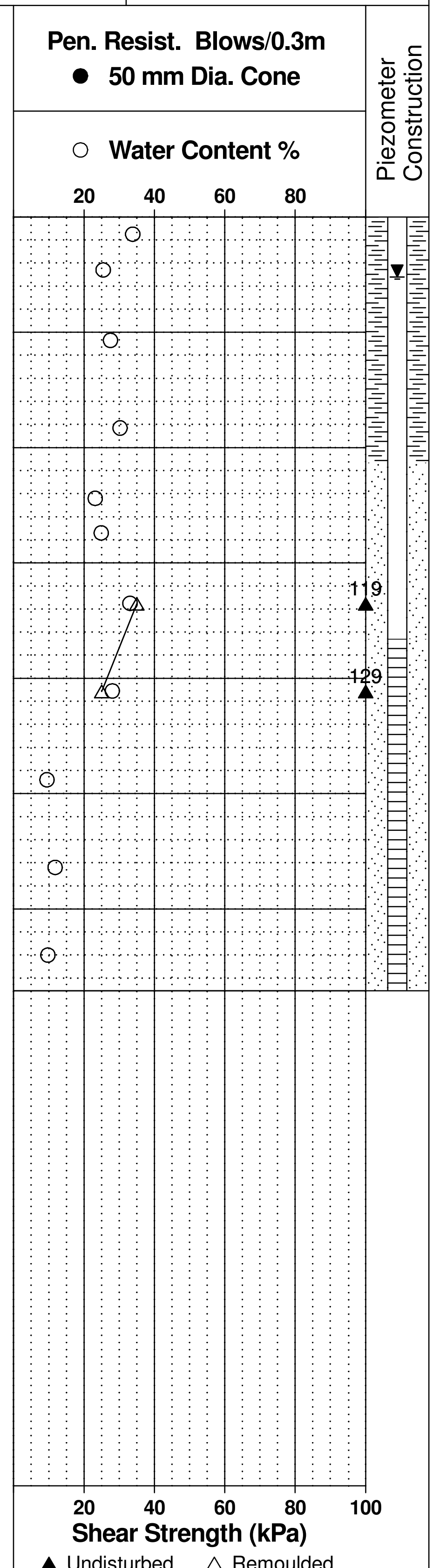
BORINGS BY Track-Mount Power Auger

DATE 2022 May 3

FILE NO. **PG4958**

HOLE NO. **BH21-22-PH18**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.59
TOPSOIL — 0.20		SS	1	33	3		
Loose, brown **SILTY SAND,** trace to some clay - clay content increasing with depth		SS	2	100	5	1	92.59
		SS	3	0	3	2	91.59
— 2.90		SS	4	100	2		
Very stiff, grey **SILTY CLAY,** trace sand — 3.96		SS	5	75	P	3	90.59
GLACIAL TILL: Very stiff, grey silty clay with sand, gravel, cobbles and boulders		SS	6	50	P	4	89.59
— 5.26		SS	7	33	15	5	88.59
GLACIAL TILL: Compact to dense, grey silty sand to sandy silt, some clay, gravel, cobbles and boulders		SS	8	25	28	6	87.59
— 6.71		SS	9	50	17		
End of Borehole (GWL at 0.52m - May 18, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Riverside South Development - Phase 18
Limebank Road, Ottawa, Ontario

DATUM Geodetic

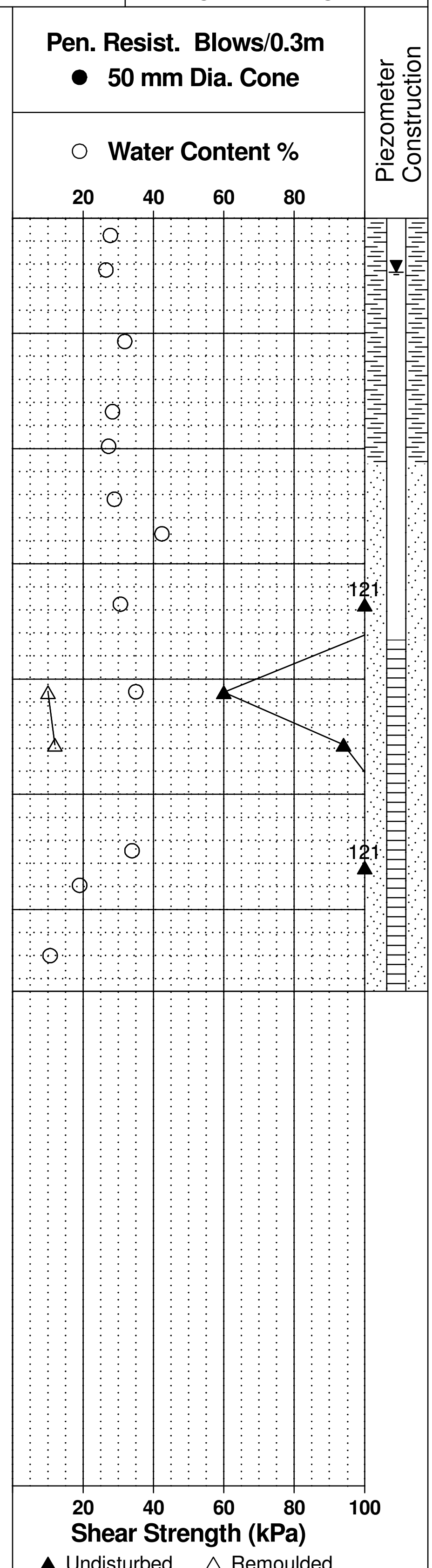
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** 2022 May 4

FILE NO. **PG4958**

HOLE NO. **BH25-22-PH18**

SOIL DESCRIPTION	Bottom depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.57
FILL: Crushed stone	0.03						
TOPSOIL	0.28	SS	1	42	3		
Loose to compact, brown **SILTY SAND,** some clay	2.59	SS	2	0	4	1	92.57
		SS	3	100	3	2	91.57
Hard to very stiff, brown **SILTY CLAY**	2.97	SS	4	100	2		
Very stiff to stiff, grey **SILTY CLAY**	5.54	SS	5	58	P	3	90.57
		SS	6	100	P	4	89.57
						5	88.57
GLACIAL TILL: Compact to dense, grey silty sand with gravel, some clay, cobbles and boulders	6.71	SS	7	63	P	6	87.57
		SS	8	38	35		
End of Borehole							
(GWL at 0.47m - May 18, 2022)							



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Riverside South Community MDP Update
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

REMARKS

BORINGS BY CME 55 Power Auger

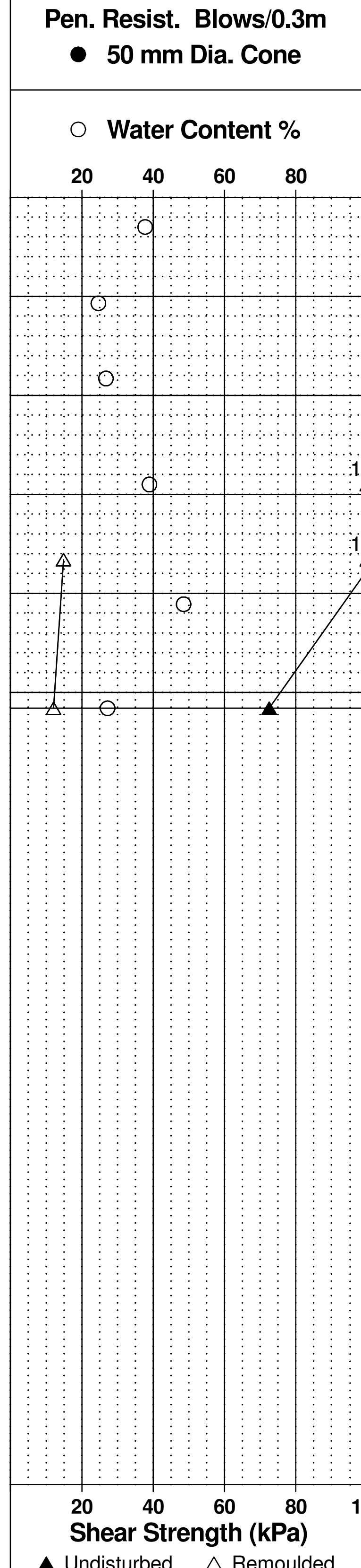
DATE 2019 June 11

FILE NO. PG4958

HOLE NO. BH 3

SOIL DESCRIPTION	Depth to base (m)	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE						
TOPSOIL	0.28		AU	1		
Loose, brown **SILTY SAND,** trace gravel	1.98		SS	2	62	6
			SS	3	100	3
Very stiff to stiff, brown **SILTY CLAY**	5.16		SS	4	79	5
End of Borehole						
Practical refusal to augering at 5.16m depth						

DEPTH (m)	ELEV. (m)
0	92.59
1	91.59
2	90.59
3	89.59
4	88.59
5	87.59



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Plaza - 1515 Earl Armstrong Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5304

REMARKS

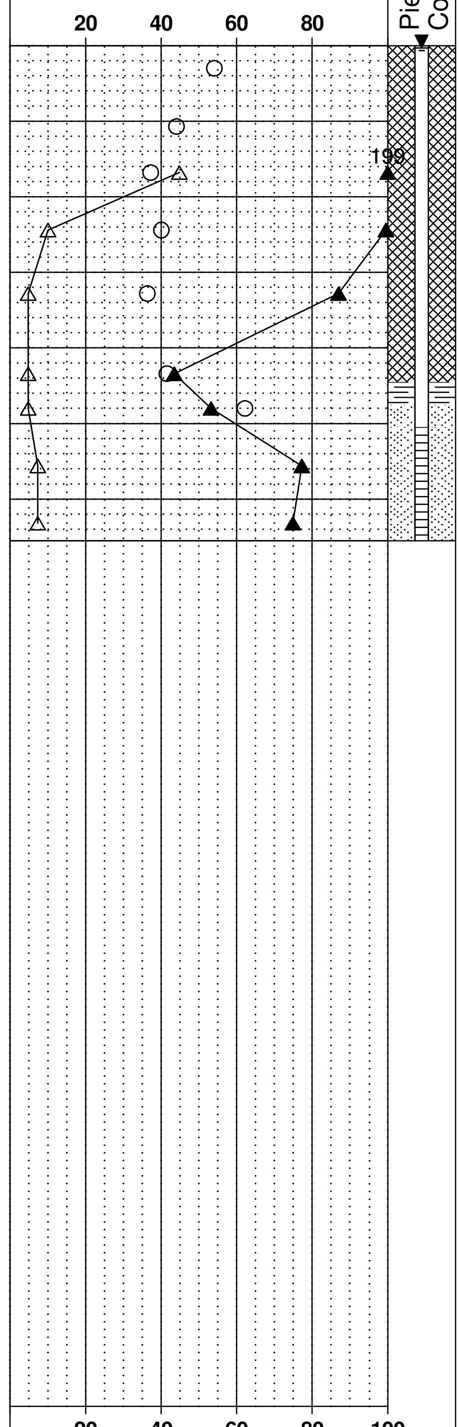
HOLE NO. BH 1-20

BORINGS BY CME 55 Power Auger

DATE March 25, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.12
TOPSOIL 0.10		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** some sand, trace organics		SS	2		6	1	91.12
						2	90.12
						3	89.12
- firm to stiff and grey by 3.8m depth						4	88.12
						5	87.12
6.55						6	86.12
End of Borehole							
(GWL @ 0.03m - March 31, 2020)							

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



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Plaza - 1515 Earl Armstrong Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

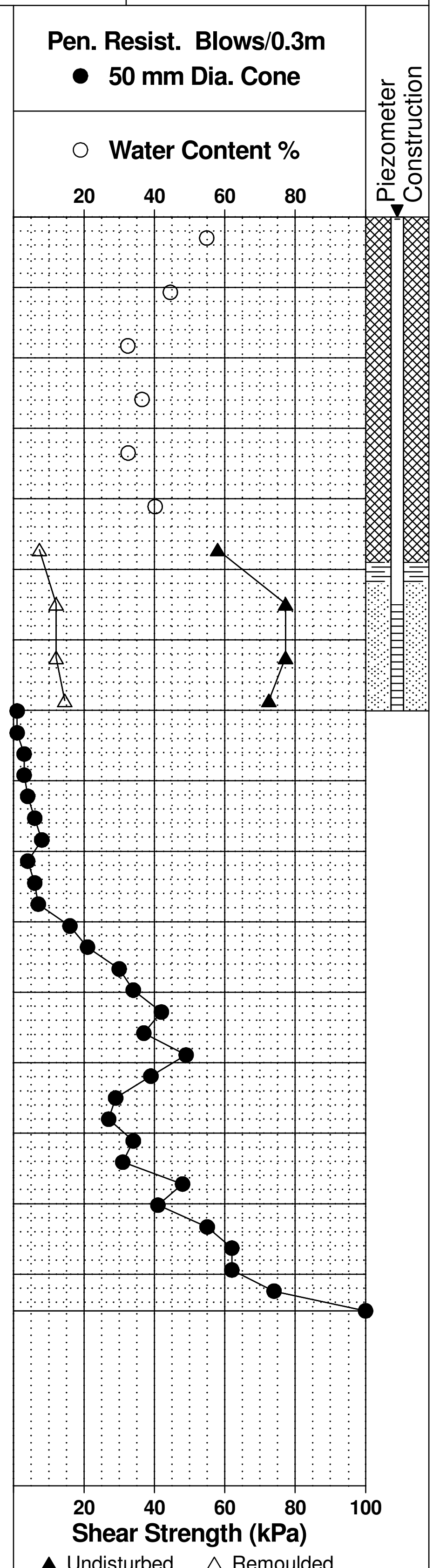
BORINGS BY CME 55 Power Auger

DATE March 23, 2020

FILE NO. PG5304

HOLE NO. BH 4-20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.15
TOPSOIL 0.10		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** some sand, trace organics - firm to stiff and grey by 3.0m depth		SS	2	67	8	1	91.15
		SS	3	88	5	2	90.15
		SS	4	100	2	3	89.15
		SS	5	100	1		
		SS	6	100	P	4	88.15
						5	87.15
						6	86.15
7.01						7	85.15
Dynamic Cone Penetration Test commenced at 7.01m depth						8	84.15
						9	83.15
						10	82.15
						11	81.15
						12	80.15
						13	79.15
						14	78.15
						15	77.15
15.52							
End of Borehole Practical DCPT refusal at 15.52m depth (GWL @ ground surface - March 31, 2020)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Plaza - 1515 Earl Armstrong Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE March 23, 2020

FILE NO. PG5304

HOLE NO. BH10-20

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	91.93
TOPSOIL 0.10	AU	1				
Very stiff to stiff, brown **SILTY CLAY,** some sand	SS	2	100	4	1	90.93
	SS	3	100	5	2	89.93
	SS	4	100	2		
- firm to stiff and grey by 3.0m depth	SS	5	100	1	3	88.93
					4	87.93
	SS	6	100	P	5	86.93
	SS	7	100	P	6	85.93
6.70 End of Boreole						

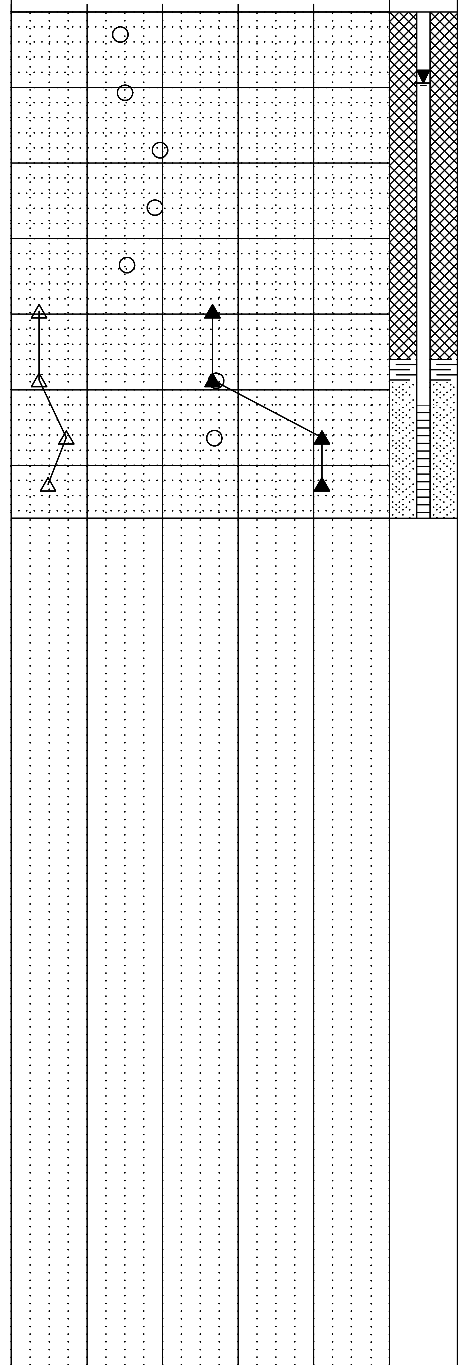
(GWL @ 0.94m - March 31, 2020)

