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Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Noise and Vibration Studies

Geotechnical Investigation

Proposed Commercial Development
101A and 103 Schneider Road
Ottawa, Ontario

Prepared For

Kepali Holdings Ltd.

March 31, 2021

Report: PG5682-1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Renfroe Land Management on behalf of Kepali Holdings Inc. to prepare the current geotechnical report for the proposed commercial development located at 101(A) and 103 Schneider Road located in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the geotechnical investigation was to:

☐ determine the subsurface soil and groundwater conditions by means of existing test holes.

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

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

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation. A report addressing environmental issues for the subject site was prepared under separate cover.

2.0 Proposed Development

Based on the latest available conceptual plans provided by Renfroe Land Management, it is our understanding that the proposed commercial development consists of a total of three commercial slab-on-grade buildings and a commercial/retail building addition of slab-on-grade construction located at 101A and 103 Schneider Road.

The three commercial buildings are currently being proposed across the vacant parcel of land located at 103 Schneinder Road. It is expected that at grade asphaltic covered car parking and access and landscaping areas are anticipated as part of the proposed development for 101(A) and 103 Schneider Road.

Furthermore, it is expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the subsoil and groundwater investigation was carried out on September 17, 2004. At that time, a total of six (6) test pits (TP1-TP6) were advanced across the site to a maximum depth of 3.5 m below existing ground surface. In addition, two (2) boreholes (BH2 and BH4) were extended to a maximum depth of 5.2 m below existing ground surface along the west boundary of the site on June 21, 2002. The test hole locations were determined in the field by Paterson personnel and distributed in a manner to provide general coverage of the proposed development taking into consideration site features and underground utilities. The test hole locations are presented on Drawing PG5682-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a truck-mounted auger drill rig operated by a two person crew. The test pits were completed using a rubber tired back-hoe at selected locations. The test hole procedure consisted of augering or excavating to the required depths at the selected locations and sampling the overburden soils. All fieldwork was conducted under the full-time supervision of personnel from Paterson's geotechnical division under the direction of a senior engineer.

Sampling and In Situ Testing

Soil samples collected from the boreholes were recovered using a 50 mm diameter split-spoon (SS) sampler. Soil samples from the test pits were recovered from the side walls of the open excavation. All soil samples were classified on site, placed in sealed plastic bags and transported to the laboratory for further review. The depths at which the split spoon and grab samples were recovered from the test holes are shown as SS and G, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

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

Undrained shear strength testing was conducted at regular intervals in cohesive soils and completed using a shear vane apparatus.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Flexible polyethylene standpipes were installed in BH2 and BH4 to permit the monitoring of groundwater levels subsequent to the completion of the sampling program. Groundwater infiltration levels was also recorded at the open test pits upon completion of the sampling program.

3.2 Field Survey

The test hole locations were determined and surveyed in the field by Paterson personnel taking into consideration existing site features. The ground surface elevation at the test pit locations was referenced to the top of spindle of the fire hydrant located on the east side of Schneider Road. An arbitrary elevation of 100.00 m as assigned to the temporary benchmark (TBM).

The test pit locations and ground surface elevation at each test pit location are presented on Drawing PG5682-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

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

4.0 Observations

4.1 Surface Conditions

The south portion of the subject site identified as 101(A) is occupied by a commercial slab-on-grade structure surrounded by asphaltic covered at grade car parking, access lanes and landscaped areas. The subject parcel is bordered to the east by commercial developments, to the south by a mixture of commercial/residential/vacant land followed by Carling Avenue and to the west by Schneider Road. The north parcel of the site identified as 103 Schneider Road is currently vacant, grass covered with sparse trees occupying the north and east boundaries of the site. 103 Schneider is bordered to the north and east by commercial development and to the west by Schneider Road.

The subject site is generally flat with the exception of the northeast portion of the site which is observed to gently slope down toward the northeast. The site is approximately at grade with the neighboring properties and adjacent roadways.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test hole locations consists of either fill and/or topsoil overlying a very stiff to stiff silty clay. An approximately 300 mm thick layer of silty sand to sandy silt was encountered at TP1, TP2, TP3, TP4 and TP6 directly over the very stiff brown silty clay at depths ranging between 0.3 to 1 m below existing ground surface. Based on our general knowledge of the areas geology and nearby test hole completed in the immediate area of the subject site, the silty clay extends to an approximate depth of 20 to 25 m below existing ground surface.

Refer to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on available geological mapping, the subject site is underlain by a mixture of metamorphic and igneous rock with an overburden drift thickness of 15 to 25 m.

4.3 Groundwater

The long-term groundwater level is estimated based on the observed color and consistency of the soil samples recovered during our field investigations. Based on these observations, it is estimated that groundwater can be expected between 2 to 2.5 m depth below existing ground surface. It should be noted that 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 considered suitable for the proposed commercial development. The proposed structures are anticipated to be founded on conventional shallow footings placed on an undisturbed, compact silty sand/sandy silt or stiff, silty clay bearing surface.

Due to the presence of a deep silty clay deposit, a permissible grade raise restriction is required for the subject site.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill, free of deleterious material and significant amounts of organics, can be left in place below the proposed building footprints, outside of lateral support zones for the footings, and below the proposed parking area and access lanes. It is recommended that the existing fill layer be proof-rolled by a vibratory roller and approved by the geotechnical consultant at the time of construction. Any poor performing areas noted during the proof-rolling operation should be removed and replaced with an approved fill.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in maximum 300 mm thick lifts and compacted to 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts compacted by the tracks of the spreading equipment to minimize voids. If the material is to be placed to increase the level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Bearing Resistance Values

Footings founded on an undisturbed, compact silty sand/sandy silt bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**.

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

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

If the silty sand/sandy silt is deemed loose by the geotechnical consultant at the time of construction, the area should be proof-rolled using a vibratory compactor and approved by the geotechnical consultant prior to placing footings.

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

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 the silty sand/sandy silt, or silty clay above the groundwater table when a plane extending horizontally and vertically from the underside of the footing at a minimum of 1.5H:1V passing through insitu soil of the same or higher bearing capacity as the bearing medium soil.

Permissible Grade Raise

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **2.0 m** is recommended.

5.4 Design for Earthquakes

The subject site can be taken as seismic site response **Class D** as defined in the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4.A) for foundations considered at this site. The soils underlying the site are not susceptible to liquefaction.

