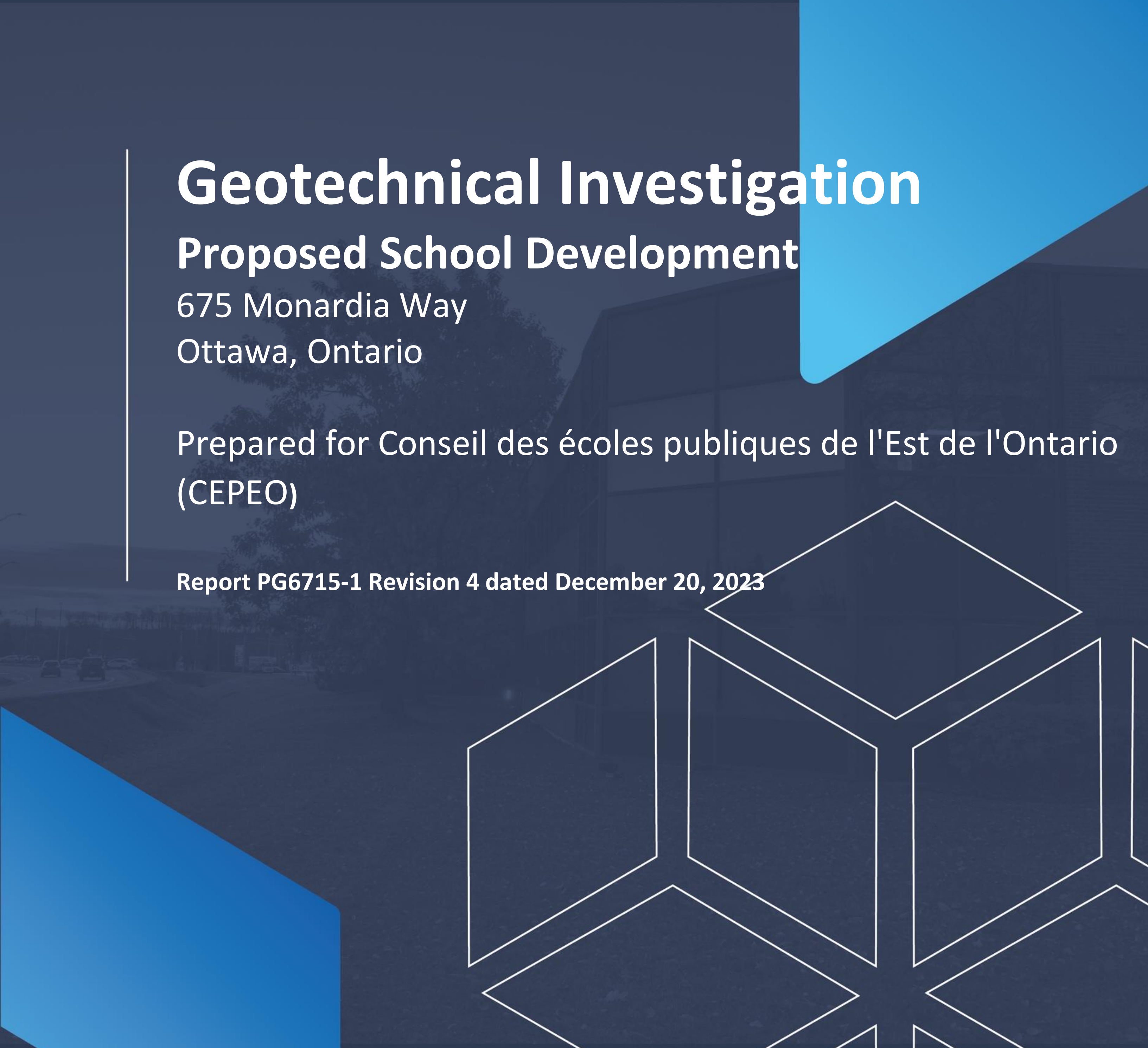

Geotechnical Investigation

Proposed School Development

675 Monardia Way
Ottawa, Ontario

Prepared for Conseil des écoles publiques de l'Est de l'Ontario (CEPEO)

Report PG6715-1 Revision 4 dated December 20, 2023

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by the Conseil des écoles publiques de l'Est de l'Ontario (CEPEO) to conduct a geotechnical investigation for the proposed industrial building to be located at 675 Monardia Way in the City of Ottawa (reference should be made to Figure 1 - Key Plan in Appendix 2 for the general site location).

The objectives of the geotechnical investigation were to:

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

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

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

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

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of a two-storey elementary school building of slab-on-grade construction along the eastern portion of the subject site.

It is further understood that associated asphalt-paved access lanes, parking areas, portable classrooms, exterior play structures and associated hardscaping will be located throughout the western portion of the subject site. It is understood the proposed building will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The current geotechnical investigation was carried between June 6 and June 9, 2023, and consisted of a total of five (5) boreholes (BH 1-23 through BH 5-23) advanced to a maximum depth of 7.3 m below the existing grade and eight (8) test pits (TP1-23 through TP 8-23) advanced to a maximum depth of 3.1 m, respectively. The findings were supplemented by a field investigation undertaken on December 14, 2023, which consisted of five test holes which were explored by a dynamic cone penetration test (DCPT) to a maximum depth of 33.9 m below ground surface. Previous boreholes were undertaken by others between April 2 and April 3, 2018, and were advanced to a maximum depth of 10.3 m below the ground surface.

The test hole locations were distributed in a manner to provide general coverage of the subject site, taking into consideration underground services and available access. The locations of the test holes are shown on Drawing PG6715-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a low-clearance track-mounted drill rig operated by a two-person crew and the test pit procedure consisted of excavating to the required depths at the selected locations and sampling the overburden using a hydraulic excavator. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer.

Sampling and In Situ Testing

The soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler or from the drill auger flights. Test pit samples were collected at selected intervals from the test pit sidewalls. The samples were initially classified on site, placed in sealed plastic bags, and transported to our laboratory. The depths at which the drill auger, split-spoon and grab samples were recovered from the boreholes and test pits are shown as AU, SS and G, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

A 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 BH 3-23, BH 5-23 to BH 10-23 and BH 18-6. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment. The rods were pushed to refusal at BH 9-23 and BH 10-23 such that blow counts were not counted until termination to the DCPT was attained. Soil samples are not attained during the DCPT process.

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

Groundwater

Flexible polyethylene standpipes were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. Open hole groundwater infiltration levels were observed at the time of excavation at each test pit location. The groundwater observations are discussed in Section 4.3 and presented in the Soil Profile and Test Data Sheets in Appendix 1.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the proposed development taking into consideration the existing site features and underground utilities.

The test hole locations, and the ground surface elevation at each borehole location, were surveyed by Paterson using a GPS unit with respect to a geodetic datum. The locations of the boreholes, and ground surface elevation at each test hole location, are presented on Drawing PG6715-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Review

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 one (1) shrinkage test, two (2) grain-size distribution analysis, and two (2) Atterberg limit tests were completed on selected soil samples. Moisture content testing was completed on all recovered soil samples. Further, two (2) Atterberg limit tests were undertaken on select soil samples recovered by others and throughout the subject site during a previous investigation.

The results are presented in Subsection 4.2 and on Grain Size Distribution and Hydrometer Testing, and Atterberg Limit Results and Shrinkage Test Results presented in Appendix 1.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site is currently a vacant grassed area and formerly used as agricultural lands. The site is occupied by a single storey residential building along the southwest portion of the site. The site is bordered by residential buildings and Monardia Way to the north, by Mer Bleue Road and Jerome Jodoin Drive to the east and west and by a garage and an under-construction residential subdivision along the south. The ground surface across the site is approximately 500 mm to 1 m lower than Jerome Jodoin Drive.

4.2 Subsurface Profile

Generally, the subsurface profile at the subject site consists of topsoil underlain by a deposit of silty clay. The topsoil layer was observed to range between 150 to 400 mm and was observed to be underlain by a layer of weathered, very stiff brown silty clay.

An approximately 550 mm layer of brown silty sand was encountered between the topsoil and silty clay layers at TP 2-23. The weathered layer of brown silty clay was observed to be underlain by a layer of firm, grey silt clay at depths ranging between 1.6 and 3.0 m below the ground surface.

A DCPT was conducted at boreholes BH 3-23, BH 5-23 to BH 10-23 and BH 18-6. Practical refusal to the DCPT was encountered BH 6-23, BH 7-23, BH 8-23, BH 9-23, BH 10-23 and BH 18-6 at depths of 31.1, 32.1, 33.4, 33.9, 29.1 and 32.1 m below ground surface, respectively. Practical refusal to DCPT was not encountered at BH 3-23 and BH 5-23 and was terminated at a depth of 31.8 m below ground surface. Refusal was not attained at BH 3-23 and BH 5-23 since the drill-rig was not equipped with more than 31.8 m of DCPT rods at the time of that investigation.

Reference should be made to the Soil Profile and Test Data Sheets in Appendix 1 for details of the soil profile encountered at each borehole location.

Bedrock

Based on available geological mapping, bedrock in the area of the subject site consists of interbedded shale and limestone of the Lindsay Formation with adrift thickness ranging between 25 to 50 m.

Atterberg Limits Testing

Atterberg limits testing was completed on select silty clay samples recovered throughout the subject site during the current and previous investigations. The results of the Atterberg Limits testing are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 – Atterberg Limits Results

Borehole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
BH 3-23	SS2	0.6 - 1.2	63	22	41	CH
BH 5-23	SS2	0.6 - 1.2	64	26	38	CH
BH 18-5	SS6	4.6 – 5.2	56	22	34	CH
BH 18-8	SS5	4.6 – 5.2	55	25	30	CH

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

Grain-Size Distribution and Hydrometer Testing

Two (2) grain-size distribution and hydrometer tests were completed to classify selected soil samples according to the Unified Soil Classification System (USCS). The results are summarized in Table 2.

Table 2 – Grain-Size Distribution and Hydrometer Testing Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 4-23 - SS2	0.7 – 1.3	0	3.1	30.9	66.0
BH 5-23 - SS3	1.5 - 2.1	0	0.6	31.4	68.0

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

Shrinkage Testing

Linear shrinkage testing was completed on a sample recovered at a depth of 1.2 m from BH 3-23 and yielded a shrinkage limit of 17.6 and a shrinkage ratio of 1.82.

4.3 Groundwater

Groundwater levels were measured in the standpipe piezometers on June 21, 2023. Depths of sidewall infiltration were also recorded in the field and are tabulated in Table 3 below. Groundwater levels encountered by others have been provided in Table 3.

The measured groundwater levels are presented on the Soil Profile and Test Data sheets in Appendix 1, and in Table 3 below.

Table 3 – Measured Groundwater Levels

Test Hole Number	Method	Ground Surface Elevation (m)	Measured Groundwater Level		Date
			Depth (m)	Elevation (m)	
BH 1-23	Piezometer	87.10	2.10	85.00	June 21, 2023
BH 2-23	Piezometer	86.12	Blocked at 1.0 mbgs		June 21, 2023
BH 3-23	Piezometer	86.55	2.39	84.16	June 21, 2023
BH 4-23	Piezometer	87.03	1.96	85.07	June 21, 2023
BH 5-23	Piezometer	86.81	1.99	84.82	June 21, 2023
TP 1-23	Sidewall Infiltration	86.56	1.75	84.81	June 9, 2023
TP 2-23	Sidewall Infiltration	86.53	2.00	84.53	June 9, 2023
TP 3-23	Sidewall Infiltration	86.82	1.90	84.92	June 9, 2023
TP 4-23	Sidewall Infiltration	86.77	2.00	84.77	June 9, 2023
TP 5-23	Sidewall Infiltration	86.55	1.65	84.90	June 9, 2023
TP 6-23	Sidewall Infiltration	86.80	1.80	85.00	June 9, 2023
TP 7-23	Sidewall Infiltration	86.55	1.70	84.85	June 9, 2023
TP 8-23	Sidewall Infiltration	86.52	1.90	84.62	June 9, 2023
BH 18-5	Piezometer	86.84	1.21	85.63	April 18, 2018
BH 18-6	Piezometer	86.77	0.14	86.63	April 18, 2018
BH 18-7	Piezometer	87.10	2.32	84.78	April 18, 2018
BH 18-8	Piezometer	86.87	1.94	84.93	April 18, 2018
BH 18-9	Piezometer	87.31	0.08	87.23	April 18, 2018

NOTE: The ground surface elevations at the test hole location of the current investigation were surveyed by Paterson using a high precision GPS unit and was referenced to a geodetic datum.

It should be noted that surface water can become trapped within a backfilled borehole, which can lead to higher than typical groundwater level observations. Similarly, it is our experience that surface water generated by snowmelt and rainfall events may sheet drain into the borehole column given the relatively impermeable nature of the silty clay soil surface.

The long-term groundwater level can also be estimated based on the observed colour, moisture content, and consistency of the recovered samples. Based on these observations, the long-term groundwater level is expected at approximate depths of **1.5 to 2.5 m** below the existing ground surface.

However, 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 suitable for the proposed development. The proposed building may be supported by a deep foundation, such as end-bearing piles, extending to the underlying bedrock formation.

Due to the presence of a deposit of silty clay, the proposed development will be subject to grade raise restrictions.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings, paved areas, pipe bedding, and other settlement sensitive structures. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and placement of additional suitable fill material.

Fill Placement

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

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 lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids.

If this material is to be used to build up the subgrade level for areas to be paved or below other settlement sensitive structures, it should be compacted in thin lifts to at least 95% of the material's SPMDD using a suitably sized vibratory sheepsfoot roller.

A representative from Paterson should be on-site periodically to observe placement of the fill and excavated native soils and to conduct compaction testing on each lift of fill placed.

Compacted Granular Fill Working Platform (Piled Foundation)

Since it is expected the proposed school building will be supported on a pile foundation, the use of heavy equipment would be required to install the piles (i.e., pile driving crane). It is conventional practice to install a compacted granular fill layer, at a convenient elevation, to allow the equipment to access the site without getting stuck and causing significant disturbance to the underlying soil.

It is recommended that a minimum 600 mm thick layer of OPSS Granular B, Type II crushed stone be placed as working platform throughout the building footprint which will be supported by piles. The working pad granular should be compacted to a minimum of 98% of its standard Proctor maximum dry density (SPMDD) in maximum 300 mm thick lifts.

Once the piles have been driven and cut off, the working platform can be re-graded, and soil tracked in, or soil pumping up from the pile installation locations, can be bladed off and the surface can be topped up, if necessary, and re-compacted to act as the substrate for further fill placement for the slab structure.

5.3 Foundation Design

Deep Foundation - End Bearing Piles

A deep foundation method, such as end bearing piles, may be considered for the foundation support of the proposed building. 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 4. 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. A full-time field review program should be conducted by Paterson field personnel during the pile driving operations to record the pile lengths, ensure that the refusal criteria is met and that piles are driven within the location tolerances (within 75 mm of proper location and within 2% of vertical).

Table 4 - 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	925	1,100	9	27
245	11	1,050	1,250	9	31
245	13	1,200	1,400	9	35

The minimum recommended centre-to-centre pile spacing is 3 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 in the bedrock.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels.

Adequate lateral support is provided to a silty clay bearing medium 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 the bearing soil.

Permissible Grade Raise

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **1.2 m** is recommended for grading within 6 m of building footprints. The permissible grade raise restriction may be considered up to **1.5 m** for the remainder of the subject site.

It is understood the finished floor elevation (FFE) within the proposed slab-on-grade school structure will be 88.00 m. Further, it is anticipated that grade raise fill between the pile equipment working pad and sub-slab fill layer will consist of crushed stone, such as OPSS Granular B Type II crushed stone. Based on our review of the grading plan, the proposed grading is acceptable and lightweight fill is not required for the proposed building.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E**. Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

5.5 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the native soil subgrade approved by Paterson field personnel at the time of excavation will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction.

However, since the subgrade will consist of the pile equipment working mat, it is recommended to ensure the working mat is cleared of loose soil debris and contaminated granulars prior to the placement of additional granulars for raising the subgrade throughout the building footprint.

It is recommended that the upper 200 mm sub-floor fill consists of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

Any poor performing areas should be removed and reinstated with an engineered fill, such as OPSS Granular B Type II and compacted to a minimum of 98% of the materials SPMDD.

5.6 Pavement Design

Car only parking, bus turning areas and access lanes are proposed at this site. The proposed pavement structures are presented in Table 6 and Table 7. It is anticipated the pavement structure provided in Table 7 would be adequate for use as a fire route.

Table 5 – Recommended Pavement Structure – Playground Area

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

Table 6 – Recommended Pavement Structure – Parking Stalls and Light-Duty Traffic Area

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

Table 7 – Recommended Pavement Structure – Heavy-Duty Traffic Areas, Bus Drop-Off Lanes, Garbage and Fire Truck Access Routes

Thickness (mm)	Material Description
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placedover fill or 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 I or II material. Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

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.

