Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

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Geotechnical Investigation

Proposed Sort Facility
Upper Canada Street at Palladium Drive
Ottawa, Ontario

Prepared For

Purolator Inc.

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

January 31, 2020

Report: PG4783-1
Revision 1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Purolator Inc. to conduct a geotechnical investigation for the proposed sort facility to be located at Blocks 26, 27, and 30 of the Kanata West Business Park. The subject site is located northwest of the intersection of Upper Canada Street and Palladium Drive in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the geotechnical investigation were to:

❏ determine the subsoil and groundwater conditions at this site by means of boreholes.

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

2.0 Proposed Development

Based on the available drawings, it is our understanding that the proposed sort facility will consist of a single-storey, slab-on-grade structure located within the central portion of the site with an approximate footprint of 5,600 m^2. Asphalt-paved access lanes and parking areas with landscaped margins are also proposed surrounding the structure.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the geotechnical investigation was carried out on January 3 and 4, 2019. At that time, a total of 9 boreholes were advanced to a maximum depth of 6 m below the existing ground surface. The boreholes were distributed in a manner to provide general coverage of the proposed development taking into consideration existing site features and underground utilities. A previous geotechnical investigation also included 4 boreholes (BH 4, BH 5, BH 14, and BH 15) completed at, or in the vicinity of, the subject site. The locations of the test holes are shown on Drawing PG4783-1 - Test Hole Location Plan included in Appendix 2.

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

A field investigation program was also completed at the subject site by others on October 29, 2018, consisting of a total of 5 boreholes advanced to a maximum depth of 6.9 m below the existing ground surface. The borehole logs prepared by others are provided in Appendix 1.

Sampling and In Situ Testing

Soil samples were recovered using a 50 mm diameter split-spoon sampler or from the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are shown as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

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

Undrained shear strength testing, 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

Flexible piezometers were installed in the boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one 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. The ground surface elevations at the borehole locations were referenced to a temporary benchmark (TBM), consisting of the top spindle of a fire hydrant located at the north end of Palladium Drive with a geodetic elevation of 105.51 m, based on topographic interpolation of available plans. The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG4783-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the boreholes and visually examined in our laboratory to review the field logs.

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 sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site consists of a former agricultural field which is bordered by Palladium Drive to the east, Upper Canada Street to the south, a vacant property to the west, and an agricultural property to the north. The site is undeveloped with fill piles, up to 3 m high, located across the site.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test hole locations consists of an approximate 0.2 to 0.3 m thick topsoil layer underlain by a deposit of silty clay to clayey silt. However, at boreholes BH 2-19 and BH 3-19, which were completed on the existing fill piles and are above the surrounding grade, an approximate 4.4 and 1.8 m thickness of fill was encountered, respectively. The fill was generally observed to consist of a brown silt with some sand and trace roots.

The silty clay to clayey silt deposit encountered underlying the fill and/or topsoil was noted to be of a very stiff to firm consistency and was observed to extend to approximate depths of 1.5 to 4.6 m below the existing ground surface.

Underlying the silty clay to clayey silt, a layer of loose to compact, brown to grey sandy silt to silt with occasional sand and gravel was encountered, which extended to the bedrock surface.

Practical refusal to augering was encountered within the borehole locations at approximate depths of 5.3 to 6.9 m below existing ground surface.

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, bedrock in the area of the subject site consists of interbedded limestone and shale of the Verulam Formation with overburden drift thickness between 5 to 10 m depth.

Laboratory Testing

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

Table 1 - Summary of Grain Size Distribution Analysis

Test Hole	Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 1	5'-7'	0.4	6.7	40.6	52.1
BH 3	10'-12'	0.4	23.8	68.8	7
BH 4	5'-7'	0.5	2.5	90	7
BH 6-19	2'6"-8'6"	0	6.7	43.8	49.5
BH 7-19	0'-2'	0	8	42	50

4.3 Groundwater

Groundwater levels were measured in the boreholes on January 8, 2019. The measured groundwater level (GWL) readings are presented in Table 1 below and on the Soil Profile and Test Data sheets in Appendix 1. It is important to note that groundwater readings at the piezometers can be influenced by water perched within the borehole backfill material. The long-term groundwater level can also be estimated based on the observed colour and consistency of the recovered soil samples. Therefore, it is estimated that the long-term groundwater table can be expected between 2 to 3 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Table 2 - Measured Groundwater Levels

Test Hole Location	Ground Surface Elevation (m)	Groundwater Level		Date
		Depth (m)	Elevation (m)	
BH 1-19	104.80	1.74	103.06	January 8, 2019
BH 2-19	107.10	1.61	105.49	January 8, 2019
BH 3-19	105.56	1.91	103.65	January 8, 2019
BH 4-19	104.49	1.08	103.41	January 8, 2019
BH 5-19	104.72	0.95	103.77	January 8, 2019
BH 6-19	104.54	1.12	103.42	January 8, 2019
BH 7-19	103.49	0.61	102.88	January 8, 2019
BH 8-19	103.64	1.00	102.64	January 8, 2019
BH 9-19	103.59	1.26	102.33	January 8, 2019

Note: - The ground surface elevations are referenced to a temporary benchmark (TBM), consisting of the top spindle of the fire hydrant located at the north end of Palladium Drive with a geodetic elevation of 105.51 m, based on topographic interpolation of available plans.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed building. It is recommended that the proposed building be constructed with conventional shallow foundations bearing on an undisturbed, stiff silty clay to clayey silt bearing surface.

Where topsoil or fill is encountered at the underside of footing, it should be sub-excavated to the surface of the undisturbed, stiff silty clay to clayey silt surface and replaced with engineered fill or lean concrete to the proposed founding elevation. The lateral limits of the engineered fill or lean concrete placement should be in accordance with our lateral support recommendations provided herein.

Due to the presence of a silty clay to clayey silt deposit, permissible grade raise restrictions are recommended for this site. The existing fill piles noted across the site should be further assessed to determine if the fill material is suitable for reuse as part of the proposed development.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill within the proposed building footprint, free of deleterious material and significant amounts of organics, can be left in place below the proposed building footprint outside of lateral support zones for the footings provided the following program is successfully completed. It is recommended that the existing fill layer be proof-rolled several times and approved by Paterson personnel at the time of construction. Any poor performing areas noted during the proof-rolling operation should be removed and replaced with an approved engineered fill.

Fill Placement

Fill used for grading beneath the proposed building footprint, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications, (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It 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 building area should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Site excavated soil can be used as general landscaping fill where the 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 these materials are to be used to build up the subgrade level for the areas to be paved, they should be compacted in thin lifts to minimum density of 95% of their respective SPMDD. Site excavated soils are not suitable for use as backfill against foundation walls due to the frost heave potential of the site excavated soils below settlement sensitive areas, such as concrete sidewalks and exterior concrete entrance areas.

Fill used for grading beneath the base and subbase layers of paved areas should consist, unless otherwise specified, of clean imported granular fill, such as OPSS Granular A, Granular B Type II or select subgrade material. This material should be test 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 paved areas should be compacted to at least 95% of its SPMDD.

Lean Concrete Filled Trenches

As an alternative to placing engineered fill, where required, consideration should be given to excavating vertical trenches to the undisturbed, stiff silty clay to clayey silt surface, and backfilling with lean concrete to the founding elevation (minimum **17 MPa** 28-day compressive strength). Typically, the excavation side walls will be used as the form to support the concrete. The trench excavation should be at least 150 mm wider than all sides of the footing (strip and pad footings) at the base of the excavation. The additional width of the concrete poured against an undisturbed trench sidewall will suffice in providing a direct transfer of the footing load to the underlying stiff silty clay to clayey silt. Once the trench excavation is approved by the geotechnical engineer, lean concrete can be poured up to the proposed founding elevation.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, stiff silty clay to clayey silt bearing surface, or on engineered fill or lean concrete placed directly over the undisturbed, stiff silty clay to clayey silt, can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**.

A geotechnical resistance factor of 0.5 was applied to the reported bearing resistance value at ULS.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Footings placed on a soil bearing surface and designed using the bearing resistance values at SLS given above 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 a stiff silty clay to clayey silt above the groundwater table 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 of the same or higher capacity as the bearing medium soil.

Permissible Grade Raise

Due to the presence of the silty clay to clayey silt deposit, a permissible grade raise restriction of **2.0 m** is recommended for grading at the subject site.

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.

5.4 Design for Earthquakes

Shear wave velocity testing was completed for the subject site to accurately determine the applicable seismic site classification for the proposed building in accordance with Table 4.1.8.4.A of the Ontario Building Code 2012. The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided in Figures 2 and 3 in Appendix 2.

Field Program

The seismic array testing location was placed within the southeast portion of the site in an approximate east-west direction as presented in Drawing PG4783-1, attached to the present report. Paterson field personnel placed 24 horizontal 4.5 Hz geophones mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 3 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a computer laptop and a hammer trigger switch attached to a 12 pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between four (4) to eight (8) times at each shot location to improve signal to noise ratio. The shot locations are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were 3, 4.5 and 30 m away from the first geophone, 3, 4.5 and 15 m away from the last geophone and at the centre of the seismic array.

Data Processing and Interpretation

Interpretation of the shear wave velocity results was completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is repeated at each shot location to provide an average shear wave velocity, Vs_{30}, of the upper 30 m profile immediately below the proposed building foundations. The layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location.

The bedrock velocity was interpreted using the main refractor wave velocity, which is considered a conservative estimate of the bedrock shear wave velocity due to the increasing quality of bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

Based on the test results, the average overburden shear wave velocity is **172 m/s**. Through interpretation, the bedrock shear wave velocity is **2,685 m/s**.

The Vs_{30} was calculated using the standard equation for average shear wave velocity provided in the OBC 2012, and as presented below.

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$

$$V_{s30} = \frac{30m}{\left(\frac{4m}{172m/s} + \frac{26m}{2{,}685m/s}\right)}$$

$$V_{s30} = 911m/s$$

Based on the results of the seismic shear wave velocity testing, the average shear wave velocity, Vs_{30}, was calculated to be **911 m/s** for an anticipated underside of footing at approximate geodetic elevation 103.5 m. Although this average shear wave velocity is sufficient for a Site Class B, as per Note 1 of Table 4.1.8.4.A of the OBC 2012, “site Classes A and B, hard rock and rock are not to be used if there is more than 3 m of softer materials between the rock and the underside of footing or mat foundations.” Therefore, for the anticipated underside of footing elevation noted above, a **Site Class C** is applicable for design of the proposed building.

However, if the underside of footing is located at or below geodetic elevation 102 m, or is supported on lean concrete trenches which extend to geodetic elevation 102 m, which is within 3 m of the bedrock surface, a **Site Class B** would be applicable for design of the proposed building. The soils underlying the subject site are not susceptible to liquefaction.

5.5 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the existing fill approved by the geotechnical consultant at the time of excavation as per Subsection 5.2, or undisturbed, native soil will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction.

It is recommended that the upper 200 mm of sub-floor fill consist of OPSS Granular A crushed stone. All backfill materials required to raise grade 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 Design

Car only parking areas, access lanes and heavy truck parking areas are anticipated at this site. The proposed pavement structures are shown in Tables 3 and 4.

Table 3 - Recommended Pavement Structure - Car Only Parking Areas

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

Table 4 - Recommended Pavement Structure
Access Lanes and Heavy Truck Parking Areas

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

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

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% 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 impervious nature 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.

5.7 Percolation Rates

Infiltration galleries are anticipated to be located beneath the asphaltic parking areas within the subject site. Paterson has completed a detailed hydrogeological investigation of the lands south of the subject site as part of previous phases of the Kanata West Business Park in order to establish hydraulic conductivity and percolation time of in-situ materials.

Varying strata at the base of the galleries will be encountered during the installation and will affect the rate of stormwater infiltration into the underlying material. The calculations for the infiltration galleries should be reviewed to correspond with the appropriate percolation rates given the appropriate strata. The percolation rate was interpreted from the hydraulic conductivity which was estimated based on the range of grain size distribution for the proposed development area. Based on these values, the average percolation rate (T-Time) was estimated to be within the ranges in Table 5.

Table 5 - Estimated Percolation Rates

Material	Hydraulic Conductivity - k (m/sec)	Percolation (T-time) - (mins/cm)
Silty Clay [1]	**3×10^{-6} to 1×10^{-10}**	**35 to 50+**
Silty Fine Sand / Sandy Silt [1]	**1×10^{-7} to 1×10^{-8}**	**20 to 50**

[1] - Values are based upon site specific testing carried out at a nearby phase of the development

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 structure. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the catch basins or running drainage ditches.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material. 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. A drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system is recommended.

6.2 Protection of Footings and Slabs 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 and loading docks, 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. It is recommended that the geotechnical consultant review the proposed frost protection detail for the loading dock footings.

6.3 Excavation Side Slopes

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

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. Excavations below the groundwater level should be cut back at a maximum slope of 1.5H:1V. 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.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within the firm grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm as directed by the geotechnical consultant at the time of construction. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of its SPMDD. The bedding material should extend at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of its SPMDD.

It should generally be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

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 (in the trench direction) 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 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

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.

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, 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 a moderate to slightly aggressive corrosive environment.

