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Geotechnical Engineering
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February 19, 2025
PG7265-LET.01 Revision 2

Ottawa Catholic School Board
570 West Hunt Club Road
Ottawa, Ontario
K2G 3R4

Attention: **Scott Divell**

Subject: **Geotechnical Investigation**
Proposed Addition to St. Philip Catholic Elementary School
79 Maitland Street South, Richmond, Ontario

Dear Scott,

Paterson Group (Paterson) was commissioned by the Ottawa Catholic School Board (OCSB) to conduct a geotechnical investigation for the proposed two-storey building addition to be located at 79 Maitland Street South within the town of Richmond, Ontario.

The objectives of the assessment were to:

- Determine the subsoil and groundwater conditions at this site by means of a test hole program.

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

The following report presents a summary of our findings and provides geotechnical recommendations pertaining to the proposed development. 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.

1.0 Field Observations

Field Program

The field program for the current investigation was conducted on September 12, 2024, and consisted of advancing three (3) test pits to a maximum depth of 4.0 m below the existing ground surface. The third test pit (TP 3-24) was completed along the west corner of the existing building, undertaken against the building footprint and confirms the foundations bearing surface at the underside of footing (USF) elevation. A previous investigation was undertaken by Paterson in December of 2012. At that time, four (4) boreholes were advanced within the subject site to maximum depth of 4.4 m.

The test holes were reviewed in the field by Paterson personnel under the direction of a senior engineer from the Geotechnical Division. The test pit procedure consisted of excavating to the required depths at the selected locations and sampling the overburden. The depths at which the grab samples were recovered from the test pits are shown as G on the Soil Profile and Test Data sheets attached to the present report.

The test pits were placed in a manner to provide general coverage of the subject site, taking into consideration existing site features and underground services. The approximate locations of the test holes are shown on Drawing PG7265-1 – Test Hole Location Plan attached to the present report.

Site Conditions

The subject site is currently occupied by the one-storey elementary school as well as associated asphalt-paved access lanes and walking paths located within the north and east portion of the subject site, parking areas along the east portion, exterior play structures and an asphalt-paved area directly west of the building and further west by portable classrooms, a rear play yard along the south portion, and a grassed area along the north portion.

The ground surface throughout the subject site is relatively flat and at grade with the surrounding roadways. The subject site is bordered to the north by Royal York Street, to the east by Maitland Street, to the south by a vacant yard, and to the west by Fortune Street.

Subsurface Conditions

Overburden

Generally, the soil profile at the test hole locations consists of topsoil and/or fill overlying a discontinuous layer of silty sand/sandy silt, which was underlain by a small deposit of clay, and further by a layer glacial till extending down to the bedrock surface.

A 0.2 m thick layer of topsoil was observed within TP 1-24 and a 25 to 50 mm thick layer of asphaltic concrete was observed within BH 1 to BH 4. Fill consisting of brown silty sand with varying amounts of gravel was seen within each test hole.

The fill layer was observed to start at either ground surface, or below the topsoil/asphalt layer, and would extend to depths ranging from 0.3 to 1.8 m below ground surface. Varying amounts of clay were observed in the fill layer of TP 2-24, beginning at a depth of approximately 0.3 m below ground surface. Cobbles were observed within the fill layer of BH 1.

A compact brown silty sand deposit was encountered within BH 2 through BH 4 at depths ranging between 0.3 to 3.0 m. A brown sandy silt deposit was observed within TP 1-24 and TP 2-24 at depths ranging between 0.5 to 1.7 m. A thin silty clay deposit was observed within TP 2-24 between a depth of 0.7 and 1.2 m. The above-noted layers were underlain by a deposit of brown to grey compact to dense glacial till. The glacial till layer was observed to begin at depths ranging between 1.5 to 3.0 m and extends down to the bedrock surface.

Building Foundation Review – TP 3-24 (Ground Surface Elevation = 95.20 m)

A test pit (TP 3-24) was completed against the foundation wall at the west corner of the existing building and extended to a maximum depth of 1.9 m. Generally, the subsurface profile encountered at this test hole consisted of granular fill underlain by clayey fill, and further by native silty clay.

The fill layer consisted of brown silty sand with a variable amount of gravel and cobbles. Clay was encountered in the sandy fill layer within a depth of approximately 0.5 to 0.9 m. A layer of grey silty clay fill with sand was observed between 1.1 and 1.8 m, and was further underlain by a deposit of native, undisturbed, very stiff, brown silty clay.

The exposed foundation wall was noted to consist of bare cast-in-place concrete (i.e., no damp-proofing or waterproofing). The top of foundation wall was observed to be approximately 50 mm above the existing ground surface elevation. The foundation wall terminated upon a 150 mm thick spread footing at a depth of 1.65 m. The footing was observed to extended approximately 100 mm beyond the exterior face of the foundation wall. The USF terminated upon the native, undisturbed, very stiff, brown silty clay approximately 1.8 m below the existing ground surface (geodetic elevation of 93.40 m). A perimeter drainage pipe was not observed within the excavation at the time of our review.

All test holes appeared to be dry at the time of completion. Based on moisture levels from the recovered samples, groundwater may be encountered at a depth of 2 to 3 m below ground surface. However, due to seasonal fluctuations, groundwater level may differ at the time construction.

The subsurface conditions observed in the test holes are presented in detail in the Soil Profile and Data Sheets attached to the end of this report.

Bedrock

Practical refusal to augering was encountered at BH 1 through BH 4 at depths ranging between 3.3 and 4.4 m below ground surface. Based on available geological mapping, the bedrock in the area consists of dolomite of the Oxford Formation, with a drift thickness of 3 to 5 m.

2.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is expected that the proposed two-storey building addition will be of slab-on-grade construction and may be founded on conventional spread footings placed on an undisturbed, very stiff brown silty clay, compact silty sand or glacial till bearing surface. All contractors should be prepared to handle and remove boulders within excavations.