Hardscaping Surface Structures

The pavement structures provided in Table 8 on the following page are recommended where associated hardscaping will be located throughout the subject site.

Table 8 – Recommended Pavement Structure – Brick/Stone Pathways

Thickness (mm)	Material Description
Specified by Others	**Wear Course** – Interlocking Stones/Brick Pavers
25 - 40	**Leveling Course** – Stone Dust or Sand
450	**SUBBASE** – OPSS Granular A
SUBGRADE – Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill.	

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during at the subgrade level of the above-noted pavement structures. The subdrain inverts should be approximately 300 mm below subgrade level and consist of a minimum 100 mm diameter perforate drainage pipe fitted with a geosock and surrounded by a minimum of 100 mm of clear crushed stone on all of its sides.

The pipe should discharge to either a catch-basins, connected to the drainage pipe, and/or become in contact with the geotextile face of the foundation drainage board that would be provided to the buried portions of the school structure.

All remaining sidewalks and pathways provided throughout the subject site should be provided with a minimum 300 mm thick layer of OPSS Granular A and provided with a subdrain at the subgrade level as noted herein.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

For areas where silty clay is encountered at subgrade level, it is recommended that subdrains be installed during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended to implement a perimeter foundation drainage system around the entire building perimeter. The system should consist of a 150 mm diameter perforated corrugated plastic pipe wrapped in a geosock and surrounded on all sides by 150 mm of 10 mm clear crushed stone. The pipe should be placed at the footing level around the exterior perimeter of the structure. The clear stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

The foundation drainage boards should be installed in horizontal lifts with a minimum horizontal and vertical overlapping of 150 mm between the sheets to minimize the joints between the sheets. All endlaps of the drainage board sheets should overlap abutting sheets by a minimum of 150 mm. All overlaps should be sealed with suitable adhesive and/or sealant material approved by the geotechnical consultant.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials. The greater part of the site 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 drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

Soccer Field Drainage

It is also recommended that drainage be provided for the proposed soccer field if an irrigation system is planned for the soccer field. The drainage system should consist of 10 m centre-to-centre spaced, 150 mm diameter, geotextile, corrugated perforated PVC pipe surrounded by a minimum of 150 mm of 19 mm clear crushed stone around all of its sides. The pipes are recommended to be placed 1 m below finished grade and have a positive outlet, such as a gravity connection, to the storm sewer.

Concrete Sidewalks Adjacent to Buildings

To avoid differential settlements within the proposed sidewalks adjacent to the proposed building, it is recommended that the upper 600 mm of backfill placed below the concrete sidewalks adjacent to the building footprints to consist of non-frost susceptible material such as OPSS Granular A or Granular B Type II. The granular material should be placed in maximum 300 mm loose lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

The subgrade material should be shaped to promote positive drainage towards the building's perimeter drainage system. Consideration should be given to placing a layer of rigid insulation below the granular fill layer, however, should be detailed by Paterson once design drawings are being complete by others.

6.2 Protection Against Frost Action

Foundation Structures

Perimeter footings and/or 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 an equivalent thickness of soil cover and foundation insulation, should be provided for adequate frost protection of heated structures.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover, or an equivalent thickness of soil cover and foundation insulation.

Frost Protection at Building Entrances

If consideration is given to placing rigid insulation below hardscaping at building entrances to mitigate heave and settlement due to freezing cycles within the underlying subgrade, the following insulation detail is recommended for building entrances:

- The sidewalk pavement structure is recommended to consist of 150 mm of OPSS Granular A and 450 mm of OPSS Granular B Type II crushed stone, all placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the materials SPMDD.

- Place a minimum 100 mm thick layer of rigid insulation consisting of extruded polystyrene, such as DOW Chemical High-Load HI-40, below the layer of crushed stone. The rigid insulation layer is recommended to extend a minimum horizontal distance of 1.2 m from all sides of the entrance.
- Provide a transition for the next 600 mm beyond the 1.2 m horizontal extension using a 50 mm layer of extruded polystyrene rigid insulation.

Implementation of the above-noted detail should be reviewed at the time of construction (placement of insulation, compaction testing on each lift of stone fill, etc.) by Paterson personnel.

6.3 Excavation Side Slopes

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

Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly Type 2 and Type 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

It is recommended that a trench box be used at all times to protect personnel working in trenches. Based on this, trench boxes should be considered for all sewer pipe installations undertaken throughout the subject site.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

Slopes in excess of 3 m in height should be periodically inspected by Paterson field personnel in order to detect if the slopes are exhibiting signs of distress.

Excavations Adjacent to 639 Monardia Way

Based on our review, a portion of the 1,200 mm diameter storm sewer alignment will be installed adjacent to an existing dwelling located at 639 Monardia Way. It is expected the invert elevation for the storm sewer adjacent to the subject dwelling will be approximately between 83.83 and 83.81 m and the centreline of the pipe will be located approximately 7.3 m from the face of the adjacent dwelling.

Based on our records, it is understood the founding elevation for this structure is 85.89 m based on the following drawing prepared by DSEL:

❒ Grading Plan – Summerside West Phases 2 & 3 – Project No. 15-808, Sheet No. 28, Revision 5 dated December 1, 2016.

Based on this information, the proposed pipe installation is anticipated to be located above the lateral support zone for the adjacent dwelling's foundation, such that it is not expected the adjacent dwelling would be negatively impacted by the installation of the proposed storm sewer. It is recommended that the proposed sewer works throughout this section of the alignment be undertaken with a trench box to mitigate excavations extending into the neighbouring property.

Should excavations be undertaken that would extend or impact the ground surface beyond the property boundary, an encroachment agreement should be obtained by the excavation contractor and as agreed upon by the owner of the adjacent dwelling prior to undertaking the proposed works.

6.4 Pipe Bedding and Backfill

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

The pipe bedding for the sewer and water pipes should consist of at least 150 mm of OPSS Granular A. The bedding layer thickness should be increased to a minimum of 300 mm where the subgrade will consist of grey silty clay. The material should be placed in a maximum 225 mm thick loose lifts and compacted to a minimum of 99% of its SPMDD. The bedding material should extend at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 225 mm thick lifts and compacted to a minimum of 99% of its SPMDD.

Reinstatement of the trench located above the pipe cover layer should consist of placing trench-generated workable soil fill (i.e., grey clay is not expected to be workable) in maximum 300 mm thick loose lifts and compacted using a suitably sized vibratory sheepsfoot roller to a minimum of 95% of the materials SPMDD. Each lift of soil fill placed within the service trenches should be reviewed and approved at the time of construction by Paterson personnel. Wet site-generated fill, such as the grey silty clay, will be difficult to re-use, as the high-water contents make compacting impractical without an extensive drying period.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. Reference should be made to Figure 2 – Proposed Clay Seal Location Plan in Appendix 2 of this report for the locations of proposed clay seals.

The clay seals should be at least 1.5 m long in the trench direction and should extend from trench wall to trench wall. Generally, the clay seals should extend from the frost line and fully penetrate the bedding, sub bedding and cover material. The clay seals should consist of relatively dry and compatible brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material’s SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches. Paterson field personnel should review the placement of all clay seals undertaken at the time of construction.

6.5 Groundwater Control

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

Groundwater Control for Building Construction

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

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

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures 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, pile caps and/or grade beams 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 into the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

Under winter conditions, if snow and ice is present within imported fill below future building slabs, or if fill is subject to freezing conditions, then settlement of the fill should be expected, and support of a future building slab will be negatively impacted and could undergo settlement during spring and summer time conditions. Paterson should complete periodic inspections during fill placement to ensure that snow and ice quantities do not impact fill placed in settlement-sensitive areas.

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 an aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Considerations

It is understood the proposed building will be founded on piles and will be decoupled from the underlying clay deposit. Therefore, foundation distress due to potential moisture depletion caused by trees is not considered applicable for this subject site from a geotechnical perspective.

Based on this, there is no applicable tree-to-foundation setback for trees considered throughout the subject site and tree planting restrictions based on the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines) are not considered applicable for the proposed school building from a geotechnical perspective.

Soccer Field Grading

It is anticipated the project landscape architect (or other project consultant) will advise on a recommended cross-section for constructing the proposed soccer field. The fill used to raise the subgrade in support of the proposed soccer field may consist of workable soil fill as briefly described in Section 5.2 of this report.

The workable soil fill should not be wet/saturated and should be in a workable state for being able to support the weight of the earthworks equipment. The material should be compacted by a combination of the tracks of the earthworks equipment and a vibratory sheepsfoot roller making several passes to achieve a minimum of 95% of the materials SPMDD. It is recommended that Paterson field personnel review the placement of subgrade fill at the time of construction.

7.0 Recommendations

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

☐ Review the installation of deep foundations (piles), including third-party testing by contractors and associated agencies.

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

☐ Sampling and testing of the concrete and fill materials.

☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

☐ Observation of all subgrades prior to backfilling and 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 undertaken by Paterson.

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

8.0 Statement of Limitations

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

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

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Conseil des écoles publiques de l'Est de l'Ontario (CEPEO), 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
December 20, 2023
D. J. PETAHTEGOOSE
100568013
PROVINCE OF ONTARIO

Drew Petahtegoose, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

☐ Conseil des écoles publiques de l'Est de l'Ontario (CEPEO)
☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERGS TESTING RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

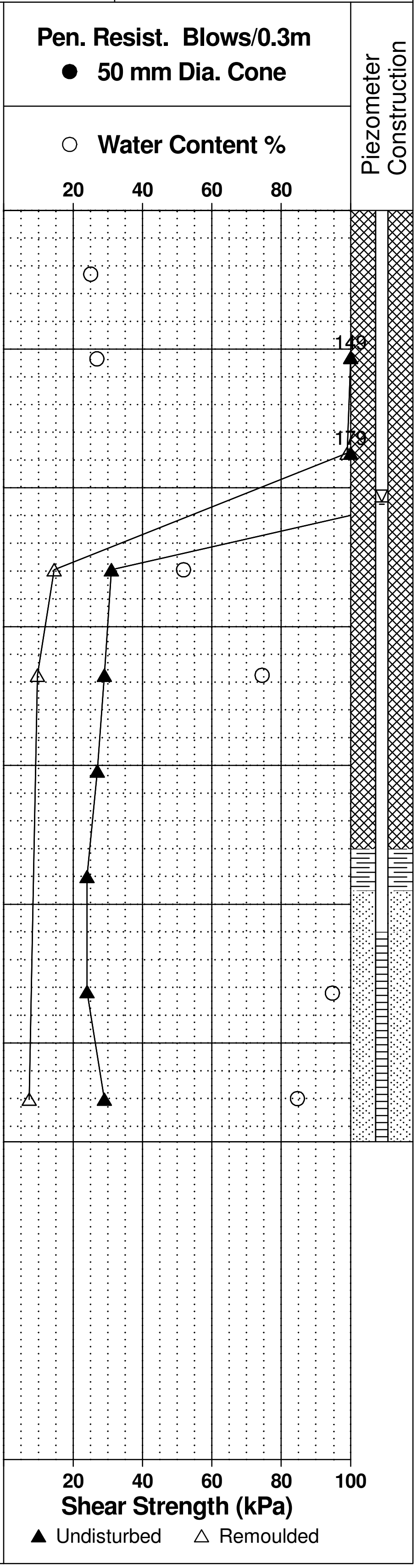
BORINGS BY CME-55 Low Clearance Drill

DATE June 6, 2023

FILE NO. PG6715

HOLE NO. BH 1-23

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						
TOPSOIL 0.15					0	87.10
Very stiff, brown **SILTY CLAY,** trace sand	AU	1				
	SS	2	42	P	1	86.10
- firm to soft and grey by 2.1m depth					2	85.10
- silty sand seam at 2.7m depth	SS	3	100	P		
					3	84.10
	SS	4	75	P		
					4	83.10
					5	82.10
	SS	5	100	P		
					6	81.10
	SS	6	100	P		
6.71						
End of Borehole						
(GWL @ 2.10m - June 21, 2023)						



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE June 6, 2023

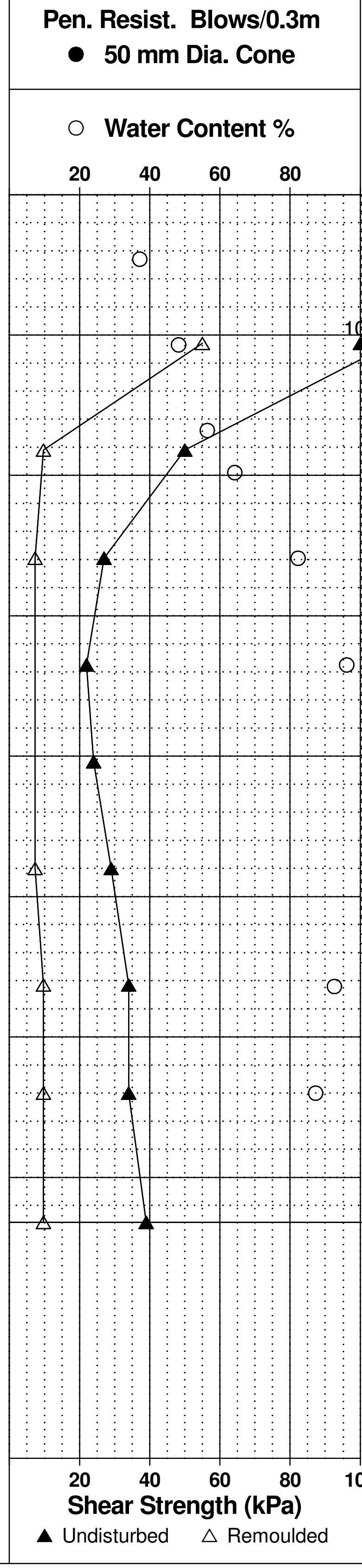
FILE NO. **PG6715**

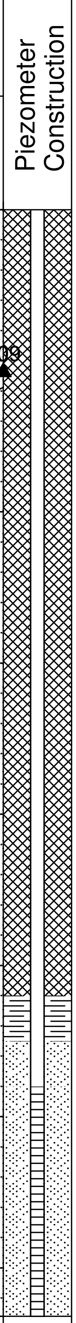
HOLE NO. **BH 2-23**

SOIL DESCRIPTION	Depth (m)
Ground Surface	
TOPSOIL	0.15
Very stiff to stiff, brown **SILTY CLAY** - firm to soft and grey by 1.9m depth - firm by 4.6m depth	7.32
End of Borehole (Piezometer blocked at 1.0m depth - June 21, 2023)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	92	P
SS	3	92	P
SS	4	83	P
SS	5	100	P
SS	6	100	P
SS	7	92	P

DEPTH (m)	ELEV. (m)
0	86.12
1	85.12
2	84.12
3	83.12
4	82.12
5	81.12
6	80.12
7	79.12





SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE June 6, 2023

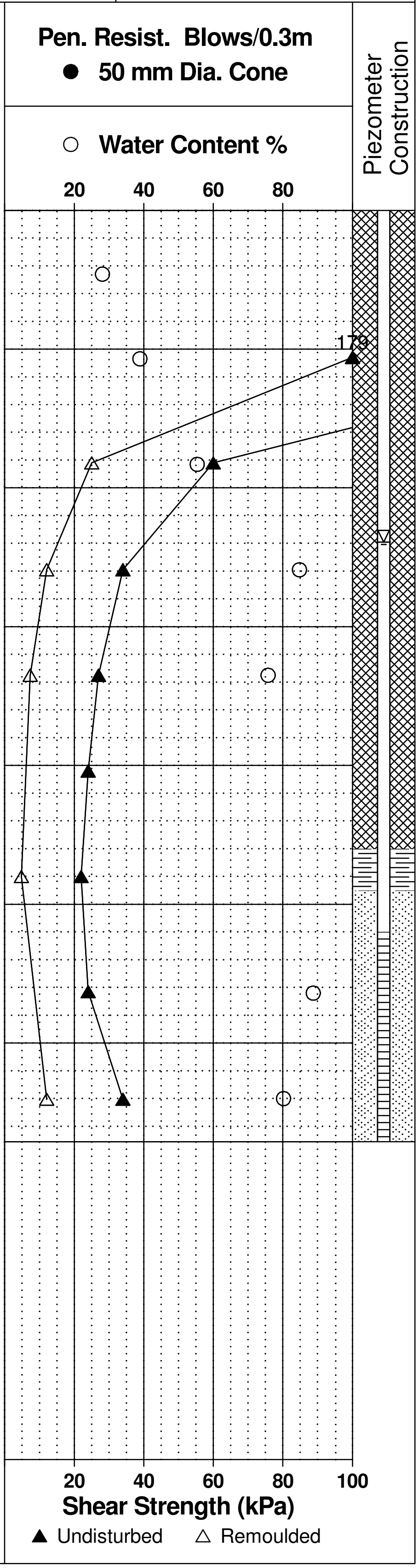
FILE NO. PG6715

HOLE NO. BH 3-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface							
TOPSOIL 0.20						0	86.55
Very stiff to stiff, brown **SILTY CLAY** - silt seam at 1.2 and 2.1m depth - firm to soft and grey by 2.0m depth		AU	1				
		SS	2	100	P	1	85.55
		SS	3	100	P	2	84.55
		SS	4	100	P	3	83.55
		SS	5	83	P	4	82.55
						5	81.55
		SS	6	75	P	6	80.55
6.71		SS	7	100	P		

Dynamic Cone Penetration Test commenced at 6.71m depth. Cone pushed to 31.85m depth, no refusal encountered, borehole terminated.

