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Geotechnical Investigation

Proposed Mixed-Use Development
Eagleson Road at Ottawa Street
Village of Richmond, Ontario

Prepared For

Taggart Group of Companies

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Taggart Group of Companies to conduct a geotechnical investigation for the proposed 125 acre development to be located south of the corner between Eagleson Road and Ottawa Street in the Village of Richmond, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the investigation were to:

❏ to determine the subsurface soil and groundwater conditions based on available subsoil information and borehole investigation.

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

The following report has been prepared specifically and solely for the aforementioned project which is described herein. Investigating the presence or potential presence of contamination on the proposed development was not part of the scope of work. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

Detailed plans of the proposed development were not available at the time of writing this report. However, it is understood that a mixed-use development is proposed consisting of residential dwellings and commercial plaza(s). Associated roadways, parking and landscaping areas are also anticipated as part of the development. It is also understood that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current investigation was conducted between December 14 and December 18, 2018. At that time, a total of ten (10) boreholes were advanced to a maximum depth of 9.75 m or auger refusal. Additionally, a supplemental investigation was completed on February 27, 2019 consisting of excavating 12 test pits to a maximum depth of 3.8 m below existing grade. The test holes were distributed in a manner to provide general coverage of the subject site taking into considerations site features. The locations of the test holes are shown on Drawing PG4216-2 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a track-mounted auger drill rig operated by a two person crew while the test pits were excavated using a hydraulic shovel. All fieldwork was conducted under the full-time supervision of personnel from our geotechnical division under the direction of a senior engineer. The testing procedure consisted of augering to the required depths and at the selected locations sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler, or from the auger flights.

All soil samples were visually inspected and initially classified on site. The split-spoon samples were placed in sealed plastic bags. All samples were transported to the our laboratory for examination and classification. The depths at which the split-spoon and auger samples were recovered from the test holes are shown as SS, AU, respectively, on the Soil Profile and Test Data sheets presented 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.

Grab samples were collected along the excavated sidewalls of the test pits. The grab samples were classified on site and placed in sealed plastic bags. All samples were transported to the Paterson laboratory. The depth at which the grab samples were recovered from the test pits are shown as G on the Soil Profile and Test Data sheets presented in Appendix 1.

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

All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for visual inspection.

Overburden thickness was evaluated during the course of the site investigations by dynamic cone penetration testing (DCPT) at BH 9. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

The subsurface conditions observed at the boreholes and test pits were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets and Borehole Logs by Others in Appendix 1.

Groundwater

Flexible standpipes were installed in all boreholes to monitor the groundwater levels subsequent to the completion of the sampling program. Groundwater infiltration levels were noted at the time of excavation at the test pit locations.

3.2 Field Survey

The borehole and test pit locations were determined by Paterson personnel taking into consideration the presence of underground and aboveground services. The location and ground surface elevation at each borehole and test pit location were provided by Stantec Geomatics Ltd. It is understood that the ground surface elevations were referenced to a geodetic datum. The test hole locations and ground surface elevations at the test hole locations are presented on Drawing PG4216-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were visually examined in our laboratory to review the results of the field logging.

A total of 10 Atterberg limit tests and 5 grain size distribution analyses were completed on selected soil samples. The results of our testing are presented in Subsection 4.2 and on Atterberg Limits Testing and Grain-Size Distribution and Hydrometer Testing sheets are attached in Appendix 1.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by agricultural lands along the east portion of the site while the west portion is occupied by tree-covered lands. The ground surface across the subject site is relatively flat with a slight upward slope from northern portion to southern portion of the site. The site is approximately 0.6 m lower than the bordering roads and the adjacent properties. A ditch is located around the perimeter of the site running north-south along Eagleson road and east-west along Ottawa Street. Also, a secondary ditch was observed running in the east-west direction, connecting to the ditch along Eagleson Road. It should be noted that an existing rail corridor runs roughly in an east-west direction through the north portion of the site.

4.2 Subsurface Profile

Overburden Profile

Generally, the subsurface profile encountered at the borehole locations consists of a layer of topsoil followed by a layer of loose to dense brown silty sand and/or a very stiff to firm silty clay to clayey silt deposit. Glacial till consisting of a silty sand with gravel, cobbles and boulders was encountered below the above noted layers. Practical refusal to augering was encountered in all boreholes except for BH 1, BH 9 and BH 10. In addition, practical refusal to excavation was encountered in TP 5 through TP 11. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on available geological mapping, the bedrock in this area mostly consists of dolomite of the Oxford Formation with an overburden drift thickness of 1 to10 m depth.

Atterberg Limit and Shrinkage Tests

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples at selected locations throughout the subject site. The results of the Atterberg limits tests are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 2	0.76	35	21	14	37.1	CL
BH 3	1.82	29	19	10	20.0	CL
BH 8	1.06	29	19	10	20.7	CL
TP 2	1.90	33	21	12	28.5	CL
TP 3	2.20	33	21	12	33.0	CL
TP 4	3.00	52	21	31	38.5	CH
TP 5	3.00	51	23	28	40.7	CH
TP 6	2.50	36	19	17	29.5	CL
TP 7	3.00	27	21	6	25.4	CL-ML
TP 8	2.50	54	26	29	43.1	CH

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content;
CH: Inorganic Clay of High Plasticity CL: Inorganic Clay of Low Plasticity
CL-ML: Inorganic Silt with Some Clay with Low Plasticity

The results of the shrinkage limit test indicate a shrinkage limit of 20% and a shrinkage ratio of 1.93.

Grain Size Distribution and Hydrometer Testing

Grain size distribution (sieve and hydrometer analysis) was also completed on five (5) selected soil samples. The results of the grain size analysis are summarized in Table 2 and presented on the Grain-Size Distribution and Hydrometer Testing Results sheets in Appendix 1.

Table 2 - Summary of Grain Size Distribution Analysis

Test Hole	Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TP 4	G 6	0.0	0.9	59.6	39.5
TP 6	G 5	0.0	0.2	84.8	15.0
TP 8	G 5	0.0	6.1	54.4	39.5
TP 9	G 1	15.9	42.5	41.6	
TP 11	G 4	6.5	64.5	29.0	

4.3 Groundwater

Generally, the groundwater levels recovered from the piezometers installed at the borehole locations were measure in the field and are summarized in Table 3. It is important to note that groundwater readings at piezometers can be influenced by surface water perched within the borehole backfill material. Long-term groundwater conditions can also be estimated based on the observed color and consistency of the recovered soil samples. Based on these observations, it is estimated that long-term groundwater level can be expected between 2.5 to 3.5 m depth. Groundwater levels are subject to seasonal fluctuations and therefore could vary during time of construction. The groundwater conditions observed at the borehole and test pits were recorded in detail in the field. Our groundwater observations are also presented in the Soil Profile and Test Data sheets in Appendix 1.

Table 3 - Summary of Groundwater Level Readings

Test Hole Number	Ground Elevation (m)	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH1	93.37	0.61	92.76	December 28, 2018
BH2	94.23	0.77	93.46	December 28, 2018
BH3	94.76	0.62	94.14	December 28, 2018
BH4	97.71	1.10	96.61	December 28, 2018
BH5	97.45	n/a	n/a	December 28, 2018
BH6	94.70	0.73	93.97	December 28, 2018
BH7	94.88	0.83	94.05	December 28, 2018
BH8	94.03	1.28	92.75	December 28, 2018
BH9	93.78	0.70	93.08	December 28, 2018
BH10	93.37	0.48	92.89	December 28, 2018

Note: The ground surface elevations at the borehole locations were provided by Stantec Geomatics.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed development. It is expected that the proposed buildings will be founded on conventional shallow footings placed on an undisturbed, very stiff to firm silty clay, compact silty sand, glacial till or clean, surface sounded bedrock bearing surface.

Due to the presence of the sensitive silty clay layer deposit, limited areas of the proposed development will be subjected to grade raise restrictions. The recommended permissible grade raise areas are presented in Drawing PG4216-3 - Permissible Grade Raise Areas in Appendix 2. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements. Furthermore, to delineate a more precise area where the clay deposit is situated, additional boreholes may be required.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding, and other settlement sensitive structures.

Due to the relatively shallow depth of the bedrock surface within the southern portion of the site, bedrock removal may be required.

Bedrock Removal

Bedrock removal can be accomplished by hoe ramming where only a small quantity of the bedrock needs to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be completed prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Vibration Considerations

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

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

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). The guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended be completed to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used 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 material. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If excavated stiff brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, under dry conditions, should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. 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.

5.3 Foundation Design

Bearing Resistance Values

Conventional style shallow footings for buildings can be designed using the bearing resistance values presented in Table 4. A geotechnical resistance factor of 0.5 was applied to the bearing resistance values at ULS.

Table 4 - Bearing Resistance Values

Bearing Surface	Bearing Resistance Value at SLS (kPa)	Factored Bearing Resistance Value at ULS (kPa)
Undisturbed, Compact Silty Sand/Sandy Silt	100	150
Undisturbed, Firm Silty Clay	100	180
Undisturbed, Stiff Silty Clay/Clayey Silt	150	225
Undisturbed, Compact Glacial Till	150	225
Clean, Surface Sounded Bedrock	-	500

Note: Pad footings, up to 5 m wide, and strip footings, up to 3 m wide, can be designed using the above noted bearing resistance values placed over an undisturbed, silty clay bearing surface.

The bearing resistance values are provided on the assumption that the footings will be placed on undisturbed soil bearing surfaces. An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

The bearing resistance values at SLS for shallow footing bearing on the abovenoted soils will be subjected to potential post-construction total and differential settlements of 25 and 15 mm, respectively.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer. Footings bearing on an acceptable bedrock bearing surface and designed using the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

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 edge of the footing at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as the soil.

Soil/Bedrock Transition

Where a building is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on soil bearing media to reduce the potential long term total and differential settlements. Also, at the soil/bedrock and bedrock/soil transitions, it is recommended that the upper 0.5 m of the bedrock be removed for a minimum length of 2 m (on the bedrock side) and replaced with nominally compacted OPSS Granular A or Granular B Type II material. The width of the subexcavation should be at least the proposed footing width plus 0.5 m. Steel reinforcement, extending at least 3 m on both sides of the 2 m long transition, should be placed in the top part of the footings and foundation walls.

Settlement/Grade Raise

Permissible grade raise restriction areas are also required due to the silty clay deposit. A permissible grade raise restriction of **2 m** is recommended for the areas where the silty clay deposit is encountered provided that the foundations of the proposed buildings are placed over the silty clay deposit. The recommended permissible grade raise areas are presented in Drawing PG4216-3 - Permissible Grade Raise Plan in Appendix 2.

5.4 Design for Earthquakes

For the south and central portions, the site class for seismic site response can be taken as **Class C** for the foundations bearing on a compact to dense glacial till and/or bedrock within the north portion of the subject site. A higher site class, such as Class A or B, is applicable for footings bearing on the bedrock surface. However, a site specific seismic shear wave test will be required to confirm the Class A or B seismic site classification.

For the north portion of the site, the bedrock depths range between 4.5 to 10 m below existing grade. Assuming a conservative shear wave velocity of 250 m/s for all overburden, and a conservative shear wave velocity of 1,500 m/s for the bedrock, the average shear wave velocity of the upper 30 m profile , Vs30, is estimated to be well above **360 m/s** throughout the north portion of the site. Therefore, the site class for seismic site response can be taken as **Class C** for the foundations within the north portion of the site.

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.

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5.5 Basement Slab/Slab on Grade Construction

With the removal of all topsoil and fill, containing deleterious or organic materials, the native soil or engineered fill specified by the geotechnical consultant will be considered to be an acceptable subgrade surface on which to commence backfilling for basement floor slab or slab on grade construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

It is recommended that the upper 200 mm of sub-floor fill for basement slab construction consist of 19 mm clear crushed stone. It is also recommended that the upper 300 mm sub-floor fill below slab on grade construction consist of OPSS Granular A crushed stone. All backfill materials within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas, local roadways and arterial roadways with bus traffic.