6.8 Tree Planting Restrictions

Given that the proposed building will be a slab-on-grade structure, the underside of footing is expected at a maximum depth of 1.5 m. As such, the silty clay which was encountered 3 to 3.5 m below design footing level was very stiff to stiff and should be considered low to medium sensitivity, and should not be considered a sensitive marine clay.

Tree planting setback limits may therefore be reduced to 4.5 m for small trees (mature tree height up to 7.5 m) and medium size trees (mature tree height 7.5 m to 14 m). It should be noted that shrubs and other small planting are permitted within the 4.5 m setback area.

It is documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils which 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 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 the following material testing and observation program be performed by the geotechnical consultant.

- ❏ Review the grading plan from a geotechnical perspective, once 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 the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available and to review our recommendations when the drawings and specifications are complete.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our 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 Purolator Inc. or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
Jan. 31, 2020
S. S. DENNIS
100519516
PROVINCE OF ONTARIO

Scott S. Dennis, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Purolator Inc. (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE & TEST DATA SHEETS

SYMBOLS AND TERMS

SOIL PROFILE & TEST DATA SHEETS BY OTHERS

GRAIN SIZE DISTRIBUTION ANALYSIS RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers	SOIL PROFILE AND TEST DATA
154 Colonnade Road South, Ottawa, Ontario K2E 7J5	Geotechnical Investigation Prop. Sort Facility - Upper Canada St. @ Palladium Dr. Ottawa, Ontario

DATUM / REMARKS TBM - Top spindle of fire hydrant located at the north end of Palladium Drive, with a geodetic elev. of 105.51 based on topographic interpolation of available plans.

FILE NO. PG4783

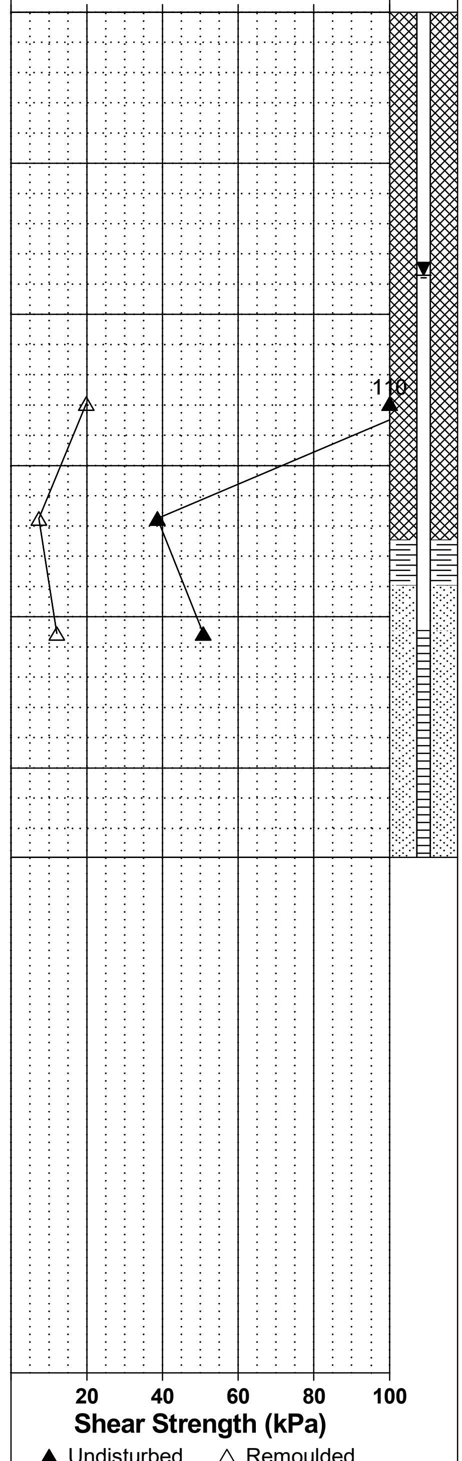
HOLE NO. BH 1-19

BORINGS BY CME-55 Low Clearance Drill **DATE** 2019 January 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.80
FILL: Topsoil, trace clay		AU	1				
0.60							
Very stiff, brown **SILTY CLAY**		SS	2	67	5	1	103.80
		SS	3	96	5	2	102.80
3.05						3	101.80
Brown **SILT,** trace clay and sand - grey by 3.8m depth						4	100.80
4.57							
Very loose, grey **SANDY SILT,** trace gravel		SS	4	96	3	5	99.80
		SS	5	100	50+		
5.59							
End of Borehole Practical refusal to augering at 5.59m depth (GWL @ 1.74m - Jan. 8, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Sort Facility - Upper Canada St. @ Palladium Dr.
Ottawa, Ontario

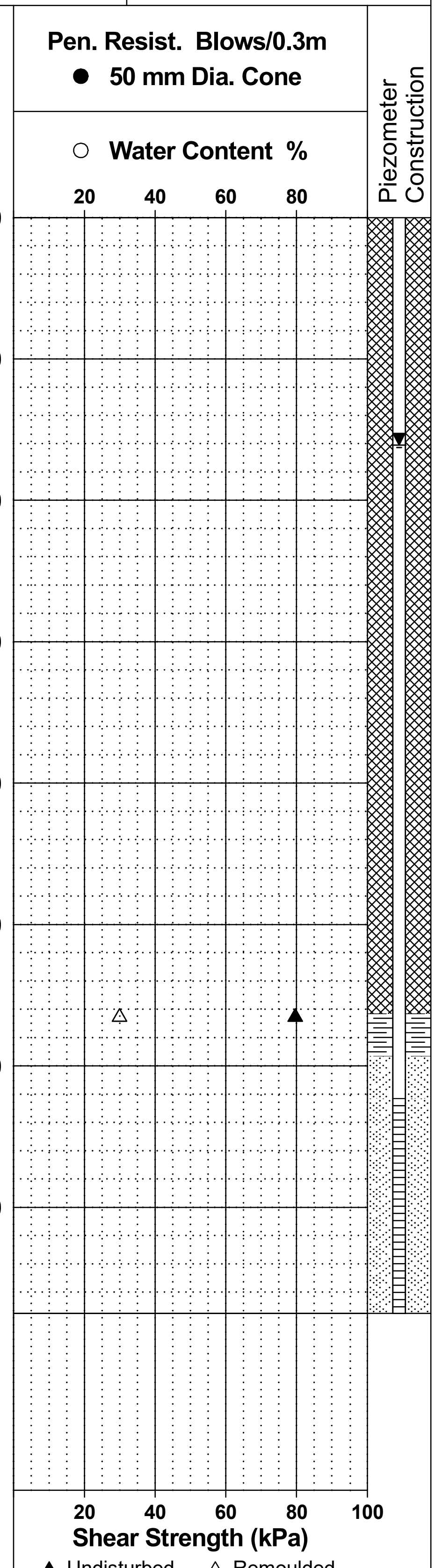
DATUM / REMARKS TBM - Top spindle of fire hydrant located at the north end of Palladium Drive, with a geodetic elev. of 105.51 based on topographic interpolation of available plans.

FILE NO. PG4783

HOLE NO. BH 2-19

BORINGS BY CME-55 Low Clearance Drill **DATE** 2019 January 4

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
FILL PILE SURFACE					0	107.10
FILL: Brown silt, some sand and roots	AU	1				
					1	106.10
	SS	2	54	3		
					2	105.10
3.05					3	104.10
FILL: Grey sandy silt, trace gravel and roots	SS	3	4	11		
	SS	4	4	8	4	103.10
4.42						
Loose, grey **SANDY SILT,** trace clay	SS	5	4	5	5	102.10
					6	101.10
	SS	6	75	9		
					7	100.10
	SS	7	71	6		
7.75	SS	8	100	50+		
End of Borehole Practical refusal to augering at 7.75m depth (GWL @ 1.61m - Jan. 8, 2019)						



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SOIL PROFILE AND TEST DATA

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REMARKS

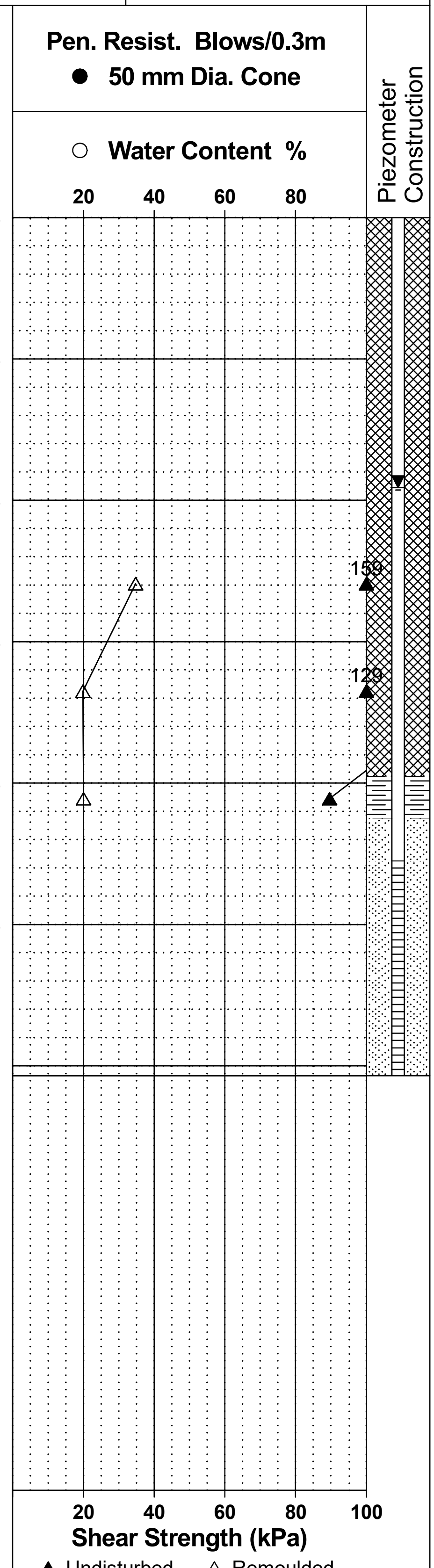
BORINGS BY CME-55 Low Clearance Drill

DATE 2019 January 4

FILE NO. PG4783

HOLE NO. BH 3-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
FILL PILE SURFACE						0	105.56
FILL: Brown silt, trace to some clay, trace sand and roots.		AU	1			1	104.56
1.83		SS	2	29	4	2	103.56
Very stiff to stiff, brown **CLAYEY SILT**						3	102.56
						4	101.56
4.57		SS	3	79	15	5	100.56
Compact to loose, brown **SANDY SILT**		SS	4	50	5		
6.07						6	99.56
End of Borehole							
Practical refusal to augering at 6.07m depth							
(GWL @ 1.91m - Jan. 8, 2019)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

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Prop. Sort Facility - Upper Canada St. @ Palladium Dr.
Ottawa, Ontario

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REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE 2019 January 3

FILE NO. PG4783

HOLE NO. BH 4-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.49
TOPSOIL 0.36		AU	1				
Very stiff to stiff, brown **CLAYEY SILT**		SS	2	12	12	1	103.49
		SS	3	71	12	2	102.49
2.90		SS	4	71	8		
End of Borehole							
(GWL @ 1.08m - Jan. 8, 2019)							

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
Prop. Sort Facility - Upper Canada St. @ Palladium Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the north end of Palladium Drive, with a geodetic elev. of 105.51 based on topographic interpolation of available plans.

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE 2019 January 3

FILE NO. PG4783

HOLE NO. BH 5-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.72
TOPSOIL (0.41)		AU	1				
Stiff, brown **CLAYEY SILT** (1.50)		SS	2	75	8	1	103.72
Loose to dense, brown **SANDY SILT,** some clay (2.90)		SS	3	71	11	2	102.72
		SS	4	88	35		
End of Borehole							

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

○ Water Content %

20 40 60 80

Piezometer Construction

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

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SOIL PROFILE AND TEST DATA

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REMARKS

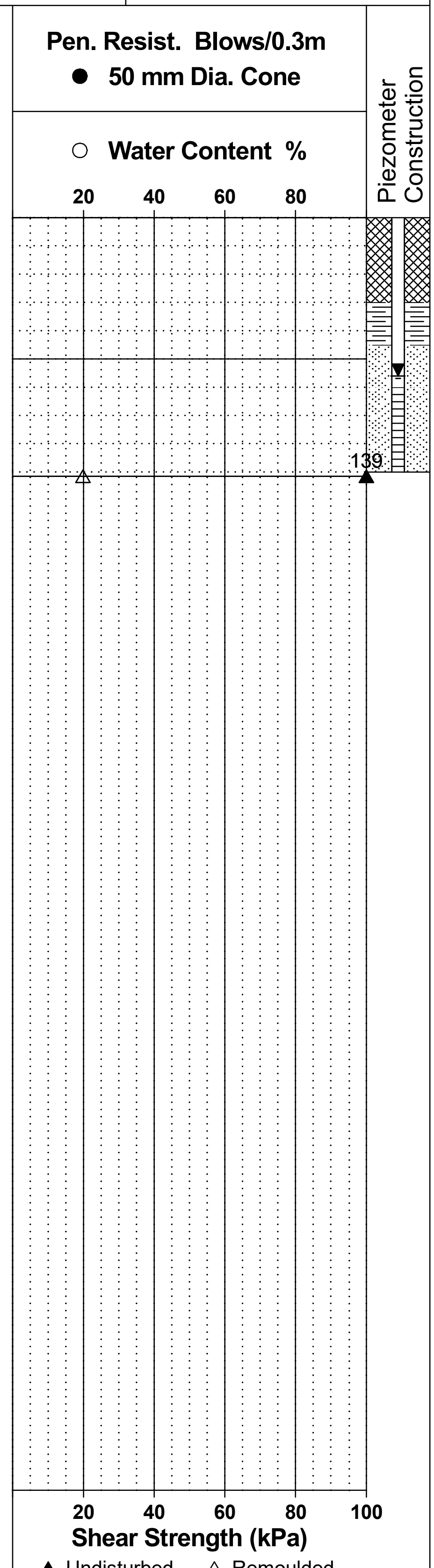
BORINGS BY CME-55 Low Clearance Drill

DATE 2019 January 3

FILE NO. PG4783

HOLE NO. BH 6-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.54
TOPSOIL (to 0.46)		AU	1				
Very stiff, brown **SILTY CLAY** (0.46 to 1.83)		SS	2	92	6	1	103.54
End of Borehole (1.83)							
(GWL @ 1.12m - Jan. 8, 2019)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Sort Facility - Upper Canada St. @ Palladium Dr.
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REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** 2019 January 3

FILE NO. PG4783

HOLE NO. BH 7-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.49		
Very stiff, brown **SILTY CLAY**		AU	1						
		SS	2	92	6	1	102.49		
1.83								129	
End of Borehole									
(GWL @ 0.61m - Jan. 8, 2019)									

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Sort Facility - Upper Canada St. @ Palladium Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the north end of Palladium Drive, with a geodetic elev. of 105.51 based on topographic interpolation of available plans.

