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Geotechnical Investigation

Proposed Multi-Storey Buildings 1509 Merivale Road Ottawa, Ontario

> Prepared For Katasa

Paterson Group Inc.

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Katasa to prepare a geotechnical investigation report for the proposed multi-storey buildings to be located at 1509 Merivale Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the geotechnical investigation report were to:

- □ Evaluate the subsoil and groundwater conditions at this site by means of previous boreholes conducted by Paterson and others;.
- Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

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

Investigating for the presence or potential presence of contamination on the subject property is not part of the scope of this geotechnical investigation report.

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of two multi-storey buildings, each with 1 level of underground parking, which will occupy the majority of the site footprint. Asphalt-paved access lanes and parking areas with landscaped margins are also anticipated surrounding the proposed buildings. It is further anticipated that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Program

A previous Phase II Environmental Site Assessment (ESA) was conducted by Paterson on November 23, 1998. During this time, 6 boreholes were advanced to a maximum depth of 2.7 m below the existing ground surface.

A previous Phase I and Phase II ESA were conducted by others between February 7, 2015 and September 7, 2017. During this period, 39 boreholes were advanced to a maximum depth of 10.8 m below the existing ground surface.

The Soil Profile and Test Data sheets from Paterson and others are provided in Appendix 1. The borehole locations are shown on Drawing PG5812-1 - Test Hole Location Plan in Appendix 2.

3.2 Field Survey

The test hole locations from the geotechnical investigations conducted by others were surveyed by others and are understood to be referenced to a geodetic datum.

The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG5812-1 Test Hole Location Plan in Appendix 2.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a low-rise commercial building with associated asphalt-paved parking areas and access lanes, and with mature trees along the east boundary of the site. A low-clearance, overhead billboard is present on the western site boundary, along Merivale Road. The site is bordered to the north and south by commercial properties, to the west by Merivale Road and to the east by Kerry Crescent. The site is generally flat and at grade with Merivale Road at approximate geodetic elevation 95 to 96 m.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test hole locations consists of a thin asphalt layer overlying either sand and gravel or fill, consisting of sand and gravel with some silt, extending to approximate depths of 0.4 to 2.4 m below the existing ground surface.

A glacial till layer was generally encountered underlying the sand and gravel or fill, extending to approximate depths of 1.8 to 2.7 m. The glacial till generally varied from gravelly sand with some silt to silty clay with some sand and gravel.

Practical refusal of the augers was generally encountered at approximate depths of 1.2 to 2.7 m below the existing ground surface.

Bedrock

Bedrock was cored in boreholes MW15-1 to MW15-11, BH/MW205, BH/MW207, BH/MW208, and MW301 to MW312, by others, to approximate depths between 4.6 and 10.8 m. According to the boreholes by others, the bedrock varies from shale to a shaley limestone.

The Rock Quality Designation (RQD) was only listed on the borehole logs for MW15-10 and MW15-11. Based on the RQDs of the bedrock core from these 2 boreholes, the bedrock is of very poor to poor quality, increasing to fair quality by 3.6 m below the existing ground surface.

Based on available geological mapping, the local bedrock consists of limestone and dolomite of the Gull River formation with a drift thickness of approximately 3 to 5 m.

4.3 Groundwater

Groundwater levels were measured in the monitoring wells by others. The observed groundwater levels are summarized in Table 1 below and on the next page:

Table 1 - Summary of Groundwater Level Readings by Paterson and Others								
Test Hole Number	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Recording Date				
BH 1	-	2.44	-	November 23, 1998				
BH 2	-	2.44	-	November 23, 1998				
BH 3	-	Dry	-	November 23, 1998				
BH 4	-	Dry	-	November 23, 1998				
BH 5	-	Dry	-	November 23, 1998				
BH 6	-	Dry	-	November 23, 1998				
MW15-1	95.47	1.6	93.87	April 21, 2016				
MW15-2	94.99	1.1	93.89	April 21, 2016				
MW15-3	95.36	2.5	92.86	April 21, 2016				
MW15-4	95.37	1.4	93.97	April 21, 2016				
MW15-5	95.36	1.9	93.46	April 21, 2016				
MW15-6	95.11	1.3	93.81	April 21, 2016				
MW15-7	94.80	0.8	94.0	April 21, 2016				
MW15-8	94.58	1.0	93.58	April 21, 2016				
MW15-9	94.90	1.5	93.4	April 21, 2016				
MW15-10	95.70	1.8	93.9	April 21, 2016				
MW15-11	95.70	2.1	93.6	April 21, 2016				
BH/MW205	95.24	1.4	93.84	April 21, 2016				
BH/MW207	95.47	2.6	92.87	April 21, 2016				
BH/MW208	94.68	1.8	92.88	April 21, 2016				

Table 1 (continued) - Summary of Groundwater Level Readings by Paterson andOthers									
Test Hole Number	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Recording Date					
MW301	95.70	2.3	93.4	September 14, 2017					
MW302	95.25	2.0	93.25	September 14, 2017					
MW303	95.42	1.8	93.62	September 14, 2017					
MW304	95.70	2.3	93.4	September 14, 2017					
MW305	95.70	2.3	93.4	September 14, 2017					
MW306	95.70	2.5	93.2	September 14, 2017					
MW307	95.38	2.3	93.08	September 14, 2017					
MW308	95.35	2.2	93.15	September 14, 2017					
MW309	95.43	2.3	93.13	September 14, 2017					
MW310	95.50	2.3	93.2	September 14, 2017					
MW311	95.70	2.3	93.4	September 14, 2017					
MW312	94.97	2.9	92.07	September 14, 2017					
Note: The group	nd surface elevation	s at the borehole loc	ations are understo	od to be referenced to					

It should be noted that the groundwater levels could be influenced by surface water infiltrating the backfilled boreholes. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater table can be expected at approximately 2 to 3 m below ground surface.

However, groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is recommended that foundation support for the proposed buildings consist of conventional spread footings placed on clean, surface sounded bedrock.

Bedrock removal will be required for the proposed building excavations. Bedrock removal may also be required for installation of site services, depending on the depths of the proposed utilities.

Expansive shale bedrock may present at this site. Precautions should be provided during construction to reduce the risks associated with the potentially heaving shale bedrock. This is discussed further in Section 6.7.

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. Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants, such as foundation walls, should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

Where the bedrock is weathered and/or where only small quantities of bedrock need to be removed, hoe ramming is an option for bedrock removal. Where large quantities of bedrock need to be removed, line drilling in conjunction with controlled blasting may be required.

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 conducted prior to commencing construction. The extent of the survey should be determined by the blasting consultant and sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocity (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 could be 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 a cooperative environment with the residents.

The following construction equipment 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 cause or the source of detrimental vibrations at the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the permissible vibrations, 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). These guidelines are current construction standards. These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a preconstruction survey is recommended to minimize the risks of claims during or following the construction of the proposed buildings.

Fill Placement

Fill used for grading beneath the proposed building footprints, 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).

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 these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of 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

Footings placed on clean, surface sounded bedrock can be designed using a bearing resistance value at ultimate limit states (ULS) of **1,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance at ULS.

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 for 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 sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passes through sound bedrock or a material of the same or higher capacity of the bedrock, such as concrete.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C**. A higher seismic site class, such as Class A or B, may be achievable for this site. However, a site specific shear wave velocity test is required to accurately determine the applicable seismic site classification for foundation design of the proposed building, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

The soils underlying the proposed foundations are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab Construction

For the proposed development, all overburden soil will be removed from the building footprint, leaving the bedrock as the founding medium for the basement floor slab. It is anticipated that the basement area for the proposed building will be mostly parking and the recommended pavement structures noted in Subsection 5.8 will be applicable. However, if storage or other uses of the lower level will involve the construction of a concrete floor slab, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

Any soft areas in the basement slab subgrade should be removed and backfilled with appropriate backfill material prior to placing fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

In consideration of the groundwater conditions at the site, an underslab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the subfloor fill under the lower basement floor. This is discussed further in Subsection 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, in our opinion, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a dry unit weight of 20 kN/m³.

The applicable effective unit weight of the retained soil can be estimated as 13 kN/m^3 , where applicable. A hydrostatic pressure should be added to the total static earth pressure when calculating the effective unit weight.

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

Static Earth Pressures

The static horizontal earth pressure (P_o) can be calculated by a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

- K_{o} = at-rest earth pressure coefficient of the applicable retained soil, 0.5
- γ = unit weight of fill of the applicable retained soil (kN/m³)
- H = height of the wall (m)

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

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

Seismic Earth Pressures

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

- $a_c = (1.45 a_{max}/g)a_{max}$
- γ = unit weight of fill of the applicable retained soil (kN/m³)
- H = height of the wall (m)
- $g = gravity, 9.81 \text{ m/s}^2$

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

The earth force component (P_o) under seismic conditions could be calculated using $P_o = 0.5 \text{ K}_o \gamma \text{ H}^2$, where $K_o = 0.5$ for the soil conditions presented above.

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

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

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

5.7 Pavement Design

For design purposes, it is recommended that the rigid pavement structure for the underground parking level consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is further presented in Table 2 below. The flexible pavement structure presented in Table 3 should be used for at grade access lanes and heavy loading parking areas.

Table 2 - Recommended Rigid Pavement Structure - Lower Parking Level							
Thickness (mm) Material Description							
150	Exposure Class C2 - 32 MPa Concrete (5 to 8% Air Entrainment)						
300	BASE - OPSS Granular A Crushed Stone						
SUBGRADE - Existing imported fill, or OPSS Granular B Type I or II material placed over bedrock.							

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the underground parking level. The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hour after the concrete has been poured during warm temperatures and up to 12 hours during cooler temperatures.

Table 3 - Recommo Parking Areas	ended Pavement Structure - Access Lanes and Heavy Truck					
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					
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						

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.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed buildings. The system should consist of a 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, which is placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Where insufficient room is available for exterior backfill, it is suggested that the composite drainage system (such as Delta Drain 6000 or equivalent) be secured against the temporary shoring system, extending to a series of drainage sleeves inlets through the building foundation wall at the footing/foundation wall interface. The drainage sleeves should be at least 150 mm diameter and be spaced 3 m along the perimeter foundation walls. An interior perimeter drainage pipe should be placed along the building perimeter along with the underslab drainage system. The perimeter drainage pipe and sub-slab drainage system should direct water to sump pit(s) within the underground level.

Underslab Drainage

Underslab drainage will be required to control water infiltration under the lowest level slab. For preliminary design purposes, we recommend that 100 or 150 mm perforated pipes be placed at approximate 6 m centres underlying the basement floor slab. The spacing of the sub-slab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Where space is available, 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 effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

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

However, the footings are generally not expected to require protection against frost action due to the founding depth. Unheated structures such as the access ramp may require insulation for protection against the deleterious effects of frost action.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials and very poor to poor quality bedrock 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.

Unsupported Excavations

The excavation side slopes in the overburden and very poor to poor quality bedrock, above the groundwater level and extending to a maximum depth of 3 m, should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be 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.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by "cut and cover" methods and excavations should not remain open for extended periods of time.

Temporary Shoring

Dependent on the final depth of the excavation, and the proximity of the excavation to the site boundaries, it is anticipated that a temporary shoring system may be required to support the overburden soils and very poor to poor quality bedrock during the building excavation. The design and approval of the temporary shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures, and include dewatering control measures.

In the event that subsurface conditions differ from the approved design during the actual installation, it is the responsibility of the shoring contractor to commission the required experts to re-assess the design and implement the required changes. The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's representative prior to implementation.

The temporary shoring system may consist of a soldier pile and lagging system. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. These systems can be cantilevered, anchored or braced. Generally, the shoring systems should be provided with tie-back rock anchors to ensure their stability.

Table 4 - Soil Parameters							
Parameters	Values						
Active Earth Pressure Coefficient (K _a)	0.33						
Passive Earth Pressure Coefficient (K _p)	3						
At-Rest Earth Pressure Coefficient (K _o)	0.5						
Unit Weight (γ), kN/m³	21						
Submerged Unit Weight (γ), kN/m ³	13						

The earth pressures acting on the temporary shoring system may be calculated using the following parameters.

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be used above the groundwater level while the effective unit weight should be used below the groundwater level.

The hydrostatic groundwater pressure should be added to the earth pressure distribution wherever the effective unit weights are used for earth pressure calculations. If the groundwater level is lowered, the dry unit weight for the soil should be used full weight, with no hydrostatic groundwater pressure component. For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

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

A minimum 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm and 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 loose lifts and compacted to a minimum of 98% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the site excavated materials above the cover material if the operations are carried out in dry weather conditions.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.5 m below finished grade) and above the cover material 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 standard Proctor maximum dry density.

6.5 Groundwater Control

Groundwater Control for Building Construction

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

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

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

Impacts on Neighbouring Structures

Based on the subsurface conditions encountered at the subject site, it is anticipated that the adjacent structures are founded on bedrock or the glacial till deposit. Therefore, no adverse effects from short term and/or long term dewatering are expected for the surrounding structures.

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 into the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions.

6.7 Protection of Potential Expansive Bedrock

Upon being exposed to air and moisture, shale may decompose into thin flakes along the bedding planes. Previous studies have concluded shales containing pyrite are subject to volume changes upon exposure to air. As a result, the formation of jarosite crystals by aerobic bacteria occurs under certain ambient conditions.

It has been determined that the expansion process does not occur or can be retarded when air (i.e. oxygen) is prevented from contact with the shale and/or the ambient temperature is maintained below 20°C, and/or the shale is confined by pressures in excess of 70 kPa. The latter restriction on the heaving process is probably the major reason why damage to structures has, for the greater part, been confined to slabs-on-grade rather than footings.

Based on the borehole logs by others, expansive shale may be encountered at the subject site. To reduce the long term deterioration of the shale, exposure of the bedrock surface to oxygen should be kept as low as possible. The bedrock surface within the proposed building footprint should be protected from excessive dewatering and exposure to ambient air. A 50 mm thick concrete mud slab, consisting of minimum 15 MPa lean concrete, should be placed on the exposed bedrock surface within a 48 hour period of being exposed. The excavated sides of the exposed bedrock should be sprayed with a bituminous emulsion to seal bedrock from exposure to air and dewatering.

Another option for protecting the shale from deterioration is placing granular fill over the exposed surface within a 48 hour period after exposure. Preventing the dewatering of the shale bedrock will also prevent the rapid deterioration and expansion of the shale bedrock. This can be accomplished by spraying bituminous emulsion as noted above.

7.0 Recommendations

For the foundation design data provided herein to be applicable, a materials testing and observation services program is required to be completed. The following aspects should be performed by the geotechnical consultant:

- □ 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.
- **□** Review bedrock excavation activities and exposed vertical bedrock faces.

A report confirming the construction has been conducted in general accordance with the 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 our present understanding of the project. We request that we be permitted 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 recommendations provided in this report are intended for the use of design professionals associated with this project. Contractors bidding on or undertaking the work should examine the factual information contained in this report and the site conditions, satisfy themselves as to the adequacy of the information provided for construction purposes, supplement the factual information if required, and develop their own interpretation of the factual information based on both their and their subcontractors construction methods, equipment capabilities and schedules.

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 Katasa 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.

Owen Canton, E.I.T.

Report Distribution:

- □ Katasa (e-mail copy)
- Paterson Group



Scott S. Dennis, P. Eng.