(GWL @ 2.39m - June 21, 2023)



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE June 7, 2023

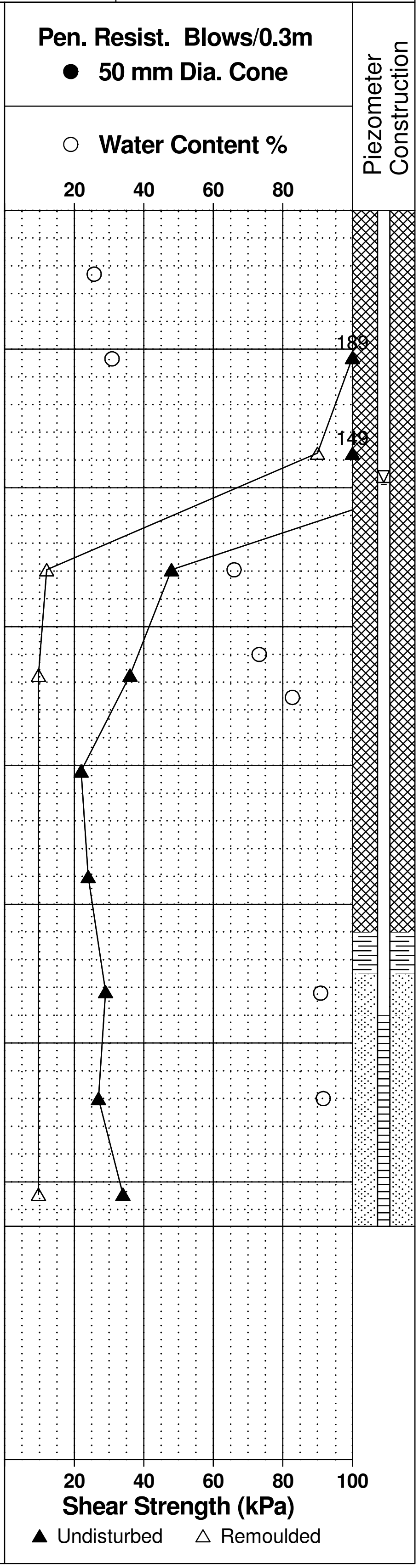
FILE NO. PG6715

HOLE NO. BH 4-23

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface					0	87.03
TOPSOIL 0.15						
	AU	1				
	SS	2	67	P	1	86.03
Very stiff to stiff, brown **SILTY CLAY**						
- firm by 2.3m depth					2	85.03
- silty sand seam at 2.4m depth	SS	3	100	P		
	SS	4	100	P	3	84.03
- soft to firm and grey by 2.4m depth						
					4	83.03
					5	82.03
	SS	5	100	P		
					6	81.03
	SS	6	100	P		
					7	80.03
7.32						

End of Borehole

(GWL @ 1.96m - June 21, 2023)



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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE June 7, 2023

FILE NO. PG6715

HOLE NO. BH 5-23

SOIL DESCRIPTION

Ground Surface

TOPSOIL 0.15

Very stiff to stiff, brown **SILTY CLAY**

- trace sand to 1.2m depth

- soft to firm and grey by 2.3m depth

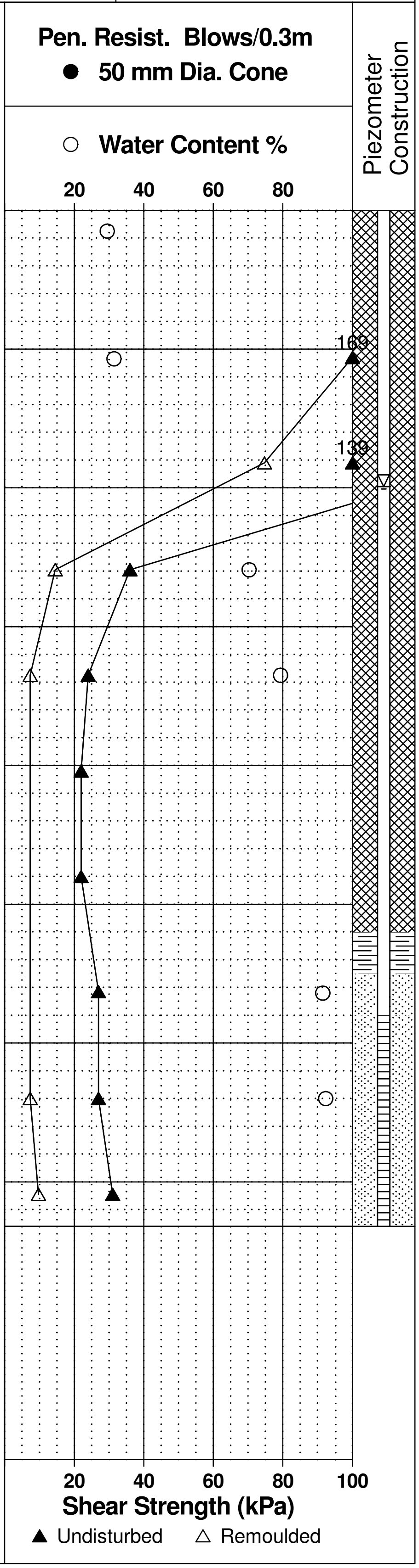
7.32

Dynamic Cone Penetration Test commenced at 6.71m depth. Cone pushed to 31.85m depth, no refusal encountered, borehole terminated.

(GWL @ 1.99m - June 21, 2023)

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	42	P
SS	3	100	P
SS	4	100	P
SS	5	100	P
SS	6	100	P
SS	7	100	P

DEPTH (m)	ELEV. (m)
0	86.81
1	85.81
2	84.81
3	83.81
4	82.81
5	81.81
6	80.81
7	79.81



SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383741.746 **NORTHING:** 5033730.318 **ELEVATION:** 86.71 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

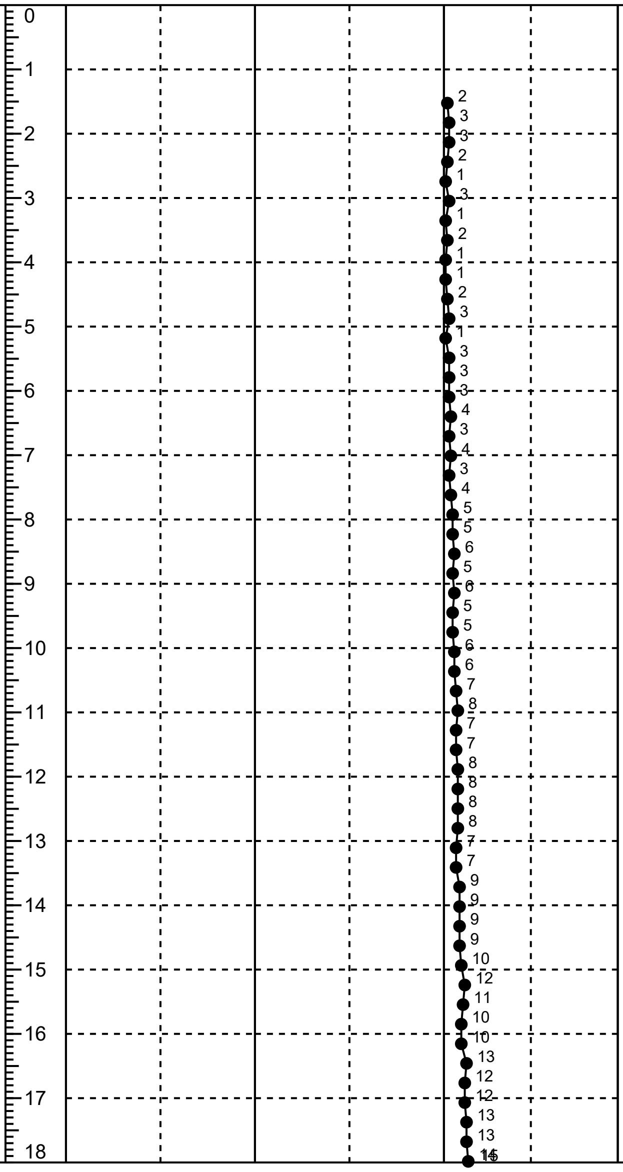
REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH 6-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction
Ground Surface EL 86.71 m										
Overburden										
1.52 m EL 85.19 m										
Dynamic Cone Penetration Test commenced at 1.52m depth.										



PATERSON GROUP

SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383741.746 **NORTHING:** 5033730.318 **ELEVATION:** 86.71 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

REMARKS:

DATE: December 14, 2023

FILE NO. PG6715

HOLE NO. BH 6-23

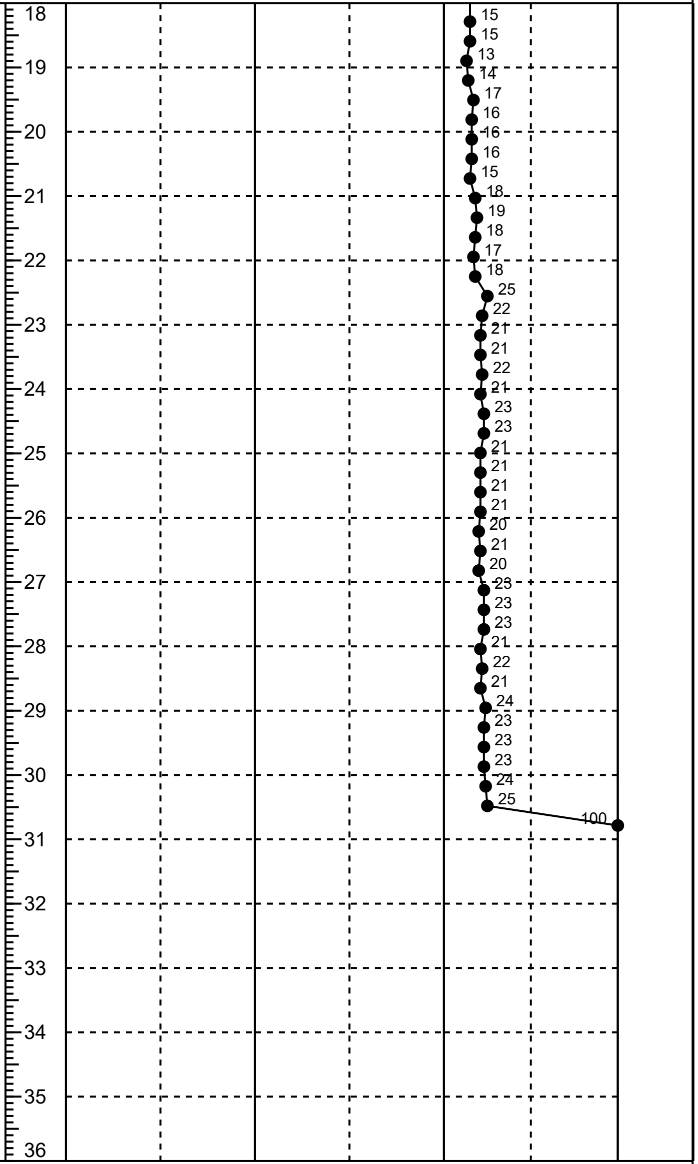
SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction

(continued)
Dynamic Cone Penetration Test commenced at 1.52m depth.

31.16 m
EL 55.55 m

End of Test Hole

Practical DCPT refusal at 31.16m depth



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PATERSON GROUP

SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383764.22 **NORTHING:** 5033711.866 **ELEVATION:** 86.58 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

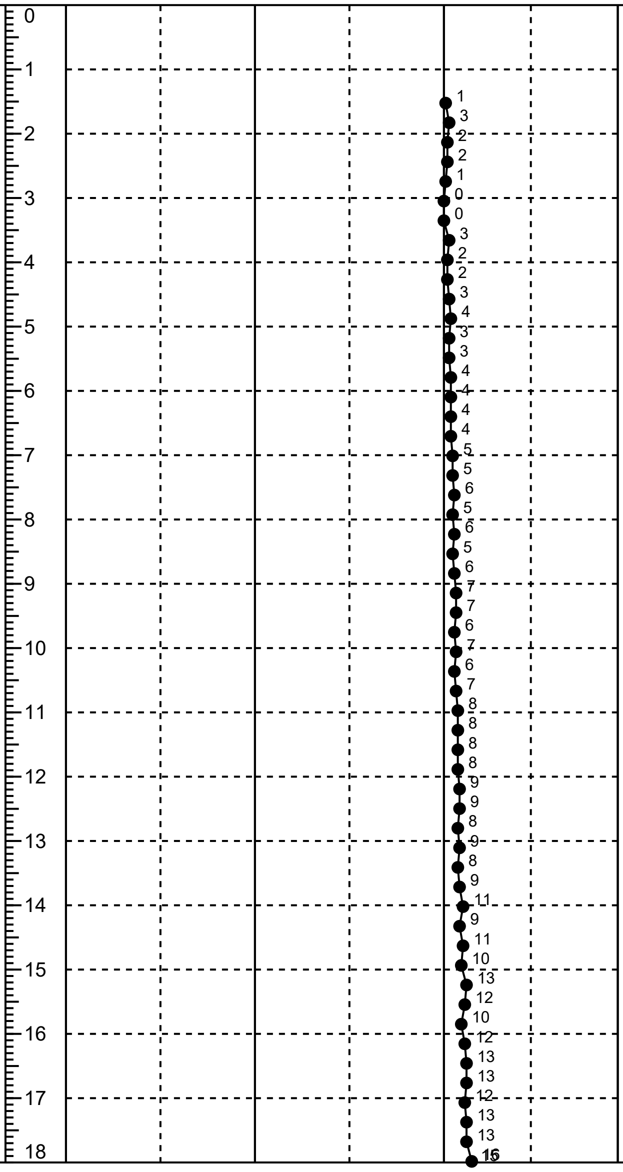
REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH 7-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction
Ground Surface EL 86.58 m										
Overburden										
1.52 m EL 85.06 m										
Dynamic Cone Penetration Test commenced at 1.52m depth.										



