Geotechnical Investigation Report

Ashbury College
362 Mariposa Avenue, Ottawa, Ontario

Prepared for:

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Table of Contents

List of Tables

List of Appendices

1.0 INTRODUCTION

Sports Turf International Ltd. hired Stantec Consulting Ltd. (Stantec) to carry out geotechnical investigation and provide geotechnical recommendations for the proposed development of two synthetic turf fields at Ashbury College located at 362 Mariposa Avenue, Ottawa, Ontario.

The work was carried out in general accordance with the scope of work for a geotechnical investigation as outlined in Stantec's proposal dated February 8, 2024.

This report has been prepared specifically and solely for the project described herein. It presents the factual results of the geotechnical investigation and provides geotechnical recommendations for the design and construction of the proposed synthetic turf development, retaining wall and utility building. In addition to the geotechnical investigations, in-situ infiltration testing was carried out on-site at the proposed synthetic turf fields.

Limitations associated with this report and its contents are provided in the statement of general conditions included in Appendix A.

2.0 PROJECT DESCRIPTION AND BACKGROUND

Ashbury college occupies a large parcel of land bounded by Mariposa Avenue to the North, Glenwood Avenue to East, Maple Lane to the South, and Springfield Road to the West. The proposed development is located to the south and west of the existing college building. The project area is relatively flat with site grade elevations varying between 70.0 m and 71.3 m (based on the recent survey drawing). The investigation area consisted of two grass fields used for sports held at Ashbury College. A line of trees exists along the perimeter of the fields. The site borehole location plan presented in Drawing No. 1 – Borehole Location Plan in Appendix B illustrates site conditions, including the surrounding structures and locations of proposed borehole and infiltration testing.

The proposed development consists of the construction of two new synthetic turf field to be used as soccer/football field. Based on the conceptual layout plan submitted to Stantec, the project also consists of construction of new fences along the west perimeter of the site, a new jump fit facility, as well as a new 3x3 slab on grade utility building and a new jump fit facility on the south side of the proposed field.

According to the Paleozoic Geology of Southern Ontario map, drift thickness map and Ottawa geoscience database, the bedrock in the area consists of limestone of Shallow Lake formation and is expected to be at depths of 1 to 3 m below the existing grades. The surficial geological mapping produced by the Geological Survey of Canada (GSC) indicates that the study area is underlain by silt and clay with minor sand.

3.0 SCOPE OF WORK

The scope of work for this geotechnical investigation are presented below:

- Advance four boreholes at synthetic turf fields (two at each turf field), drilled to depth of approximately 6 m, or practical refusal.
- Advance twelve boreholes at synthetic turf fields (six at each turf field), drilled to depth of approximately 3 m, or practical refusal.
- Carry out six (6) infiltration tests (3 at each synthetic turf field) at about 200 to 500 mm below the grade.
- Collect of soil samples for geotechnical laboratory testing.
- Preparation of a geotechnical investigation report that provides engineering comments and recommendation in support of the design and construction of the turf drainage system.

4.0 METHOD OF INVESTIGATION

4.1 GEOTECHNICAL FIELD INVESTIGATION

Prior to commencing the field work, public utility authorities were contacted to confirm the locations of underground utilities at the site.

Between March 12, 2024 and March 13, 2024, a total of 16 boreholes were advanced at the locations shown in Drawing No. 1 – Borehole Location Plan . The boreholes were advanced using a geoprobe rig supplied and operated by Downing Drilling Inc. The boreholes were advanced to depths ranging from 1.0 m to 2.6 m below the existing ground surface. Refusal to casing advancement was encountered at all borehole locations.

Soil samples were collected at regular intervals while conducting Standard Penetration Tests (SPT) in accordance with the procedures outlined in ASTM specification D1586. The subsurface stratigraphy encountered in each borehole was recorded in the field by Stantec personnel. The boreholes were backfilled with silica sand and bentonite hole plug.

All recovered soil samples were transported to the Stantec Ottawa laboratory for detailed geotechnical classification and testing.

4.2 INFILTRATION TEST FIELD METHODS

Infiltration testing completed at the Site involved the use of the Guelph Permeameter. Stantec was engaged to complete infiltration testing at six (6) locations (IT-No.1 to IT-No.6) shown in Drawing No. 1 – Borehole Location Plan , which were situated across the proposed outdoor synthetic turf fields (3 at each field). The Guelph Permeameter testing was completed at depths ranging from approximately 200 to 500 mm below the grade.

The Guelph Permeameter is a constant head permeameter designed to measure in-situ saturated vertical hydraulic conductivity of a given substrate. The testing involved Stantec personnel to manually auger an approximately 65 mm diameter cylindrical hole into the substrate to depths ranging from roughly 200 to 500 mm below the grade. The Guelph Permeameter was then filled with water and inserted into the hole while making a concerted effort to avoid knocking debris in. The constant head of water was then applied through the support tube in the middle of the permeameter. Stantec personnel then proceeded to allow water in the tube to flow into the soil until a steady state was attained. The constant head is then increased and water in the tube is allowed to flow into the soil until a steady state was attained at the increased head level.