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

2.1 Site Grading and Preparation

Stripping Depth

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

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill 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 and under the full-time supervision of Paterson field personnel in dry and above-freezing conditions. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

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.

2.2 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, very stiff brown silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**.

Footings placed on an undisturbed, compact silty sand or glacial till bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. Provisions should be carried for reinstating localized portions of sub-excavations requiring the removal of cobbles and boulders exceeding the depth of the foundation where footings are founded within the glacial till deposit.

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

As a general procedure, it is recommended that footings located adjacent to the existing structure, be founded at the same level as the existing footings. This accomplishes three objectives. First, the behavior of the two structures at their connection will be similar due to the similar bearing medium. Second, there will be minimal stress added to the existing structure from the new structure. Third, the bearing of the new structure will likely not be influenced by any backfill material associated with the existing structure.

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 soil bearing medium when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as that of the bearing medium.

2.3 Design for Earthquakes

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

2.4 Slab-on-Grade Construction

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

It is recommended to proof-roll (i.e., re-compact) the subgrade surface using a suitably-sized smooth drum roller, under the supervision of Paterson personnel, prior to placing fill in support of the proposed slab on grade. Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab (outside the zone of influence of the footings).

Consideration may also be given to re-using site-generated sandy fill for re-use for raising the subgrade throughout the building footprint, however, these efforts would need to be undertaken in the dry and in above-freezing conditions under the supervision and approval of Paterson personnel. Gradation and proctor testing would be recommended to be completed on the retained fill if this is considered at the time of construction. OPSS Granular A and OPSS Granular B Type II crushed stone fill is otherwise appropriate for this purpose.

It is recommended that the upper 200 mm of sub-slab fill consist of OPSS Granular A crushed stone compacted to a minimum of 98% of the materials SPMDD. All backfill material within the footprint of the building footprint should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

2.5 Pavement Design

Car only parking areas, driveways and access lanes are anticipated at this site. The proposed pavement structures are shown in Tables 1 and 2.

Table 1 - Recommended Pavement Structure - Car Only Parking Areas

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

Table 2 - Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas

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

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type 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.

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 vibratory equipment. All subgrade surfaces should be proof rolled with a suitably sized vibratory sheepsfoot roller prior to the placement of the subbase stone layer. If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be sub-excavated and replaced with OPSS Granular A or Granular B Type II Material.

Existing base and subbase stone may be considered for re-use for building up subgrade and as the sub-base layers provided the fill is not contaminated with high amounts of fine soil particles (i.e., clays and silts) and generally consists of well-graded crushed stone. The potential re-use material should be reviewed and tested by Paterson field personnel at the time of exposing the material to assess the suitability for re-use and overall quality of the material, since it was not encountered at the time of this investigation.

Pavement Joint Tie-In

Where the proposed pavement structure meets the existing asphalt surface, the following recommendations should be followed:

- A 300 mm wide section of existing asphalt roadways should be saw cut from the existing pavement edge to provide a sound surface to abut the proposed pavement structure.
- It is recommended to mill a 300 mm wide and 50 mm deep section of the existing asphalt at the saw cut edge.

- The proposed pavement structure subbase materials should be tapered no greater than 3H:1V to meet the existing subbase materials.
- Clean existing granular road subbase materials can be reused upon assessment by Paterson personnel at the time of excavation (construction) as to its suitability.
- All compaction efforts should be reviewed and approved by Paterson at the time of construction.

2.6 Foundation Backfill and Drainage

Backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials or site-generated clean sand. The clean sand is considered non-frost susceptible provided it is not mixed with clay soils that may be generated by the building excavation. Provided the sand fill is segregated from the excavation for re-use as backfill against the building footprint, or engineered fill such as OPSS Granular A or OPSS Granular B Type I or II is considered for this purpose, a perimeter foundation drainage system is not considered required from a geotechnical perspective.

If it is anticipated the fill would consist of potentially frost-susceptible site-generated non-sandy soils, it would be recommended to implement a foundation drainage system. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe wrapped in a geosock and surrounded by 150 mm of 10 mm clear crushed stone. The clear stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

The perimeter drainage pipe may be placed up to 600 mm below proposed finished grade and against the building footprint upon site-generated compacted soil backfill to ensure adequate drainage of the overlying granular fill layer is provided from precipitation events and/or spring meltwater. The proposed drainage pipe would be recommended to connect to a nearby stormwater catch-basin.

2.7 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard. For footings founded directly on sound bedrock where insufficient soil cover is available, the suggested insulation can be omitted.

Exterior unheated footings, such as those for isolated exterior piers are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

2.8 Excavation Side Slopes

The side slopes of 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 assumed that sufficient room will be available in selected areas of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back 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.

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

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

2.9 Groundwater Control

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

2.10 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur. In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means.

In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings/pile caps/grade beams are protected with sufficient soil cover to prevent freezing at founding level. Trench excavations and pavement construction are difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be considered if such activities are to be completed during freezing conditions. Additional information could be provided, if required.

2.11 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 slightly aggressive corrosive environment.

2.12 Landscaping and Tree Planting Considerations

Based on Paterson’s review of the proposed building footprint, a portion of the northern half of the building addition bound between TP 2-24 and TP 3-24 may be founded upon clay subsoils. The remainder of the proposed building addition footprint is anticipated to be founded upon non-clay subsoils (i.e., silty sand and/or glacial till).