REMARKS

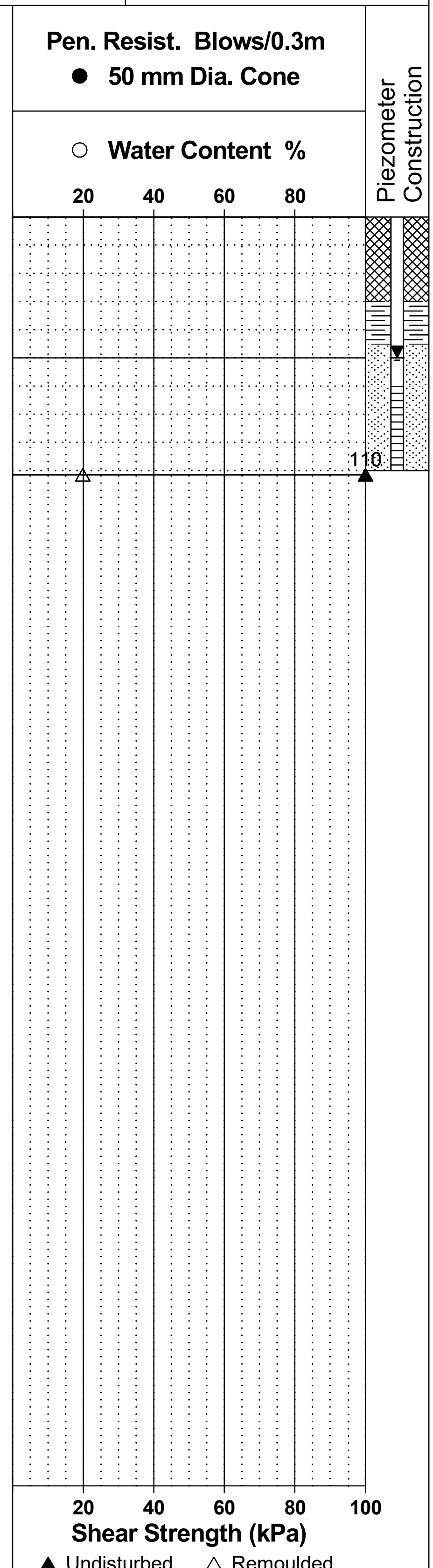
BORINGS BY CME-55 Low Clearance Drill

DATE 2019 January 3

FILE NO. PG4783

HOLE NO. BH 8-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.64
TOPSOIL 0.30		AU	1				
Very stiff, brown **SILTY CLAY**		SS	2	96	4	1	102.64
1.83							
End of Borehole							
(GWL @ 1.00m - Jan. 8, 2019)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

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Prop. Sort Facility - Upper Canada St. @ Palladium Dr.
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DATUM TBM - Top spindle of fire hydrant located at the north end of Palladium Drive, with a geodetic elev. of 105.51 based on topographic interpolation of available plans.

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE 2019 January 3

FILE NO. PG4783

HOLE NO. BH 9-19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.59		
TOPSOIL 0.38		AU	1						
Stiff, brown **SILTY CLAY** 1.83		SS	2	100	5	1	102.59		
End of Borehole									
(GWL @ 1.26m - Jan. 8, 2019)									

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 Commercial Development - Huntmar Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. **PG3115**

REMARKS

HOLE NO. **BH 4**

BORINGS BY CME 55 Power Auger

DATE January 14, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.12
TOPSOIL — 0.30		AU	1				
		AU	2				
Very stiff, brown **SILTY CLAY**		SS	3	100	4	1	103.12
— 2.13						2	102.12
Grey **CLAYEY SILT**		SS	4	71	13		
		SS	5	54	9	3	101.12
- trace gravel below 4.6m depth		SS	6	50	5	4	100.12
		SS	7	71	7	5	99.12
		SS	8	100	19	6	98.12
— 6.50		SS	9	86	50+		

End of Borehole

Practical refusal to augering at 6.50m depth

(GWL @ 2.0m depth based on field observations)

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

○ Water Content %

20 40 60 80

Piezometer Construction

Shear strength at 2 m depth: 110 (Undisturbed)

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

patersongroup Consulting Engineers

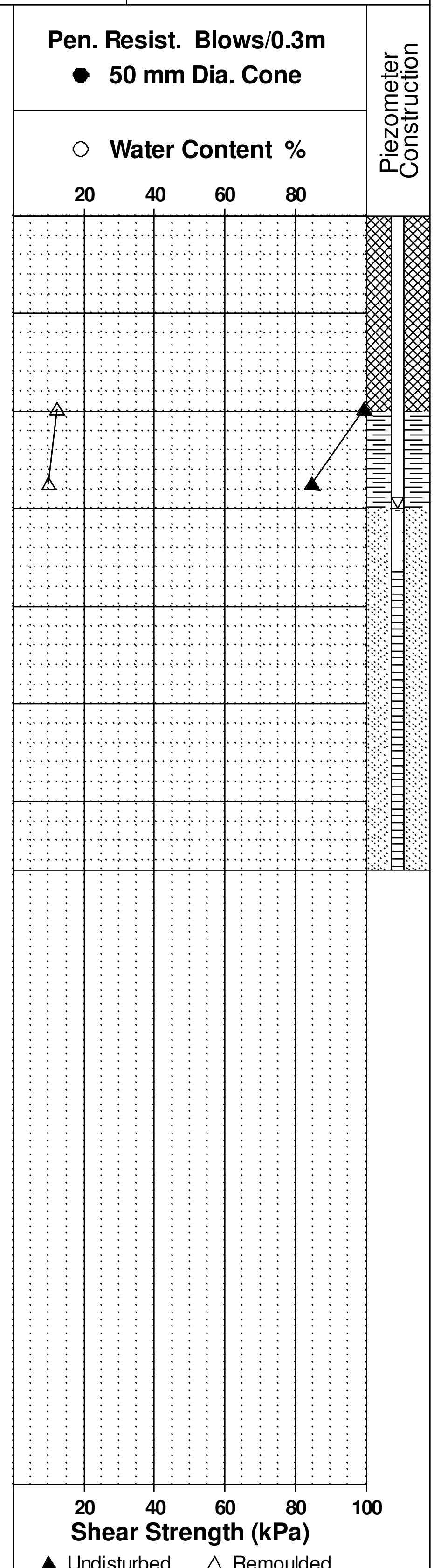
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development - Huntmar Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.	**FILE NO.** PG3115
REMARKS	**HOLE NO.** BH 5
BORINGS BY CME 55 Power Auger **DATE** January 14, 2014	

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.56
TOPSOIL 0.28		AU	1				
		SS	2	100	2	1	102.56
Stiff, brown **SILTY CLAY**						2	101.56
- grey-brown by 2.9m depth						3	100.56
		SS	3	100	8		
4.50		SS	4	83	5	4	99.56
GLACIAL TILL: Grey-brown clayey silt with gravel 5.25		SS	5	58	3	5	98.56
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders		SS	6	50	11	6	97.56
6.70		SS	7	100	17		
End of Borehole							
(GWL @ 3.0m depth based on field observations)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development - Huntmar Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. **PG3115**

REMARKS

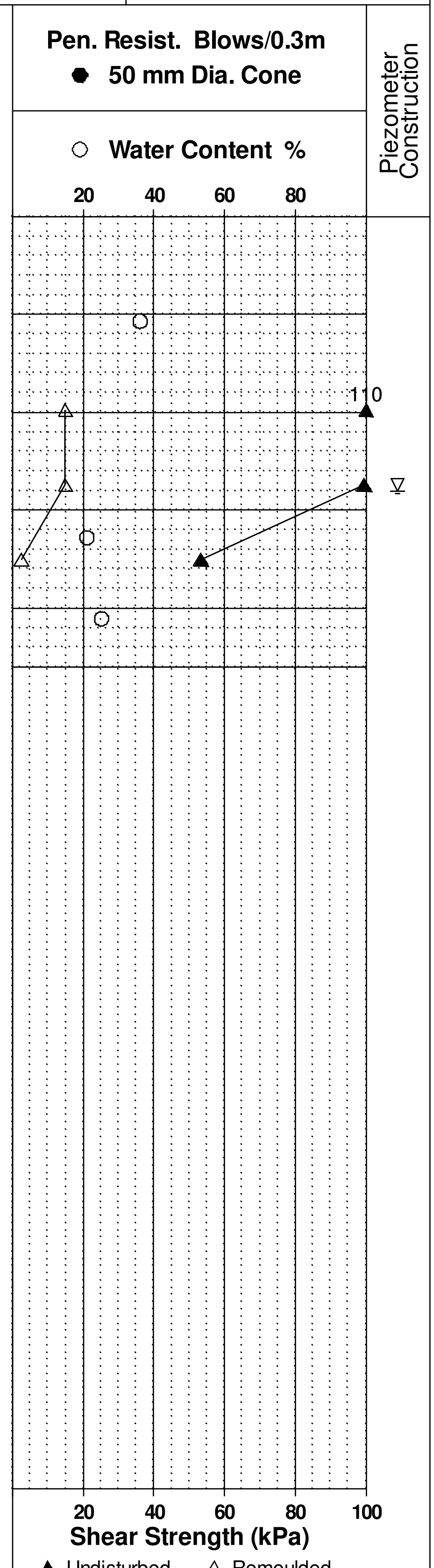
HOLE NO. **BH14**

BORINGS BY CME 55 Power Auger **DATE** January 13, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.55
TOPSOIL 0.28							
Very stiff to stiff, brown **SILTY CLAY**		SS	1	100	3	1	102.55
						2	101.55
3.66						3	100.55
Grey-brown **SILTY FINE SAND**		SS	2	71	6	4	99.55
4.60		SS	3	0	50+		
End of Borehole							

Practical refusal to augering at 4.60m depth

(GWL @ 2.8m depth based on field observations)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development - Huntmar Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG3115

REMARKS

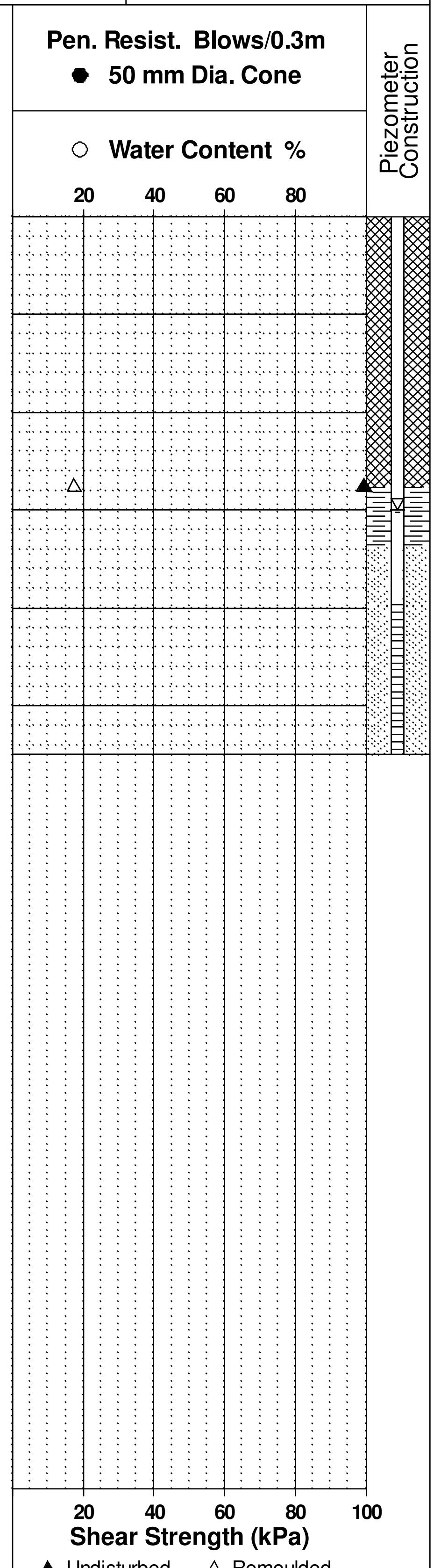
HOLE NO. BH15

BORINGS BY CME 55 Power Auger **DATE** January 14, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.43
TOPSOIL 0.20		AU	1				
Stiff, brown **SILTY CLAY**		SS	2	83	4	1	103.43
		SS	3	100	4	2	102.43
2.90						3	101.43
Grey-brown **SILTY FINE SAND**		SS	4	67	14		
		SS	5	42	3	4	100.43
		SS	6	83	5	5	99.43
5.49		SS	7	0	50+		
End of Borehole							