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

○ Water Content %

20 40 60 80

Piezometer Construction



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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM TBM - Cut-cross on concrete located on the concrete island opposite the southwest corner of subject site. Geodetic elevation = 92.87m

REMARKS N 5014454; E 447682

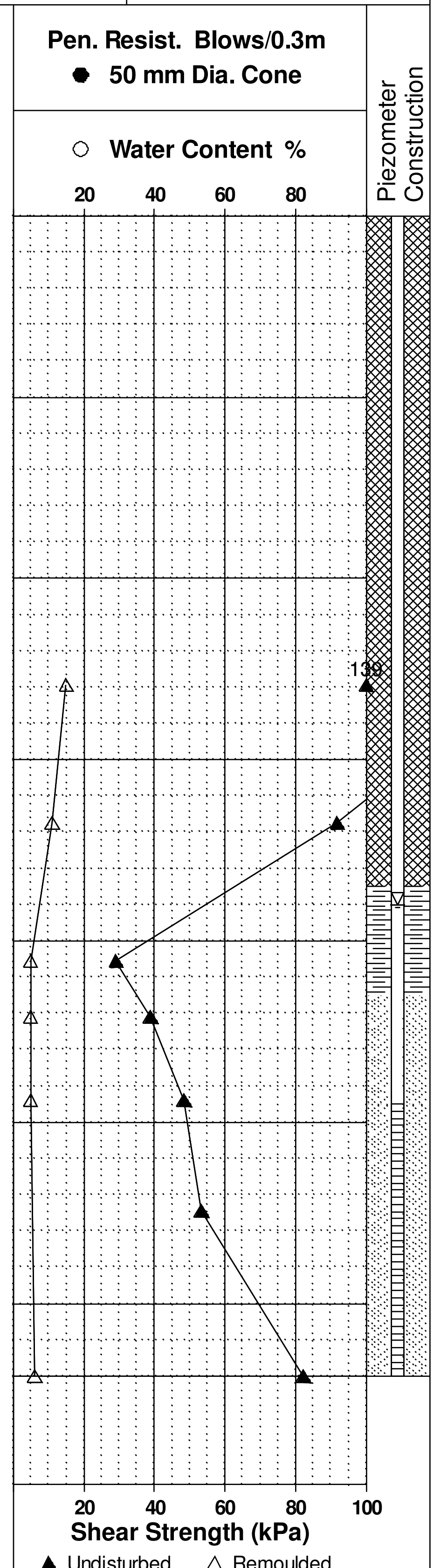
BORINGS BY CME 55 Power Auger

DATE 27 April 2016

FILE NO. PG2776

HOLE NO. BH 2-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.26
TOPSOIL with rootlets (to 0.18)		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand seams		SS	2	100	10	1	91.26
		SS	3	100	5	2	90.26
						3	89.26
- firm to stiff and grey by 3.7m depth						4	88.26
						5	87.26
(to 6.40)						6	86.26
End of Borehole							
(GWL @ 3.8m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM TBM - Cut-cross on concrete located on the concrete island opposite the southwest corner of subject site. Geodetic elevation = 92.87m

REMARKS N 5014397; E 447708

BORINGS BY CME 55 Power Auger

DATE 27 April 2016

FILE NO. PG2776

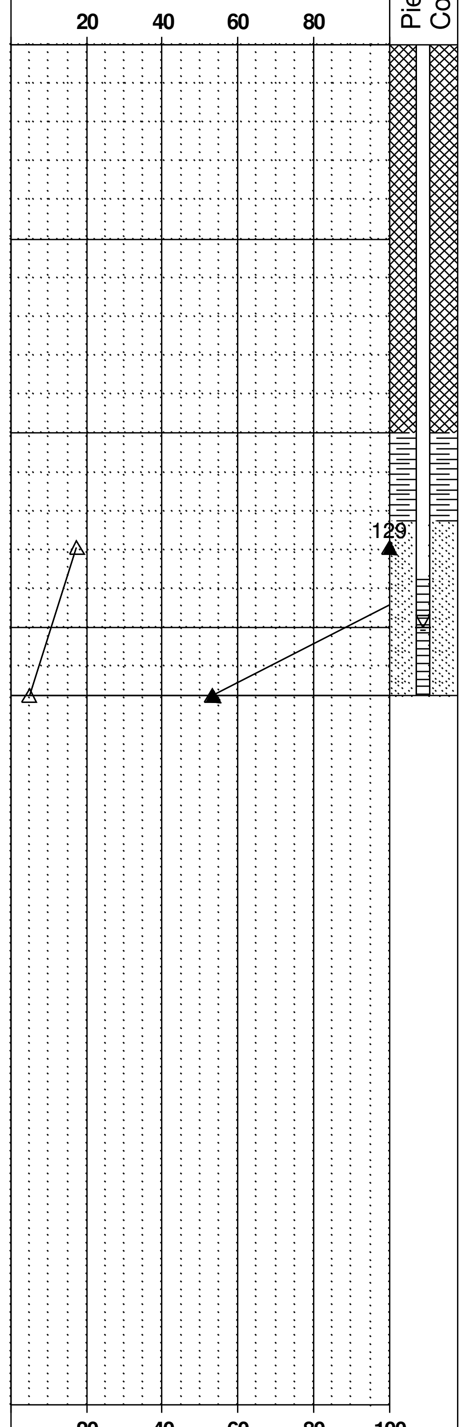
HOLE NO. BH 3-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.25
TOPSOIL with rootlets (0.13)		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** some sand		SS	2	100	8	1	91.25
		SS	3	100	4	2	90.25
- grey by 3.2m depth (3.35)						3	89.25
End of Borehole (GWL @ 3.0m depth based on field observations)							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM TBM - Cut-cross on concrete located on the concrete island opposite the southwest corner of subject site. Geodetic elevation = 92.87m

REMARKS N 5014424; E 447749

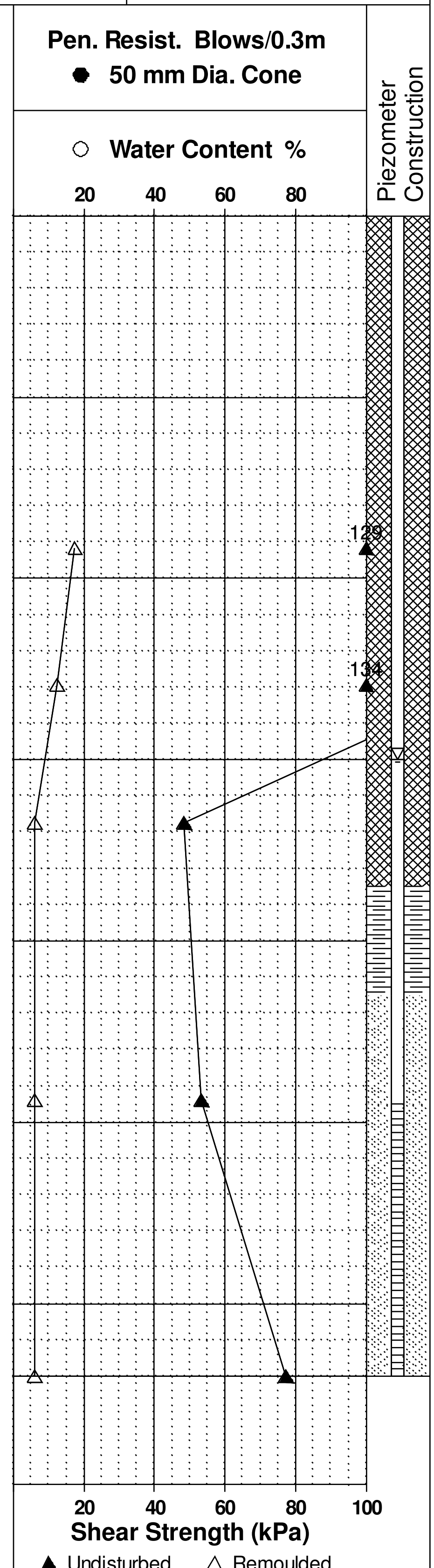
BORINGS BY CME 55 Power Auger

DATE 27 April 2016

FILE NO. PG2776

HOLE NO. BH 4-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.01
		AU	1				
		SS	2	100	7	1	91.01
Veyr stiff to stiff, brown **SILTY CLAY,** some sand						2	90.01
- firm to stiff and grey by 2.9m depth						3	89.01
						4	88.01
						5	87.01
6.40						6	86.01
End of Borehole							
(GWL @ 3.0m depth based on field observations)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM TBM - Cut-cross on concrete located on the concrete island opposite the southwest corner of subject site. Geodetic elevation = 92.87m

REMARKS N 5014448; E 447796

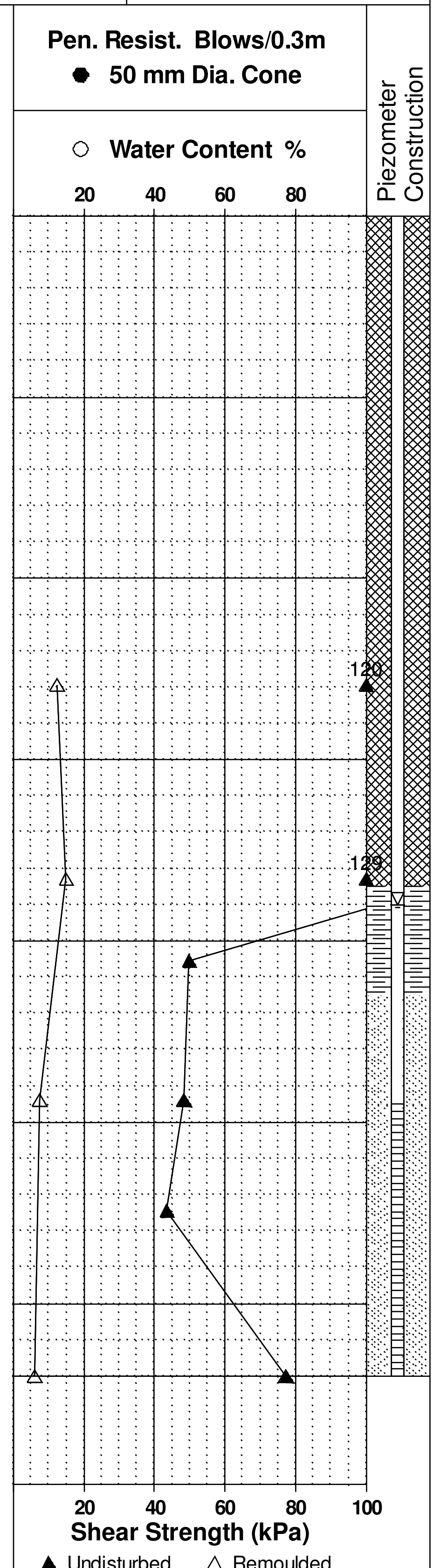
BORINGS BY CME 55 Power Auger

DATE 27 April 2016

FILE NO. PG2776

HOLE NO. BH 5-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.24
FILL: Brown silty clay, some topsoil and organics (to 0.36)		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** some sand		SS	2	100	9	1	91.24
		SS	3	100	9		
						2	90.24
						3	89.24
- firm to stiff and grey by 3.7m depth						4	88.24
						5	87.24
(to 6.40)						6	86.24
End of Borehole							
(GWL @ 3.8m depth based on field observations)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016051; E 370149.4

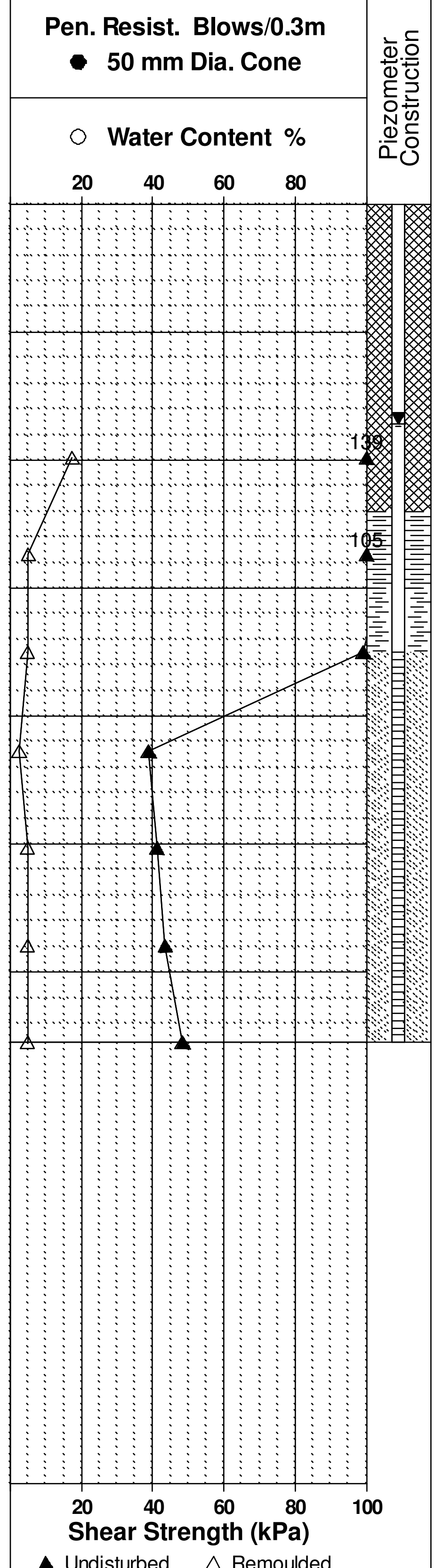
BORINGS BY CME 55 Power Auger

DATE December 7, 2012

FILE NO. PG2776

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.21
TOPSOIL 0.30		AU	1				
		AU	2				
Very stiff to stiff, brown **SILTY CLAY**		SS	3		6	1	91.21
						2	90.21
						3	89.21
- firm and grey by 3.7m depth						4	88.21
						5	87.21
6.55						6	86.21
End of Borehole							
(GWL @ 1.72m-Dec. 18, 2012)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016039; E 370187.4

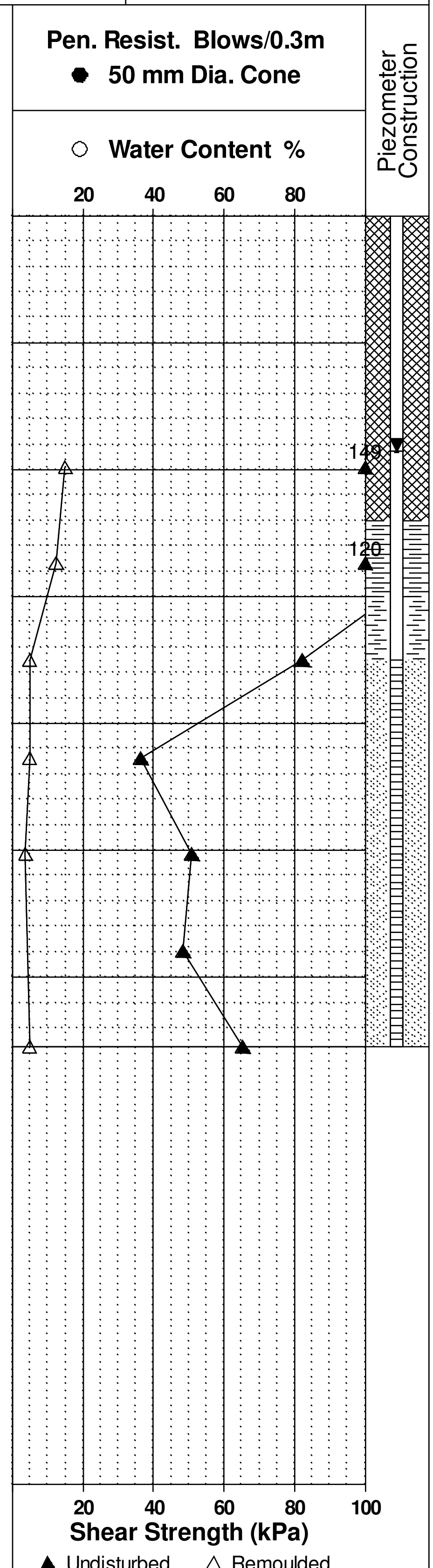
BORINGS BY CME 55 Power Auger

DATE December 6, 2012

FILE NO. PG2776

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.12
TOPSOIL		AU	1				
0.69							
Very stiff to stiff, brown **SILTY CLAY**		SS	2	100	6	1	91.12
						2	90.12
						3	89.12
- firm to stiff and grey by 3.7m depth						4	88.12
						5	87.12
						6	86.12
6.55							
End of Borehole (GWL @ 1.85m-Dec. 18, 2012)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016064; E 370240.5

