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Geotechnical Engineering

Environmental Engineering

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Materials Testing

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Noise and Vibration Studies

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Road and Decoeur Drive
Ottawa, Ontario

Prepared For

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Report: PG5914-1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Mattamy Homes to conduct a geotechnical investigation for the proposed mixed-use development site (subject site) to be located on Tenth Line Road and Decoeur Drive in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

- Determine the subsoil and groundwater conditions at this site by means of test holes.
- Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

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

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

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of five three-storey mixed-use buildings and several blocks of back-to-back three-story stacked town homes, with slab-on-grade, crawl spaces or full basements. It is also anticipated that one level of underground parking will be located below each of the proposed mixed-use buildings.

Associated roadways, walkways, at-grade parking areas and landscaped areas are also anticipated as part of the development. It is expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on August 5, 2021 and consisted of advancing a total of four (4) test holes to a maximum depth of 6.6 m below existing ground surface. A previous geotechnical investigation was completed by this firm within the subject site on September 28, 2005 which included one (1) borehole advanced to a maximum depth 20 m below existing grade. The test hole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and site features. The test hole locations are shown on Drawing PG5914-1 - Test Hole Location Plan included in Appendix 2.

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

Sampling and In Situ Testing

The soil samples were recovered from the auger flights and using a 50 mm diameter split-spoon sampler or 73 mm diameter thin walled Shelby tubes in combination with a piston sampler. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. The Shelby tubes were sealed at both ends. All samples were transported to our laboratory. The depths at which the auger and split-spoon, and Shelby tube samples were recovered from the boreholes are shown as AU, SS, ant TW, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

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

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at borehole BH 5 (2005). 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.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

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

All boreholes were fitted with flexible standpipe piezometers to allow for groundwater level monitoring. Groundwater level observations are discussed in Section 4.3 and are presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

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

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 ground surface elevation at each test hole location were surveyed by Paterson using a handheld GPS and referenced to a geodetic datum. The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG5914-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of 1 shrinkage test, 1 grain size distribution analysis, and 4 Atterberg limit tests were completed on selected soil samples.

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, one of which was collected from borehole BH 2-21. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site consists of an agricultural land. The existing ground surface across the subject site is relatively at grade with adjacent properties and roadways at approximate geodetic elevation of 87.5 to 88.5 m. A patch of trees was noted within central south portion of the site, while the remainder of the site was covered with grass and vegetation. A 0.5m high pile of fill was observed to cover a large area within the south portion of the site.

The site is bordered by Brian Coburn Boulevard to the north, Tenth Line Road to the east, Decoeur Drive to the south, and a school and residential dwellings to the west.

4.2 Subsurface Profile

Generally, the soil profile at the test hole locations consists of topsoil and/or fill underlain by a deep deposit of silty clay. The fill was encountered at the location of BH 1-21. The fill layer extended down to approximately 0.9 m depth below ground surface and it was observed to consist of organics and silty clay. The silty clay was encountered beneath the topsoil and/or fill at all test hole locations. The silty clay deposit consisted of a weathered silty clay crust followed by firm grey silty clay.

The upper portion of the silty clay has been weathered to a brown desiccated crust at all test hole locations. In situ shear vane field tests carried out within the silty clay crust yielded peak undisturbed shear strength values in excess of 100 kPa. These values reflect a stiff to very stiff consistency in the silty clay crust. Grey silty clay was encountered below the brown silty clay crust in all boreholes. In situ shear vane field testing conducted within the grey silty clay layer yielded undisturbed shear strength values generally ranging from 24 to 45 kPa. These values are indicative of a firm consistency. The natural moisture of grey silty clay materials, as measured in the consolidation test samples ranged from 27 to 87 percent.

Practical refusal to DCPT was encountered at borehole BH 5 (2005) at a depth of 20 m below the existing ground surface.

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

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of interbedded limestone and shale of the Lindsay formation, with an overburden drift thickness of 25 to 50 m depth.

Grain Size Distribution and Hydrometer Testing

One sieve analysis was completed to classify selected soil samples according to the Unified Soil Classification System (USCS). The results are summarized in Table 1 and presented in Appendix 1.

Table 1 – Summary of Grain Size Distribution Analysis

Borehole	Sample	Gravel (%)	Sand (%)	Silt and Clay (%)
BH 1-21	SS 3	0	0.5	99.5

Atterberg Limit Tests

Four selected silty clay samples were submitted for Atterberg limits testing. The results are summarized in Table 2 and presented in Appendix 1.

Table 2 – Atterberg Limits Results

Borehole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)
BH 1-21	SS2	1.16	61	26	35
BH 2-21	SS2	0.76	62	25	37
BH 3-21	SS3	1.52	60	24	36
BH 4-21	SS3	1.52	60	23	37

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

Shrinkage Test

The results of the shrinkage limit test indicate a shrinkage limit of 7.59 and a shrinkage ratio of 1.82.

4.3 Groundwater

Groundwater levels were measured over the current investigation on August 11, 2021, within the installed standpipes. The measured groundwater levels are presented in Table 3 below.

Table 3 – Summary of Groundwater Levels

Test Hole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Dated Recorded
		Depth (m)	Elevation (m)	
Current Investigation				
BH 1-21	88.49	3.25	85.24	August 11, 2021
BH 2-21	88.21	3.55	84.66	
BH 3-21	87.98	3.26	84.72	
BH 4-21	87.53	3.53	84.00	

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

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Long-term groundwater levels can be estimated based on the observed color and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximate depths of 2 to 3 m below ground surface. The recorded groundwater levels are noted on the Soil Profile and Test Data sheet presented in Appendix 1.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. The proposed buildings can be founded using conventional style shallow foundations placed on an undisturbed, very stiff to stiff brown silty clay, firm grey silty clay or engineered fill placed over one of the above noted bearing surfaces

Due to the presence of the sensitive silty clay layer, the proposed development will be subjected to grade raise restrictions. If a higher permissible grade raise is required, preloading with or without surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction and differential settlements.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing significant organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the 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 these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of SPMDD.

If excavated brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, it is recommended that the material be placed under dry conditions and above freezing temperatures. The silty clay should be compacted in thin lifts to at least 95% of the material's SPMDD.

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

Excess Soils

Excess soils generated by construction activities that will be transported off-site should be handled as per *Ontario Regulation 406/19: On-Site Excess Soil Management*.

5.3 Foundation Design

Bearing Resistance Values (Conventional Shallow Foundation)

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, founded on an undisturbed, very stiff to stiff brown silty clay 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 **250 kPa** incorporating a geotechnical factor of 0.5.