Practical refusal to augering at 5.49m depth

(GWL @ 3.0m depth based on field observations)



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 x D60)
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

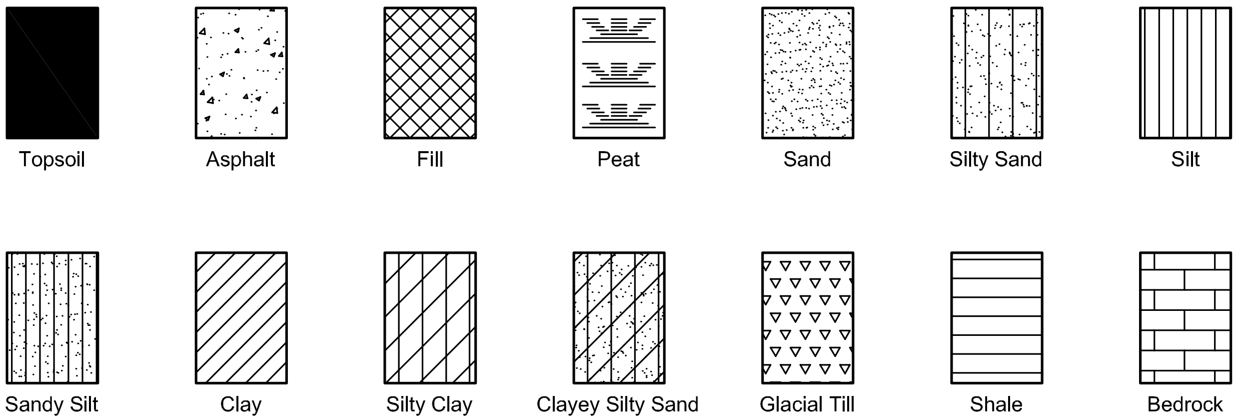
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

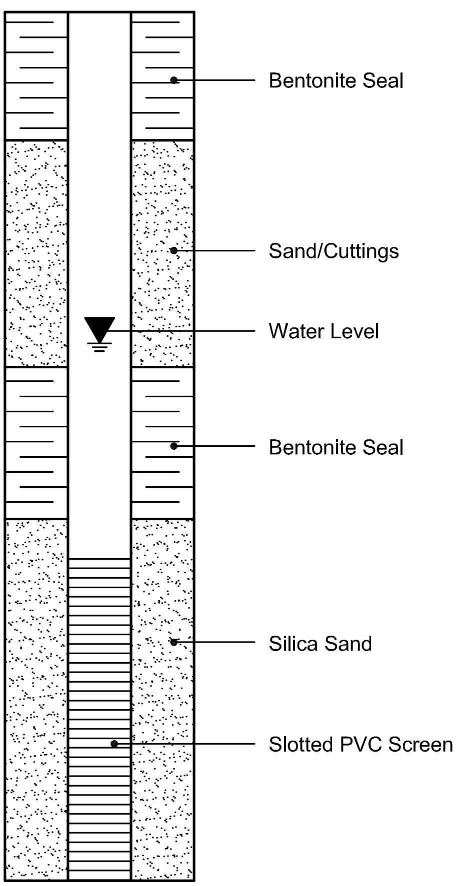
SYMBOLS AND TERMS (continued)

STRATA PLOT

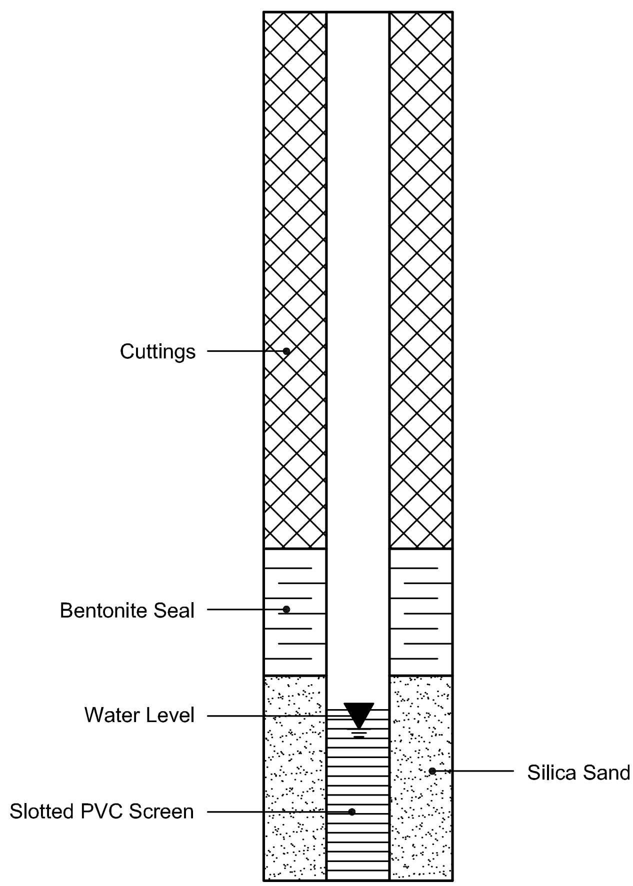


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Log of Borehole: BH1

Project #: 231270.001 **Logged By:** WT

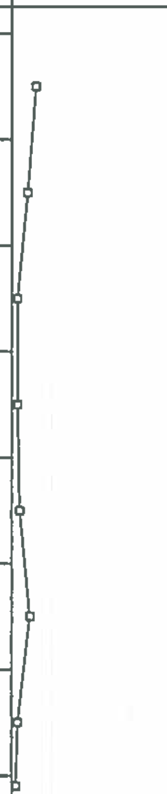
Project: Geotechnical Investigation

Client: Purolator Inc.

Location: Part of Lots 3 & 4, Concession 1, Blocks 26 to 33, Ottawa, ON

Drill Date: October 29, 2018 **Project Manager:** WT

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value 20 40 60	Shear Strength kPa 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
		Ground Surface	0.00											
0		Clay and silt, trace gravel, trace sand, DTPL to ATPL, grey, soft to stiff			SS	SS1	40	12						
1					SS	SS2	80	8						
2			-2.29		SS	SS3	100	3			32.7			Hydrometer
		Silt, trace to some sand, trace gravel, trace clay, wet, grey, very loose			SS	SS4	80	3						
3			-3.81		SS	SS5	100	4						
4		Till - Sandy silt, trace to some clay, trace gravel, wet, grey, very loose to loose			SS	SS6	100	9						
5			-5.49		SS	SS7	80	3						
					SS	SS8	100	2						
6		End of Borehole Due to SPT refusal on probable bedrock												
7														



Contractor: Strata Drilling Group

Drilling Method: Direct Push/Split Spoon

Well Casing Size: N/A

Grade Elevation: N/A

Top of Casing Elevation: N/A

Sheet: 1 of 1

PINCHIN

Log of Borehole: BH2

Project #: 231270.001 **Logged By:** WT

Project: Geotechnical Investigation

Client: Purolator Inc.

Location: Part of Lots 3 & 4, Concession 1, Blocks 26 to 33, Ottawa, ON

Drill Date: October 29, 2018 **Project Manager:** WT

SUBSURFACE PROFILE				SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value 20 40 60	Shear Strength kPa 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0		Ground Surface	0.00											
		Fill - Sand and gravel, some silt, some clay, damp, brown, compact	-0.76		SS	SS1	40	14						
1		Clay and silt, trace gravel, trace sand, DTPL to WTPL, grey, very soft			SS	SS2	80	1						
2			-2.29		SS	SS3	100	0						
		Till - Sandy silt, trace to some clay, trace gravel, wet, grey, compact			SS	SS4	80	15						
3					SS	SS5	100	12						
4														
5			-5.79		SS	SS6	100	12						
6		End of Borehole Due to casing refusal on probable bedrock												
7														

Contractor: Strata Drilling Group **Grade Elevation:** N/A

Drilling Method: Direct Push/Split Spoon **Top of Casing Elevation:** N/A

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH3

PINCHIN

Project #: 231270.001 **Logged By:** WT

Project: Geotechnical Investigation

Client: Purolator Inc.

Location: Part of Lots 3 & 4, Concession 1, Blocks 26 to 33, Ottawa, ON

Drill Date: October 29, 2018 **Project Manager:** WT

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value 20 40 60	Shear Strength kPa 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0		Ground Surface	0.00											
0		Silt, trace gravel, trace sand, trace clay, damp to moist, grey, very loose to compact			SS	SS1	80	12						
1					SS	SS2	60	2						
2					SS	SS3	50	3						
					SS	SS4	100	4						
3			-3.05											
		Till - Sandy silt, trace to some clay, trace gravel, wet, grey, loose to compact			SS	SS5	100	19			16.7			Hydrometer
4														
5					SS	SS6	80	6						
6														
					SS	SS7	100	8						
			-6.86											
7		End of Borehole Due to casing refusal on probable bedrock												

Contractor: Strata Drilling Group

Drilling Method: Direct Push/Split Spoon

Well Casing Size: N/A

Grade Elevation: N/A

Top of Casing Elevation: N/A

Sheet: 1 of 1

Log of Borehole: BH4

Project #: 231270.001 **Logged By:** WT

Project: Geotechnical Investigation

Client: Purolator Inc.

Location: Part of Lots 3 & 4, Concession 1, Blocks 26 to 33, Ottawa, ON

Drill Date: October 29, 2018 **Project Manager:** WT

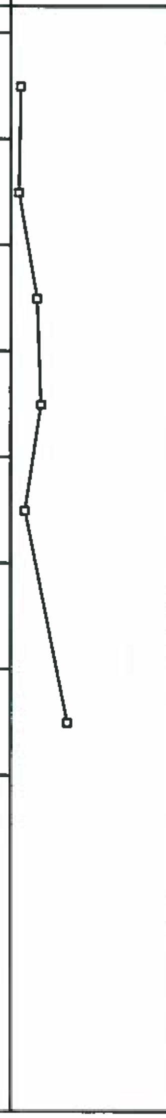
SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface	0.00	
0 – 1.52	Clay and silt, trace gravel, trace sand, DTPL to ATPL, grey, soft to firm	-1.52	
1.52 – 4.57	Silt, trace to some sand, trace gravel, trace clay, wet, grey, loose to compact	-4.57	Water level (approx. 1.9 m)
4.57 – 5.33	Till - Sandy silt, trace to some clay, trace gravel, wet, grey, compact	-5.33	
5.33	End of Borehole Due to casing refusal on probable bedrock		

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	SS1	60	5				
SS	SS2	100	4				
SS	SS3	100	13	17.4			Hydrometer
SS	SS4	100	15				
SS	SS5	100	7				
SS	SS6	100	28				

Standard Penetration N-Value (20 40 60) | Shear Strength kPa (100 200)



Contractor: Strata Drilling Group

Drilling Method: Direct Push/Split Spoon

Well Casing Size: N/A

Grade Elevation: N/A

Top of Casing Elevation: N/A

Sheet: 1 of 1

Log of Borehole: BH5

Project #: 231270.001 **Logged By:** WT

Project: Geotechnical Investigation

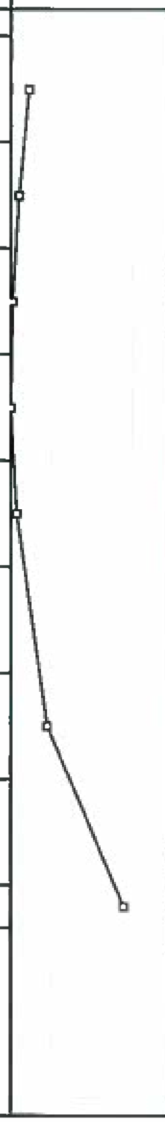
Client: Purolator Inc.