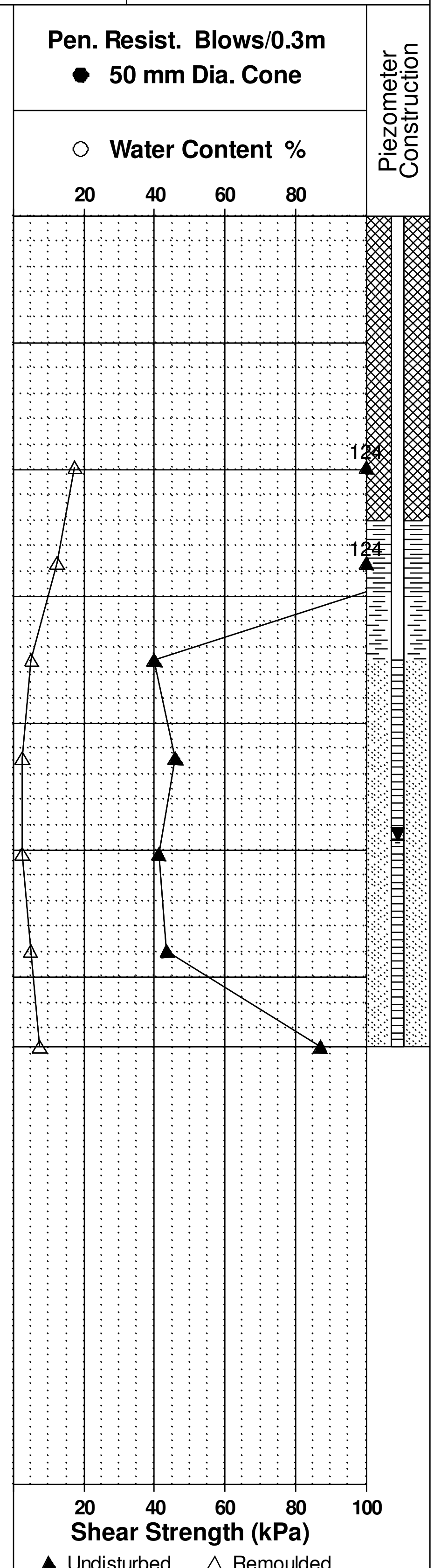
BORINGS BY CME 55 Power Auger

DATE December 6, 2012

FILE NO. PG2776

HOLE NO. BH 3

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	91.75
TOPSOIL (to 0.30)	AU	1				
Very stiff to stiff, brown **SILTY CLAY**	AU	2				
	SS	3	100	6	1	90.75
- firm to stiff by 2.9m depth					2	89.75
					3	88.75
					4	87.75
					5	86.75
(to 6.55)					6	85.75
End of Borehole						
(GWL @ 4.92m-Dec. 18, 2012)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016105; E 370304.7

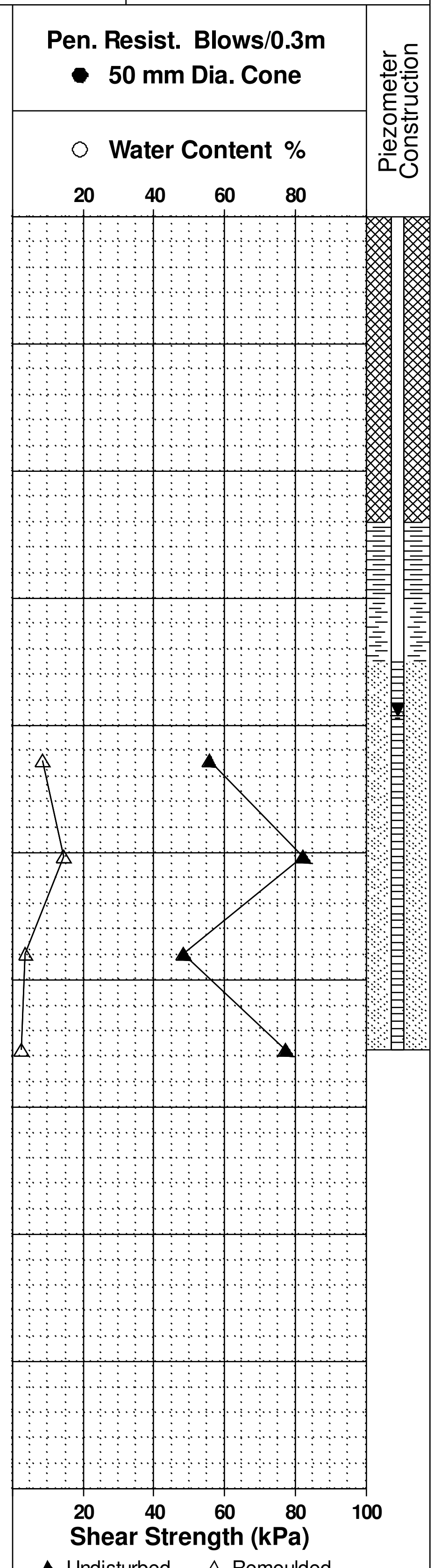
BORINGS BY CME 55 Power Auger

DATE December 6, 2012

FILE NO. PG2776

HOLE NO. BH 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.95
FILL: Gravel with sand		AU	1				
		SS	2	67	29	1	90.95
		SS	3	17	9	2	89.95
2.21							
Very stiff to stiff, brown **SILTY CLAY**		SS		8	7	3	88.95
		SS	5	67	3	4	87.95
						5	86.95
						6	85.95
6.55							
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 14.6m depth.						7	84.95
						8	83.95
						9	82.95
						10	81.95



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016105; E 370304.7

BORINGS BY CME 55 Power Auger

DATE December 6, 2012

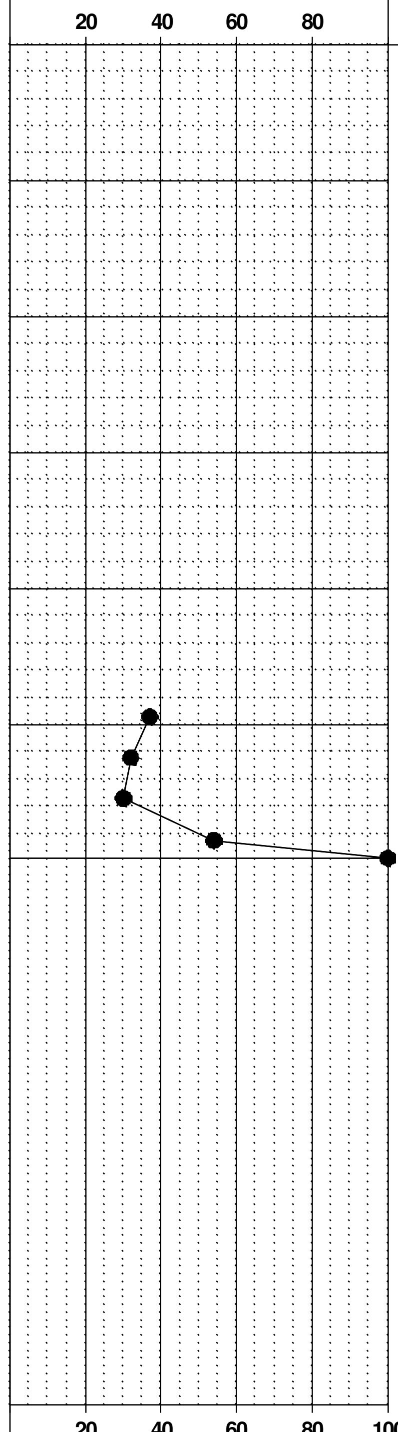
FILE NO. PG2776

HOLE NO. BH 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						10	81.95
						11	80.95
						12	79.95
						13	78.95
						14	77.95
						15	76.95
15.98							
End of Borehole Practical cone refusal at 15.98m depth. (GWL @ 3.92m-Dec. 18, 2012)							

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

○ Water Content %



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016122; E 370349.2

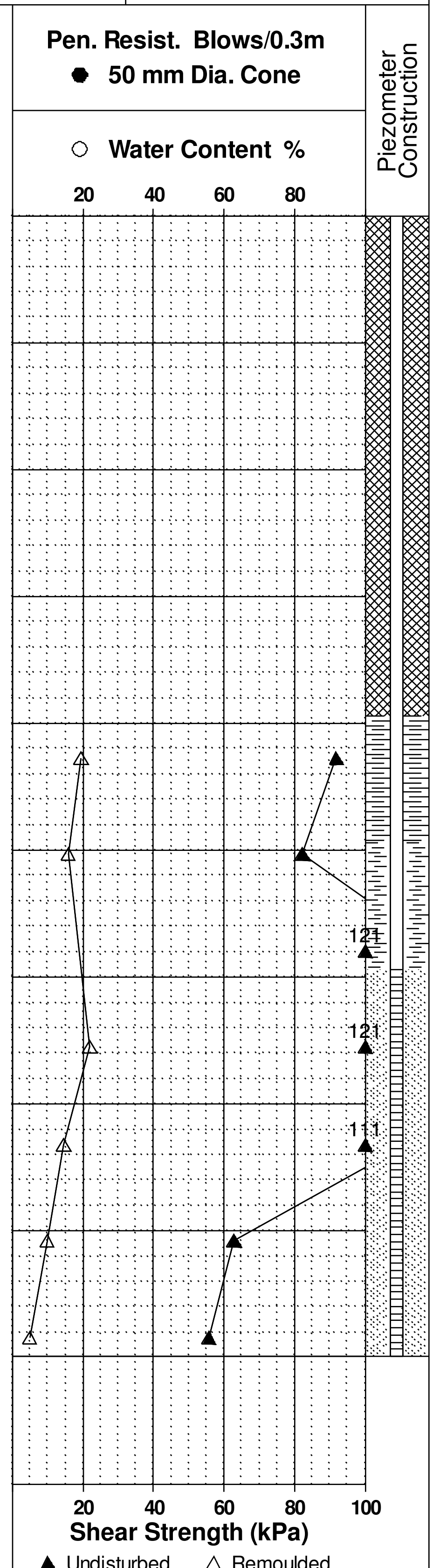
BORINGS BY CME 55 Power Auger

DATE December 6, 2012

FILE NO. PG2776

HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.91
FILL: Gravel (to 0.30)		AU	1				
FILL: Crushed stone with gravel and sand (0.30 to 2.21)		AU	2				
		SS	3	58	31	1	90.91
		SS	4	67	23	2	89.91
Very stiff to stiff, brown **SILTY CLAY** (2.21 to 8.99)		SS	5	17	6		
		SS	6	83	6	3	88.91
						4	87.91
						5	86.91
						6	85.91
						7	84.91
						8	83.91
End of Borehole (8.99)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016135; E 370251.6

BORINGS BY CME 55 Power Auger

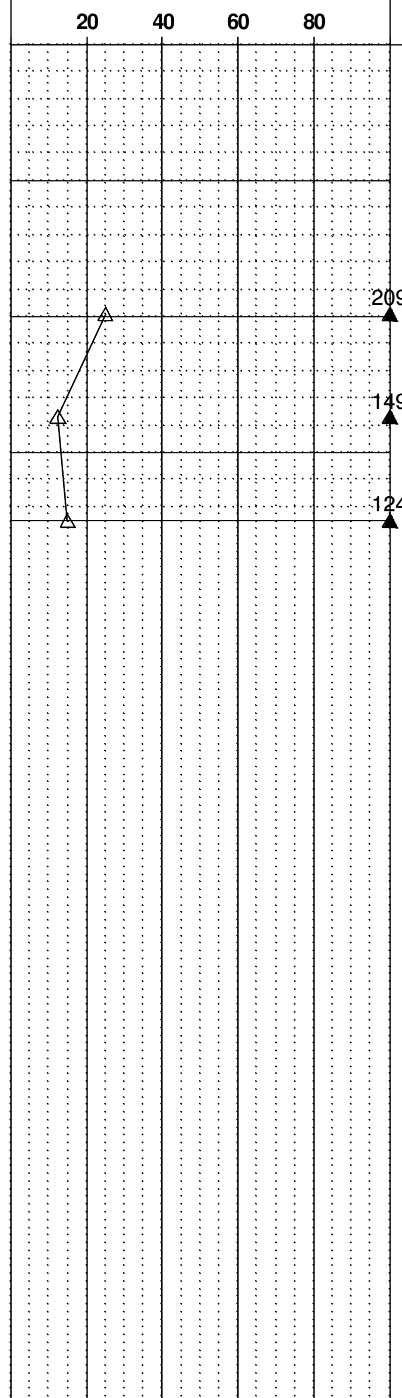
DATE December 7, 2012

FILE NO. PG2776

HOLE NO. BH 6

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.51
TOPSOIL	0.08	AU	1				
FILL: Brown silty sand with gravel	0.48						
Hard to very stiff, brown **SILTY CLAY**		SS	2	58	7	1	91.51
						2	90.51
	3.50					3	89.51
End of Borehole							

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



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

REMARKS N 5016108; E 370205.4

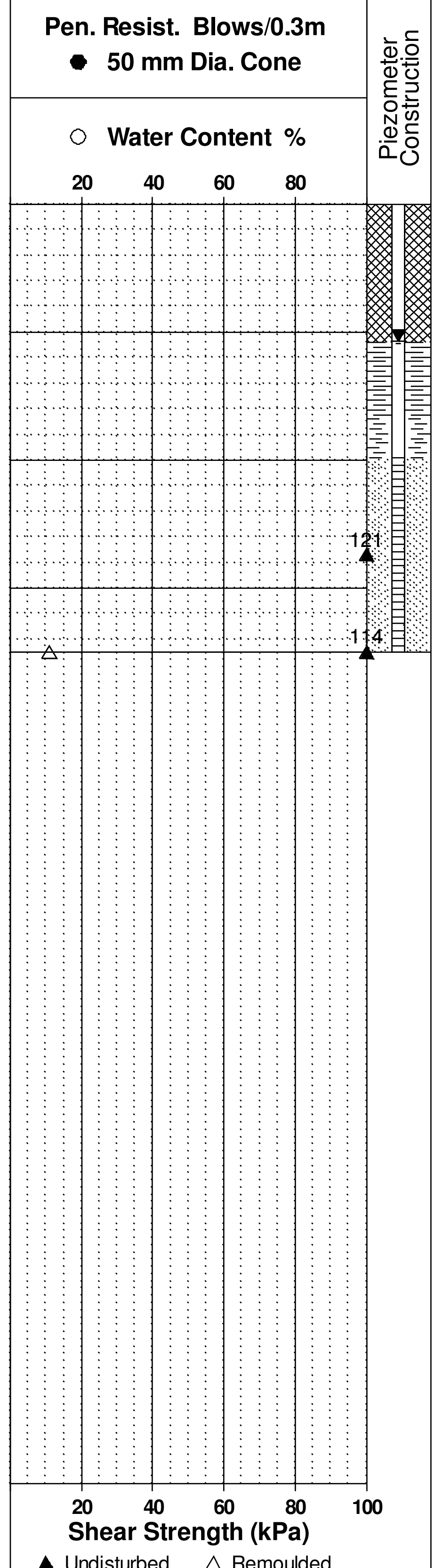
BORINGS BY CME 55 Power Auger

DATE December 7, 2012

FILE NO. PG2776

HOLE NO. BH 7

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	92.74
FILL: Brown silty sand, some gravel	AU	1				
	SS	2	75	3	1	91.74
1.45						
Very stiff, brown **SILTY CLAY** with sand seams	SS	3	83	2	2	90.74
					3	89.74
3.50						
End of Borehole						
(GWL @ 1.07m-Dec. 18, 2012)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - Limebank Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O`Sullivan, Vollebekk Ltd.