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS & TERMS

SOIL PROFILE AND TEST DATA SHEETS BY OTHERS

JOHN	D. PA1	ERSON	&	ASSOCIA	TES	LTD.
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SOIL PROFILE & TEST DATA

Consulting Geotechnical and Environmental Engineers 28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

DATUM										FILE	NO.	F167	7
REMARKS										HOL	E NO.	DULA	
BORINGS BY Truck-mount Drill	T				C	DATE	23 Nove	mber 19	98			BH 1	
SOIL DESCRIPTION		PLOT		SAN	/IPLE		DEPTH (m)	ELEV. (m)	Pen. I	Resist. 50 m	Blow m Dia.	s/0.3m Cone	VIC MELL
		STRATA	ТҮРЕ	UMBER	20VER	VALUE			O Lov	ver Ex	plosive	Limit %	ITORIA NSTRU
GROUND SURFACE				~	R	ZŬ	0-	_	20	40	60	80	ĔΩ
Grey crushed stone	Q.10												
	00						1				***		
GLACIAL TILL: Compact to dense, brown sandy silt, some gravel			ss	1	54	42		-					
			SS	2	50	18	2-	-					
Weathered LIMESTONE with occasional shale seams End of Borehole	2.34 2.59		SS	3	67	41			0				Ā
Auger refusal in inferred bedrock @ 2.59m depth													
(Open hole WL @ 2.44m depth)													
									100 Gaster	200 ch 13' Gas Res	300 I 4 Rdg p. ∆ Me	400 50 . (ppm) ethane Elim.	00

JOHN D. PATERSON & ASSOCIATES LTD.

SOIL PROFILE & TEST DATA

Consulting Geotechnical and Environmental Engineers 28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

DATUM									FILE NO.	E167	7
REMARKS									HOLE NO.	DU 2	-
BORINGS BY Truck-mount Drill	1			E	DATE	23 Nove	mber 19	98			
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)	Pen. Re	esist. Blow i0 mm Dia.	s/0.3m Cone	NG MEL
	STRATA	ТҮРЕ	NUMBER	× ECOVER	Dr Rad			O Lowe	er Explosive	Limit %	UITORI
GROUND SURFACE			_		2	0-	-	20	40 60	80	5º
Grey crushed stone											
GLACIAL TILL: Compact to very dense, brown sandy silt, some gravel		SS	4	79	14	1-					
		ss	5	42	50 + 50 +	2-	-	Δ			
			2								
Weathered LIMESTONE with occasional shale seams	4	SS	7	100	50+				Δ		₩.
End of Borehole		–									
Auger refusal in inferred bedrock @ 2.74m depth.											
(Open hole WL @ 2.44m depth)								100 Gastech	200 300 1 1314 Rdg	400 50 . (ppm)	00

JOHN D. PATERSON & ASSOCIATES LTD.

SOIL PROFILE & TEST DATA

Consulting Geotechnical and Environmental Engineers 28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

DATUM			17 - 14 -						FILE N	10.	-	
REMARKS											E167	7
BORINGS BY Truck-mount Drill				0	DATE 2	23 Novei	mber 19	98	HOLE	NO.	BH 3	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.	Pen. Re	sist. 0 mm	Blows Dia.	s/0.3m Cone	MELL
	гкөтө	ΓΥΡΕ	JMBER	× COVERY		(m)	(m)	O Lowe	r Expl	osive	Limit %	TORING VSTRUC
GROUND SURFACE	ပ		N	REC	2 p			20	40	60	80	
Asphaltic concrete 0.05						0-						- <u>></u>
Grey crushed stone	000											
0.45	-											
		ss	8	88	39	1-		Δ				
GLACIAL TILL: Dense, dark brown to brownish		-					8					
grey sandy silt, some gravel												
		SS	9	17	50+			×				
						2-						
		ss	10	71	25			4				
0.74												
End of Borehole		1										
Auger refusal on inferred bedrock @ 2.74m depth.												
(BH dry upon completion)												
								100 Gastech	200 1314	300 Rdg.	400 50 (ppm)	00



SOIL PROFILE & TEST DATA

FILE NO.

Consulting Geotechnical and Environmental Engineers

28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

DATU	JM
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REMARKS										100	0.00	1	E167	7	
BORINGS BY Truck-mount Drill				П	ATE	23 Nove	mher 19	98		HOL	ENO),	BH 4	1	
not the print									D						
SOIL DESCRIPTION	PLO		SAN			DEPTH	ELEV.	Pen.	- ке 5	sist. 0 mr	n Di	ia. Co	one	법	
	ATA	щ	ËR	JERY	Щ	(111)	(111)			2010-1220			573	RING	
	STRF	TYF	NUME		N N			O Lo	owe	er Explosive Limit %					
GROUND SURFACE				2	ZŬ	0-	_	2	0	40	6	0	80	1 <u>É</u> o	
Asphaltic concrete															
Grey crushed stone 0.27	-										4.4.1				
FILL: Brown sand	$\overline{\mathbb{X}}$														
Q <u>.</u> 47	\mathbb{X}							*******	******					ala	
		KK													
		KK													
		Eau	11			-	•	۵							
GLACIAL TILL: Dense.															
brown sandy silt, some		Ĕ													
gravel														÷	
		\mathbb{V}_{aa}												1	
		55	12		61			4		10.00					
			1												
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		Êau	13					Δ			1.1.1.1				
End of Borebole	<u>~</u> ^	Ê										++-		-	
Auger refusal on inferred bedrock @ 2.29m depth.															
(BH ary upon completion)															
	- 25														
	-														
									130				ISE3		
								IC Gast	io iech	200	30 4 R	10 4 10 1	00 { nom}	00	
								A Fu	ill Ga	s Res	p. ∆	Metha	ine Elin	۱.	

JOHN D.	PATERSON	& ASSOCIATES	LTD.
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SOIL PROFILE & TEST DATA

Consulting Geotechnical and Environmental Engineers 28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

Lancaster Plaza, 1509-1531 Merivale Road

	1, 146	hean!	UIII.			Nepean	, Ontari	o				1997	
DATUM									FIL	E NO.			
REMARKS										ENO	Ele	677	
BORINGS BY Truck-mount Drill				C	ATE	23 Novei	mber 19	98		LE NU.	BH	5	
SOIL DESCRIPTION	PLOT		SAN	NPLE		DEPTH	ELEV.	Pen. Resist, Blows/0.3m					
	тката	ТҮРЕ	NUMBER	× ECOVERY	I VALUE	()	(1117	O Lov	ver Ex	plosiv	e Limit	VITORIN ONSTRUC	
GROUND SURFACE					2	0-	-	20	40	60	80	<u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	
Grey crushed stone	30 L												
FILL: Brown sand												Ten o a la constante de la con	
				Ĩ							***		
GLACIAL TILL: Dense to		SS	14	54	40	1-	-	Δ					
compact, brown sandy silt, some gravel													
		7											
		SS	15	88	28			Δ					
2.12						2-							
End of Borehole		1											
Auger refusal on inferred bedrock @ 2.13m depth.											- -		
(BH dry upon completion)											1 1		
								100 Gaste ▲ Full	200 ch 13 Gas Re	300 1 4 Rd ؤ sp. ∆ M	400 g. (ppn lethane E	500 n) Elim.	

JOHN D. PATERSON & ASSOCIATES LTD.

SOIL PROFILE & TEST DATA

Consulting Geotechnical and Environmental Engineers Phase II Environmental Site Assessment 28 Concourse Gate Unit 1 Nenean Opt K2E 7T7

Lancaster Plaza, 1509-1531 Merivale Road

	, one i	, 110	pean,	Unit.		17	Nepean	, Ontari	io				100		100		
DATUM						_	16 - Orio				FII	LENO) .	E 4	07	7	
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BORINGS BY Truck-mount Drill			31		0	DATE	23 Novei	mber 19	98	-3			ю.	Bł	16		
SOIL DESCRIPTION		PLOT		SAN	/IPLE		DEPTH	ELEV.	Pe	en. F	lesist 50 n	t. B nm I	low: Dia.	s/0.3 Cone	m	S WELL	
		RATA	YPE	MBER	× OVERY	ALUE		(11)	0	Low	/er E	xplo	sive	Limi	mit %		
GROUND SURFACE		ST		R	REC	ZO				20	40)	60	80		CON	
Asphaltic concrete Grey crushed stone	0.06						0-									<u> </u>	
FILL: Dark brown, mixture of clay, silt and sand		***															
	0.60		<u> </u>	10													
				10													
			SS	17	75	61	1-	÷	Δ								
GLACIAL TILL: Very dense	, , , ,			A l													
to compact, brown sandy silt						-											
			V														
			SS	18	79	18	2		4								
	2.20						-										
End of Borehole	2.29	* * *								-	• •		+ -		•		
Auger refusal on inferred bedrock @ 2.29m depth.											***						
(BH dry upon completion)																	
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										100							
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Gastech 1314 Rdg. (ppm) ▲ Full Gas Resp. △ Methane Elim.

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

St < 2
$2 < S_t < 4$
$4 < S_t < 8$
$8 < S_t < 16$
St > 16

ROCK DESCRIPTION

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

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

RQD % ROCK QUALITY

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
ΡI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Сс	-	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 > 4Well-graded sands have: 1 < Cc < 3 and Cu > 6Sands 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)
Сс	-	Compression index (in effect at pressures above p'c)
OC Ra	tio	Overconsolidaton ratio = p'c / p'o
Void Ra	atio	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 Topsoil Asphalt Peat Sand Silty Sand Fill ∇ Sandy Silt Clay Silty Clay Clayey Silty Sand Glacial Till Shale Bedrock

MONITORING WELL AND PIEZOMETER CONSTRUCTION



PIEZOMETER CONSTRUCTION



Project:	olect: Environmental Drilling and Groundwater Monitoring									Figure No. 3							
Location:	1509 - 1531 Merivale Boad, Ottawa	vater wornit	2011	y						Pa	ge	1_ of	_1_				
Data Drillod:	2/24/15																
		Split Spoon Sample 🛛 🕅 Auger Sample 🕅							Combus Natural								
Drill Type: <u>Geoprobe</u> Datum: <u>Geodetic</u>			_	SPT (N)	Value			0		Atterberg Limits					i—∂		
			Shelby Tube						Undrained Triaxial at % Strain at Faiture					\oplus			
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moist	, no odour	94.8		1016	10.0	10104					1210			\square			
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		93.4						1000	0 []					X	53		
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flushi	ng médium, no odour	_	3				100				1519	1465					
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Borehole data requires interpretation by exp. before use by others		WATER	WATER LEVEL RECORDS							COF	CORE DRILLING R				CORD		
use by others		anser i		VV gtor	-	a second of 10 Million	ALC: 1 1							1.00	10.8/		

Project to Environmental Drilling and Groupdwater Monitoring									Figure No4_						
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ş			5	Standard Penetration Test N Vai					Comb	ustible Va	Vapour Reading (ppr		Ş		
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cobbles	s present, brown, moist, no odo	ur _	2	0000					- P		1 112	351	X	S3	
Ref	usal at 2.4 m Depth on Bedroc	sk							ů.	101		1251	X	S4	
- SHALE Dark gr	BEDROCK ey cuttings, brown water in air	92.5	9	4953	1420		172.5			121		125.21	Ē	1	
flushing	g medium, no odour	_	3	2011	100										
				6 E.13 0 0 00 7 0 00											
		-							1 223	1923					
-		-	4												
					122										
				6425											
-		-	5	10000	4155		-2-2-3		10 2 40 fr		9	12.2.10			
		-		5355	4.50			1.1							
					100				1 11				1		
		-	6	13010	122	-1-1	12	111	8 13.13		1 1124				
-		_		1910					6 5210						
			,	2242	i.c.		0.04					-014			
			ľ	2112				1010				131			
		-							1 1111	1.7.1					
_		_	8		112			1110							
						0.100						3211			
		-			136	- 1.1	1	1123	1 203	1100					
		- 86.2	9	1010	-1000	5132				11.01		2213	-		
Bore	hole Terminated at 9.2 m Dept	th	1										$\uparrow \uparrow$		
				11443	15332				1		- 19				
Borehole data requir use by others	es interpretation by exp. before	WATE	RL	EVEL R	ECORE	NS Hole C	100	Dur	CO	RE DR	ILLING R	ECOR)	20.6	
A flushmount monito tandpipe was install completion.	ring well with a 19 mm slotted led in the borehole upon	Time 10 days	_L	evel (m) 2.1		тою Ор То (т	uen 1)	No.	(ŋ	p(n 1)	% Re	C.	R	JD %	
field work supervise	d by an exp representative.	-pi# 21, 2010		2.5											

Project	Environmental Drillion and Groundwate	ar Monito	rin	-					F	igure	No.	6	<u> </u>		
ocation	1509 - 1531 Merivala Road, Ottawa			9					_	Pa	age.	1_ of	_1_		
	1509 - 1531 Merivale Road, Ottawa								_						
Date Drilled:	3/31/15		-	Split Spo Auger S	on Sam; amole	ple				Combu	stible Vi	apour Rea	ding		$\overline{\Box}$
Drill Type:	Geoprobe			SPT (N)	Value			0		Atterbe	ng Limit	e Conteni s			-0
Datum:	Geodetic			Dynamic Shelby T	: Cone Ti lube	est	_			Undrain % Strai	ned Tria In at Fail	xial at ure			\oplus
.ogged by:	MAD Checked by: MGM	_		Shear S Vane Te	irength b st	À		+ s		Shear : Penetro	Strength ometer 1	by lest			
SY MR	SOIL DESCRIPTION	Geodelic	Dep	Sta	andard Pe	enetratio 40	n Test 60	N Valı	0 Je	Combi	ustible V 250 atural Mo	apour Rea 500	ding (ppm) 750		Natur:
Ŭ		m 95.37	h	Shear	Strength 50	100	150	20	kPa 00	Atte	rberg Lin 20	nits (% Dr) 40	Weight) 60	LES	kN/m
	ALT ~ 60 mm	95.3	ľ	1222	1351					5				N	
- grave clay,	el from a commercial pit, with silt and - brown to dark brown then grey, moist,	-			1000									ľ	S1
	-		1			01-1				\$ P				\mathbb{X}	S2
	-	93.63								s D				Ń	S3
FILL	Refusal at 2.4 m Depth on Bedrock	93.0	5											-14	
Dark	grey cuttings, brown water in air ing medium, no odour]													
			1												
	-		4												
		-00 B					1000								
В	orehole Terminated at 4.6 m Depth	50.0											1 19763		
												-			
OTES:						1.	1				1	_			
Borehole data red use by others	quires interpretation by exp. before	WATER	LE 	Water	CORD	S Hole O	nen		Bun	00	RE DF)	20.02
A flushmount mor	nitoring well with a 51 mm stotted	18	L,e	<u>evel (m)</u>	_ _	To (r	n)		No.	(m)	76 71	с с.	710	JJ 7⁄0
completion.	April 21	,2016		1.4		•									
Field work superv	rised by an exp representative.														
. Goe Hotes UN 38	uhua maanuhunnia														