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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383764.22 **NORTHING:** 5033711.866 **ELEVATION:** 86.58 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

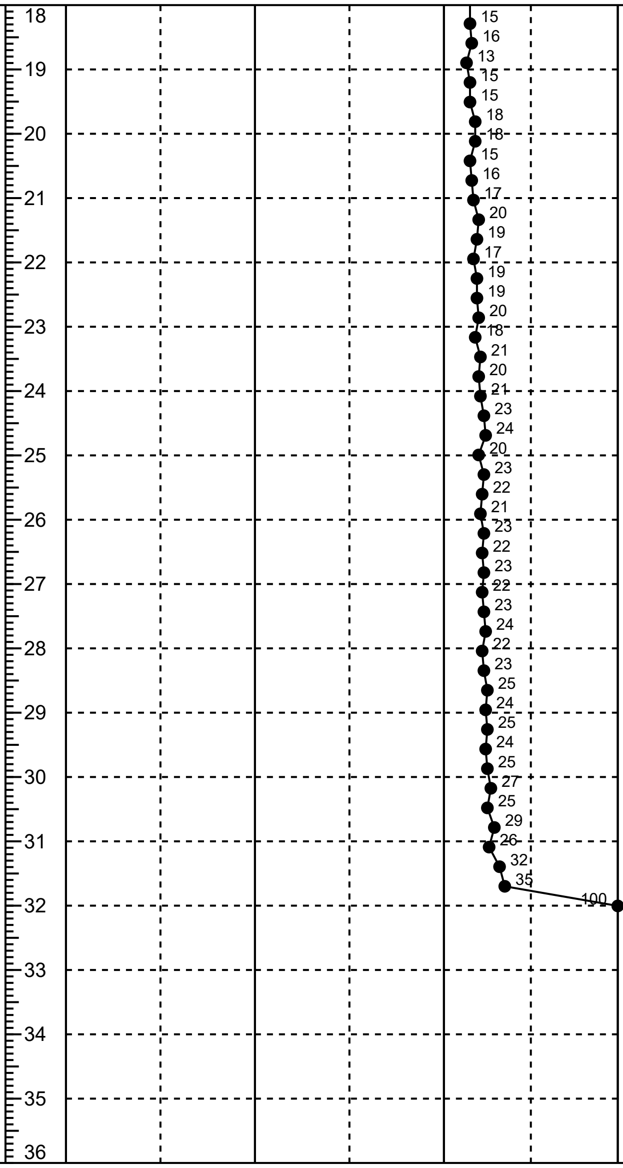
REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH 7-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction
(continued) Dynamic Cone Penetration Test commenced at 1.52m depth.										
32.1 m EL 54.48 m										
End of Test Hole Practical DCPT refusal at 32.10m depth										



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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383793.205 **NORTHING:** 5033685.898 **ELEVATION:** 86.72 m

PROJECT: Proposed School Development

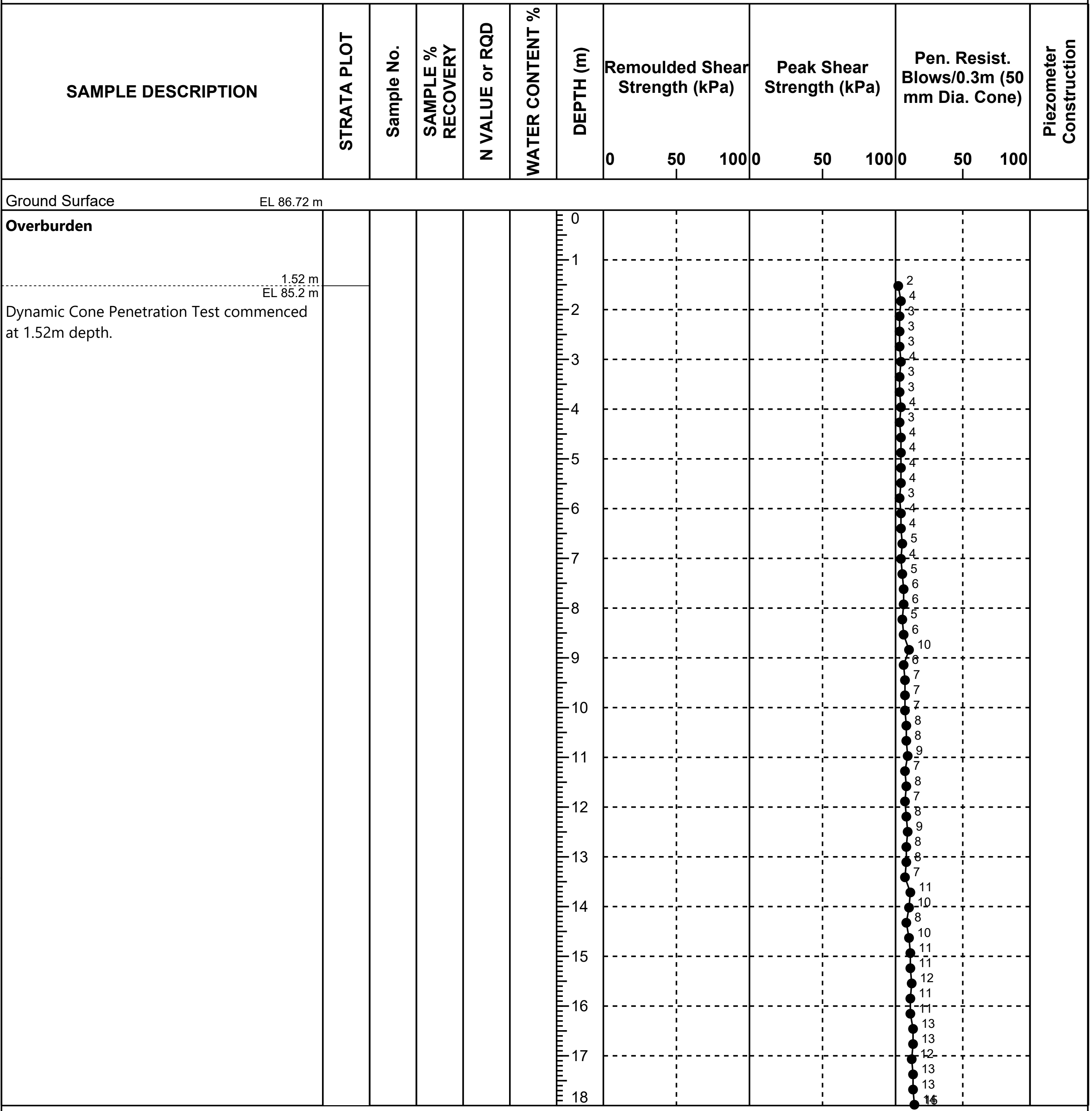
BORINGS BY: CME 55 Low Clearance Power Auger

REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH 8-23



Ground Surface EL 86.72 m

Overburden

1.52 m
EL 85.2 m

Dynamic Cone Penetration Test commenced at 1.52m depth.

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383793.205 **NORTHING:** 5033685.898 **ELEVATION:** 86.72 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

REMARKS:

DATE: December 14, 2023

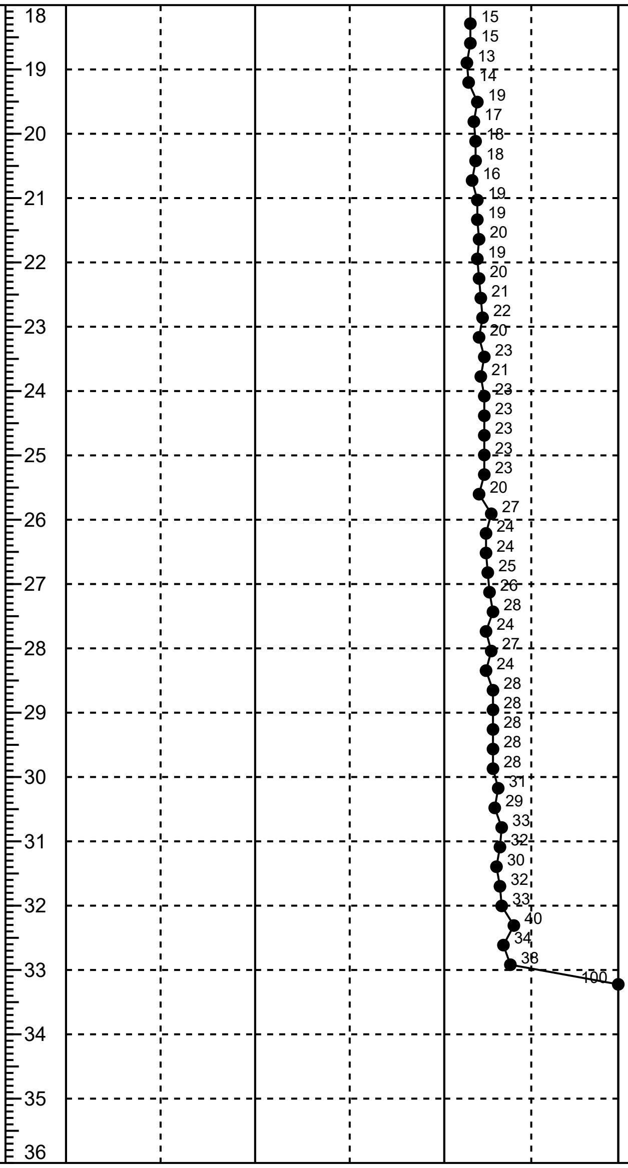
FILE NO. **PG6715**

HOLE NO. BH 8-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction

(continued)

Dynamic Cone Penetration Test commenced at 1.52m depth.



33.47 m
EL 53.25 m

End of Test Hole

Practical DCPT refusal at 33.47m depth

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383799.94 **NORTHING:** 5033709.194 **ELEVATION:** 86.84 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

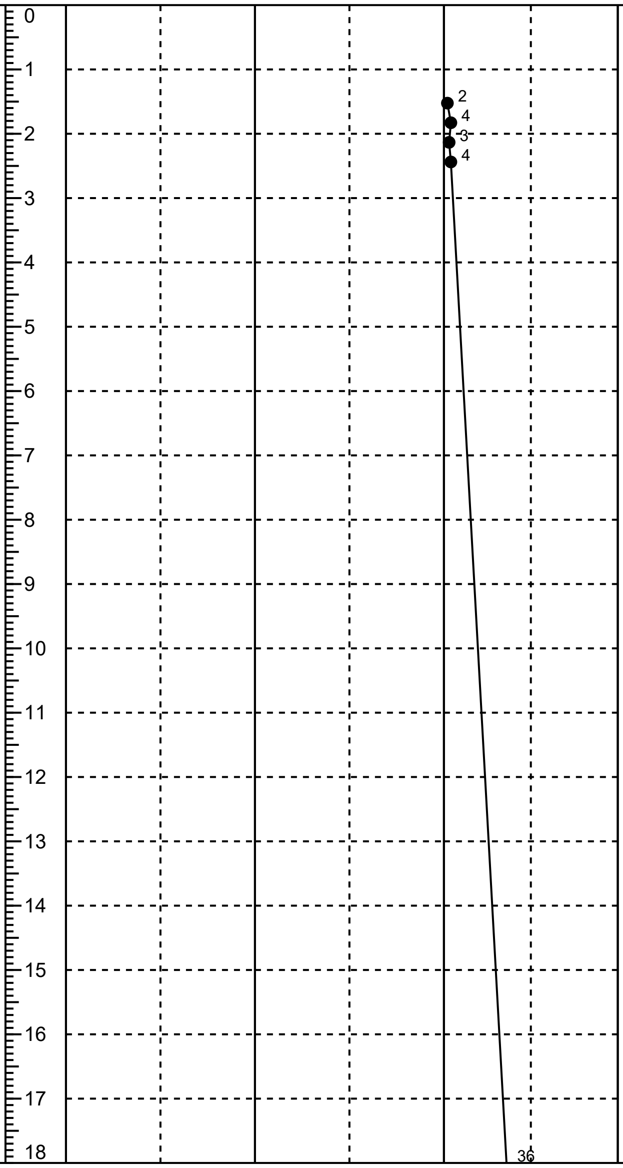
REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH 9-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction
Ground Surface EL 86.84 m										
Overburden 1.52 m EL 85.32 m										
Dynamic Cone Penetration Test commenced at 1.52m depth. The cone was pushed until resistance was attained at the depth which our field personnel started counting blow counts.										



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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383799.94 **NORTHING:** 5033709.194 **ELEVATION:** 86.84 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH 9-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction

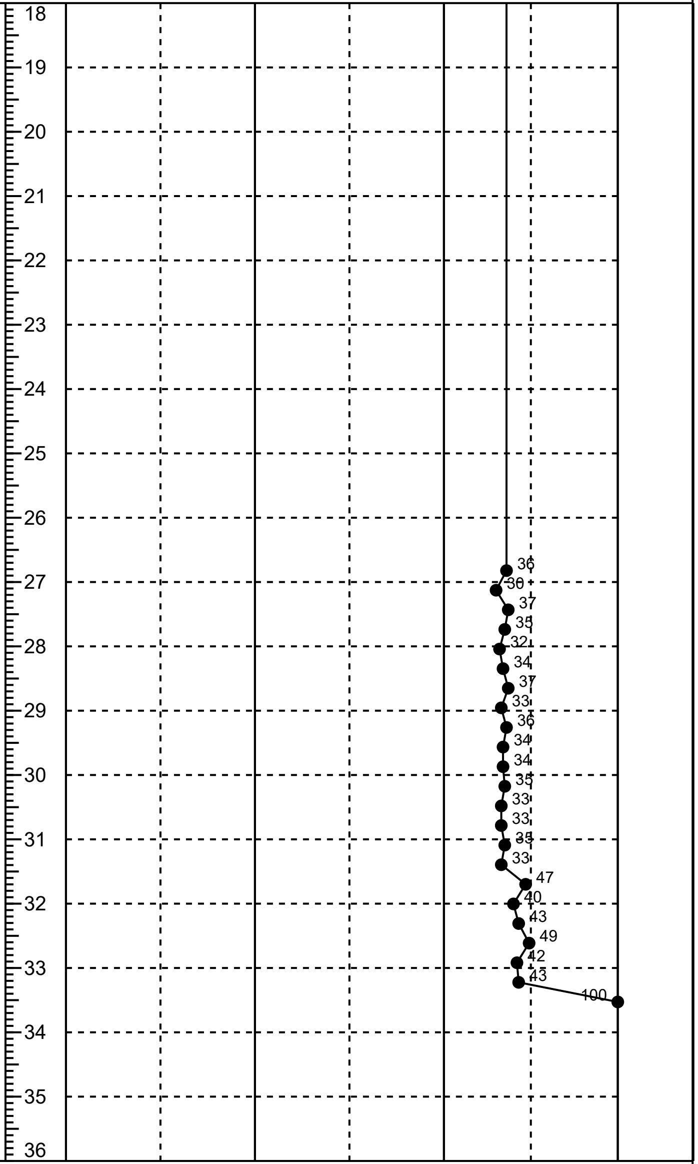
(continued)

Dynamic Cone Penetration Test commenced at 1.52m depth. The cone was pushed until resistance was attained at the depth which our field personnel started counting blow counts.

33.9 m
EL 52.94 m

End of Test Hole

Practical DCPT refusal at 33.90m depth



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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383786.537 **NORTHING:** 5033743.901 **ELEVATION:** 86.92 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH10-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction
Ground Surface EL 86.92 m										
Overburden						0				
1.52 m EL 85.4 m						1				
Dynamic Cone Penetration Test commenced at 1.52m depth. The cone was pushed until resistance was attained at the depth which our field personnel started counting blow counts.						2				
						3				
						4				
						5				
						6				
						7				
						8				
						9				
						10				
						11				
						12				
						13				
						14				
						15				
						16				
						17				
						18				

PATERSON GROUP

SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

2401 and 2419 Mer Bleue Road, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 383786.537 **NORTHING:** 5033743.901 **ELEVATION:** 86.92 m

PROJECT: Proposed School Development

BORINGS BY: CME 55 Low Clearance Power Auger

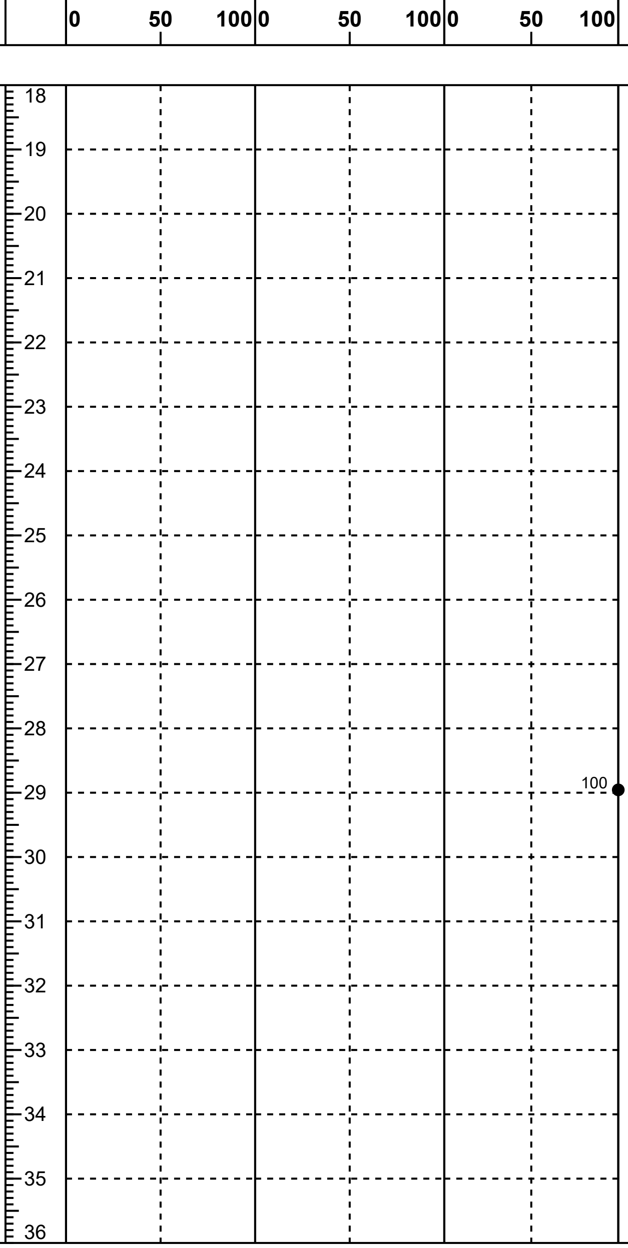
REMARKS:

DATE: December 14, 2023

FILE NO. **PG6715**

HOLE NO. BH10-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 50 100	Peak Shear Strength (kPa) 0 50 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 50 100	Piezometer Construction
(continued) Dynamic Cone Penetration Test commenced at 1.52m depth. The cone was pushed until resistance was attained at the depth which our field personnel started counting blow counts.										
29.18 m EL 57.74 m										
End of Test Hole Practical DCPT refusal at 29.18m depth										