5.5 Slab on Grade Construction

With the removal of all topsoil and deleterious fill, such as those containing significant amounts of organic matter, within the footprint of the proposed buildings, undisturbed native soil surface or existing fill approved by the geotechnical consultant at the time of construction will be considered acceptable subgrade on which to commence backfilling for floor slab construction. It is recommended that the existing fill layer, free of deleterious and organic materials, be proof-rolled by a suitably-sized vibratory roller making several passes and approved by the geotechnical consultant at the time of construction.

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

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II with a maximum particle size of 50 mm, compacted to a minimum of 98% of the material's SPMDD are recommended for backfilling below the floor slab.

5.6 Pavement Structure

For design purposes, the following pavement structures presented below could be used for the design of car parking areas and access lanes. It should be noted that both pavement structures provided would be adequate for use as a fire route.

Table 1 - Recommended Pavement Structure - Car Only Parking Areas

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

Table 2 - Recommended Pavement Structure - Access Lanes and Heavy Loading Parking Area

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

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

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

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

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

- ☐ A 300 mm wide section of the existing asphalt roadway should be saw cut from the existing pavement edge to provide a sound surface to abut the proposed pavement structure.
- ☐ It is recommended to mill a 300 mm wide and 40 mm deep section of the existing asphalt at the saw cut edge.
- ☐ The proposed pavement structure subbase materials should be tapered no greater than 3H:1V to meet the existing subbase materials.
- ☐ Clean existing granular road subbase materials can be reused upon assessment by the geotechnical consultant at the time of excavation (construction) as to its suitability.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended to be provided for the proposed structures. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or ditches.

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose. 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 blanket, such as Miradrain G100N or Delta Drain 6000.

Concrete Sidewalks Adjacent to Buildings

To avoid differential settlements within the proposed sidewalks adjacent to the proposed buildings, it is recommended that the upper 600 mm of backfill placed below the concrete sidewalks adjacent to the building footprint consist of non-frost susceptible material such as OPSS Granular A or Granular B Type II. The granular material should be placed in maximum 300 mm loose lifts and compacted to 98% of the material's SPMDD using suitable compaction equipment. The subgrade material should be shaped to promote positive drainage towards the building's perimeter drainage pipe. Consideration should be given to placing a rigid insulation layer below the granular fill layer to prevent frost heave issues at the building entrances.

6.2 Protection 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 equivalent) should be provided.

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

6.3 Excavation Side Slopes

The excavations for the proposed development will be through fill and/or native silty sand/sandy silt and silty clay material. The subsurface soil is considered to be mainly a Type 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects. Above the groundwater level, for excavations to depths of approximately 1.0 m, the excavation side slopes should be stable in the short term at 1H:1V. Shallower slopes should be provided for deeper excavations or for excavation below the groundwater level.

The slope cross-sections recommended above are for temporary slopes. Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should maintain safe working distance 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 be installed at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

6.4 Pipe Bedding and Backfill

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

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of its SPMDD. The bedding material should extend at a minimum to the spring line of the pipe. The cover material, which should consist of OPSS Granular A crushed stone, should extend from the spring line of the pipe to a minimum of 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of its SPMDD.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should consist of 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 SPMDD.

6.5 Groundwater Control

The groundwater infiltration into the excavations are anticipated to be moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding mediums.

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

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

6.6 Winter Construction

Precautions should be provided if winter construction is considered for this project. The subsurface soil conditions mostly consist of frost susceptible materials. In 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 installation of straw, propane heaters and tarpaulins or other suitable means. 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.

The trench excavations should be constructed to avoid the introduction of frozen materials, snow or ice into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving during construction. Also, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure.

7.0 Recommendations

The following is recommended to be completed once the site plan and development are determined:

☐ Review detailed grading plan(s) from a geotechnical perspective.

☐ Observation of all bearing surfaces prior to the placement of concrete.

☐ Observation of all subgrades prior to backfilling.

☐ Field density tests to ensure that the specified level of compaction has been achieved.

☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

☐ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming the construction has been completed in general accordance with the recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The report recommendations are in accordance with the present understanding of the project. Paterson requests permission to review the grading plan, once available, and recommendations when the drawings and specifications are complete.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations are based on information gathered at the specific test locations and could 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.

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 Kepali Holdings Ltd., Renfroe Land Management or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
March 31, 2021
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Maha Saleh, P.Eng. (Provisional)

David J. Gilbert, P.Eng.

Report Distribution

- ☐ Renfroe Land Management (3 copies)
- ☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Southern Portion of 105 Schneider Road
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Assumed elevation = 100.00m

REMARKS

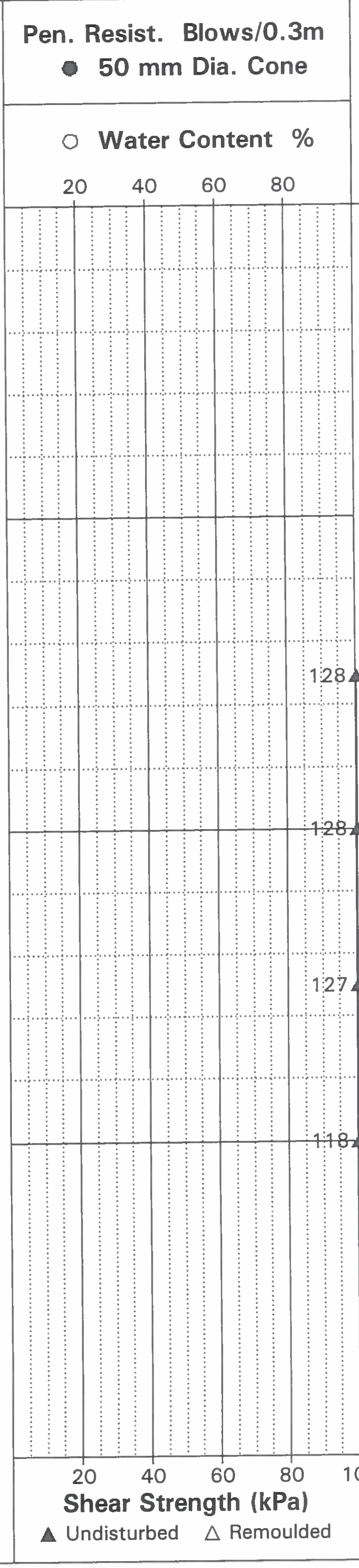
BORINGS BY Backhoe

DATE 17 SEP 04

FILE NO. PG0405

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.95
TOPSOIL 0.10							
FILL: Brown sandy silt with silty clay pockets - 25mm crushed stone layer @ 0.3m depth 0.80		G	1				
Compact to dense, brown **SILTY** fine **SAND** 1.00		G	2			1	98.95
Very stiff, brown **SILTY CLAY**, trace sand 3.00		G	3			2	97.95
						3	96.95
End of Test Pit (TP dry upon completion)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Southern Portion of 105 Schneider Road
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Assumed elevation = 100.00m