Draiaati	Environmental Drilling and Ora							I	Figure	No.	7	_	
Project:	Environmental Drilling and Gro	undwater Monito	oring]					Pa	ige.	1_ of	_1_	
Location:	1509 - 1531 Merivale Road, Ot	tawa											
Date Drilled	4/30/15		-	Split Spo	xon Samp ample	ie]	Combu	istible Va	pour Read	ing	Ö
Drill Type:	Geoprobe		-	SPT (N)	Value		0		Atterbe	rg Limits	Content	H	
Datum:	Geodetic	_	_	Dynamic Shelby T	: Cone Te 'ube	st		•	Undrair % Strai	ned Triax n at Failu	ial at ire		\oplus
logged by:	MAD Checked by: I	MGM		Shear S Vane Te	trength by	/	+		Shear Shear	Strength ometer Te	by ast		
s				Sta	andard Pe	netration	Test N Va	lue	Combi	ustible Va	pour Read	ng (ppm)	Ş
	SOIL DESCRIPTION	Geodetic	e p	Shear	20 Strength	40	60 (80 kPa	Na	250 Itural Moi	500 7 sture Conte	150 Int %	A Natur P Unit W
L ASP	HALT ~ 60 mm	95.36	ĥ 0	2416.01	50 1	100 1	50 2	200		20	40	60	S kN/m
SAN	D AND GRAVEL				1993	2002	10000						
- Disti	urbed native soil, grey and brown st, no odour	194.7						1000		19.1/2-			
	erred from MW15-1)		1	4444	1434	0.1.1.0	-GX-414 		0.3.2.2				
Grav turni	velly sand, some silt, brown, mois ing moist/wet, no odour	t										32.10	
(Infe	rred from MW15-1)				节制						GREE		
		93.2	4 2	1012		11512.0	12111	1993	1.646			12211	
SHA	LE BEDROCK	93.0		2638 800 M	.1.2.5.3	1.200	1.5.1.5.1.5.1.5 		100				
Dark flush	c grey cuttings, brown water in air ning medium, no odour			12.111	114	1.1.1.1		1221					
			3	2013	1221	1519	10 (0 E 12 15 (0 E 12	112.0.5	251	127	1121	3243	
		_		12-11-12- 12-11-12-12-12-12-12-12-12-12-12-12-12-1	1000	11111	121121			-	0103		
		_	4	General de General de Deservation				10.21					
	orehole Terminated at 4.3 m De	91.1		1271113		2133	23.25	10151	121413	1.5.5			
Note	: stratigraphy inferred from MW1	5-1											
										100			
													t I
									81				
					1							18	
NOTES:		I				-					1		
.Borehole data re use by others	equires interpretation by exp. before	Elapsed I	H LE	VEL RI Water		5 Hole On	en -	Run	CC Der	offe DR	KILLING R	ECORD	ROD %
	phitoring well with a 51 mm slotted	Time	Le	2.1		To (m))	No.	(n	1)			
A flushmount me standpipe was in	istaired in the polenoie opon	o days 1											
 A flushmount mo standpipe was in completion. 	rvised by an evo representative	April 21, 2016		1.9									

roject:	Environmental Drilling and Groundwa	ter Monito	nin	g				I	Figure	No	8	-	
ocation:	1509 - 1531 Merivale Road, Ottawa								Pá	age	1_ of	_1	
ate Drilled:	4/30/15			Colit Fee			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Comb	addia Ma		1	
rill Type:	Geoprohe		-	Auger S	ampte	n a	Ĩ]	Natura	istible va Moisture	Content	ing	$\overset{\square}{\times}$
atum:	Geodetic		-	SPT (N) Dynamic	Value : Cone Te	st		-	Atterbe Undrai	irg Limits ned Triaxi	ial at	F	0
paged by:	MAD Checked by: MGM		-	Shelby T	ube			T	% Strai	in at Faitu Strenoth I	ire DV		
-9900 - 71				Vane Te	st st	1	S		Penetri	ometer Te	st		
S		Geodetic	D	Sta	andard Pe	netration	Test N Va	ເມ່ນອ	Combi	ustible Va 250	pour Readi 500 7	ing (ppm) '50	S A Natu
E C	SOIL DESCRIPTION	m	p L h	Shear	20 Strength	40	60	80 kPa	N: Atte	atural Moi rberg Limi	sture Conte Its (% Dry \	ant % Veight)	P Unit V L kN/π
ASPH	ALT ~ 60 mm	95.11	0	1013	50	00	150 3	200	24.23 21.14	20	40	60	\$
-Distu	bed native soil, grey and brown,	- 94 4		3833 42.55				11131					
(Infer	, no odour red from MW15-1)			3233	1321	\$1-54 \$4-73						1213	
Grave	lly sand, some silt, brown, moist		[1010				1131			1.000	1010	
turnin (Infen	g moist/wet, no odour red from MW15-1)	93.43	3	10000	1001	1372						2000	
-		-	2	8555	102		1033						
CUAL	E BEDROCK	92.7		1000	1321								
Dark	grey cuttings, brown water in air	7		3315			333	11.11	100			1212	1
	ig medium, no odour	-	3	2002	1.2.5-1					122	2121	10010	
		_		2222		9103 7191	24(2)					10010	
					1352		1			100			
Ba	rehole Terminated at 4.2 m Depth	90.9	4	1111		2.53						11212	
	in the second												
Note:	stratigraphy inferred from MW15-1												
			$\left \right $										
DTES: Borehole data req	uires interpretation by exp. before	WATER	RLE	EVEL RE	ECORD	5			CC	RE DRI	LLING R	ECORD	
use by others	Ela Ela	psed me	L	Water evel (m)		Hole Op To (m	en	Run No.	Dep (m	oth 1)	% Re	C.	ROD %
A flushmount mon			-										
A flushmount mon standpipe was ins completion.	talled in the borehole upon 8 c	lays 1, 2016		1.7 1.3		-							

Project:	Environmental Drilling and Ground	wate	er Monito	ńл	a					F	igure	No	9	-		
ocation:	1509 - 1531 Merivale Road. Ottawa	a			<u> </u>	_				_	Pa	ige	1_ of	1		
ate Drilled:	6/26/15				Collin Con					-	G					_
rill Type	Geoprobe				Auger Sa	on samp Imple	016				Natural	stible va Moisture	pour Headi Conlent	ng		×
)atum:	Geodetic			•	SPT (N) Dynamic	Value Cone Te	est		0		Atterbe Undrair	rg Limits red Triax	alat	F		0
oggod by:	Checked by MC				Shelby T	ube					% Strai	n at Failu	ire			⊕
оуува ру.	Checked by: MG	VI			Shear St Vane Te:	rength by st	¥		+ s		Penetro	ometer To	est			A
S Y			Geodetic	D	Sta	ndard Pe	netralion	Test N	Valu	0	Combu	ustible Va	pour Readi	ng (ppm) sä	SA	Natura
	SOIL DESCRIPTION		m	p t b	Shear S	20 Strength	40	60	80	kPa	Na Atter	itural Moi berg Lim	sture Conte its (% Dry V	nt % Veight)	PLE	Unit W kN/m
ASPI	HALT ~ 40 mm		94.8 94.7	0	3115	ю 	100 1	150	20	0	1111	20	40 (50	Š	
Sand	and gravel, grey and brown, moist,	f	94.4		\$5155	1000	11111	1	131	11:11	111	122		1.1.1		
no oc TILL	dour				2015											
Brow	n, silty clay, some sand and gravel,	-	93.47	1						1132) 1100	51.54 (-4-5-)	121		12213	11	
-		-			87445 94412			10.00	12	1932	Sec.13			14 64 25 16 7 4 3		
SHAI	E BEDROCK		93.0		63145 67755						3513	185	2121	2011-2 2011-2		
Dark flushi	grey cuttings, brown water in air ing medium, no odour			ľ	1999 1997 1997 1997		2112	10113		1404) 1121:	1113	1.5				
		-	1		2.813	1000	2100	1000		100 M				2 10 2		
		_		3			2120	12		in a la		154				
						1321	0.000	12.01								
		-	1		2223	1331	18138	1.1.1			10113	1221	11111	0.113		
		_	-	4												
		_	00.2		02.23	10.61					1115					
Bo	prehole Terminated at 4.57 m Depth		50.2	t						1344						
						1										
											11					
								1				131				
Borehole data rec use by others	quires interpretation by exp. before	Elane	WATER		EVEL RE	CORD	S Hole On	en		Run		REDR		ECORD	- Pr	_» مר
A flushmount mor standoipe was in	nitoring well with a 51 mm slotted	Tim 11 de	e	L	evel (m)	_	To (m)	वार 		No.	(m)	70 MBI		HL.	⊿ ⊔⁄ 7⁄o
IN A REAL PROPERTY OF A REAL PRO		11.00	·74		ت	1			L L							
completion.	Api	ril 21,	2016		8.0											

Project:	Environmental Drilling and Groundwa	ter Monito	ring	3				F	igure	No	10	_	
ocation:	1509 - 1531 Merivale Road. Ottawa								Pa	ge	1_ of	1	
ate Drilled	6/26/15			Dalis D-				_	6	asilar - Pr	-		-
rill Type	Geographe		-	Split Spt Auger Si	ion Samp ample	00			Combu: Natural	stible Vap Moisture	content	ng	×
)atum:	Geodetia		-	SPT (N) Dynamic	Value Cone Te	et	0		Atterber	ng Linnits and Trianai	al ai	ŀ	—Ð
atum.			-	Shelby T	ube				% Strain	at Failu	ne		\oplus
.oggea by:	DC Checked by: MGM			Shear Si Vane Te	rengih by st	1	+ s		Penetro	meter Te	γγ ISI		
S			D	Sta	indard Pe	netration	Test N Val	lue	Combu	stible Vaj	pour Readi	ing (ppm)	S Nobe
B	SOIL DESCRIPTION	Geodetic	e P t h	Shear :	20 Strangth	40	60 8	80 kPa	Na Atter	tural Mois berg Limi	sture Conte ts (% Dry V	50 Int % Neight)	P Unit V
ASP		94.58	0		50 1	00 1	50 2	00	2013	20	40 (06	S
Distu	rbed native soil, brown, moist, no	H ^{94.4}		2,212	1.1.1.1		3.11		2112	2333	1421		
Discourse in the second	r			0.0494 31013		211		100-010	212	1039			
Brow	m, silty clay, some sand and gravel, t, no odour	93.4			1211	2444	(1)(1)1 (1)(1)			1.07	110		
- SHA Dark	LE BEDROCK grey cuttings, brown water in air	-		0.616 9.946	1444	1999-1999 1999-1999	1		24-2-0			10000	
flush	ing medium, no odour	_	2		3.33	(data)		1111	1			10.12	
					1013						1131		
				0.444.9	12361				1111	12:21	11121	(2-C-1)-	
-		-	з		1111	212	14.5.1.1. 1.5.16.1.5.	11111	Sec. 1	14.251	5.00	0110	
				0.01472									
					1255	3118	1301				1161		
		-	4	5.555	1111	ente ente							
		90.0		3653	1.250	2132	2513	10.2	213	1344	1.2333	13233	
8	prenote Terminated at 4.57 m Depth												
						1121							
DTES:		WATER	- L 		0000	-				DE DE		50000	
porenoie data re use by others	quires interpretation by exp. before Elap	sed	115	Water	COHD:	Hole Op	en	Aun	Dep	th I	% Rec		RQD %
A flushmount moi standpipe was in: completion	nitoring well with a 51 mm slotted Tir stalled in the borehole upon 11 c	tays	_Le	ivel (m) 1.3		To (m)		No.	(m)				
Field work superv	vised by an exp representative.	1, 2016		1.0									

roject:	Environmental Drilling and Groun	idwater Monito	ninc	g					Pa		1 of	1	
ocation	n: 1509 - 1531 Merivale Road, Otta	wa						_		-			
ate Dri	illed: 6/26/15		_	Split Spo	on Samp	0	\boxtimes		Combu	stible Vaj	pour Read	ing	
Drill Typ	e: Geoprobe		_	Auger S SPT (N)	ample Value				Natural Atterber	Molsture rg Limits	Content	F	— Ə
)atum:	Geodelic		_	Dynamic	Cone Te	st			Undrain % Strair	ed Triaxi	ial at		Ð
.ogged	by: DC Checked by: MC	GM		Shear Si	ube trangth by		-+-		Shear S	Strength I	by		
				Vane Te	st		5		renetro		531		
S Y M		Geodetic	0	Su	andard Pe	netration	Test N Va 60 i	lue RO	Combu	stible Va 250	pour Readi	ing (ppm) '50	A Natur
- B		m 94.9	Pr h	Shear	Strength 50 1	00 1	50 2	kPa 00	Alter	turai Moi: berg Limi 20	ts (% Dry V	veight) 50	
1110	ASPHALT ~ 40 mm SAND AND GRAVEL	F 94.8	ľ	3700	1.201	44.94	5535				- 4125	1997	
	Disturbed native soil, brown, moist, no	H		112.2.4	10.2.0.2.	4440	11.13	-1.1.0.01	10449	1444	1 1 1 1 1 1 1 1 1 1	-52-213 -52-135	
M_	TILL		,		12.52		1.325			100		124010	
	Brown, silty clay, some sand and gravel moist, no odour	^{I,} /	ľ			2528	191141	10.00	1.1.1.1.1				
	SHALE BEDROCK Dark grey cuttings, brown water in air	93.2	1	22.17	19664	0.555	10.000	1.0.00	0.642-0	1111		12010	
-	flushing medium, no odour	_	2	111633	1861	2018	1111	211.02				1001	
				12223		3235	0.010 2.051 0.051	10000	1000	0.0.0		19815	
		-		4.9.13	1251	9195	2253	1.2.2.1	10220			2012	
		_	3			2012		1.1.1.1	1.111	12.19		3218	
					1601		12213						
				2223	1351	2133	12213	11111	1.11	1.55	11111	115.15	
		_	4	1911	1224	21.22	12.0.19				1111	7111	
		00.0		1210	1951	2122			1342			1010	
	Borehole Terminated at 4.57 m Dept	-190.3	+						in the second			- 11 -	
											1:10		
			1										
												114	
OTES:											1		1 <u></u> l
Borehole use by oth	data requires interpretation by exp. before hers	WATE Elapsed	RL	EVEL RI Water		lole On	en	Run	CO	RE DRI	ILLING A	ECORD	ROD %
A flushmo standpipe	unt monitoring well with a 51 mm slotted was installed in the borehole upon	Time 11 days	L	evel (m) 1 7		To (m)		No.	(m)			
completio	D. A	pril 21, 2016		1.5									
Field work	s on Sample Descriptions												
2001000													

roiect:	Environmental Drilling and Groundwat	er Monito	rina				F	igure	No	12		
ocation	1509 - 1531 Merivale Boad. Ottawa		n ng				_	Pa	ge	1_ of	1	
ato Drillodi	7/2/15						_					
ale Dimeu.	112/15		_ Split Sp Auger 5	oon Samp Sample	ie			Combus Natural	stible Vap Moisture	our Readir Conteni	ng	
nii type:	Manual Crew		- SPT (N) Value		0		Atterber	g Limits		ŀ	—Ð
atum:	Geodetic		Shelby	ic Cone Te Tube	51			Undrain % Strair	ed Triaxi 1 at Failu	al at re		\oplus
ogged by:	DC Checked by: MGM		Shear S Vane T	Strength by est	ł.	+ s		Shear S Penetro	ilrength b meter Te	9y st		
S Y		Geodetic	D S	landard Pe	netration 7	fest N Val	ue	Combu 2	stible Vaj 150	oour Readir 500 71	ng (ppm) 50	S A Natu
D L	SOIL DESCRIPTION	m	h Shear	20 Strength	40 6	50 8	kPa	Na Atter	tural Mois berg Limi 20	ture Contex ts (% Dry W	nt % /eight)	[원 Unit V 놀 kN/n
CON	CRETE SLAB ~ 100 mm	95.6	0		10100	50 21		0342	diate:	40 0	-312	13
- Distu	Irbed native soil, brown, moist, no	95.1	12 10 P.O.		0133	1.11	0/1	482	1244		12.2.2.2	$\overline{\mathbb{N}}_{ss}$
odou TILL			2010		2108			4913			2913	M 33
Brow	m, silty clay, some sand and gravel,	1	365			1813		P	1611		1993	X ss
-		94.1	99.00			1010	25	1490	4000	1.1.1.1.1		S IS
Dark	THERED ROCK WITH TILL SEAMS		3.247		1422			영문	1222			H
		93.49	0.000		1111							H
-			121111	11000			115-24	67453 648.6	19929		0.010	łI –
SHA	LE BEDROCK	92.9	3		1.1			0.350	1030	1215.2	1111	Н
Dark	grey cuttings, nó odour		0.546	181		2012	1121. 1400	2623	2013	11100	10.610	11
		01.0	19-11-1	122.2.1	10.4.5	39.62	11121	11111	11111		100000	H

hiant-	Environmental Drilling and Organit	unter Martin	nin c					Figure	No.	13	}		
geot:	1500 1521 Maximia Dent Office	water Monito	ring					P	age	1_ of	_1_		
	1509 - 1531 Merivale Road, Ottawa	1							_				
te Drilled	: 7/2/15		Split S	poon Sam	p le	2	1	Combi	istible Va	pour Read	ling		
ПТуре:	Manual Crew		- SPT (I	Sampie I) Vatue		0)	Atterb	a Moisture arg Limits	Content	ŀ		х Ю
tum:	Geodetic		Dynan Shelby	nic Cone T 7 Tube	est			Undrai % Stra	ned Triax in at Faitu	ial at Ire			\oplus
iged by:	DC Checked by: MGN	1	Shear Vane 1	Strength t	уу	+	-	Shear Penetr	Strength I ometer Te	by Əst			
s				Standard P	enetration	Test NV	ม่นค	Comb	ustible Va	nour Bead	ing (opm)	151	
¥ M B	SOIL DESCRIPTION	Geodetic	D P P	20	40	60	80	N	250 atural Moi	500 sture Cont	750 ent %	- M P	Natur Unit W
2	CPETE CLAP 100 mm	95.7	h Shea	50	100	150	kP	'a Atte	rberg Lim 20	40	Weight) 60	E S	kN/m
SAN	ID AND GRAVEL		201					20/1000				H	
Dist odo	urbed native soil, brown, moist, no ur	-	1111 1111	1155		1111	1.14	P				-IXI	SS1
6-		- 94.6	1 333				1.11	25/1823_			1516	-17	667
Brov	wn, silty clay, some sand and gravel,						1112	F		1101		М	332
mois	st, no odour	93.9	111		1015		10			1933		Ш	
Darl	grey cuttings, no odour	-	2	1.0.0		- 1 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5	1.10	10 24444 14 214-14			11-01-0	Π	
		93.31	1.01	1000	1 1121		111			19493	1.1.1.1		
SHA	LE BEDROCK	93.0	371			10 OE	1313					H	
- Dark	k grey cuttings, no odour	-	3	211221	a shas	1313	1222	1 2 1 1 1 2 1 1	1.53	1.1.1.1	10225		
-			1000			12.21	111		112.2		2010	11	
E	Borehole Terminated at 3.7 m Depth	92.0						-				M	