Table 5 - Recommended Pavement Structure - Car Only Parking Areas/Driveways

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

Table 6 - Recommended Pavement Structure - Local Roadways

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 in situ soils or OPSS Granular B Type I or II material placed over in situ soil	

Table 7 - Recommended Pavement Structure - Arterial Roadways with Bus Traffic

Thickness (mm)	Material Description
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
550	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soils 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 local roadways and parking areas. Minimum Performance Graded (PG) 64-34 asphalt cement should be used for arterial roadways with bus traffic.

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

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.

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 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.

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

6.2 Protection of Footings Against Frost Action

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

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.

6.3 Excavation Side Slopes

The side slopes of excavations in the 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 for the greater part of the excavations 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 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 & 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 bedding for sewer and water pipes when placed on soil subgrade. 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 (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist, not wet, silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

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, subbedding 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

Due to the relatively impervious nature of the silty clay/clayey silt materials, it is anticipated that groundwater infiltration into the excavations should be low 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.

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.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. These results are indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The results of the chloride content, pH and resistivity indicate the presence of a non-aggressive to slightly aggressive environment for exposed ferrous metals at this site.

6.8 Landscaping Considerations

Tree Planting Restrictions

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

Based on the results of the atterberg limit testing mentioned above, the plasticity index was found to be less than 40% in all the tested clay samples. In addition, based on the clay content found in the clay samples from the grain size distribution test results, moisture levels and consistency, the silty clay across the subject site is considered low to medium sensitivity clay and cannot be designated as sensitive marine clays.

The following tree planting setbacks are recommended for the low to medium sensitivity silty clay deposit throughout the subject site where silty clay was encountered (permissible grade raise restriction area) as shown in Drawing PG4216-3 - Permissible Grade Raise Plan. Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). Tree planting setback limits may be reduced to **4.5 m** for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the condition noted below are met:

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

☐ A small tree must be provided with a minimum 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 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 surround the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

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.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that a materials testing and observation services program including the following aspects be performed by the geotechnical consultant.

- Grading plan review from a geotechnical perspective, once the final grading plan is available.
- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials used.
- 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 request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement Of Limitations

The recommendations made in this report are in accordance with Paterson's present understanding of the project. Paterson requests permission to review the grading plan once available. Paterson's recommendations should be reviewed when the drawings and specifications are complete.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only. Test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

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 to be notified immediately in order to permit reassessment of the recommendations.

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 Taggart Group of Companies or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

LICENSED PROFESSIONAL ENGINEER
April 4, 2019
F. I. ABOU-SEIDO
100156744
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.

Report Distribution:

- ❏ Taggart Group of Companies (3 copies)
- ❏ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

GRAIN SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

FILE NO. PG4216

HOLE NO. BH 1

SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOPSOIL	0.20
Loose, brown **SANDY SILT,** some clay	1.22
Dense to compact, brown **SILTY SAND,** trace gravel	5.94
GLACIAL TILL: Dense to very dense, grey silty sand with gravel and clay	9.75
End of Borehole (GWL @ 0.61m - Dec. 28, 2018)	

SAMPLE

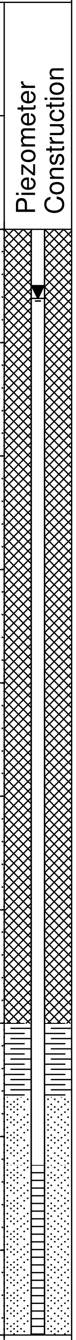
TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	54	5
SS	3	67	39
SS	4	71	23
SS	5	58	14
SS	6	71	32
SS	7		24
SS	8	100	3
SS	9	67	42
SS	10	91	82
SS	11		7

DEPTH (m)	ELEV. (m)
0	93.96
1	92.96
2	91.96
3	90.96
4	89.96
5	88.96
6	87.96
7	86.96
8	85.96
9	84.96

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

○ **Water Content %**
20 40 60 80

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



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Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
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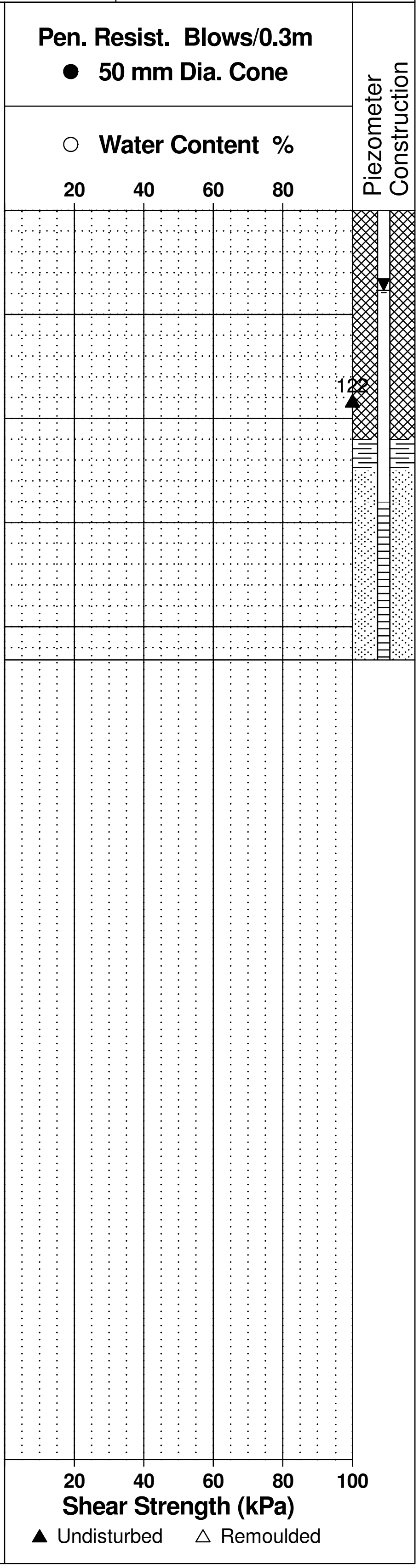
DATE December 13, 2018

FILE NO. PG4216

HOLE NO. BH 2

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	94.23
TOPSOIL 0.25	AU	1				
Stiff, brown **SILTY CLAY/CLAYEY SILT,** some sand 1.07	SS	2	92	4	1	93.23
Very stiff, brown **SILTY CLAY** 2.13					2	92.23
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders	SS	3	8	12	3	91.23
	SS	4	42	35	4	90.23
4.32						
End of Borehole Practical refusal to augering at 4.32m depth (GWL @ 0.77m - Dec. 28, 2018)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

FILE NO. PG4216

HOLE NO. BH 3

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	94.76
TOPSOIL 0.15	AU	1				
Stiff to firm, brown **SILTY CLAY/CLAYEY SILT**	SS	2	92	6	1	93.76
	SS	3	92	6	2	92.76
2.13						
GLACIAL TILL: Brown sandy silt with clay, gravel, cobbles and boulders	SS	4	0	50+		
	SS	5	67	23	3	91.76
					4	90.76
4.42						

End of Borehole

Practical refusal to augering at 4.42m depth

(GWL @ 0.62m - Dec. 28, 2018)

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

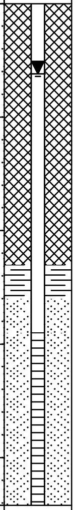
○ **Water Content %**

20 40 60 80

Shear Strength (kPa)
20 40 60 80 100

▲ Undisturbed △ Remoulded

Piezometer Construction



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

FILE NO. PG4216

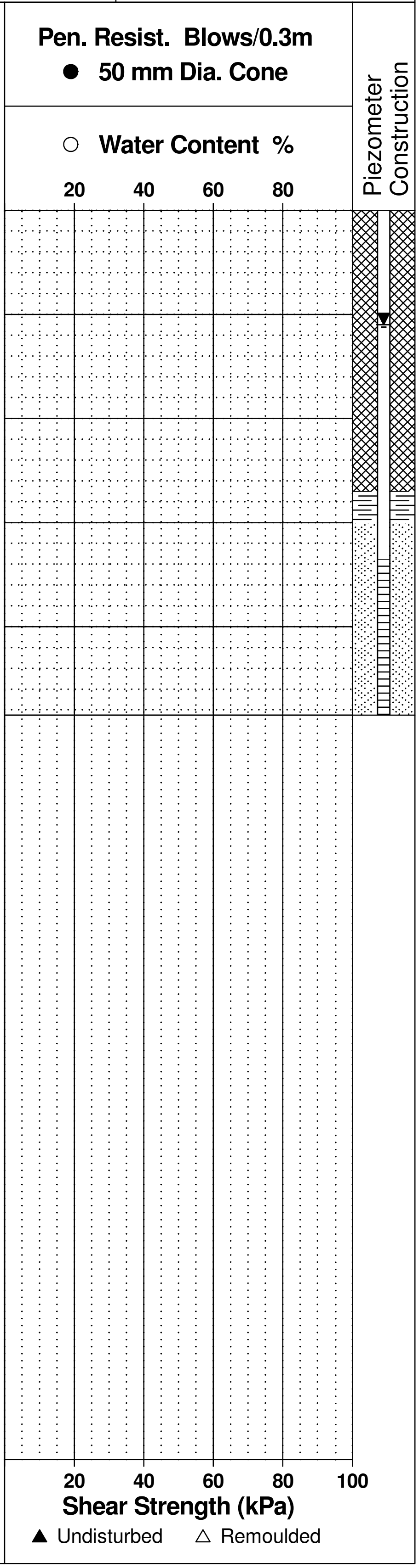
HOLE NO. BH 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.71
TOSPOIL 0.30		AU	1				
		SS	2	71	40	1	96.71
		SS	3	71	68	2	95.71
GLACIAL TILL: Very dense, brown silty sand with gravel, cobbles and boulders		SS	4	71	50+		
						3	94.71
		SS	5	88	73		
						4	93.71
4.85		SS	6	100	50+		

End of Borehole

Practical refusal to augering at 4.85m depth

(GWL @ 1.10m - Dec. 28, 2018)



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

FILE NO. **PG4216**

REMARKS

HOLE NO. **BH 5**

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	97.45		
TOPSOIL 0.30	■	AU	1						
Very stiff, brown **CLAYEY SILT** 1.01	▨	SS	2		50+	1	96.45		
End of Borehole Practical refusal to augering at 1.01m depth (BH dry upon completion)									

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

FILE NO. PG4216

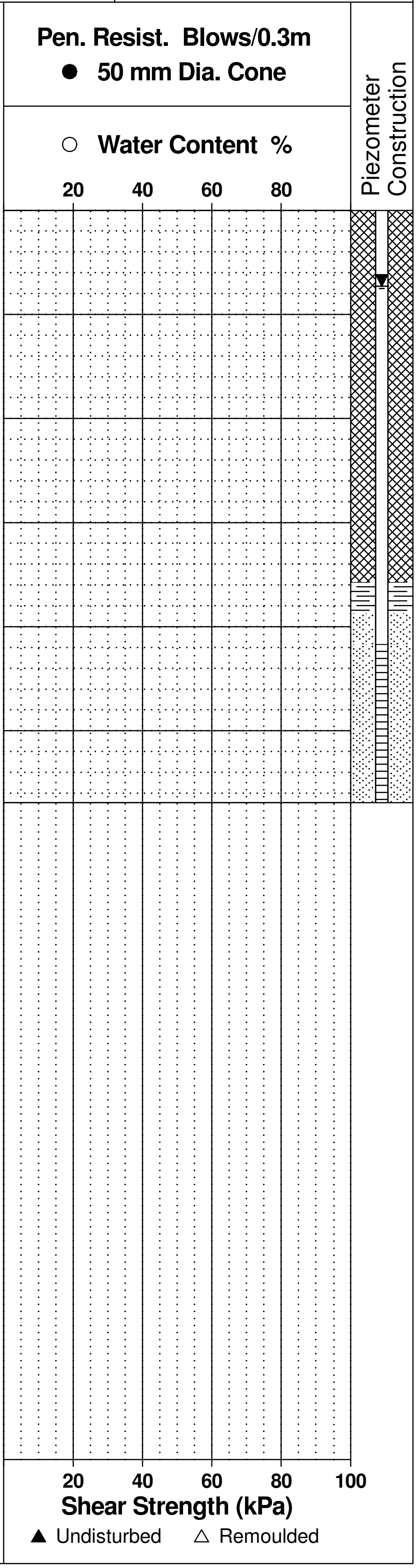
HOLE NO. BH 6

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	94.70
TOPSOIL 0.30	AU	1				
Compact to loose, brown **SANDY SILT,** trace clay	SS	2	67	12	1	93.70
1.93	SS	3	92	5		
Brown **SILTY CLAY** 2.19					2	92.70
GLACIAL TILL: Very dense, brown silty sand with gravel, cobbles and boulders	SS	4	88	59		
	SS	5	71	68	3	91.70
					4	90.70
	SS	6	100	50	5	89.70
5.69	SS	7	100	50+		