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG6715

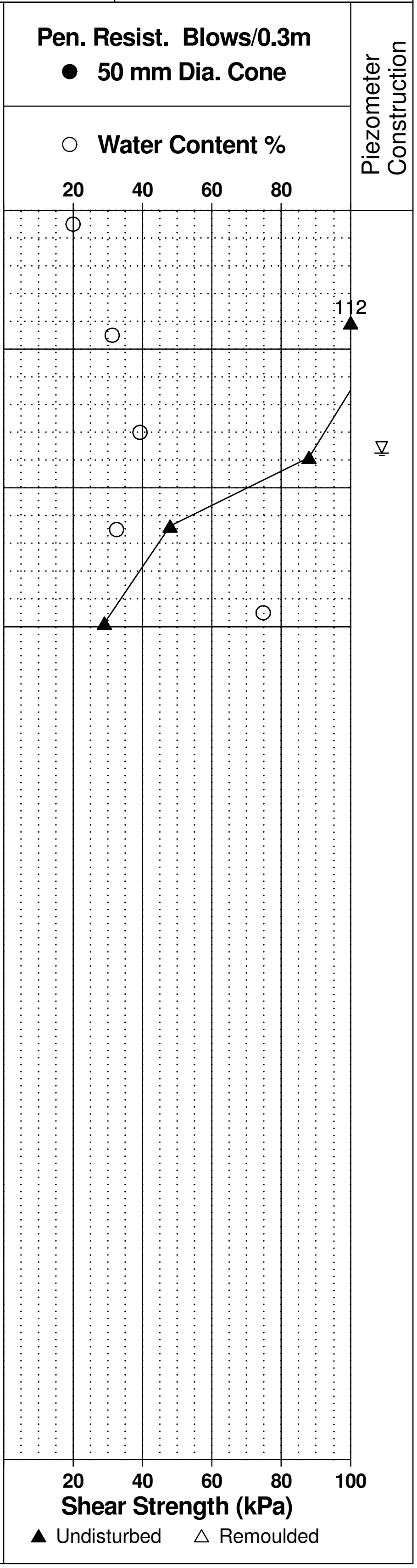
REMARKS

HOLE NO. TP 1-23

BORINGS BY Excavator

DATE June 9, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	86.56
TOPSOIL 0.20		G	1				
Very stiff to stiff, brown **SILTY CLAY** - trace sand to 0.4m depth 1.95		G G	2 3			1	85.56
Firm, grey **SILTY CLAY** 3.00		G G	4 5			2 3	84.56 83.56
End of Test Pit (Groundwater infiltration at 1.75m depth)							



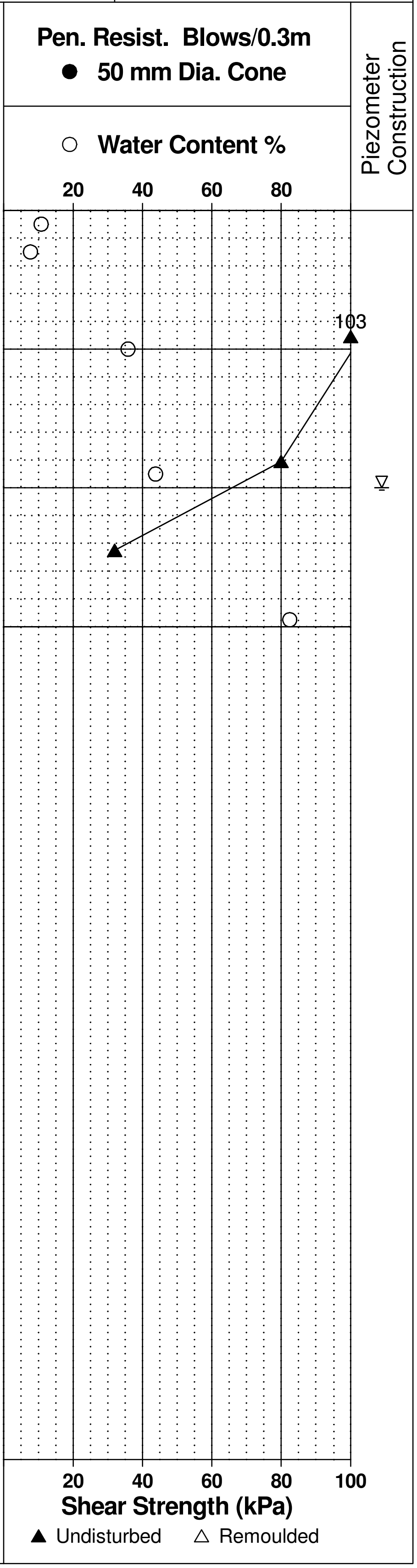
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY Excavator
DATE June 9, 2023

FILE NO. PG6715
HOLE NO. TP 2-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	86.53
TOPSOIL 0.20		G	1				
Brown **SILTY SAND** 0.75		G	2				
Very stiff to stiff, brown **SILTY CLAY**		G	3			1	85.53
2.00		G	4			2	84.53
Firm, grey **SILTY CLAY** 3.00		G	5			3	83.53
End of Test Pit (Groundwater infiltration at 2.0m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE June 9, 2023

FILE NO. PG6715

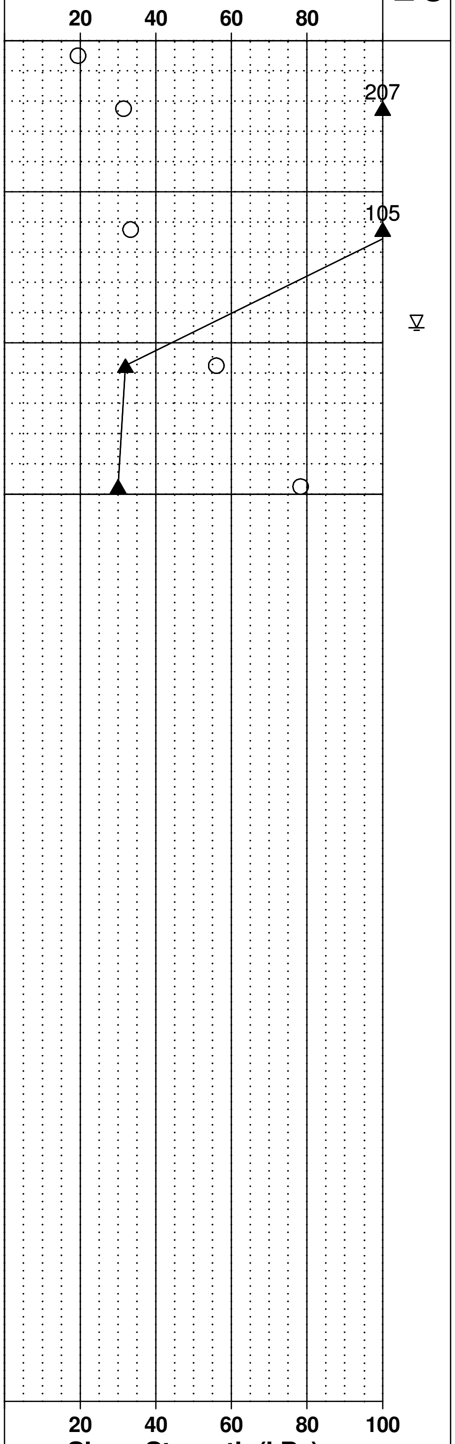
HOLE NO. TP 3-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface							
TOPSOIL 0.25	■	G	1			0	86.82
Hard to very stiff, brown **SILTY CLAY**	▨	G	2				
	▨					1	85.82
1.90	▨	G	3				
Firm, grey **SILTY CLAY**	▨	G	4			2	84.82
3.00	▨	G	5			3	83.82
End of Test Pit (Groundwater infiltration at 1.9m depth)							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

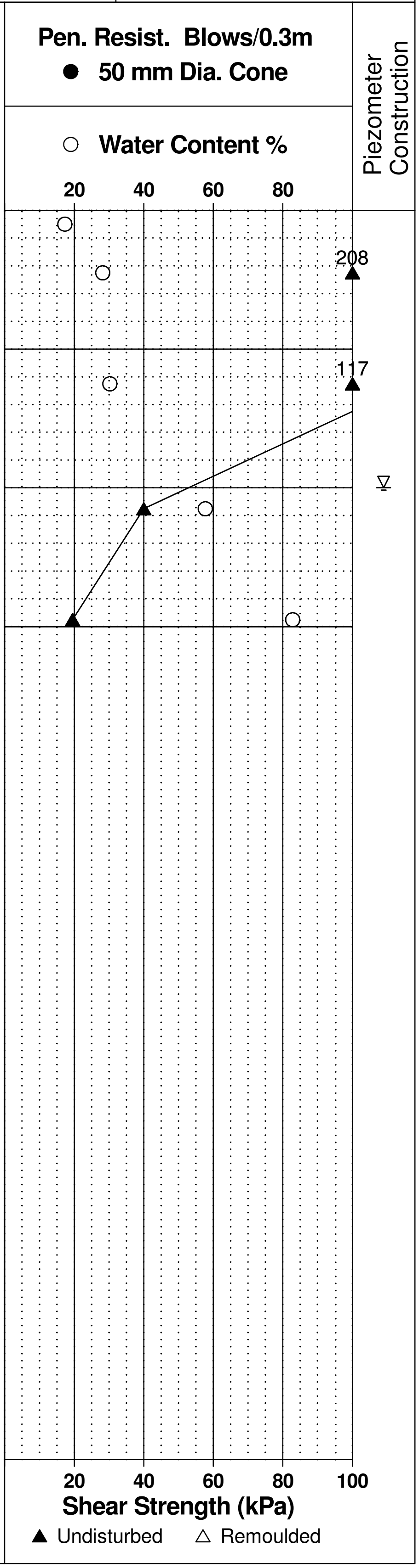
BORINGS BY Excavator

DATE June 9, 2023

FILE NO. PG6715

HOLE NO. TP 4-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	86.77
TOPSOIL 0.30		G	1				
		G	2				
Hard to very stiff, brown **SILTY CLAY**						1	85.77
		G	3				
2.00						2	84.77
Firm to soft, grey **SILTY CLAY**		G	4				
3.00		G	5			3	83.77
End of Test Pit (Groundwater infiltration at 2.0m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

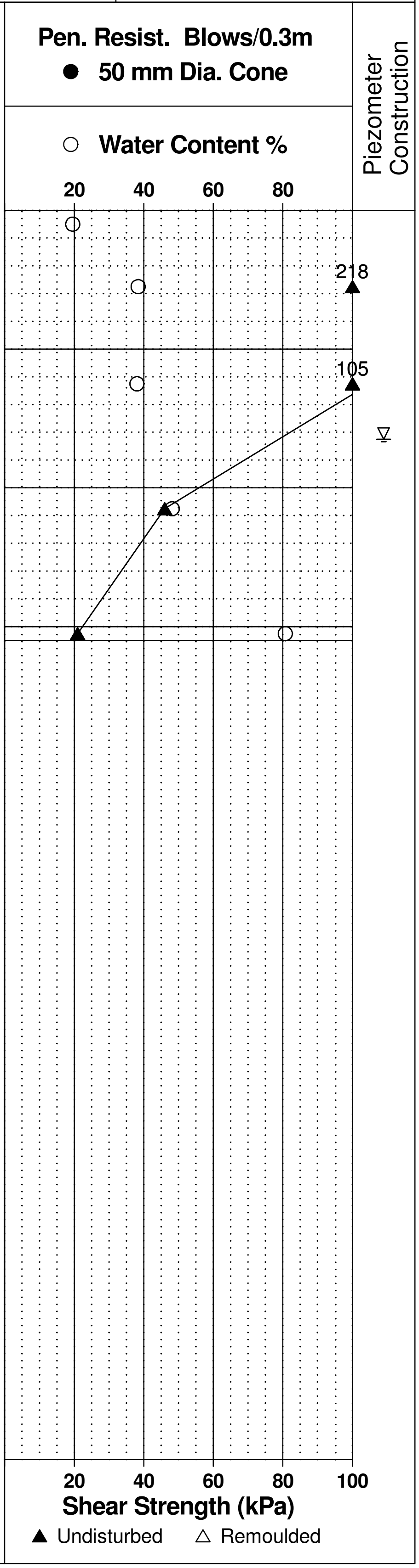
BORINGS BY Excavator

DATE June 9, 2023

FILE NO. PG6715

HOLE NO. TP 5-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	86.55
TOPSOIL 0.30		G	1				
Hard to very stiff, brown **SILTY CLAY**		G	2				
						1	85.55
- silt seam at 0.6m depth 1.65		G	3				
						2	84.55
Firm to soft, grey **SILTY CLAY** 3.10		G	4				
		G	5			3	83.55
End of Test Pit (Groundwater infiltration at 1.65m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

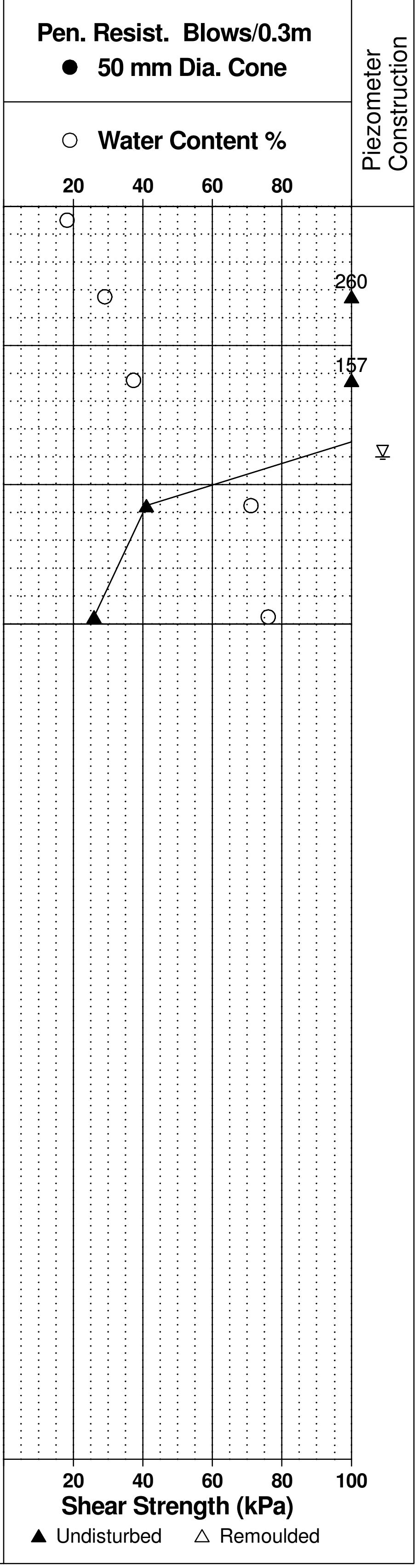
BORINGS BY Excavator

DATE June 9, 2023

FILE NO. PG6715

HOLE NO. TP 6-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	86.80
TOPSOIL 0.40		G	1				
Hard to very stiff, brown **SILTY CLAY**		G	2			1	85.80
- trace sand to 0.8m depth 1.80		G	3				
Firm, grey **SILTY CLAY**		G	4			2	84.80
3.00		G	5			3	83.80
End of Test Pit (Groundwater infiltration at 1.8m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
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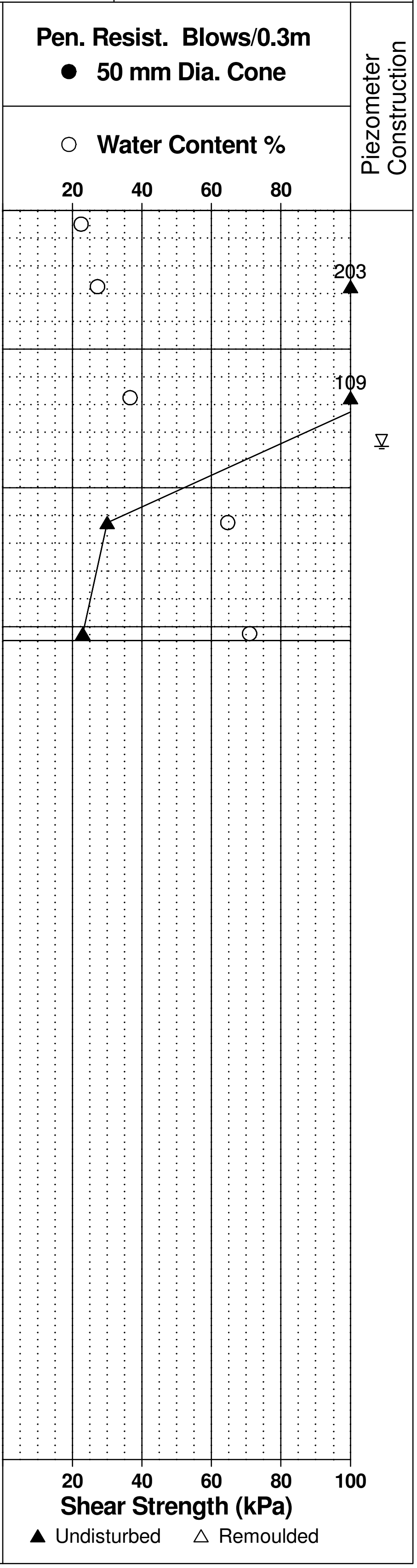
DATUM Geodetic
REMARKS
BORINGS BY Excavator
DATE June 9, 2023
FILE NO. PG6715
HOLE NO. TP 7-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	86.55
TOPSOIL 0.40		G	1				
		G	2				
Hard to very stiff, brown **SILTY CLAY**						1	85.55
		G	3				
1.70							
						2	84.55
Firm to soft, grey **SILTY CLAY**		G	4				
- silty sand seam at 2.2m depth 3.10		G	5			3	83.55
End of Test Pit (Groundwater infiltration at 1.7m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. School Development - 2401 & 2419 Mer Bleu Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