Location: Part of Lots 3 & 4, Concession 1, Blocks 26 to 33, Ottawa, ON

Drill Date: October 29, 2018 **Project Manager:** WT

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00									
0 – 1.52	Organics ~ 150 mm Clay and silt, trace gravel, trace sand, DTPL to ATPL, grey, soft to stiff	-1.52		SS	SS1	80	9				
				SS	SS2	100	4				
1.52 – 4.57	Silt, trace to some sand, trace gravel, trace clay, moist to wet, grey, very loose	-4.57		SS	SS3	100	1				
			▼ (water level)	SS	SS4	100	0				
				SS	SS5	100	3				
4.57 – 6.40	Till - Sandy silt, trace to some clay, trace gravel, wet, grey, compact to dense	-6.40		SS	SS6	100	18	15.3			Hydrometer
				SS	SS7	100	56				
6.40	End of Borehole Due to SPT refusal on probable bedrock										

Standard Penetration N-Value (20 40 60); Shear Strength kPa (100 200)



Contractor: Strata Drilling Group

Drilling Method: Direct Push/Split Spoon

Well Casing Size: N/A

Grade Elevation: N/A

Top of Casing Elevation: N/A

Sheet: 1 of 1

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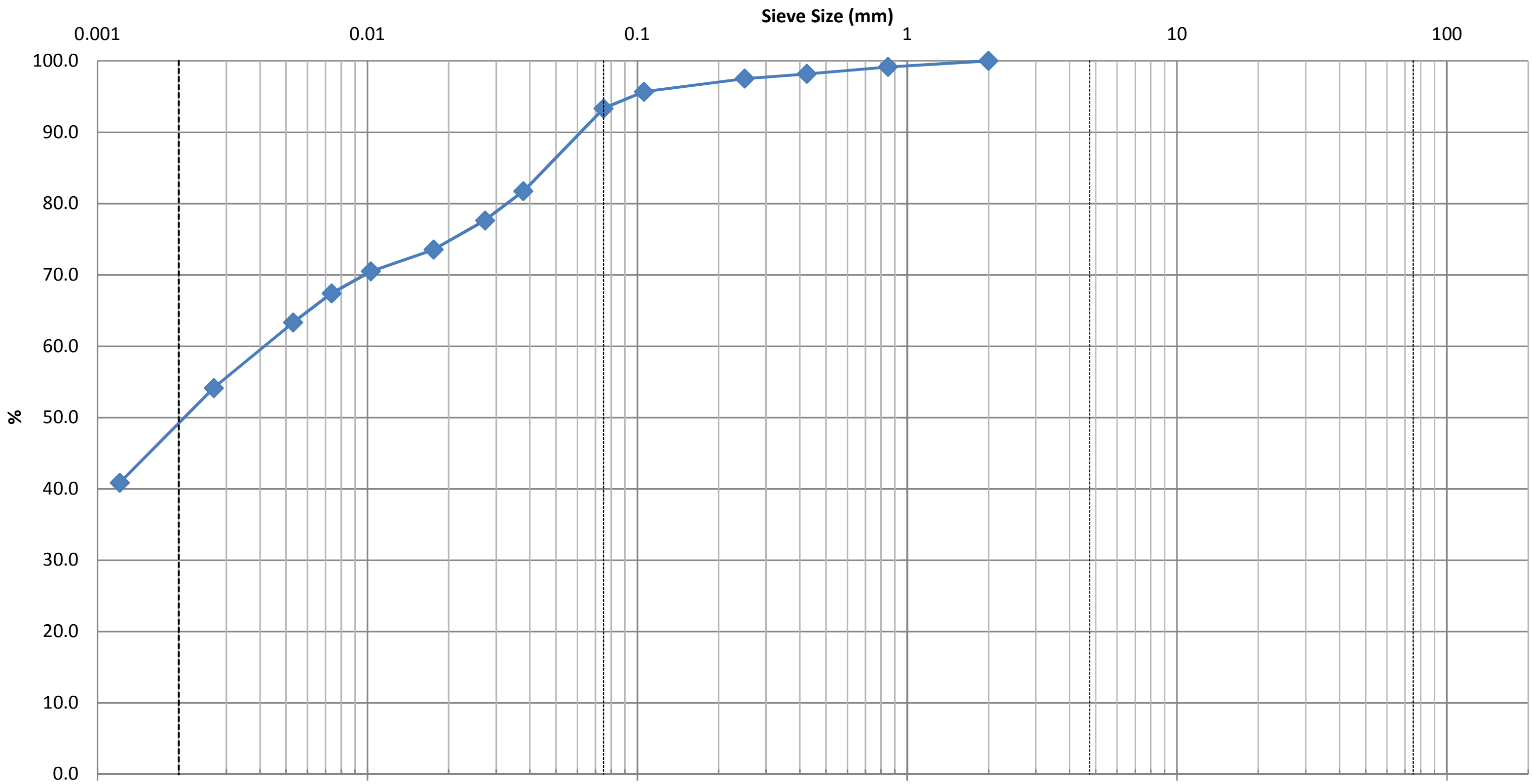
CLIENT:	Purolator Inc.	DEPTH:	2' 6" - 8' 6"	FILE NO:	PG4783
CONTRACT NO.:		BH OR TP No.:	BH6 - SS2	LAB NO:	06706
PROJECT:	Purolator Sort Facility			DATE RECEIVED:	4-Jan-19
				DATE TESTED:	9-Jan-19
DATE SAMPLED:	4-Jan-19			DATE REPORTED:	11-Jan-19
SAMPLED BY:	D. Lattin			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					28.6					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)	Clay (%)	
					0.0	6.7		43.8	49.5	

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Purolator Inc.	DEPTH:	2' 6" - 8' 6"	FILE NO.:	PG4783
PROJECT:	Purolator Sort Facility	BH OR TP No.:	BH6 - SS2	DATE SAMPLED:	04-Jan-19
LAB No. :	06706	TESTED BY:	D. Bertrand	DATE RECEIVED:	04-Jan-19
SAMPLED BY:	D. Lattin	DATE REPT'D:	11-Jan-19	DATE TESTED:	09-Jan-19

SAMPLE INFORMATION

SAMPLE MASS	109.8	50.00
SPECIFIC GRAVITY (Gs)		2.700
HYGROSCOPIC MOISTURE		Tare No.
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	146.80	96.80
F=(Wo/Wa)	0.968	
INITIAL Wt. (Ma)	50.00	
Wt. CORRECTED	48.40	
Wt. AFTER WASH BACK SIEVE		3.45
SOLUTION CONCENTRATION		40 g / L

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5			
4.75			
2.0	**0.0**	0.0	100.0
Pan	**109.8**		
0.850	**0.42**	0.8	99.2
0.425	**0.91**	1.8	98.2
0.250	**1.24**	2.5	97.5
0.106	**2.16**	4.3	95.7
0.075	**3.33**	6.7	93.3
Pan	**3.45**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (^{o}C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	8:41	46.0	6.0	23.0	0.0378	81.7	81.7
2	8:42	44.0	6.0	23.0	0.0273	77.6	77.6
5	8:45	42.0	6.0	23.0	0.0176	73.5	73.5
15	8:55	40.5	6.0	23.0	0.0103	70.5	70.5
30	9:10	39.0	6.0	23.0	0.0074	67.4	67.4
60	9:40	37.0	6.0	23.0	0.0053	63.3	63.3
250	12:50	32.5	6.0	23.0	0.0027	54.1	54.1
1440	8:40	26.0	6.0	21.0	0.0012	40.9	40.9

COMMENTS

Moisture Content = 28.6%

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

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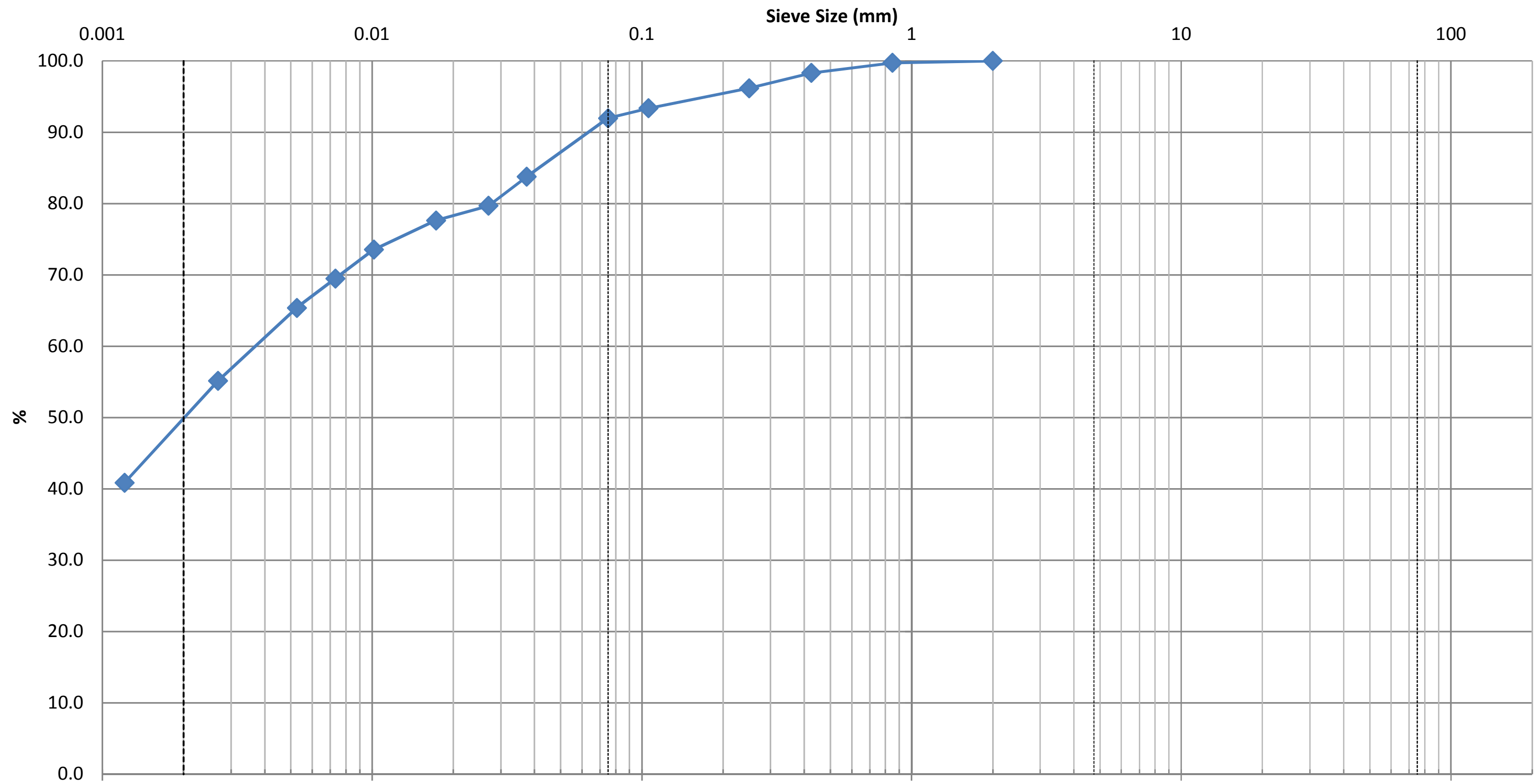
CLIENT:	Purolator Inc.	DEPTH:	0' - 2'	FILE NO:	PG4783
CONTRACT NO.:		BH OR TP No.:	BH7 - AU1	LAB NO:	06707
PROJECT:	Purolator Sort Facility			DATE RECEIVED:	4-Jan-19
				DATE TESTED:	9-Jan-19
DATE SAMPLED:	4-Jan-19			DATE REPORTED:	11-Jan-19
SAMPLED BY:	D. Lattin			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					28.2					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)	Clay (%)	
					0.0	8.0		42.0	50.0	

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Purolator Inc.	DEPTH:	0' - 2'	FILE NO.:	PG4783
PROJECT:	Purolator Sort Facility	BH OR TP No.:	BH7 - AU1	DATE SAMPLED:	04-Jan-19
LAB No. :	06707	TESTED BY:	D. Bertrand	DATE RECEIVED:	04-Jan-19
SAMPLED BY:	D. Lattin	DATE REPT'D:	11-Jan-19	DATE TESTED:	09-Jan-19

SAMPLE INFORMATION

SAMPLE MASS	109.8	50.00
SPECIFIC GRAVITY (Gs)		2.700
HYGROSCOPIC MOISTURE		Tare No.
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	146.80	96.80
F=(Wo/Wa)	0.968	
INITIAL Wt. (Ma)	50.00	
Wt. CORRECTED	48.40	
Wt. AFTER WASH BACK SIEVE		3.45
SOLUTION CONCENTRATION		40 g / L

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5			
4.75			
2.0	**0.0**	0.0	100.0
Pan	**111.3**		
0.850	**0.14**	0.3	99.7
0.425	**0.85**	1.7	98.3
0.250	**1.92**	3.8	96.2
0.106	**3.32**	6.6	93.4
0.075	**4.02**	8.0	92.0
Pan	**4.12**		
SIEVE CHECK -19.4	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (^{o}C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	8:59	47.0	6.0	23.0	0.0374	83.8	83.8
2	9:00	45.0	6.0	23.0	0.0270	79.7	79.7
5	9:03	44.0	6.0	23.0	0.0173	77.6	77.6
15	9:13	42.0	6.0	23.0	0.0102	73.5	73.5
30	9:28	40.0	6.0	23.0	0.0073	69.5	69.5
60	9:58	38.0	6.0	23.0	0.0053	65.4	65.4
250	13:08	33.0	6.0	23.0	0.0027	55.2	55.2
1440	8:58	26.0	6.0	21.0	0.0012	40.9	40.9