The previously mentioned field observations were used to calculate the vertical hydraulic conductivity of the soil per the Soil Moisture manual[1] using the two head calculation method. The vertical hydraulic conductivity was then used to estimate the rate of infiltration in millimeters per hour (mm/hour) using the established relationships between vertical hydraulic conductivity and infiltration rates as presented in the Low Impact Development Stormwater Management Planning and Design Guide – Version 1.0 by the Credit Valley Conservation - Toronto and Region Conservation Authority (CVC-TRCA), 2010.

Guelph Permeameter testing was repeated at location IT-No.3 due to uncertainty in the first test. Results of the first test were confirmed to be unsuccessful during analysis, while the second test yielded results suitable for analysis.

4.3 LABORATORY TESTING

All samples returned to the laboratory were subjected to detailed visual examination and classification by a geotechnical engineer. Selected samples were tested for moisture content, Atterberg Limits, and grain size analyses.

The results of the laboratory tests are discussed in the text of this report and are provided on the Borehole Records in Appendix C and the test results are provided in Appendix D.

Soil samples will be stored for one (1) month after the issuance of the final report unless directed by the client.

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[1] Soil Moisture Equipment Corp. 2008. Model 2800K1 Guelph Permeameter Operating Instructions. Obtained from https://www.ictinternational.com/content/uploads/2014/03/Guelph-Manual.pdf on 27 August, 2021.

5.0 RESULTS OF INVESTIGATION

5.1 SUBSURFACE INFORMATION

The subsurface profile generally consists of topsoil over silty sand to sandy silt fill underlain by a discontinuous layer of glacial till material over bedrock. Glacial till consisting of silty sandy gravel to sandy silt with gravel was encountered at boreholes BH24-10, BH24-02, BH24-08 and BH24-04.

The subsurface conditions observed in the boreholes are presented in detail on the Borehole Records provided in Appendix C. An explanation of the symbols and terms used to describe the Borehole Records is also provided in Appendix C.

A general overview of the soil encountered in the boreholes is provided below.

5.1.1 Surficial Material

Topsoil was encountered at ground surface in all the boreholes. The thickness of topsoil ranged from 180 mm to 510 mm. The table below outlines the topsoil thickness.

Table 5.1: Summary of Topsoil Thickness

Test Hole Location	Topsoil Thickness (mm)
BH24-01	200
BH24-02	230
BH24-03	180
BH24-04	460
BH24-05	305
BH24-06	510
BH-24-07	410
BH24-08	180
BH24-09	200
BH24-10	310
BH24-11	200
BH24-12	360
BH24-13	200
BH24-14	180
BH24-15	230
BH24-16	230

5.1.2 FILL

A layer of fill material consisting of brown silty sand to sandy silt with some gravel was encountered beneath the topsoil in all borehole locations. Occasional rock fragment, organic matter and brick debris were encountered within the fill layer. The thickness of the fill material ranged from 0.6 m to 2.5 m and extends to depths ranging from 1.0 m to 2.6 m.

The Standard Penetration Test (SPT) N values from the fill ranged from 2 to more than 50 indicating a very loose to very dense state.

The moisture content of the fill ranged from 5% to 41%.

Ten representative samples of the fill were selected for grain size distribution testing and the results are summarized in the table below with the grain size distribution curve shown on Figure No. 1 and Figure No. 2 in Appendix D.

Table 5.2: Summary of Grain Size Analysis of Fill

Borehole No.	Sample No.	Depth (m)	Gravel (%)	Sand (%)	Silt and Clay (%)
BH24-2	SS-2	0.6 – 1.2	11.5	57.5	31
BH24-4	SS-2	0.6 – 1.2	5.1	72	22.9
BH24-5	SS-2	0.6 – 1.2	24.8	58.5	16.7
BH24-5	SS-3	1.2 – 1.8	24.1	54.3	21.6
BH24-8	SS-2	0.6 – 1.2	4.5	72.1	23.4
BH24-10	SS-2	0.6 – 1.2	17.1	61.9	21
BH24-12	SS-2	0.6 – 1.2	27.9	47.8	24.3
BH24-14	SS-2	0.6 – 1.2	16.3	59.1	24.6
BH24-16	SS-2B	0.6 – 1.2	0	86.8	13.2
BH24-16	SS-4	1.8 – 2.4	22.1	36.1	41.8

In accordance with the Unified Soil Classification System (USCS), the fill material can be classified as silty sand (SM) to sandy silt with gravel (ML).

5.1.3 TILL

A till material was encountered beneath the fill material at boreholes BH24-02, BH24-04, BH24-08 and BH24-10.

The till was described as silty gravelly sand to silty sandy gravel to sandy silt with gravel. Occasional cobbles and boulders were noted in the till layer. A till material is grey or greyish brown in color.

The Standard Penetration Test (SPT) N values in the till was 20 to greater than 50 indicating a compact to very dense compactness.