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, founded on an undisturbed, firm grey silty clay can be designed using a bearing resistance value at SLS of **70 kPa** and a factored bearing resistance value at ULS of **150 kPa** incorporating a geotechnical factor of 0.5.

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

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

Lateral Support

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

Permissible Grade Raise

Based on the undrained shear strength values of the silty clay deposit, encountered throughout the subject, a permissible grade raise restriction of **1.0 m** is recommended for the subject site. If greater permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements. Provided sufficient time is available to induce the required settlements, consideration could be given to surcharging the subject site.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E** for foundations bearing over the deep silty clay deposit identified throughout the subject site. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab / Slab-on-grade Construction

With the removal of all topsoil and deleterious fill within the footprint of the proposed building, the very stiff to stiff brown silty clay and firm grey silty clay will be considered an acceptable subgrade upon which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with OPSS Granular B Type II, with a maximum particle size of 50 mm and compacted to 98% of the material’s SPMDD.

Where existing fill, free of deleterious material and significant organic content, is encountered below the floor slab, provisions should be made to removing the existing fill from within the building footprint and replacing the fill with OPSS Granular A or Granular B Type II compacted to a minimum 98% of the material’s SPMDD. It is also acceptable to use workable, site excavated brown silty clay material, free of deleterious materials and organics, below the floor slab and outside the lateral support zone of the proposed footings provided the material is reviewed and approved by Paterson prior to placement.

If the silty clay is to be used as backfill material, it is critical that the material be placed under dry conditions and above freezing temperatures and be compacted using a sheepsfoot roller making several passes under the full supervision of Paterson field personnel.

It is recommended that the upper 200 mm of sub-floor fill consists of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings (but outside the zones of influence of the footings) should be placed in maximum 300 mm thick loose layers and compacted to at least 95% of its SPMDD. Within the zones of influence of the footings, the backfill material should be compacted to a minimum of 98% of its SPMDD.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3.

The applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight. However, if a full drainage system is being implemented and approved by Paterson at the time of construction, hydrostatic pressure can be omitted in the structural design.

Two distinct conditions, static and seismic, should be reviewed for design calculations. The corresponding parameters are presented below.

Lateral Earth Pressures

The static horizontal earth pressure (po) can be calculated using a triangular earth pressure distribution equal to Ko·γ·H where:

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

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

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

Seismic Earth Pressures

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

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

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

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32 g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

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

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

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

5.7 Pavement Design

Car only parking areas, heavy truck parking areas and access lanes are anticipated at this site. The proposed pavement structures are presented in Tables 4 and 5.

Table 4 – Recommended Pavement Structure – Driveways and 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.	

Table 5 – Recommended Pavement Structure – Access Lanes and Local Residential Roadways

Thickness (mm)	Material Description
40	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Wear Course –** HL-8 or Superpave 19 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.	

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 98% of the material's SPMDD using suitable compaction equipment.

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.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terrafix 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

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.

Due to the impervious nature of the subgrade materials, consideration should be given to installing subdrains during the pavement construction. These drains should extend in four orthogonal directions or longitudinally when placed along a curb. The clear crushed stone surrounding the drainage lines or the pipe, should be wrapped with suitable filter cloth. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines. Discharge of the subdrains should be directed by gravity to storm sewers or deeper drainage ditches

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

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

Underfloor Drainage

Underfloor drainage may be required to control water infiltration below the basement area for the underground parking structure. For preliminary design purposes, it is recommended that 150 mm diameter perforated PVC pipes be placed at every bay opening. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

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.

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

6.2 Protection of Footings Against Frost Action

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

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

The footings located along parking garage entrance may require protection against frost action depending on the founding depth. Unheated structures, such as the access ramp wall footings, may be required to be insulated against the deleterious effect of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations). Where space restrictions exist, or to reduce the trench width, the excavation can be carried out within the confines of a fully braced steel trench box.

The excavations for the proposed development will be mostly through a very stiff to stiff silty clay. 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 a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

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

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

6.4 Pipe Bedding and Backfill

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

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

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

The backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

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

Permit to Take Water

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

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

6.6 Winter Construction

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

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (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 to very aggressive corrosive environment.

6.8 Landscaping Considerations

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Grain size distribution and hydrometer testing were also completed on selected soil sample at BH 2. The above noted soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Subsection 4.2 and in Appendix 1.

Based on the results of our review, the subject site is considered as a low/medium sensitivity area for tree planting according to the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines).

Since the modified plasticity limit (PI) does not exceed 40%, large trees (mature height over 14 m) can be planted at the subject site provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g., in a park or other green space).

According to the City of Ottawa Tree Planting Guidelines, tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the 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 m3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

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

- The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

In-Ground Swimming Pools

The in-situ soils are considered to be acceptable for the installation of in-ground swimming pools. The soil removed to accommodate an in-ground swimming pool weighs more than the water filled in-ground pool. Therefore, no additional load is being applied to the underlying sensitive clays.

Aboveground Swimming Pools, Hot Tubs, Decks and Additions

If consideration is given to construction of an above ground swimming pool, a hot tub or an exterior deck, a geotechnical consultant should be retained by the homeowner to review the site conditions. No additional grading should be placed around the exterior structure. The swimming pool should be located at least 3 m away from the existing foundation to avoid adding localized loading to the foundation and the hot tub should be located at least 2 m away from the existing foundation. Otherwise, construction is considered routine, and can be constructed in accordance with the manufacturer’s specifications.

7.0 Recommendations

It is recommended that the following be carried out once the master plan and detailed site plans are prepared for the subject site:

- Review of the grading plans from a geotechnical perspective
- 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.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

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

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 Mattamy Homes 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.

Sept. 7, 2021

LICENSED PROFESSIONAL ENGINEER
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Maha Saleh, M.A.Sc., PEng. (Prov.)

