OTTAWA SOUTH UNITED

CLUB HOUSE

DRAFT GEOTECHNICAL STUDY

PROJECT NO.: 211-13935-00
DATE: June 2022

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 CONTEXT

WSP Canada Inc. (WSP) was retained by the Ottawa South United (OSU) to conduct a Geotechnical Study for the Club house located at 1128 Clapp (the Site) in Ottawa, Ontario. The geotechnical study comprises a desktop study combined with the previous field investigation and recommendation of any gap analysis required.

The purpose of this report is to present the findings of the desktop study, previous investigation and o provide comments and recommendations which may affect the design of the proposed field house.

1.2 PROJECT AND SITE DESCRIPTION

1.2.1 1.2.1 SITE DESCRIPTION

It is understood that the Ottawa South United is intending to construct a club house at George Nelms Sports Park, located at 5650 Mitch Owens Road in Ottawa, Ontario. The house is approximately 575 m^2 footprint and situates north to the soccer fields and south of the parking area as per **Appendix A.**

1.3 OBJECTIVES AND LIMITATIONS

The current report was prepared at the request and for the sole use of Ontario South United (OSU) to the specific terms of the mandate given to WSP. The use of this report by a third party, as well as any decision based upon this report, is under this party's sole responsibility. WSP may not be held accountable for any possible damages resulting from third party decisions based on this report.

The scope of this report is the geotechnical aspects of the project. Furthermore, any opinions regarding conformity with laws and regulations expressed in this report are technical in nature; the report is not and shall not, in any case, be considered as a legal opinion.

Information in this report is only valid for the borehole and test-pit locations as described. Reference should be made to the Limitations of this Report, attached in Appendix C, which follows the text but forms an integral part of this document.

2 GEOTECHNICAL INVESTIGATION

2.1 SCOPE OF WORK

The geotechnical scope of work for this assignment included:

- A desktop study and review of existing geotechnical investigations.
- Geotechnical analysis.
- Preparation of this report which presents the results of the desk top study, previous investigation and provides geotechnical recommendations related to the new field house site application Plan.

2.1.1 *DESKTOP STUDY*

Published surficial geology maps indicate the area is underlain by a fine-textured glaciomarine deposits, consisting of silt and clay, with some sand and gravel. The deposits are described as massive to well laminated. Off-site and to the east and west of the Site, the clay is absent, and the underlying glacial till is present at the surface. Water well and borehole logs suggest that the overburden thickness is vastly variable in the area, ranging from less than one metre to more than 20 metres.

Most of the Ottawa area is underlain by a sequence of Paleozoic sedimentary rocks of Ordovician age. The uppermost bedrock unit at the Site is the Oxford Formation, which is primarily dolostone, with minor shale and sandstone. The Oxford is underlain by the March Formation, consisting of sandstone, dolomitic sandstone and dolostone. The March is a transitional unit between the overlying Oxford and the underlying Nepean Formation, which is described as sandstone with minor conglomerate. The top of the Nepean Formation is defined by the last occurrence of dolostone. Numerous faults are present in the general area, but none are mapped within 4.5 kilometres of the Site.

The fine-textured glaciomarine deposits consisting of clay, silty clay and silt with minor sand and gravel deposits. This deposit is underlain by older alluvial deposits consisting of clay, silt, sand, gravel and may contain organic remains. Areas of organic deposits were also noted to the north of the Site. Bedrock geology includes shale, limestone, dolostone and siltstone of the Georgian Bay Formation and other formations.

2.1.2 *EXISTING GEOTECHNICAL INFORMATION*

The following reports/investigations were available for this site.

- A previous geotechnical report was conducted by Paterson titled “Geotechnical Investigation, proposed turf field and soccer dome”. Details of the field investigations is provided in the section below.
- Report issued by Golders in December 2013 titled “Hydrogeology Assessment 5650 Mitch Owens Drive, Manotick, Ontario”.
- Well log reported an overburden of about 15 m is attached in appendix B.

2.1.3 *FIELD INVESTIGATION*

Paterson Group (Paterson) conducted a geotechnical investigation for the Northeast field area located near Mitch Owens Drive where the soccer fields and the field house planned to be constructed.

The field program for the geotechnical investigation was carried out on June 25, 2015. A total of eleven (11) boreholes were completed to a maximum depth of 6.1 m. The locations of the test holes are shown on **Appendix A.** The test holes were distributed across the proposed turf field and in the vicinity of the proposed field house footprint.

2.1.4 LABORATORY TESTING

Based on the previous investigation conducted by Paterson, some Laboratory testing was conducted. Borehole logs reported moisture content values for samples at BH-1 and BH-10 for fill, topsoil and silty clay, while remoulded shear strength was reported for some samples at BH-1 and BH-10. The testing results was not attached.

3 SUBSURFACE GEOTECHNICAL CONDITIONS

The subsurface conditions encountered within the boreholes and test pits at the site are discussed in the following sections. Detailed descriptions of the soil and groundwater conditions encountered at each of the borehole and test-pit locations are included in the individual borehole logs in **Appendix B**.

3.1 SOIL CONDITIONS

The following provides a general description of the major soil types encountered during the previous geotechnical investigation. It should be noted that the following discussion includes some simplifications for the purposes of discussing broadly similar soil strata. It should also be noted that the differences in soil types and changes between various soil strata are often gradational, as opposed to precise boundaries of geological change.

A detailed description of the soil stratigraphy encountered at each borehole or test-pit location is shown on the borehole log or test-pit log sheets shown in **Appendix B**. Please note that the factual descriptions shown in each log take precedence over the generalized (and simplified) descriptions presented below. Also, consider the fact that borehole/test-pit findings represent the very location of these holes and not necessarily mean it represents the soil formation in the surrounding area.

3.1.1 TOPSOIL

A layer of topsoil was encountered at the surface in all the boreholes ranged in thickness between 0.10 m to 0.66 m from ground surface. Based on the borehole logs, the moisture content is about 18%.

3.1.2 FILL

A layer of fill was encountered underlying the topsoil in all the boreholes. The fill consists of grey to brown silty sand/sandy silt with some clay. This fill extended to depths ranging from 0.10 m to 1.90 m below the existing groundsurface.

The SPT "N" values within the fill ranged from 1 blow to 12 blows per 305 mm of penetration indicating a loose to compact state of packing. This layer reported moisture content of 20%-25%

3.1.3 SILTY CLAY

A layer of sensitive silty clay was encountered underlying the fill in both boreholes drilled in this area. This deposit generally consists of interlayered clay and silty clay. This layer extended to depth of 1.3 m and 6.1 m in boreholes BH1, BH4, BH5, BH6 and BH8 to BH10 respectively.