							1	Figure	No.	14			
Project:	Environmental Drilling and Groun	dwater Monito	ring					Pa		1 of	- 1		
ocation:	1509 - 1531 Merivale Road, Ottav	wa						10	.go	<u> </u>			
ate Drilled:	April 14th, 2016		_ Split S	ipoon Sam;	ple	\boxtimes		Combu	stible Vaț	our Read	ling		
Drill Type:	Geoprobe (GM100GT)		Auger - SPT (Sample N) Value				Natural Atterbe	Moisture ra Limits	Content	ŀ		X
Datum:	Geodetic		Dynar	nic Cone Te	est			Undrain % Strain	ix friaxi	al al			Ð
ogged by:	MAD Checked by: MG	БМ	Shelby	/ Tube Strength b	y	+		Shear S	Strength b	y y			
			Vane	Test		S		Fenerac	Alleter Le	151			
S N	SOLDESCRIPTION	Geodelic	De	Standard Pe	40	60 8	iue 30	Combu	rstible Va 250 Jural Moir	pour Readi 500 7	ing (ppm) 750 apt %	- M	Natura
ÖL		m 95.53	h She	50 Strength	100	150 2	kPa 00	Atler	berg Limi 20_	40	Weight) 60	LES	kN/m
SAND	ALT ~ 50 mm AND GRAVEL	95,4	101	-1351			1.553	30	1000			М	
-Crust	ned limestone above fine sand, gre	∋y94.8	400							2.2.1.0	1 - 1 -	Ŵ	51
SANE	DY SILT WITH ORGANICS		1	3 417 1	17,233	11211	1.121	20	1223			M	
moist	, no odour	94.2			010			P				Ŵ	S2
Sand	and gravel, shale gravel througho	ut,	46.2			1213	1-1-6-1	20		12450	10.13	M	S 3
grey,	Refusal at 2.0 m Depth, Borehole	93.5	- e	0 9980 1 1 1 1			121 1	1111	and the		10010	H	
OTES													
OTES: Borehole data rec use by others	uires interpretation by exp. before	WATEI	R LEVEL Wate	RECORD	S Hole Oz	pen	Bun	CO	REDRI	LLING R	ECORD		
DTES: Borehole data rec use by others Borehole was bac completion.	uires interpretation by exp. before	WATEI Elapsed Time	A LEVEL Wate Level (r	RECORD	IS Hole Op To (m	pen)	Bun No.	CO Dep (m		LLING R % Re	ECORD IC.	RC	20%

Project:	Environmental Drilling and Groundwat	er Monito	rino						Figure	e No.	1	5		
ocation:	1509 - 1531 Merivale Road Ottawa		nng				_		F	age.	of	_1_		
	1509 - 1531 Merivale Hoad, Ollawa													
ate Dhileo:	April 14th, 2016		_ 5 	plit Spo uoer Sa	ion Samp ample	чe		⊠ ATT	Comt	ustible V al Molstu	apour Rea re Content	ding		
nll Type:	Geoprobe (GM100GT)		- s	PT (N)	Value			0	Attert	erg Limit	s	ŀ		-Õ
atum:	Geodetic		- S	ynamic helby T	Cone Te ube	st	_		Undra % Str	iined Tria ain at Fai	xial at ture			\oplus
ogged by:	MAD Checked by: MGM		SI Vi	hear St ane Te	rength by st	/		+ s	Shea Pene	Strength rometer	n by Test			•
S Y MB	SOIL DESCRIPTION	Geodetic	Dep	Sta	indard Pe	netration	Test I	N Value 80	Com	oustible V 250 latural Mi	apour Rea 500 bisture Con	ding (ppm) 750 tent %	SAMP.	Naturi Unit W
ŏĽ		95.98	h	Shear :	Strength 50 1	00	150	200	(Pa Att	erberg Lir 20	nits (% Dry 40	Weight) 60	- EUC	kN/m
SANE	ALT ~ 75 mm	95.9	ľ		127	1.1.1							M	
- Crust	hed limestone, grey, moist, no odour	-	100	111			144						Ŵ	S1
TILL		95.1	1 2	1111								- 22.13	-17	
Grey, no od	, sand and gravel, moist turning wet, lour		10000						P		1-		Ŵ	S2
			1000		1222	3133	1	11111	20				M	
<i>6</i>		-	2	101-12	4444	1.5.0		12-01	<u>P</u>	0 0993 0 0993			٩XI	S3
DTES: Borehole data req use by others	uires interpretation by exp, before	WATER		EL RE	CORD	S Hole On	100		C	ORE DF	AILLING I	RECORD		
Borehole was bac completion. Field work superv See Noles on Sar	kfilled with hole plug upon Tin	ne	_Lev	el (m)		_To (m)	No		m)				ar /0

Project:	Environmental Drilling and Ground	water M	Ionita	rina					I	Figure	No	16	_		
Location:	1509 - 1531 Merivale Road. Ottawa	a		my					_	Pa	ge	<u>1</u> of	_1_		
Date Drilled:	April 14th, 2016								_			_			_
Drill Type:	Geoprobe (GM100GT)				Split Spi Auger S	on Samp ample	ie			Combu: Natural	stible Vap Moisture	our Read Content	ing		×
Datum:	Geodetic			- 5 [SPT (N) Dynamic	Value : Cone Te	sl	0		Atterbe Undrain	rg Limits led Triaxia	alat	ŀ		-0
.ogged by:	MAD Checked by: MGM	VI			Shelby 1 Shear Si /ane Te	Tube trength by st	1	+ s		% Strair Shear S Penetro	h at Failur Strength b meter Te:	9 Y St			⊕ ▲
S MB P BO	SOIL DESCRIPTION	G	eodelic m	D e p 1 h	Sta Shear	andard Pe 20 Sirength	netration 1 40 f	fest N Val 30 - 8	lue 90 kPa	Combu Na Atter	stible Vap 250 5 tural Mois berg Limit	our Readi 500 7 ture Conte s (% Dry V	ng (ppm) 150 Int % Veight)	SA MP LIE	Natur Unit V kN/π
ASP	HALT ~ 75 mm	95.	.44 .3	0	1221	50 1	00 1	50 2	00	25	20	40 (60	Š	
-Crus	hed limestone above fine sand, grey	,	.7		1210	11101		1011		Ë.	141	1120	1810	X	\$1
TILL					2218			1213	100.	20	0.0(0 0.0(0)	10-52 (0.64)	5015	H	
no oc	and gravel, grey and brown, moist, dour						2.22			Ë.				X	S2
					1613		diff			15		1323		M	62
<u> </u>	Refusal at 2.1 m Donth Rocehola	- 93.	.3	2	11 17 199 11 11 11 11 11 11 11 11 11 11 11 11 11	1.1.1.1		12.000	10.00		100000			М	- 33
	guires interpretation by exp. before	W	ATER	LEV	/EL RE	CORDS	;			CO	RE DRIL	LING RE	CORD	-	-
OTES: Borehole data rec		lansod	T	W	/ater		tole Ope	in	Run	Dept	th	% Rec	.	RO	D %
OTES: Borehole data rec use by others Borehole was bac	ckfilled with hole plug upon	Time		Lev	el (m)		To (m)		No.	(m)					

- 1							
۰.							
	- 4	C	R I and A and		Country	Descriptions	
5. I	- 44		NULIBR	00	Samue	I NOCCIID/ID/ID/ID/	

roject:	Environmental Drilling and Groundwat	er Monito	ring	3					Figure	No	17	-		
ocation:	1509 - 1531 Merivale Road, Ottawa				_				Pa	ge	1_ of			
ate Drilled:	April 14th, 2016			Solit Soc	on Same	te.	-		Combu	tible Vee	our Dood			
rill Type:	Geoprobe (GM100GT)		-	Auger Si	ample				Natural	Moisture	Content	ng		×
atum:	Geodetic		-	SPT (N) Dynamic	Value Cone Te	st		0	Atterber Undrain	g Limits ed Triaxla	il at	ł		- 0
naged by:	MAD Checked by: MGM		-	Shelby T	ube				% Strain Shear S	i at Failur Irenoth b	8			Ð
-33).				Vane Te	st	1		s	Penetro	meter Te:	, st			A
S Y		Gaodata	0	Sta	indard Pe	netration	Test N	Value	Combu	stible Vap	our Read	ng (ppm) '50	SA	Natur
BO	SOIL DESCRIPTION	m	P h	Shear	20 Strength	40	60	80 kP	a Atter	ural Moisi berg Limit	ure Conte s (% Dry \	nt % Veight)	- MP L	Unit W
ASP	HALT ~ 50 mm	95.38 95.3	0	1.000	50 1	100 1	150	200	8 6893	20	+0	50	Š	
-Distu	D AND GRAVEL urbed native soil, grey/brown, moist, no -					1111	10	13-122	30		dist.	18.5.13	IXI	S1
odou	r			2012	1221					2230	1121	2443	Д	
		1	1	3.bit			12		-30				M	\$ 2
	-	-		1217		25.57		15 133.0		22.53		22.1.5	Щ	
771 TILL		93.6					32		25			1211	M	60
Brow wet	m, sandy silt, with gravel, moist turning ⁻ no odour		2				34		E 64490	1012	ti:	1213	M	33
TES: Borehole data re	quires interpretation by exp. before	WATEF	 3 L E	VEL RE	CORD	S			CO	REDRIL	LING R	ECORD		

Proiect:	Environmental Drilling and G	roundwate	r Monita	vina						Figure	No.	18	}		
Location:	1509 - 1531 Merivale Road, 0	Ottawa	. monte	n ing						Pa	ige	1_ of	_1_		
Date Drilled:	April 13th 2016														
Drill Type:	Geopretes (GM100CT)			- ;	Split Spo Auger S	xon Sam ample	iple	0		Combu Natural	stible Va Moisture	pour Read a Content	ting		
Datum.				- 5	SPT (N)	Value		(0	Atterbe	rg Limits		ŀ		Ð
Jatum:	Geodetic			- :	Shelby 1	ube	est			Undrair % Strai	n at Fallu	ial at ire			\oplus
Logged by:	MAD Checked by	MGM	_	5	Shear S /ane Te	irength b st	γy	-	+- 5	Shear S Penetro	Strength Imeter To	by est			
ş				Ы	Sta	Indard P	eneiration	Test N V	alue	Combu	istible Va	ipour Read	ling (ppm)	ş	
	SOIL DESCRIPTION		Geodetic m	1 P	Shear	20 Strength	_40	60	80 kPa	Na Atta	250 tural Moi bern Lim	500 sture Cont	750 ent %	- A	Natur Unit V
L ASPI	HALT ~ 50 mm		95.24	0	Snoa	50	100	150	200		20	40	60	JE S	kN/m
SANE	AND GRAVEL	/	33,1	11	904-9 8848					20	101	1 1 1 0 1		М	S1
moist	no odour	m, —				138	100		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				1.1.1.1.1. 1.1.1.1.1.1.1.1.1.1.1.1.1.1.	M	0.
	ted from MW15-1)	_		1	9040 5255	4.6.0	1 23424	14-26-26- 26-26-26-26-		-20				$\overline{\mathbb{N}}$	0.0
· · · · ·		_						1111						M	52
			93.4							20	1201			M	53
Grave	elly sand, with silt, trace clay, b	rown _	93.1	2	11.11			200	२ - २२ - २२ २ - २२ - २२					4	55
	lark grey, moist lefusal at 2.1 m Depth on Bedr	ock					9 11 12				dia;				
BHAL Dark	<u>EBEDROCK</u> grey cuttings, grey water in air					3					125	10100	12113		
- flushi	ng medium, no odour	-		3	11.52	122	1.2112.8			22253		12132	2594		
-		-													
- Br	prehole Terminated at 4.6 m D	eoth	90.6			1.0.1.1		1879141							_
				11											
														11	
							116								
				L											
OTES:			WATER			COPO	<u> </u>				DE DOT		FOORT		
DTES: Borehole data req use by others	uires interpretation by exp. before	Elapse	WATEF		EL RE	CORD	S Hole Op	en	Run	CO		LLING R	ECORD	- FIQI	D %
DTES: Borehole data req use by others A flushmount mon standpipe was insi	uires Interpretation by exp. before itoring well with a 38 mm slotted talled in the borehole upon	Elapse	WATEF		/EL RE /ater /ater	CORD	S Hole Op To (m)	en	Run No.	CO Dep (m)	RE DRI	LLING R	ECORD	RQI	D %
OTES: Borehole data req use by others A flushmount mon standpipe was insi completion. Field work supervi	uires interpretation by exp. before itoring well with a 38 mm slotted talled in the borehole upon ised by an exp representative.	Elapse Time April 21, 1	WATEF		/EL RE /ater /el (m) 1.4	CORD	S Hole Op To (m)	en	Run No.	CO: Dep (m)	RE DRI	LLING R	ECORD	RQI	D %