The moisture content of the till ranged from 9% to 13%.

Three representative sample of the till was tested for grain size analysis (hydrometer) testing and the results are summarized in the table below and on Figure No. 3 in Appendix D.

Table 5.3: Summary of Grain Size Analysis of Till

Borehole No.	Sample No.	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH24-02	SS-3	1.2 – 1.8	7.0	32.0	53.0	8.0
BH24-04	SS-3	1.2 – 1.8	29.0	45.1	20.9	5.0
BH24-10	SS-4	1.8 – 2.4	46	34.4	19.6	

Sample SS-3 from BH-24-2 was also selected for Atterberg Limit testing. The laboratory results are summarized in the table below and presented in Figure No. 4 in Appendix D.

Table 5.4: Atterberg Limit Test of Till

Borehole No.	Sample No.	Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index
BH24-02	SS-3	1.2 – 1.8	20	14	6

In accordance with the USCS, the till material can be classified as silty gravel with sand (GM), silty sand (SM) to sandy silt with gravel (ML).

5.1.4 Bedrock

Bedrock was not cored within the depths of the investigation. However, all boreholes were terminated due to auger refusal on inferred bedrock at depths ranging from 1.0 m to 2.6 m.

5.1.5 Groundwater

All open boreholes were dry (no observed groundwater seepage) upon completion of auger drilling operations.

Groundwater levels at the site will be subject to fluctuations due to seasonal changes, snowmelt and precipitation events. The water levels should be expected to be higher during the spring season and during and following periods of heavy precipitation or snow melt.

5.2 INFILTRATION TEST DATA ANALYSIS AND RESULTS

The materials encountered within the augured holes and subjected to infiltration testing was described as silty sand. Nearby borehole logs indicate the soil tested typically consisted of silty sand / silty sand with gravel fill as indicated in Table 1 in Appendix D. Shallow soils and fill material often include formation heterogeneities. Heterogeneity indicates that the soil infiltration characteristics can vary spatially at the same depth, which can potentially impact the test data in the following ways:

- There may be an unusual response when tests completed in different pilot holes using different head settings are compared (i.e., a lower infiltration rate is indicated for the test that has the higher head setting).
- The infiltration rate may not stabilize during a test (i.e., a steady state may not be reached).

The two head method calculation in the Soil Moisture manual is the preferred method and was used for all analyses, comparing all available head levels for each testing location. A range of results were presented when 3 or more head levels were available for analysis at a testing location. Tests IT-3 (2) and

IT-No.6 consisted of only 2 head levels and therefore yielded a single hydraulic conductivity value and corresponding infiltration rate.

Table 1 (Appendix D) presents the results of each Guelph Permeameter test. Vertical hydraulic conductivities using the Guelph Permeameter ranged from approximately 7.5 x 10^{-8} m/s to 2.0 x 10^{-5} m/s for the sandy silt fill that was tested, corresponding to infiltration rates ranging from approximately 23 mm/hour to 103 mm/hour (Table 1). Some results indicated unsuccessful tests. IT-No.2 infiltration rates at head levels of 10 cm and 15 cm stabilized at the same rates, indicating soil heterogeneity or improper functioning of the Guelph Permeameter. Rates at the 20 cm head level were higher and able to be compared to both 10 cm and 15 cm head level rates for appropriate analysis. IT-No.5 infiltration rates at head level of 15 cm stabilized at a lower rate than rates at a 10 cm head level, indicating soil heterogeneity or improper functioning of the Guelph Permeameter. Rates at the 5 cm head level were lower than both the 10 cm and 15 cm head level rates and could be compared to both for appropriate analysis.

6.0 DISCUSSION AND RECOMMENDATIONS

This section of the report provides geotechnical engineering input related to the proposed development of two synthetic turf fields at Ashbury College, based on our interpretation of the available subsurface information and our understanding of the project requirements.

The following geotechnical input is based on the information that was available at the time of writing this report. Where comments are made on construction, they are provided in order to highlight those aspects which could affect the design. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the factual information for construction, and make their own interpretation of the factual data with respect to the profile provided at the time of tendering, as it affects their proposed construction techniques, schedule, safety, and equipment capabilities.

6.1 SITE GRADING

Details on the final site grades and/or floor slab elevation for the proposed building were not available at the time of preparation of this report. However, it is understood that the site grades in the synthetic turf field and proposed building are not planned to be changed substantially from current levels.

The subsurface conditions at this site consist of surficial layer of topsoil and cohesionless fill materials that contains rock fragments, organic matters, and debris (e.g. bricks) that are underlain by till material over bedrock at relatively shallow depth. Temporary excavations required for the construction of the foundations for the building pad and new retaining wall will extend through the surficial topsoil and fill and into the native till deposit. Any topsoil and existing fill materials encountered at the subgrade level for foundations should be removed and replaced with engineered fill.