This layer is classified as soft to firm grey silty clay with some sand and have an increasing moisture content with depth that ranges between 25% to 60 %.

3.2 GROUNDWATER CONDITIONS

Based on the borehole logs in appendix B, standpipe piezometers were installed in boreholes BH1, BH10. The water depth encountered ranged between 1.95 to 2.0 m depth from the ground surface. It should be noted that water levels vary seasonably and are expected to be higher during the spring period and severe rainfall events.

3.3 SUMMARY

The following table provides an overview of the soil strata encountered at each of the borehole and test-pit locations.

Table 3-1 Simplified Soil Conditions

BH/TP Number	Topsoil		Fill		Silty Clay		Water Depth
	Start	End	Start	End	Start	End	-
20-01	0.0	0.66	0.66	1.95	1.95	5.94	1.95
20-02	0.0	0.10	0.1	1.83	-	-	-
20-03	0.0	0.25	0.25	1.83	-	-	-
20-04	0.0	0.20	0.20	1.57	1.57	1.83	-
20-05	0.0	0.10	0.10	1.37	1.37	1.83	-
20-06	0.0	0.10	0.10	1.5	1.5	2.44	-
20-07	0.0	0.15	0.15	1.83	-	-	-
20-08	0.0	0.20	0.20	1.68	1.68	1.83	-
20-09	0.0	0.13	0.13	1.68	-	-	-
20-10	0.0	0.10	0.10	2.44	2.44	6.1	2.0

4 RECOMMENDATIONS

4.1 GENERAL

This section of the report provides an engineering guidance related to the geotechnical design aspects of the project based on our interpretation of the available information described herein and project requirements. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, safety, and equipment capabilities. Reference should be made to the Limitations of this Report, attached in Appendix C, which follows the text but forms an integral part of this document.

4.2 FROST PROTECTION

The depth of frost penetration for the site is 1.8 m. Exterior foundations of heated structures should be provided with a minimum of 1.5 m of soil cover (or equivalent insulation) for the purposes of protection from frost. Foundations of unheated structures should be provided with a minimum of 1.8 m of earth cover (or equivalent insulation).

In the event that foundations are to be constructed during the winter months, foundation soils are required to be protected from freezing temperatures using suitable construction techniques. Therefore, the base of all excavations should be insulated from freezing temperatures immediately upon exposure, until the time that heat can be supplied to the building interior and/or the foundations have sufficient earth cover to prevent freezing of the subgrade soils.

4.3 SEISMIC CLASSIFICATION

As outlined in the Ontario Building Code, building foundations must be designed to resist a minimum earthquake

force. In accordance with Table 4.1.8.4.A of the Ontario Building Code, the seismic site response for foundations placed on soft soil like silty clay/silty sand with SPT less than 15, would have a site classification of Class E.

4.4 LATERAL EARTH PRESSURES

4.4.1 *STATIC EARTH PRESSURE*

The lateral earth pressure acting on permanent retaining walls and temporary shoring, etc. may be calculated using the following expression:

$P = K(\gamma h+q)$

Where:

P = lateral earth pressure (kPa) acting at depth h

K = earth pressure coefficient; for unrestrained walls and structures where some movement is acceptable

(such as retaining walls) use a coefficient of active earth pressure (Ka) equal to 0.3 for silty clay and 0.26 for silty sand, for restrained walls (such as basement walls) use the coefficient of earth pressure at rest (K0) equal to 0.5 for silty clay and 0.46 for silty sand.

γ= the unit weight of soil (21.5 kN/m3 for granular fill or 18 kN/m3 for native silty clay soils)

h = the depth to the point of interest (m)

q = the magnitude of any design surcharge at the ground surface.

The above calculation yields lateral earth pressures due to soil loading only. If the retaining walls are intended to become partially submerged during the design flood event, then appropriate hydrostatic pressures below the water table should be added to the lateral earth pressures calculated as above in order to obtain the total lateral earth pressure acting on the structures.

4.4.2 SEISMIC EARTH PRESSURE

Lateral earth pressures will be higher under seismic loading conditions. In order to account for seismic lateral earth pressures, the total lateral earth pressure during a seismic event (including both the seismic and static components) may be assumed to be:

PAE = 1/2γH2(1 - kv) KAE

and

PPE = 1/2γH2(1 - kv) KPE

Where:

PAE = Resultant active lateral earth load, including static and dynamic loads (kN);

H = Total height of the wall (m);

kv= Vertical acceleration coefficient (use 0);

KAE = Seismic active earth pressure coefficient (use 0.4 for yielding wall);

PPE = Resultant passive lateral earth load, including static and dynamic loads (kN);

KPE = Seismic passive earth pressure coefficient (use 3 for yielding wall).

The above earth lateral pressure values (both static and seismic) are unfactored values.

The seismic lateral earth pressure component (PAE – PA) should be assumed to act at a height of 0.6H above the base of the wall (i.e., higher than the non-seismic lateral earth pressure component, PA, which is typically assumed to act at 0.33H).

4.5 FOUNDATIONS

The proposed structure is expected to be 2 floors with 6 m height. Owing to the soft sensitive clay material found at ~1.8 m depth, recommended foundation options would include: (a) shallow thickened slab foundation near existing grade (i.e. below top soil) or (b) helical piles to transfer the foundation load to stiff material below 6 m. Option (a) can be designed using a bearing resistance value at serviceability limit states (SLS) of **60 kPa for footing width between 0.6 -1.0 m and bearing value of 50 kPa for footings width between 1.2- 1.5 m** and a factored bearing resistance value at ultimate limit states (ULS) of **120 kPa.** A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS. For option B, on the other hand, more detailed investigation will be required.

It is recommended that the site preparation for option a include stripping of topsoil and proof roll under dry conditions by suitable compaction equipment making several passes. Also, any poor performing and/ or soft spots areas noted during proof rolling or areas containing significant amounts of organics should be assessed by the geotechnical consultant and removed prior to footing placement and replaced with Granular B Type II compacted to 98% SMPDD. Rigid Styrofoam insulation shall be placed a cross the entire building footprint, and extending beyond the foundation edges, according to the manufacture specifications.

An undisturbed, soil bearing surface consists of topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, must be removed prior to the placement of concrete for footings. The bearing resistance values at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively. To limit differential settlement, which could occur across the field footprint due to additional loading, a permissible grade raise restriction of **1.2 m** is recommended for the field surface

4.6 CONSTRUCTION CONSIDERATION

4.6.1 *SERVICES*

It is understood that localized trenches will need to be carried out for the installation of utilities and septic tank. Construction of new site services are expected to be within either the fill material or the native silty clay. Trenches can be temporarily supported using sloped excavations or trench boxes as outlined in Section 4.5.3 of this report.