Project No:	OTT-00224605-C0								Figure	No.	19)		
Project:	Environmental Drilling and Groundwate	r Monito	ring				10.000		Pa	ide.	1 of	- 1		
location:	1509 - 1531 Merivale Road, Ottawa									.g				
ate Drilled:	April 13th, 2016			Split Spo	ion Samp	10	{	8	Combu	stible Va	pour Read	ling		
rill Type:	Geoprobe (GM100GT)		- 5	SPT (N)	Value		(N D	Atterbe	Moisturi rg Limits	e Content	1		-0
atum:	Geodetic		0 - 5	Synamic Shelby T	: Cone Te 'ube	st	_		Undrain % Strai	ned Trlax n at Faili	cial at ure			\oplus
ogged by:	MAD Checked by: MGM	_	9	Shear Si /ane Te	irength by st			+ 5	Shear 5 Penetro	Strength Imeter T	by est			*
SY MBOL	SOIL DESCRIPTION	Geodelic m	Depro	Sta Shear	Indard Pe 20 4 Strength	netration 10	Test N V 60	80 kPa	Combi Na Atter	istible Va 250 tural Mo berg Lim	500 500 sture Contr its (% Dry 1	ling (ppm) 750 ent % Weight)	SAMPLE	Natur Unit W kN/m
ASPH	IALT ~ 25 mm	95,47 95,4	°	1111	50 1	00 1	50	200	1.1112	20	40	60	Š	
Crust	ned limestone, grey, moist, no odour	95,1		34.10 53.312	1323		1.1.1	11121	Ď	2.44	1. 11.11	22.11	X	S1
Sand	and gravel, trace silt, brown with							1 112 CO		103	1 4124	4444	\mathbb{H}	
no oc	orange mottling, moist turning wet, lour								Ť.			201	X	S2
	_				1221				0 D				Ŕ	S3
	Terminated													
TES: Borehole data req ise by others Borehole was bac completion. Field work supervi	uires interpretation by exp. before Elapse Kfilled with hole plug upon sed by an exp representative.	WATER	LEV W	/EL RE /ater el (m)		lole Ope To (m)	en	Run No.	COI Dep (m)	RE DRI	LLING R % Ref	ECORD	AC	2D %

Project:	Environmental Drilling and Gr	oundwati	er Monito	orin	g				_	Figure	No	20	2	
Location:	1509 - 1531 Merivale Road, C)ttawa								Pa	ige	1_ of	_2_	
Date Drille	d: April 13th, 2016				Solit Sp	oon Sam	Die	R	1	Combu	stible Var	nour Read	lina	
Drill Type:	Geoprobe (GM100GT)			_	Auger S	ampie		(I)	Natural	Moisture	Content	in rg	×L
Datum:	Geodetic			_	SPT (N) Dynamic	Value : Cone Tr	est	0		Atterbei Undrain	rg Umits led Triaxi	alat	ł	0
ogged by	" MAD Checked by:	MGM		_	Shelby 1	iube				% Strain	n al Fallu Strength h	re W		Ð
.oggcu by	Ollecked by.	MIGHVI			Shear S Vane Te	trength b ist	У	+ s		Penetro	imeter Te	ist		A
S S				0	Sta	andard P	enetration	Test NV	lue	Combu	istible Vaj	our Read	ling (ppm)	S
	SOIL DESCRIPTION		Geodetic m	e p	Shear	20 Strength	40	60	80 kPa	Na Alter	tural Mois berg Limi	ture Contr ts (% Dry 1	750 ent % Weight)	P Unit V
AS	SPHALT		95.47	0		50	100	150 2	00	1172.24	20	40	60	S
N. S	ND AND GRAVEL				12010	100		033		0.472) (0.472) (0.472)	12.041	192		
	pist, no odour	/	94.B			158	1.44	5 5345	1453	10000 10000 10000		1.120	3610	
I II			-	1	4444		1			0414	1000		2140	
Gr Gr	avelly sand with some silt, brown, ming moist/wet, no odour	moist -						5.91-1	1221					
(Ir	ferred from MW15-1)													
		-	93.2	2		12.2.24	5100		11.21	2610	10.60	1100		-
SI D	IALE BEDROCK	corey -			1.211	1253	2133	0.11	1.1.1.1		1,38	1335		
wa	iter in air flushing medium, no odo	ur			2415									
		-	1	3	2.212	19-94	1.5120	1.123	1.4.1.1	11112	2992	2194	11.2-1-	
-		-	-		2010	1.1.1			(C) (C) (C) (L)-	1220			1010	
										2122				
		-	1	1	\$413				10,52	5132	1.255		3315	
		-	-					fa Grava	11151			1.1.1.1	1.1.1.1.2	
		_			23418 37418	-1.4		12114	1100	21016	123	12125	3343	
				5		-1		19611		2018				
		-	1		1999-24 1999-242		01000		145-049	104410	9030	1.5.4.5.5	-04239	
		_		5	12.21		6125				1.1.1.1	2101	1212	
						1321	0.00	1.01			1000	1111	0315	
		-	1		3213				10.00		2-22		12212	
		_		7	22.53	1241		-1-0-0		1.0.101		-	1010	
						1.520	6143		1101	1.14		6-3-5-1	5 6 1 6 10 6 1 6	
		_	1		1011		19193		1325	2012	1830	\$151	12.010	
		-		8			1.2.1.2	401.4				11122	2.515	
		_				1111	2115	1.55		10.1020	1311	11100 (1110) (1110)		
			Ì		1010	1100	4112 9192		1.12.1		10.00		0.011	
		_		9	1444	144	0144	12013		52-52	10.23(4)	1.11.1		
		_				12.13				Part a			2552 3600	
							24376		1107	2010		1000	2010	
OTES	Continued Next Page			J ₁₀ L	-1993 (D)		1000102				-22891	0.203	0.61.0	
Borehole data use by others	requires interpretation by exp, before	Elana	WATE	R LE	VEL RE	CORD	S Hole OF		Dur 1	CO		LING R	ECORD	000 0
A flushmount standbios was	monitoring well with a 38 mm slotted	Tim	8	_Le	wel (m)		To (m		No.	(m)	u1	% He	c.	HOD %
completion,		April 21,	2016		2.6									
rield work sup	pervised by an exp representative,													

Log of Borehole <u>BH/MW207</u>

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Figure	No.	20

©ехр.

												P	ag	e	2	of	_2		
G	S Y		Gandalin	D	Sta	indard F	20netr	ation 1	Test N	Value		Com	busti 250	ible Va D	1pour 500	Readi 7	ing (pp 150	om) S	Natu
Ŵ	B	SOIL DESCRIPTION	m	P	Shear	20 Strenati	40		50	80	kPa	Att	vatu:	rat Moi Iro Lim	isture	Conte Dry V	nt %	n lê	Unit
	Ľ			10		50	100	1	50	200			_20		40		60	Ĭ. Š	KIN//
		Dark grey cuttings with light and dark grey			1.1.1.1	120	1	120	122	4	551			123		135	122	120	
	_	-water in air flushing medium, no odour	′ -		11-112	1.25		14.5	1923		101	294		12.2		1.50		100	
ł	=	(continued)	84.7		1.2.1.1	1.1	1		1.1	4	384	3.32	21		1				
		Borehole Terminated at 10.8 m Depth			1.1	111			199			111			-				
					1112				181			1.1							
l																			
I							- 1												
						111													
						116			8										
									3										
																			-
l						313			181										
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									313			123							
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												353							
					li iti												16		
				11	1833										123				
					1.53					1		1935							
												1941							1
1							1												
L] [1					15 3							
۱T ک	ES:	data requires interpretation by our before	WATE	RIF		0.080	15			Г	-	0			41.1		00	30	
IS	e by ot	thers Federal interpretation by expl. before	lapsed		Nater		Hold	000		F	tun T	- De	orst	UHI T	LLIN 0	G HL			00.9
	(L n h. mar.	ount monitoring well with a 38 mm slotted	Тіте	_Le	vel (m)		T() (m)		N	10.	(7	ри п)	_	1	0 1100	1	П	GU 70
23	nusnim	a second between the second				-				100				- T					
0	andpipe mpletic	an.	121 2010		26														
20 	andpipe mpletic	k supervised by an exp representative.	121,2016		2.6														
ii ii ii	andpipe mpletic eld wor	k supervised by an exp representative.	121,2016		2.6														
ie ie	indshim andpipe mpletic eld wor el Note	As installed in the borenoie upon Jn. Apri k supervised by an exp representative. son Sample Descriptions ire is to read with exp. Services for report	121,2016		2.6														

Project	Environmental Drilling and Cra	unducat	or Monite	uries-					I	Figure	No	21	_	
ocation:	1509 - 1521 Maximala Based Of	Nuriowali	er Monilé	กมาต						Pa	ge	1_ of	2	
	1509 - 1551 Merivale Hoad, O	uawa												
Date Drilled:	April 13th, 2016			-	Split Spo Auger Si	ion Sam;	le	×	1	Combus	stible Vaj	our Read	ing	
Orill Type:	Geoprobe (GM100GT)			_	SPT (N)	Value		0)	Atterber	ng Limits	Content	ŀ	$-\hat{\Theta}$
Datum:	Geodetic			_	Dynamic Shelby T	Cone Te ube	est			Undrain % Strair	ed Triaxi n at Failu	al at re		\oplus
ogged by:	MAD Checked by:	MGM			Shear Si Vane Te	rength b	ý	+ s		Shear S Penetro	itrength t meter Te	oy İst		
ş				D	Sta	indard Pe	metration	Test N Va	itue	Combu	slible Va	pour Readi	ing (ppm)	S
	SOIL DESCRIPTION		Geodetic) e () - h	Shear	Strength	40	60	80 kPa	2 Na Atter	250 tural Mois berg Limi	500 7 sture Conte ts (% Dry V	750 ant % Weight)	_ Ω Natur P Unit V L KN/π
ASPH			_94.68 ~94.6 194.5	0	2142	50	100	150 2	200	2213	20	40	60	S
Distu	rbed native soil, grey and brown	n, †					1111	11000		4444	4044		4443	
(Infer	red from MW15-1)		02.6					12363		12219				
Brow	n, silty clay, some sand and gra	vel, /												
(Infer	, no odour red from MW15-9)	t	1		2010			2513	i.tei			1992	25.15	
- SHAL Dark	EBEDROCK grey cuttings with light and dark	grey -	-	2		-1-5-6-1	- 6463.9 - 6460.6		1444			10400	0.046	
water	in air flushing medium, no odou	ur –	-			1281	5135	1.513			121.	1933	2212	
						1221	0100					11120	122-03	
		-	1	3	2212	1351	2112	12212	12:2:2:1	2112	1.5.2-1	1325	0.518	
		-	-		A SALE	1245	112			11010 11010 200100			10010 11111	
		_												
		-	1				111							ł
		-		5	115.0	12511				1	120141	1155	5815	
							92.50	1000	10101				8110 6 6 16	
		-						1.11	1101	333				
-		-	-	6	(1993) (1993)	49.63 77451	4150	2010	-1-25-1	2442.5	1611	03.6K	19-91-5 19-91-5	
		-	-			1001	614							
					1057350 1057510 1057510 105761	10-01	0100	1010			1011	0103		
		_	•	7	1312	12.11	1.1.1	1111				5125	1.11	
-		-	-		1000	T-BACK						11111		
		_										61100		
										0.030	1553			
		-				1101	1.1.1.1	1.2.1.1	11122	102.2.5				
		_		8			2,223		1.1.5.1	1.1.1	17:51	64.64	10-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	
			ł				0100	1211	pieli	2010				
		-	1			11960CE	2111		12-1	2442		119-0-8		
	Continued Next Page		l	J ₁₀ L		1999	211.10	3.844	144.84	nder.	4923	2.34.2	1000	
DTES: Borehole data req use by others	uires Interpretation by exp. before		WATE	A LE	VEL RE	CORD	S			CO	RE DRI	LLING RI	ECORD	
A flushmount mon standpipe was ins	itoring well with a 38 mm slotted . talled in the borehole upon	Elaps Tim	ie	Le	Vater vel (m)	_	Hole Op To (m))	Run No,	Dep (m)	th	% Red	c.	ROD %
Field work supervi	ised by an exp representative.	April 21,	2016		1.8									
	· · · · · · · · · · · · · · · · · · ·													

Project No: OTT-00224605-CO BOREhole BH/MW208

Project:	Environmental	Drilling and	Groundwater	Monitoring
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F	iaure	No.	
	iguio	110.	

®exp.

Project:	Environmental Drillion and G	iroundwater Mor	nitori	0.0					Figure	No.	21	<u> </u>		
	Envolumental Driving and G		illon	ng					Pa	age.	2_ of	_2_		
G Y				D Sta	ndard	Penetrati	on Test I	N Value	Comb	ustible V	apour Read	ding (ppm) <u>S</u>	Nati
W B B	SOIL DESCRIPTION	Geog	Hantic	p] Shear S	20 Strengt	40 h	60	80 ki	Pa Atte	atural Mo	histure Cont nits (% Dry	tent % Weight)	M M L	Unit
		84.68		n 10	50	100	150	200		20	40	60	ŝ	KiN/
Darl	grey cuttings with light and da	ırk grey		2.532					261 0-1607 37 0-8676 38 0-8676 38 0-8676		1 22	1235	2	
-wate	er in air flushing medium, no oc tinued)	lour –		0.010	100			1973 - 243 1974 - 1955		12.00	14 20121 14 701207			
	orehole Terminated at 10.8 m	Depth 83.9		111111	111			111 111		1101	5 2 1 2 2			_
				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1										
												1		
												1.12		
				100			1							
				-13										
		ĺ												
										165				
										115				
							8 8							
				18										
				194										
						111								
										- 11				
		ł										8,8		
												1.55		
DTES						_	_			1	_		1	
Borehole data re use by others	quires interpretation by exp. before	WAT	TEAL	EVEL RE	CORI	DS			cc	REDR	ILLING R	RECORE	2	
A flushmount mo	nitoring well with a 38 mm slotted	Elapsed		Water Level (m)		Hole (/pen m}	Run No.	Dep (m	oth 1)	% Re	ю.	RC	2D %
standpipe was in completion.	stalled in the borehole upon	April 21 2016		1.8										
Field work super	vised by an exp representative.			1.0										
See Notes on Sa	imple Descriptions													
This Figure is to	read with exp. Services Inc. report													

	Log of Bo	rehole E	3H16-	1	ovn
Project No:	OTT-00224605-C0	_		-	exp.
Project:	Environmental Drilling and Groundwater Monito	ring		Figure No. 27	
Location:	1509 - 1531 Merivale Road, Ottawa			Page. <u>1</u> of _	1
Date Drilled:	10/11/16	_ Split Spoon Sample	\boxtimes	Combustible Vapour Reading	
Drill Type:	Manual Crew	Auger Sample - SPT (N) Value	80	Natural Molsture Content Atterbara Limits	×
Datum:	Geodetic	Dynamic Cone Test		Undrained Triaxial at % Strain at Failure	•
Logged by:	MAD Checked by: MGM	Shear Strength by Vane Test	+ s	Shear Strength by Penetrometer Test	
		Standard Penetrativ	On Tast N Value	Combustible Vessus Reading	(000) [2]

	G W L	57 M BO	SOIL DESCRIPTION		Geodetic	D e P	Did Chant	20	40	ritation	60	80	10-	Combu 2 Na	stible V 150 tural Mo	500 500 Asture C	eading (pp 750 ontent %	0m) 8 A N	Natural Unit Wt.
		Ĕ		9	5.37	<u> 6 [</u>	Suear :	50 50	יייק 100		150	200	кна	Atten	oerg Lin 20	40 40	ry weigni 60	" 6	kN/m ³
			ASPHALT ~ 60 mm		5.3	l°l		142					1.1		Same			22	<u> </u>
		-01	SAND AND GRAVEL		5.1			13			11101			0	100		121		, I
			Crushed limestone, grey, moist, no	odour /	4,9	$\left \right $	111	125	1.7		1.53	1.1		1 2 2 1	2.1.2		1 2 1 2		
			SAND AND GRAVELImported sand	and []				53	12		133	88	110	1111			1.		
			graver from a commercial pit, with s	silt and				122										10	
			no odour	y, moist, [l í		1.333	11		12.3	88.8	12	1112	1.11	11	17 18	11	
			End of Borehole					122						5115			- 35	13	
								11			1.13	8	123	1111					
																	1.1	131	
								11			133	13	121						
				(161	1211			1.1.1.1	3	(I
								1.1			183	1 1	111					12	
											101		141				12 23		1 1
					í	1		1.1				1	133	111					
								1.1				- 1	200	相比			12 E E		
													13						
				[12			1.1					i
								313			100	8.8	112			1.3.5			
					1												-16 BE		
													1153				19 18		
													444			12.5			
		- 1		1			111				133	1	254						
													534			111			
											191								
					1						18.1	11							
							1111								111				
				1									81						ł I
							111	111			1813	4	21		151				
											0.5				1.1	: 11			Í
															1.1		18 E I I		
					ľ			111			123	1			1 2				
216												81	191						
012				1		ł					1.54		111	1153					
Ē											534		111				E 1153		
8											111		2.5						
X											111						1.1		
¥.											1								
0														1994			1 333		
NO NO						1	1.12												
Ĕ											11			1111					
<u>P</u>					[110												
ES.C									1			1 3					1		
5														123			8 8 8		
Ë							1.55			11				1.131					
ğl						L	11123	- 1		1.10		1 2		112 - 1	1		1 1 1 1		
5	NOT	TES:														_			
GS	1.Bo	orehole se by n	e data requires interpretation by exp. before there	'	WATER	LE/	EL RE	COF	RDS					COF	RE DR	ILLING	RECOP	20	
<u>Š</u>	~ ~			Elapsed		W	ater		Ho	le Ope	en j	A	un	Dept	h	%	Rec.	R	QD %
Ę	۷.					e/	(m)	-+-		io (m)		N	0	(m)					
읽	3.Fi	eid wo	rk supervised by an exp representative.																