The native till deposit, and/or engineered fill materials placed above the till, are considered suitable for the subgrade support of lightly loaded slabs and/or foundations for the proposed retaining wall. Following the removal of all topsoil and any fill materials that may be present within the zone of influence of the pad foundation, the exposed till subgrade should be proofrolled in conjunction with inspection by qualified geotechnical personnel to determine if the materials are acceptable or if soft or otherwise deleterious materials are present that would need to be removed and replaced with compacted engineered fill.

Till materials are not considered to be highly compressible when subjected to new site grade fills. Therefore, grade raises of less than 1 m on the exterior of the building or retaining walls, if required, are not anticipated to result in settlements of the underlying soil/bedrock that would adversely affect the performance of the proposed facility. If grade raises greater than 1 m are contemplated, additional geotechnical input should be provided.

The final site grades should be sloped to prevent ponding and to direct water away from any existing building or proposed utility building/structure.

In preparation for construction of paved areas, any vegetation, organic soil (including topsoil), and any soft, wet, and/or otherwise disturbed native material should be removed. Following removal of the above noted materials, the prepared subgrade should be proofrolled in conjunction with inspection by geotechnical personnel to verify all unsuitable materials have been removed. Any soft/weak and/or poorly-performing soils identified during the proofrolling operations should be removed and replaced with engineered fill. Where grades are required to be raised below proposed pavement structures, subgrade fill should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of the material's SPMDD.

6.2 SUBGRADE PREPARATION

6.2.1 Building Pad and Reuse of Site Materials

Very loose to compact fill materials comprised of silty sand to sandy silt containing pieces of debris (e.g. bricks and rock) or organic matters were generally encountered at all borehole locations. We understand that the client does not have quality control records related to the placement and compaction of these materials and/or other documents indicating these materials were placed as engineered/structural fill. As the existing fill materials were not placed as engineered fill, construction of the new building pad or retaining wall above the existing fill could result in unacceptable differential settlement of the structures and is not recommended. In this regard, the existing fill materials should be removed to expose the underlying bedrock or native glacial till (if encountered) and replaced with engineered/structural fill within the zone of influence of the foundation slab for the new structures.

All existing topsoil, fill, and any organic materials or other softened/disturbed native soils (if any), must be removed (i.e. stripped) within the proposed structure footprint and the proposed retaining wall, and 1 m beyond the perimeter of the new structures in all directions, to expose the underlying bedrock or glacial till prior to placing engineered fill.

Following stripping of the above noted materials, the subgrade in the proposed area of engineered fill is to be inspected by geotechnical personnel to review that all unsuitable materials are removed. Any fill, organic matter, loose/soft materials, or disturbed/softened areas identified during the subgrade inspection are to be removed and replaced with approved engineered fill.

The existing fill materials are variable in composition with some portions of the fill containing high silt contents which are susceptible to frost action/heave. As such, these materials should not be used as backfill against building foundation elements or as engineered fill to support the new structures. Topsoil and/or other soils containing organic material and debris are not suitable as backfill material in settlement-sensitive areas. These materials should only be reused in landscape areas where settlements are tolerable. Existing topsoil was not assessed for re-use as landscaping topsoil.

The engineered fill used to construct the building pad for the proposed utility building and retaining wall should consist of Ontario Provincial Standard Specification (OPSS) Granular A and Granular B Type I or II materials that are placed in maximum 300 mm thick loose lifts and compacted to at least 100% of the materials Standard Proctor maximum dry density (SPMDD). To achieve the specified compaction level, fill materials should have moisture contents near to their optimum moisture content for compaction.

No underfloor drains are required for buildings without basement levels provided that exterior grades are lower than the finished floor and positively slope away from the building. Provision should be made for placement of at least 150 mm of OPSS Granular A materials, compacted to 100% of their SPMDD, immediately beneath the floor slab(s) for leveling and support purposes. The requirements for an underslab vapour barrier should be determined in accordance with the requirements of the National Building Code.

The settlement performance of the retaining wall foundations and floor slab of the proposed building will be heavily dependent on the subgrade preparation and engineered fill placement activities. Accordingly, the subgrade preparation activities and placement of engineered fill are not recommended to be carried out in winter weather/freezing conditions to avoid difficulties obtaining suitable compaction of the engineered fill and the fill placement should monitored by experienced geotechnical personnel on a full-time basis. Once the site grades are reinstated/raised to the underside of the proposed slab, additional care would be needed to protect the finished surface from the environment during the construction.

Existing fill and/or excavated till soils may be reused for general site grading fill or as trench backfill, provided it does not contain organic soils or other deleterious materials and the moisture content allows for adequate compaction to be achieved. It is noted that the reuse of site-generated materials will be highly dependent on the materials' moisture contents at the time of placement.

Materials testing and inspection should be carried out during construction to ensure the materials meet the project specifications and required level of compaction.