David J. Gilbert, P.Eng

Report Distribution:

❑ Mattamy Homes (1 copy)
❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN-SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

SHRINKAGE TESTING RESULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

FILE NO. PG5914

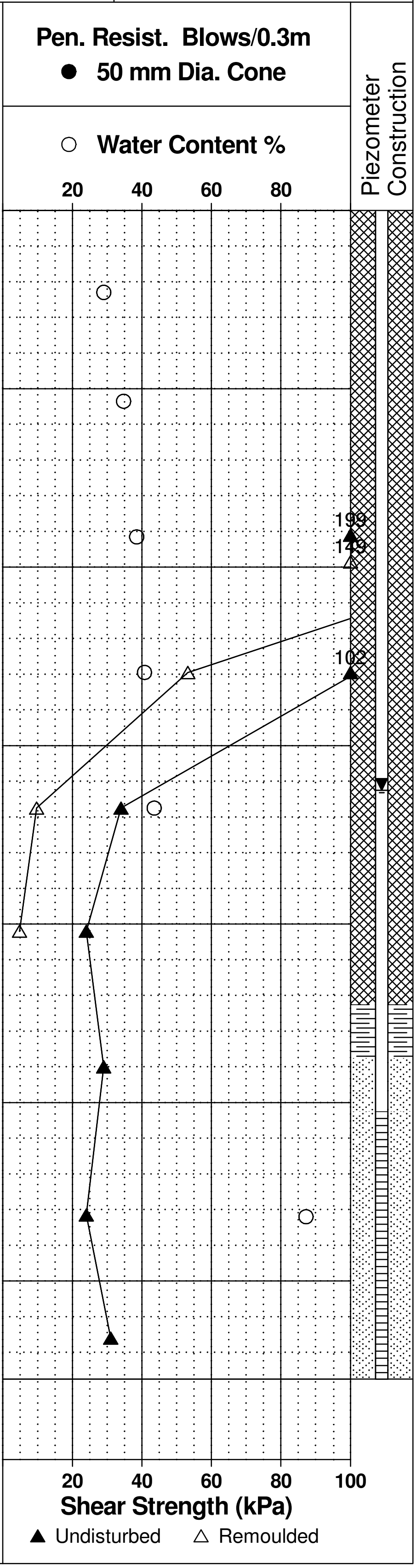
HOLE NO. BH 1-21

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Organics and silty clay	0.05				
FILL: Brown silty clay	0.97	AU	1		
TOPSOIL	1.17	SS	2	42	7
Very stiff to stiff, brown **SILTY CLAY** - firm and grey by 3.0m depth	6.55	SS	3	75	P
		SS	4	100	P
		SS	5	83	P
		TW	6	100	P
		SS	7	100	P

End of Borehole

(GWL @ 3.25m - August 11, 2021)

DEPTH (m)	ELEV. (m)
0	88.49
1	87.49
2	86.49
3	85.49
4	84.49
5	83.49
6	82.49



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5914

REMARKS

HOLE NO. BH 2-21

BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

SOIL DESCRIPTION

GROUND SURFACE

TOPSOIL 0.25

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

- firm and grey by 2.3m depth

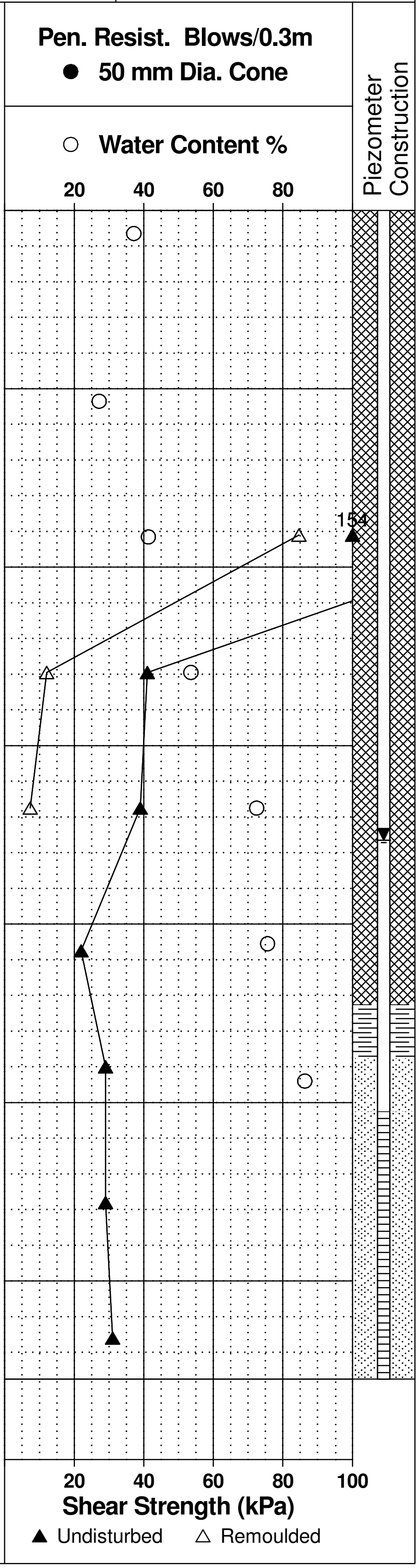
6.55

End of Borehole

(GWL @ 3.53m - August 11, 2021)

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	50	10
SS	3	67	P
SS	4	83	P
SS	5	100	P
TW	6	100	P
SS	7	100	P

DEPTH (m)	ELEV. (m)
0	88.21
1	87.21
2	86.21
3	85.21
4	84.21
5	83.21
6	82.21



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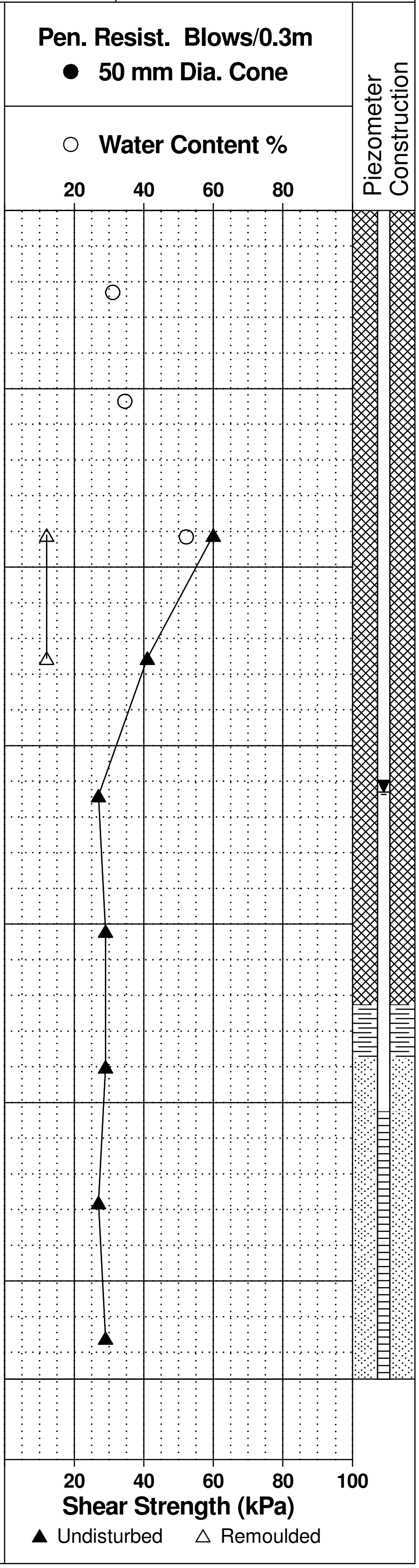
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY Track-Mount Power Auger
DATE August 5, 2021
FILE NO. PG5914
HOLE NO. BH 3-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.98
TOPSOIL 0.30						
	AU	1				
	SS	2	67	10	1	86.98
	SS	3	100	P		
Very stiff to stiff, brown **SILTY CLAY**					2	85.98
- firm and grey by 2.8m depth						
					3	84.98
	TW	4	83	P		
					4	83.98
					5	82.98
					6	81.98
6.55 End of Borehole						
(GWL @ 3.26m - August 11, 2021)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Mixed-Use Development
Tenth Line Rd. & Decoeur Drive, Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5914**