Due to lack of testing, it is recommended to assume the in-situ clay subsoils consist of a high plasticity clay soil (corresponding to high potential for soil volume change in accordance with the City of Ottawa’s Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines). Based on this assumption, the following tree planting setbacks are recommended for the northern portion of the building addition bound between TP 2-24 and TP 3-24 where native, undisturbed, in-situ very stiff silty clay is anticipated to be encountered at the design founding elevation and as encountered below the existing buildings footings at TP 3-24. It should be noted that these recommendations are not considered applicable to the remainder of the structure founded upon non-cohesive subsoils (i.e., silty sand and/or glacial till) and that there are no applicable landscaping or tree planting setback restrictions for the remainder of the structure.

- Large trees (mature height over 14 m) can be planted within this area provided a tree to foundation setback equal to the full mature height of the tree can be provided.
- Tree planting setback limits is 7.5 m for small (mature tree height up to 7.5 m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the following conditions are met:
    - The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the center of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.
    - A small tree must be provided with a minimum of 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 uncompacted when backfilling in street tree planting locations.
    - The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.
    - The foundation walls fronting the tree are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).
    - Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the subdivision Grading Plan.

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

3.0 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 and structural plan(s) from a geotechnical perspective.

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

- 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 by Paterson field personnel.

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

4.0 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 hole 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 the purposes other than those described herein or by person(s) other than the Ottawa Catholic School Board or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

N Versolato

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

LICENSED PROFESSIONAL ENGINEER
February 19, 2025
D. J. PETAHTEGOOSE
100568013
PROVINCE OF ONTARIO

Drew Petahtegoose, P.Eng.

Attachments

- ☐ Soil Profile and Test Data Sheets
- ☐ Symbols and Terms
- ☐ Analytical Testing Results
- ☐ Figure 1 - Key Plan
- ☐ Drawing PG7265-1 - Test Hole Location Plan

Report Distribution

- ☐ Ottawa Catholic School Board (e-mail copy)
- ☐ Paterson Group (1 copy)

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

79 Maitland Street South, Richmond, Ontario

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 356889.46 **NORTHING:** 5005226.85 **ELEVATION:** 94.78

PROJECT: Proposed Addition to St. Philip Catholic Elementary School

BORINGS BY: Back Hoe

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7265

HOLE NO. : TP 1-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 △ REMOULDED SHEAR STRENGTH, Cur (kPa) ▲ PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0							
TOPSOIL 0.20m [94.58m]									
FILL: Gravel 0.50m [94.28m]									94
Compact, brown **SILTY SAND**, trace clay		1	G 1 G 2 G 3						
1.65m [93.13m]									93
GLACIAL TILL: Dense, brown silty sand, with gravel, cobbles and boulders		2	G 4						
- Sand content increasing with depth			G 5						92
- with clay below 2.90 m depth 3.00m [91.78m]		3	G 6						
End of Test Pit		4							91
		5							90

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

79 Maitland Street South, Richmond, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 356927.78 **NORTHING:** 5005240.12 **ELEVATION:** 95.02

PROJECT: Proposed Addition to St. Philip Catholic Elementary School

FILE NO. : PG7265

BORINGS BY: Back Hoe

HOLE NO. : TP 2-24

REMARKS:

DATE: September 12, 2024

SAMPLE DESCRIPTION

GROUND SURFACE

FILL: Crushed stone 0.10m [94.92m]

FILL: Compact, brown silty sand, with gravel 0.25m [94.77m]

FILL: Loose, brown silty sand, trace gravel 0.30m [94.72m]

FILL: Compact, brown sandy silt, trace clay and gravel 0.65m [94.37m]

Very stiff, brown **SILTY CLAY**, trace sand 1.20m [93.82m]

Compact, brown **SANDY SILT** 1.60m [93.42m]

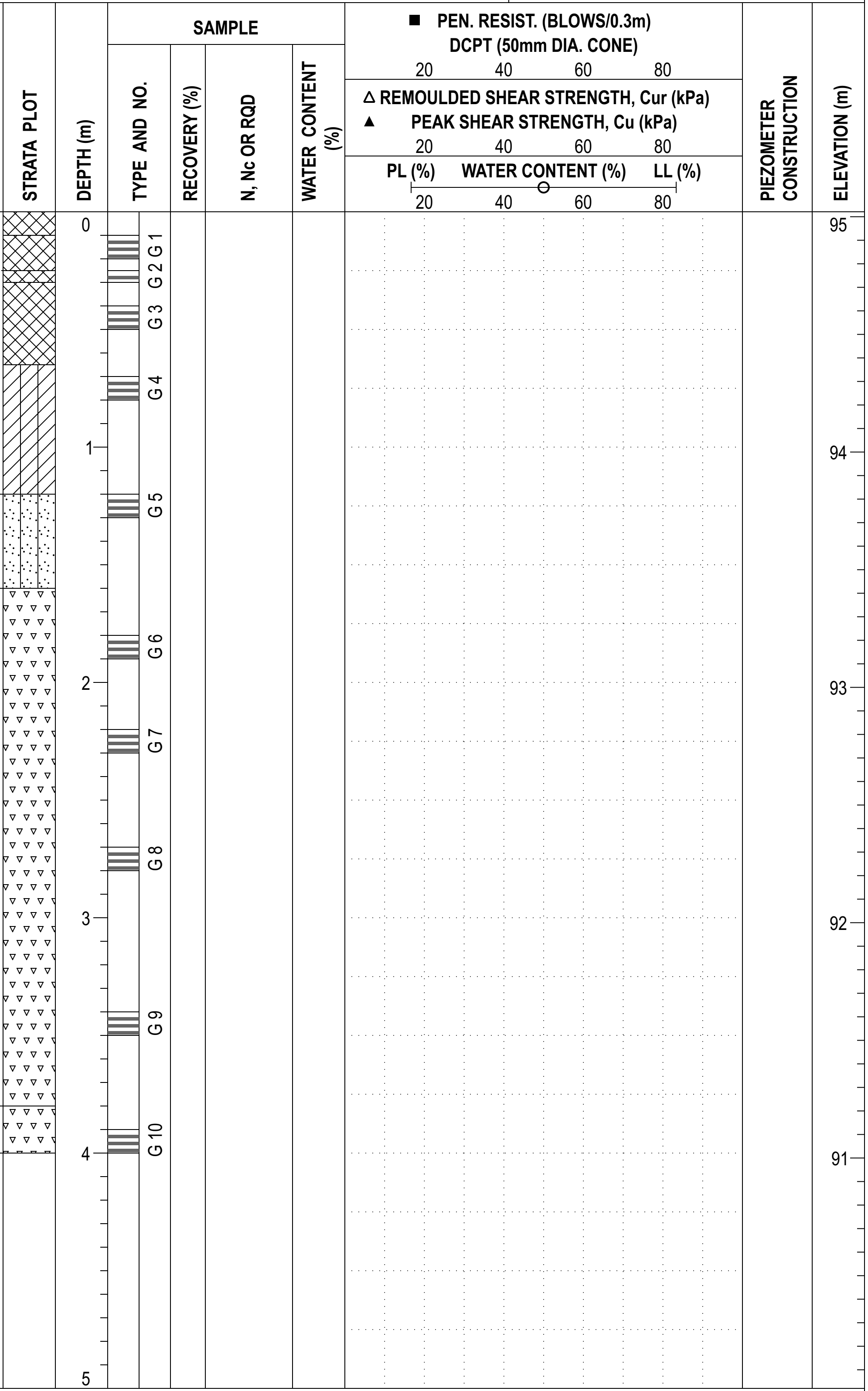
GLACIAL TILL: Compact to dense, brown silty sand, with gravel, cobbles and boulders