 S - Freid work supervised by an exp rep
 4. See Notes on Sample Descriptions
 5. This Figure is to read with exp. Servi
 OTT-00224605-C0 5. This Figure is to read with exp. Services inc. report OTT-00224605-C0

	Log	of B	orehole	SV1	1000 1000 1000 1000 1000 1000 1000 100	avn
Project No:	OTT-00224605-C0					evh.
Project:	Environmental Drilling and Groundwate	r Monito	ring		Figure No. 22	1
Location:	1509 - 1531 Merivale Road, Ottawa				Page. <u>1</u> of <u>1</u>	,
Date Drilled:	April 14th, 2016		Split Spoon Sample	\boxtimes	Combustible Vapour Reading	0
Drill Type:	Geoprobe (GM100GT)		Auger Sample		Natural Moisture Content	×
D .			SPT (N) Value	0	Atterberg Limits	H0
Datum:	Geodetic		Shelby Tube		Undrained Triaxlal at % Strain at Failure	\oplus
Logged by:	MAD Checked by: MGM	_	Shear Strength by Vane Test	+ s	Shear Strength by Penetrometer Test	
G¥L G¥L	SOIL DESCRIPTION	Geodetic m	D Standard Penetration P 20 40 D Shear Strength	on Test N Value 60 80 kP	Combustible Vapour Reading (ppn 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight)	n) A Naturai P Unit Wt. E kN/m ³

	Ë	Ö	SOLDESCHIFTION	r	n	11	Shear	Strength		0g	00	kРа	Na: Alteri	tural Moi berg Lim	istune Co ⊭ts (% Dr	nteni % 'y Weight)	E	Unit W1. kN/m ³
		L .	10011117	94,9	4	0		50	100	150	200	2		20	40	60	5	
			ASPHALI				2012	1321	1 323	1112		15111	1235	132	1 2 1	11 1121	a -	
	8	1.He	SAND AND GRAVEL	194.7			Salt	1821	1 213	12 12	231	11311	32.53	1215	1011		23	
			Disturbed native soil, brown, moist, no	П				1.1.2.1	- 14.	1 1.1	1.1	11111	12.1-	4.2.2.	1 4.1.1	1 111	1.1	
		HA		1				1321			4.2		0.0499 125 15		1335	1253		
		7R	Brown silty clay some sand and gravel	-		1	10.00-3.14	11.11			1.1	1.1.1.1	0.040	1614555	1 1 1 1	-	1	
		1 de la compañía de	moist, no odour				2012	1211	1		11	10101 41	024310	-100	1 223	100	33	
	E.	<u>HA</u>		93.4	93.54		0.0400	14-524		1.1.1.1.1.1.1	14	1.1.1.1.	1,64.6	108	1.504	1.000		
			Borehole Terminated at 1.5 m Depth	-						1 3 1		1311	NE E	1.68				
										1 21	1.5	1.11		-112	111	8 888		
												1.1.1		- 11		1.1	81	
										1 23		888 B					Ξ.	
									1.1	1 14	2.12	EEEE		1995	1.11	8 188	5	
								1.153						113	1.513	3 1331		
														115			8	
									113	1.38	- 11	1111		111		1.251		
										111	11	1121		199		9 133	2	
											10							
										111							5	
								1.121		E 11 E		1111		12.3	1.11	1 1 1 1		
								1151		E 187	111	1111		18.8		1 11		
										1		1111		135		1.12	1	
									1.53		1.5				1 1 1 1			
									193	1.1	88	175.8		12.15		1 14	2	
									100					1844		1.111		
								1.13	1.812	1 11	11	1111				1.141		
										1 1 1 1						1 11	2	
					Í											111		
	- 1					- 1		111	4.5.5	1 - 1 -								
								1 8		1 33						1111		
								8.6	111					- 13.1	1.1.3	8 8 8		
		1						1.13	1.53					- 11				
								1108	151	6 31				2387	1 202			
								1.63	1 1					, 백왕.,		1 1 1 2		
														185		1.11		
12								1963	111	3 (44)					1.12	1 114		
<u>s</u>								1361	111	1 1 5				1993	1.22	9.988		
비						- 1								16.61	1.11	115		
0									112						1.5.5			
ŝ	- [1895.5	115	1 1 1 1								
È	- [1993	116	1 111				1.1.12	153	1112		
읽									111					in Pr				
õ							LEFT.	19.63	1.15						123			
Ē							1321	16.51	112	3 111		1.11				: 116		
6							12313	1553	212				12121		188	1 111		
ŝ						- [12.001	143				1.1.1		111	1016		
5								1341	111				1.11					
틢							125	1564		1 1 1			11 1					
ğί	1					L	13(1.2)	1224			1		1.4	10.11	1.54	1112		
۳	NŌ	TES:								-	Г	_					_	_
35	1.B	orehole	data requires interpretation by exp. before	WA	ATER	LE	VEL RE	CORD	S				CO	RE DR	ILLING	RECOR	D	2200220
ğ	100	no uy u	Ela	psed		V	Nater	T	Hole (Open		Run	Dept	ih [% F	Rec.	R	D %
щ	2.A	stainle binn w	ss steel soil vapour probe with 6 mm diameter	me	+-	Le	vel (m)		To (m)	11-	No.	(m)					
õ	14	ung w	as makened in the objencie upon completion,															
ÎĤ	3.Fi	ield wo	rk supervised by an exp representative.															
8	4. S	ee Noti	es on Sample Descriptions		1													
비	5. TI	his Fio	ure is to read with exp. Services Inc. report															
8	0	TT-002	24605-C0															
- 1 I																		

	Log	of B	C	re	ho	le _	sv	2				619 619 919 919	е	xn
Project No:	OTT-00224605-C0							F	iqure 1	No.	23		$\overline{}$	NP.
Project:	Environmental Drilling and Groundwate	er Monito	rin	9					Pa		1 of	- 1		
Location:	1509 - 1531 Merivale Road, Ottawa									90		<u> </u>		
Date Drilled:	April 14th, 2016		-	Split Spo	on Samp	le	\boxtimes	3	Combus	tible Vap	our Read	ing		
Drill Type:	Geoprobe (GM100GT)			Auger Sa SPT (N) 1	umple Value		III.]	Natural Atterber	Molsture (Limits	Content	I.		×
Datum:	Geodetic		_	Dynamic	Cone Te	st		-	Undrain	ed Triaxia	lat			
Logged by:	MAD Checked by: MGM			Shelby Ti Shear Sti Vane Tes	ube rength by st		+ s		Shear S Penetroi	trength by meter Tes	e / st			<u>ـ</u>
G Y			D	Sta	ndard Pe	netration	Test N Va	ປມອ	Combus	stible Vap	our Readi	ng (ppm)	SA	Natural
W B C	SOIL DESCRIPTION	m	P 1	2 Shear S	to 4 Strength	0	60	80 kPa	Nat Attert	ural Moist berg Limits	ure Conte	Veight)	PL	Unit Wt. kN/m ³
ASP	HALT	94.62 94.5	0	5000	0 1	00 1	150 2	200	1	20 4	10	60	ŝ	
SAN Distu	D AND GRAVEL Irbed native soil, brown, moist, no	94,4		2013			11111		1.10	1211				
GI A						2132				1001		1001		
Brow	m, silty clay, some sand and gravel,	93.493.52	2 '	450.04		1		12.1.5.2	5.64.5	12.44	4			
\(Infe	rred from MW15-8)													
	forenoie Terminated at 1.2 m Depth													
							+							
				le se									H	
				N O N										
				SHE										
														ĺ
												111		

10/7/16	
TROW OTTAWA.GDT	
BOREHOLES.GPJ	
LOGS OF	
REHOLE	

NOTES: 1. Borehole data requires interpretation by exp. before use by others	WAT	ER LEVEL RECO	RDS		CORE DR	ILLING RECO	10
2.A stainless steel soll vapour probe with 6 mm diameter tubing was installed in the borehole upon completion.	Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	ADD %
3. Field work supervised by an exp representative.							
4.See Notes on Sampla Descriptions							
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0							

Project:	Environmental Drilling and Groundwa	ter Monito	prin	9				F	igure I	No	24	<u> </u>		
ocation:	1509 - 1531 Merivale Road, Ottawa			2				_	Pa	ge	1 of	_1_		
ate Drilled	April 14th 2016			C-14 C		-	53	_	.		-	a).		_
rill Type:	Geographa (GM100GT)		-	Auger Sa	on Samp Imple	ю			Natural	stible vap Moisture	Content	ang		×
)atum:	Geodetia		-	SPT (N) ¹ Dynamic	Value Cone Te	st			Atterber	g Limits ed Tdavi	alat	ŀ		Ð
acont by:	MAD Checked by MCM		-	Shelby T	ape				% Strain	al Failu	ne ne			⊕
oggeo by.	Checked by: MGM			Shear Sti Vane Tes	rength by st		+ S		Penetro	meter Te	sl			A
S Y			D	Sta	ndard Pe	netration	Test N Val	UB	Combu	stible Var	our Read	ling (ppm)	S	Natura
	SOIL DESCRIPTION	Geodelic m	P 1 h	2 Shear S	trength	40 (50 8	i0 kPa	Nal Attert	tural Mois berg Limit	iture Cont ts (% Dry	ent % Weight)	- MP Li	Unit W
ASP	HALT	94.79	0	5	0 1	00 1	50 2	00	599.0	20	40	60	Š	
SAN Distu	D AND GRAVEL Irbed native soil, brown, moist, no	94.4		10010		2133	1013	10121	5115	12.13	1333	1213		
odou	IT CIAL TILL	/		0.510		6112	1000							
Brow	n, silty clay, some sand and gravel,	-	1	10020		21.2	12.15	13.56	1018			2233	11	
Infe.	rred from MW15-7 and MW15-8)	93.3	+	1220	10/01	Sist	3811	1400		532	1022	0.513	$\left \right $	
OTES														
OTES: Borehole data re use by others	quires interpretation by exp. before	WATE	R LI	EVEL RE	CORDS	5			со	RE DRI	LLING F	RECORD)	
A stainless steel tubing was instal Field work super See Notes on Sa	soil vapour probe with 6 mm diameter led in the borehole upon completion, vised by an exp representative, imple Descriptions	psed me	L	water evel (m)		поне Ор То (m)	en	Run No,	Dep (m	m)	% Re	ec.	RC	20 %

	Log of Borehole SV4		4	evn
Project No:	OTT-00224605-C0	Pierce Mail	05	CAP.
Project:	Environmental Drilling and Groundwater Monitoring	rigure No.	20	_ I

	Page. <u>1</u> of <u>1</u>
⊠	Combustible Vapour Reading

Date Drilled:	April 14th, 2016
Dell Turner	0 1 /01/

1509 - 1531 Merivale Road, Ottawa

Checked by: MGM

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Location:

Logged by: MAD

Split Spoon Sample	\boxtimes
Auger Sample	
SPT (N) Value	0
Dynamic Cone Test	
Shelby Tube	
Shear Strength by Vane Test	+ s

Combustible Vapour Reading Natural Molsture Content	
Atterberg Limits	<u>— Ә</u>
Undrained Trlaxial at % Strain at Failure	\oplus
Shear Strength by Penetrometer Test	

Γ	Τ	ş			_	D	Sta	Indard F	enetra	lion Te	esi N Vali	U18	Combu	stible Vaj	pour Real	ting (ppm)) <u>S</u>	
	Ŵ	B	SOIL DESCRIPTION		Geodeti	c e P	Church	20	40	60	9 0	0	Na!	50 tural Mois	500 sture Coni	750 tent %	- P	Unit Wt,
		Ľ			94.98	h	i Shears	Strenger 50	100	15	0 20	kIPa 00	Atten	berg Limi 20	εs (% Dry 40	Weight) 60	ES	kN/m³≊
ł			ASPHALT		94.9	ľ	6245	1.1.1	11	13	3813.	133.0	2133	1555			ſ	
		• 61	TDisturbed pative soil brown moist no		94.5		22,13	1.2	1 24			1.1.1	2223	1211	12122	122.2		
		Z	odour					1.2.2		10		11111	0.03 0	1233				
		U/A	GLACIAL TILL			1	10121-1	144		13		2922	1147	3333	24.00	32.73	2	
		ĦD	Brown, silty clay, some sand and gravel, moist turning wet, no odour				2343	123						14.40				
-	-	9.29	(Inferred from MW15-7)	سر	<u>93,5</u>		0.000	12-5-32	1-1-1-1	42	9.0 0 2 9	1111	2142			1.44.34	1	
			Borehole Terminated at 1.5 m Depth											112.2				
							12.23						12 Pe	- 12	1123			
		- 1						E HE								358		
								HHE.						14.24	1123			
								HE					1.510	1253	1111			
													2005					
														1611	112			
														1551				
													1914					
												t nat	841					
															1.13	110		
											1							
														- 111	1.12	1.55		
								15			11							
								112			11							
								118								1133		
								15			1.4							
/16								125							13.53			
10/7												1111			12.53			
5														13.51		1.111		
VA.G										81		111		1933		123		
TAV															1963			
10 2		- 1													1313	1.33		
NOH																		
1												1.11				11.33		
SG										38 F					1.83			
ы б																* 8		
E E												11	111			1185		
<u>ğ</u> L	_									- (S-					1.001	11123		
	101 .Bc	TES: prehole	e data requires interpretation by exp. before		WATE	R LE	VEL RE	COR	os			_	CO	RE DAII	LLING F	ECORD)	
ő	US	se by o	thers	lapse	be	-1	Vater		Hole	Oper		Run	Dept	th	% He	ю.	R	<u>ה מכ</u>
<u>ء</u> 2	A tul	stainle bing w	ss steel soil vapour probe with 6 mm diameter	Time		Le	vel (m)		To	(m)	-	No.	(m)					
Ē,	- File	eld wo	rk supervised by an expresentative															
BI ,	0.01	aa Not	as on Sample Descriptions															
비송	. 36 . 74		es un paripie pescriptions															
50	01	115 Figu TT-002	224605-C0															