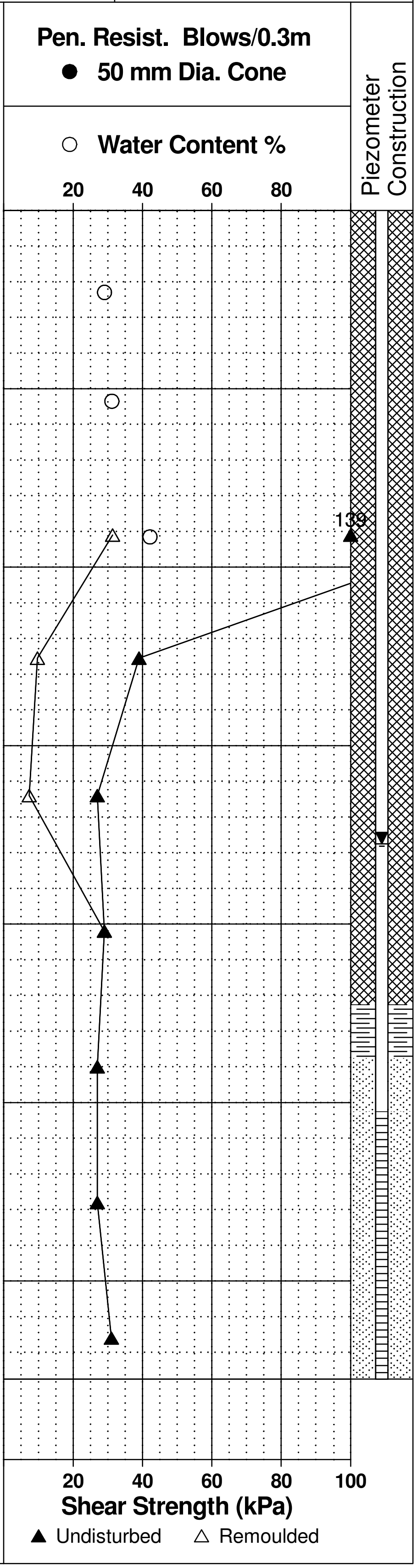
REMARKS

HOLE NO. **BH 4-21**

BORINGS BY Track-Mount Power Auger

DATE August 5, 2021

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.53
TOPSOIL 0.25						
	AU	1				
	SS	2	67	10	1	86.53
	SS	3	100	P	2	85.53
Very stiff to stiff, brown **SILTY CLAY** - firm and grey by 3.0m depth					3	84.53
	TW	4	17	P		
					4	83.53
					5	82.53
					6	81.53
6.55						
End of Borehole (GWL @ 3.55m - August 11, 2021)						



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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Development, Mer Bleue Rd. and 10th Line Rd.
Ottawa, Ontario

DATUM Approximate geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 28 Sep 05

FILE NO. PG0685

HOLE NO. BH 5

SOIL DESCRIPTION

GROUND SURFACE

TOPSOIL 0.18

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

- firm to soft and grey by 2.6m depth

- firm by 6.0m depth

- stiff to firm by 12.5m depth

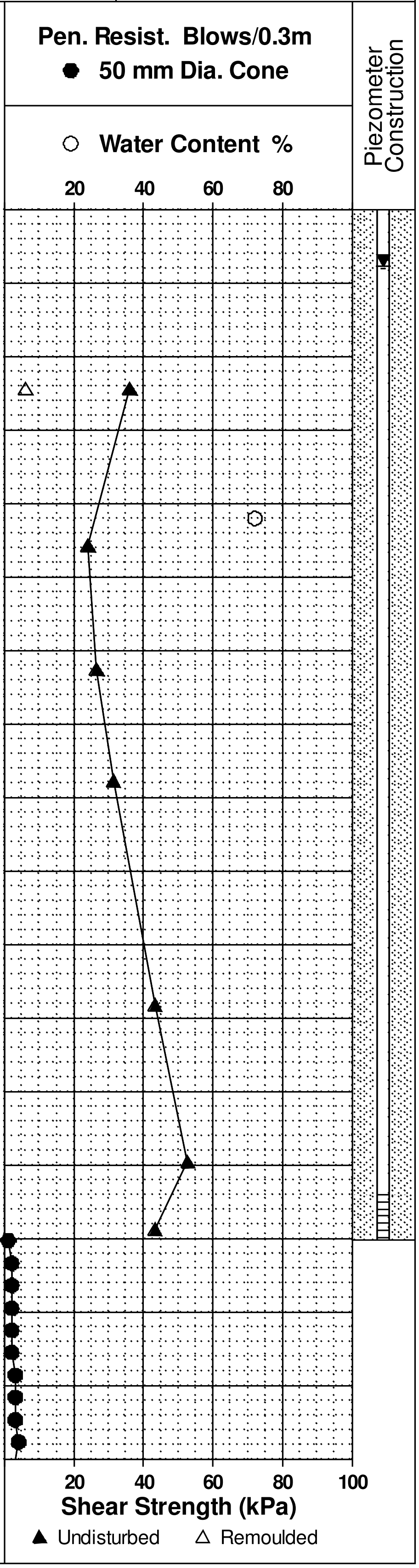
14.02

Dynamic Cone Penetration Test commenced @ 14.02m depth

SAMPLE

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
SS	1	75	17
SS	2	100	4
SS	3	100	1
TW	4	97	
SS	5	100	1
SS	6	100	1
SS	7	100	1
SS	8	100	1