The following recommendations are made; however, they can be refined once the location and depth of the proposed utilities is known.

4.6.2 *COMPACTION*

Bedding for site services should be in accordance with the relevant OPSD standard drawing and would typically consist of Granular "A" compacted to 95% of the Standard Proctor Maximum Dry Density (SPMDD). Where wet or disturbed conditions are encountered in the base of the trench or where the fill is unsuitable it may be necessary to over-excavate and replace unsuitable soils with compacted granular fill to provide a stable subgrade for the bedding. The use of clear stone as a bedding and cover material is not recommended as the finer particles of the native soils and backfill may migrate into the voids of the clear stone, resulting in loss of pipe support.

Cover material above the spring line should consist of Granular "A" or Granular "B" material with a maximum particle size of 25 mm. Cover material should be compacted to a minimum of 95% SPMDD.

Backfill may consist of additional granular fill, or properly moisture conditioned native silty clay and should be compacted to 95% SPMDD (98% if below structures). Where backfill is within the frost depth, the backfill profile (above the minimum cover required) in the trench should be made to match the native soils on either side as much as is practical in order to minimize the potential for differential frost heave. As a result, portions of the silty clay above the water table may be retained, moisture conditioned (if necessary) and reused.

Any service trenches which extend below the water table should have clay cut-offs installed across the trench at regular intervals (typically 100 m) to prevent the trench acting as a drain and lowering the groundwater table in the general area. These cut-offs should extend the full width of the trench and must completely penetrate the bedding, cover and any other granular materials in the trench. To avoid damaging or laterally displacing the structures, care should be exercised when compacting fill adjacent to new structures or adjacent to existing retaining walls. Heavy equipment should be kept a minimum of 1 m away from the structure during backfilling. The 1 m width adjacent to the wall should be compacted using hand-operated equipment unless otherwise authorized.

The above are general guidelines for typical site services. All services installations should be completed in accordance with the relevant OPSS's and OPSD's for the particular application and size.

All backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content. Unsuitable materials such as organic soils, the existing fill on site, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

4.6.3 *SLAB ON GRADE*

Upon the removal of all topsoil and deleterious materials within the footprint of the slab on grade, the native soil surface may be considered as an acceptable subgrade surface. However, any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, is recommended for backfilling below the floor slab. The upper 150 mm of sub-slab fill should consist of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed structures should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of the SPMDD.

4.6.4 TEMPORARY DEWATERING

The groundwater level was found to be at approximately 2.0 m below the existing surface elevation. For excavations within the silty clay above the water table and slightly below (less than 0.5 m) the water table, it is likely that seepage into the excavations can be managed using properly filtered sumps, ditches, etc.

The requirement for a MOECC Environmental Activity and Sector Registration (EASR – which covers construction dewatering up to 50,000 l/day) or a Permit to Take Water (PTTW – which is required for dewatering in excess of 400,000 l/day) are not expected. However this can be confirmed once the excavation location and depths are confirmed.

The soils present at the site are expected to be sensitive to disturbance and proper control of the groundwater infiltration (by construction of sumps, use of well points, etc.) will be required to prevent excessive disturbance. Failure to adequately control groundwater inflows may result in disturbance of the subgrade and a need for over-excavation and replacement of disturbed subgrade soil.

4.6.5 TEMPORARY EXCAVATIONS

All excavations should be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA), Part III of Ontario Regulation 213/91.

The soils within the expected excavation include fill and silty clay (weathered and unweathered). These soils (save the unweathered silty clay) above the groundwater level or depth of dewatering can be classified as Type 3 soils and Type 4 soils below the groundwater table (or depth of watering). The unweathered silty clay can be considered a Type 4 soil. These classifications must be reviewed and confirmed by a qualified person during excavation. Excavations within Type 3 soil requires side slopes with a minimum gradient of 1 horizontal to 1 vertical and excavations within Type 4 soil require side slopes of 3 horizontal to 1 vertical.

If limited space is available, a temporary shoring system may be used. Once the location of the building and various excavations is determined. The potential need for vertical shoring can be reviewed. The design of any the shoring system must be carried out by a professional engineer and take into consideration the stability of the excavation as well as the effect of the excavation upon the neighbouring buildings and structures. The contractor is typically responsible for the detailed design of temporary shoring.

If required, WSP can provide additional guidance the detailed design phase of the project.

4.7 GAP ANALYSIS

The boreholes specified in the previous field investigation by Paterson covered a large area of the concerned site but were not directly located within the proposed field house footprint. Therefore, additional boreholes (2 boreholes @9 m depth) may be required to be drilled within the proposed club house footprint.

The following laboratory tests are also recommended:

- Moisture content
- Grain size analysis (Sieves and hydrometers)
- Atterberg limits (for cohesive soils)
- Corrosion package chemical testing (pH, sulfate, chloride, and resistivity)

This report will be revisited and updated based on the findings of the content of the gap analysis, additional lab testing may be considered based on the field investigation results.

5 CLOSURE

The Limitations of Report, as presented in Appendix C, are an integral part of this report.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

WSP Canada Inc.

Report prepared by:

Mohamed Elsayed

Senior Geotechnical Engineer, M.Eng., P.Eng

Reviewed by:

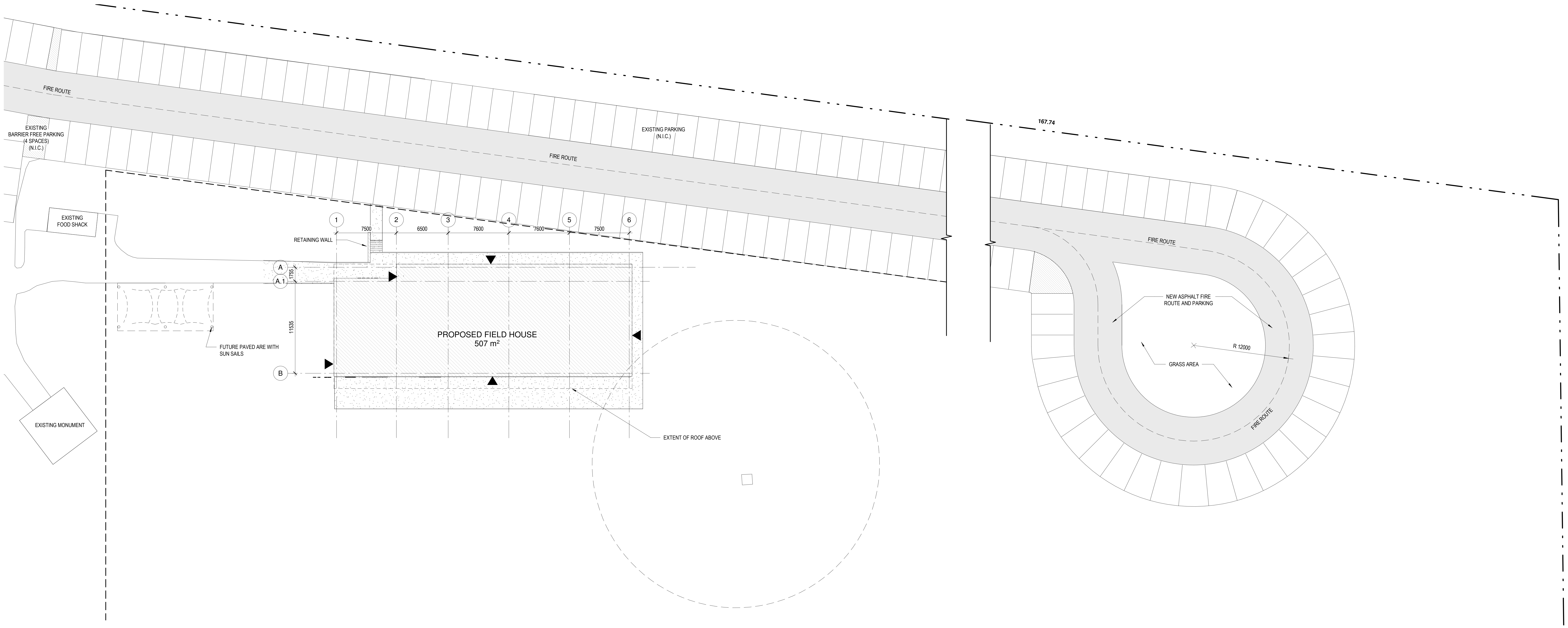
Imad Alainachi, Ph.D., P.Geo.

Senior Engineering Geologist

APPENDIX

A

DRAWINGS



ENLARGED SITE PLAN

1 / A100
Scale: 1 : 200

LEGEND

▨	CONCRETE SIDEWALK
— · —	PROPERTY LINE

ARCHITECTURE | 49

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SEAL:

CLIENT:

OTTAWA SOUTH UNITED

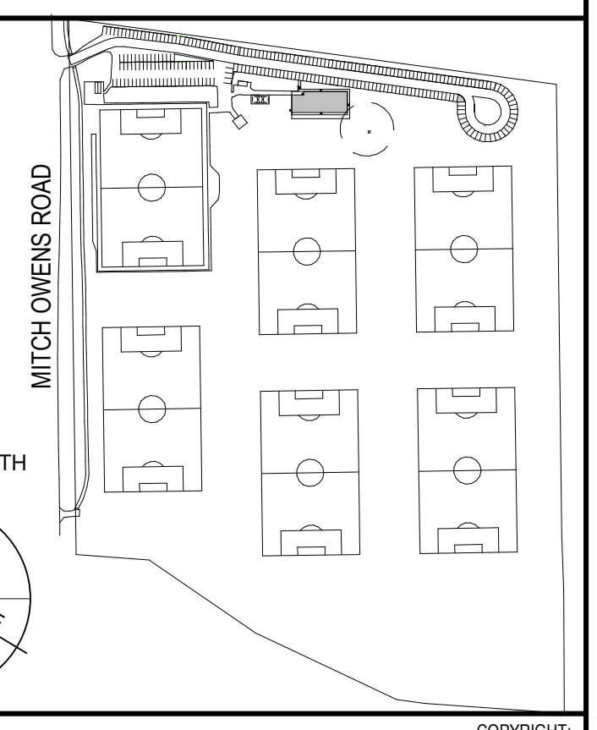
CLIENT REF. #:

PROJECT:

OTTAWA SOUTH UNITED
FIELD HOUSE

5650 MITCH OWENS ROAD
OTTAWA, ONTARIO

KEY PLAN:



DISCLAIMER: COPYRIGHT:

ISSUED FOR - REVISION:

IS	DATE	DESCRIPTION

PROJECT NO: 211-13935-00
DATE: 2022-05-13
ORIGINAL SCALE: As indicated
DESIGNED BY: WP
DRAWN BY: ML
CHECKED BY: WP

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
25mm

DISCIPLINE: ARCHITECTURAL

TITLE: ENLARGED SITE PLAN

SHEET NUMBER: A101
SHEET #: OF

ISSUE: ISSUED FOR REVIEW
REV #
DATE OF: 2022-05-13

D07-12-21-0095
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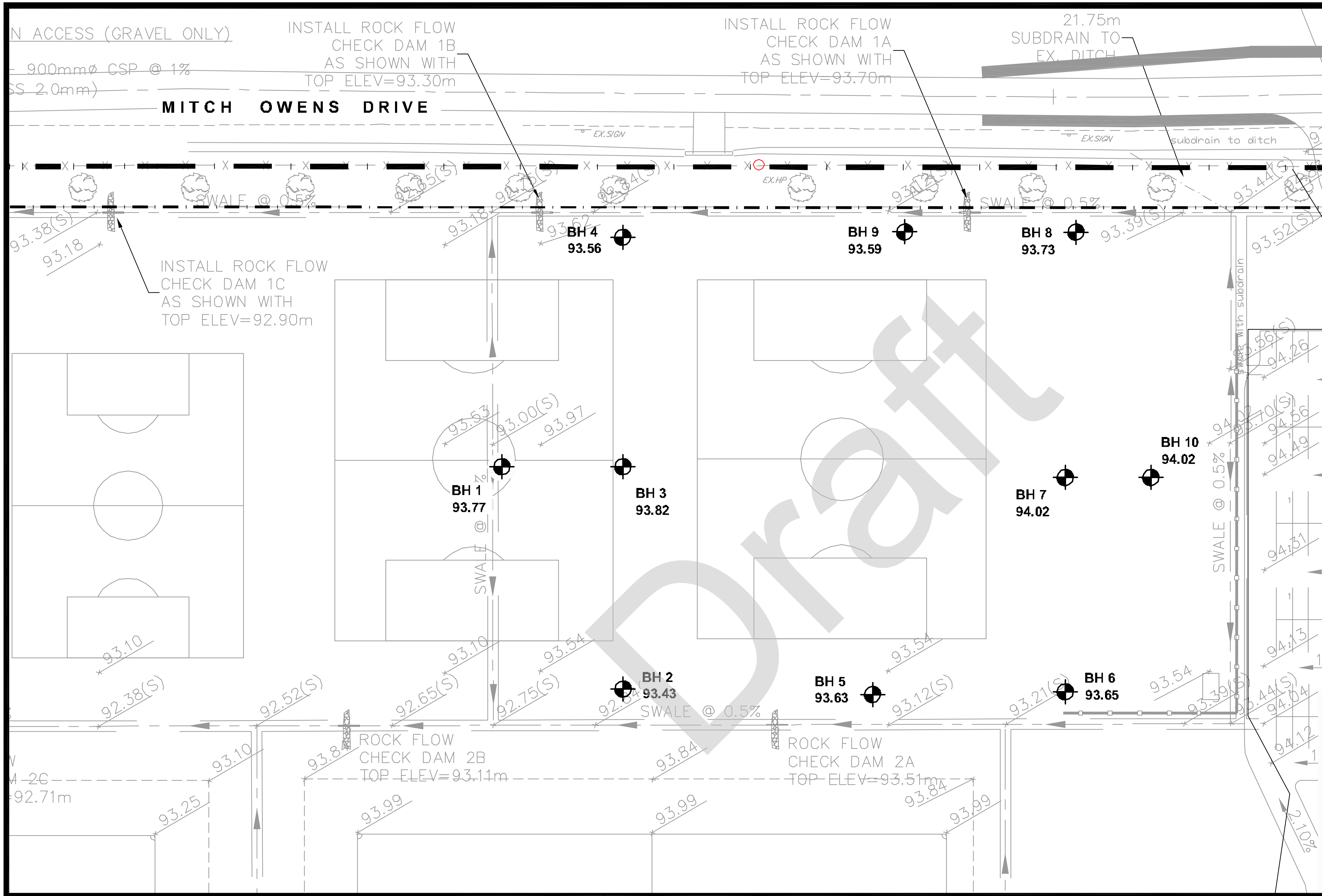