REMARKS

BORINGS BY Backhoe

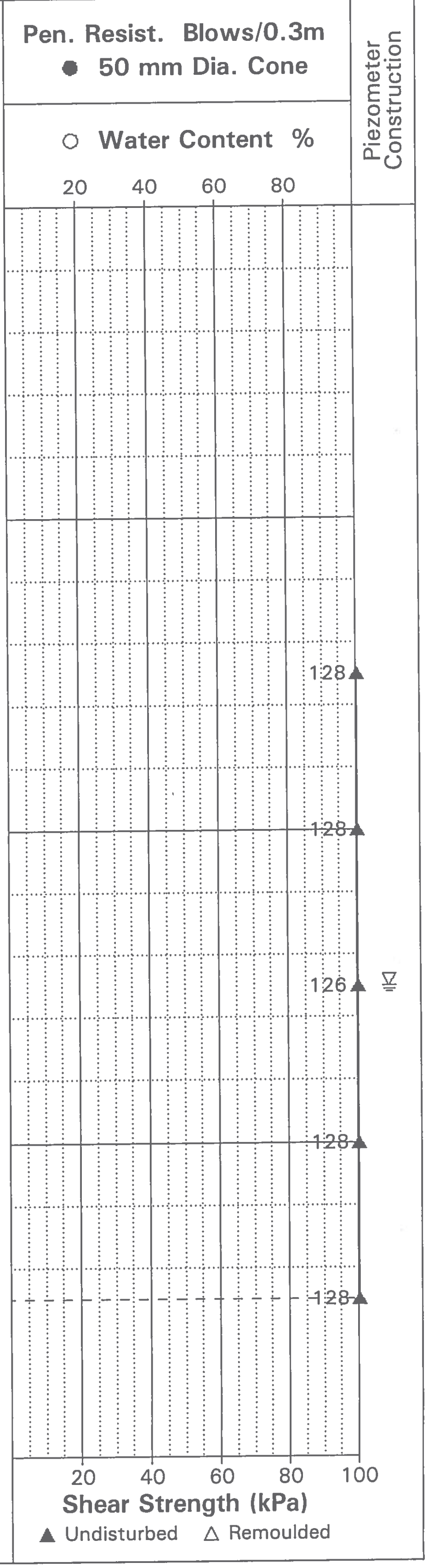
DATE 17 SEP 04

FILE NO. PG0405

HOLE NO. TP 2

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.10				
FILL: Brown sandy silty clay, with organic matter, occasional gravel	0.90	G	4		
Compact to dense, brown SILTY fine SAND	1.10	G	5		
Very stiff, brown SILTY CLAY, trace sand - brown-grey by 2.5m depth	3.50				
End of Test Pit (Water infiltration @ 2.5m depth)					

DEPTH (m)	ELEV. (m)
0	99.41
1	98.41
2	97.41
3	96.41



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Southern Portion of 105 Schneider Road
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Assumed elevation = 100.00m

REMARKS

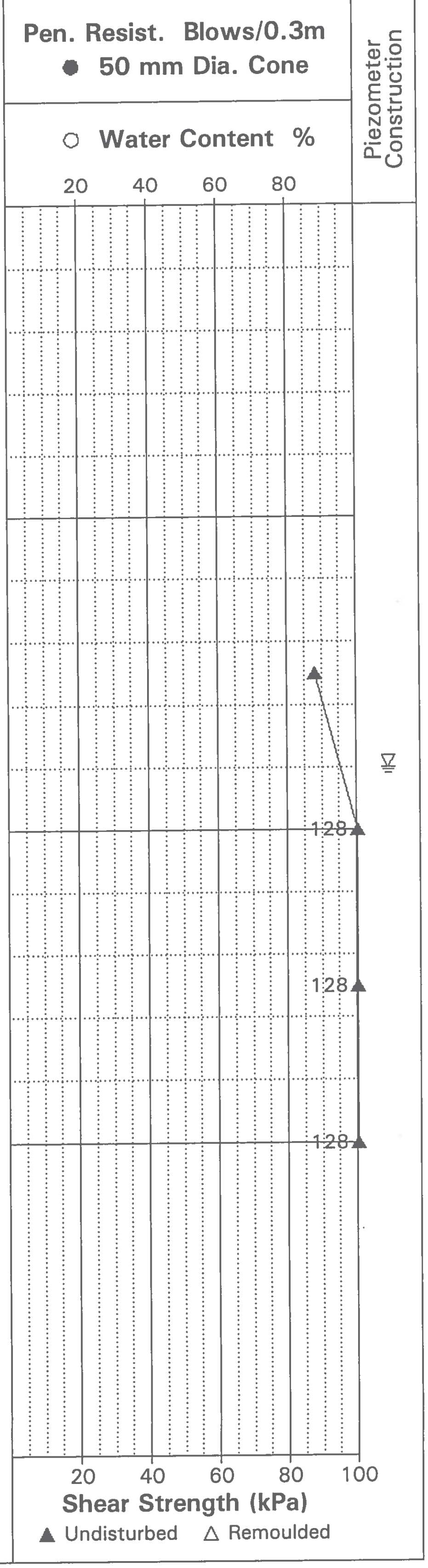
BORINGS BY Backhoe

DATE 17 SEP 04

FILE NO. PG0405

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.52
5mm Topsoil FILL: Mixture of sand, silty clay, crushed stone, organic matter, asphaltic concrete fragments and nails — 1.05		G	6			1	98.52
Dark brown SANDY SILT with organic matter — 1.24		G	7				
Stiff to very stiff, brown SILTY CLAY - trace sand from 1.25 to 1.8m depth - grey-brown by 1.8m depth — 3.00						2 3	97.52 96.52
End of Test Pit (Water infiltration @ 1.8m depth)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Southern Portion of 105 Schneider Road
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Assumed elevation = 100.00m