DEPTH (m)	ELEV. (m)
0	87.75
1	86.75
2	85.75
3	84.75
4	83.75
5	82.75
6	81.75
7	80.75
8	79.75
9	78.75
10	77.75
11	76.75
12	75.75
13	74.75
14	73.75
15	72.75
16	71.75
17	70.75



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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Development, Mer Bleue Rd. and 10th Line Rd.
Ottawa, Ontario

DATUM Approximate geodetic

REMARKS

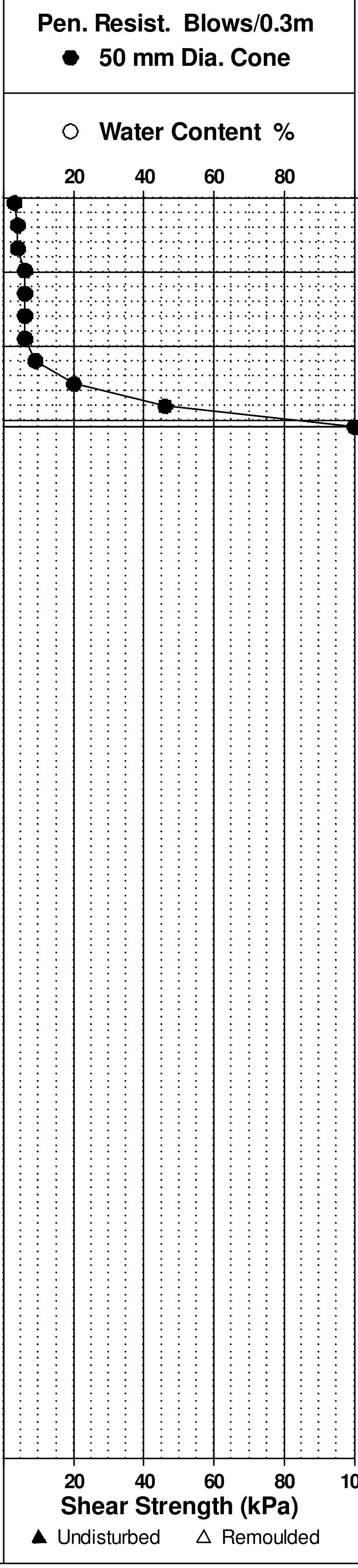
BORINGS BY CME 55 Power Auger

DATE 28 Sep 05

FILE NO. PG0685

HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD			
Inferred **SILTY CLAY**	▨					17	70.75	
	▨					18	69.75	
	▨					19	68.75	
20.09	▨					20	67.75	
End of Borehole DCPT refusal @ 20.09m depth (GWL @ 0.77m-Oct. 28/05)								



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

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

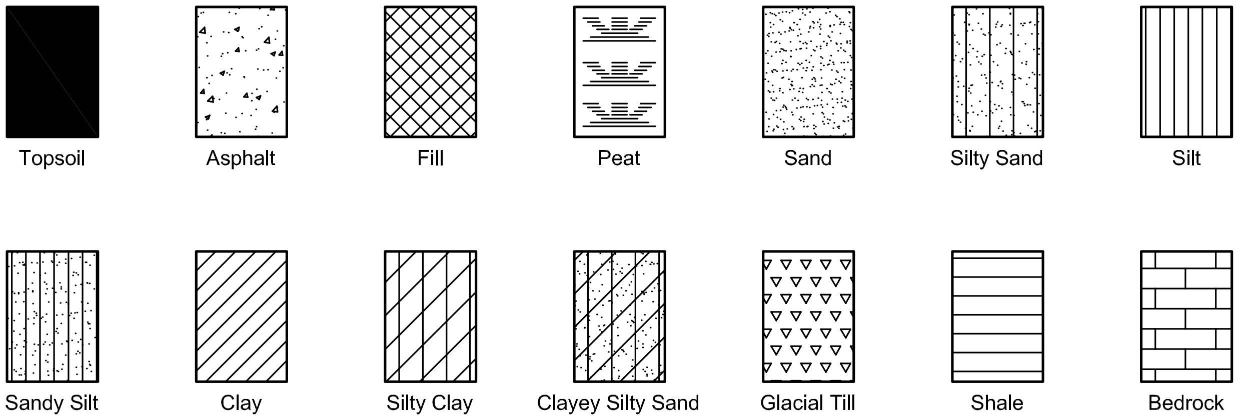
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

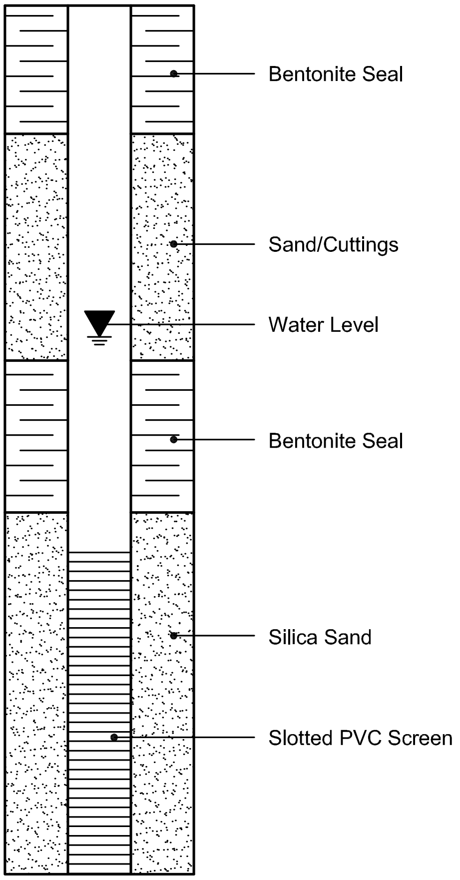
SYMBOLS AND TERMS (continued)