End of Borehole

Practical refusal to augering at 5.69m depth

(GWL @ 0.73m - Dec. 28, 2018)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

FILE NO. PG4216

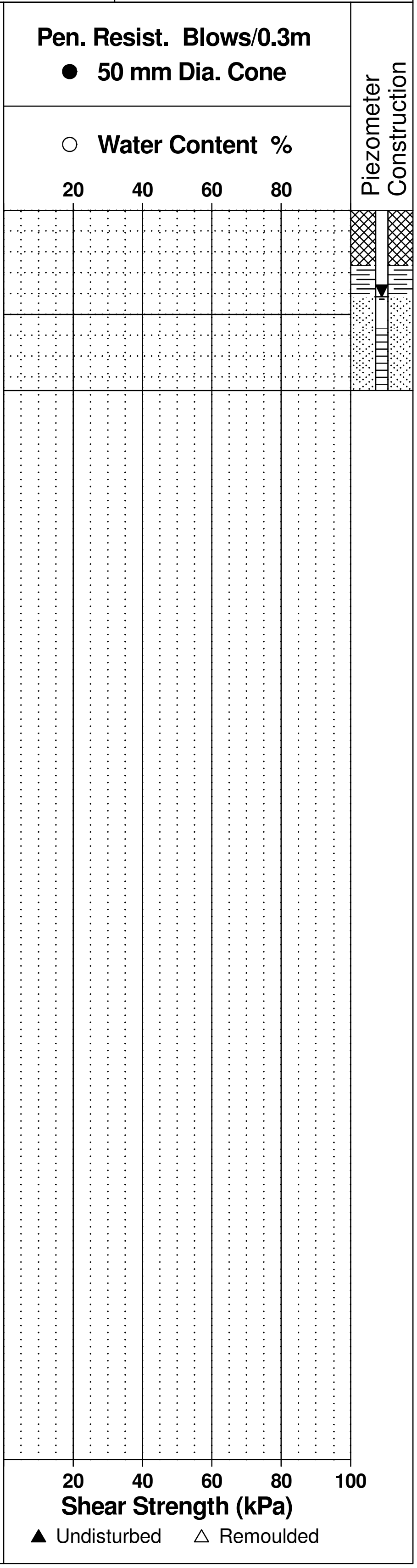
HOLE NO. BH 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.88
TOPSOIL 0.25		AU	1				
GLACIAL TILL: Brown silty sand with clay and gravel		SS	2	67	9	1	93.88
1.73		SS	3	50	50+		

End of Borehole

Practical refusal to augering at 1.73m depth

(GWL @ 0.83m - Dec. 28, 2018)



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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

FILE NO. PG4216

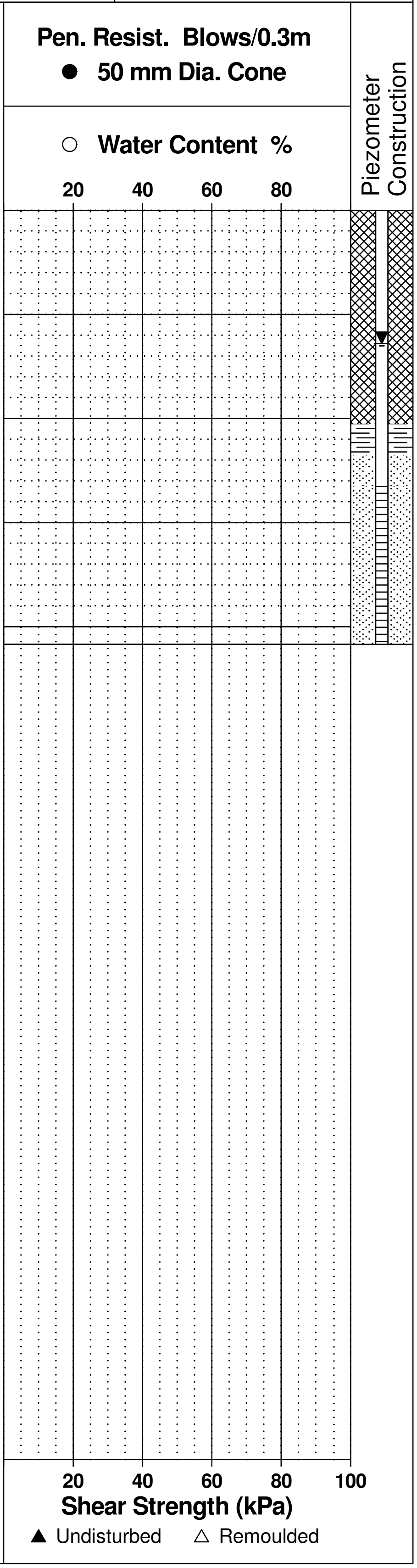
HOLE NO. BH 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.03
TOPSOIL 0.25		AU	1				
Very stiff, brown **CLAYEY SILT**		SS	2	79	13	1	93.03
1.73		SS	3	96	6	2	92.03
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders		SS	4	71	7	3	91.03
		SS	5	50	36	4	90.03
4.17							

End of Borehole

Practical refusal to augering at 4.17m depth

(GWL @ 1.28m - Dec. 28, 2018)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE December 13, 2018

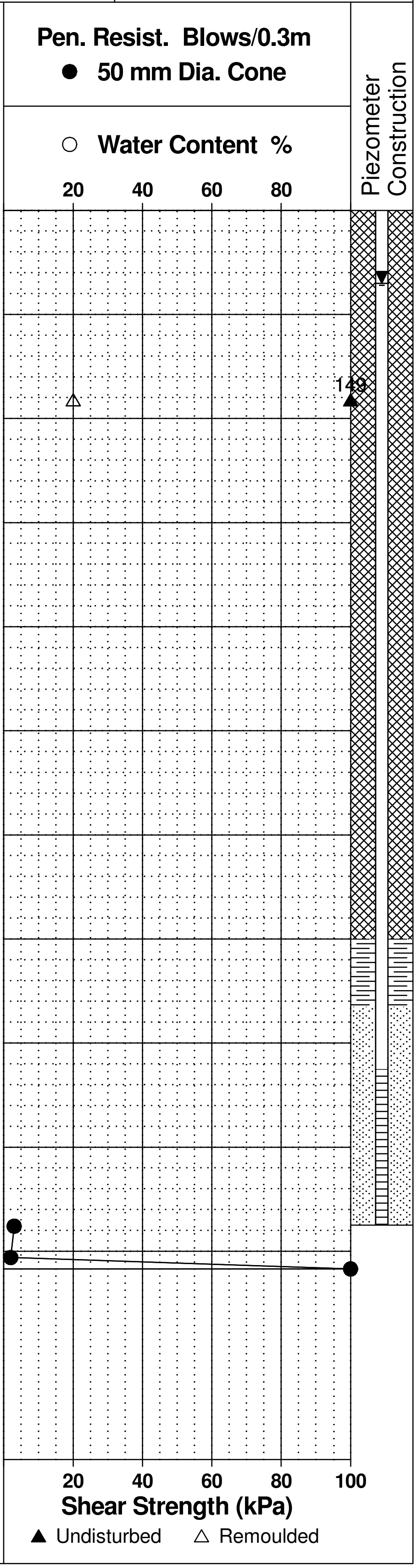
FILE NO. PG4216

HOLE NO. BH 9

SOIL DESCRIPTION	
GROUND SURFACE	
TOPSOIL	0.25
Very stiff, brown **SILTY CLAY**	2.29
Brown **SANDY SILT,** trace clay	3.05
Loose, brown **SILTY SAND** with gravel, trace clay	6.10
Compact to dense, grey **SILTY SAND**	9.75
Dynamic Cone Penetration Test commenced at 9.75m depth.	10.17
End of Borehole Practical DCPT refusal at 10.17m depth (GWL @ 0.70m - Dec. 28, 2018)	

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	96	4
SS	3	83	P
SS		88	P
SS	5	46	7
SS	6	79	9
SS	7	71	9
SS	8	100	26
SS	9	62	14
SS	10	62	36
SS	11	42	31

DEPTH (m)	ELEV. (m)
0	93.78
1	92.78
2	91.78
3	90.78
4	89.78
5	88.78
6	87.78
7	86.78
8	85.78
9	84.78
10	83.78



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

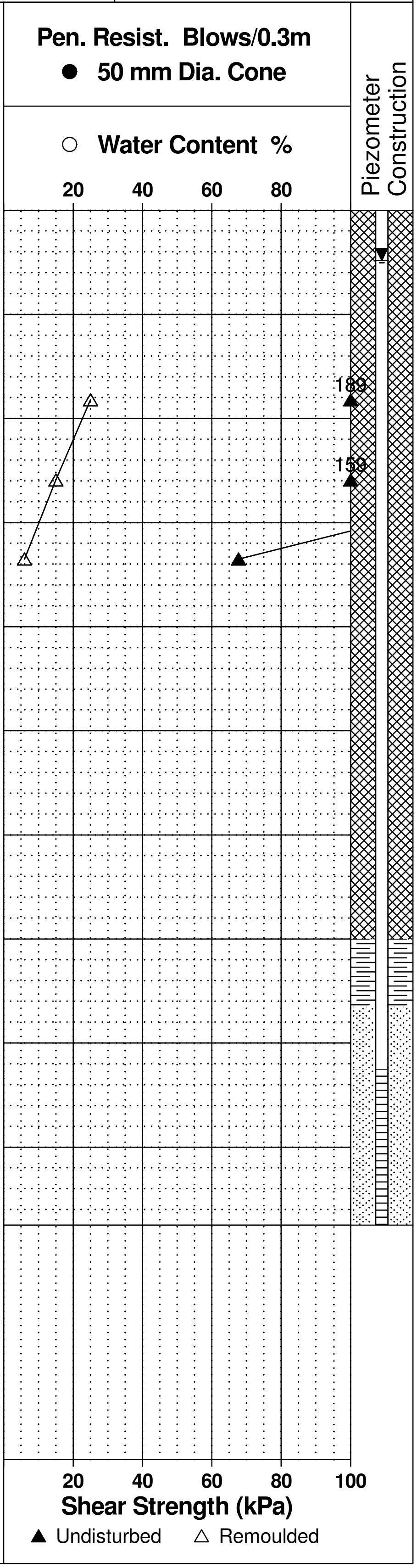
DATE December 13, 2018

FILE NO. PG4216

HOLE NO. BH10

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
TOPSOIL 0.30	AU	1		
Very stiff, brown **SILTY CLAY** - grey by 2.9m depth	SS	2	96	6
	SS	3	54	P
	SS	4	100	P
	SS	5	58	10
5.41	SS	6	83	37
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles and boulders	SS	7	96	50+
	SS	8	83	75
	SS	9	92	
9.75		10	100	50+
End of Borehole (GWL @ 0.48m - Dec. 28, 2018)				

DEPTH (m)	ELEV. (m)
0	93.37
1	92.37
2	91.37
3	90.37
4	89.37
5	88.37
6	87.37
7	86.37
8	85.37
9	84.37



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.63
TOPSOIL 0.30	■						
GLACIAL TILL: Loose to compact, grey-brown silty sand with clay, gravel and cobbles - some rootlest at upper 0.2m depth - grey by 2.0m depth	▨	G	1				
						1	93.63
		G	2				
						2	92.63
		G	3				
		G	4				
						3	91.63
3.70		G	5				
End of Test Pit (Groundwater infiltration at 3.5m depth)							

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

○ **Water Content %**

20 40 60 80

Piezometer Construction

∇

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

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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

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REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