- Dense by 2.10 m depth
- Boulder content increasing with depth
- Trace clay by 2.7 m depth
- Clay content increasing with depth

3.80m [91.22m]

GLACIAL TILL: Dense, grey sandy silt, with gravel, cobbles, boulders and clay 4.00m [91.02m]

End of Test Pit



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SOIL PROFILE AND TEST DATA
Geotechnical Investigation
79 Maitland Street South, Richmond, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 356939.59 **NORTHING:** 5005262.28 **ELEVATION:** 95.20

PROJECT: Proposed Addition to St. Philip Catholic Elementary School

BORINGS BY: Back Hoe

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7265

HOLE NO. : TP 3-24

SAMPLE DESCRIPTION

GROUND SURFACE

FILL: Compact, brown silty sand, with gravel and crushed stone 0.20m [95.00m]

FILL: Loose, brown silty sand, trace gravel 0.50m [94.70m]

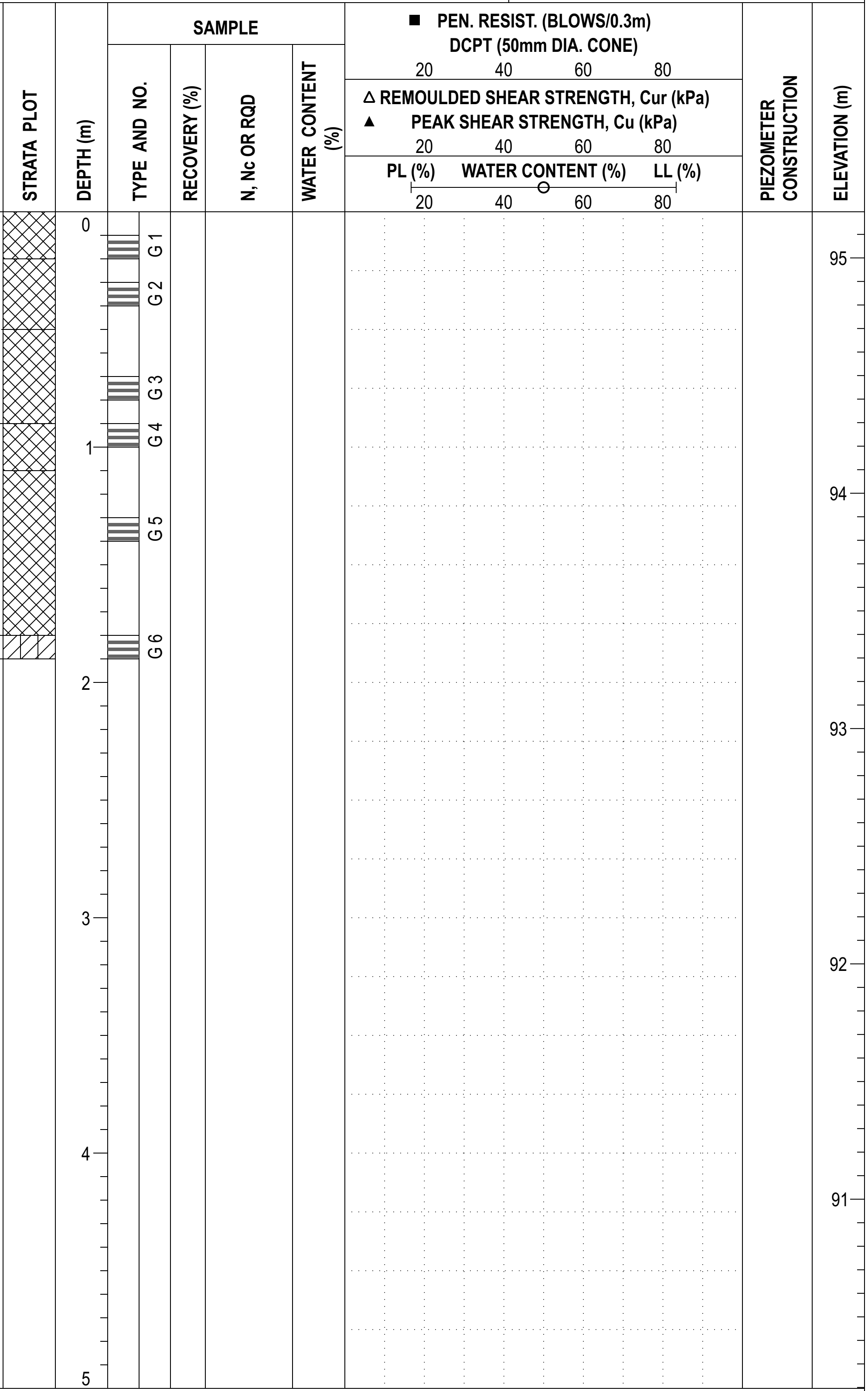
FILL: Compact, brown silty sand to sandy silt, trace clay, gravel and cobbles 0.90m [94.30m]