REMARKS

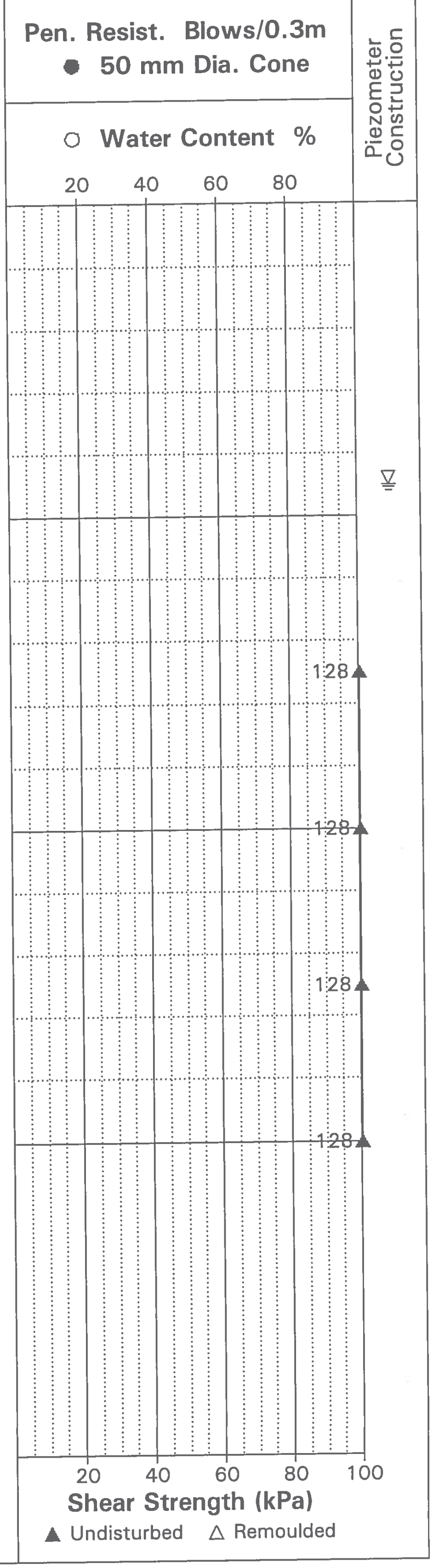
BORINGS BY Backhoe

DATE 17 SEP 04

FILE NO. PG0405

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	98.52
TOPSOIL 0.25	■						
Brown SILTY fine **SAND/SANDY SILT** 0.50	⁙	G	8				
Very stiff, brown SILTY **CLAY** - trace sand from 0.5 to 0.9m depth	▨					1	97.52
	▨					2	96.52
	▨	G	9				
3.00	▨					3	95.52
End of Test Pit (Water infiltration @ 0.9m depth)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Southern Portion of 105 Schneider Road
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Assumed elevation = 100.00m

REMARKS

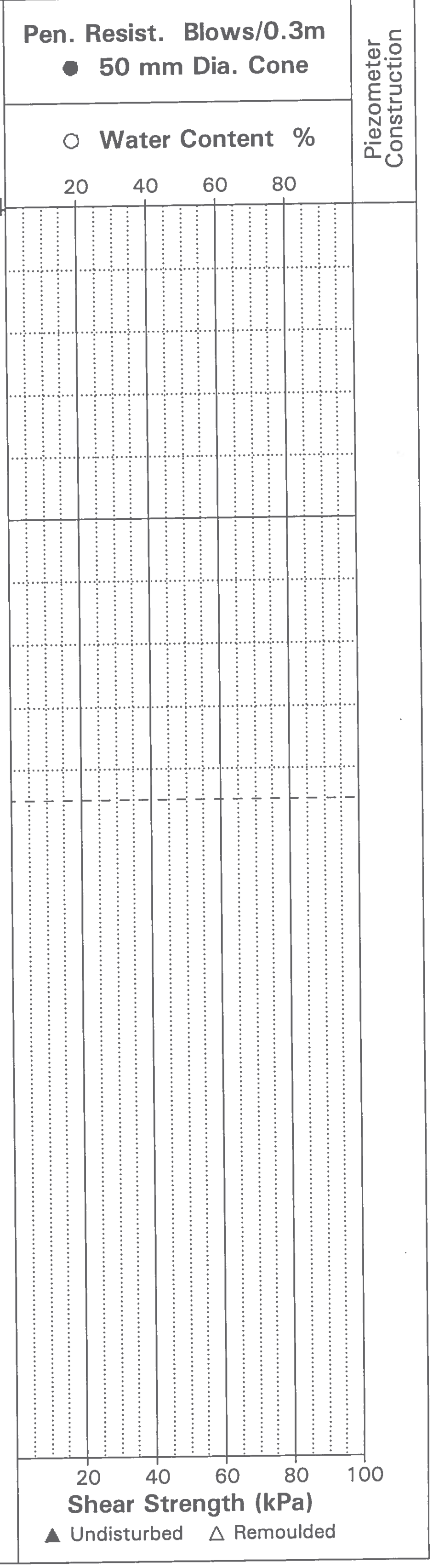
BORINGS BY Backhoe

DATE 17 SEP 04

FILE NO. PG0405

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.34
FILL: Brown silty clay, sand, topsoil, gravel - plastic bag @ 1.4m depth	▨					1	99.34
1.60		G	10				
Very stiff, brown **SILTY CLAY**	▨						
1.90							
End of Test Pit (TP dry upon completion)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Southern Portion of 105 Schneider Road
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Assumed elevation = 100.00m