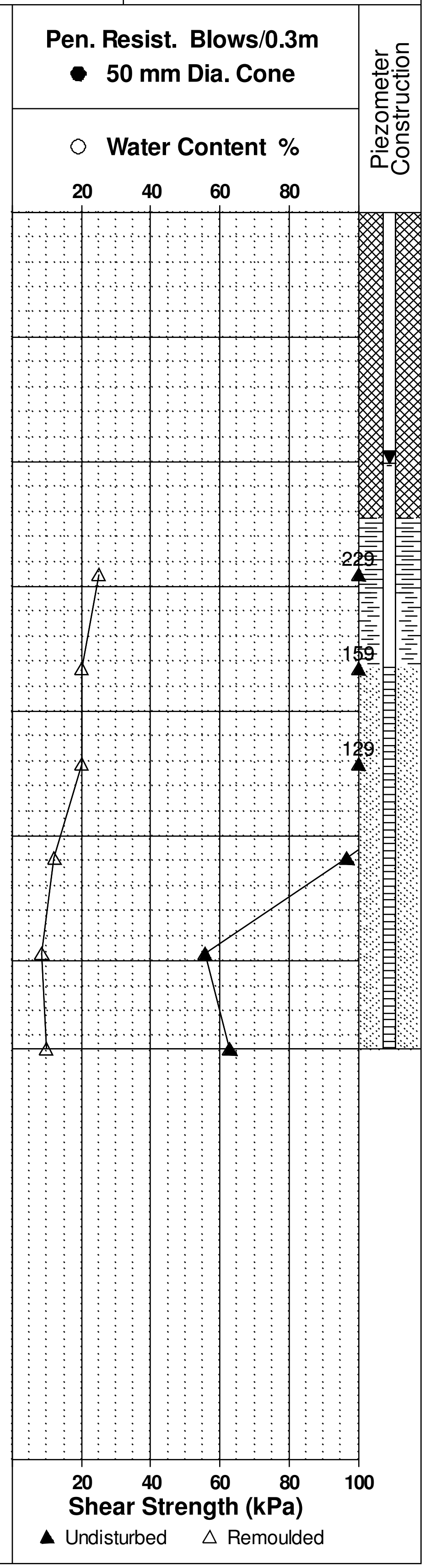
FILE NO. PG2776

REMARKS N 5016181; E 370260

HOLE NO. BH12

BORINGS BY CME 55 Power Auger **DATE** December 10, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.09
FILL: Silty sand with concrete — 0.60							
		SS	1	21	11	1	92.09
		SS	2	71	7	2	91.09
						3	90.09
Hard to stiff, grey **SILTY CLAY**						4	89.09
						5	88.09
						6	87.09
— 6.70 End of Borehole							
(GWL @ 2.01m-Dec. 18, 2012)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Rd.
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

REMARKS E 370234; N 5015944

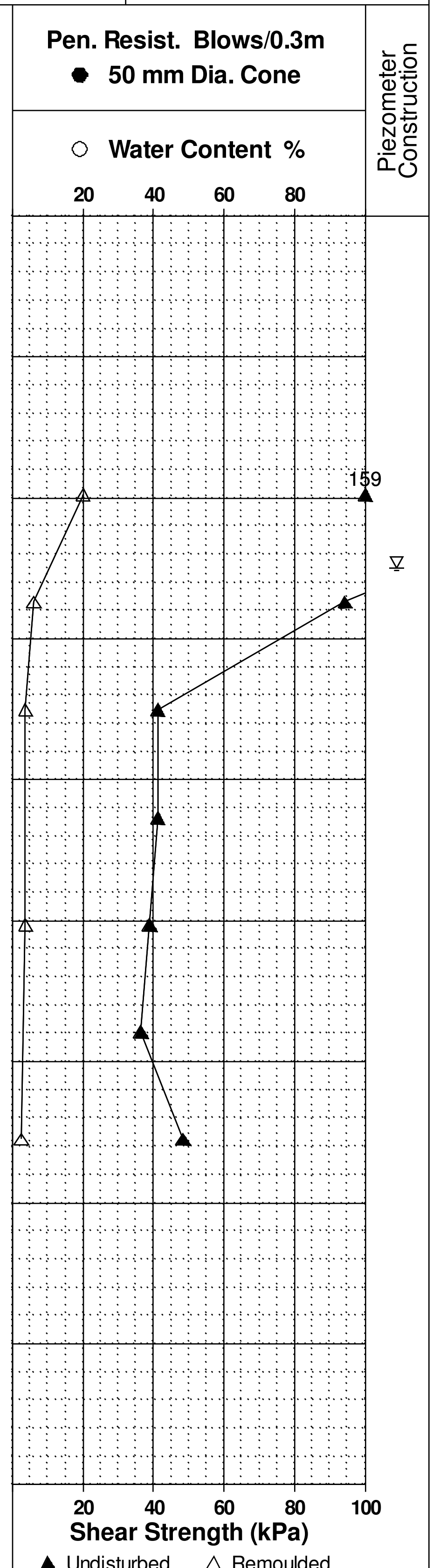
BORINGS BY CME 55 Power Auger

DATE December 17, 2012

FILE NO. PG2744

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.44
TOPSOIL (to 0.30)							
		SS	1	100	9	1	91.44
Very stiff to stiff, brown **SILTY CLAY** (0.30 to 3.20)						2	90.44
						3	89.44
						4	88.44
Firm, grey **SILTY CLAY** (3.20 to 6.55)						5	87.44
						6	86.44
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 14.3m depth.						7	85.44
						8	84.44
						9	83.44



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Rd.
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

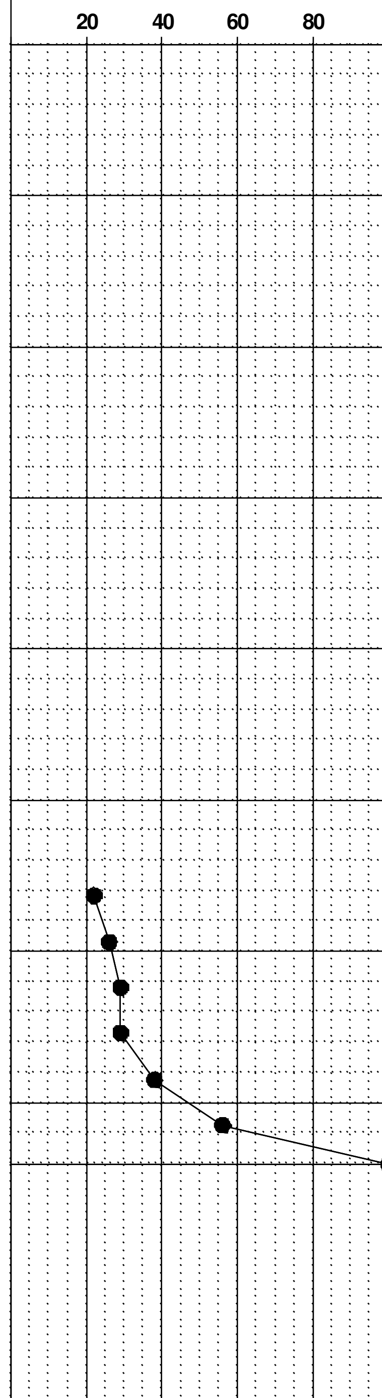
FILE NO. PG2744

REMARKS E 370234; N 5015944

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** December 17, 2012

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 %	Piezometer Construction
GROUND SURFACE						9	83.44		
						10	82.44		
						11	81.44		
						12	80.44		
						13	79.44		
						14	78.44		
						15	77.44		
						16	76.44		
16.41 End of Borehole Practical DCPT refusal at 16.41m depth. (GWL @ 2.5m depth based on field observations)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Rd.
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2744

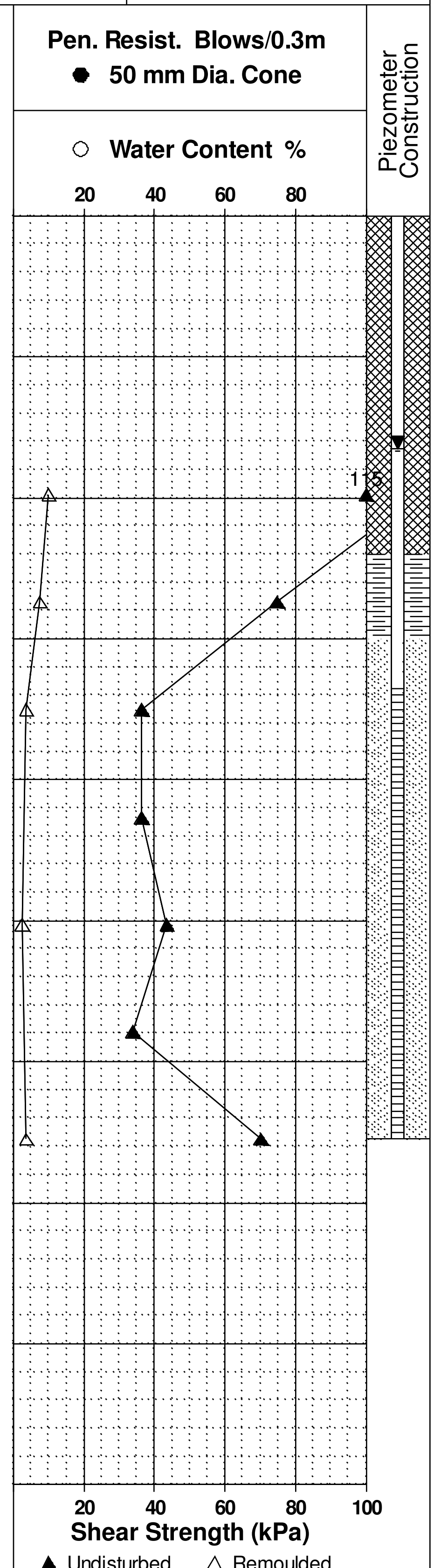
REMARKS E 370383; N 5015914

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger

DATE December 14, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.88
TOPSOIL (to 0.33)		AU	1				
Very stiff to stiff, brown **SILTY CLAY** (0.33 to 3.05)		SS	2	100	4	1	90.88
						2	89.88
Firm to stiff, grey **SILTY CLAY** (3.05 to 6.55)						3	88.88
						4	87.88
						5	86.88
						6	85.88
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 14.0m depth.						7	84.88
						8	83.88
						9	82.88



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Rd.
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2744

REMARKS E 370383; N 5015914

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger

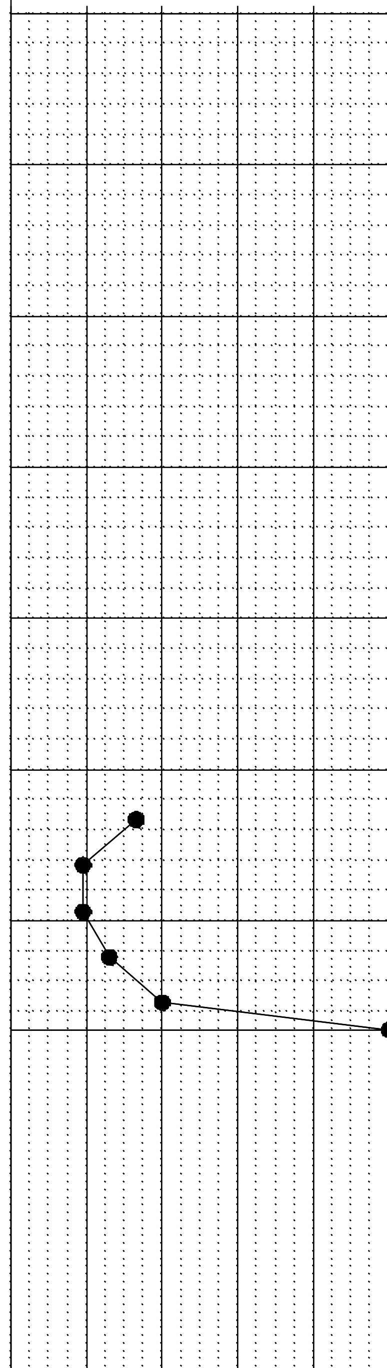
DATE December 14, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						9	82.88
						10	81.88
						11	80.88
						12	79.88
						13	78.88
						14	77.88
						15	76.88
15.72							
End of Borehole Practical DCPT refusal at 15.72m depth (GWL @ 1.65m-Jan. 2, 2013)							

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

○ Water Content %

20 40 60 80



20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Rd.
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

REMARKS E 370320; N 5015745

BORINGS BY CME 55 Power Auger

DATE December 18, 2012

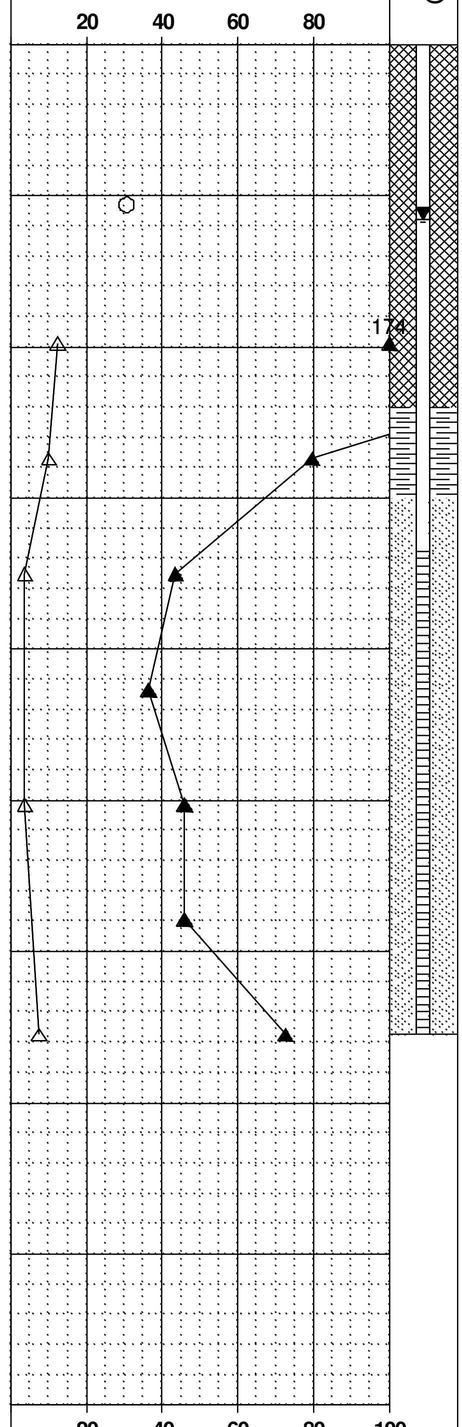
FILE NO. PG2744

HOLE NO. BH15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.49
TOPSOIL 0.30							
		SS	1	100	5	1	91.49
Very stiff to stiff, brown **SILTY CLAY** 3.05						2	90.49
						3	89.49
						4	88.49
Firm to stiff, grey **SILTY CLAY** 6.55						5	87.49
						6	86.49
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 12.9m depth.						7	85.49
						8	84.49
						9	83.49

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Rd.
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2744

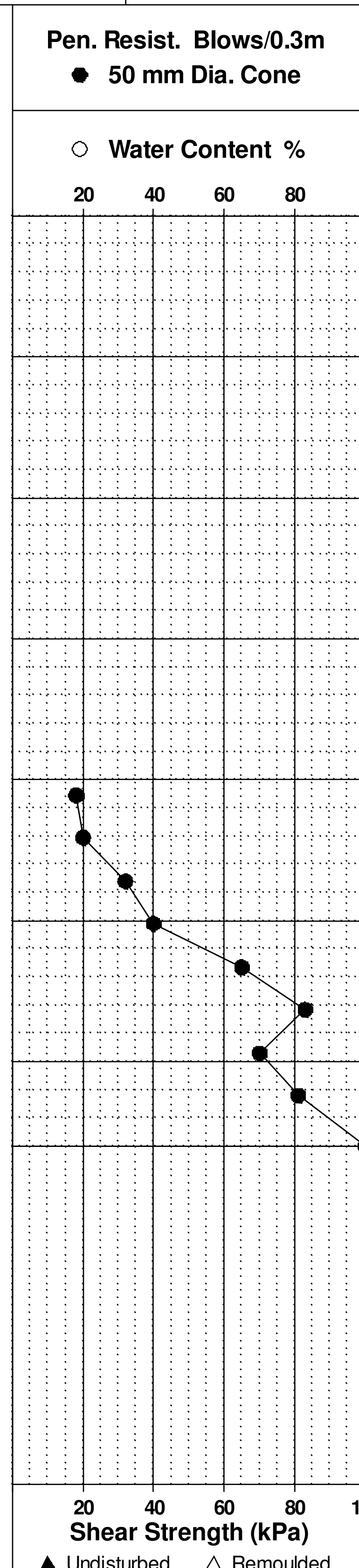
REMARKS E 370320; N 5015745

HOLE NO. BH15

BORINGS BY CME 55 Power Auger

DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						9	83.49
						10	82.49
						11	81.49
						12	80.49
						13	79.49
						14	78.49
						15	77.49
15.60							
End of Borehole Practical DCPT refusal at 15.60m depth (GWL @ 1.16m-Jan. 2, 2013)							



Piezometer Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 31 May 2011

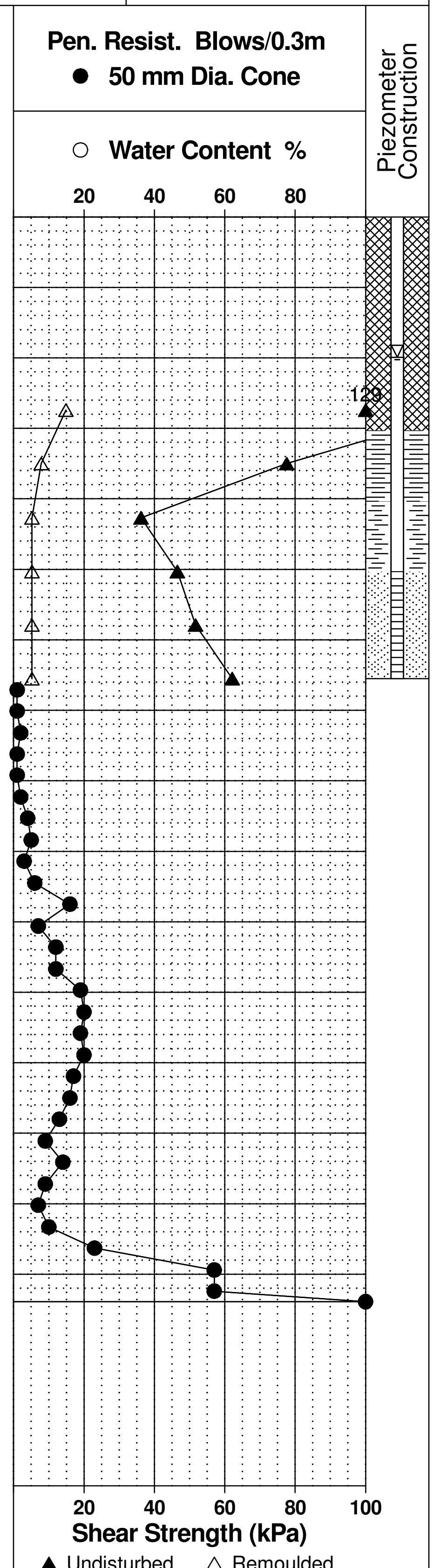
FILE NO. PG2404

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.18
TOPSOIL 0.15							
Very stiff to stiff, brown **SILTY CLAY**		SS	1	92	10	1	91.18
- grey-brown by 1.2m depth		SS	2	0	3	2	90.18
- grey by 2.3m depth						3	89.18
						4	88.18
						5	87.18
6.55						6	86.18
Dynamic Cone Penetration Test commenced @ 6.55m depth						7	85.18
						8	84.18
						9	83.18
						10	82.18
						11	81.18
						12	80.18
						13	79.18
						14	78.18
15.39						15	77.18
End of Borehole							

Practical refusal to DCPT @ 15.39m depth.