FILL: Compact, grey silty sand, with clay, trace gravel and cobbles 1.10m [94.10m]

FILL: Firm, grey silty clay, with sand, trace organics 1.80m [93.40m]

Very stiff, brown **SILTY CLAY** 1.90m [93.30m]

End of Test Pit



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patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed School Addition - St. Philip School
79 Maitland Street (Richmond), Ottawa, Ontario

DATUM TBM - Finished floor level of existing school. Assumed geodetic elevation = 95.37m as per plan provided by Stantec Geomatics Ltd.

REMARKS

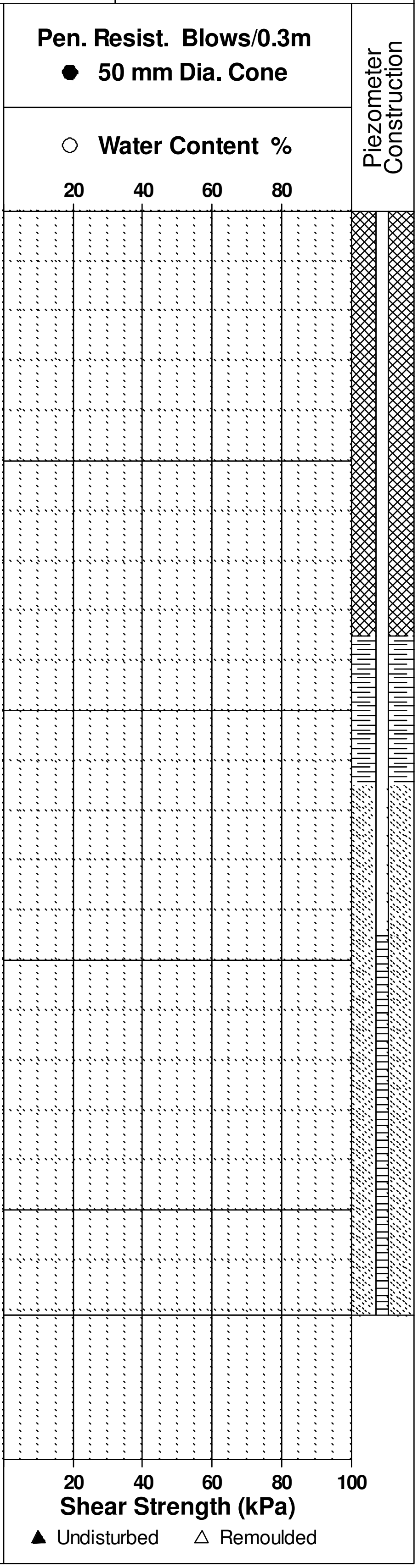
BORINGS BY CME 55 Power Auger

DATE December 3, 2012

FILE NO. PG2851

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.33
25mm Asphaltic concrete **FILL:** Brown silty sand with gravel and cobbles		SS	1	25	4	1	94.33
1.45							
Loose to dense, brown **SANDY SILT**		SS	2	67	9	2	93.33
		SS	3	58	32		
2.97						3	92.33
GLACIAL TILL: Compact silty sand with gravel, cobbles, boulders, trace clay		SS	4	42	16		
		SS	5	40	12	4	91.33
4.42							
End of Borehole Practical refusal to augering at 4.42m depth							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed School Addition - St. Philip School
79 Maitland Street (Richmond), Ottawa, Ontario

DATUM TBM - Finished floor level of existing school. Assumed geodetic elevation = 95.37m as per plan provided by Stantec Geomatics Ltd.