	Log	of B	C	ore	ho	le	S	SV5	5						vn
Project No:	OTT-00224605-C0								-					-	$\sim \rho$.
Project:	Environmental Dritting and Groundwate	er Monitor	ring	g					ŀ	-igure I	NO	26	<u>)</u>		I
Location:	1509 - 1531 Merivale Road, Ottawa									Pa	ge	1_ of			
Date Drilled:	April 14th, 2016			Split Spo	on Sam	pie		\boxtimes		Combus	tible Vap	our Read	tina		
Drill Type:	Geoprobe (GM100GT)			Auger S	ample					Natural	Vioisture	Content			×
Datum:	Geodetic			SPT (N) Dynamic	Value : Cone T	est	_	0		Atterben	g Limits ed Triaxia	alat	ŀ		-0
Logged by:	MAD Checked by: MGM			Sheiby T Shear Si Vane Te	'ube rength b st	y		+ s		% Strain Shear S Penetroi	at Failur trength by meter Tes	e y st			⊕ ▲
SY MBOL L	SOIL DESCRIPTION	Geodetic m	Depth	Sla	Indard P 20 Strength	enetratio 40	60	N Value 80	kPa	Combus 2 Nat Attent	stible Vap 50 5 ural Moist erg Limit:	iour Read i00 ture Cont s (% Dry	ling (ppm) 750 ant % Weight)	SAZD THE	Natural Unit Wt. kN/m ³
ASP SAN Distu- odou GERA Brow (Infe)	ALT D AND GRAVEL Irbed native soil, brown, moist, no r VELLY SAND WITH SOME SILT n, moist turning wet, no odour red from MW15-2) orehole Terminated at 1.5 m Depth	93.98 93.5	1										60	5	

	Y		GRAVELLY SAND WITH SOME SILT	02.09	5915		15 15.25	0.000	3573		3131	7115	
			Brown, moist turning wet, no odour] 53.50						2.5		18.10	
		<u>م ۲</u>	(interrea from MVV15-2)	93.5	43.00	12-51 345	13	1.1.1.1.1	-145	1000	1131	1914	
			Borehole Terminated at 1.5 m Depth						- 165	100	101 = 10	11 - F	
				}				1201	1953				
									1155	1112			
					1111				1 11				
								12 81					
							1 2 2	15.53					
									1919				f I
								1000	10.0				
							1 1 1		1.13				
								1221					
								12231		1994		111	
								1993					
								1111	16.33				
								19855					
								1.500.5				4	
								1945					
									188				
									18.				
/16								8.41	- 83				
107				(8.4					
DI								1111			1		
VA.G								188 m			4 8		
TAV													
Ģ	- 1									1995			
ð	[
F									1991	12.21	133		
6													1
CES													
H	1										113	.111	
gl					1000		1 2111	10.52	28.12	24		12.12	
6	NO	TES:		WATER		0000		_	0.00			0.000	
DGS	1.0	se by oth	cata requires interpretation by exp. before hers	and I	Water	UHUS	2000	Run	Doot		LING HE	COHD	000 %
Ĩ	2 A	stainles	s steel soil vapour probe with 6 mm diameter	e	Level (m)	To (m)	No.	(m)		in Hec	·	NUD %
Į	TU	ung wa	s installed in the borehole upon completion.										
BR	3.Fi	eld work	supervised by an exp representative.										
FBC	4.5	se Notes	s on Sample Descriptions	1			- 11						
- 261						1							
öl	5. Tr	nis Figur	re is to read with exp. Services Inc. report										

	Log of	Во	re	eho	ole	Μ	W 3	<u>801</u>				1		xn
Project No:	OTT-00224605-C0							F			27		-	~P
Project:	Environmental Drilling and Groundwate	er Monitor	in	g				_ '	igure i	····	1	1		
Location:	1509 - 1531 Merivale Road, Ottawa								Ра	ge		<u> </u>		
Date Drilled:	9/6/17			Split Sp	oon Sampl	e	\boxtimes		Combus	tib l e Vap	our Readir	ng		
Drill Type:	Geoprobe			Auger S	ample				Natural M	Moisture (Content			×
Datum:	Geodetic			Dynamic	c Cone Te	st			Undraine	ed Triaxia	l at			Ф Ф
Logged by:	JO Checked by: MGM			Shelby ⁻ Shear S Vane Te	Tube strength by		■ + s		% Strain Shear St Penetror	at Failun trength by neter Tes	e y st			↓
G Y M		Geodetic	De	St	andard Per	netration 1	Fest N Val	ue	Combus 2	stible Vap 50 5	our Readir	ng (ppm) 50	S A M	Natural
L B O L	SOIL DESCRIPTION	m OF 7	t h	Shear	Strength	00 1	50 2	kPa	Atterb	erg Limit	s (% Dry W	/eight)	ГЦЩО	kN/m ³
Silt to	o fine sand, light brown, some gravel		0)					S1
								Ē)					S2
	-													
	-	93.7						[ХX	S3
≝ BED Grey	ROCK , shaley limestone, no odour	93.4	2										X	S4
	-													
	-		3										•	
	-													
	-	-	4											
	-	91.1												
	Borehole Terminated at 4.58 m													

1/12/18	
AWA GDT	
TROW OTI	
OLES.GPJ	
BOREH	
LOGS OF	
REHOLE	
OF BOF	
LOG	:

NOTES: 1.Borehole data requires interpretation by exp. before	WAT	ER LEVEL RECO	DRDS		CORE DR	ILLING RECOF	RD
use by others	Elapsed	Water	Hole Open	Run	Depth (m)	% Rec.	RQD %
standpipe was installed in the borehole upon completion.	September 14, 201	7 2.3					
3 Field work supervised by an exp representative.							
4. See Notes on Sample Descriptions							
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0							

	Log of	Boi	re	ehole <u>MV</u>	V302	2		14	2	xn
Project No:	OTT-00224605-C0				ſ	Figuro No	28		-	~P
Project:	Environmental Drilling and Groundwate	r Monitor	inę	g			20			
Location:	1509 - 1531 Merivale Road, Ottawa					Page. 1	_ of _	1		
Date Drilled:	9/6/17			Split Spoon Sample	\boxtimes	Combustible Vapou	r Readir	ng		
Drill Type:	Geoprobe			Auger Sample SPT (N) Value		Natura l Moisture Co Atterberg Limits	ontent	⊢		× -
Datum:	Geodetic			Dynamic Cone Test		Undrained Triaxial a % Strain at Failure	at	-		⊕
Logged by:	JO Checked by: MGM			Shear Strength by Vane Test	+ s	Shear Strength by Penetrometer Test				A
G Y W B L O L	SOIL DESCRIPTION	Geodetic m	D e p t h	Standard Penetration Test 20 40 60 Shear Strength 50 100 150	N Value 80 kPa 200	Combustible Vapou 250 500 Natural Moistur Atterberg Limits (20 40	ir Readir) 75 e Contei % Dry W	ng (ppm) 50 nt % /eight) 0	SAZPLEV	Natural Unit Wt. kN/m ³
ASP 50 m FILL Grey	HALT	95.2	0		200	0				S1
with	some gravel, moist, no odour		1			.0			X	S2
	-	93.24	2			35			X	S3
Grey	ROCK , shaley limestone, no odour	-	3							
	-	91.6								

Borehole Terminated at 3.66 m

1/12/18	
WA.GDT	
DW OTTA	
GPJ TRO	
REHOLES	
SS OF BO	ſ
DLE LOC	
REHC	

B								
S OF	NOTES: 1.Borehole data requires interpretation by exp. before	WAT	ER LEVEL RECO	ORDS		CORE DI	RILLING RECO	RD
LOG	use by others 2.A flushmount monitoring well with a 51 mm slotted	Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %
HOLE	standpipe was installed in the borehole upon completion.	September 14, 201	7 2.0					
ORE	3. Field work supervised by an exp representative.							
OF B	4. See Notes on Sample Descriptions							
LOG	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0							

	Log of	Bo	re	ehole _	M١	N30:	<u>3</u>			14		xn
Project No	D: OTT-00224605-C0			_					20	`	-	np.
Project:	Environmental Drilling and Groundwate	er Monito	ring	g			Figure No) \1	<u>29</u>	1		
Location:	1509 - 1531 Merivale Road, Ottawa						Faye	,. <u> </u>	_ 01 _	<u> </u>		
Date Drille	ed: 9/6/17		_	Split Spoon Sample		\boxtimes	Combustib	le Vapou	r Readir	ng		
Drill Type:	Coorrela			Auger Sample			Natural Mo	isture Co	ontent			Х
Dim Type.	Geoprope		-	SPT (N) Value		0	Atterberg I	imits.		H		-O
Datum:	Geodetic			Dynamic Cone Test	-		Undrained	Triaxial a	ıt			\oplus
				Shelby Tube			% Strain a	t Failure				•
Logged by	Checked by: MGM			Shear Strength by Vane Test		+ s	Penetrome	eter Test				A
S		Geodetic	D	Standard Penetr	ation Te	st N Va l ue	Combustil 250	ole Vapou 500	ır Readir) 75	ng (ppm) 50	S A M	Natural
	SOIL DESCRIPTION	m	p	20 40 Shear Strength	60	80 kPs	Natur	al Moistur	e Contei % Dry W	nt % (eight)	P	Unit Wt.
		95 42	ĥ	50 100	150	200	20	40 g Linnie (6	0	Ē	KIN/ITI
	SPHALT) mm	95.4					0				$\overline{\mathbb{N}}$	01
GI	- rey and brown, sand and gravel to sand th some gravel moist, no adour										Д	51
		-	1				0				X	S2
	-	93.62	2				0 □				$\left \right\rangle$	S3

	Ľ	B O L	SOL DESCRIPTION		m	t h	Shea	ar St	reng	gth	<u>.</u> 10	15	, 	200	kPa	Att	erbe	erg Limit	s (% [10	Dry W	reight)	L E		kN/m ³
		\otimes	ASPHALT 50 mm		95.42 95.4	0			, 					200		0							/	0.1
			FILL Grey and brown, sand and gravel to sa	and																		1		51
				_		1										0 							\langle	S2
			-	_	93 62							2 - C+ 2 - C+ 2 - C+ 2 - C+				 0							/	60
		×		9	93.3	2	-2		10													_/	V	53
:		X	<u>BEDROCK</u> _Grey, shaley limestone, no odour	_																				
		X	_			3																		
		X										2 - 2 - 2												
	ΗK		Borehole Terminated at 3.66 m	6	91.8																		+	
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1/12/1															· · ·									
GDT									· · · · · · · · · · · · · · · · · · ·						· · · ·									
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W OT									· · · · · · · · · · · · · · · · · · ·						· · · ·									
J TRC															· · · ·									
ES.GP															· · · ·									
REHOL									· · · · · · · · · · · · · · · · · · ·						· · ·									
OF BO	NO	TES:							 CO		2					·`						 		
LOGS	1 B u	orenol se by c	thers	Elapse	d	、 L [Wate	er m)		ł	Hole	Ope	n	R	un	D	ept	h	ссия %	Rec		F	RQ	D %
JOLE	2 A st co	tlushn andpip omplet	nount monitoring well with a 51 mm slotted be was installed in the borehole upon on.	ntomber 4	4 2017		1 0	<u>)</u>			10	<u>(11)</u>					(111)							
SOREF	3.F	ield wo	rk supervised by an exp representative.	prember 1	4, 2011/		I.Ŏ																	
OFE	4.S	ee Not	es on Sample Descriptions																					
Š	5.T 0	nis Fig TT-00	ure is to read with exp. Services Inc. report 224605-C0																					

roject: Envi	ronmental Drilling and Groundwat	ter M	Ionitor	ring	r					F	igure N	No	30			
ocation: 1500	- 1531 Merivale Road Ottawa		011101		1						Paę	ge	1_ of	1		
ate Drilled: 0/6/4	7				0 11 0	6					o .		.			_
	/				Split Spo Auger Sa	on Samp ample	le	[× I		Combus Natural N	tible Vap Noisture (our Readi Content	ng		⊔ X
atum: Coo					SPT (N) Dynamic	Value Cone Te	est		0		Atterberg	g Limits ed Triaxia	alat	F		-O
atum. <u>Geo</u>					Shelby T	ube		I			% Strain	at Failur	e			\oplus
					Shear St Vane Tes	rength by st	/	-	+ s		Penetror	neter Tes	st			A
S Y				D	Sta	ndard Pe	enetration	Test N \	/alue		Combus 2	stible Vap	our Readii	ng (ppm)	S A	Natura
M B O	SOIL DESCRIPTION		m	p t h	2 Shear S	20 Strength	40	60	80 ki	⊃a	Nat Atterb	ural Moisi berg Limit	ture Conte s (% Dry V	nt % /eight)	PLE	Unit W kN/m
		95.	.7	0	5	50 *	100	150	200	0	2 	20 4	<u>40 6</u>	i0	s ://	Q1
with rock f	ragments, moist, no odour	_						· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·						$\frac{1}{2}$	31
										ſ					X	S2
SILT		94.	.5	1											:	
Dark brow	n, sandy silt with some gravel,	7	.2							ە]::::::::::::::::::::::::::::::::::::::				X	S3
BEDROCK	Kilimaatana na adaur			2											://	
Grey, sha	ey imesione, no odour		93.45												•	
		_		3											•	
															•	
		-		4						·····					•	
		-91	.1					· · · · · · · · · · · · · · · · · · ·		· · · ·						
Bore	ehole Terminated at 4.58 m															

S OF	NOTES: 1. Borehole data requires interpretation by exp. before		WAT	ER LEVEL RECO	RDS	CORE DRILLING RECORD					
Ő		$ \Gamma$	Elapsed	Water	Hole Open	Run	Depth	% Rec.	RQD %		
ш	2 A flushmount monitoring well with a 51 mm slotted		TIME	Level (III)	10 (11)						
HOLI	standpipe was installed in the borehole upon completion.	Se	ptember 14, 201	7 2.3							
ORE	3. Field work supervised by an exp representative.										
OF B	4.See Notes on Sample Descriptions										
LOG	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0										

	Log of	Bo	re	eho	ole	N	W	<u>/30</u>) <u>5</u>				1		xr
Project No:	OTT-00224605-C0								F	iaure N	lo	31		-	~r
Project:	Environmental Drilling and Groundwat	er Monito	rin	g					'	Bac	••••	<u> </u>	- 1		
Location:	1509 - 1531 Merivale Road, Ottawa									гаų	je				
Date Drilled:	9/6/17		_	Split Sp	oon Sam	ble		\boxtimes		Combust	iib l e Vap	our Readi	ng		
Drill Type:	Geoprobe		_	Auger S	ample Value					Natural M	Aoisture	Content	L		×
Datum:	Geodetic			Dynami	c Cone Te	est				Undraine	ed Triaxia	al at			0
Logged by:	JO Checked by: MGM		-	Shelby ⁻ Shear S Vane Te	Tube strength b est	у		■ + s		% Strain Shear St Penetror	at Failur rength b neter Te:	e y st			▲
S			D	St	andard Pe	enetration	Test N	Value		Combus	tible Vap	our Readi	ng (ppm)	S	Natural
	SOIL DESCRIPTION	Geodetic	e p t	Shear	20 Strength	40	60	80	kPa	Nati Atterb	ural Mois erg Limit	ture Conte s (% Dry V	nt % Veight)	P	Unit Wt. kN/m ³
		95.7	0		50	100	150	200		2	0	40 6	30	S	
Silt v	Silt with fine sand and clay, some gravel, _ rusty mottling, moist, no odour -														
									E]				X	S1
		94.5	1												
Bou Rock	ders and Cobbles < fragments with brown, silty fine	_							([) 				ł	S2
sand	ldry, no odour														
			2]:-:					S3
BED	ROCK	93.3												-	
Grey	, shaley limestone, no odour		3											•	
		-												•	
		_	4											•	
														•	
	Borehole Terminated at 4.58 m	91.1	-											-	

1/12/18	
GDT	
LAWA.	
OT	
TROW	
ES.GPJ	
REHOLE	
BOF	
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LOGS	
EHOLE	

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ñ											
2	NOTES: 1.Borehole data requires interpretation by exp. before	WAT	ER LEVEL RECC	RDS		CORE DRILLING RECORD					
3	use by others	Elapsed	Water	Hole Open	Run	Depth	% Rec.	RQD %			
1	2. A flushmount monitoring well with a 51 mm slotted	Time	Level (m)	To (m)	No.	(m)					
	standpipe was installed in the borehole upon completion.	September 14, 201	7 2.3								
	3. Field work supervised by an exp representative.										
5	4. See Notes on Sample Descriptions										
3	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0										