6.2.2 Synthetic Turf

All existing topsoil, and any organic materials or other softened/disturbed fill (if any), must be removed (i.e. stripped) within the proposed footprint of synthetic turf. The exposed soil subgrade should be proof rolled with heavy equipment. Loose or soft areas and presence of any organics and debris identified by proof rolling should be sub-excavated and replaced with approved earth fill materials and to at least 95% of the materials SPMDD. After proof rolling, Site grades should be adjusted (cut/fill) to the design subgrade profile with appropriate center crowning to effectively remove surface water.

Synthetic turf fields typically have high permeability turf and base layers, allowing rainfall to rapidly infiltrate vertically through the synthetic turf and laterally through the aggregate base. It should be noted at this point that the contractor/supplier should be responsible for the detailed design of the synthetic turf and its drainage system. However, as a minimum requirement, the base layer should consist of 200 mm granular material separated by a non-woven geotextile from subgrade. Subsurface drainage must be maintained in all areas of new synthetic field and should be connected to the perimeter drain. The subdrains should comprise 100 mm to 150 mm diameter perforated corrugated pipes installed in a trench, lined by suitable geotextile and surrounded by a minimum 50 mm thick free draining sand/clear stone.

6.3 FROST PROTECTION

The design frost penetration depth for this site is 1.8 m below grade. All foundations for unheated structures or isolated exterior foundations (retaining walls, signs, lamp posts, etc.) founded on frost-susceptible materials should be provided with a minimum of 1.8 of earth cover. All of the exterior building foundations for heated structures should be placed at least 1.5 m beneath the final exterior grade in order to provide adequate frost protection.

Exterior slabs-on-grade or slabs-on-grade within unheated areas will be subject to the risk of heave due to frost action. If frost penetration depth cannot be provided, alternatives should be given to use a layer of rigid insulation (e.g. high density extruded polystyrene) to be placed beneath the entire slab supporting the new building for frost protection purposes.

The insulation should extend minimum of 1.2 m beyond the outside edges of the foundation slab. The type, compressive strength, and thickness of the insulation should be selected to support the design structural loads. Installation details for the insulation should follow the manufacturers recommendations. Appropriate frost tapers equivalent to the frost depth minus the embedment depth would need to be incorporated at the ends of the insulation beneath paved areas or other hard surfaces (e.g. sidewalks).

6.4 SEISMIC SITE CLASS

The seismic Site Class value, as defined in Section 4.1.8.4 of the 2012 Ontario Building Code (OBC), contains a seismic analysis and design methodology which uses a seismic site response and site classification system defined by the average shear stiffness of the upper 30 meters of the ground below the foundation level. There are six site classes (from A to F), decreasing in stiffness from A (hard rock) to E (soft soil); Site Class F denotes problematic soils for which a site-specific evaluation is required.

Based on the subsurface conditions encountered at the site, a Site Class C should be used in the design of the new structures. Due to the shallow depth to bedrock, a more favorable Site Class (e.g. A or B) could also be achievable. However, the OBC indicates that measurement of the shear wave velocities of the site materials is required before these Site Classes are used in design.

6.5 FOUNDATION DESIGN

Based on the casing refusal depths from the current investigation and the drift thickness mapping, bedrock is anticipated to be encountered within about 1.0 to 2.6 m below the existing ground surface.

The designed floor slab elevation and foundation for the utility building and retaining wall were not available at the time of preparation of this report. It is anticipated that a 3 by 3 m utility building structure will be supported on a slab/raft type foundation or a thickened -edge slab foundation. Although the slab will generally act as a single foundation unit, structural loads acting on the thickened portions of the slab will generally be higher than at other portions of the slab. Retaining wall foundations could be designed as conventional spread footing supported on or within the underlying glacial till/bedrock or on compacted engineered fill placed on the glacial till/bedrock.

For preliminary design purposes, the factored geotechnical resistance values presented in the table below can be considered when assessing areas of concentrated loading conditions or for the design of stand-alone shallow strip foundations bearing directly on engineered fill materials over bedrock/till.

Table 6.1: Geotechnical Resistance

Foundation width (m)	Factored Geotechnical Resistance at Ultimate Limit States (ULS) (kPa)	Geotechnical Resistance at Serviceability Limit States (SLS) (kPa)
1 to 3	250	200

Note:
1) The geotechnical resistances/reactions are provided for the range of loaded dimensions listed in the above table assuming foundations bear on engineered fill materials overlying either bedrock or glacial till. Additional input should be provided by the geotechnical engineer if the loaded areas are outside of the ranges outlined above.
2) The geotechnical resistances/reactions are based on the subsurface soil and bedrock conditions present at the site. The loads that the slab can support may be governed by the grade/strength of insulation installed beneath the slab and may be lower than the values in the table above. The bearing pressure applied to the insulation should not exceed about one third of the insulation’s compressive strength due to time dependent creep characteristics of the insulation.

The factored geotechnical bearing resistance at ULS incorporates a resistance factor of 0.5. The post construction total and differential settlements of foundations sized using the above SLS net bearing resistance value is expected be less than about 25 and 15 mm, respectively, provided that the soil below founding level is consistent with the assumptions made.