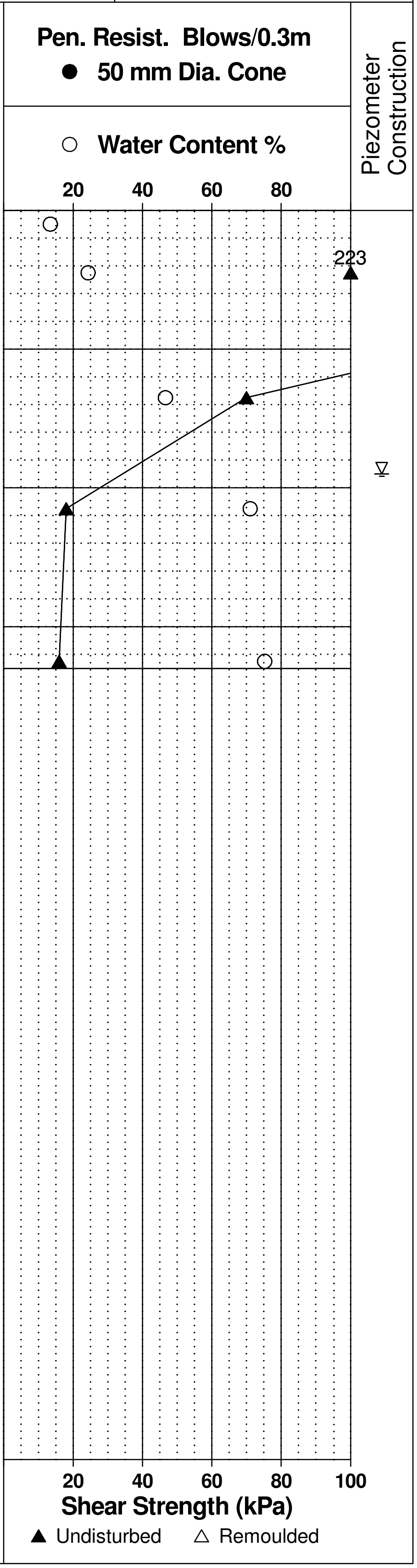
BORINGS BY Excavator

DATE June 9, 2023

FILE NO. **PG6715**

HOLE NO. **TP 8-23**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
Ground Surface						0	86.52
TOPSOIL 0.25	■	G	1				
Hard to stiff, brown **SILTY CLAY** - thin silt layer ar 0.5m depth 1.90	▨	G G	2 3			1	85.52
Soft, grey **SILTY CLAY** 3.30	▨	G G	4 5			2 3	84.52 83.52
End of Test Pit (Groundwater infiltration at 1.9m depth)							

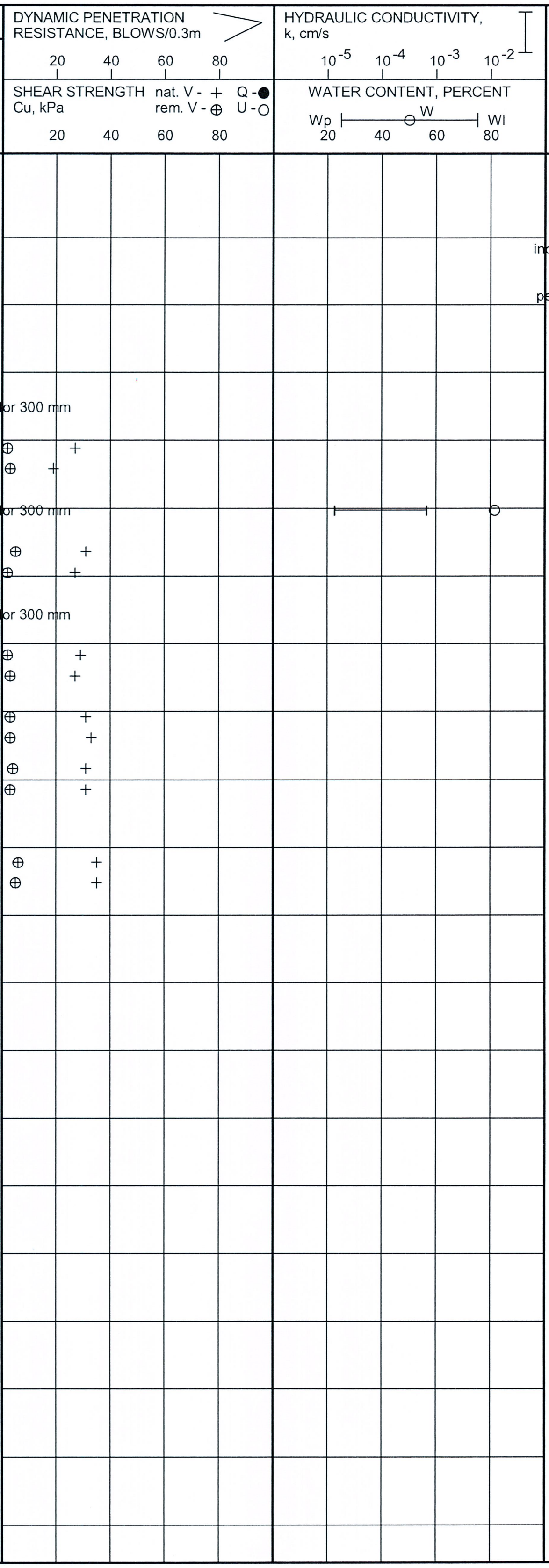


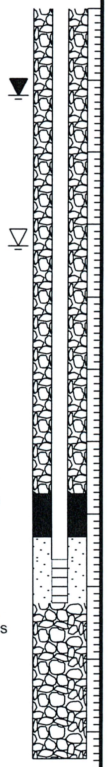
RECORD OF BOREHOLE 18-5

PROJECT: 62721.07
LOCATION: See Borehole Location Plan, Figure 2
BORING DATE: April 6, 2018

SHEET 1 OF 1
DATUM: Geodetic
SPT HAMMER: 63.5 kg; drop 0.76 metres

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface	86.84					
		Brown SILTY CLAY, trace sand with organics	86.23 0.61	1	50 DO	4	PAHs, metals and inorganics, and OC pesticides PHCs, and BTEX	Soil cuttings
1		Very stiff, brown SILTY CLAY Weathered Crust)		2	50 DO	6		
2				3	50 DO	4		
			84.10 2.74	4	50 DO	2		
3		Firm to soft, grey SILTY CLAY		5	50 DO	WH for 300 mm		
5				6	50 DO	WH for 300 mm		
6				7	50 DO	WH for 300 mm		Bentonite seal
7								Filter sand
8								22 mm diameter, 0.6 metres long well screen
9				8	TW			Soil cuttings
10		End of Borehole	76.47 10.37					





GROUNDWATER OBSERVATIONS		
DATE	DEPTH (m)	ELEV. (m)
18/04/09	3.30 ▽	83.54
18/04/18	1.21 ▼	85.63

DEPTH SCALE
1 to 100

GEMTEC

LOGGED: M.L.
CHECKED:

PROJECT: 62721.07

RECORD OF BOREHOLE 18-6

SHEET 1 OF 2

LOCATION: See Borehole Location Plan, Figure 2

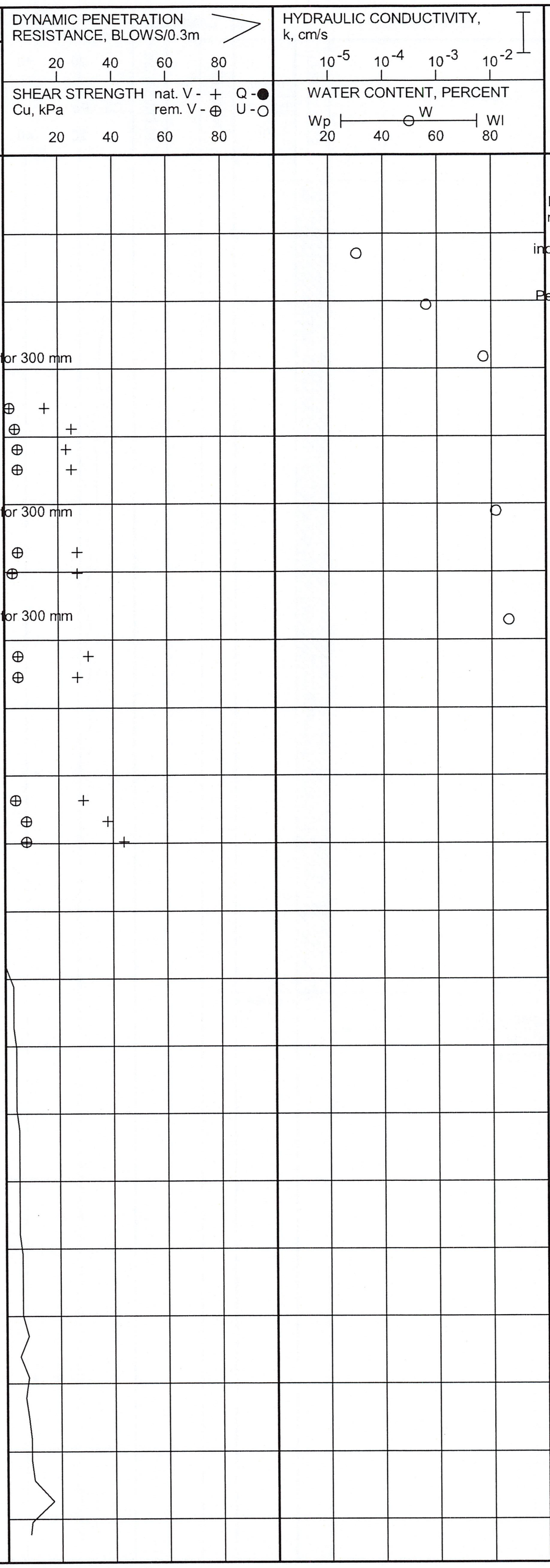
DATUM: Geodetic

BORING DATE: April 6, 2018

SPT HAMMER: 63.5 kg; drop 0.76 metres

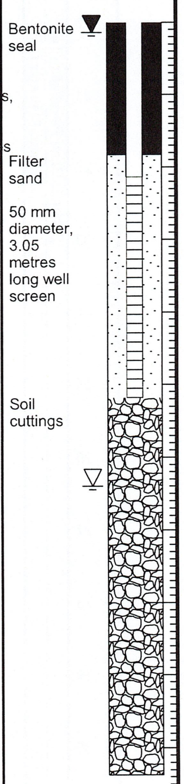
DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
		Ground Surface	86.77
0	Power Auger 200 mm Diameter Hollow Stem	Brown SILTY CLAY, trace sand with organics	86.16 0.61
1		Very stiff, brown SILTY CLAY (Weathered Crust)	84.48 2.29
2		Firm to soft, grey SILTY CLAY	77.02 9.75
10		Possible clayey deposits	

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	50 DO	3
2	50 DO	7
3	50 DO	5
4	50 DO	WH for 300 mm
5	50 DO	WH for 300 mm
6	50 DO	WH for 300 mm
7	TW	



ADDITIONAL LAB. TESTING: PAHs, metals and inorganics, and OC Pesticides

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/04/09	6.40 ∇	80.37
18/04/18	0.14 ▼	86.63

DEPTH SCALE

1 to 100

GEMTEC

LOGGED: M.L.

CHECKED:

PROJECT: 62721.07

RECORD OF BOREHOLE 18-6

SHEET 2 OF 2

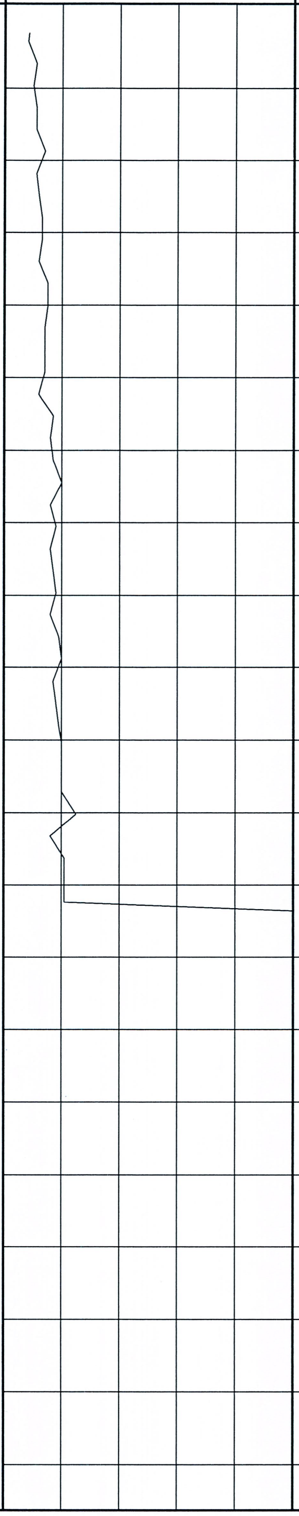
LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: April 6, 2018

SPT HAMMER: 63.5 kg; drop 0.76 metres

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	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^{-5}, 10^{-4}, 10^{-3}, 10^{-2}) WATER CONTENT, PERCENT Wp ⊢—○W—⊣ Wl (20, 40, 60, 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	Dynamic Cone Penetration Test 38 mm Diameter Cone		▨								
21			▨								
22			▨								
23			▨								
24			▨								
25			▨								
26			▨								
27			▨								
28			▨								
29			▨								
30			▨								
31			▨								
32		Possible glacial till DCPT Refusal End of Borehole	▨	54.76 32.01 54.64 32.13							
33											
34											
35											
36											
37											
38											
39											
40											



DEPTH SCALE

1 to 100

GEMTEC

LOGGED: M.L.