	Log of	Bo	r	eho	ole	N	IW:	<u>306</u>				1	e	xn
Project No:	OTT-00224605-C0							F	iaure N	Jo	32		-	np
Project:	Environmental Drilling and Groundwate	er Monito	rin	g				'	De		1	- 1		
Location:	1509 - 1531 Merivale Road, Ottawa								Pa	ge				
Date Drilled:	9/6/17			Split Sp	oon Samo	le		1	Combus	tib l e Vapo	our Readi	na		
Drill Type:	Geoprobe		-	Auger S	ample]	Natural	Aoisture C	Content	-		X
Datum:	Geodetic		-	SPT (N) Dynami	⊨Value c Cone Te	st		, -	Atterberg	g Limits ed Triaxial	at	ŀ		
Logged by:	JO Checked by: MGM		-	Shelby Shear S Vane Te	Tube strength by est	I	+	 -	% Strain Shear Si Penetror	at Failure rength by neter Tes	e t			●
G Y M B O L	SOIL DESCRIPTION	Geodetic m	D e p t h	St Shear	andard Pe 20 Strength 50 1	netration 40	Test N Va 60 150	alue 80 kPa 200	Combus 2 Nat Atterb	stible Vapo 50 50 ural Moistu erg Limits	our Readi 00 7 ure Conte (% Dry V	ng (ppm) 50 Int % Veight)	SAMPLEO	Natural Unit Wt. kN/m ³
FILL Grey mois SILT Brow	crushed stone, with silt and fine sand,	95.4	0						0 0 0 0					S1 S2
grave	al, dry to moist, no odour	94.2	1						0					S3
Grey	, shaley limestone, no odour –	-	2											
	- -	93.18	3										· · · · · · · · · · · · · · · · · · ·	

-91.1

Borehole Terminated at 4.58 m

1/12/18	
OTTAWA.GDT	
GPJ TROW	
BOREHOLES	
LOGS OF	
OREHOLE	

m]											
S OF	NOTES: 1.Borehole data requires interpretation by exp. before	WAT	ER LEVEL RECO	RDS		CORE DRILLING RECORD					
ğ	use by others 2 A flushmount monitoring well with a 51 mm slotted	Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %			
HOLE	standpipe was installed in the borehole upon completion.	September 14, 201	2.5								
SCR	3. Field work supervised by an exp representative.										
Ы	4. See Notes on Sample Descriptions										
9	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0										

roiect:	Environmental Drilling and Groundwate	er Monito	rine	a					F	igure	No	33	-		
ocation:				5					_	Pa	age	<u>1</u> of	1		
ate Drilled [.]	9/7/17				0	1-			_	Combu		o na Do o di			
rill Type:	Gooprobe		-	Auger Sa	on Samp ample	e				Natural	Moisture	Content	ng		\mathbf{X}
atum:	Geodetic		-	SPT (N) Dynamic	Va l ue Cone Te	st	_	0		Atterbe Undrair	rg Limits ned Triaxia	al at	ŀ		
arand by:	Occurrence Charles by: MGM		-	Shelby T	ube					% Strai Shear S	n at Failui Strength b	re Iv			⊕
byged by.				Vane Tes	rength by st	(+ s		Penetro	ometer Te	st			•
S Y		Quadatia	D	Sta	indard Pe	netratior	n Test	i N Va l u	e	Combi	ustible Var	oour Readii	ng (ppm) 50	SA	Natura
M B O	SOIL DESCRIPTION	m	p t h	Shear S	20 4 Strength	40	60	80) kPa	Na Atte	atural Mois	ture Conte ts (% Dry V	nt % Veight)	–∣≌ L	Unit W kN/m
	HALT /	95.38 95.3	0		50 1	00	150	20	0		20	<u>40 6</u>	50	Ŝ	/
	······································	_							[0 				X	S1
Grey with	and brown, sand and gravel to sand some gravel, moist, no odour		1												7
			'							20					S2
SAN	D AND GRAVEL	93.9								15					
Grey	and brown, some silt, moist, no odour -	93.3	2							P					S3
BED Grey	ROCK /, shaley limestone, no odour	93.11													
	-														
	-	-	3					<u></u>			· · · · · · · · · · · · · · · · · · ·				
	-	_													
	-		4												
×2	Porcholo Torminated at 4 57m	90.8												-	
	Borenole reminated at 4.5/m														

0													
ŏ.													
IS OF	NOTES: 1.Borehole data requires interpretation by exp. before		WAT	WATER LEVEL RECORDS				CORE DRILLING RECORD					
LOG	use by others 2 A flushmount monitoring well with a 51 mm slotted		Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %				
EHOLE	standpipe was installed in the borehole upon completion.	Se	eptember 14, 2017	7 2.3									
ORE	3. Field work supervised by an exp representative.												
OFB	4. See Notes on Sample Descriptions												
LOG	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0												

			Log of	Bo	re	ehole <u>MV</u>	V308	<u> 8</u>	*e	2	xn
Pr	rojec	t No:	OTT-00224605-C0						24		np.
Pr	rojec	t:	Environmental Drilling and Groundwate	r Monitor	rinę	g					
Lc	ocatio	on:	1509 - 1531 Merivale Road, Ottawa					Page. 1	_ of		
Da	ate D	rilled:	9/6/17			Split Spoon Sample	\boxtimes	Combustible Vapour	Reading	I	
Dr	Drill Type: <u>Geoprobe</u>					Auger Sample		Natural Moisture Cor	ntent		×
Da	atum	:	Geodetic			Dynamic Cone Test		Undrained Triaxial at	t		0 A
Lo	ggeo	d by:	JO Checked by: MGM		-	Shelby Tube Shear Strength by Vane Test	■ + s	% Strain at Failure Shear Strength by Penetrometer Test			
G₩L	S Y M B O L		SOIL DESCRIPTION	Geodetic m	Dep th	Standard Penetration Test I 20 40 60 Shear Strength 100 150	N Value 80 kPa	Combustible Vapour 250 500 Natural Moisture Atterberg Limits (%	Reading (ppm) 750 Content % 6 Dry Weight)		Natural Jnit Wt. kN/m ³
		∖ <u>ASPI</u> 50 m − <u>FILL</u>	HALT	95.35 95.3	0	50 100 150	200	0 0		{	S1
		with SAN Grey	and brown, sand and gravel to sand some gravel, moist, no odour <u>D AND GRAVEL</u> and brown, some silt, moist, no odour	94.5	1			0			S2
			-	93.12	2			60			S3
			- ROCK	92.7				5		3	S3
l H	\gg	-Grey	, shaley limestone, no odour –	1	3				····		

4

90.8

Borehole Terminated at 4.57m

/12/18	
TROW OTTAWA.GDT 1	
BOREHOLES.GPJ	
JGS OF	N 1
OLE LC	2.
OREH	3.

SRE										
БЩ		N] []							
s o	1.Bore	, nole data requires interpretation by exp. before		WATE	ER LEVEL RECC	CORE DRILLING RECORD				
00	use t	by others	Elaps	əd	Water	Hole Open	Run	Depth	% Rec.	RQD %
HOLE 1	2. A flus stand comp	shmount monitoring well with a 51 mm slotted lpipe was installed in the borehole upon letion.	September	9 14, 2017	Level (m)	<u>lo (m)</u>	No.	<u>(m)</u>		
ORE	3.Field	work supervised by an exp representative.								
OF B	4.See I	Notes on Sample Descriptions								
LOG (5 This OTT	Figure is to read with exp. Services Inc. report 00224605-C0								

	Log of	Bo	re	ehole _	<u>MN</u>	/309	<u>)</u>			*	2	xp	
Project No:	OTT-00224605-C0						Figure N	No	35		-	~P	
Project:	Environmental Drilling and Groundwate	er Monito	ring	g			De	···		. 1			
Location:	1509 - 1531 Merivale Road, Ottawa						Pa	ye		<u> </u>			
Date Drilled:	9/6/17	_	Split Spoon Sample		\boxtimes	Combus	tib l e Vapo	our Readir	ıg				
Drill Type:	Geoprobe		_	Auger Sample			Natural I	Moisture C	Content	L	×		
Datum:	Geodetic			Dynamic Cone Test			Undraine	ed Triaxial	at	•		⊕	
Logged by: JO Checked by: MGM			-	Shelby Tube Shear Strength by Vane Test	■ + s	Strain at Failure Shear Strength by Penetrometer Test							
SY MBOL	SOIL DESCRIPTION	Geodetic m	D e p t h	Standard Penetra 20 40 Shear Strength	ation Test N 60	l Value 80 kPa	Combus 2 Nat Attert	stible Vapo 50 50 ural Moistu berg Limits	our Readir 00 7: ure Contei (% Dry W	ng (ppm) 50 nt % /eight)	SA∑P – щ	Natural Unit Wt. kN/m ³	
ASP 50 m FILL Grey With SAN Grey BED Grey	HALT	95.4 94.2 93.9 93.17	1									S1 S2	
	Borehole Terminated at 4.57m	-90.9	4										

C	OTES: Borehole data requires interpretation by exp. before		WAT	ER LEVEL RECO	ORDS		CORE DRILLING RECORD						
A	ise by d A flushr	nount monitoring well with a 51 mm slotted	Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %				
standpipe completion		be was installed in the borehole upon	September 14, 201	7 2.3									
F	ield wo	ork supervised by an exp representative.											
. 5	See No	tes on Sample Descriptions											
Т. С	This Fig	ure is to read with exp. Services Inc. report 224605-C0											

oject:	Environmental Drilling and Groundwa	ter Mo	onitori	ng						F	igure	No	36	-		
Location: 1509 - 1531 Merivale Road, Ottawa										_	Pa	ge	<u>1</u> of	_1_		
Date Drilled: 9/7/17				Spli	t Spo	on Samp	е		\boxtimes		Combus	stib l e Vap	our Readi	ng		
ill Type: <u>Geoprobe</u>			Aug	jer Sa	ample Value					Natural Atterber	Moisture a Limits	Content	F		×	
atum:	Geodetic		Dyr	amic	Cone Te	st	_			Undrain	ed Triaxia	al at	•		\oplus	
ogged by: JO Checked by: MGM			She She Var	elby T ear St ne Tes	ube rength by st	,		+ s		Shear S Penetro	itrength b meter Te	ey est			•	
S Y M B O	SOIL DESCRIPTION	Geo	odetic m		Sta 2 hear \$	ndard Pe 20 4 Strength	netration 40	n Tesi 60	tN Va l ı 8	ue 0kPa	Combu 2 Na Atter	stible Vap 250 - 1 tural Mois berg Limit	oour Readi 500 7 sture Conte ts (% Dry V	ng (ppm) 50 nt % Veight)	SAMPL	Natura Unit W
L	PHALT nm	95.5	5	0	5	50 1	00	150	20)0) 	20	40 0	50	S	<u>S1</u>
Gre	y and brown, sand and gravel to sand some gravel, moist, no odour			1												01
		93.9	9								15				Å	S2
Gre	y and brown, some silt, moist, no odour	93.4	1 93.25	2											Å	S3
Gre	y, snaley limestone, no odour														• • •	
				3											•	
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		90.9	9							· · · · · · · · · · · · · · · · · · ·						
	Borehole Terminated at 4.57m															

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S OF	NOTES: 1. Borehole data requires interpretation by exp. before		WAT	ER LEVEL RECC	RDS	CORE DRILLING RECORD					
ГО	use by others		Elapsed Time	Water Level (m)	Hole Open To (m)	Rur No.	ו	Depth (m)	% Rec.	RQD %	
HOLE	standpipe was installed in the borehole upon completion.	s	eptember 14, 201	7 2.3							
ORE	3. Field work supervised by an exp representative.										
OF B	4. See Notes on Sample Descriptions										
LOG	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0										

roject:	Environmental Drilling and Groundwate	er Mon	itorii	ng						ſ	-igure l	No	37	-			
ocation:											ge	<u>1</u> of	_1_				
ate Drilled:	9/7/17			Sp	lit Spo	on Sam	e		X	1	Combus	stible Vap	our Readi	ng			
rill Type:	Geoprobe			Au	iger Sa	mple			Ĩ		Natural	Moisture	Content		×		
atum:	Geodetic			Dy	namic	Zone Te	est				Undrain	ed Triaxia	al at		——⊖ ⊕		
ogged by:	JO Checked by: MGM			Sh Sh Va	ielby Tu iear Str ine Tes	ube rength b <u>r</u> it	y		+ s		% Strair Shear S Penetro	n at Fallur strength b meter Te	re vy st		A		
S Y		Geode	etic	De	Star	ndard Pe	enetra	ation T	est N Va	ue	Combu 2	stible Vap 250 5	oour Readi 500 7	ng (ppm) 50	S A M Natura		
B O L	SOIL DESCRIPTION	m		p t s h	2 Shear S	0 Strength	40 100		50 1	80 kPa	Atter	tural Mois berg Limit 20	ture Conte ts (% Dry V	nt % Veight)	P Unit W		
<mark>ASP</mark> \50 m	HALT /	95.7 95.7		0	,	0					0		40 0				
Grey	, v and brown, sand and gravel to sand some gravel, moist, no odour														S1		
SAN Grev	D AND GRAVEL	94.5		1							10				S2		
				2							30				X 53		
BED	ROCK -	93.393	3.41												/ \		
Grey	, shaley limestone, no odour -			3													
	-	92.0															
	Borehole Terminated at 3.66m	02.0															
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S OF	NOTES: 1.Borehole data requires interpretation by exp. before		WAT	ER LEVEL RECC	RDS	CORE DRILLING RECORD									
P	use by others		Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %						
EHOLE	standpipe was installed in the borehole upon completion.	s	eptember 14, 201	7 2.3											
BOR	3. Field work supervised by an exp representative.														
Ы	4. See Notes on Sample Descriptions														
POG	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0														
roject:	Environmental Drilling and Groundwat	er Monito	rin	g					Εl	gure N	NO	<u>38</u>			
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ocation:	1509 - 1531 Merivale Road, Ottawa									Pag	ge	1_of	1		
ate Drille	ed: <u>9/7/17</u>		_	Split Spo	oon Samp	е		3	(Combust	tib l e Vapo	our Readii	ng		
Drill Type: <u>Geoprobe</u>			Auger Sample SPT (N) Value O Dynamic Cone Test					Natural Moisture Content Atterberg Limits Undrained Triaxial at				L		×	
Datum: Geodetic		_					•					•			
ogged by	r: JO Checked by: MGM			Shelby T Shear Si Vane Te	⁻ube trength by st	,	-	+ s	s F	% Strain Shear St Penetror	trength by meter Tes	e / st			•
S Y M B O	SOIL DESCRIPTION	Geodetic m	D e p t h	D e p t Shear Strength			/alue 80 kP	Combustible Vapour Read 250 500 kPa Atterberg Limits (% Dry 20 40			our Readii 00 7: ure Conte s (% Dry W	ling (ppm) 750 ent % Weight)		Natura Unit W kN/m	
	SPHALT) mm/	94.97	0		50 1	00	150	200	10)]	20 2	10 c			S1
	LL rey and brown, sand and gravel to sand th some gravel, moist, no odour AND AND GRAVEL	94.2	1						10)					S2
G	rey and brown, some silt, moist, no odour, EDROCK rey, shaley limestone, no odour														
			2												
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S OF	IOTES: Borehole data requires interpretation by exp. before		WATER LEVEL RECORDS				CORE DRILLING RECORD					
HOLE LOG	use by others		Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %			
	standpipe was installed in the borehole upon completion.	s	eptember 14, 201	7 2.9	, <i>, , ,</i>		、 /					
ORE	3. Field work supervised by an exp representative.											
OF B	4. See Notes on Sample Descriptions											
LOG	5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0											

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5812-1 - TEST HOLE LOCATION PLAN

patersongroup

KEY PLAN

FIGURE 1