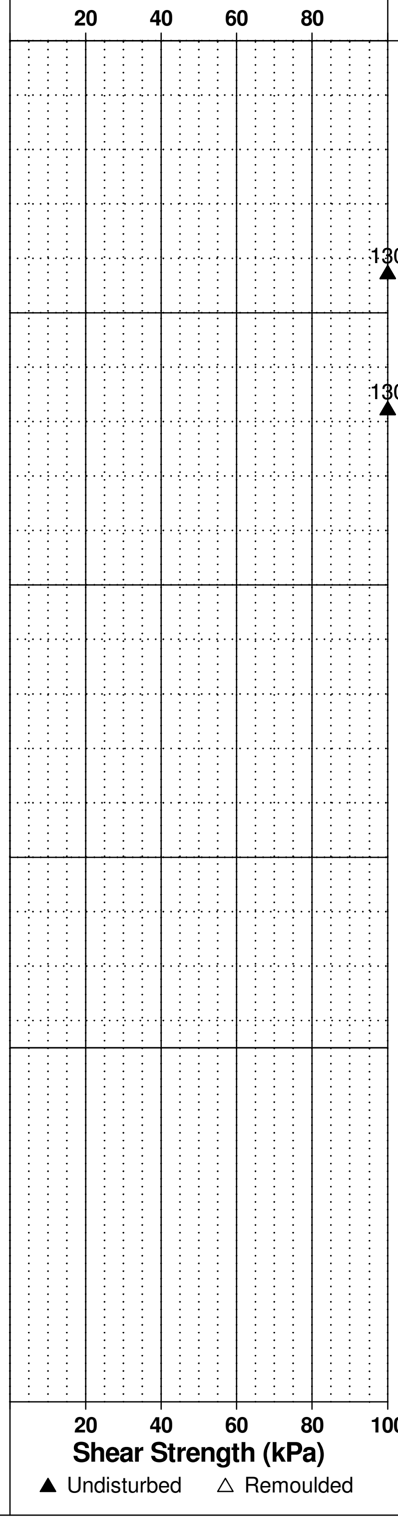
FILE NO. PG4216

HOLE NO. TP 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.42
TOPSOIL	■						
0.30							
Very stiff, grey-brown **SILTY CLAY** - some rootlets at upper 0.2m depth - grey by 1.0m depth	▨	G	1				
						1	93.42
		G	2				
2.00		G	3				
						2	92.42
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		G	4				
		G	5			3	91.42
		G	6				
3.70		G	7				
End of Test Pit (TP dry upon completion)							

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

Piezometer Construction



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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

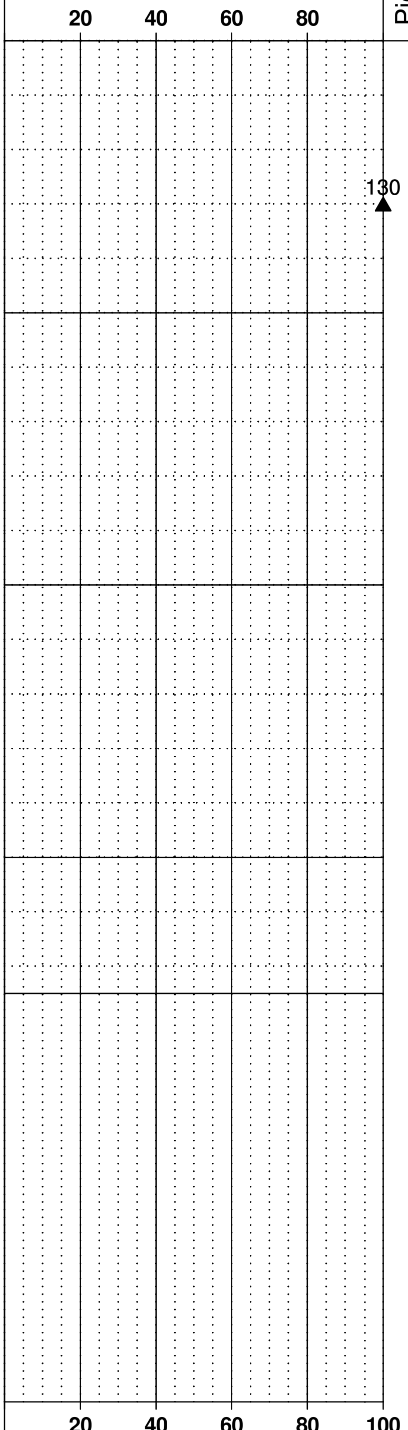
FILE NO. PG4216

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.48
TOPSOIL 0.30							
Very stiff, brown **SILTY CLAY** - grey by 1.6m depth		G	1				
		G	2			1	93.48
		G	3				
						2	92.48
2.50		G	4				
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		G	5				
						3	91.48
3.50		G	6				
End of Test Pit (Water infiltration at base of test pit)							

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

○ **Water Content %**



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

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REMARKS

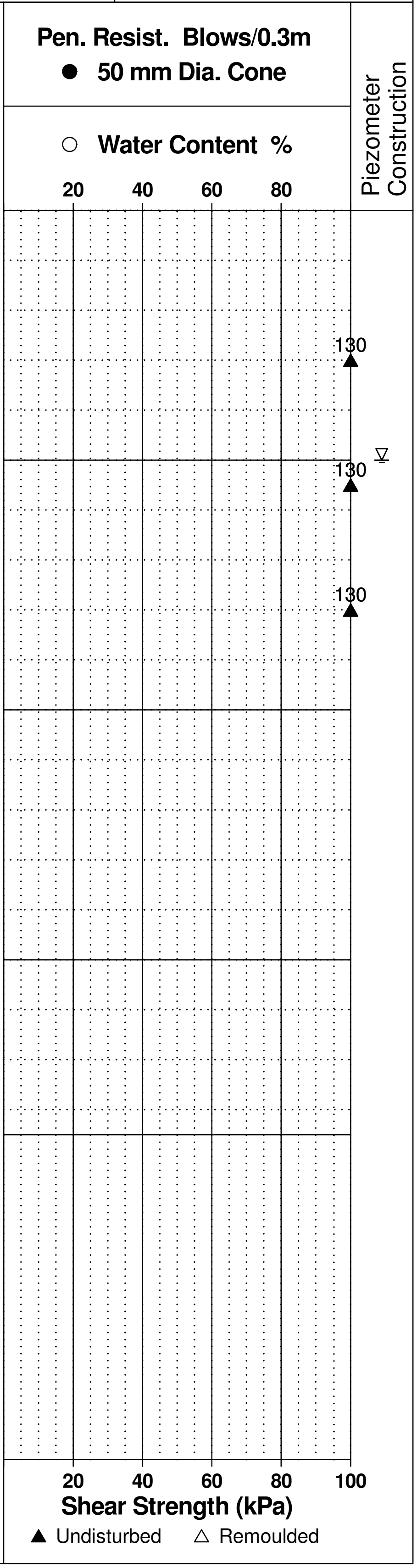
BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.63
TOPSOIL 0.30	■						
Very stiff, brown **SILTY CLAY**	▨	G	1				
	▨	G	2			1	92.63
	▨	G	3				
	▨	G	4			2	91.63
- grey by 2.8m depth	▨	G	5				
	▨	G	6			3	90.63
3.70	▨	G	7				
End of Test Pit (Groundwater infiltration at 1.0m depth)							



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SOIL PROFILE AND TEST DATA

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FILE NO. PG4216

REMARKS

HOLE NO. TP 5

BORINGS BY Hydraulic Shovel

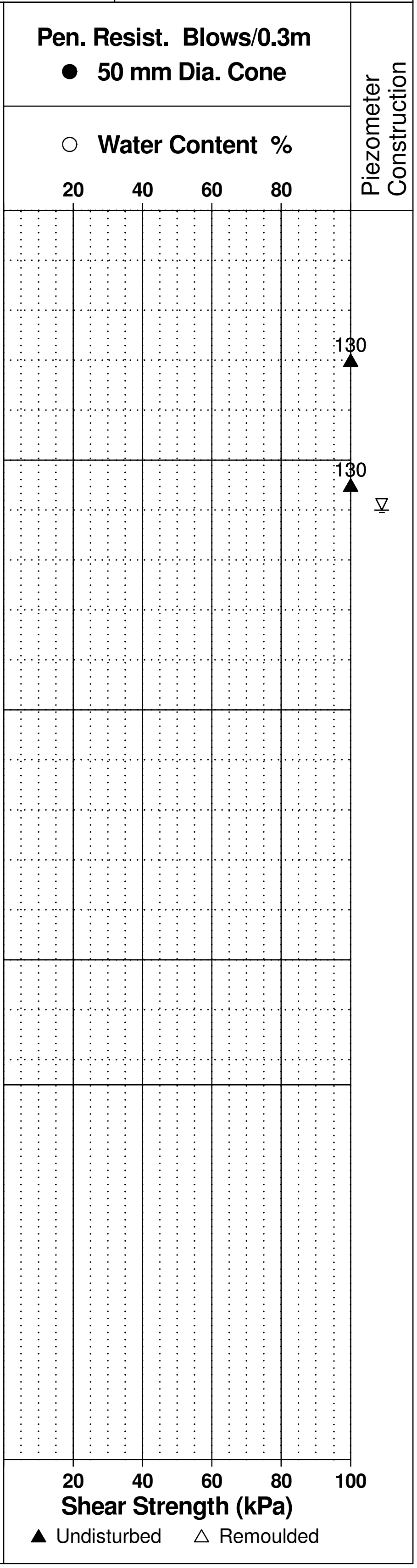
DATE February 27, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.28
TOPSOIL 0.30							
Very stiff, brown **SILTY CLAY**		G	1				
- grey-brown by 1.0m depth		G	2			1	93.28
		G	3				
- grey by 1.8m depth		G	4			2	92.28
		G	5				
		G	6			3	91.28
3.50		G	7				

End of Test Pit

Practical refusal to excavation at 3.50m depth

(Groundwater infiltration at 1.2m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

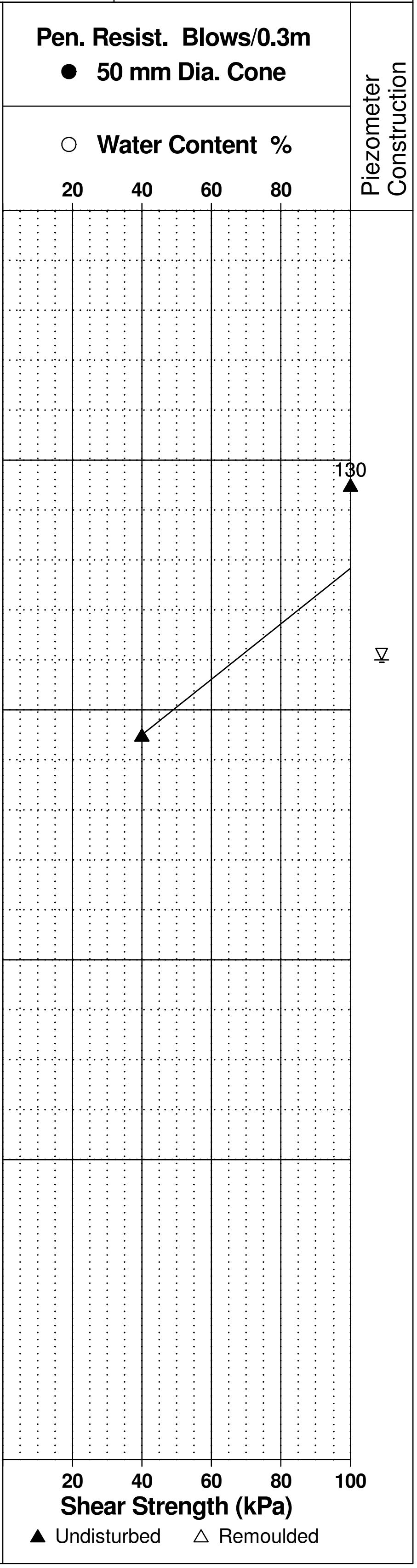
BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.03
TOPSOIL 0.30	■						
Very stiff to stiff, brown **SILTY CLAY**	▨	G	1				
	▨	G	2			1	93.03
- firm and grey by 1.8m depth	▨	G	3				
	▨	G	4			2	92.03
2.80	▨	G	5				
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders	^^^	G	6			3	91.03
3.80	^^^	G	7				
End of Test Pit Practical refusal to excavation at 3.80m depth (Groundwater infiltration at 1.8m depth)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	94.46		
TOPSOIL 0.30									
Very stiff, brown **SILTY CLAY**		G	1						
		G	2			1	93.46		
- grey and with sand by 1.8m depth		G	3						∇
		G	4			2	92.46		
		G	5						
3.20		G	6			3	91.46		
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders 3.70		G	7						