6.6 LATERAL EARTH PRESSURE PARAMETERS

A discussion of lateral pressures that will need to be considered in the design of the retaining walls is provided below. The earth pressure coefficients recommended below assume that a permanent horizontal back slope will be utilized behind potential retaining walls. Both static and seismic (earthquake) lateral earth pressures must be considered in the design.

6.6.1 Static Lateral Earth pressures

To avoid problems with frost adhesion and heaving, retaining walls should be backfilled with non-frost susceptible granular fill meeting the gradation requirements of OPSS Granular A or B Type I materials. The backfill for walls should be placed in maximum 300 mm thick lifts and should be compacted to at least 98 percent of the material's SPMDD using suitable vibratory compaction equipment. Longitudinal drains or weep holes should be installed to provide positive drainage of the granular backfill. To use the coefficients of pressure for the granular materials, the granular backfill must be provided within a wedge extending from the base of the wall at 45 degrees (or smaller) to the horizontal. If a smaller wedge is used, the coefficients of earth pressure of the materials outside the backfill wedge must be used for lateral pressure design calculations.

The total active (P_A), and at-rest (P_O) thrusts acting on the walls can be calculated using the following equations:

$$P_A = \frac{1}{2} K_a \gamma H^2$$
$$P_O = \frac{1}{2} K_o \gamma H^2$$

where;

H = height of the wall
γ = unit weight of the backfill soil

Values for K_a, K_o and γ for granular backfill material are provided in the table below. These values are based on the assumption that a horizontal back slope is present behind and adjacent to the wall system(s). The earth pressure coefficients need to be adjusted (i.e. increased) where sloping backfill will be present behind the walls.

For retaining walls that are designed to allow rotation, active earth pressure may be used for design. For rigidly tied structures, the at-rest pressure should be used for design, unless the wall can deflect enough (approximately 0.05% of the wall height) to establish the active pressure.

Table 6.2: Lateral Earth Parameters

Parameters	**Structural Backfill (OPSS Gran A or Gran B Type I)**
Unit weight (kN/m3)	23.0
Angle of Internal friction	35°
Cohesion (kPa)	0
Coefficient of Active Earth Pressure, Ka	0.27
Coefficient of Passive Earth Pressure, Kp	3.7
Coefficient of Earth Pressure at Rest, K0	0.43

Retaining wall foundations can be designed as conventional spread footings as described in Section 6.6.

The underside of the retaining walls should be provided with a minimum of 1.8 m of soil cover or equivalent insulation for frost protection.

6.6.2 Seismic Lateral Earth Pressures

The total active and passive thrusts under earthquake conditions can be calculated using the following equations:

$$P_{AE} = ½ K_{AE}\, \gamma\, H^2$$

where;

K_{AE} = active earth pressure coefficient (combined static and seismic)= 0.38 for yielding wall and 0.53 for non-yielding wall
H = height of wall
γ = total unit weight as provided in Table 6.2

Combined (static and seismic) at-rest earth thrust should be applied at a point 0.41H above the base of the wall.

For submerged backfill conditions, the total unit weight of soil should be replaced with the effective unit weight, and full hydrostatic pressure should be incorporated into the total thrust by adding it to the P_{oE} value calculated above.

6.7 EXCAVATION AND BACKFILL

6.7.1 Temporary Excavations

All temporary excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects and care should be taken to direct surface water away from the open excavations.

It is understood that excavations of up to about 3.0 m will be required for construction of utility building, retaining walls and installation of the service pipes. Excavations of up to 3 m are expected to be developed within predominantly fill materials, till and underlying bedrock. No unusual problems are anticipated in excavating the fill/overburden using conventional hydraulic excavating equipment, recognizing that the fill is inherently variable and could contain boulders or other large-sized particles. Materials with particle sizes larger than 0.3 meters in size should be removed from the excavation side slopes.

Provided that appropriate groundwater control is implemented to maintain the water level below the base of the excavation, the existing fill materials would be classified as Type 3 soils as defined by the Occupational Health and Safety Act and Regulations for Construction Projects. Within Type 3 soils, open cut excavations must be sloped no steeper than one horizontal to one vertical (1H:1V) from the bottom of the excavation.

Bedrock is anticipated within the depth of excavation for service pipe installation. Within the sound, good quality bedrock, or where less than 1 m of bedrock removal is required, near-vertical excavations (10V:1H) can be considered for this project. Considering bedrock removal is not required significantly, the excavation to bedrock may be possible with mechanical equipment such as jackhammer and hydraulic shovel. To minimize overbreak of bedrock, line-drilling should be completed along the excavation perimeter. This will maintain the integrity of the rock face throughout the depth of the excavation.

Stockpiling of excavated materials adjacent to the excavations should not be permitted (even temporarily) due to the potential for overstressing the excavation walls leading to instability.

6.7.2 Temporary Dewatering

Based on observations made during drilling and the moisture contents of the existing materials, the groundwater level at the time of the investigation is interpreted to be below the base of the planned excavation depths at the site. However, groundwater conditions may vary seasonally and may rise to within the fill materials during and following periods of sustained precipitation or snowmelt.