(GWL @ 1.99m - June 7/11)



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

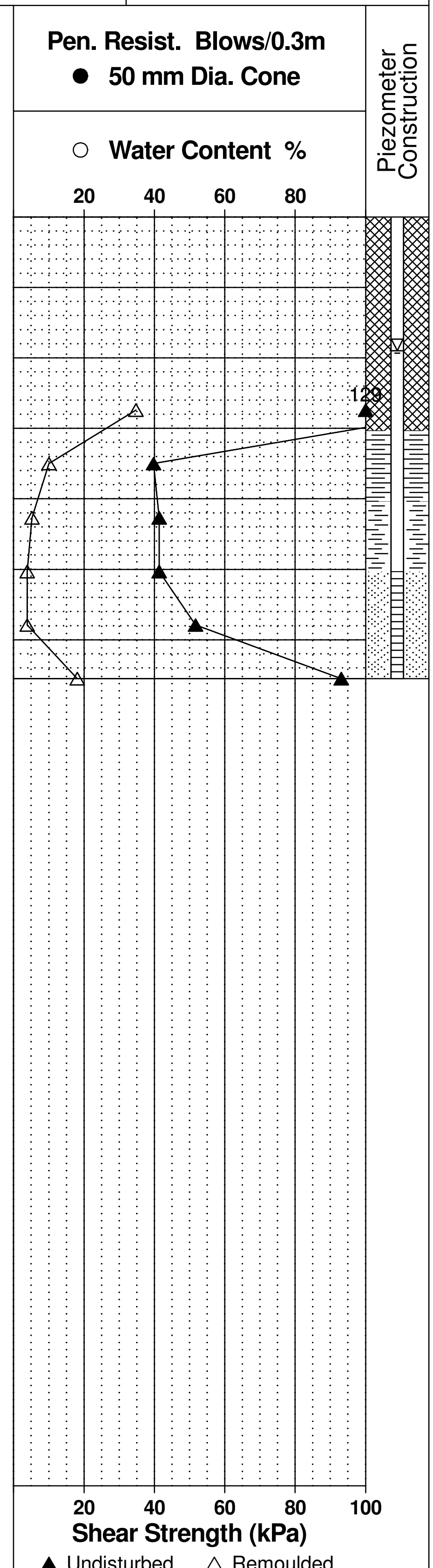
BORINGS BY CME 55 Power Auger

DATE 31 May 2011

FILE NO. PG2404

HOLE NO. BH 4

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
FILL: Brown silty clay with sand and gravel	0.30	AU	1			0	92.44
Very stiff to firm, grey-brown **SILTY CLAY** with sand - grey and silty clay by 3.0m depth		SS	2	100	8	1	91.44
		SS	3	33	4	2	90.44
						3	89.44
						4	88.44
						5	87.44
	6.55					6	86.44
End of Borehole (GWL @ 1.90m - June 7/11)							



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

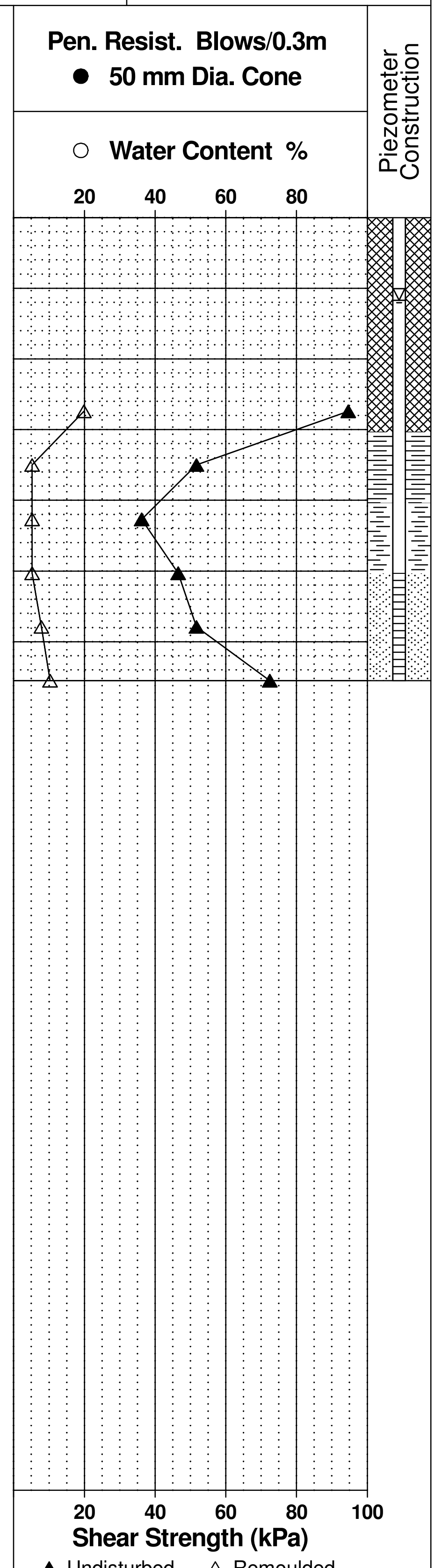
FILE NO. PG2404

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** 31 May 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.15
Stiff to firm, brown **SILTY CLAY** with sand		SS	1	75	6		
- grey-brown by 1.1m depth		SS	2	100	8	1	91.15
		SS	3	12	3	2	90.15
- grey by 2.4m depth						3	89.15
- silty clay by 3.7m depth						4	88.15
						5	87.15
						6	86.15
6.55							
End of Borehole							
(GWL @ 1.17m - June 7/11)							



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 30 May 2011

FILE NO. PG2404

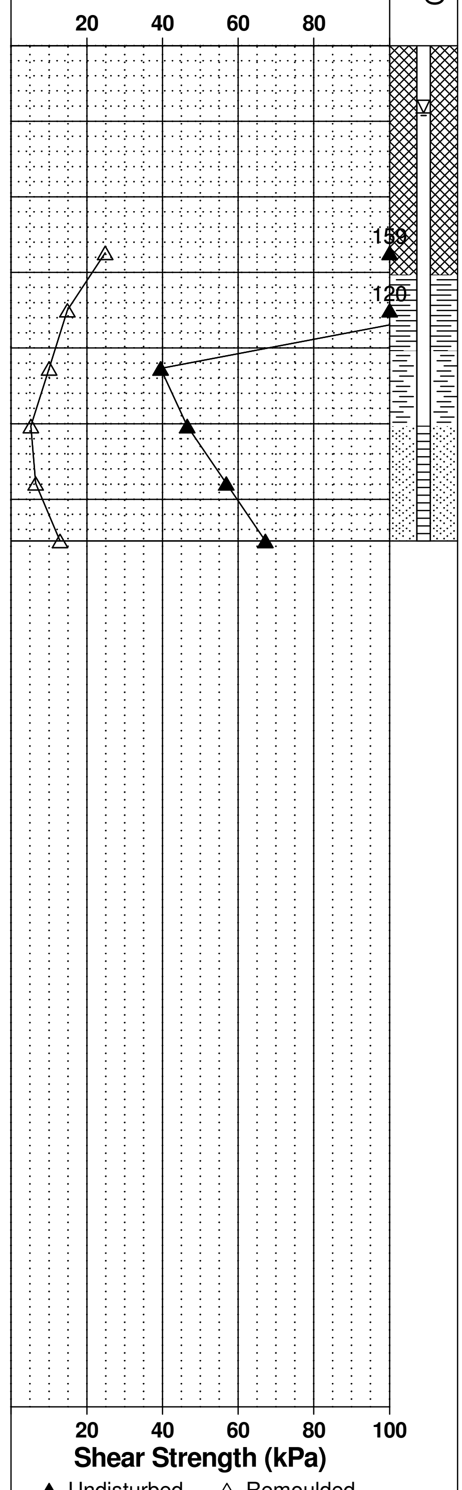
HOLE NO. BH 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.22
TOPSOIL 0.13							
		SS	1	96	6	1	91.22
		SS	2	88	4	2	90.22
Very stiff to stiff, brown **SILTY CLAY** with sand - grey by 2.7m depth - silty clay by 3.7 m depth						3	89.22
						4	88.22
						5	87.22
						6	86.22
6.55 End of Borehole (GWL @ 0.89m - June 7/11)							

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

○ Water Content %

Piezometer Construction



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-Earl Armstrong Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

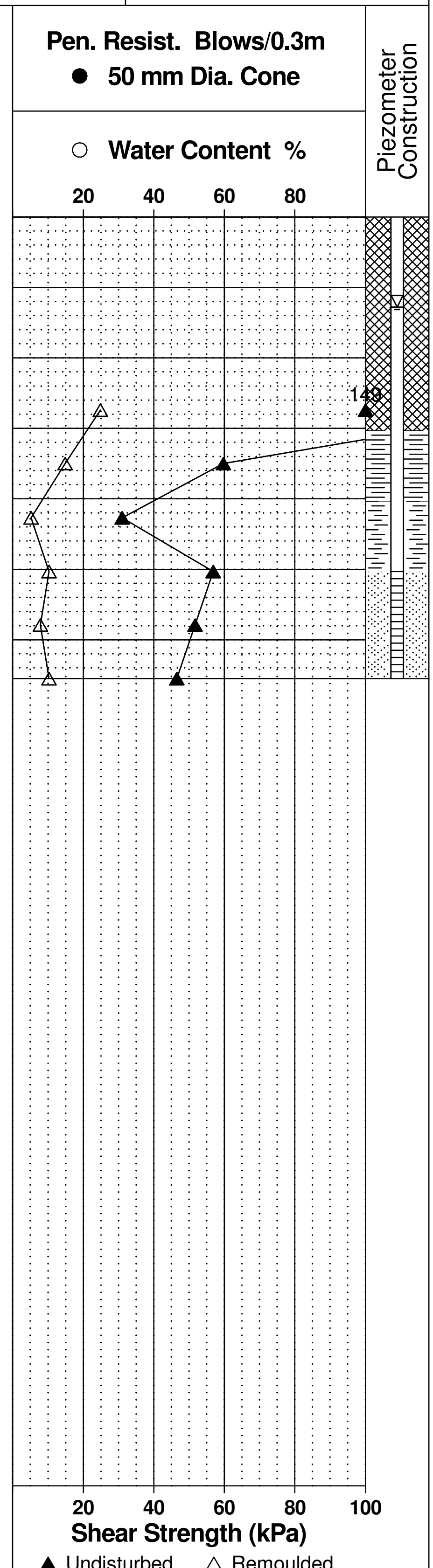
FILE NO. PG2404

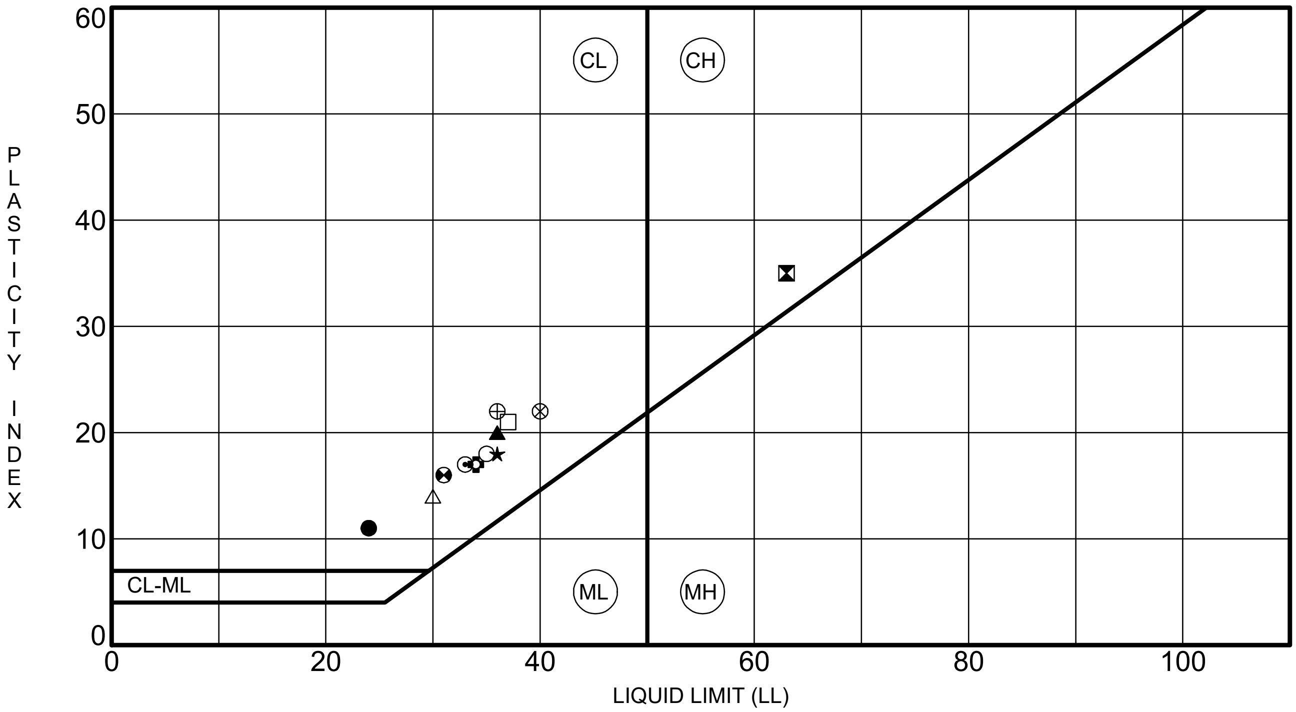
REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** 30 May 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.11
TOPSOIL 0.15							
		SS	1	100	7	1	91.11
		SS	2	58	4	2	90.11
Very stiff to stiff, grey-brown **SILTY CLAY** with sand - silty clay by 1.8 m depth - grey by 3.0m depth						3	89.11
						4	88.11
						5	87.11
						6	86.11
6.55							
End of Borehole (GWL @ 1.28m - June 7/11)							