LEGEND:

⌖	BOREHOLE LOCATION
93.77	GROUND SURFACE ELEVATION (m)

TBM - EXISTING GROUND SURFACE AT EAST PROPERTY BOUNDARY. GEODETIC ELEV. = 94.02m.

SCALE: 1:750

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NO.	REVISIONS	DATE	INITIAL

OTTAWA SOUTH UNITED

GEOTECHNICAL INVESTIGATION
PROP. TURF FIELD AND SOCCER DOME - 5650 MITCH OWENS DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750
Date: 07/2015
Drawn by: MPG
Report No.: PG3545-1
Checked by: DJG
Drawing No.: PG3545-1
Approved by: DJG
Revision No.:

p:\autocad drawings\geotechnical\pg35xx\pg3545\150605_osu_base plan.dwg

APPENDIX

B

BOREHOLE LOGS

EXPLANATION OF TERMS USED IN BOREHOLE RECORDS

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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

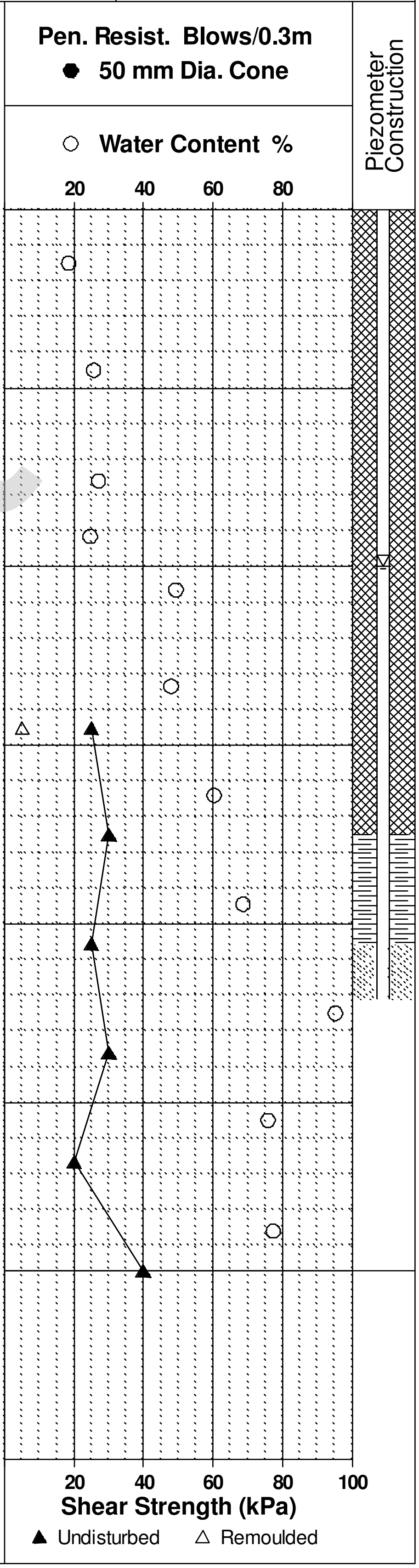
BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 1

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	93.77
TOPSOIL 0.66	SS	1	33	4		
Loose to very loose, grey **SILTY SAND,** some clay 1.95	SS SS	2 3	42 33	5 5	1	92.77
Soft to firm, grey **SILTY CLAY,** some sand 5.94	SS	4	50	W	2 3 4 5	91.77 90.77 89.77 88.77
End of Borehole (GWL @ 2.0m depth based on field observations)						



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. **PG3545**

HOLE NO. **BH 2**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
GROUND SURFACE						0	93.43		
TOPSOIL 0.10									
Loose to very loose, grey **SILTY SAND,** some clay		SS	1	67	8				
		SS	2	75	4	1	92.43		
1.83		SS	3	100	2				
End of Borehole (BH dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	93.82		
TOPSOIL 0.25									
FILL: Brown silty sand, some clay 0.60		SS	1	50	3				
Very loose to loose, brown to grey **SILTY SAND,** some clay		SS	2	100	10	1	92.82		
		SS	3	100	8				
1.83									
End of Borehole (BH dry upon completion)									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