The temporary excavation required for the engineered fill pad construction will need to be maintained in a ‘dry’ condition (i.e. the groundwater level will need to be lowered to below the base of the excavation) to reduce the potential for sloughing/instability of the sidewalls of the excavation and to permit placement and compaction of the engineered fill materials. Based on the site conditions, the water infiltrating into the excavation can be controlled/lowered by pumping from filtered sumps established within the excavation.

6.7.3 Pipe Bedding and Backfill

Bedding for service and utility pipes should consist of at least 150 mm of OPSS Granular ‘A’ material and should be placed up to spring line of the pipe. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to thicken the bedding layer or provide a sub-bedding layer of compacted Granular B Type II materials. Pipe backfill and cover materials from spring line of the pipe to at least 300 mm above the top of the pipe should consist of either OPSS Granular A material or Granular B Type I with a maximum particle size of 25 mm. Bedding and cover materials should be compacted to at least 95% of the material’s SPMDD in lifts no greater than 200 mm. Clear crushed stone backfill should not be permitted as pipe bedding or cover materials.

Where the pipe trenches will be covered with hard surfaced areas, the type of native material placed in the frost zone (i.e. between subgrade level and the top of the pipe cover materials) should match the soil exposed on the trench walls for frost heave compatibility. If materials different than those present in excavation sidewalls are used as backfill, a 3H:1V frost taper is recommended in order to minimize the effects of differential frost heaving.

Trench backfills above the pipe cover materials should be placed in maximum 300 mm thick lifts and should be compacted to at least 98% of the material’s SPMDD using suitable vibratory compaction equipment. The till material and existing fill materials that are free of organic matter and other deleterious materials, may be considered suitable for reuse as trench backfill or as general site grade fill (i.e. materials used to raise the site grade to the design elevations in landscape or settlement-tolerant areas). The ability to compact these materials to the required levels is dependent on the moisture content of the materials; thus, the amount of re-useable material will be dependent on the natural moisture content, weather conditions and the construction techniques at the time of excavation and placement. In addition, any boulders or cobbles with dimensions greater than 150 mm should be removed from these materials prior to placement.

6.8 PAVEMENT DESIGN RECOMMENDATIONS

The pavement subgrade soils are expected to comprise generally silty sand to sandy silt fill. Where required, site grades below pavement structures are to be raised using subgrade fill. Details pertaining to site preparation below pavement structures are provided in Section 6.1.

In the absence of traffic data, the pavement structure presented in Table 6.3 may be considered for the design of site access roads, parking areas and any areas with light traffic and occasional garbage or service trucks.

Table 6.3: Recommended Pavement Design

Asphalt Thickness	Base Thickness OPSS.MUNI 1010 Granular ‘A’ (mm)	Subbase Thickness OPSS.MUNI 1010 Granular ‘B’ Type II (mm)
40 mm SP12.5 50 mm SP19	150	300

The following are recommended for this project:

- The pavement subgrade must be proof rolled under the supervision of geotechnical personnel prior to subbase or engineered fill placement. Any soft areas identified during proof rolling may require subexcavation and replacement with additional Granular ‘B’.
- The finished subgrade surface and the pavement surface should be crowned and graded to direct runoff water away from the development and associated infrastructure.
- Given the low permeability of the native subgrade soils, perimeter drains and pavement subdrains connected to catch basins are recommended to promote drainage of the pavement structure. The subdrains should comprise 100 mm diameter perforated corrugated pipes installed in a trench lined by suitable geotextile and surrounded by a minimum 50 mm thick free draining sand.
- Asphalt performance grade PG 58-28.
- Superpave mix designs should be based on Traffic Category of A.
- Asphalt materials should be compacted to at least 92% of their Maximum Theoretical Relative Density (MTRD) in accordance with OPSS 310.
- All granular materials should be in accordance with the requirements of OPSS Specifications. Both the base and subbase layers should be compacted to 100% of their Standard Proctor Maximum Dry Densities (SPMDD).
- The transition from the new pavement surfaces and the existing road should be carried out with a stepped joint constructed by saw cutting and milling the existing asphalt. The transition should be constructed as per the City of Ottawa standard detail R10 “Standard Road Cut Reinstatement”.
- A tack coat is recommended between asphalt layers and along the edges of any cuts in asphalt.
- In the event that the asphalt layer is not placed at the same time as the granular sub-base/base and the base is left exposed for a period of time, the top layer of granular material should be re-shaped, surface compacted and replaced with a fresh layer of Granular A prior to the placement of the asphalt surface.

- Concrete paving for walkway, if required, can be constructed as per the City of Ottawa standard detail S22 “Light Duty Walkway Concrete Paving”.