End of Test Pit

Practical refusal to excavation at 3.70m depth

(Groundwater infiltration at 1.8m depth)

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	94.53	
TOPSOIL 0.30	■							
Very stiff, brown **SILTY CLAY** - grey-brown by 0.8m depth - grey by 1.4m depth 2.80	▨	G G G G G	1 2 3 4 5			1 2	93.53 92.53	∇
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders 3.80	^	G G	6 7			3	91.53	
End of Test Pit Practical refusal to excavation at 3.80m depth (Groundwater infiltration at 1.9m depth)								

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

○ **Water Content %**

20 40 60 80

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. **PG4216**

HOLE NO. **TP 9**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	97.18		
TOPSOIL 0.30	■								
Brown **SILTY SAND** with rootlets 0.60									
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders, some clay 1.80	^^^	G	1			1	96.18		
End of Test Pit Practical refusal to excavation at 1.80m depth (TP dry upon completion)									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP 9A

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	97.48		
TOPSOIL — 0.30									
Brown **SILTY SAND,** trace rootlets — 0.60									
GLACIAL TILL: Light brown to grey silty sand with clay, gravel, cobbles and boulders						1	96.48		
						2	95.48		
— 2.40									
End of Test Pit Practical refusal to excavation at 2.40m depth (TP dry upon completion)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

FILE NO. PG4216

REMARKS

HOLE NO. TP10

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	95.63		
TOPSOIL 0.35									
Very stiff, red-brown **SILTY CLAY,** some sand, trace organics 0.65		G	1						
GLACIAL TILL: Brown silty sand with gravel and sand 0.90		G	2						
End of Test Pit Practical refusal to excavation at 0.90m depth (TP dry upon completion)									

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

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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Eagleson Road at Ottawa St.
Ottawa, Ontario

DATUM Ground surface elevations were referenced to a geodetic datum.

REMARKS

BORINGS BY Hydraulic Shovel

DATE February 27, 2019

FILE NO. PG4216

HOLE NO. TP11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	94.45		
FILL: Sand with cobbles 0.25	▨								
GLACIAL TILL: Loose to compact, grey-brown silty sand with clay, gravel, cobbles and boulders	^^^					1	93.45		
		G	1						
		G	2						
						2	92.45		
		G	3						
		G	4						
2.80									
End of Test Pit Practical refusal to excavation at 2.80m depth (TP dry upon completion)									

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

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)

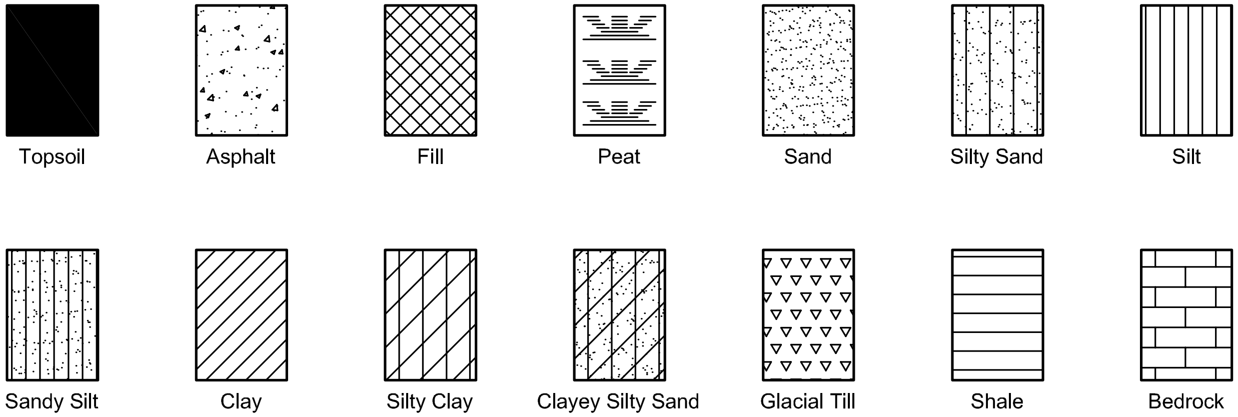
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

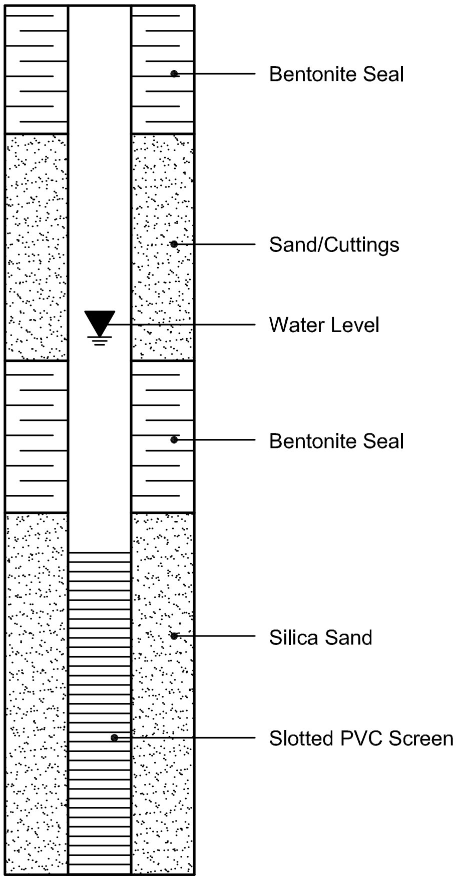
SYMBOLS AND TERMS (continued)

STRATA PLOT

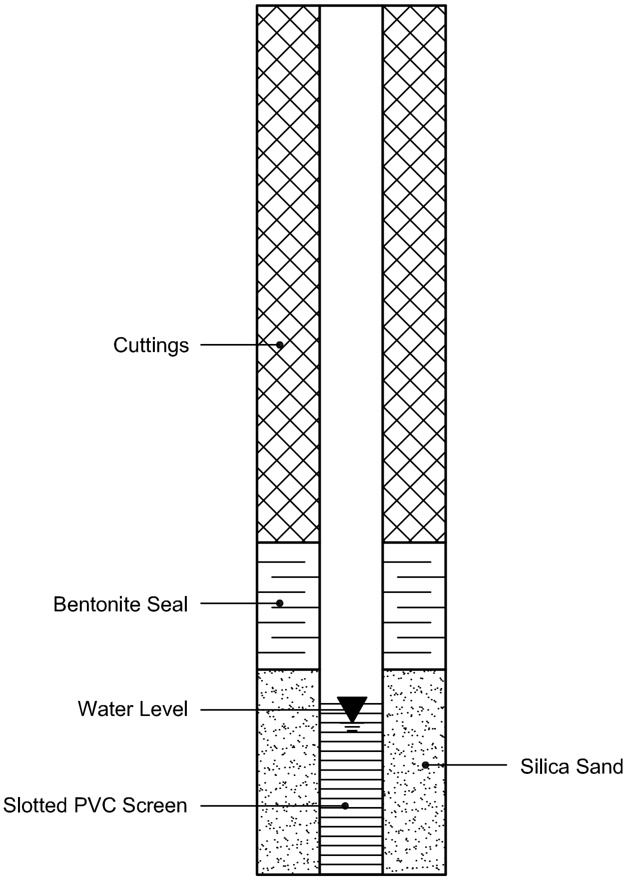


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 25710

Report Date: 27-Dec-2018

Order Date: 19-Dec-2018

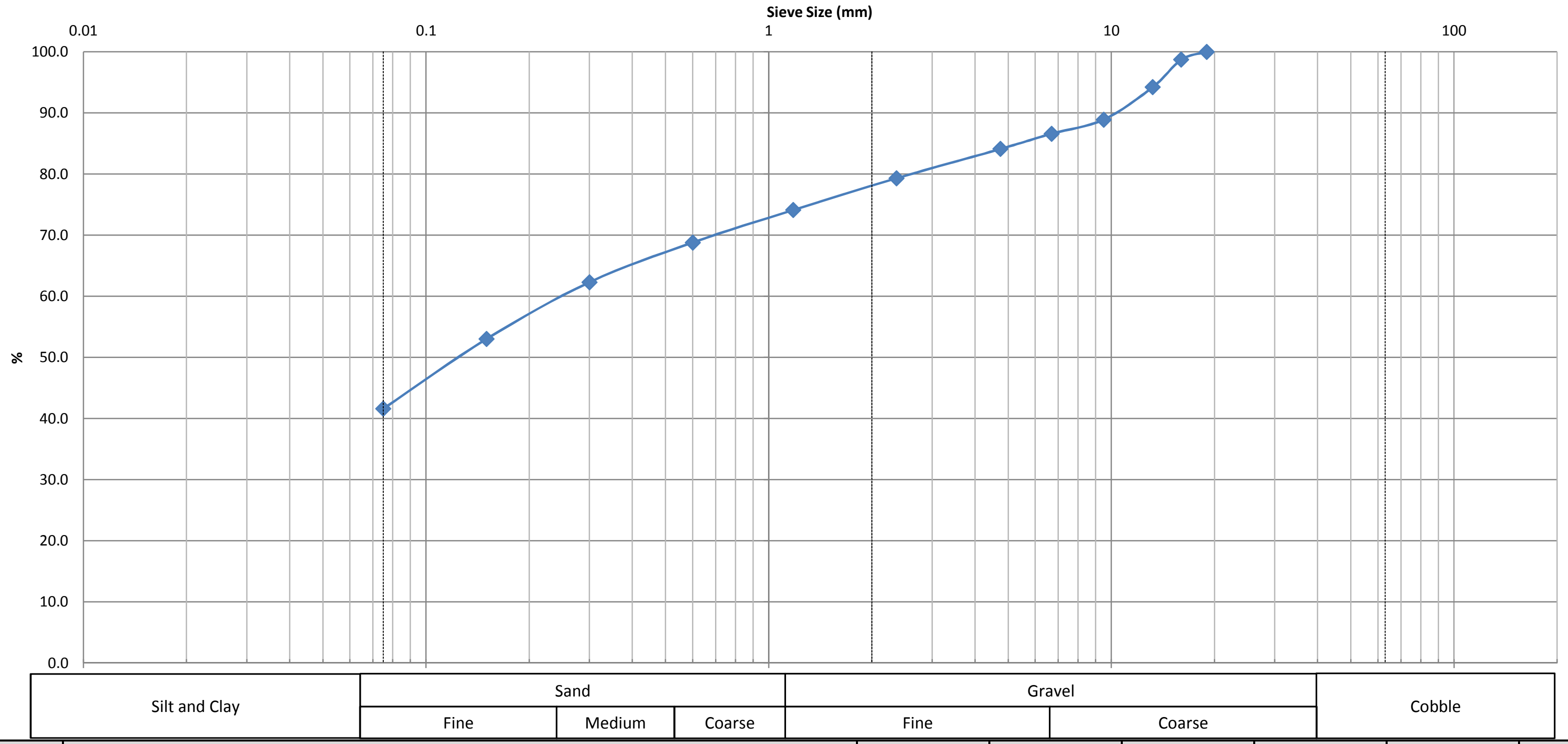
Project Description: PG4216

	Client ID:	BH8-SS3	-	-	-
	Sample Date:	12/17/2018 15:00	-	-	-
	Sample ID:	1851341-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	89.5	-	-	-
General Inorganics					
pH	0.05 pH Units	7.94	-	-	-
Resistivity	0.10 Ohm.m	96.9	-	-	-
Anions					
Chloride	5 ug/g dry	6	-	-	-
Sulphate	5 ug/g dry	<5	-	-	-

patersongroup
consulting engineers

SIEVE ANALYSIS
ASTM C136

CLIENT:	Taggart	DESCRIPTION:	Sand	FILE NO:	PG4216
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	06833
PROJECT:	Eagleson Rd.	INTENDED USE:	-	DATE RECEIVED:	1-Mar-19
		PIT OR QUARRY:	0	DATE TESTED:	4-Mar-19
DATE SAMPLED:	27-Feb-19	SOURCE LOCATION:	TP9 - G1	DATE REPORTED:	7-Mar-19
SAMPLED BY:	D.P	SAMPLE LOCATION:	-	TESTED BY:	D.K/D.B