REMARKS

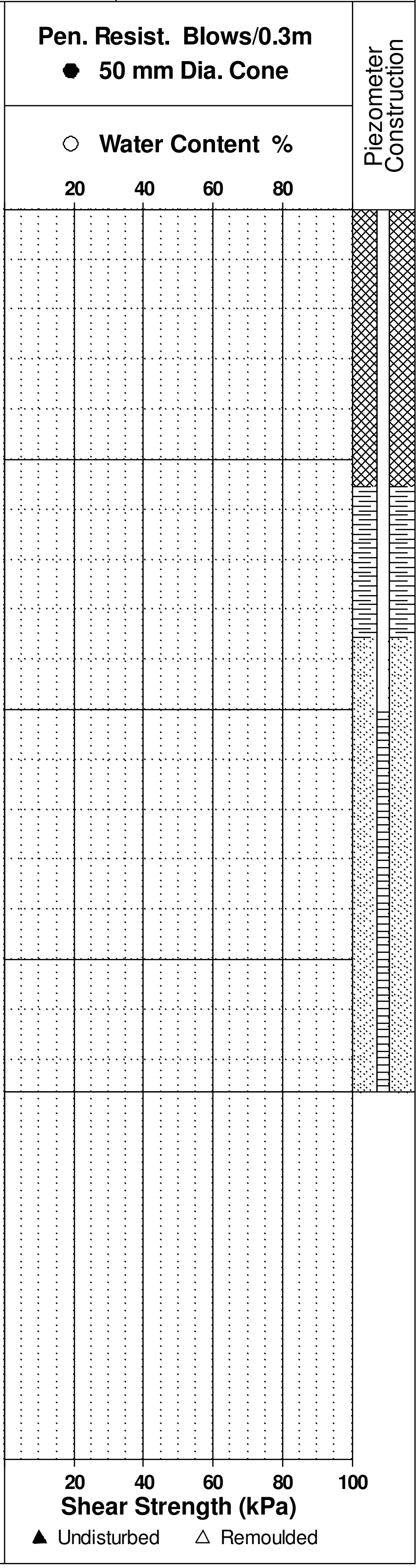
BORINGS BY CME 55 Power Auger

DATE December 3, 2012

FILE NO. PG2851

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.17
Asphaltic concrete 0.05							
FILL: Crushed stone 0.25							
Compact, brown **SILTY SAND**		SS	1	33	20	1	94.17
1.45							
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders		SS	2	42	35		
						2	93.17
		SS	3	42	14		
						3	92.17
		SS	4	40	50+		
3.53							
End of Borehole Practical refusal to augering at 3.53m depth							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed School Addition - St. Philip School
79 Maitland Street (Richmond), Ottawa, Ontario

DATUM TBM - Finished floor level of existing school. Assumed geodetic elevation = 95.37m as per plan provided by Stantec Geomatics Ltd.

REMARKS

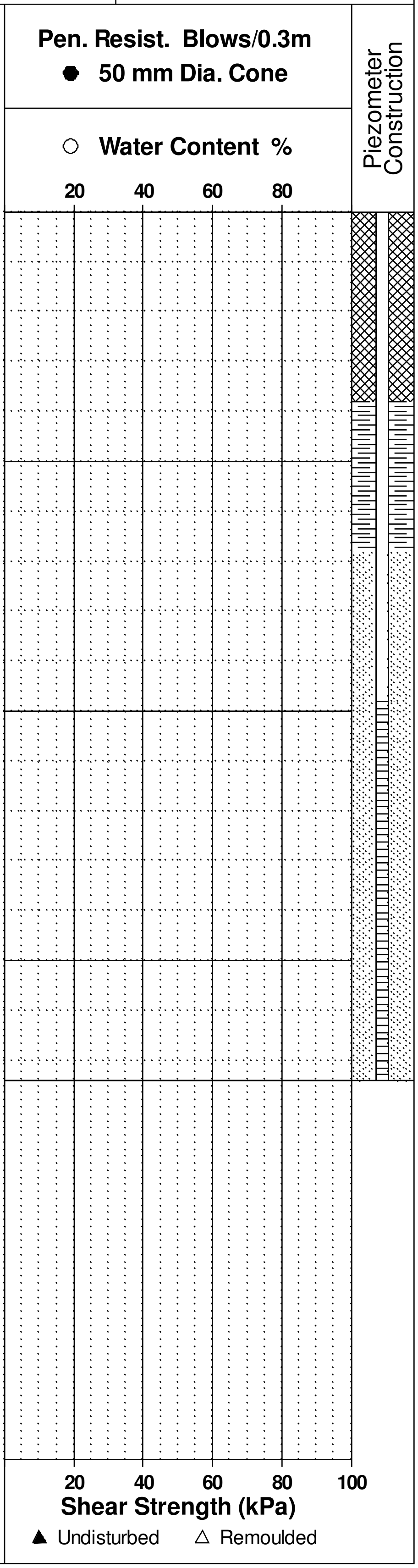
BORINGS BY CME 55 Power Auger

DATE December 3, 2012

FILE NO. PG2851

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.13
50mm Asphaltic concrete over brown silty sand with gravel 0.30							
Compact, brown **SILTY SAND**						1	94.13
		SS	1	33	18		
1.45							
GLACIAL TILL: Compact to dense silty sand with gravel, cobbles, boulders		SS	2	42	18		
						2	93.13
		SS	3	25	19		
						3	92.13
		SS	4	59	50+		
3.48							
End of Borehole Practical refusal to augering at 3.48m depth							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed School Addition - St. Philip School
79 Maitland Street (Richmond), Ottawa, Ontario

DATUM TBM - Finished floor level of existing school. Assumed geodetic elevation = 95.37m as per plan provided by Stantec Geomatics Ltd.