CHECKED:

PROJECT: 62721.07

RECORD OF BOREHOLE 18-7

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

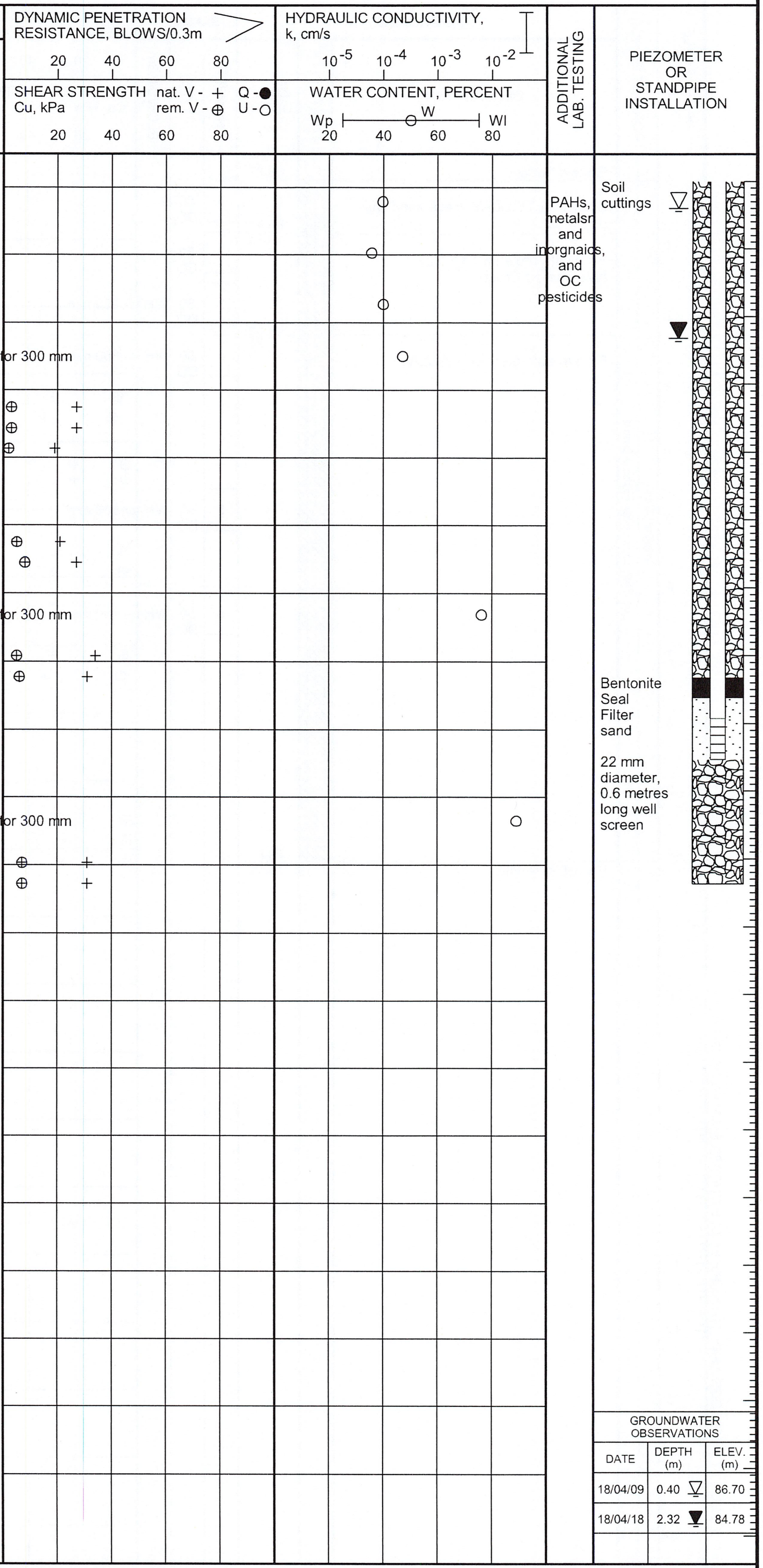
BORING DATE: April 4, 2018

SPT HAMMER: 63.5 kg; drop 0.76 metres

BORING METHOD: Power Auger 200 mm Diameter Hollow Stem

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	87.10
Brown SILTY CLAY, trace sand with organics	86.49 0.61
Very stiff, brown SILTY CLAY (Weathered Crust)	84.81 2.29
Firm to soft, grey SILTY CLAY	76.73 10.37
End of Borehole	

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	50 DO	5
2	50 DO	4
3	50 DO	4
4	50 DO	WH for 300 mm
5	TW	
6	50 DO	WH for 300 mm
7	50 DO	WH for 300 mm



ADDITIONAL LAB. TESTING: PAHs, metalsn and inorgnaics, and OC pesticides

PIEZOMETER OR STANDPIPE INSTALLATION:

Soil cuttings

Bentonite Seal

Filter sand

22 mm diameter, 0.6 metres long well screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/04/09	0.40 ▽	86.70
18/04/18	2.32 ▼	84.78

DEPTH SCALE

1 to 100

LOGGED: M.L.

CHECKED:

PROJECT: 62721.07

RECORD OF BOREHOLE 18-8

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

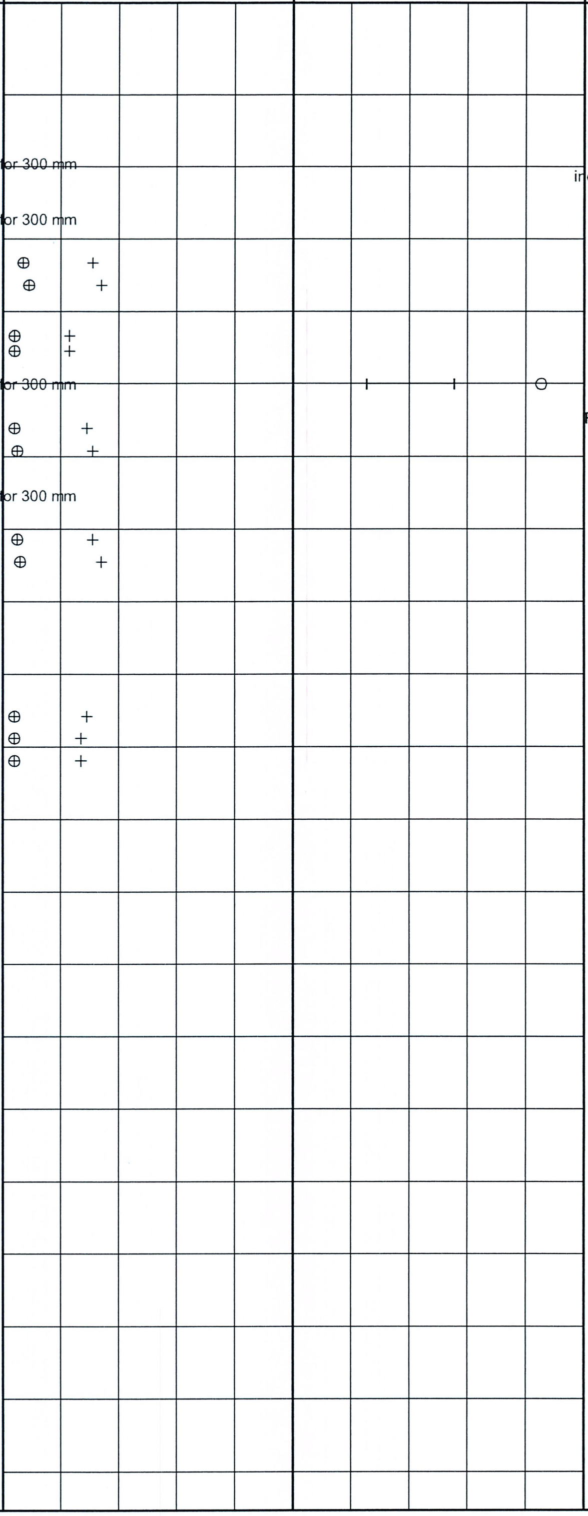
BORING DATE: April 4, 2018

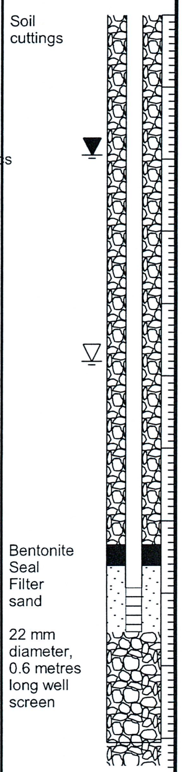
SPT HAMMER: 63.5 kg; drop 0.76 metres

BORING METHOD: Power Auger, 200 mm Diameter Hollow Stem

DESCRIPTION	ELEV. / DEPTH (m)
Ground Surface	86.87
Brown SILTY CLAY, trace sand with organics	86.11 0.76
Very stiff, brown SILTY CLAY (Weathered Crust)	84.58 2.29
Firm to soft, grey SILTY CLAY	76.81 10.06
End of Borehole	

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	50 DO	2	
2	50 DO	6	PAHs, and metals and inorganics PHCs, and BTEX
3	50 DO	WH for 300 mm	
4	50 DO	WH for 300 mm	
5	50 DO	WH for 300 mm	MH, See Fig. B1
6	50 DO	WH for 300 mm	





GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/04/09	4.80 ▽	82.07
18/04/18	1.94 ▼	84.93

DEPTH SCALE

1 to 100

GEMTEC

LOGGED: M.L.

CHECKED:

BOREHOLE LOG 62721.07 GINT LOGS APRIL 2018.GPJ HOULE CHEVRIER 2015.GDT 20/4/18

PROJECT: 62721.07

RECORD OF BOREHOLE 18-9

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: April 2, 2018

SPT HAMMER: 63.5 kg; drop 0.76 metres

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	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^{-5} 10^{-4} 10^{-3} 10^{-2}); WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		87.31							
0	Power Auger 200 mm Diameter Hollow Stem	Brown SILTY CLAY, trace sand with organics	▨	87.21 0.10	1	50 DO	6			PAHs, metals and inorganics, and OC pesticides PHCs, and BTEX	Bentonite seal
1		Very stiff, brown SILTY CLAY (Weathered Crust)	▨		2	50 DO	8				Filter sand 50 mm diameter, 3.05 metres long well screen
2					3	50 DO	4				
					4	50 DO	2				
3		Firm to soft, grey SILTY CLAY	▨	84.26 3.05	5	50 DO	WH for 300 mm				
4					6	50 DO	2				
		End of Borehole		82.74 4.57							
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/04/09	0.70 ▽	86.61
18/04/18	0.08 ▼	87.23

DEPTH SCALE

1 to 100

GEMTEC

LOGGED: M.L.

CHECKED:

BOREHOLE LOG 62721.07 GINT LOGS APRIL 2018.GPJ HOULE CHEVRIER 2015.GDT 20/4/18

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) ‘N’ value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of “P” denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

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

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

CONSOLIDATION TEST

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

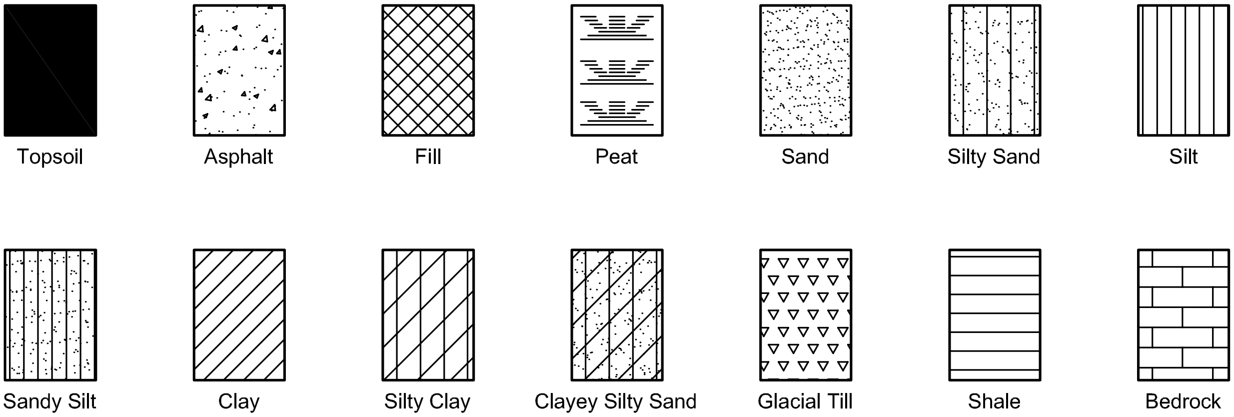
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

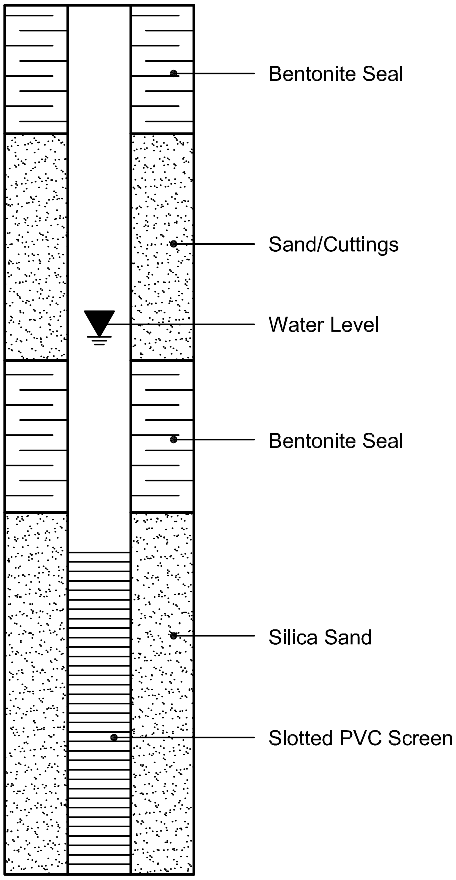
SYMBOLS AND TERMS (continued)

STRATA PLOT

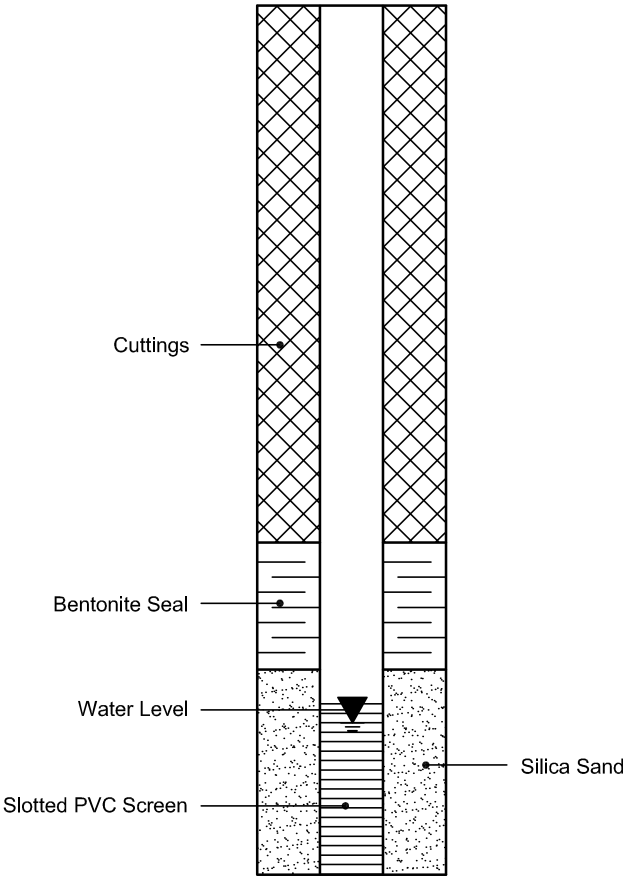


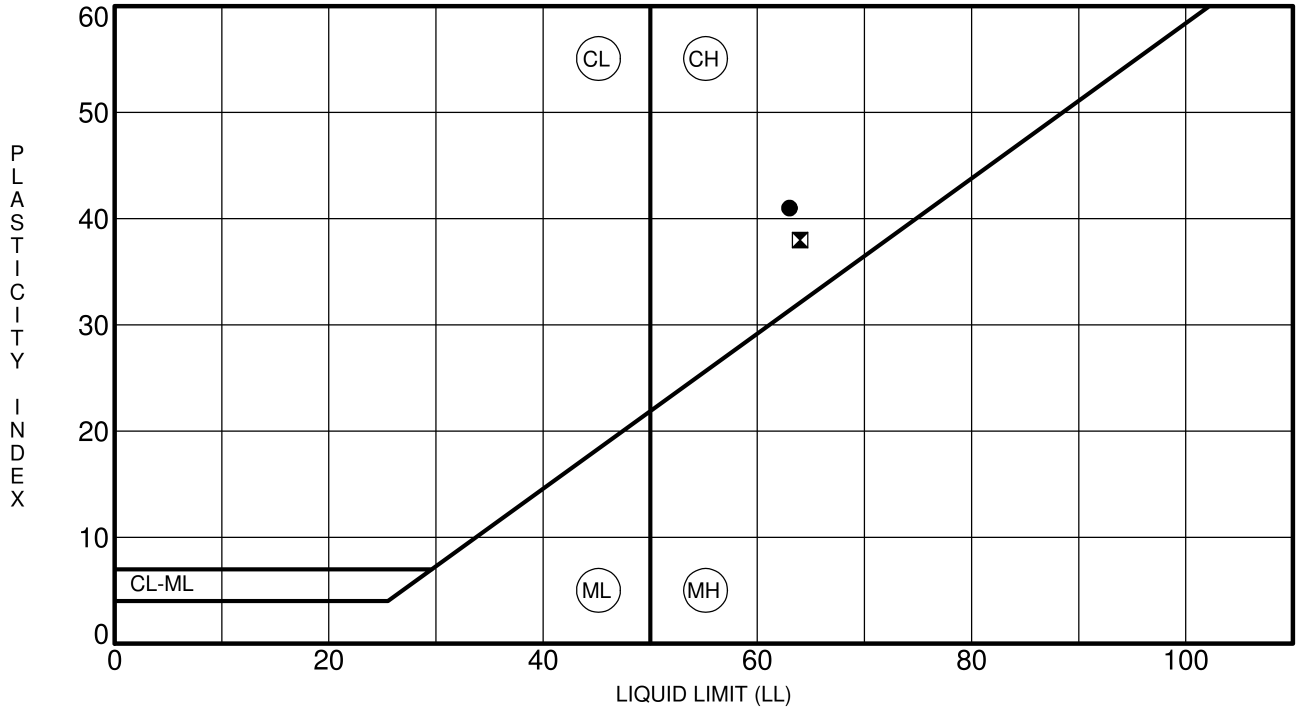
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 3-23**	**SS2**	**63**	**22**	**41**		**CH - Inorganic clays of high plasticity**
⧗	**BH 5-23**	**SS2**	**64**	**26**	**38**		**CH - Inorganic clays of high plasticity**