REMARKS

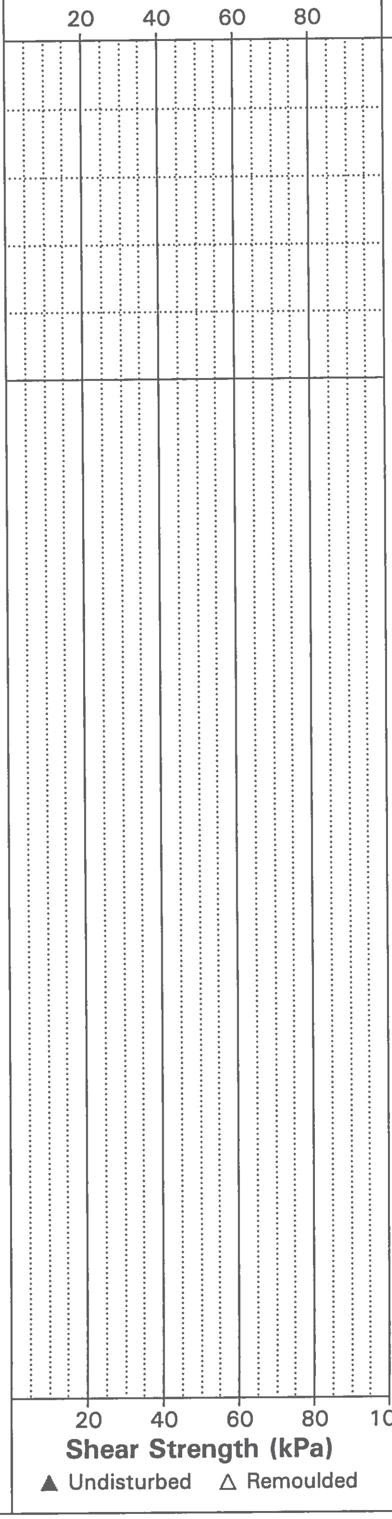
BORINGS BY Backhoe

DATE 17 SEP 04

FILE NO. PG0405

HOLE NO. **TP 6**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
GROUND SURFACE						0	97.50		
TOPSOIL 0.25	■								
Brown **SILTY** fine **SAND/SANDY SILT** 0.50	⁘								
Very stiff, brown **SILTY CLAY**, trace sand 1.00	▨					1	96.50		
End of Test Pit (TP dry upon completion)									



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

SOIL PROFILE & TEST DATA

Phase I-II Environmental Site Assessment
105 Schneider Road
Ottawa (Kanata), Ontario

DATUM

REMARKS

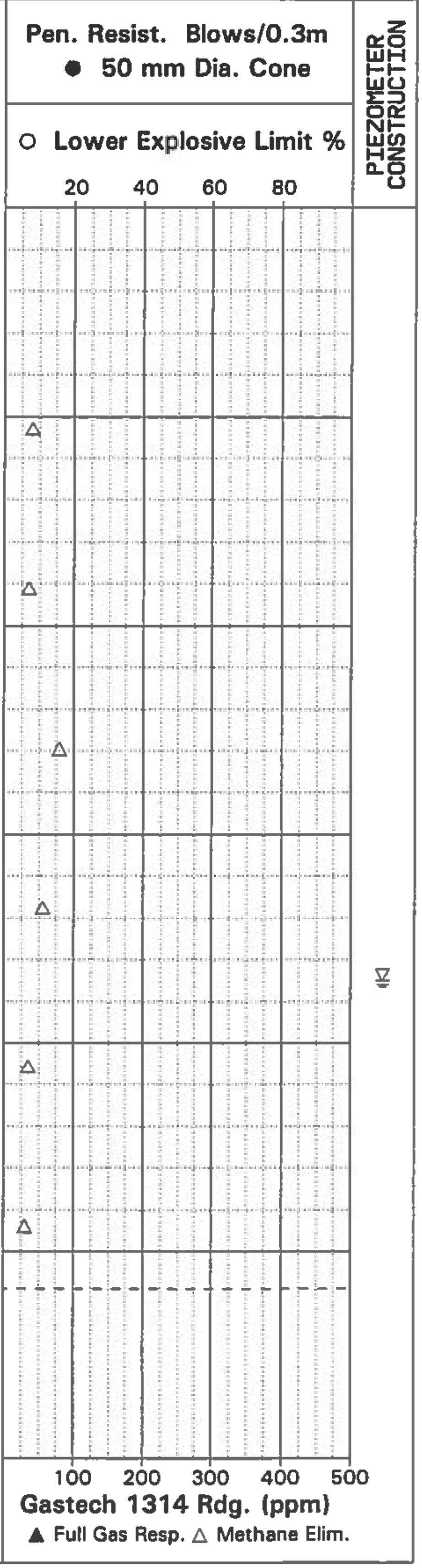
BORINGS BY CME 55 Power Auger

DATE 21 JUN 02

FILE NO. E2429

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.15							
		SS	1	42	7	1	
		SS	2	67	5	2	
Firm, brown SILTY CLAY, occasional sand layers		SS	3	100	3	3	
		SS	4	100	3		
		SS	5	100	2	4	
		SS	6	100	3	5	
5.18							
End of Borehole (Open hole GWL @ 3.7m depth)							



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SOIL PROFILE & TEST DATA

Phase I-II Environmental Site Assessment
105 Schneider Road
Ottawa (Kanata), Ontario