STRATA PLOT

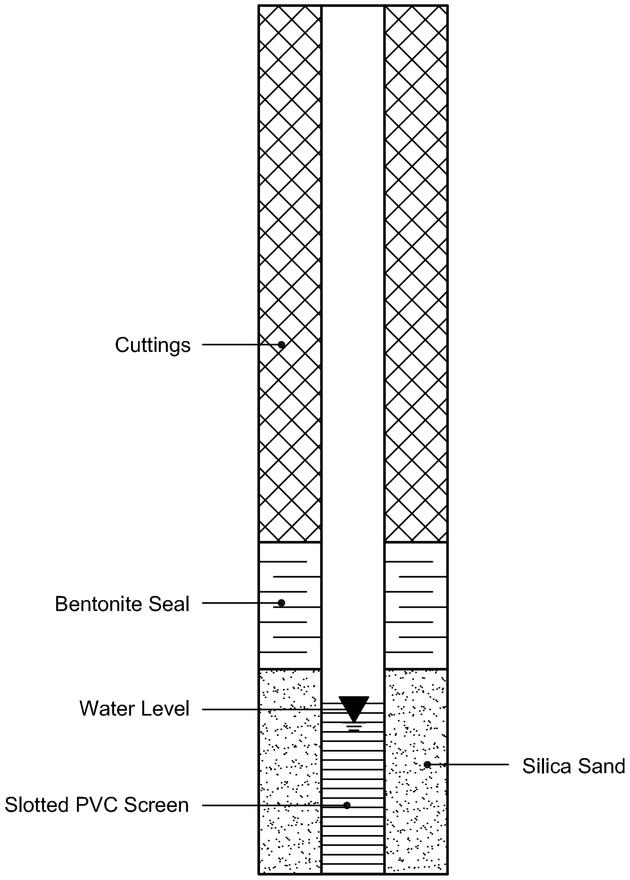


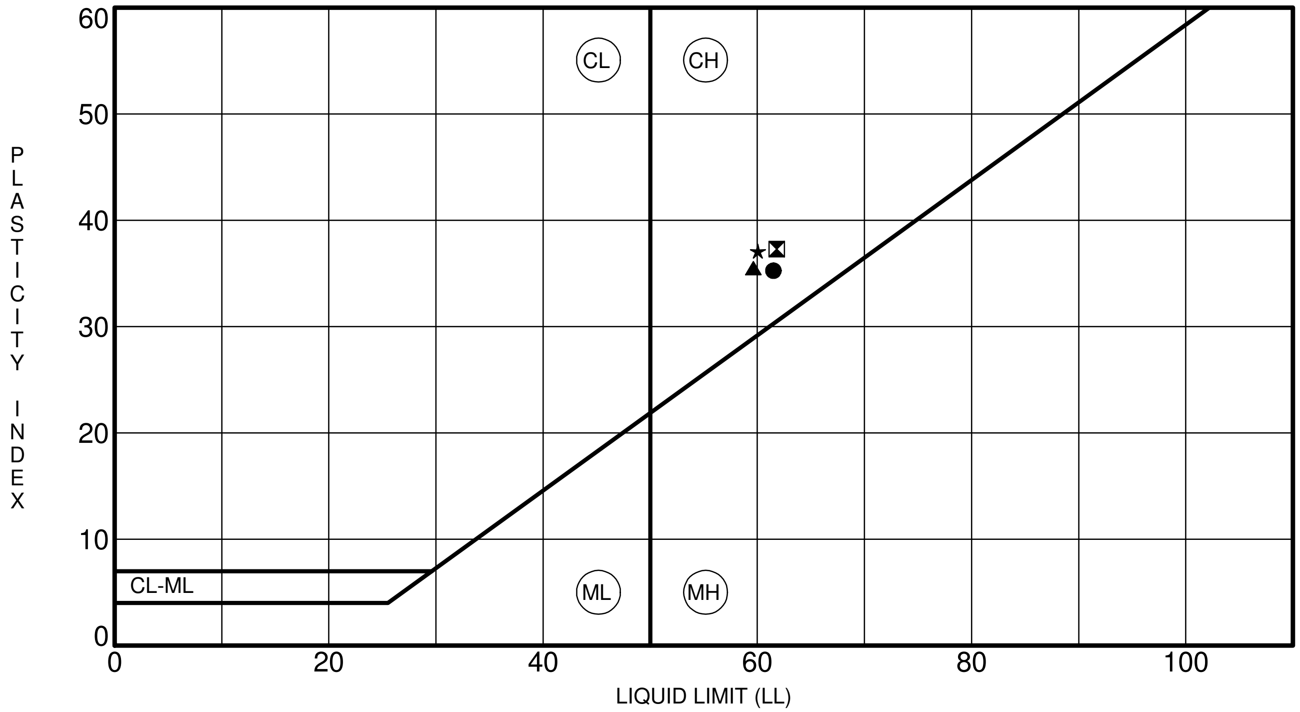
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





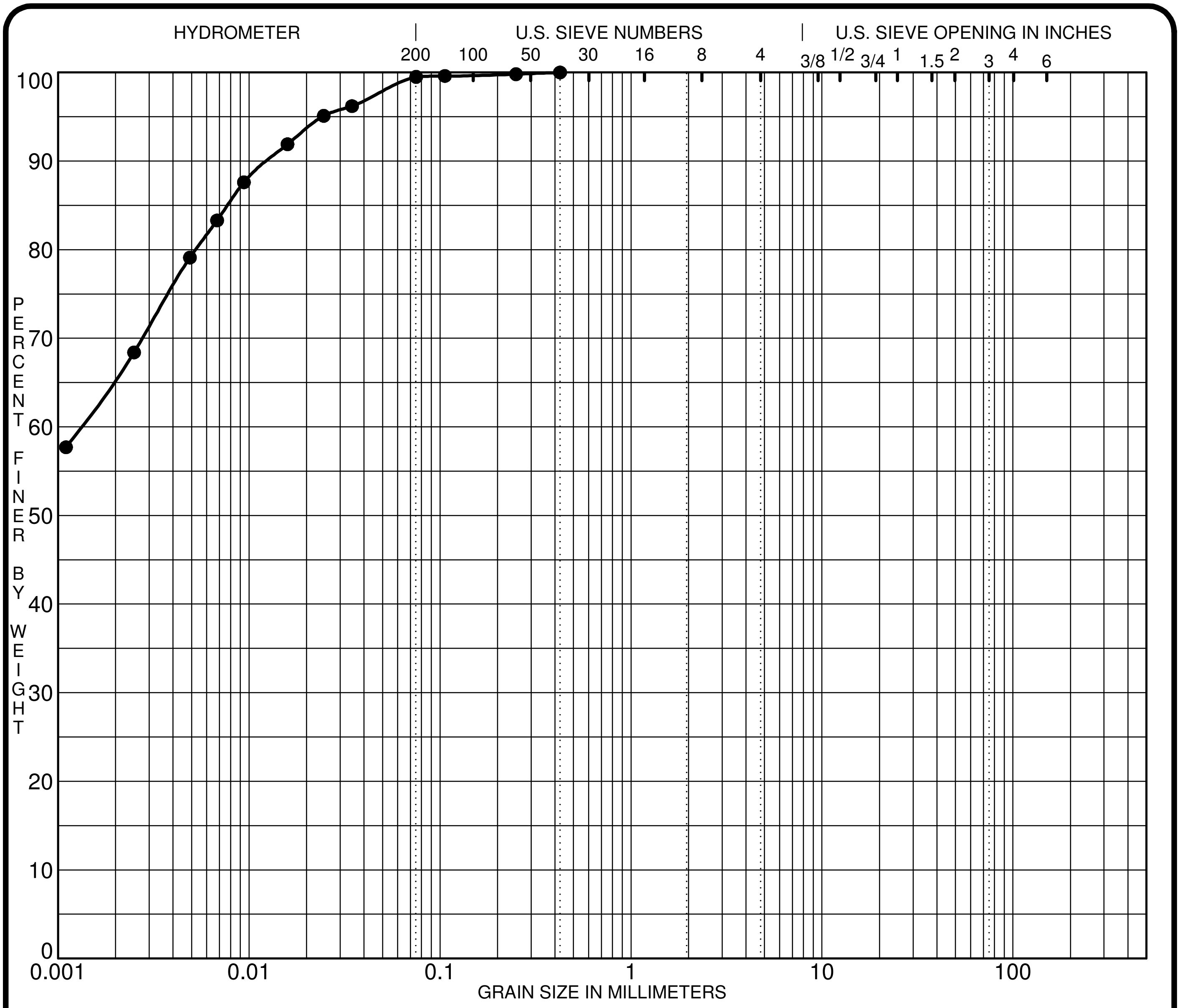
	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-21**	**SS 2**	**61**	**26**	**35**		**CH - Inorganic clays of high plasticity**
⧗	**BH 2-21**	**SS 2**	**62**	**25**	**37**		**CH - Inorganic clays of high plasticity**
▲	**BH 3-21**	**SS 3**	**60**	**24**	**36**		**CH - Inorganic clays of high plasticity**
★	**BH 4-21**	**SS 3**	**60**	**23**	**37**		**CH - Inorganic clays of high plasticity**