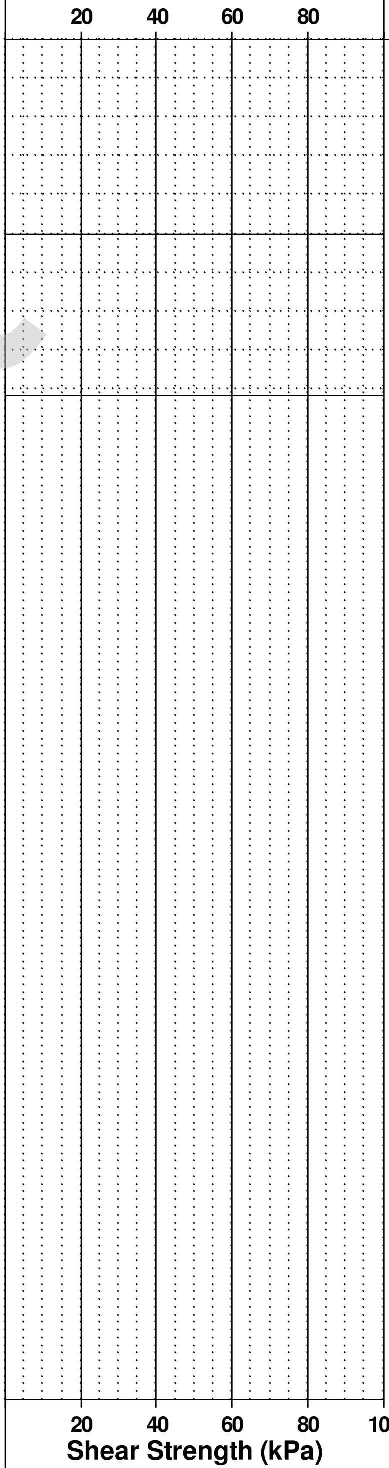
BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	93.56		
TOPSOIL 0.20									
Loose, grey **SILTY SAND,** some clay		SS	1	75	8				
		SS	2	100	9	1	92.56		
1.57		SS	3	100	1				
Soft, grey **SILTY CLAY,** some sand 1.83									
End of Borehole									
(BH dry upon completion)									



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

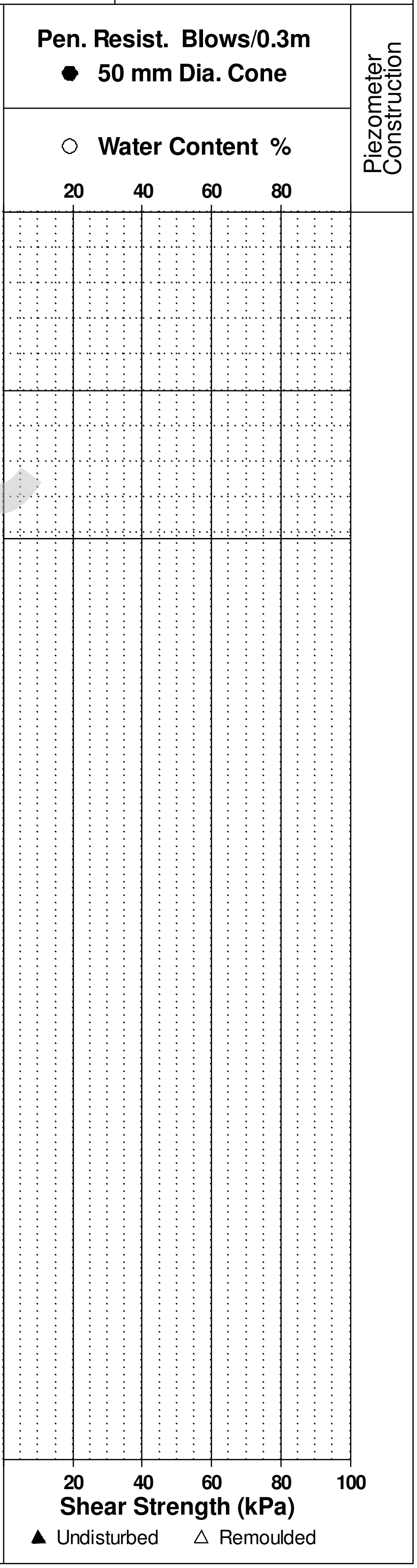
BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 5

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.63
TOPSOIL	0.10						
Loose, brown **SILTY SAND,** some clay		SS	1	67	6		
		SS	2	100	6	1	92.63
	1.37						
Soft, grey **SILTY CLAY**		SS	3	100	W		
	1.83						
End of Borehole (BH dry upon completion)							



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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

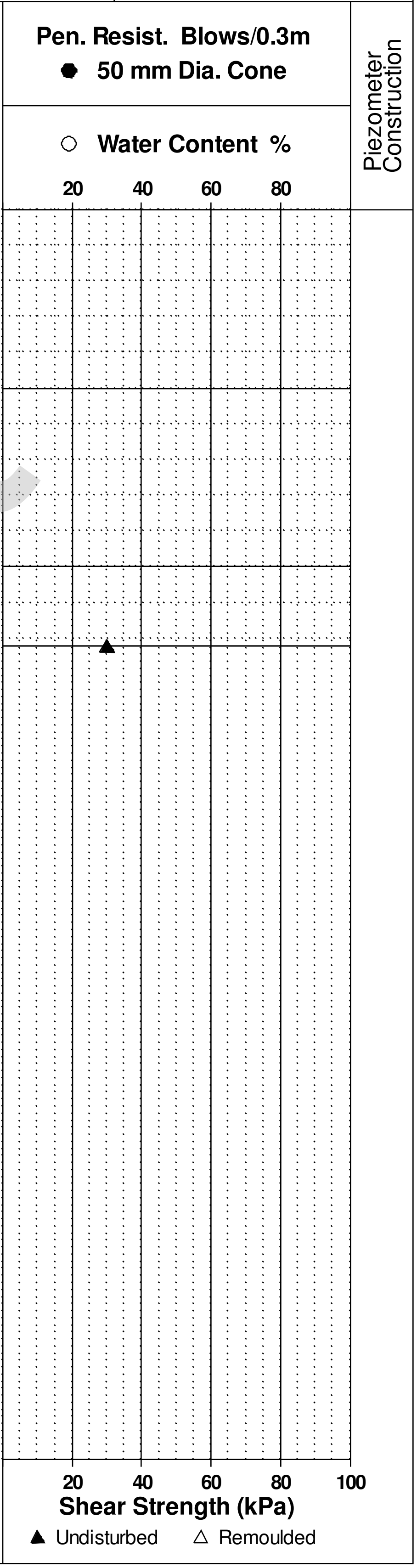
BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.65
TOPSOIL 0.10							
Loose, brown **SILTY SAND,** some clay		SS	1	75	10		
		SS	2	58	8	1	92.65
1.50		SS	3	100	W		
Firm, grey **SILTY CLAY**						2	91.65
2.44							
End of Borehole (BH dry upon completion)							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	94.02		
TOPSOIL 0.15	■								
FILL: Brown silty sand, some clay 0.60	▨	SS	1	75	5				
Loose, brown **SILTY SAND**, some clay	▥	SS	2	100	8	1	93.02		
- grey by 1.2m depth 1.83	▥	SS	3	100	6				
End of Borehole (BH dry upon completion)									