DATUM

REMARKS

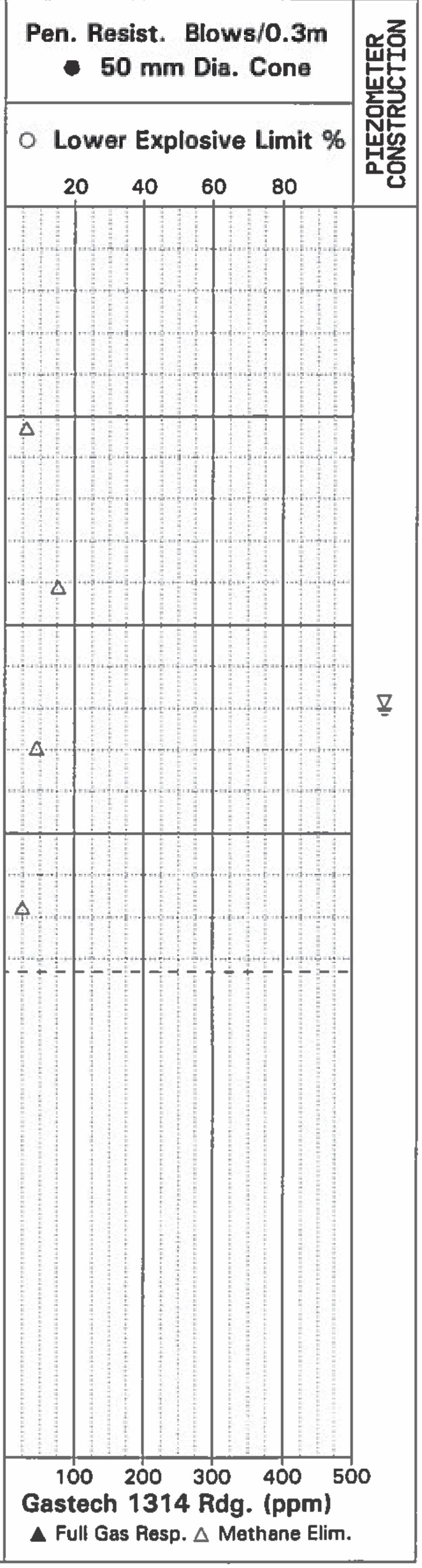
BORINGS BY CME 55 Power Auger

DATE 21 JUN 02

FILE NO. E2429

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.15							
Firm, brown SILTY CLAY, occasional sand layers		SS	1	33	9	1	
		SS	2	58	6	2	
		SS	3	100	7		
3.66		SS	4	100	4	3	
End of Borehole							
(Open hole GWL @ 2.4m depth)							



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SOIL PROFILE & TEST DATA

Phase I-II Environmental Site Assessment
105 Schneider Road
Ottawa (Kanata), Ontario

DATUM

REMARKS

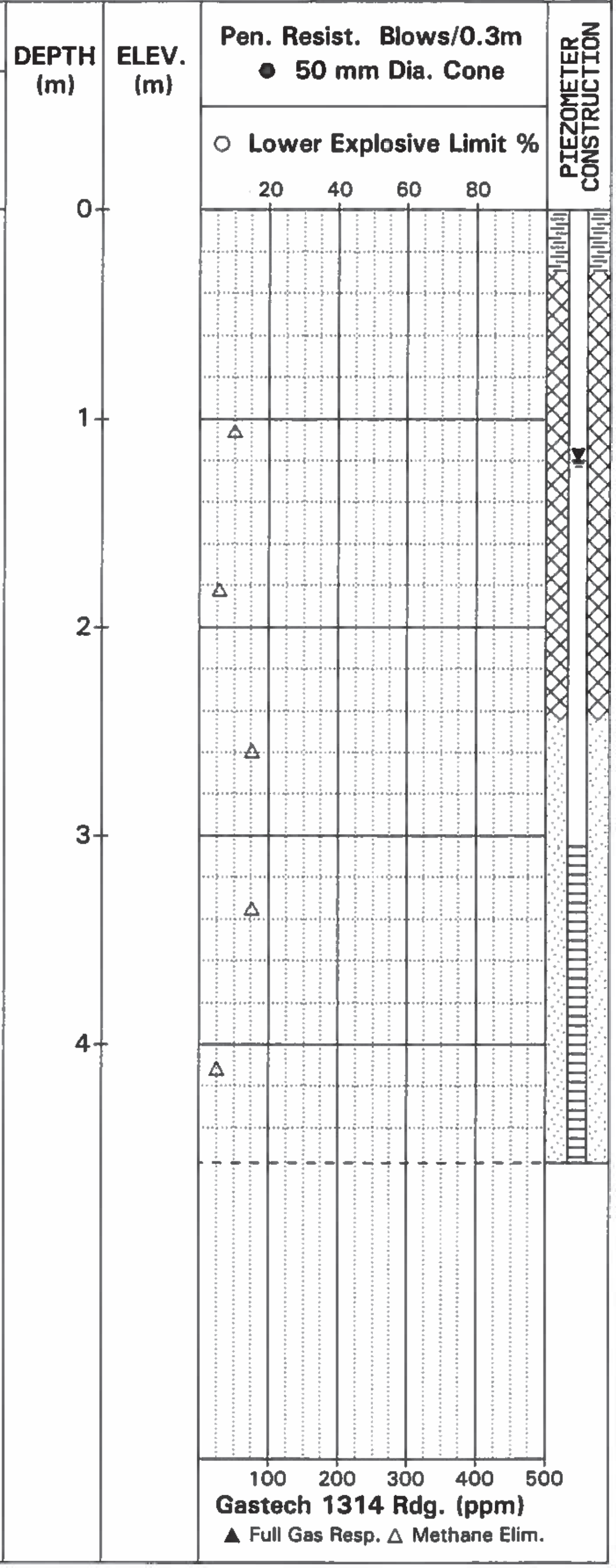
BORINGS BY CME 55 Power Auger

DATE 21 JUN 02

FILE NO. **E2429**

HOLE NO. **BH 4**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.15					
Firm, brown SILTY CLAY		SS	1	25	7
		SS	2	92	6
		SS	3	100	6
		SS	4	100	3
		SS	5	100	3
4.57					
End of Borehole (GWL @ 1.2m-Jul.4/02)					



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

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

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

CONSOLIDATION TEST

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

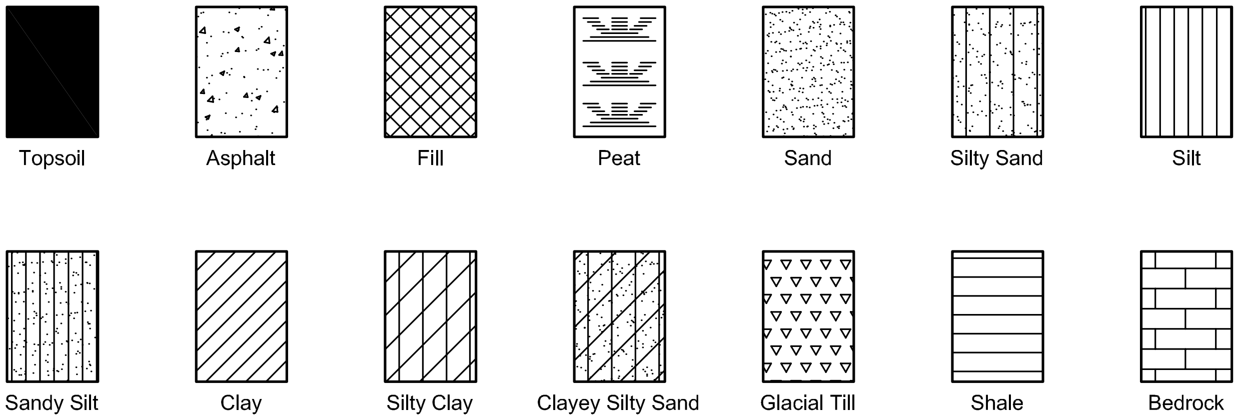
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