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
									0.23	23.3
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)		Clay (%)	
	19.5	0.35	0.035	0.015	15.9	42.5	41.6			

Comments:

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

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Taggart	DESCRIPTION:	Sand	FILE NO.:	PG4216
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO.:	06833
PROJECT:	Eagleson Rd.	INTENDED USE:	-	DATE REC'D:	1-Mar-19
		PIT OR QUARRY:		DATE TESTED:	4-Mar-19
DATE SAMPLED:	27-Feb-19	SOURCE LOCATION:	TP9 - G1	DATE REP'D:	7-Mar-19
SAMPLED BY:	D.P	SAMPLE LOCATION:	-	TESTED BY:	D.K/D.B

WEIGHT BEFORE WASH	719.1
WEIGHT AFTER WASH	442.5

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150						
106						
75						
63						
53						
37.5						
26.5						
19	**0.0**	0.0	**100.0**			
16	**9.4**	1.3	**98.7**			
13.2	**41.8**	5.8	**94.2**			
9.5	**80.0**	11.1	**88.9**			
6.7	**96.4**	13.4	**86.6**			
4.75	**114.6**	15.9	**84.1**			
2.36	**148.6**	20.7	**79.3**			
1.18	**186.5**	25.9	**74.1**			
0.6	**224.6**	31.2	**68.8**			
0.3	**270.8**	37.7	**62.3**			
0.15	**337.8**	47.0	**53.0**			
0.075	**419.8**	58.4	**41.6**			
PAN	**441.6**					

SIEVE CHECK FINE	0.20	0.3% max.	**REFERENCE MATERIAL**

OTHER TESTS	RESULT	LAB NO.	RESULT

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

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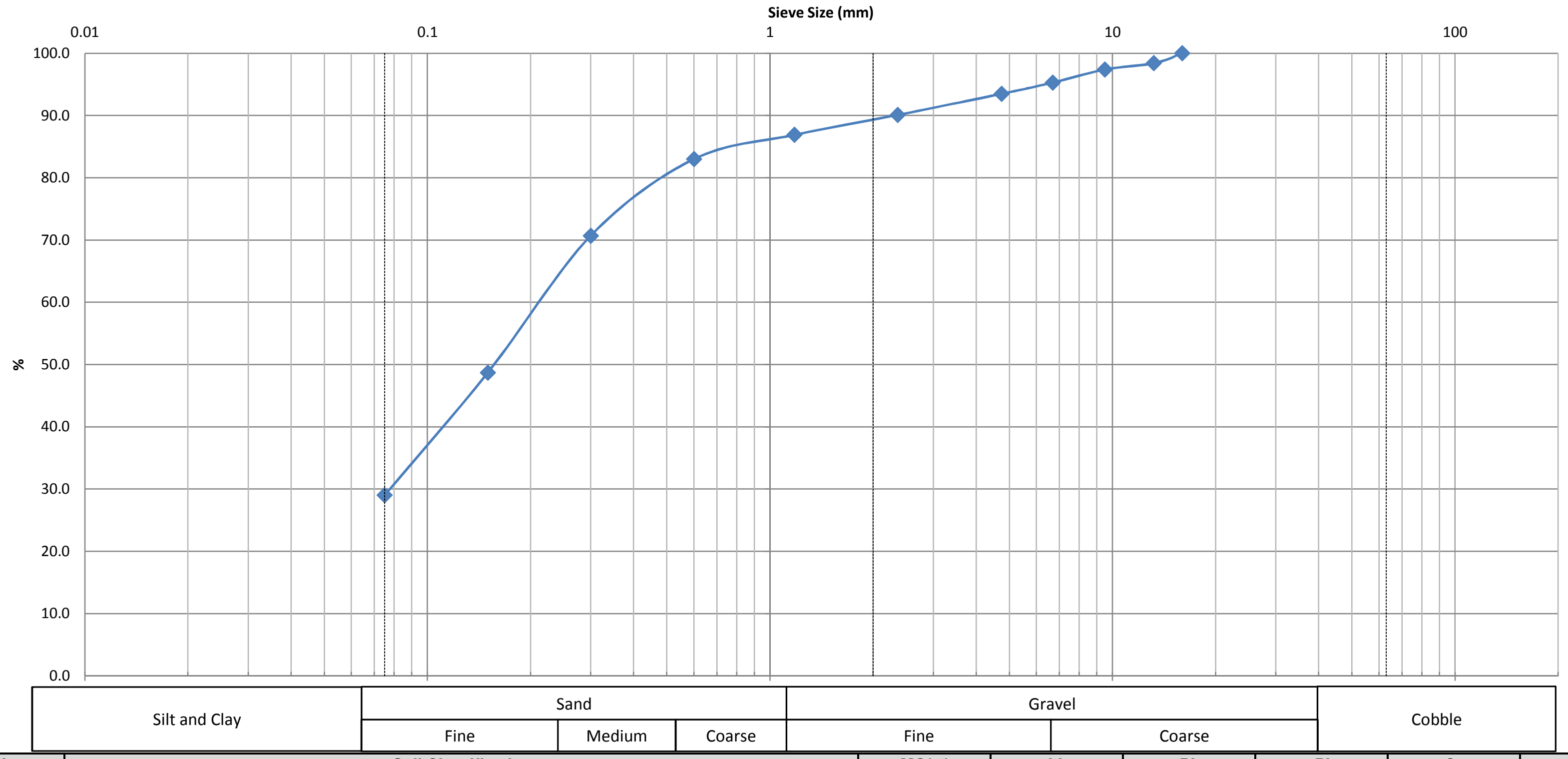
SIEVE ANALYSIS
ASTM C136

CLIENT:	Taggart	DESCRIPTION:	Sand	FILE NO:	PG4216
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	06834
PROJECT:	Eagleson Rd.	INTENDED USE:	-	DATE RECEIVED:	1-Mar-19
		PIT OR QUARRY:	0	DATE TESTED:	4-Mar-19
DATE SAMPLED:	27-Feb-19	SOURCE LOCATION:	TP11 - G4	DATE REPORTED:	7-Mar-19
SAMPLED BY:	D.P	SAMPLE LOCATION:	-	TESTED BY:	D.K/D.B



Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
						1.27	4.7

D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
17.5	0.15	0.078	0.032	6.5	64.5	29.0	

Comments:

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

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Taggart	DESCRIPTION:	Sand	FILE NO.:	PG4216
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO.:	06834
PROJECT:	Eagleson Rd.	INTENDED USE:	-	DATE REC'D:	1-Mar-19
		PIT OR QUARRY:		DATE TESTED:	4-Mar-19
DATE SAMPLED:	27-Feb-19	SOURCE LOCATION:	TP11 - G4	DATE REP'D:	7-Mar-19
SAMPLED BY:	D.P	SAMPLE LOCATION:	-	TESTED BY:	D.K/D.B

WEIGHT BEFORE WASH	846.2
WEIGHT AFTER WASH	644.5

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150						
106						
75						
63						
53						
37.5						
26.5						
19						
16	0.0	0.0	100.0			
13.2	13.8	1.6	98.4			
9.5	22.2	2.6	97.4			
6.7	39.9	4.7	95.3			
4.75	55.1	6.5	93.5			
2.36	84.0	9.9	90.1			
1.18	110.8	13.1	86.9			
0.6	144.2	17.0	83.0			
0.3	248.3	29.3	70.7			
0.15	434.4	51.3	48.7			
0.075	600.7	71.0	29.0			
PAN	643.6					
SIEVE CHECK FINE		0.14	0.3% max.			**REFERENCE MATERIAL**

OTHER TESTS	**RESULT**	**LAB NO.**	**RESULT**

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

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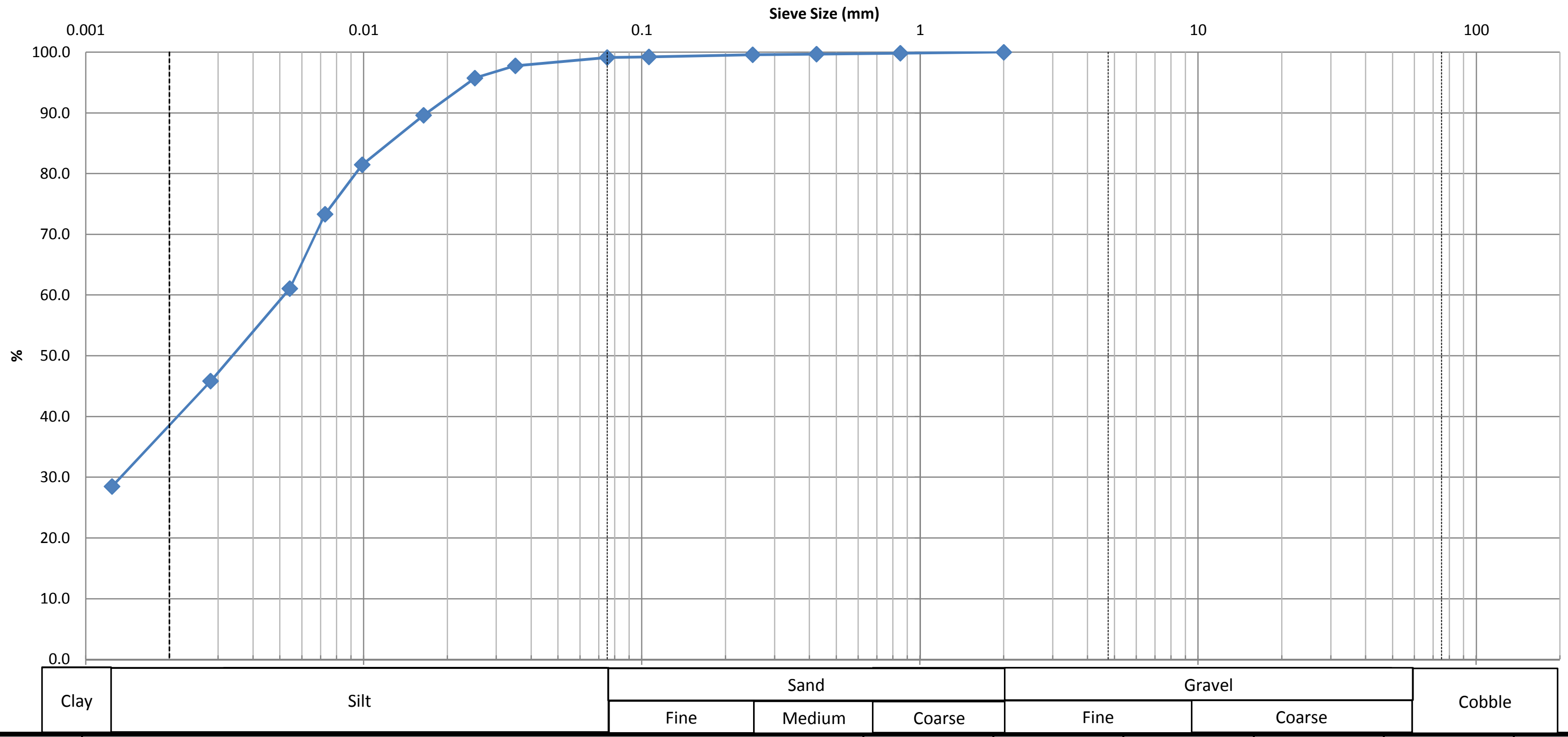
SIEVE ANALYSIS **ASTM C136**

CLIENT:	Taggart	DEPTH:	3.0m	FILE NO:	PG4216
CONTRACT NO.:		BH OR TP No.:	TP4 - G6	LAB NO:	06830
PROJECT:	Eagleson Road			DATE RECEIVED:	1-Mar-19
				DATE TESTED:	5-Mar-19
DATE SAMPLED:	27-Feb-19			DATE REPORTED:	7-Mar-19
SAMPLED BY:	Drew			TESTED BY:	D. Bertrand