CLIENT **Conseil des ecoles publiques de l'Est de l'Ontario**

FILE NO. **PG6715**

PROJECT **Geotechnical Investigation - Prop. School Development - 2401 & 2419 Mer Bleu Road**

DATE **7 Jun 23**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

ATTERBERG LIMITS' RESULTS

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**

Client PO: 57679

Report Date: 09-Jun-2023

Order Date: 7-Jun-2023

Project Description: PG6715

	Client ID:	BH3-23-SS2	-	-	-
	Sample Date:	06-Jun-23 09:00	-	-	-
	Sample ID:	2323342-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	75.9	-	-	-
General Inorganics					
pH	0.05 pH Units	7.75	-	-	-
Resistivity	0.1 Ohm.m	16.3	-	-	-
Anions					
Chloride	10 ug/g dry	199	-	-	-
Sulphate	10 ug/g dry	84	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2 – PROPOSED CLAY SEAL LOCATION PLAN

DRAWING PG6715 - 1 - TEST HOLE LOCATION PLAN

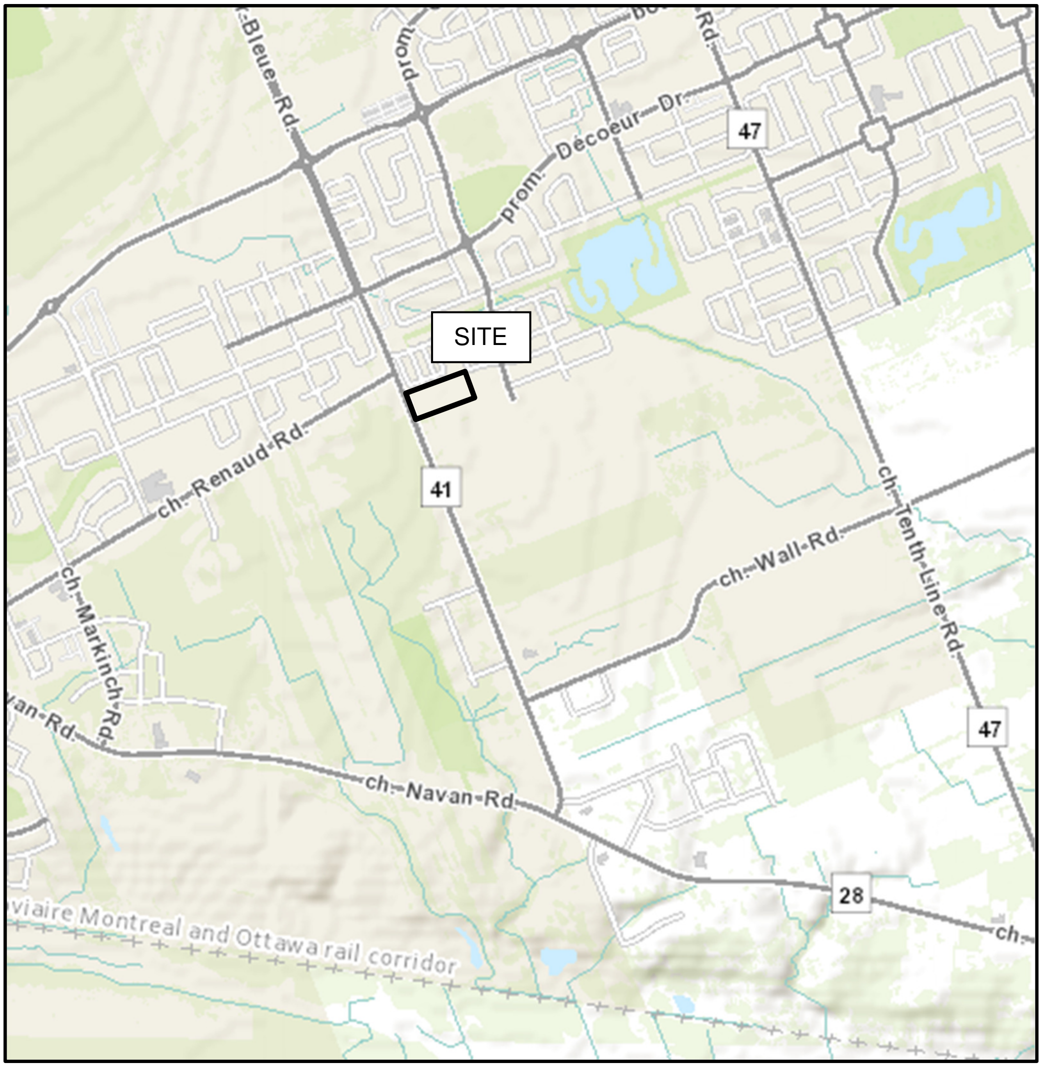


FIGURE 1

KEY PLAN

PATERSON GROUP

PG6715 - FIGURE 2 - PROPOSED CLAY SEAL LOCATION PLAN

CLAY SEAL RECOMMENDED FOR EACH OF STORM, SANITARY AND WATER PIPE SERVICE TRENCHES

LEGEND

🟥 MINIMUM 1.5m LONG CLAY SEAL IN SERVICE TRENCH EXTENDING FROM SIDEWALL TO SIDEWALL AND BETWEEN TRENCH SUBGRADE UP TO TOP OF PIPE COVER LAYER.

NOTES:

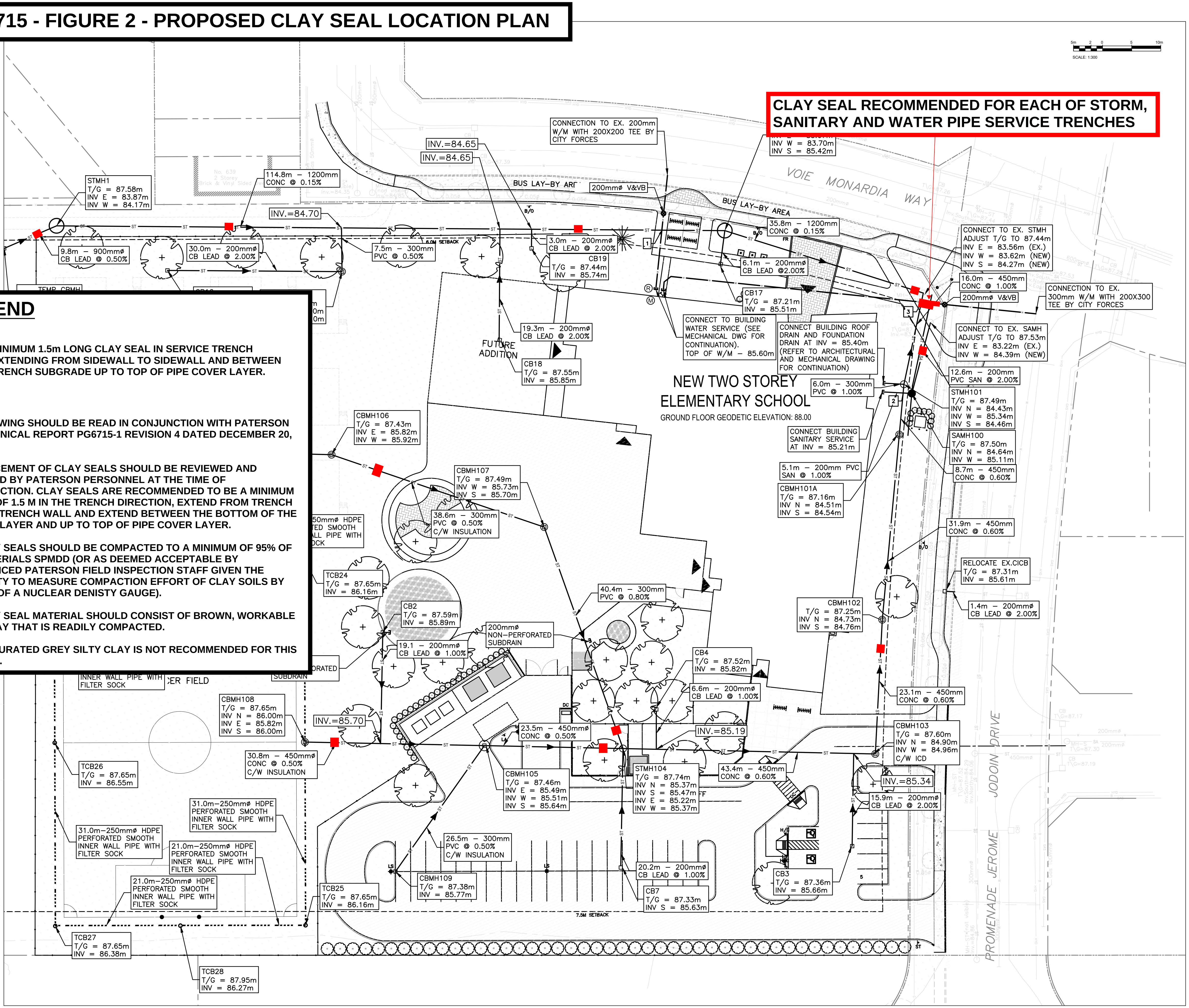
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH PATERSON GEOTECHNICAL REPORT PG6715-1 REVISION 4 DATED DECEMBER 20, 2023.

THE PLACEMENT OF CLAY SEALS SHOULD BE REVIEWED AND APPROVED BY PATERSON PERSONNEL AT THE TIME OF CONSTRUCTION. CLAY SEALS ARE RECOMMENDED TO BE A MINIMUM LENGTH OF 1.5 M IN THE TRENCH DIRECTION, EXTEND FROM TRENCH WALL TO TRENCH WALL AND EXTEND BETWEEN THE BOTTOM OF THE BEDDING LAYER AND UP TO TOP OF PIPE COVER LAYER.

THE CLAY SEALS SHOULD BE COMPACTED TO A MINIMUM OF 95% OF THE MATERIALS SPMDD (OR AS DEEMED ACCEPTABLE BY EXPERIENCED PATERSON FIELD INSPECTION STAFF GIVEN THE DIFFICULTY TO MEASURE COMPACTION EFFORT OF CLAY SOILS BY THE USE OF A NUCLEAR DENISTY GAUGE).

THE CLAY SEAL MATERIAL SHOULD CONSIST OF BROWN, WORKABLE SILTY CLAY THAT IS READILY COMPACTED.

WET, SATURATED GREY SILTY CLAY IS NOT RECOMMENDED FOR THIS PURPOSE.



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4	0	2023/11/17	ISSUED FOR COORDINATION
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2	0	2023/09/21	ISSUED FOR SITE PLAN CONTROL
1	0	2023/07/19	ISSUED FOR SITE PLAN CONTROL

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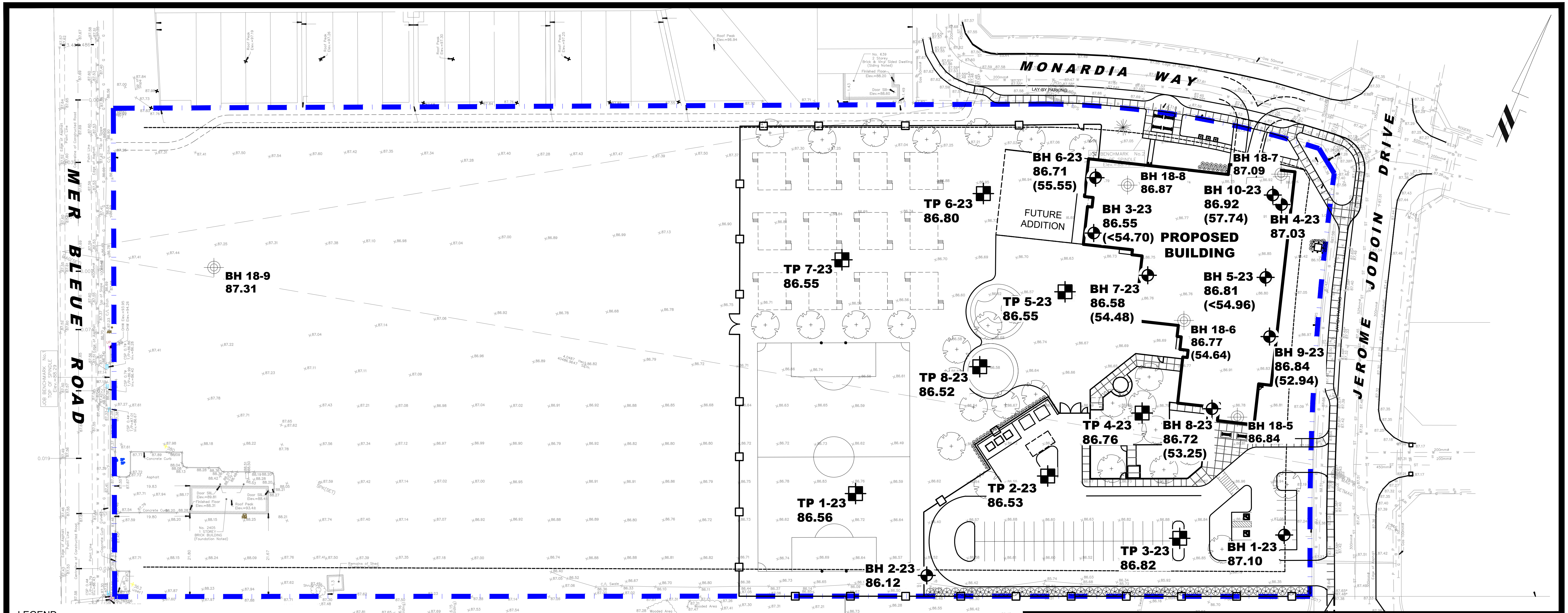


LEGEND:

⊞	TEST PIT LOCATION (2023)
⊕	BOREHOLE LOCATION (2023)
⊕	BOREHOLE BY OTHERS LOCATION (GEMTECH PROJECT NO. 62721,2018)
86.55	GROUND SURFACE ELEVATION (m)
(54.64)	PRACTICAL DCPT REFUSAL ELEVATION (m)

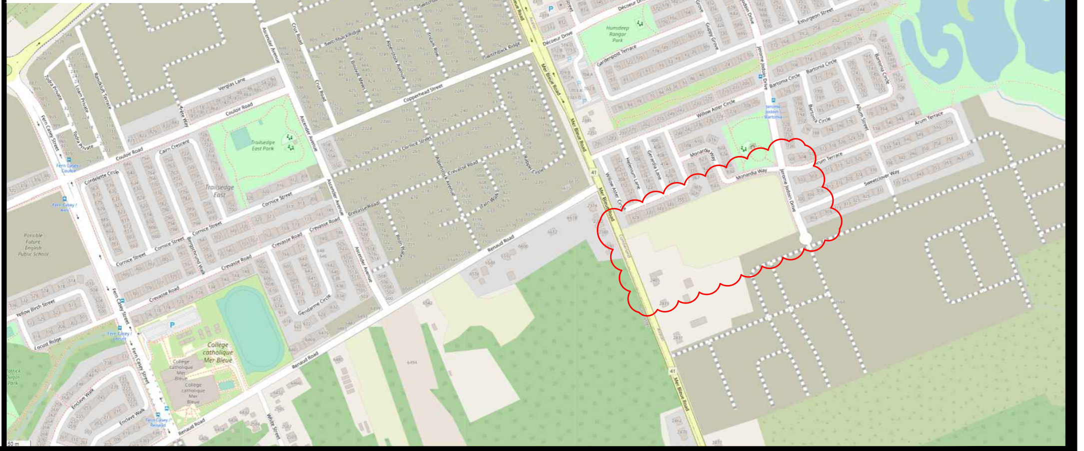
BASE PLAN AND TOPOGRAPHIC MAPPING PROVIDED BY
EDWARD J. CUHACI & ASSOCIATES ARCHITECS INC.

GROUND SURFACE AT TEST HOLE LOCATIONS ARE
REFERENCED TO A GEODETIC DATUM

SCALE: 1:1000

0 10 20 30 40 50m 75m

KEYPLAN



PATERSON GROUP

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NO.	REVISIONS	DATE	INITIAL
2	ADDED BOREHOLE LOCATION BH6-23 TO BH 10-23	19/12/2023	DP
1	UPDATED BASE PLAN ADDED TO DRAWING	21/11/2023	KB

CONSEIL DES ÉCOLES PUBLIQUES DE L'EST DE L'ONTARIO (CEPEO)

GEOTECHNICAL INVESTIGATION
PROPOSED SCHOOL DEVELOPMENT
675 MONARDIA WAY

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1000
Date: 07/2023
Drawn by: RCG
Report No.: PG6715-1
Checked by: PB
Dwg. No.: PG6715-1
Approved by: DJG
Revision No.: 2

11x17

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