COMMENTS

Moisture Content = 28.2%

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

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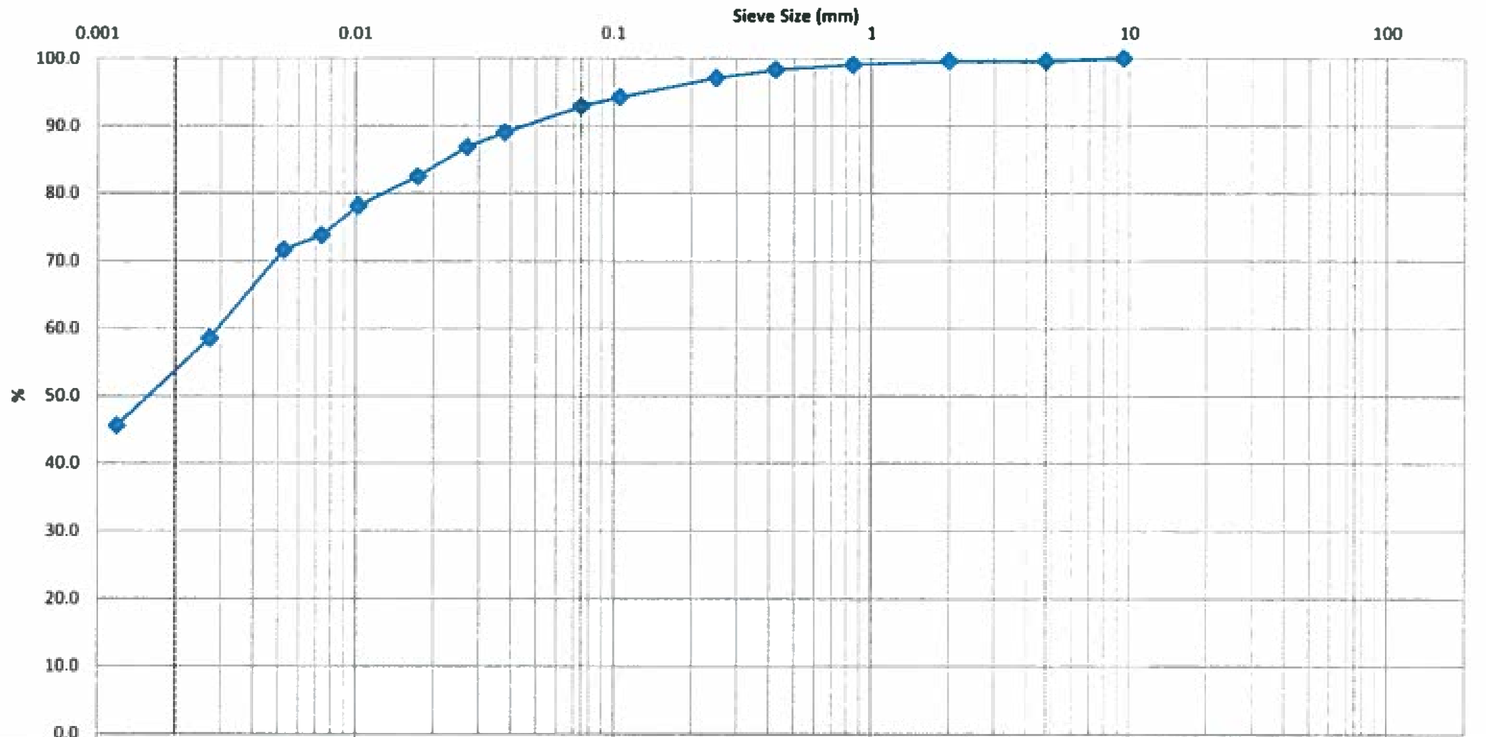
CLIENT:	Pinchin Limited	DEPTH:	5' - 7'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH1	LAB NO:	06027
PROJECT:	231270.001			DATE RECEIVED:	6-Nov-18
				DATE TESTED:	9-Nov-18
DATE SAMPLED:	29-Oct-18			DATE REPORTED:	13-Nov-18
SAMPLED BY:	W. Tabaczuk			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					32.7					
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)		
					0.4	6.7	40.8	52.1		

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Pinchin Limited	DEPTH:	5' - 7'	FILE NO.:	PM4184
PROJECT:	231270.001	BH OR TP No.:	BH1	DATE SAMPLED:	29-Oct-18
LAB No. :	06027	TESTED BY:	D. Bertrand	DATE RECEIVED:	06-Nov-18
SAMPLED BY:	W. Tabaczuk	DATE REPT'D:	13-Nov-18	DATE TESTED:	09-Nov-18

SAMPLE INFORMATION

SAMPLE MASS	112.3	50.30
SPECIFIC GRAVITY (Gs)	2.700	
HYGROSCOPIC MOISTURE	Tare No.	
TARE Wt. 50.00	ACTUAL Wt.	
AIR DRY (Wa) 150.00	100.00	
OVEN DRY (Wo) 140.15	90.15	
F=(Wo/Wa)	0.902	
INITIAL Wt. (Ma)	50.30	
Wt. CORRECTED	45.35	
Wt. AFTER WASH BACK SIEVE	3.51	
SOLUTION CONCENTRATION	40 g / L	

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5	0.0	0.0	100.0
4.75	0.5	0.4	99.6
2.0	0.5	0.4	99.6
Pan	111.8		
0.850	0.26	1.0	99.0
0.425	0.65	1.7	98.3
0.250	1.25	2.9	97.1
0.106	2.68	5.7	94.3
0.075	3.38	7.1	92.9
Pan	3.51		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	9:43	47.0	6.0	22.0	0.0379	89.4	89.0
2	9:44	46.0	6.0	22.0	0.0271	87.2	86.8
5	9:47	44.0	6.0	22.0	0.0175	82.9	82.5
15	9:57	42.0	6.0	22.0	0.0103	78.5	78.2
30	10:12	40.0	6.0	22.0	0.0074	74.1	73.8
60	10:42	39.0	6.0	22.0	0.0053	72.0	71.6
250	13:52	33.0	6.0	22.0	0.0027	58.9	58.6
1440	9:42	27.0	6.0	22.0	0.0012	45.8	45.6

COMMENTS

Moisture Content = 32.7%

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

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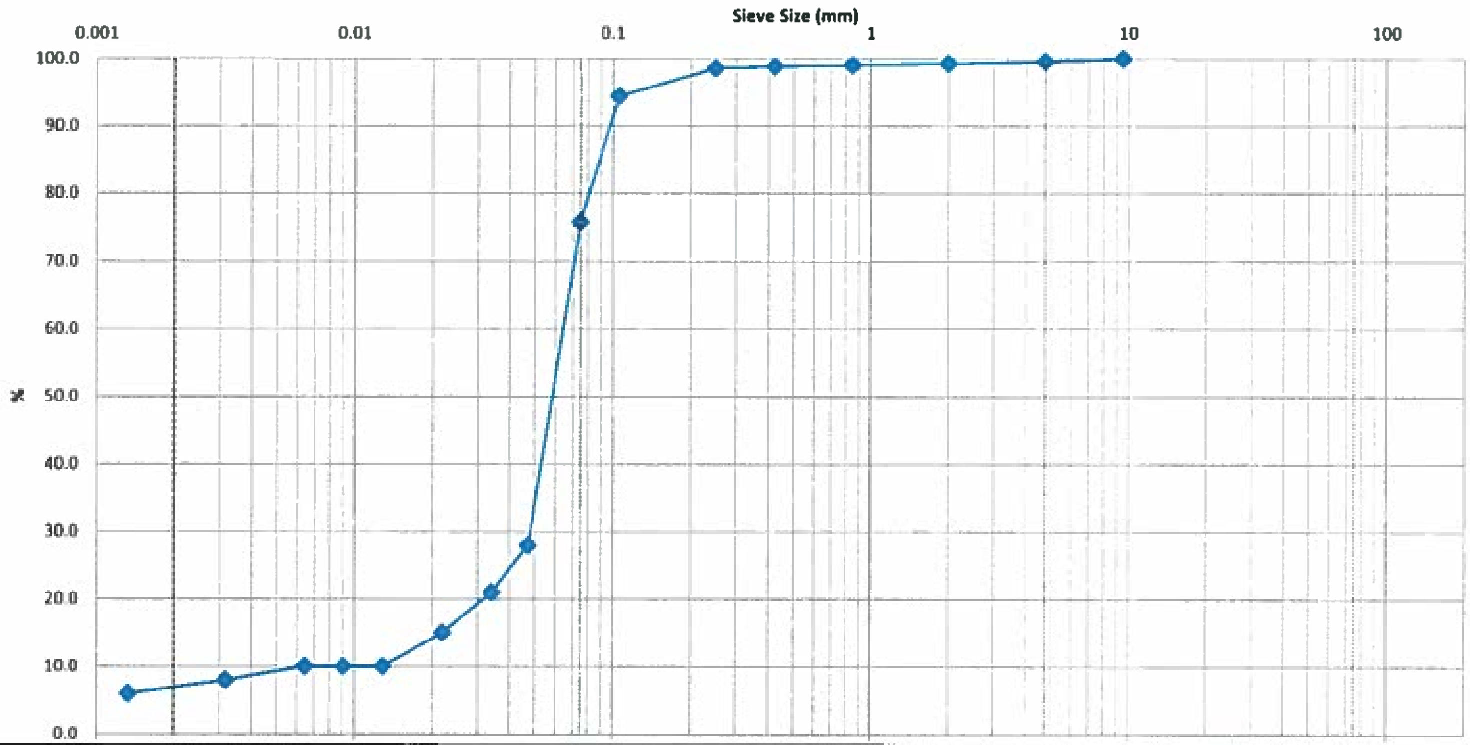
CLIENT:	Pinchin Limited	DEPTH:	10' - 12'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH3	LAB NO:	06028
PROJECT:	231270.001			DATE RECEIVED:	6-Nov-18
				DATE TESTED:	9-Nov-18
DATE SAMPLED:	29-Oct-18			DATE REPORTED:	13-Nov-18
SAMPLED BY:	W. Tabaczuk			TESTED BY:	D. Bertrand



Clay	Silt	Sand			Gravel		Cobble
		Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification				MC(%)	LL	PL	PI	Co	Cu
					16.7					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)
					0.4	23.8		68.8		7.0

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Pinchin Limited	DEPTH:	10' - 12'	FILE NO.:	PM4184
PROJECT:	231270.001	BH OR TP No.:	BH3	DATE SAMPLED:	29-Oct-18
LAB No. :	06028	TESTED BY:	D. Bertrand	DATE RECEIVED:	06-Nov-18
SAMPLED BY:	W. Tabaczuk	DATE REPT'D:	13-Nov-18	DATE TESTED:	09-Nov-18

SAMPLE INFORMATION

SAMPLE MASS	151.1	50.30
SPECIFIC GRAVITY (Gs)		2.700
HYGROSCOPIC MOISTURE		Tare No.
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	147.55	97.55
F=(Wo/Wa)	0.976	
INITIAL Wt. (Ma)	50.30	
Wt. CORRECTED	49.07	
Wt. AFTER WASH BACK SIEVE		17.65
SOLUTION CONCENTRATION		40 g / L

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5	0.0	0.0	100.0
4.75	0.6	0.4	99.6
2.0	1.1	0.7	99.3
Pan	150		
0.850	0.12	1.0	99.0
0.425	0.22	1.2	98.8
0.250	0.35	1.4	98.6
0.106	2.44	5.5	94.5
0.075	11.87	24.2	75.8
Pan	17.65		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	9:57	20.0	6.0	22.0	0.0472	28.2	28.0
2	9:58	16.5	6.0	22.0	0.0342	21.2	21.0
5	10:01	13.5	6.0	22.0	0.0220	15.1	15.0
15	10:11	11.0	6.0	22.0	0.0129	10.1	10.0
30	10:26	11.0	6.0	22.0	0.0091	10.1	10.0
60	10:56	11.0	6.0	22.0	0.0064	10.1	10.0
250	14:06	10.0	6.0	22.0	0.0032	8.1	8.0
1440	9:56	9.0	6.0	22.0	0.0013	6.0	6.0