Identification	**Soil Classification**				**MC(%)**	**LL**	**PL**	**PI**	**Cc**	**Cu**
					30.3					
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)		Clay (%)	
					0.0	0.9	59.6		39.5	

Comments:

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

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Taggart	DEPTH:	3.0m	FILE NO.:	PG4216
PROJECT:	Eagleson Road	BH OR TP No.:	TP4 - G6	DATE SAMPLED	27-Feb-19
LAB No. :	06830	TESTED BY:	D. Bertrand	DATE RECEIVE	01-Mar-19
SAMPLED BY:	Drew	DATE REPT'D:	07-Mar-19	DATE TESTED:	05-Mar-19

SAMPLE INFORMATION

SAMPLE MASS	SPECIFIC GRAVITY
111.7	2.700

		HYGROSCOPIC MOISTURE		
INITIAL WEIGHT	50.00			
WEIGHT CORRECTED	48.55	TARE WEIGHT	50.00	ACTUAL WEIGHT
WT. AFTER WASH BACK SIEVE	0.450	AIR DRY	150.00	100.00
SOLUTION CONCENTRATION	40 g/L	OVEN DRY	147.10	97.10
		CORRECTED	0.971	

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
13.2			
9.5			
4.75			
2.0	**0.1**	0.0	**100.0**
Pan	**111.6**		
0.850	**0.08**	0.2	**99.8**
0.425	**0.14**	0.3	**99.7**
0.250	**0.21**	0.4	**99.6**
0.106	**0.37**	0.8	**99.2**
0.075	**0.42**	0.9	**99.1**
Pan	**0.45**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (^{o}C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	9:53	54.0	6.0	22.0	0.0351	97.8	97.8
2	9:54	53.0	6.0	22.0	0.0251	95.7	95.7
5	9:57	50.0	6.0	22.0	0.0164	89.6	89.6
15	10:07	46.0	6.0	22.0	0.0099	81.5	81.5
30	10:22	42.0	6.0	22.0	0.0073	73.3	73.3
60	10:52	36.0	6.0	22.0	0.0054	61.1	61.1
250	14:02	28.5	6.0	22.0	0.0028	45.8	45.8
1440	9:52	20.0	6.0	22.0	0.0012	28.5	28.5

COMMENTS:

Moisture Content = 30.3%

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

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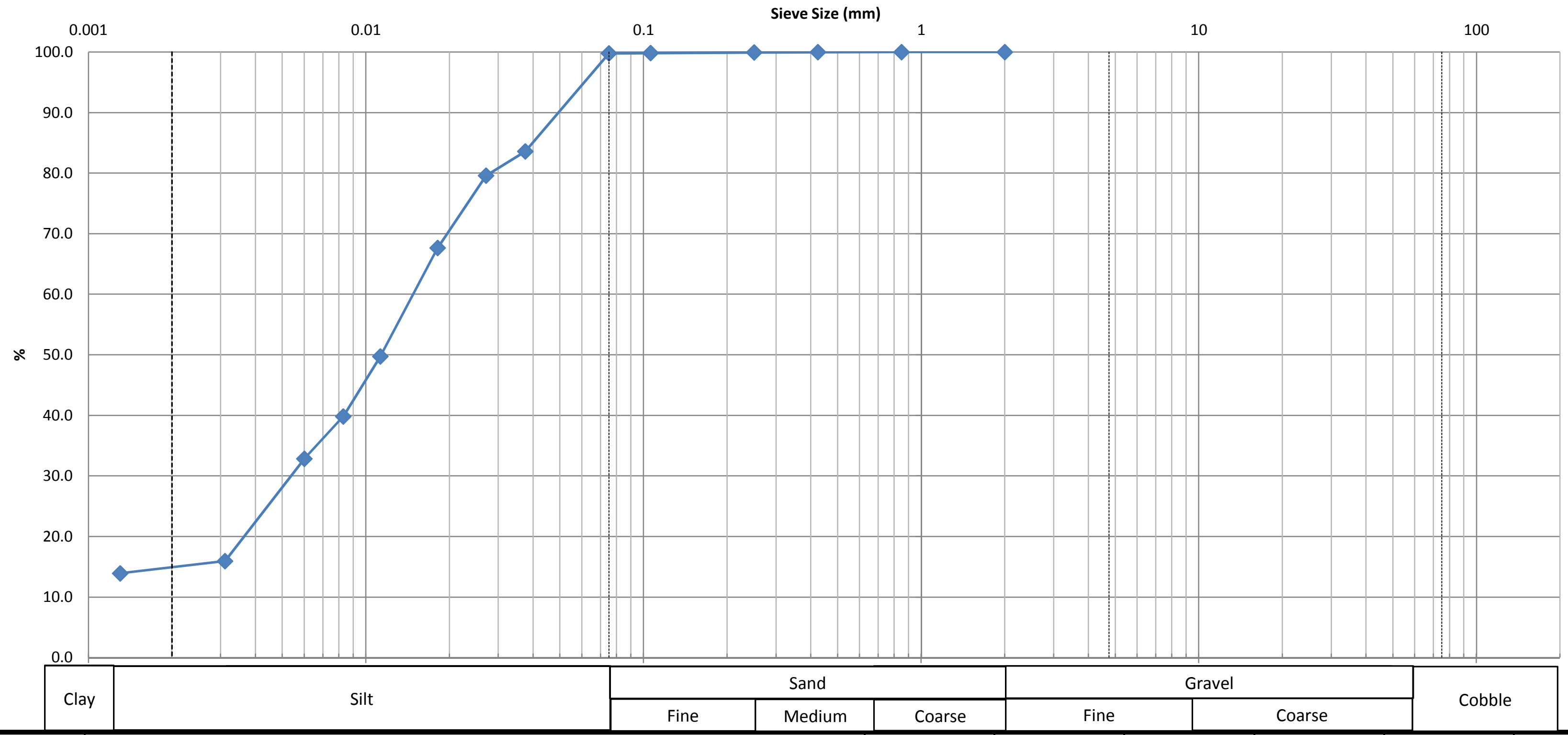
SIEVE ANALYSIS ASTM C136

CLIENT:	Taggart	DEPTH:	2.5m	FILE NO:	PG4216
CONTRACT NO.:		BH OR TP No.:	TP6 - G5	LAB NO:	06831
PROJECT:	Eagleson Road			DATE RECEIVED:	1-Mar-19
				DATE TESTED:	5-Mar-19
DATE SAMPLED:	27-Feb-19			DATE REPORTED:	7-Mar-19
SAMPLED BY:	Drew			TESTED BY:	D. Bertrand



Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
		21.6					

	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
					0.0	0.2	84.8	15.0

Comments:

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

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Taggart	DEPTH:	2.5m	FILE NO.:	PG4216
PROJECT:	Eagleson Road	BH OR TP No.:	TP6 - G5	DATE SAMPLEI	27-Feb-19
LAB No. :	06831	TESTED BY:	D. Bertrand	DATE RECEIVE	01-Mar-19
SAMPLED BY:	Drew	DATE REPT'D:	07-Mar-19	DATE TESTED:	05-Mar-19

SAMPLE INFORMATION

SAMPLE MASS	SPECIFIC GRAVITY
120.9	2.700

INITIAL WEIGHT	50.00	**HYGROSCOPIC MOISTURE**		
WEIGHT CORRECTED	49.68	TARE WEIGHT	50.00	ACTUAL WEIGHT
WT. AFTER WASH BACK SIEVE	0.120	AIR DRY	150.00	100.00
SOLUTION CONCENTRATION	40 g/L	OVEN DRY	149.35	99.35
		CORRECTED	0.994	

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
13.2			
9.5			
4.75			
2.0	**0.0**	0.0	**100.0**
Pan	**120.9**		
0.850	**0.00**	0.0	**100.0**
0.425	**0.01**	0.0	**100.0**
0.250	**0.04**	0.1	**99.9**
0.106	**0.09**	0.2	**99.8**
0.075	**0.11**	0.2	**99.8**
Pan	**0.12**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (^{o}C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	10:04	48.0	6.0	22.0	0.0375	83.6	**83.6**
2	10:05	46.0	6.0	22.0	0.0271	79.6	**79.6**
5	10:08	40.0	6.0	22.0	0.0181	67.7	**67.7**
15	10:18	31.0	6.0	22.0	0.0113	49.8	**49.8**
30	10:33	26.0	6.0	22.0	0.0083	39.8	**39.8**
60	11:03	22.5	6.0	22.0	0.0060	32.8	**32.8**
250	14:13	14.0	6.0	22.0	0.0031	15.9	**15.9**
1440	10:03	13.0	6.0	22.0	0.0013	13.9	**13.9**

COMMENTS:

Moisture Content = 21.6%

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

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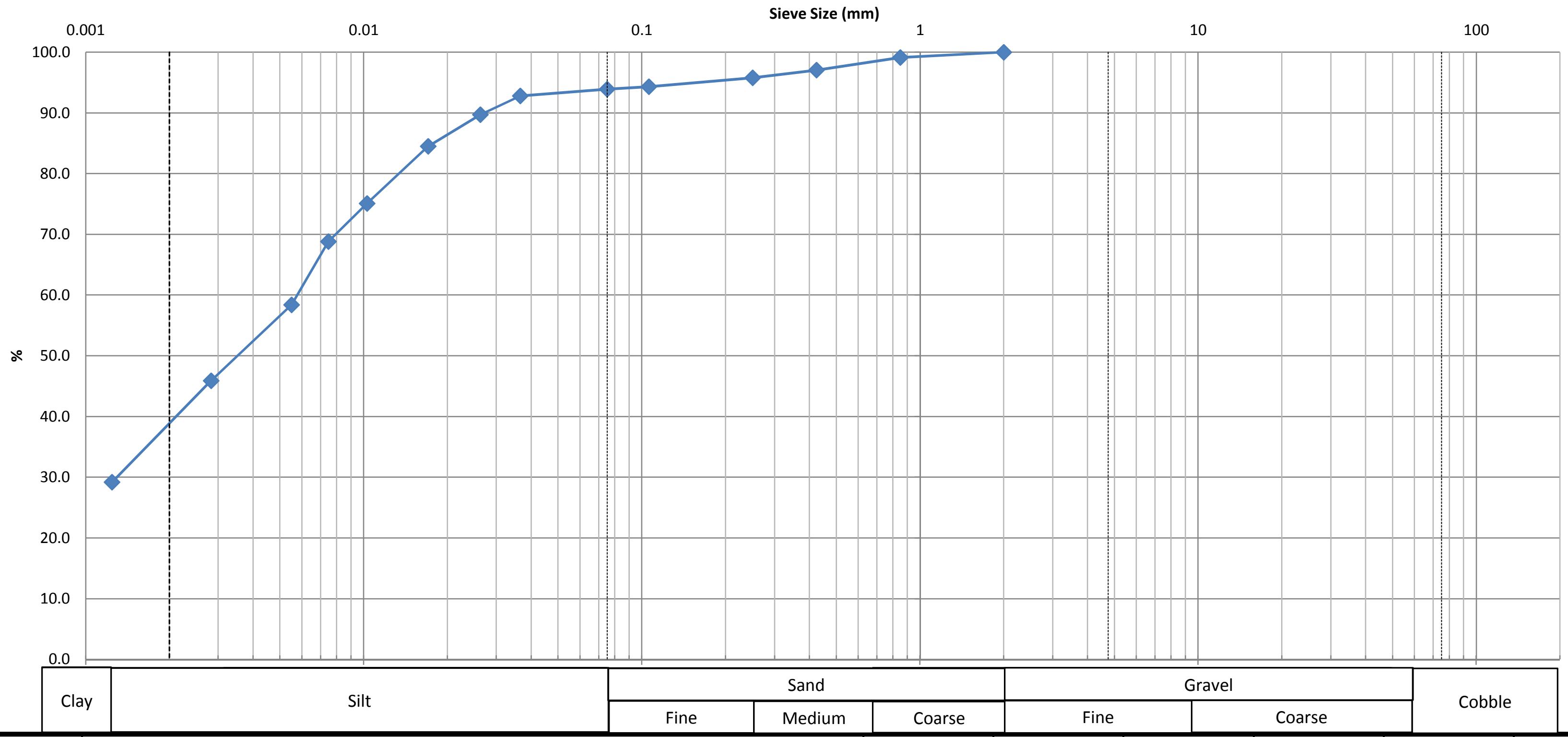
SIEVE ANALYSIS **ASTM C136**