Symbol	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-24**	**SS 4**	**24**	**13**	**11**		**CL - Inorganic clays of low plasticity**
⧗	**BH 3-24**	**SS 4**	**63**	**28**	**35**	**93.9**	**CH - Inorganic clays of high plasticity CH**
▲	**BH 4-24**	**SS 4**	**36**	**16**	**20**		**CL - Inorganic clays of low plasticity**
★	**BH 5-24**	**SS 3**	**36**	**18**	**18**	**72.0**	**CL - Inorganic clays of low plasticity CL**
⊙	**BH 6-24**	**SS 4**	**33**	**16**	**17**	**69.4**	**CL - Inorganic clays of low plasticity CL**
✿	**BH 7-24**	**SS 3**	**34**	**17**	**17**		**CL - Inorganic clays of low plasticity**
○	**BH 8-24**	**SS 4**	**35**	**17**	**18**	**74.6**	**CL - Inorganic clays of low plasticity CL**
△	**BH11-24**	**SS 4**	**30**	**16**	**14**		**CL - Inorganic clays of low plasticity**
⊗	**BH14-24**	**SS 3**	**40**	**18**	**22**	**63.7**	**CL - Inorganic clays of low plasticity CL**
⊕	**BH15-24**	**SS 3**	**36**	**14**	**22**		**CL - Inorganic clays of low plasticity**
□	**BH17-24**	**SS 4**	**37**	**16**	**21**	**82.5**	**CL - Inorganic clays of low plasticity CL**
◉	**BH18-24**	**SS 4**	**31**	**15**	**16**		**CL - Inorganic clays of low plasticity**

CLIENT **Riverside South Limited Partnership**

FILE NO. **PG4958**

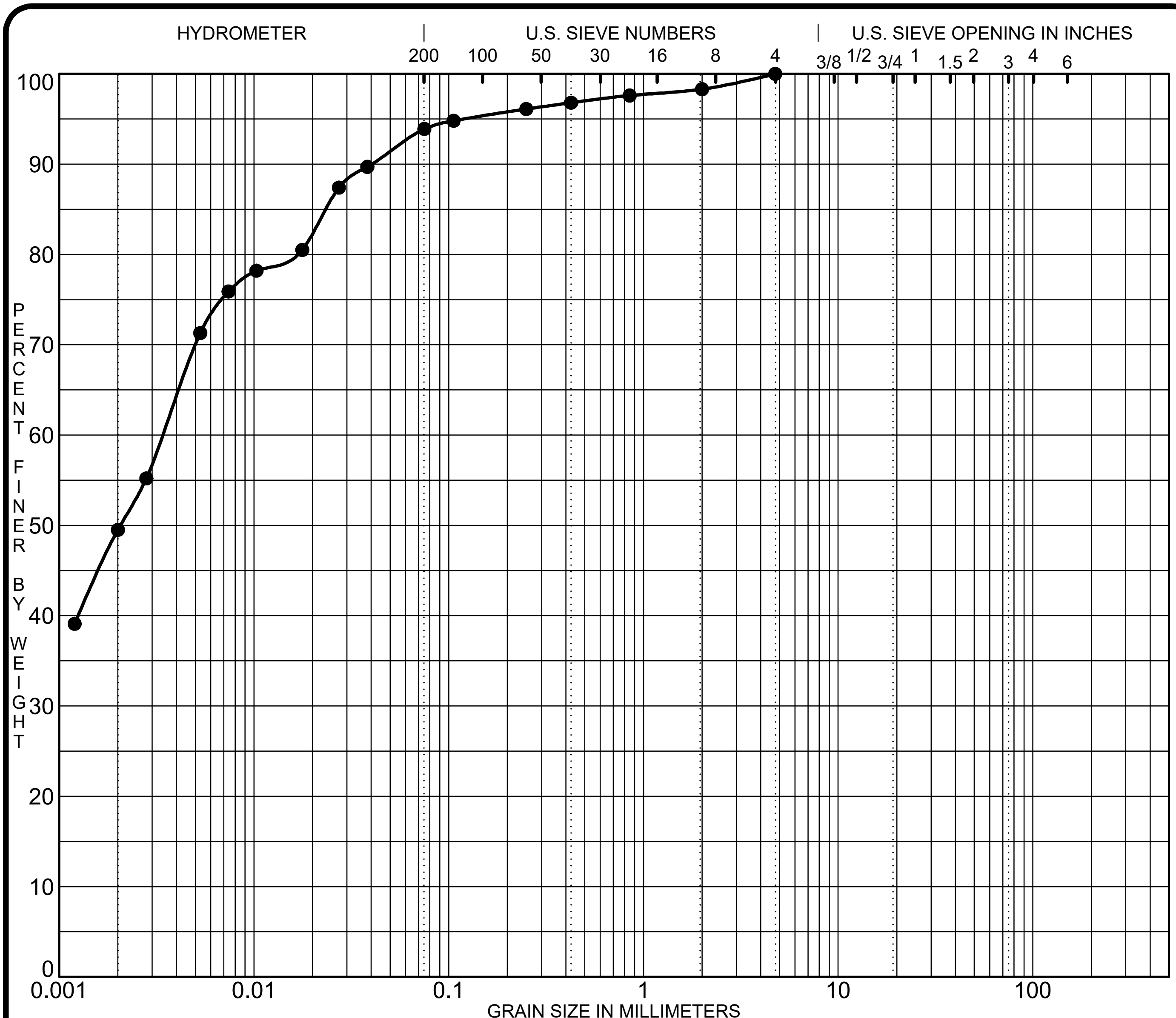
PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A**

DATE **8 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

ATTERBERG LIMITS' RESULTS



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 3-24**	**SS 4**	**CH - Inorganic clays of high plasticity**	**53.8**	**63**	**28**	**35**		
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 3-24**	**SS 4**	**4.75**	**0.00**			**0.0**	**6.1**	**44.4**	**49.5**
⊠										
▲										
★										

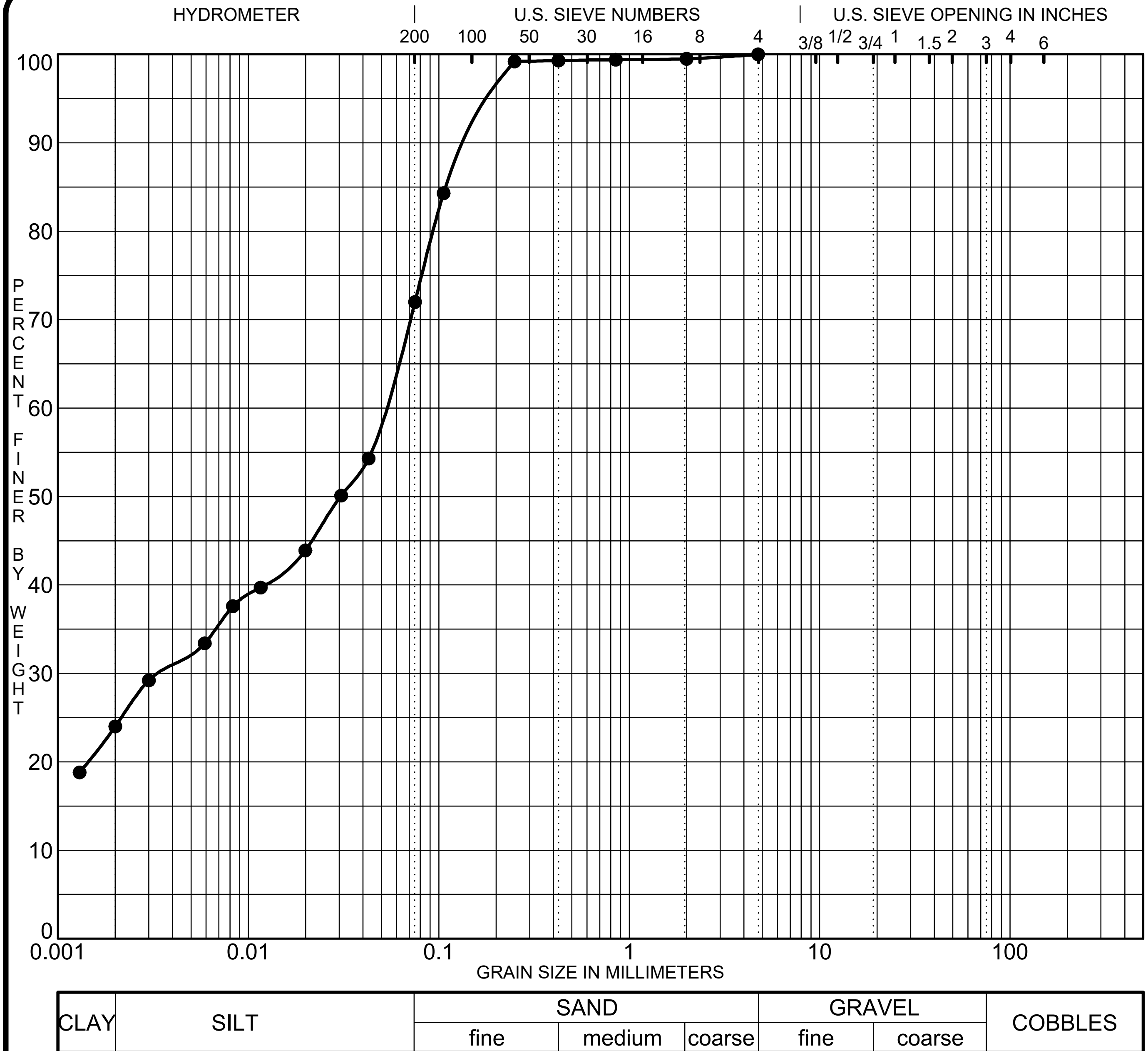
CLIENT **Riverside South Limited Partnership** FILE NO. **PG4958**

PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A** DATE **2 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 5-24**	**SS 3**	**CL - Inorganic clays of low plasticity**	**33.3**	**36**	**18**	**18**		
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 5-24**	**SS 3**	**4.75**	**0.05**	**0.003**		**0.0**	**28.0**	**48.0**	**24.0**
⊠										
▲										
★										

CLIENT **Riverside South Limited Partnership**

FILE NO. **PG4958**

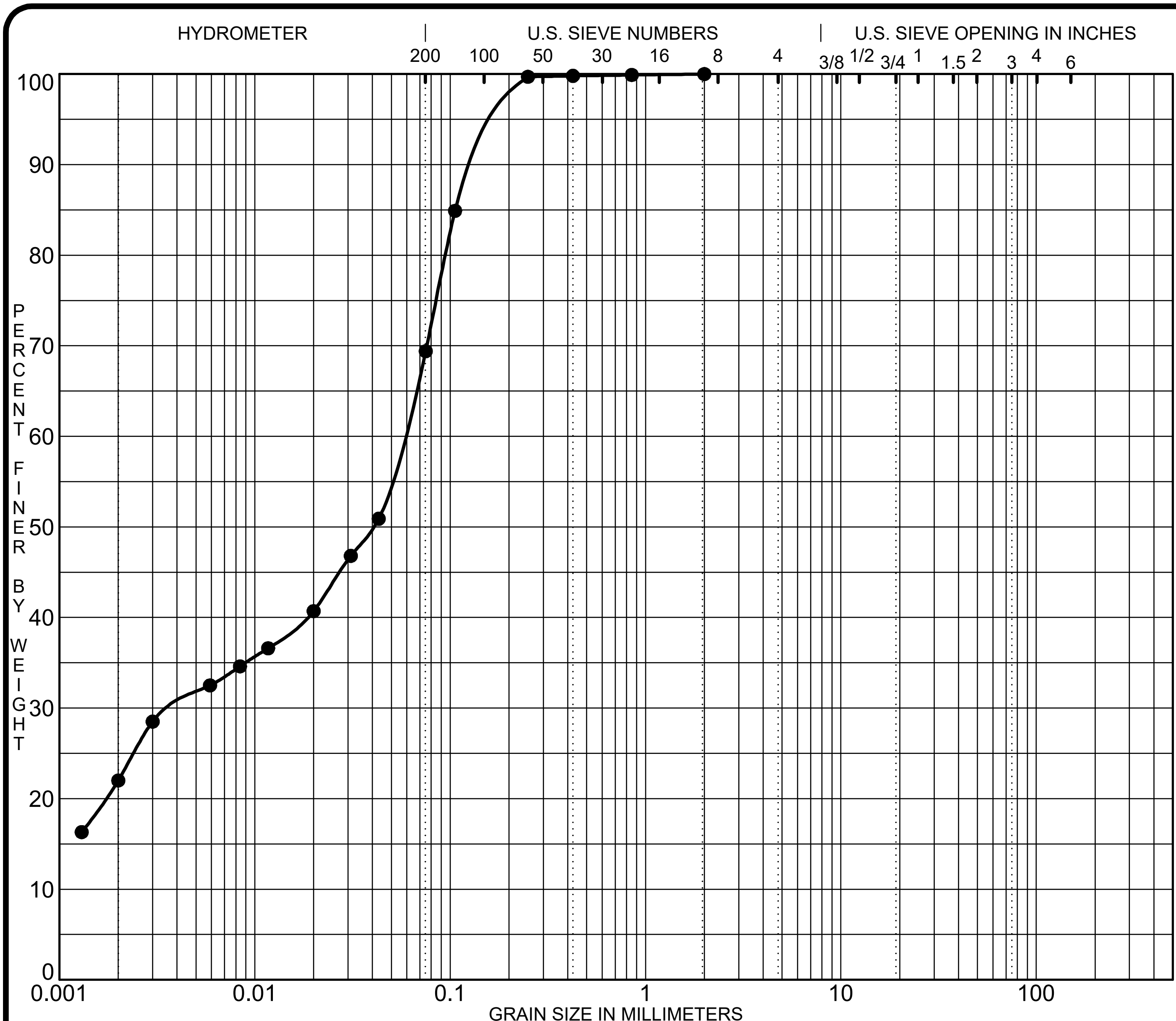
PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A**

DATE **3 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 6-24**	**SS 4**	**CL - Inorganic clays of low plasticity**	**30.5**	**33**	**16**	**17**		
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 6-24**	**SS 4**	**2.00**	**0.06**	**0.004**		**0.0**	**30.6**	**47.4**	**22.0**
⊠										
▲										
★										

CLIENT **Riverside South Limited Partnership**

FILE NO. **PG4958**

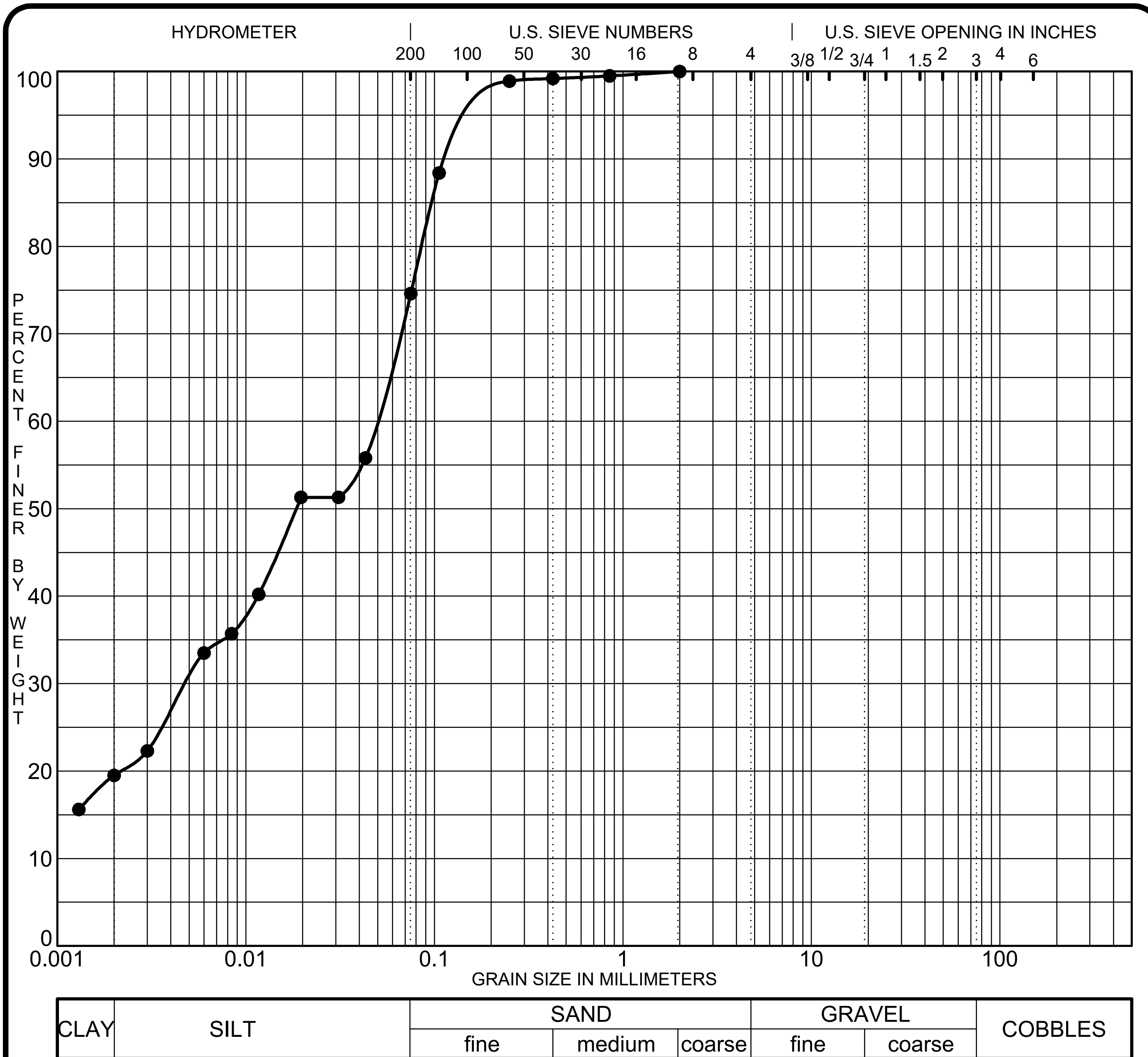
PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A**