REMARKS

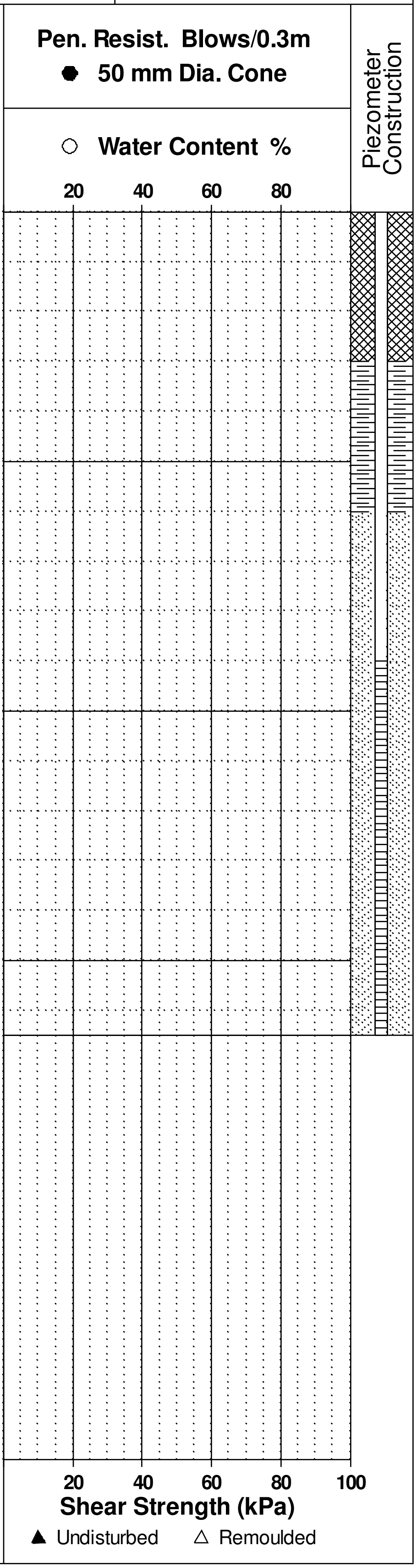
BORINGS BY CME 55 Power Auger

DATE December 3, 2012

FILE NO. PG2851

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						0	95.03
50mm Asphaltic concrete over brown silty sand with gravel — 0.36							
		SS	1	42	29	1	94.03
Compact, brown **SILTY SAND**		SS	2	33	21		
						2	93.03
— 2.97		SS	3	58	23		
GLACIAL TILL: Dense silty sand with gravel, cobbles, boulders — 3.30		SS	4	100	50+	3	92.03
End of Borehole Practical refusal to augering at 3.30m depth							



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

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

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

CONSOLIDATION TEST

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

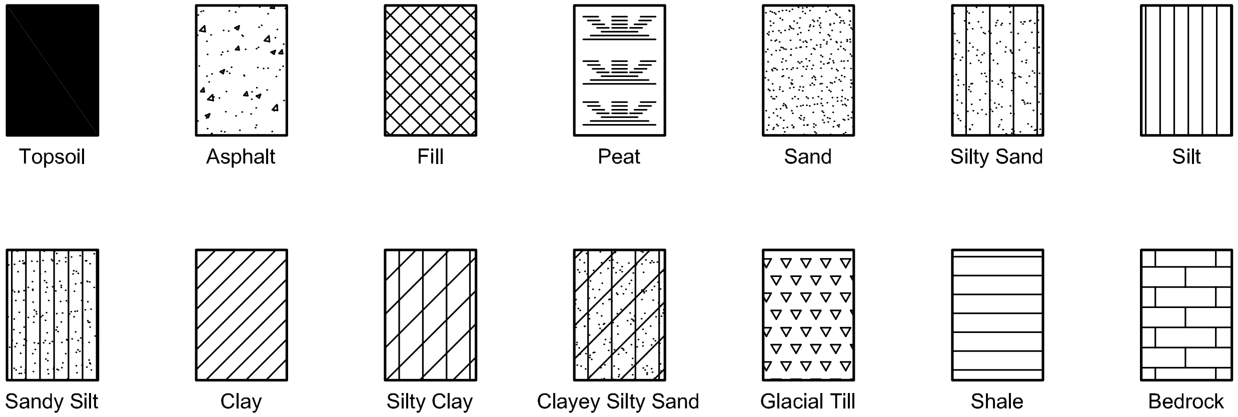
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

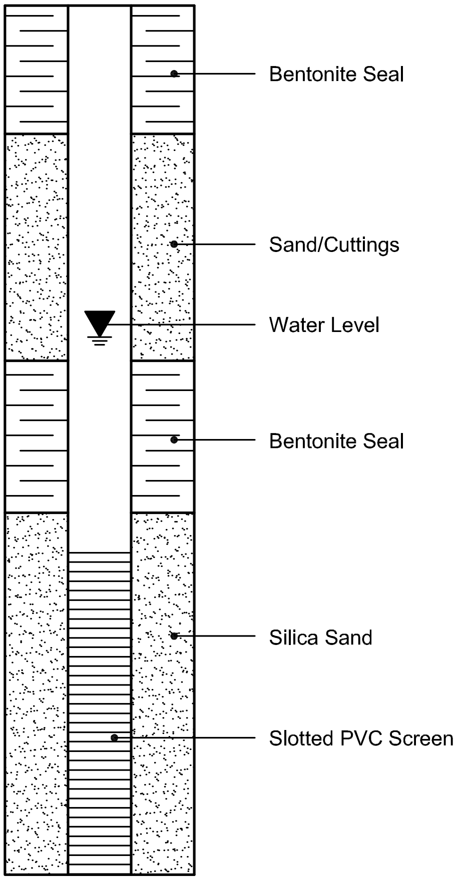
SYMBOLS AND TERMS (continued)