CLIENT:	Taggart	DEPTH:	2.5m	FILE NO:	PG4216
CONTRACT NO.:		BH OR TP No.:	TP8 - G5	LAB NO:	06832
PROJECT:	Eagleson Road			DATE RECEIVED:	1-Mar-19
				DATE TESTED:	5-Mar-19
DATE SAMPLED:	27-Feb-19			DATE REPORTED:	7-Mar-19
SAMPLED BY:	Drew			TESTED BY:	D. Bertrand



Identification	**Soil Classification**					**MC(%)**	**LL**	**PL**	**PI**	**Cc**	**Cu**
						29.9					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
					0.0	6.1		54.4		39.5	

Comments:

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

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Taggart	DEPTH:	2.5m	FILE NO.:	PG4216
PROJECT:	Eagleson Road	BH OR TP No.:	TP8 - G5	DATE SAMPLED	27-Feb-19
LAB No. :	06832	TESTED BY:	D. Bertrand	DATE RECEIVE	01-Mar-19
SAMPLED BY:	Drew	DATE REPT'D:	07-Mar-19	DATE TESTED:	05-Mar-19

SAMPLE INFORMATION

SAMPLE MASS	SPECIFIC GRAVITY
108.4	2.700

INITIAL WEIGHT	50.00	HYGROSCOPIC MOISTURE		
WEIGHT CORRECTED	47.40	TARE WEIGHT	50.00	ACTUAL WEIGHT
WT. AFTER WASH BACK SIEVE	2.910	AIR DRY	150.00	100.00
SOLUTION CONCENTRATION	40 g/L	OVEN DRY	144.80	94.80
		CORRECTED	0.948	

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
13.2				
9.5				
4.75				
2.0		**0.0**	0.0	**100.0**
Pan		**108.4**		
0.850		**0.42**	0.9	**99.1**
0.425		**1.39**	2.9	**97.1**
0.250		**2.00**	4.2	**95.8**
0.106		**2.69**	5.7	**94.3**
0.075		**2.87**	6.1	**93.9**
Pan		**2.91**		
SIEVE CHECK	0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (^{o}C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	10:16	50.5	6.0	22.0	0.0365	92.8	**92.8**
2	10:17	49.0	6.0	22.0	0.0262	89.7	**89.7**
5	10:20	46.5	6.0	22.0	0.0170	84.5	**84.5**
15	10:30	42.0	6.0	22.0	0.0103	75.1	**75.1**
30	10:45	39.0	6.0	22.0	0.0075	68.8	**68.8**
60	11:15	34.0	6.0	22.0	0.0055	58.4	**58.4**
250	14:25	28.0	6.0	22.0	0.0028	45.9	**45.9**
1440	10:15	20.0	6.0	22.0	0.0012	29.2	**29.2**

COMMENTS:

Moisture Content = 29.9%

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

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4216-2 - TEST HOLE LOCATION PLAN

DRAWING PG4216-3 - PERMISSIBLE GRADE RAISE PLAN

FIGURE 1

Key Plan

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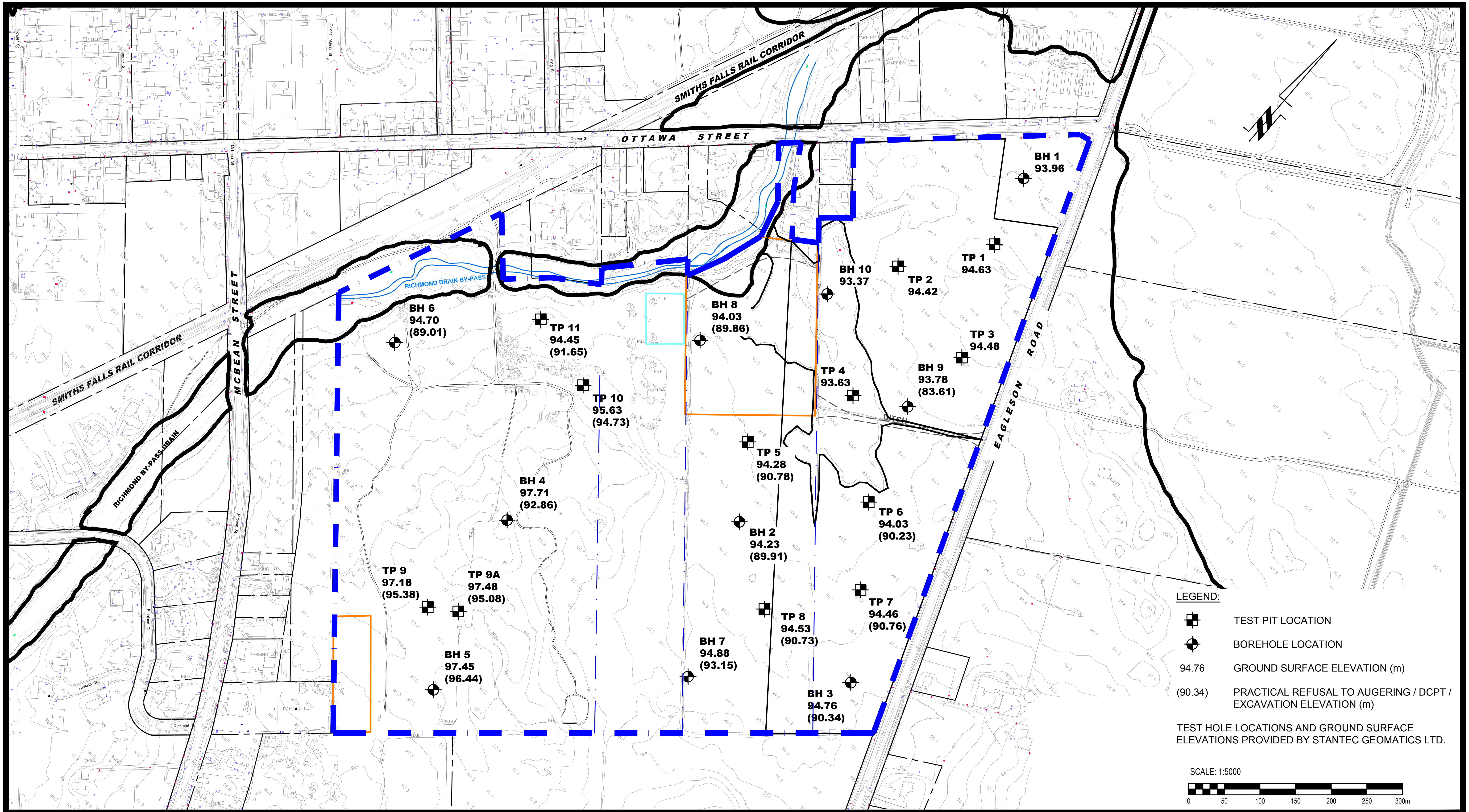

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NO.	REVISIONS	DATE	INITIAL
1	NEW TEST PITS ADDED	28/03/2019	DP

TAGGART GROUP OF COMPANIES

GEOTECHNICAL INVESTIGATION
PROP. MULTI-USE DEVELOPMENT - EAGLESON ROAD AT OTTAWA STREET
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:5000
Date: 01/2019
Drawn by: MPG
Report No.: PG4216
Checked by: DG
Dwg. No.: PG4216-2
Approved by: DG
Revision No.: 1

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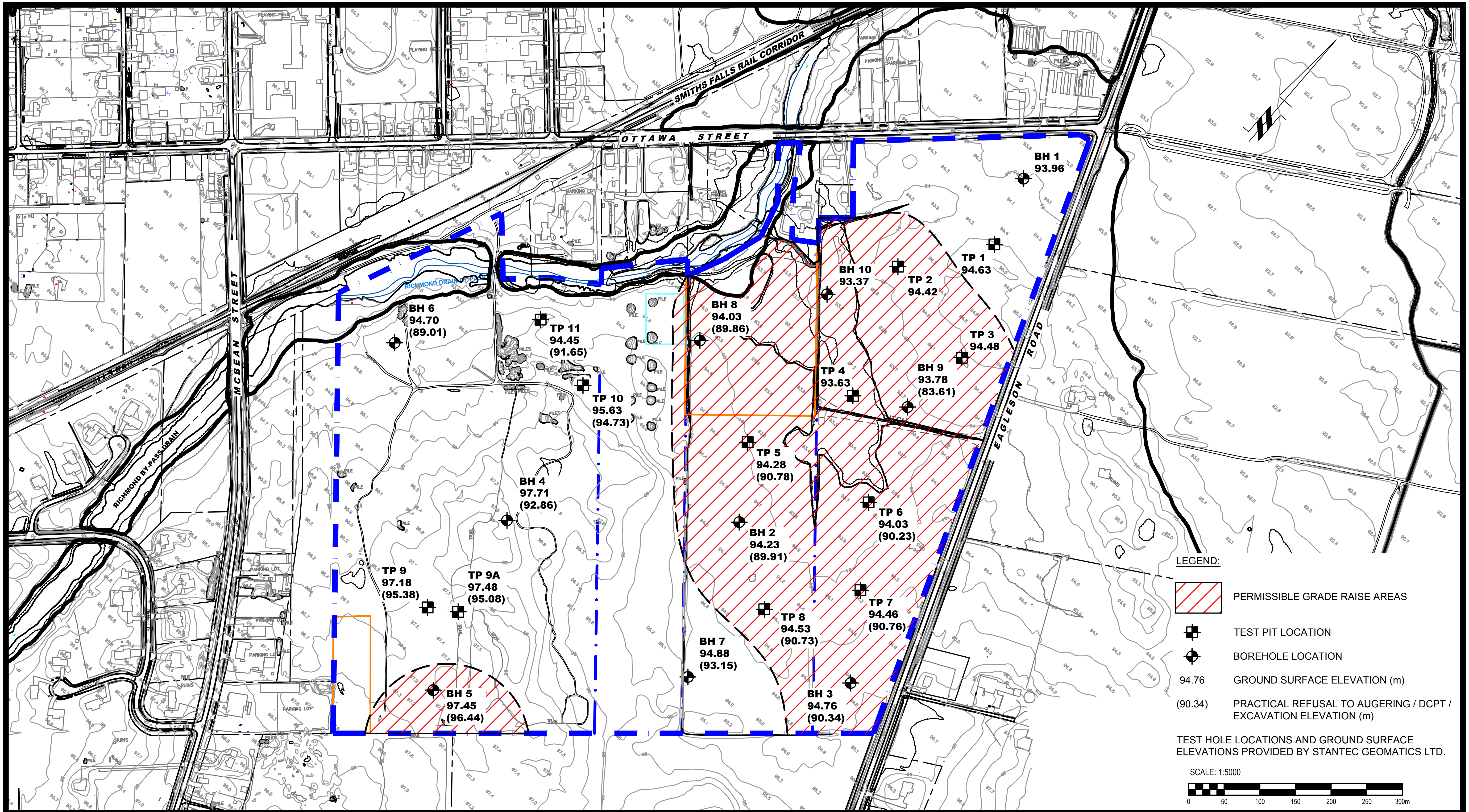

LEGEND:

▨	PERMISSIBLE GRADE RAISE AREAS
⊞	TEST PIT LOCATION
⊕	BOREHOLE LOCATION
94.76	GROUND SURFACE ELEVATION (m)
(90.34)	PRACTICAL REFUSAL TO AUGERING / DCPT / EXCAVATION ELEVATION (m)

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY STANTEC GEOMATICS LTD.

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Ottawa, Ontario K2E 7J5
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NO.	REVISIONS	DATE	INITIAL
1	NEW TEST PITS ADDED	28/03/2019	DP

TAGGART GROUP OF COMPANIES
GEOTECHNICAL INVESTIGATION
PROP. MULTI-USE DEVELOPMENT - EAGLESON ROAD AT OTTAWA STREET
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Title:
PERMISSIBLE GRADE RAISE PLAN

Scale: 1:5000
Date: 01/2019
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Dwg. No.: PG4216-3
Approved by: DG
Revision No.: 1

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