COMMENTS

Moisture Content = 16.7%

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

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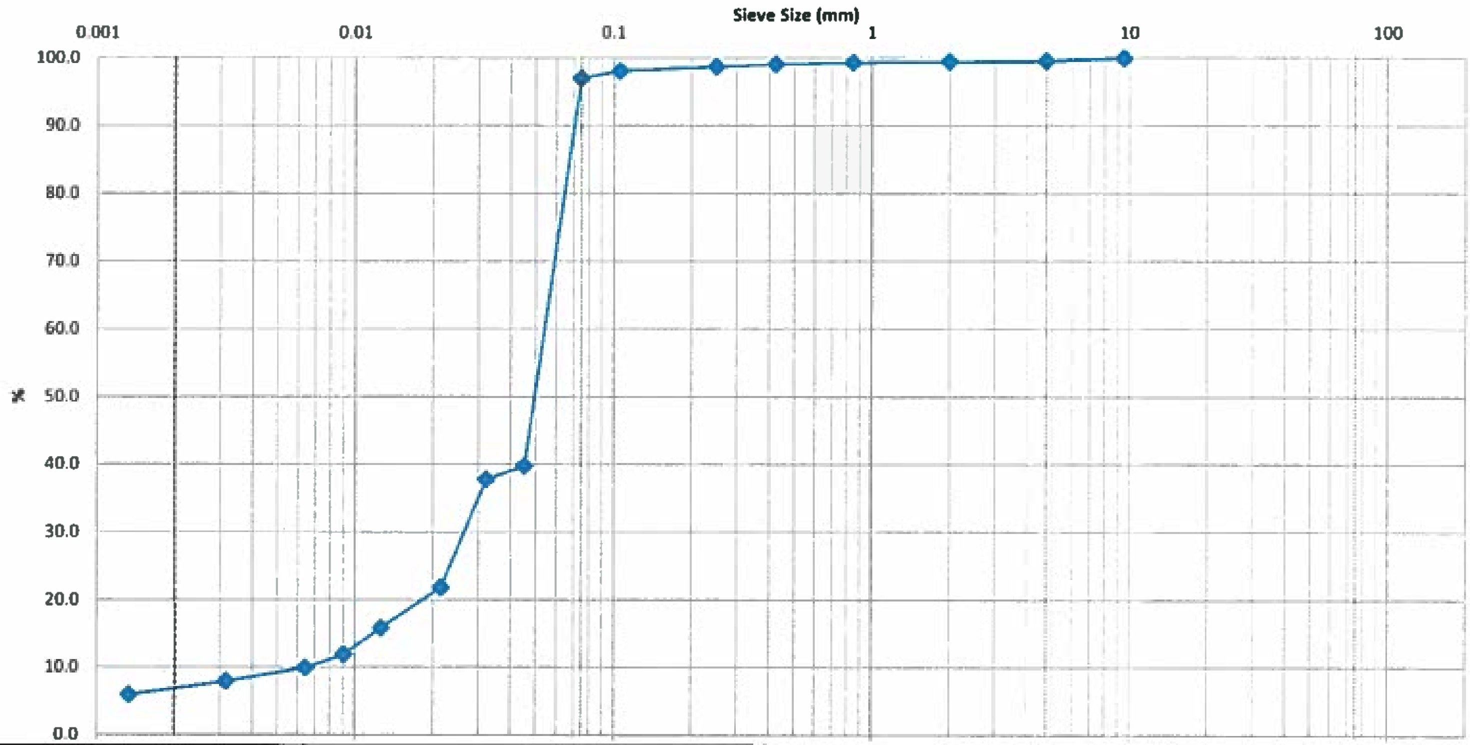
CLIENT:	Pinchin Limited	DEPTH:	5' - 7'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH4	LAB NO:	06029
PROJECT:	231270.001			DATE RECEIVED:	6-Nov-18
				DATE TESTED:	9-Nov-18
DATE SAMPLED:	29-Oct-18			DATE REPORTED:	13-Nov-18
SAMPLED BY:	W. Tabaczuk			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
		17.4					

D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
				0.5	2.5	90.0	7.0

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Pinchin Limited	DEPTH:	5' - 7'	FILE NO.:	PM4184
PROJECT:	231270.001	BH OR TP No.:	BH4	DATE SAMPLED:	29-Oct-18
LAB No. :	06029	TESTED BY:	D. Bertrand	DATE RECEIVED:	06-Nov-18
SAMPLED BY:	W. Tabaczuk	DATE REPT'D:	13-Nov-18	DATE TESTED:	09-Nov-18

SAMPLE INFORMATION

SAMPLE MASS	131.4	50.30
SPECIFIC GRAVITY (Gs)	2.700	
HYGROSCOPIC MOISTURE	Tare No.	
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	148.50	98.50
F=(Wo/Wa)	0.985	
INITIAL Wt. (Ma)	50.30	
Wt. CORRECTED	49.55	
Wt. AFTER WASH BACK SIEVE	1.54	
SOLUTION CONCENTRATION	40 g / L	

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5	0.0	0.0	100.0
4.75	0.6	0.5	99.5
2.0	0.7	0.5	99.5
Pan	132.1		
0.850	0.07	0.7	99.3
0.425	0.21	0.9	99.1
0.250	0.38	1.3	98.7
0.106	0.71	1.9	98.1
0.075	1.26	3.0	97.0
Pan	1.54		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	10:14	26.0	6.0	22.0	0.0453	39.9	39.7
2	10:15	25.0	6.0	22.0	0.0323	37.9	37.7
5	10:18	17.0	6.0	22.0	0.0215	22.0	21.8
15	10:28	14.0	6.0	22.0	0.0127	16.0	15.9
30	10:43	12.0	6.0	22.0	0.0091	12.0	11.9
60	11:13	11.0	6.0	22.0	0.0064	10.0	9.9
250	14:23	10.0	6.0	22.0	0.0032	8.0	7.9
1440	10:13	9.0	6.0	22.0	0.0013	6.0	6.0

COMMENTS

Moisture Content = 17.4%

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

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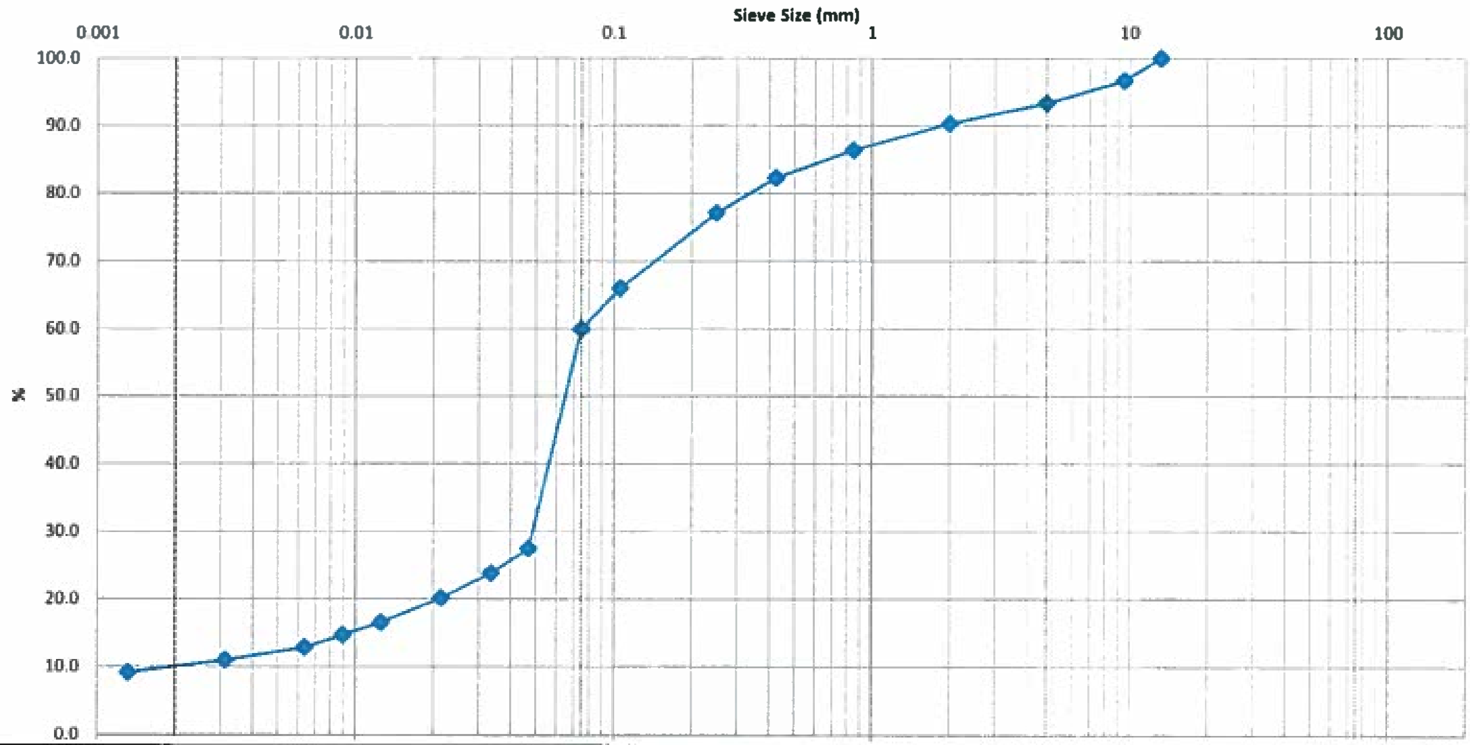
CLIENT:	Pinchin Limited	DEPTH:	15' - 17'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH5	LAB NO:	06030
PROJECT:	231270.001			DATE RECEIVED:	6-Nov-18
				DATE TESTED:	9-Nov-18
DATE SAMPLED:	29-Oct-18			DATE REPORTED:	13-Nov-18
SAMPLED BY:	W. Tabaczuk			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					17.4					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)	Clay (%)	
					6.6	33.5		49.9	10.0	

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Pinchin Limited	DEPTH:	15' - 17'	FILE NO.:	PM4184
PROJECT:	231270.001	BH OR TP No.:	BH5	DATE SAMPLED:	29-Oct-18
LAB No. :	06030	TESTED BY:	D. Bertrand	DATE RECEIVED:	06-Nov-18
SAMPLED BY:	W. Tabaczuk	DATE REPT'D:	13-Nov-18	DATE TESTED:	09-Nov-18

SAMPLE INFORMATION

SAMPLE MASS	147.6	50.30
SPECIFIC GRAVITY (Gs)	2.700	
HYGROSCOPIC MOISTURE	Tare No.	
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	146.75	96.75
F=(Wo/Wa)	0.968	
INITIAL Wt. (Ma)	50.30	
Wt. CORRECTED	48.67	
Wt. AFTER WASH BACK SIEVE	17.73	
SOLUTION CONCENTRATION	40 g / L	

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2	0.0	0.0	100.0
9.5	4.9	3.3	96.7
4.75	9.8	6.6	93.4
2.0	14.3	9.7	90.3
Pan	133.3		
0.850	2.19	13.6	86.4
0.425	4.49	17.7	82.3
0.250	7.37	22.9	77.1
0.106	13.55	34.0	66.0
0.075	16.92	40.1	59.9
Pan	17.73		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	10:32	21.0	6.0	22.0	0.0469	30.5	27.5
2	10:33	19.0	6.0	22.0	0.0336	26.4	23.9
5	10:36	17.0	6.0	22.0	0.0215	22.4	20.2
15	10:46	15.0	6.0	22.0	0.0126	18.3	16.5
30	11:01	14.0	6.0	22.0	0.0090	16.3	14.7
60	11:31	13.0	6.0	22.0	0.0064	14.2	12.8
250	14:41	12.0	6.0	22.0	0.0031	12.2	11.0
1440	10:31	11.0	6.0	22.0	0.0013	10.2	9.2

COMMENTS

Moisture Content = 15.3%

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

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 25691

Report Date: 17-Dec-2018

Order Date: 13-Dec-2018

Project Description: PG4778

	Client ID:	BH2 SS3 5' - 7'	-	-	-
	Sample Date:	12/12/2018 11:00	-	-	-
	Sample ID:	1850490-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	69.7	-	-	-
General Inorganics					
pH	0.05 pH Units	7.47	-	-	-
Resistivity	0.10 Ohm.m	43.1	-	-	-
Anions					
Chloride	5 ug/g dry	41	-	-	-
Sulphate	5 ug/g dry	102	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURES 2 & 3 - SEISMIC SHEAR WAVE VELOCITY PROFILES