STRATA PLOT

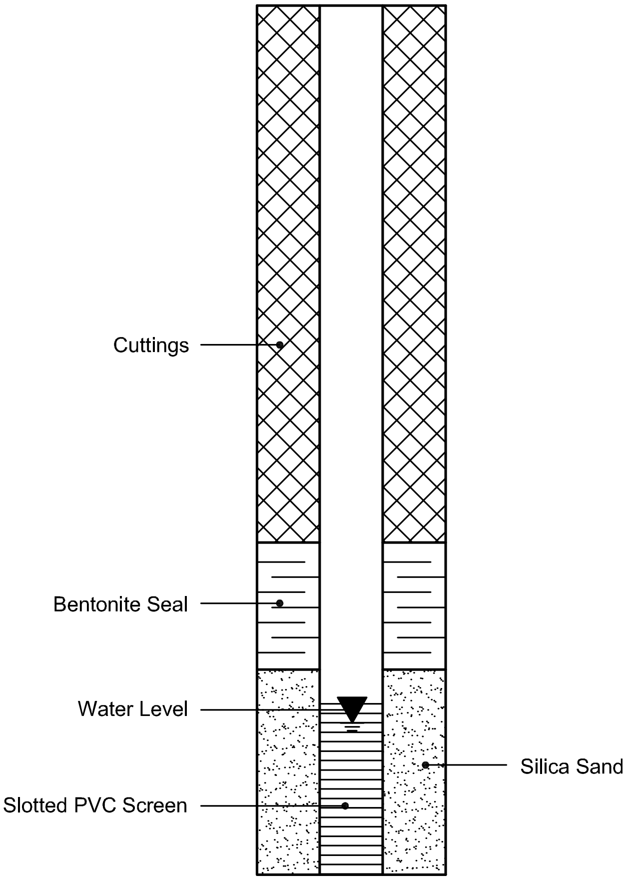


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Report Date: 19-Sep-2024

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

Order Date: 13-Sep-2024

Client PO: 61266

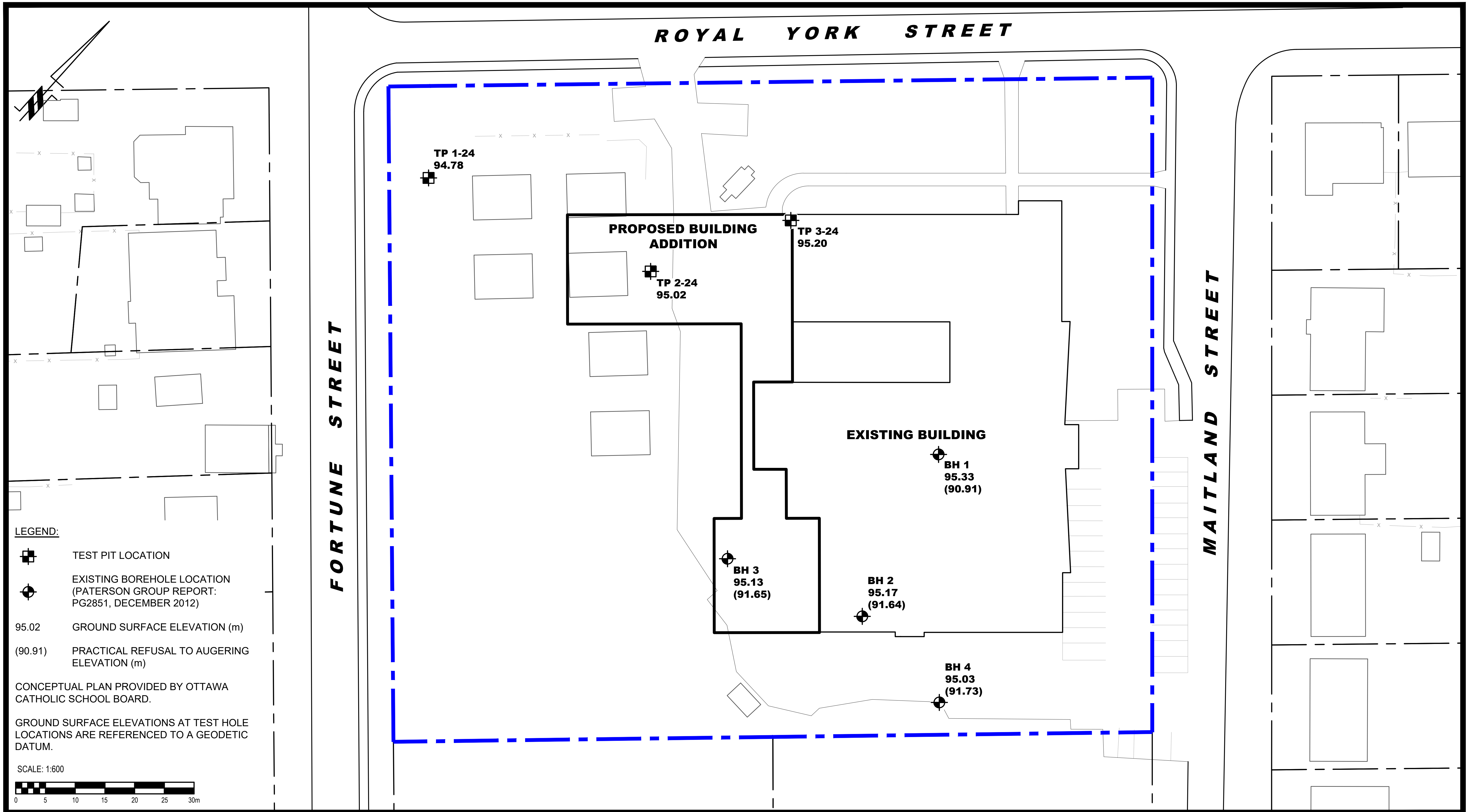
Project Description: PG7265

	Client ID:	TP 2-24 G6	-	-	-		
	Sample Date:	12-Sep-24 09:00	-	-	-	-	-
	Sample ID:	2438025-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	88.9	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.09	-	-	-	-	-
Resistivity	0.1 Ohm.m	68.8	-	-	-	-	-
Anions							
Chloride	10 ug/g	36	-	-	-	-	-
Sulphate	10 ug/g	23	-	-	-	-	-

FIGURE 1

KEY PLAN

PATERSON
GROUP



LEGEND:

⊞	TEST PIT LOCATION
⊕	EXISTING BOREHOLE LOCATION (PATERSON GROUP REPORT: PG2851, DECEMBER 2012)
95.02	GROUND SURFACE ELEVATION (m)
(90.91)	PRACTICAL REFUSAL TO AUGERING ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY OTTAWA CATHOLIC SCHOOL BOARD.

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

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

NO.	REVISIONS	DATE	INITIAL

OTTAWA CATHOLIC SCHOOL BOARD
GEOTECHNICAL INVESTIGATION
PROPOSED ADDITION TO ST. PHILIP CATHOLIC ELEMENTARY SCHOOL
79 MAITLAND STREET SOUTH
RICHMOND, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale:	1:600
Date:	09/2024
Drawn by:	ZS
Report No.:	PG7265-1
Checked by:	NFRV
Dwg. No.:	PG7265-1
Approved by:	DP
Revision No.:	

11x17

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