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.73
TOPSOIL 0.20							
FILL: Brown silty sand 0.60		SS	1	67	8		
Loose to very loose, brown **SILTY SAND** 1.68		SS	2	100	8	1	92.73
		SS	3	100	2		
Firm, grey **SILTY CLAY** 1.83							
End of Borehole (BH dry upon completion)							

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

○ Water Content %

20 40 60 80

Piezometer Construction

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

BORINGS BY Geoprobe

DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.59
TOPSOIL 0.13							
FILL: Brown silty sand, some clay 0.60		SS	1	62	8		
Loose to very loose, brown **SILTY SAND,** some clay		SS	2	75	7	1	92.59
1.68		SS	3	100	2		
Firm, grey **SILTY CLAY,** some sand 1.83							
End of Borehole (BH dry upon completion)							

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

○ **Water Content %**

20 40 60 80

Piezometer Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Turf Field & Soccer Dome - 5650 Mitch Owens Dr.
Ottawa, Ontario

DATUM TBM consists of existing ground surface at eat property boundary. Geodetic elevation = 94.02m.

REMARKS

BORINGS BY Geoprobe

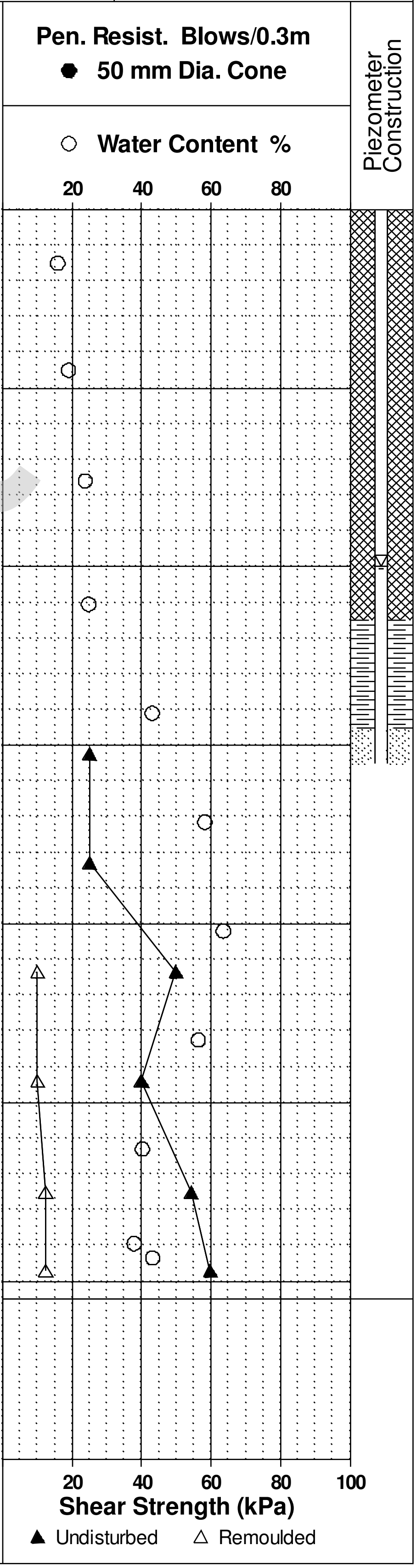
DATE June 25, 2015

FILE NO. PG3545

HOLE NO. BH10

SOIL DESCRIPTION	Depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.10				
FILL: Brown silty sand, some clay	0.60	SS	1	83	7
Compact to very loose, brown **SILTY SAND,** some clay		SS	2	100	12
	1.83	SS	3	100	2
Loose, grey **SANDY SILT** with clay	2.44				
Soft to firm, grey **SILTY CLAY** - stiff by 5.0m depth	6.10	SS	4	100	24
End of Borehole (GWL @ 2.0m depth based on field observations)					

DEPTH (m)	ELEV. (m)
0	94.02
1	93.02
2	92.02
3	91.02
4	90.02
5	89.02
6	88.02



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 = $(D30)^2 / (D10 \times D60)$
Cu - Uniformity coefficient = $D60 / D10$

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

CONSOLIDATION TEST

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

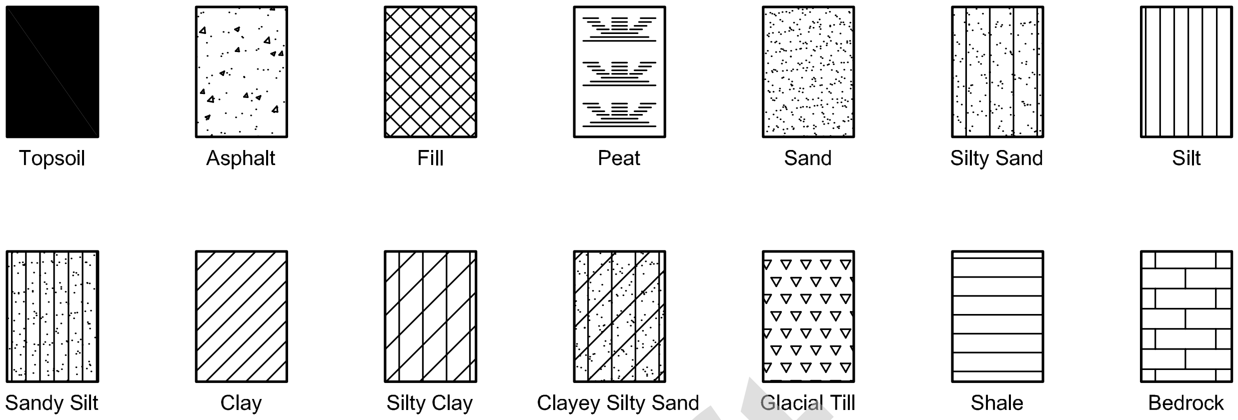
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

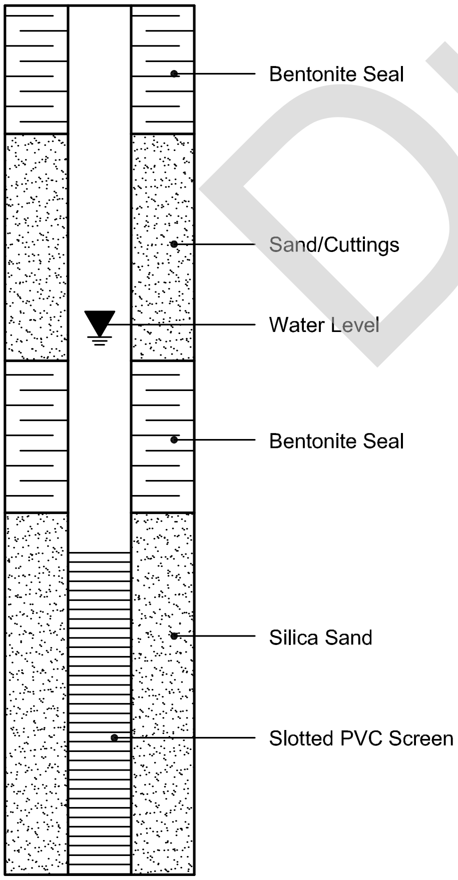
SYMBOLS AND TERMS (continued)