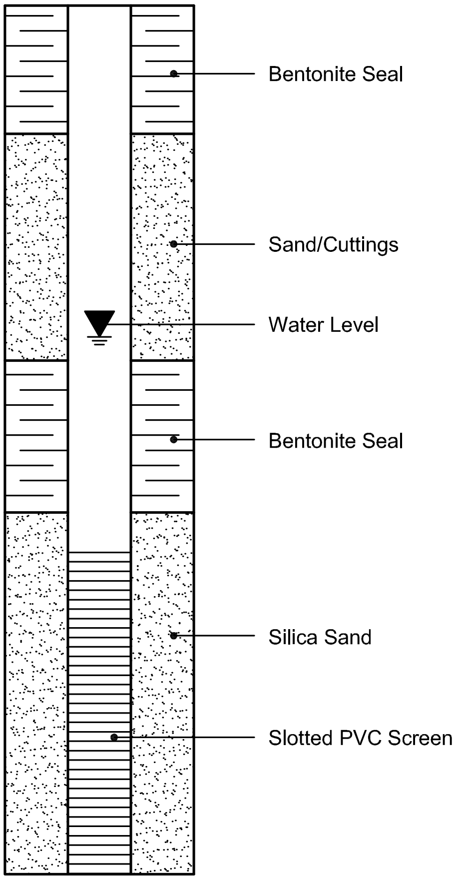
k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during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

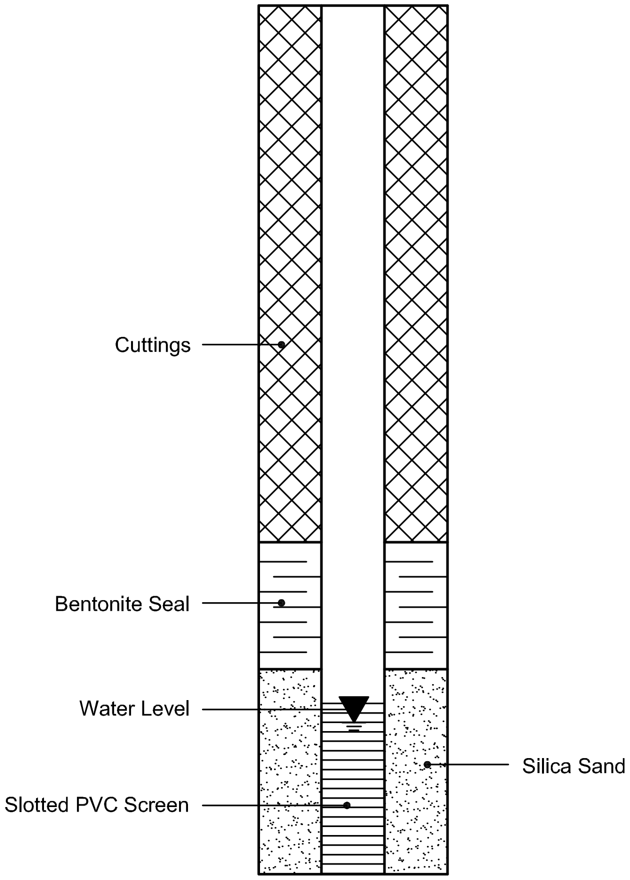
SYMBOLS AND TERMS (continued)

STRATA PLOT



MONITORING WELL AND PIEZOMETER CONSTRUCTION


MONITORING WELL CONSTRUCTION


PIEZOMETER CONSTRUCTION

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5682 -1 - TEST HOLE LOCATION PLAN