Mixed Use

CLIENT **Mattamy Homes**
FILE NO. **PG5914**
PROJECT **Geotechnical Investigation - Proposed**
~~Residential/Commercial~~ Development
DATE **5 Aug 21**

patersongroup **Consulting Engineers**
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 1-21**	**SS 3**	**CH - Inorganic clays of high plasticity**						
☒									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 1-21**	**SS 3**	**0.43**	**0.00**			**0.0**	**0.5**	**99.5**	
☒										
▲										
★										

Mixed Use

CLIENT **Mattamy Homes**

PROJECT **Geotechnical Investigation - Proposed**
~~Residential/Commercial~~ Development

FILE NO. **PG5914**

DATE **5 Aug 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Mattamy Homes	DEPTH	5'-7'	FILE NO.:	PG5914
PROJECT:	Tenth Line Rd & Decoeur Rd	BH OR TP No:	BH2-21 SS3	DATE SAMPLED	5-Aug-21
LAB No:	27172	TESTED BY:	DB	DATE RECEIVED	9-Aug-21
SAMPLED BY:	PB	DATE REPORTED:	16-Aug-21	DATE TESTED	11-Aug-21

LABORATORY INFORMATION & TEST RESULTS

		Calibration (Two Trials)	**Tin NO.(x33)**	
Tare	4.54	Tin	4.49	4.49
Soil Pat Wet + Tare	66.02	Tin + Grease	4.54	4.54
Soil Pat Wet	57.58	Glass	48.97	48.97
Soil Pat Dry + Tare	42.57	Tin + Glass + Water	91.07	91.07
Soil Pat Dry	38.03	Volume	37.56	37.56
Moisture	**51.41**	**Average Volume**	**37.56**	

Soil Pat + String	38.12
Soil Pat + Wax + String in Air	42.03
Soil Pat + Wax + String in Water	16.74
Volume Of Pat (Vdx)	25.29

RESULTS:

Shrinkage Limit	**7.59**
Shrinkage Ratio	**1.820**
Volumetric Shrinkage	**79.741**
Linear Shrinkage	**17.752**

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

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 32631

Report Date: 12-Aug-2021

Order Date: 9-Aug-2021

Project Description: PG5914

	Client ID:	BH2-21 SS3	-	-	-
	Sample Date:	06-Aug-21 09:00	-	-	-
	Sample ID:	2133111-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	70.0	-	-	-
General Inorganics					
pH	0.05 pH Units	7.85	-	-	-
Resistivity	0.10 Ohm.m	18.1	-	-	-
Anions					
Chloride	5 ug/g dry	114	-	-	-
Sulphate	5 ug/g dry	257	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG5914-1 – TEST HOLE LOCATION PLAN