DATE **3 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 8-24**	**SS 4**	**CL - Inorganic clays of low plasticity**	**37.4**	**35**	**17**	**18**		
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 8-24**	**SS 4**	**2.00**	**0.05**	**0.005**		**0.0**	**25.4**	**55.1**	**19.5**
⊠										
▲										
★										

CLIENT **Riverside South Limited Partnership**

FILE NO. **PG4958**

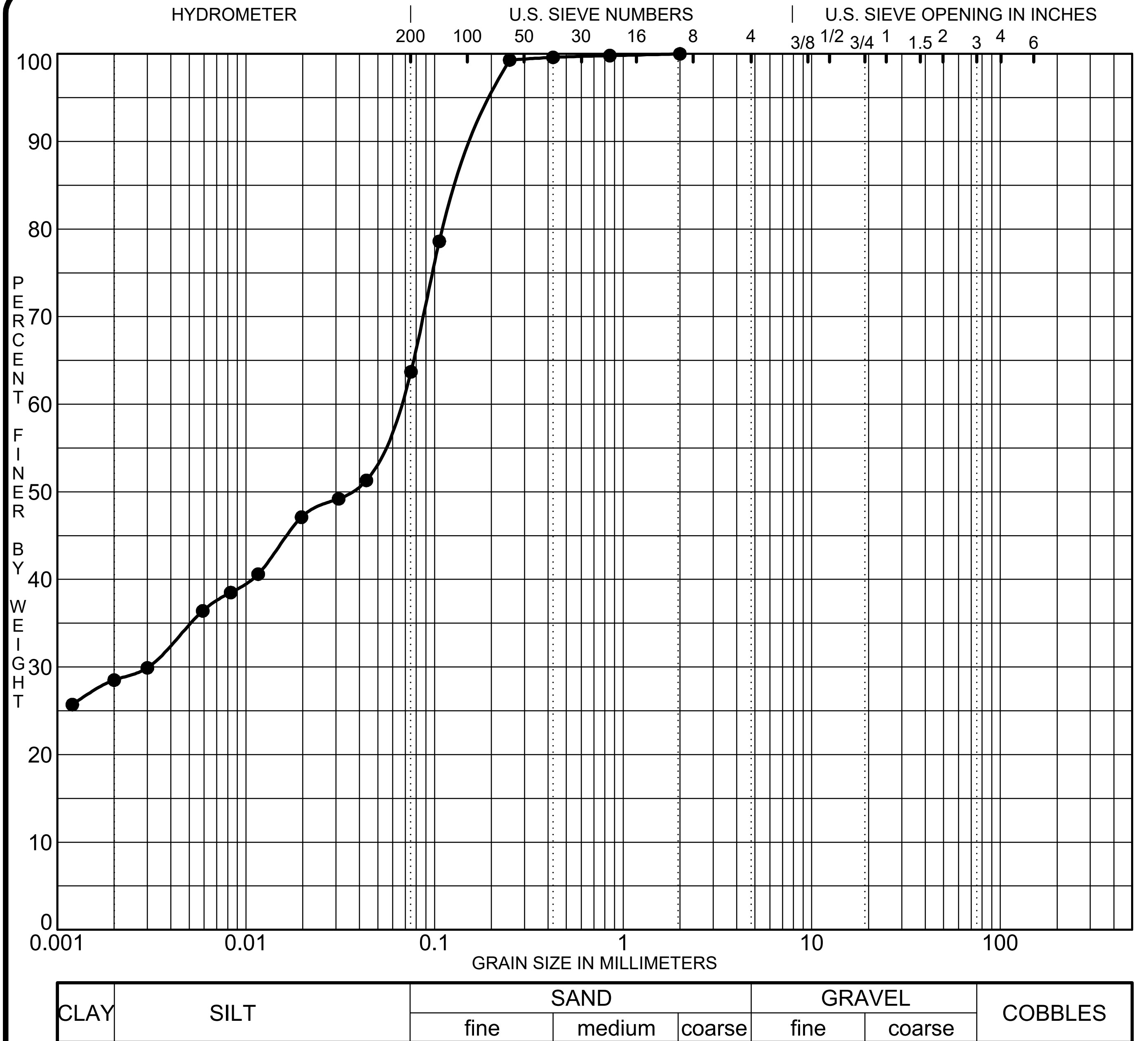
PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A**

DATE **4 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH14-24**	**SS 3**	**CL - Inorganic clays of low plasticity**	**34.9**	**40**	**18**	**22**		
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH14-24**	**SS 3**	**2.00**	**0.06**	**0.003**		**0.0**	**36.3**	**35.2**	**28.5**
⊠										
▲										
★										

CLIENT **Riverside South Limited Partnership**

FILE NO. **PG4958**

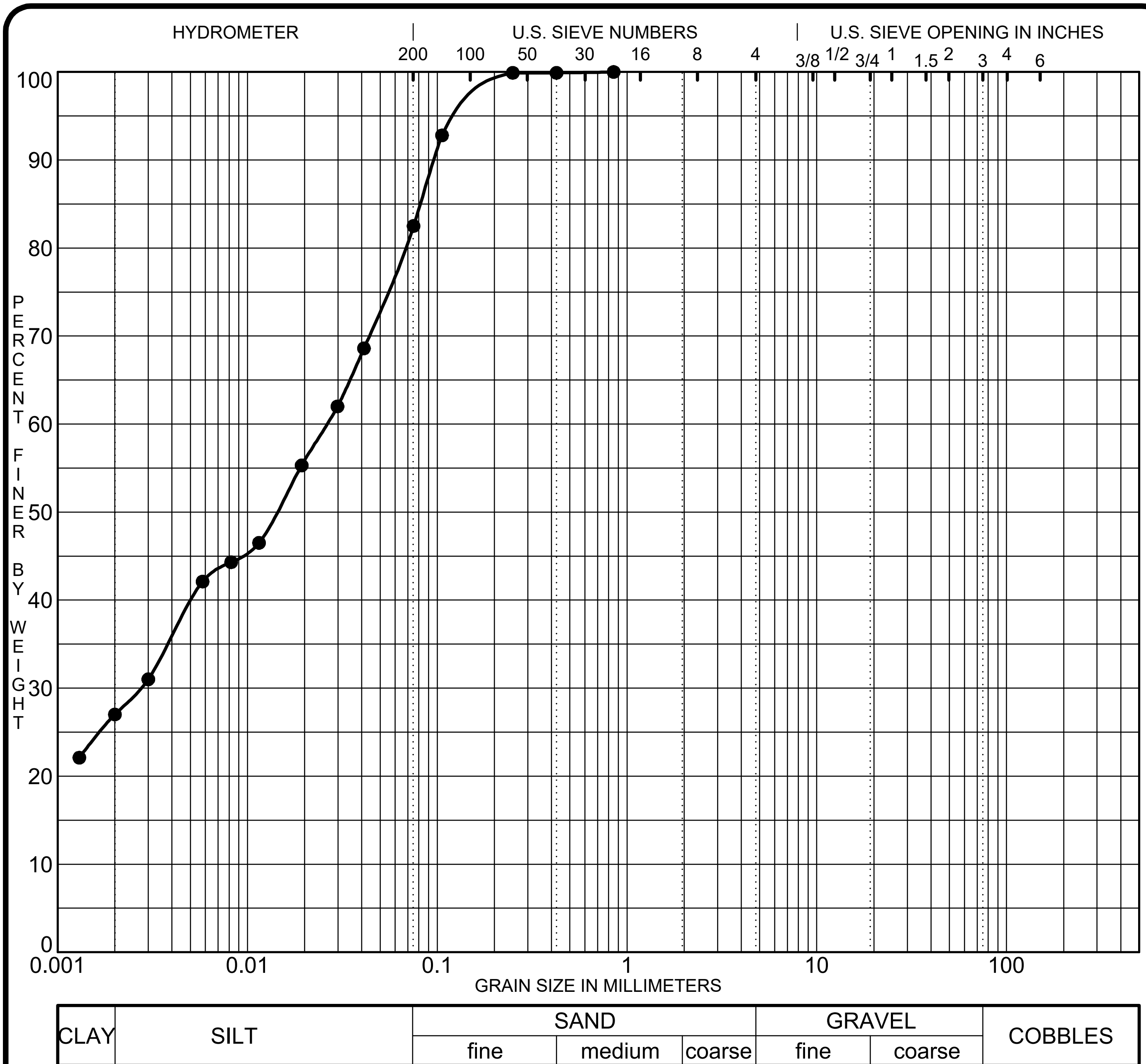
PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A**

DATE **5 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH17-24**	**SS 4**	**CL - Inorganic clays of low plasticity**	**35.6**	**37**	**16**	**21**		
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH17-24**	**SS 4**	**0.85**	**0.03**	**0.003**		**0.0**	**17.5**	**55.5**	**27.0**
⊠										
▲										
★										

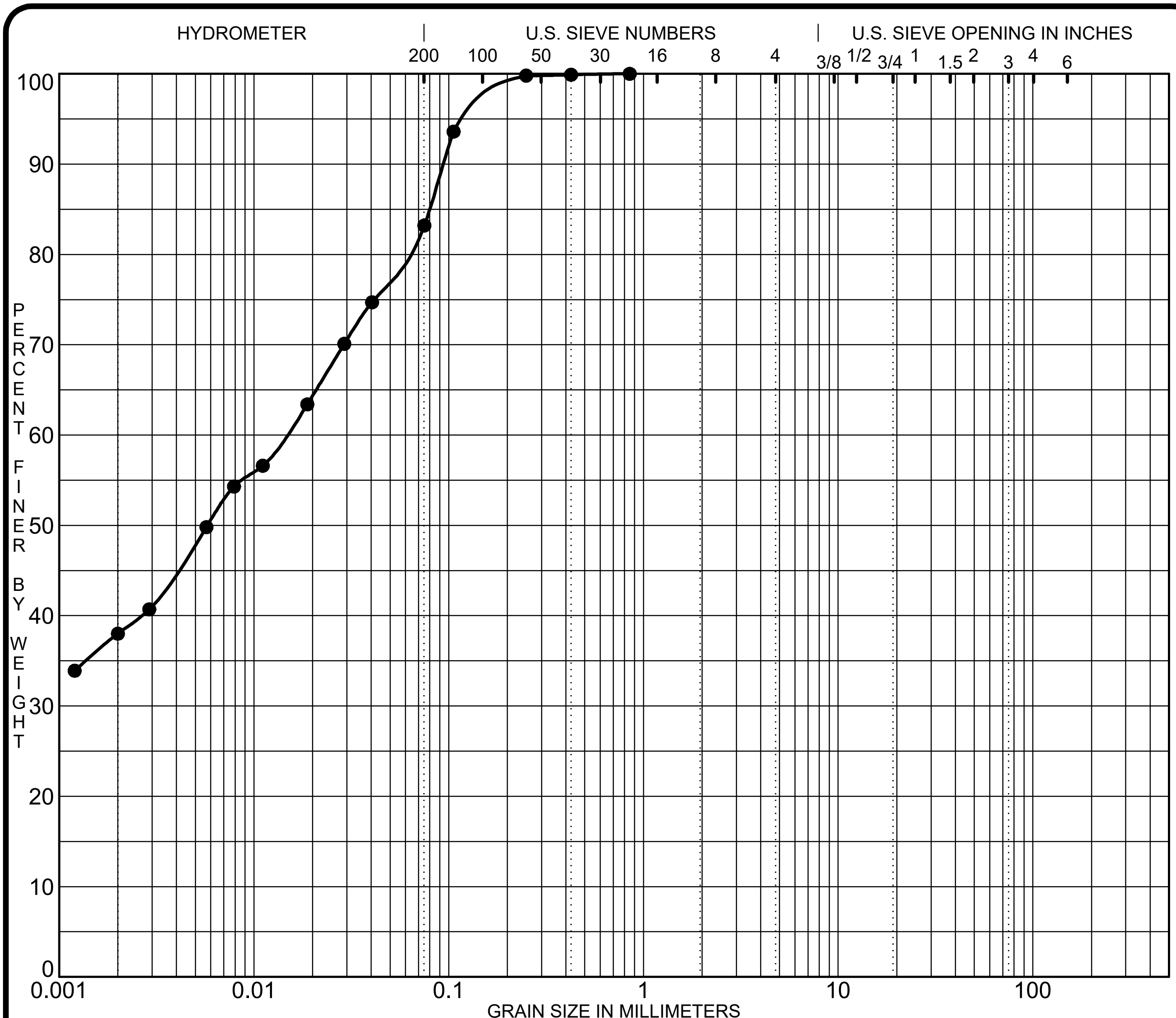
CLIENT **Riverside South Limited Partnership** FILE NO. **PG4958**

PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A** DATE **8 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH19-24**	**SS 4**		**41.7**					
⌛									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH19-24**	**SS 4**	**0.85**	**0.01**			**0.0**	**16.8**	**45.2**	**38.0**
⌛										
▲										
★										

CLIENT **Riverside South Limited Partnership**

PROJECT **Geotechnical Investigation - Prop. Mixed-Use Dev. - Riverside South - Town Center Phase 7A**

FILE NO. **PG4958**

DATE **8 Apr 24**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION

PATERSON GROUP

Linear Shrinkage
ASTM D4943-02

CLIENT:	Riverside South	DEPTH	7'6"-9'6"	FILE NO.:	PG4958
PROJECT:	Mosquito Creek	BH OR TP No:	BH4-24 SS4	DATE SAMPLED	2-Apr-24
LAB No:	51474	TESTED BY:	C.P	DATE RECEIVED	5-Apr-24
SAMPLED BY:	C.E	DATE REPORTED:	12-Apr-24	DATE TESTED	8-Apr-24

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(7)	Calibration (Two Trials)	Tin NO.(x41)	
Tare	4.91	Tin	4.76	4.76
Soil Pat Wet + Tare	74.12	Tin + Grease	4.93	4.92
Soil Pat Wet	69.21	Glass	40.35	40.34
Soil Pat Dry + Tare	56.1	Tin + Glass + Water	82.31	82.33
Soil Pat Dry	51.19	Volume	37.03	37.07
Moisture	**35.20**	**Average Volume**	**37.05**	

Soil Pat + String	51.36
Soil Pat + Wax + String in Air	57.61
Soil Pat + Wax + String in Water	24.12
Volume Of Pat (Vdx)	33.49

RESULTS:

Shrinkage Limit	**14.53**
Shrinkage Ratio	**1.934**
Volumetric Shrinkage	**39.983**
Linear Shrinkage	**10.605**

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

PATERSON GROUP

Linear Shrinkage
ASTM D4943-02

CLIENT:	Riverside South	DEPTH	5'-7'	FILE NO.:	PG4958
PROJECT:	Mosquito Creek	BH OR TP No:	BH7-24 SS3	DATE SAMPLED	2-Apr-24
LAB No:	51475	TESTED BY:	C.P	DATE RECEIVED	5-Apr-24
SAMPLED BY:	C.E	DATE REPORTED:	12-Apr-24	DATE TESTED	8-Apr-24

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(8)	Calibration (Two Trials)	Tin NO.(x33)	
Tare	4.67	Tin	4.47	4.47
Soil Pat Wet + Tare	72.94	Tin + Grease	4.67	4.67
Soil Pat Wet	68.27	Glass	40.34	40.34
Soil Pat Dry + Tare	54.6	Tin + Glass + Water	81.95	81.93
Soil Pat Dry	49.93	Volume	36.94	36.92
Moisture	**36.73**	**Average Volume**	**36.93**	

Soil Pat + String	50.1
Soil Pat + Wax + String in Air	54.8
Soil Pat + Wax + String in Water	22.62
Volume Of Pat (Vdx)	32.18

RESULTS:

Shrinkage Limit	**16.64**
Shrinkage Ratio	**1.856**
Volumetric Shrinkage	**37.291**
Linear Shrinkage	**10.025**