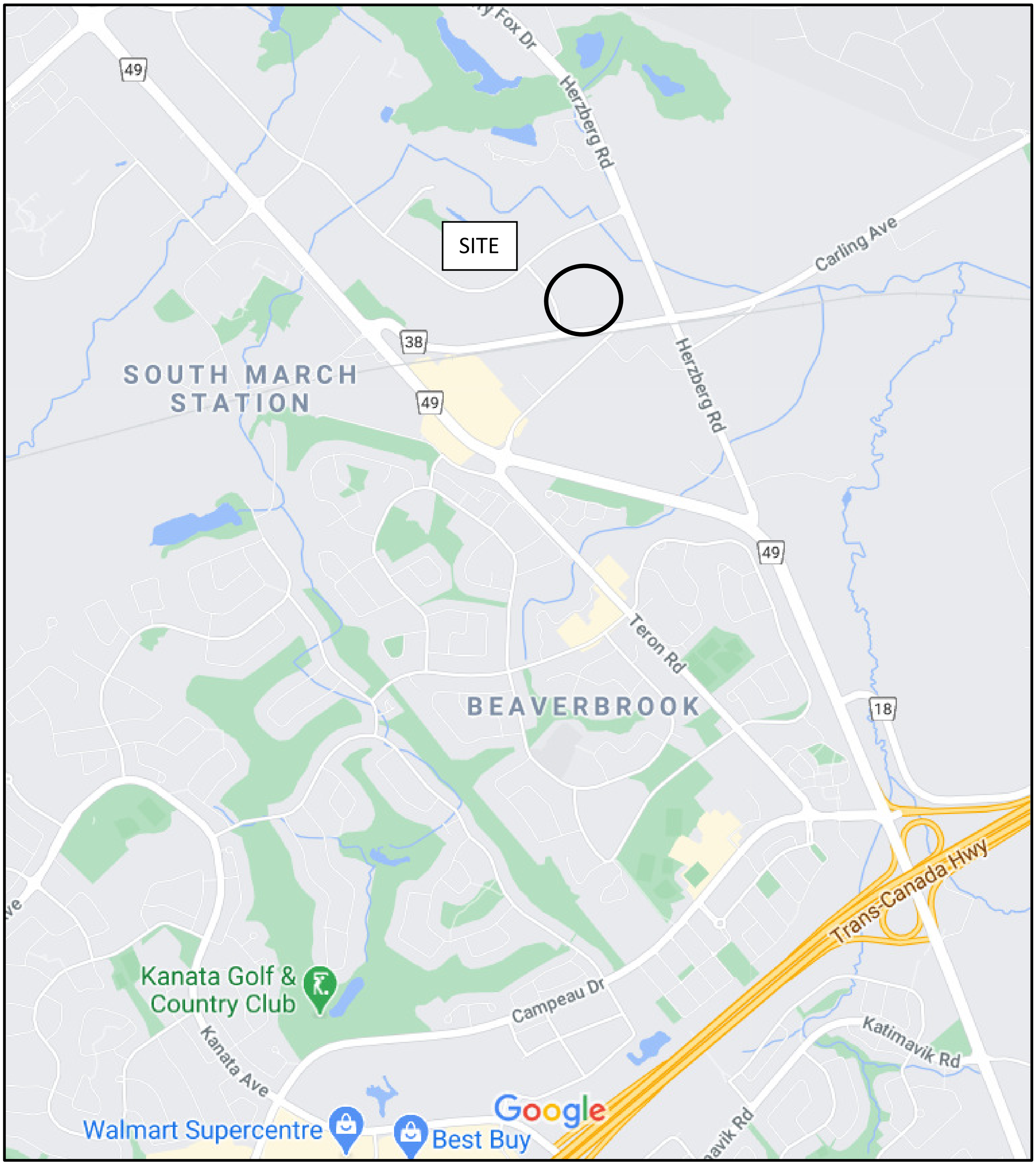
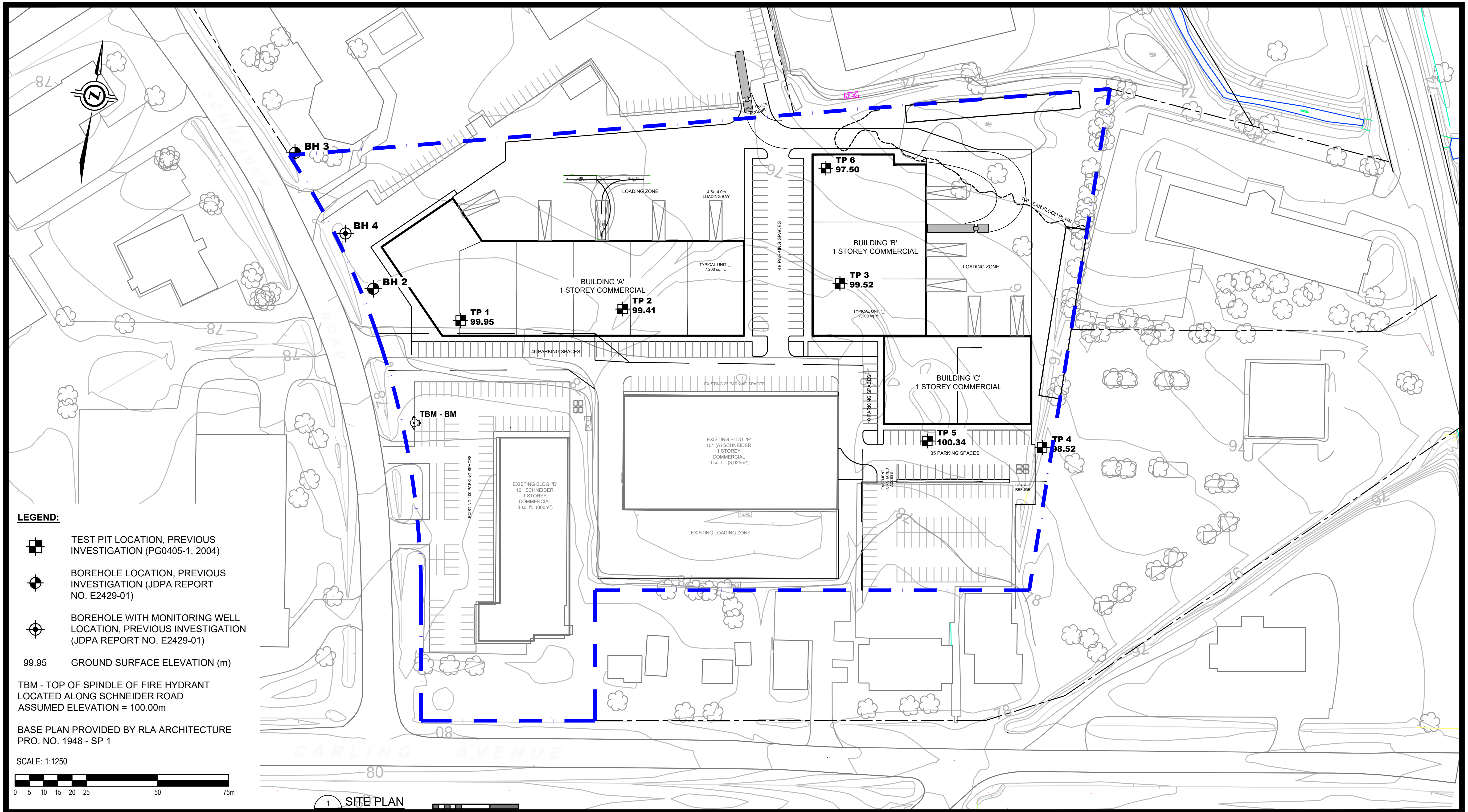


FIGURE 1

KEY PLAN



LEGEND:

▣	TEST PIT LOCATION, PREVIOUS INVESTIGATION (PG0405-1, 2004)
⊕	BOREHOLE LOCATION, PREVIOUS INVESTIGATION (JDPA REPORT NO. E2429-01)
⌖	BOREHOLE WITH MONITORING WELL LOCATION, PREVIOUS INVESTIGATION (JDPA REPORT NO. E2429-01)
99.95	GROUND SURFACE ELEVATION (m)

TBM - TOP OF SPINDLE OF FIRE HYDRANT
LOCATED ALONG SCHNEIDER ROAD
ASSUMED ELEVATION = 100.00m

BASE PLAN PROVIDED BY RLA ARCHITECTURE
PRO. NO. 1948 - SP 1

SCALE: 1:1250

0 5 10 15 20 25 50 75m

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NO.	REVISIONS	DATE	INITIAL
0			

KEPALI HOLDINGS LTD C/O RENFROE LAND MANAGEMENT

GEOTECHNICAL INVESTIGATION - PROPOSED COMMERCIAL DEVELOPMENT
101A AND 103 SCHNEIDER ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale:	1:1250
Date:	02/2021
Drawn by:	RCG
Report No.:	PG5682-1
Checked by:	MS
Dwg. No.:	PG5682-1
Approved by:	RG
Revision No.:	0

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