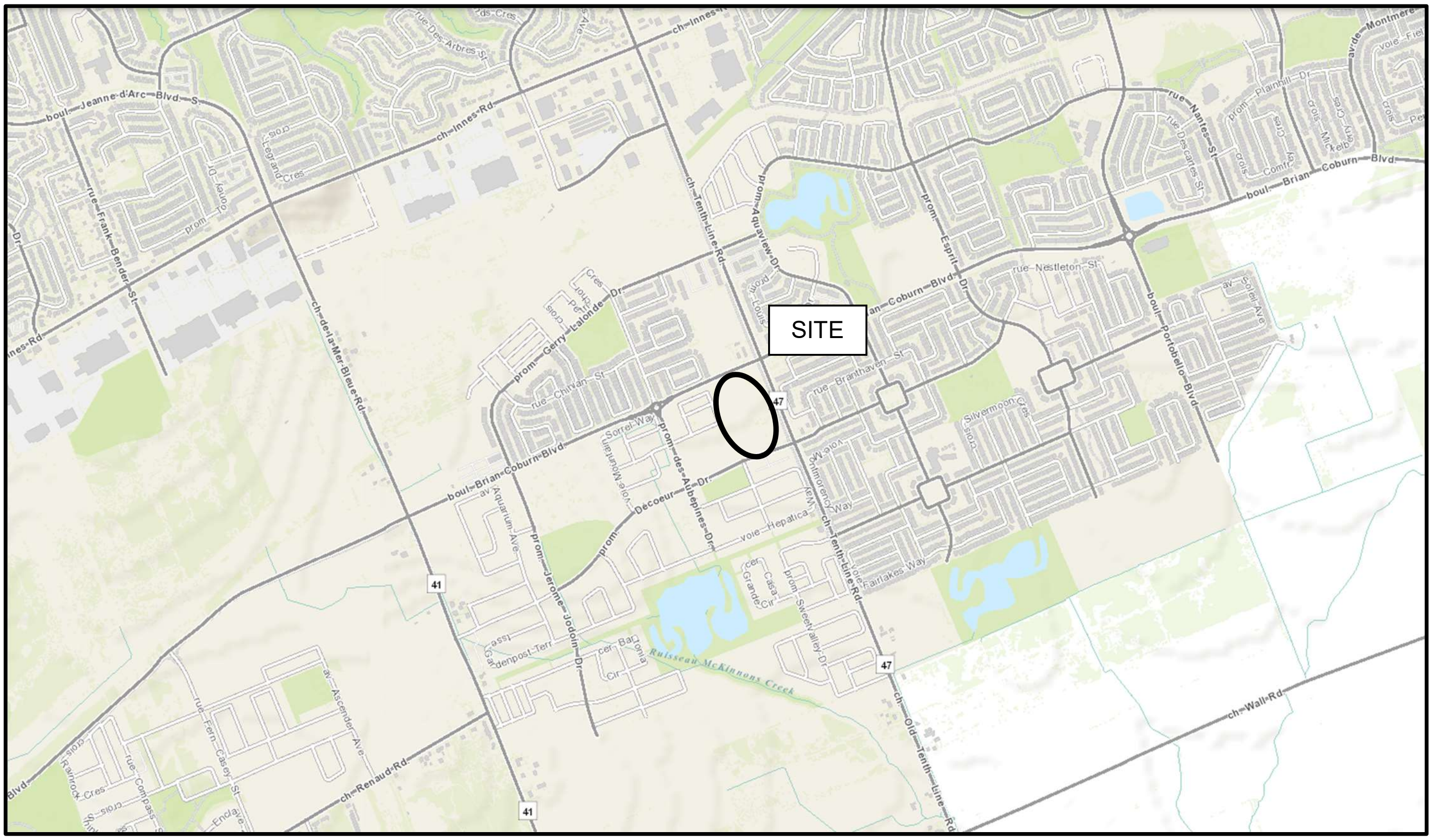
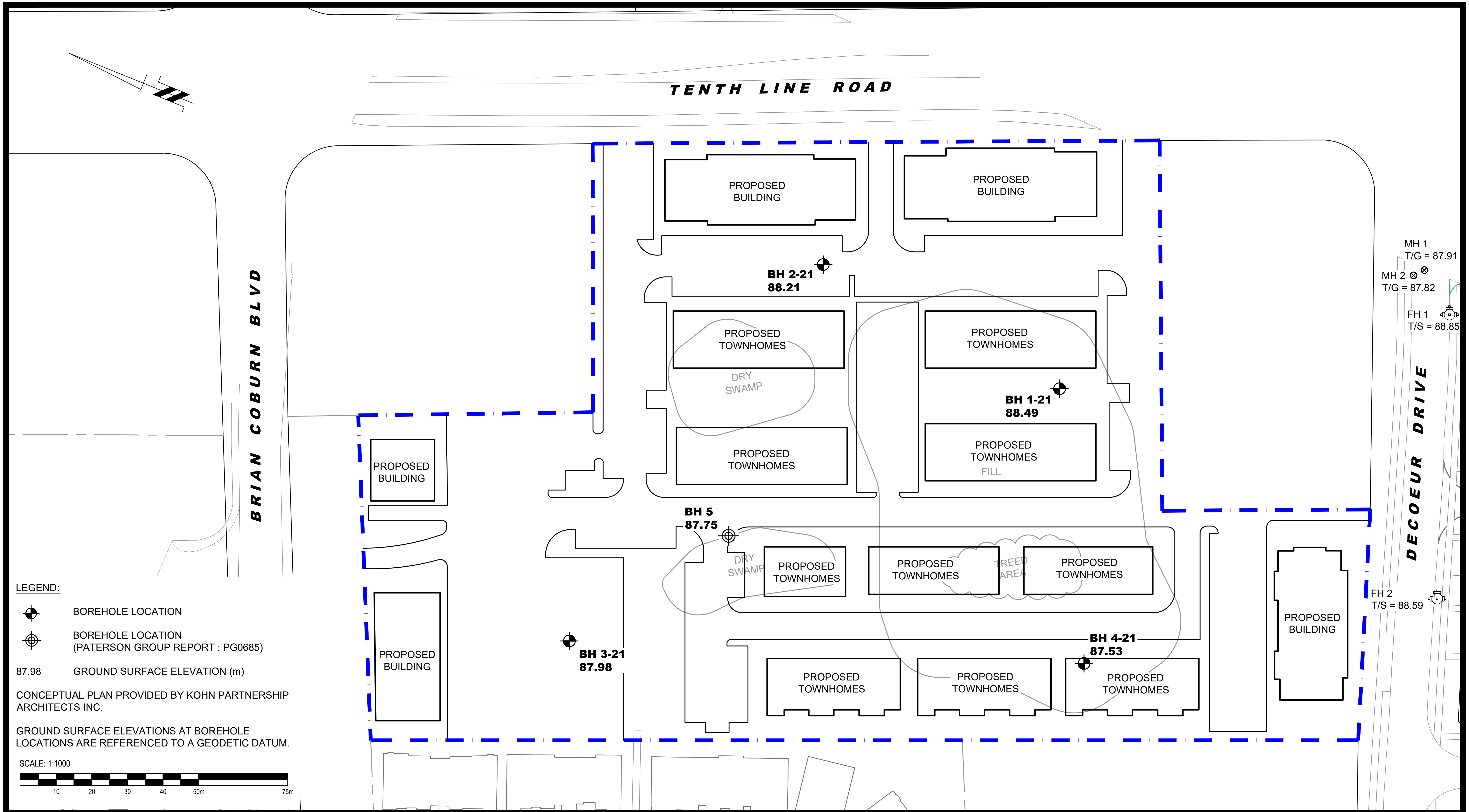


FIGURE 1

KEY PLAN



LEGEND:

⊕	BOREHOLE LOCATION
⊕	BOREHOLE LOCATION (PATERSON GROUP REPORT ; PG0685)
87.98	GROUND SURFACE ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY KOHN PARTNERSHIP ARCHITECTS INC.

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

SCALE: 1:1000

10 20 30 40 50m 75m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

MATTAMY HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
TENTH LINE ROAD AT DECOEUR DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1000
Drawn by: JM
Checked by: FC
Approved by: DJG
Date: 08/2021
Report No.: PE5914-1
Dwg. No.: PG5914-1
Revision No.:

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