STRATA PLOT

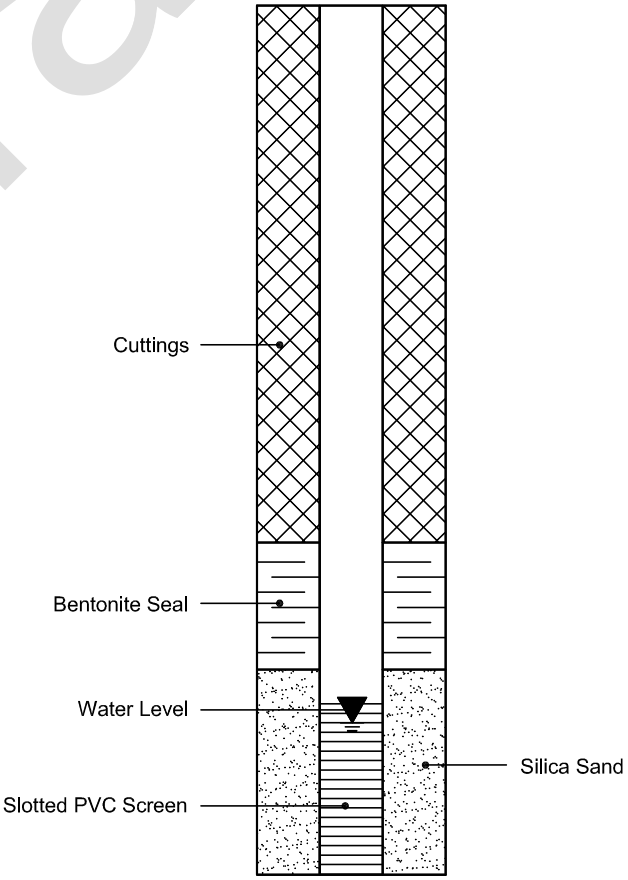


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Ontario Ministry of the Environment and Climate Change

Measurements recorded in: ☒ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*
A199999
Tag#: A199999

Well Record

Regulation 903 Ontario Water Resources Act

Page ______ of ______

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	
	Ottawa South United		☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
1128 Clapp Lane	Manotick	Ontario	K4M 1A4	613 266 1224

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
5650 Mitch Owens Road	Osgoode		

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Manotick	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	448902	5010081		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth *(m/ft)* From	To
Brown	Sandy Soil			0	1.82
Grey	Clay		Loose	1.82	7.31
Grey	Till	Large Boulders		7.31	14.93
Grey	Limestone		Hard	14.93	35.05
Grey & White	Sandstone		Hard	35.05	53.33

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
16.45	0	Grouted Bentonite Slurry	.49m^3

Results of Well Yield Testing

After test of well yield, water was:
☒ Clear and sand free
☐ Other, *specify* ______

If pumping discontinued, give reason:

Pump intake set at *(m/ft)*: 30.47

Pumping rate *(l/min / GPM)*: 54.6

Duration of pumping: 1 hrs + ____ min

Final water level end of pumping *(m/ft)*: 4.76

If flowing give rate *(l/min / GPM)*: 45.5

Recommended pump depth *(m/ft)*: 30.47

Recommended pump rate *(l/min / GPM)*: 45.5

Well production *(l/min / GPM)*:

Disinfected? ☒ Yes ☐ No

Draw Down Time *(min)*	Water Level *(m/ft)*	Recovery Time *(min)*	Water Level *(m/ft)*
Static Level	+0		
1	.27	1	3.91
2	.54	2	3.02
3	.82	3	2.49
4	1.09	4	1.97
5	1.35	5	1.23
10	1.95	10	.76
15	2.45	15	.21
20	3.00	20	.03
25	3.54	25	+0
30	4.02	30	+0
40	4.76	40	
50	4.76	50	
60	4.76	60	

Method of Construction

☐ Cable Tool
☒ Rotary (Conventional) Mud
☐ Rotary (Reverse)
☐ Boring
☒ Air percussion
☐ Other, *specify* ______
☐ Diamond
☐ Jetting
☐ Driving
☐ Digging

Well Use

☐ Public
☐ Domestic
☐ Livestock
☒ Irrigation
☐ Industrial
☐ Other, *specify* ______
☐ Commercial
☐ Municipal
☐ Test Hole
☐ Cooling & Air Conditioning
☐ Not used
☐ Dewatering
☐ Monitoring

Construction Record - Casing

Inside Diameter *(cm/in)*	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness *(cm/in)*	Depth *(m/ft)* From	To
27.13	Open		0	16.45
15.86	Steel	.48	+.45	16.45

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify* ______
☐ Other, *specify* ______

Water Details

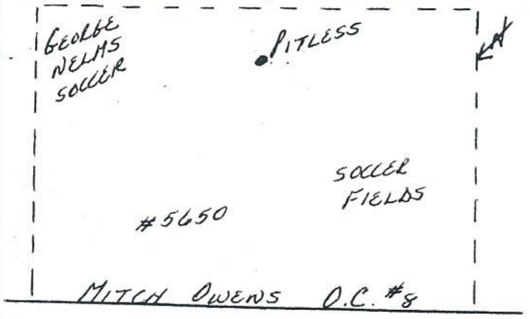
Water found at Depth 41.14 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify* ______
Water found at Depth 50.28 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify* ______
Water found at Depth ____ *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ______

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	16.45	15.86
16.45	53.33	15.55

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Capital Water Supply Ltd.	1558

Business Address (Street Number/Name)	Municipality
Box 490	Stittsville

Province	Postal Code	Business E-mail Address
Ontario	K2S 1A6	office@capitalwater.ca

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
6138361766	Miller, Stephen

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
0097		20171016

Well owner's information package delivered ☒ Yes ☐ No

Date Package Delivered: 20171012

Date Work Completed: 20171011

Ministry Use Only

Audit No. Z256772

Received

0506E (2014/11)

Ministry's Copy

APPENDIX

C

LIMITATIONS OF THIS REPORT

LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to WSP Canada Incorporated (WSP) at the time of preparation. Unless otherwise agreed in writing by WSP, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.