DRAWING PG4783-1 - TEST HOLE LOCATION PLAN

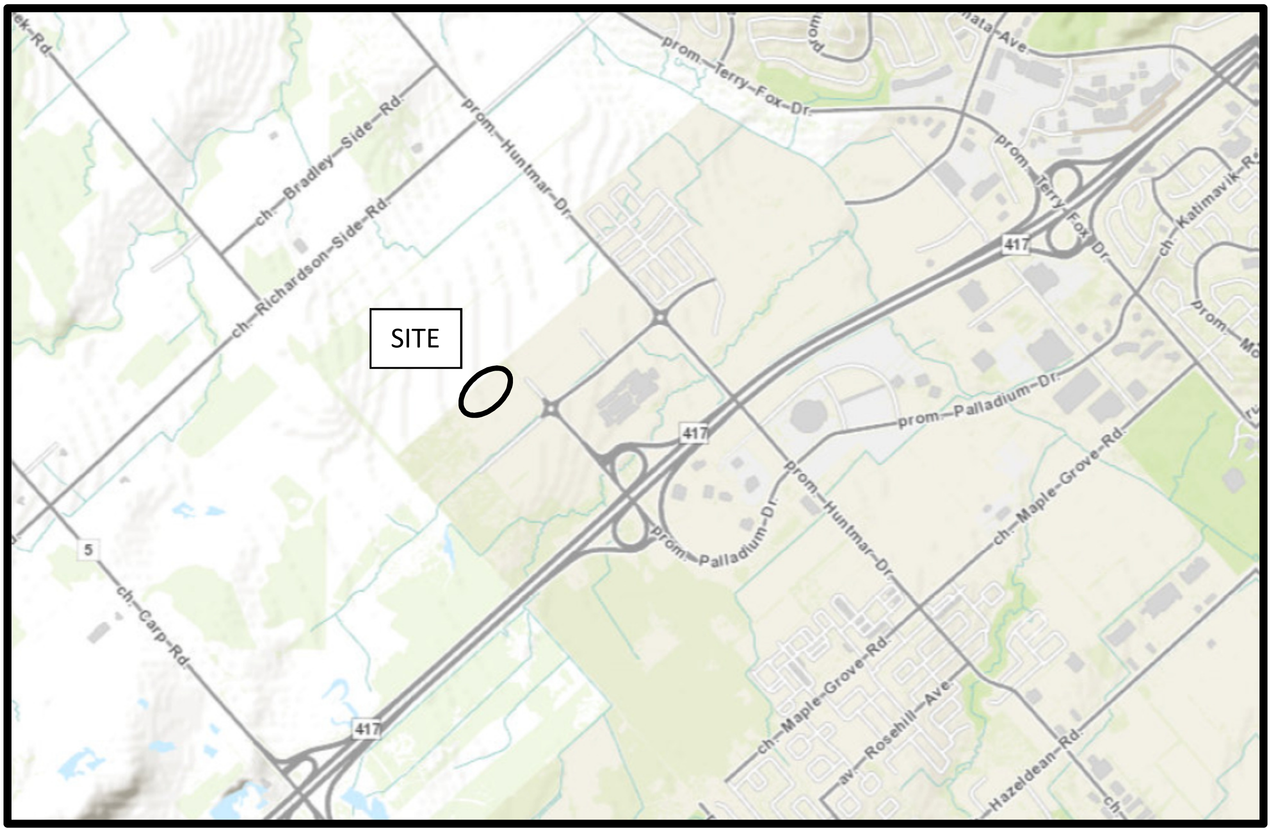

FIGURE 1

KEY PLAN

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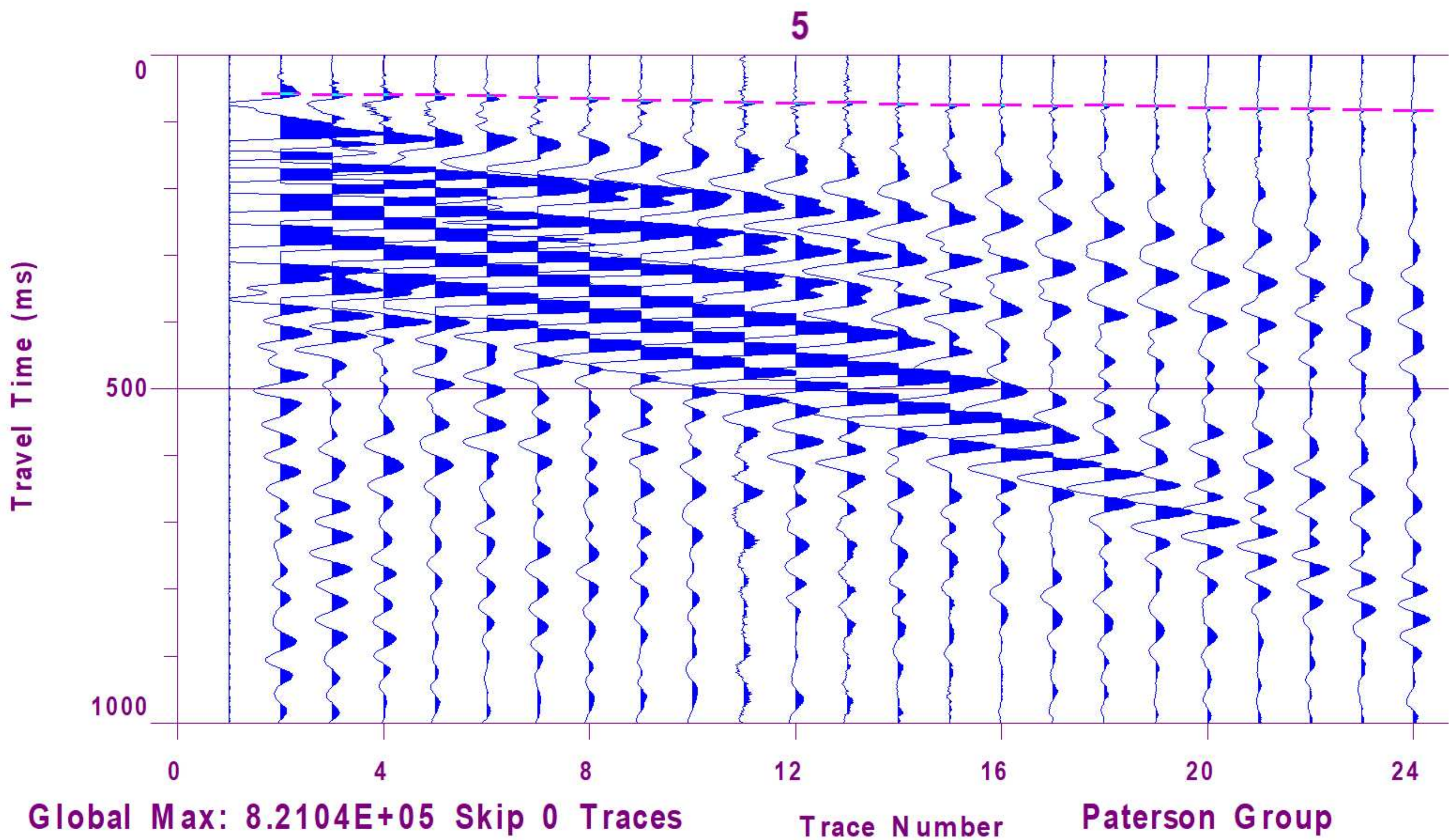


FIGURE 2 –Shear Wave Velocity Profile at Shot Location -15 m

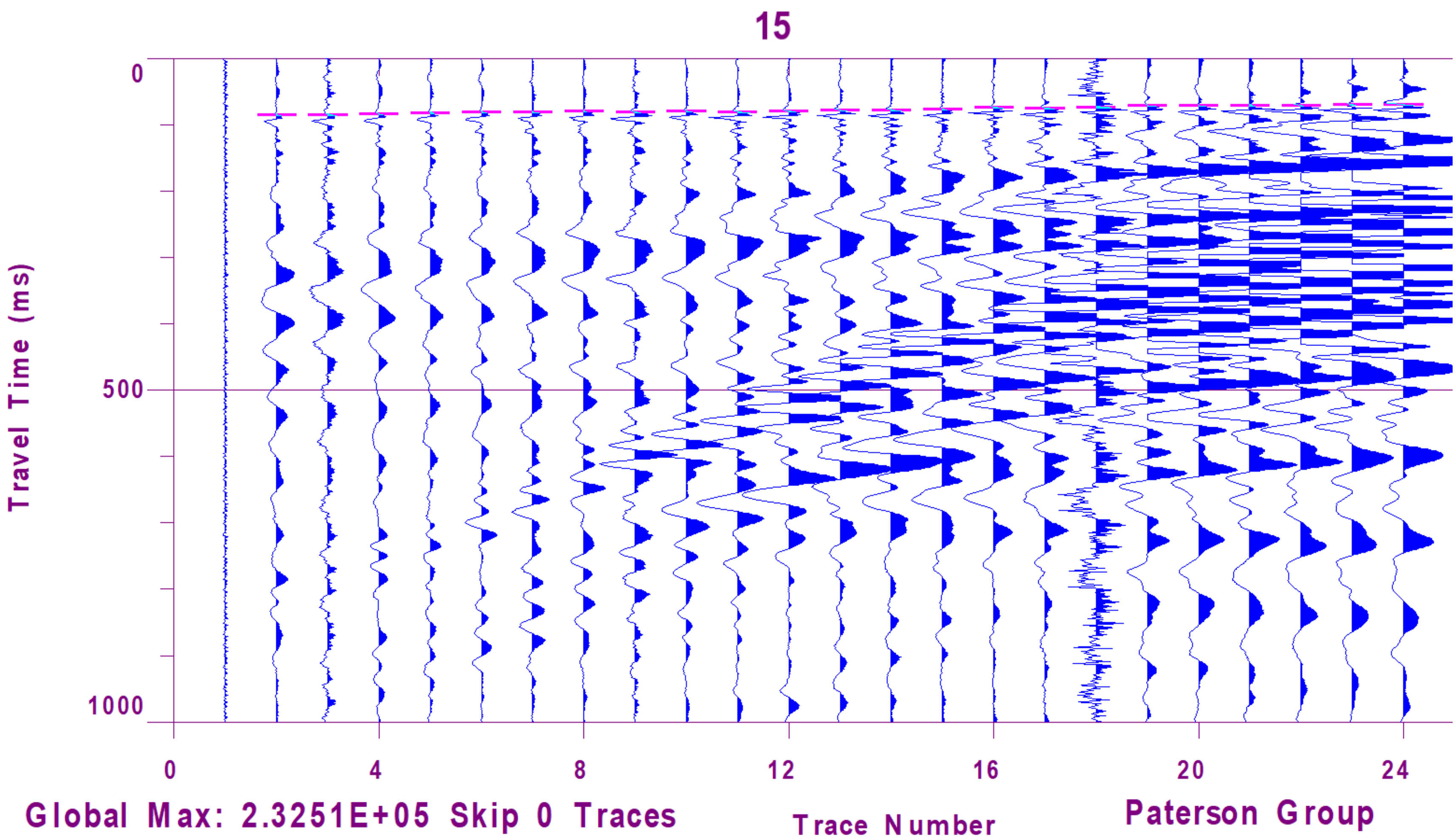
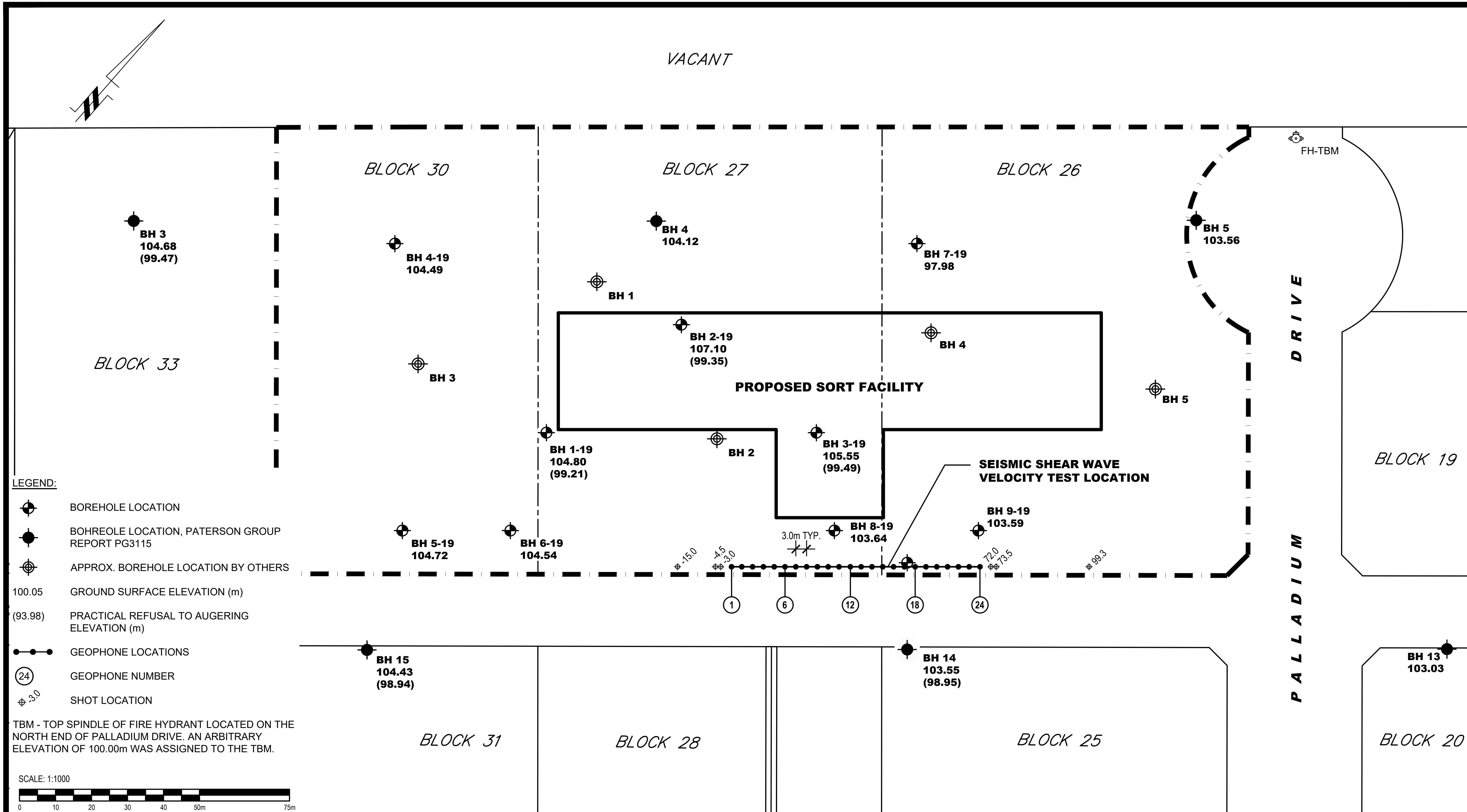


FIGURE 3 – Shear Wave Velocity Profile at Shot Location +72 m



patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
1	SEISMIC SHEAR WAVE VELOCTY TEST ADDED	30/01/2020	SD

PUROLATOR INC.

GEOTECHNICAL INVESTIGATION
PROP. SORT FACILITY - UPPER CANADA ST. @ PALLADIUM DRIVE
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:1000	Date: 01/2019
Drawn by: MPG	Report No.: PG4783-1
Checked by: SD	**PG4783-1**
Approved by: SD	Revision No.: 1

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