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

Certificate of Analysis

Report Date: 11-Apr-2024

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

Order Date: 5-Apr-2024

Client PO: 59872

Project Description: PG4958

	Client ID:	BH1_24_SS3	-	-	-	-	-
	Sample Date:	02-Apr-24 09:00	-	-	-	-	-
	Sample ID:	2414430-01	-	-	-	-	-
	Matrix:	Soil	-	-	-	-	-
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	76.4	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.26	-	-	-	-	-
Resistivity	0.1 Ohm.m	83.9	-	-	-	-	-
Anions							
Chloride	10 ug/g	<10	-	-	-	-	-
Sulphate	10 ug/g	<10	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

FIGURE 2 – TEST FILL PILE SETTLEMENT MONITORING PROGRAM AREA B

DRAWING PG4958-19 – TEST HOLE LOCATION PLAN

DRAWING PG4958-20 – PERMISSIBLE GRADE RAISE PLAN

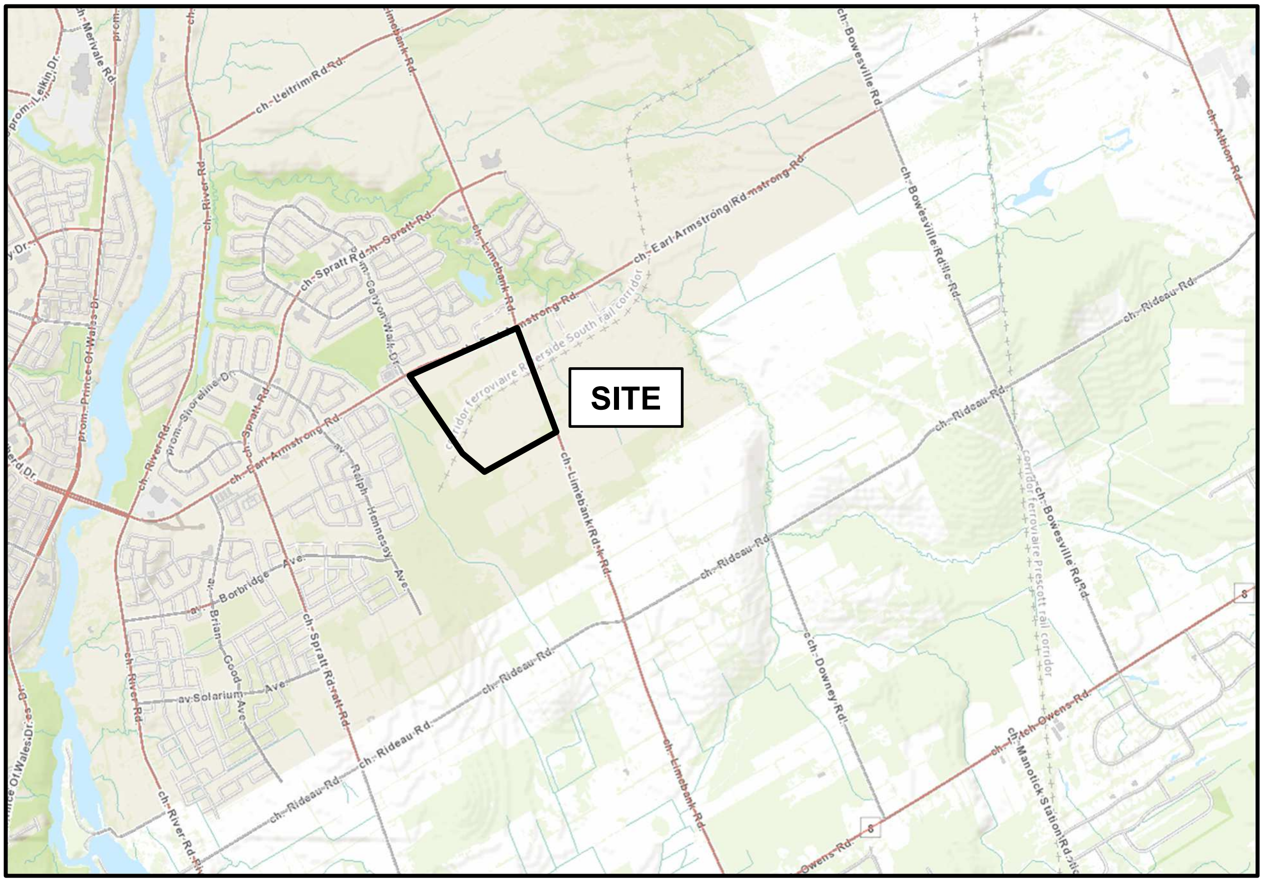


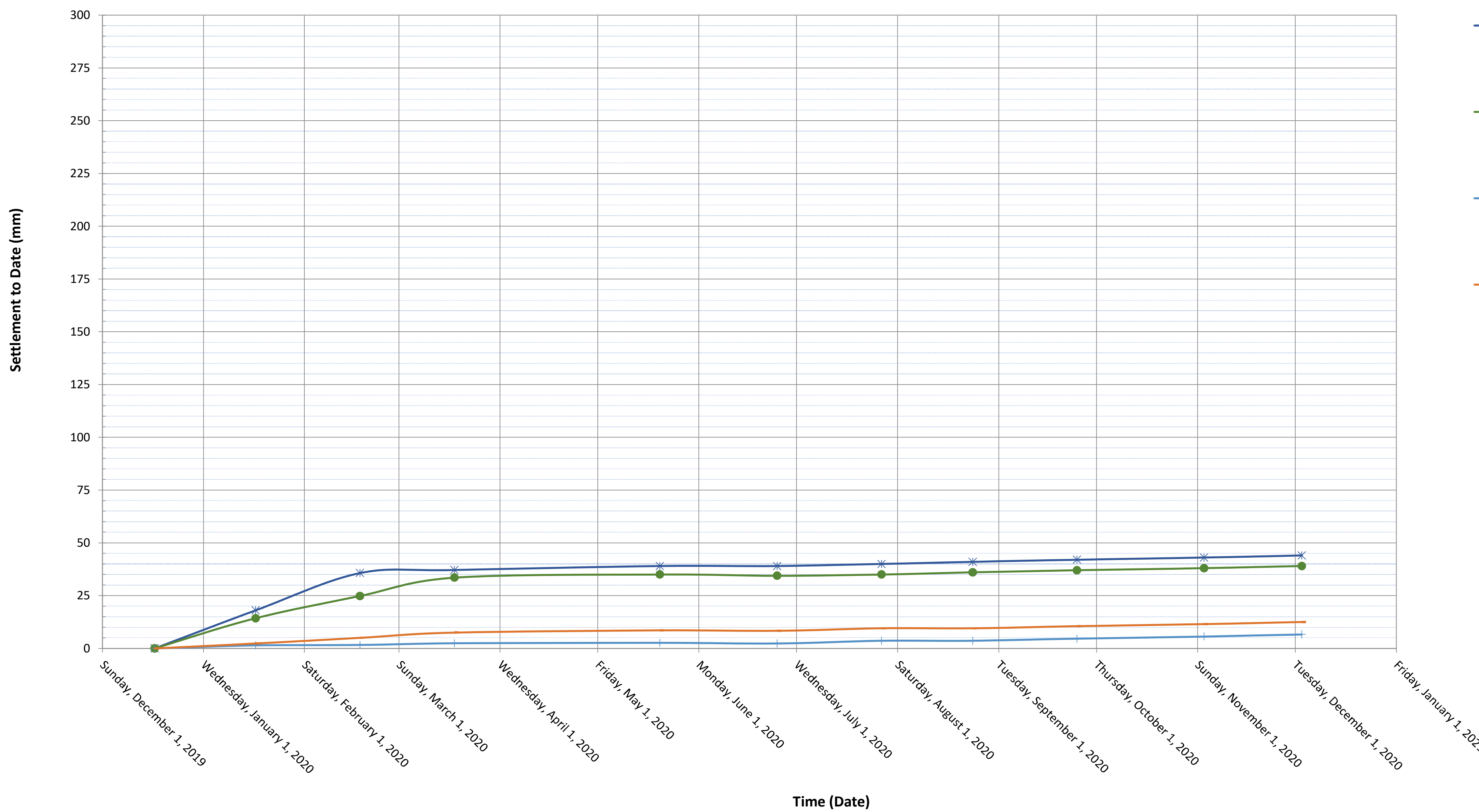
FIGURE 1

KEY PLAN

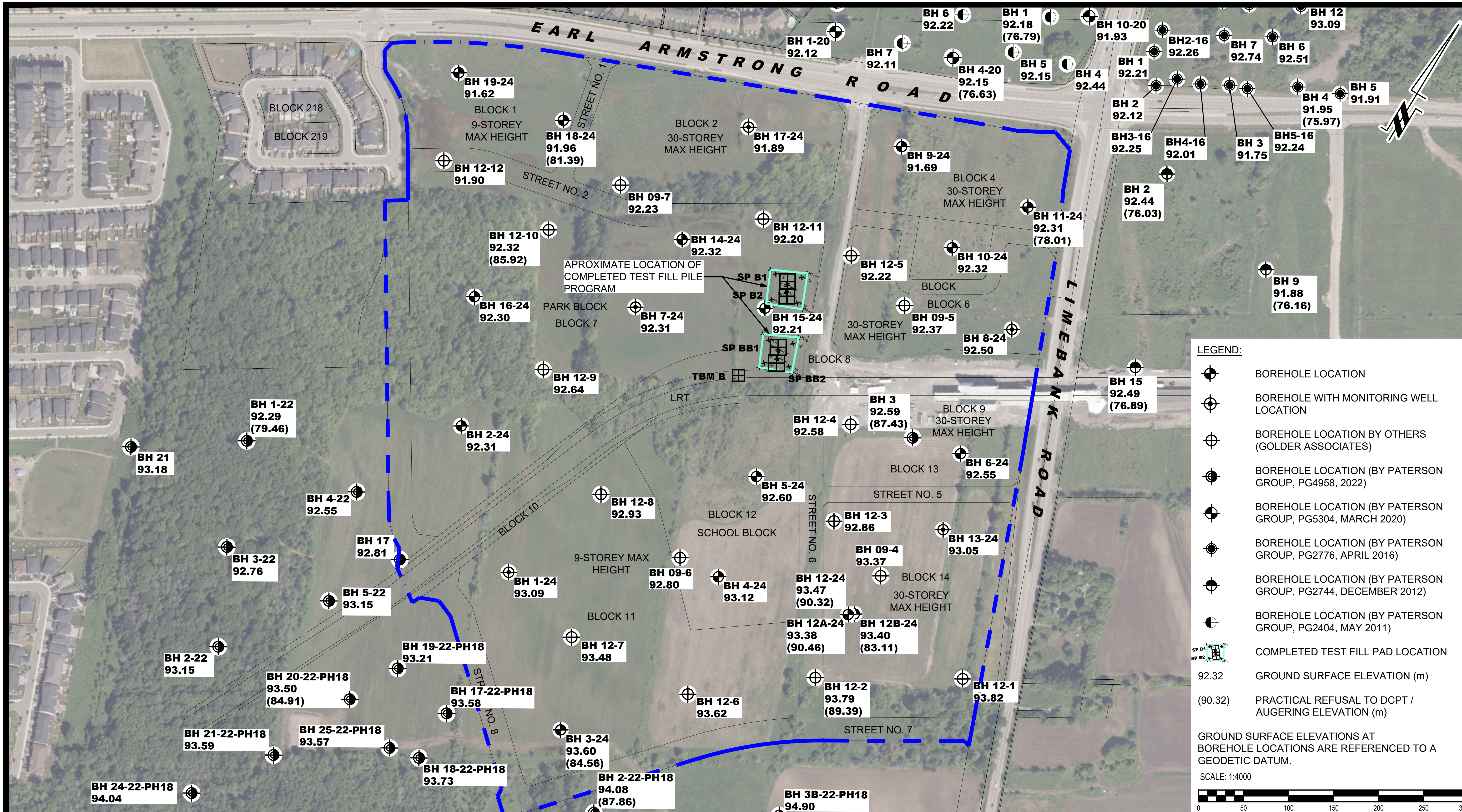
PATERSON GROUP

PATERSON GROUP

Figure 2 - Test Fill Pile Settlement Monitoring Program - Area B
Riverside South - Ottawa



Settlement Plate	Fill Height	Geodetic Elevation
SP-B1	2.1 m	94.45 m
SP-B2	2.2 m	94.55 m
SP-BB1	2.4 m	94.8 m
SP-BB2	2.2 m	94.6 m



PATERSON GROUP
9 AURIGA DRIVE
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NO.	REVISIONS	DATE	INITIAL

RIVERSIDE SOUTH LIMITED PARTNERSHIP
GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
RIVERSIDE SOUTH - TOWN CENTER PHASE 7A

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:4000	Date: 06/2024
Drawn by: ZS	Report No.: PG4958-6
Checked by: NP	Dwg. No.: PG4958-19
Approved by: DJG	Revision No.:

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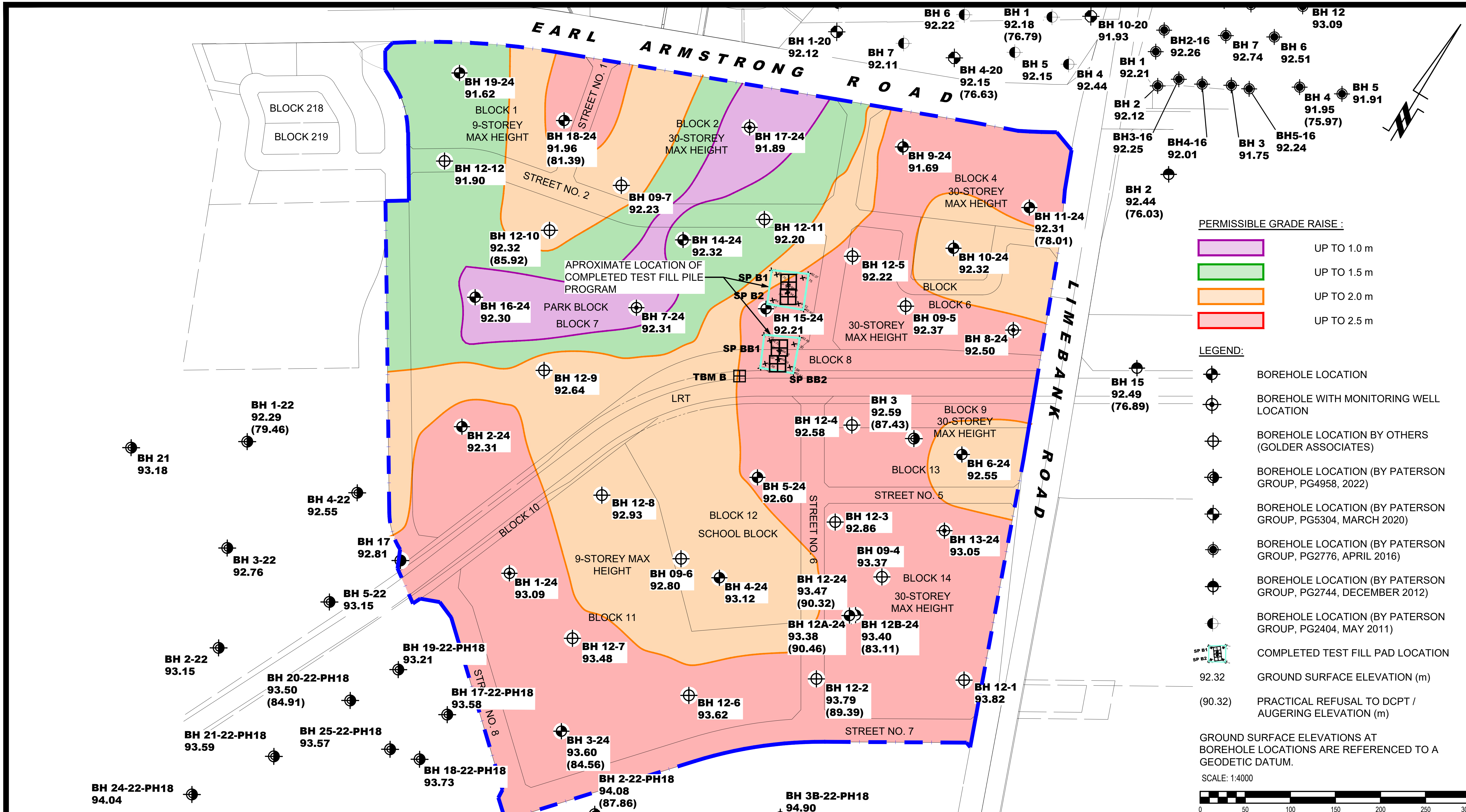
11x17



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GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
RIVERSIDE SOUTH - TOWN CENTER PHASE 7A

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:4000	Date: 06/2024
Drawn by: ZS	Report No.: PG4958-6
Checked by: NP	Dwg. No.: PG4958-20
Approved by: DJG	Revision No.:

11x17

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