6.9 ADVERSE WEATHER CONSTRUCTION

Additional precautions, effort, and measures may be required, when and where construction is undertaken during late fall, winter, and/or early spring (i.e. when the temperature and climatic conditions can have an adverse influence on the standard construction practices) or during periods of inclement weather. With respect to all earthworks activities undertaken during the late fall through to late spring, when less-than-ideal weather and construction conditions may prevail, the following comments are provided:

1. Foundations shall be constructed on non-frozen ground only; where non-frozen ground includes the material at surface and all underlying soils. The non-frozen nature of the ground must be confirmed by a geotechnical inspection within 1 hour of concrete placement.
2. Similarly, concrete for floor slabs should not be placed on frozen ground. Test pits or other measures should be undertaken to confirm that the soils beneath the slab(s) are frost-free prior to slab construction.
3. Following construction of footings, protection measures must be provided to prevent freezing of the foundation subgrade/bearing soils and for protection of the concrete during curing.
4. Backfill materials, including imported materials, that contain ice, snow, or any frozen material should not be accepted for use.
5. Overnight frost penetration may occur, even in granular fill materials, where precipitation and ground surface runoff pools and accumulates, and freezing temperatures exist. Any frozen materials should be removed prior to placing subsequent lifts of engineered fill. Breaking the frost in-situ is not considered acceptable.
6. Fill materials that will support building foundations (e.g. engineered fill materials) are not recommended to be placed in freezing weather conditions. If engineered fill is planned to be placed in cold-weather conditions, fill placement should be inspected by qualified field personnel on a full-time basis under the supervision of a geotechnical engineer, with the authority to stop the placement of fill at any time when conditions are considered to be unfavourable. It may be necessary to stop the placement of engineered fill during periods of cold, where ambient temperatures of 0° C or less exist.

Appropriate scheduling of the work may also require specific consideration and revision from that typically adopted. The scope of work intended may have to be reduced or adjusted, and/or only select construction activities be undertaken during specific climatic conditions. The areas of planned fill placement may have to be reduced on a daily basis, and the extent of excavations may have to be limited.

7.0 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in Appendix A. This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected geotechnical conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities, or claims, howsoever arising, from third party use of this report.

Should additional information become available which differs significantly from our understanding of conditions presented in this report, Stantec requests that this information be brought to our attention so that we may reassess the conclusions provided herein.

We trust that the information contained in this report is adequate for your present purposes. If you have any questions about the contents of the report or if we can be of any other assistance, please contact us at your convenience.

Respectfully submitted;

STANTEC CONSULTING LTD.

Omar El-Ghazal
Geotechnical Engineering Intern

LICENSED PROFESSIONAL ENGINEER
S. SOLEIMANI
100135329
2024/05/28
PROVINCE OF ONTARIO

Sahar Soleimani, Ph.D., P.Eng.
Senior Geotechnical Engineer

APPENDIX A

A.1 STATEMENT OF GENERAL CONDITIONS

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This professional work product ("hereinafter referred to as the Report") has been prepared for the sole benefit of the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance, or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

BASIS OF THIS REPORT: This Report relates solely to the site-specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The information, opinions, conclusions and/or recommendations made in this Report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time the scope of work was conducted and do not take into account any subsequent changes. If the proposed site-specific project differs or is modified from what is described in this Report or if the site conditions are altered, this Report is no longer valid unless Stantec is requested by the Client to review and revise the Report to reflect the differing or modified project specifics and/or the altered site conditions. This Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose or site, and any unauthorized use or reliance is at the recipient's own risk.

STANDARD OF CARE: Preparation of this Report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

PROVIDED INFORMATION: Stantec has assumed all information received from the Client and third parties in the preparation of this Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this Report are based on site conditions encountered by Stantec at the time of the scope of work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in-situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this Report or encountered at the test and/or sample locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the Report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or subsurface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec geotechnical engineers, sufficiently ahead of initiating the next project stage (e.g., property acquisition, tender, construction, etc.), to confirm that this Report completely addresses the elaborated project specifics and that the contents of this Report have been properly interpreted. Specialty quality assurance services (e.g., field observations and testing) during construction are a necessary part of the evaluation of subsurface conditions and site work. Site work relating to the recommendations included in this Report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

APPENDIX B

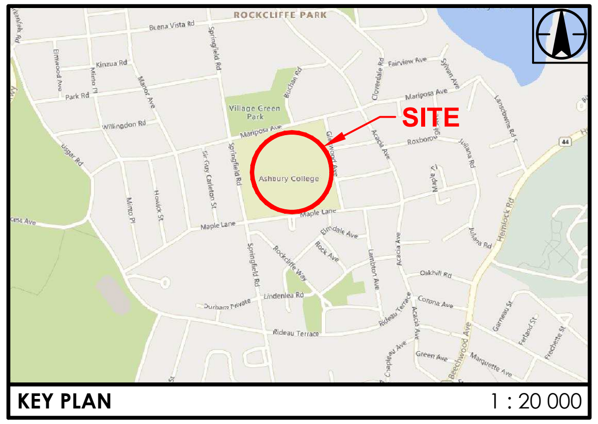
B.1 DRAWING NO. 1 – BOREHOLE LOCATION PLAN

Stantec

300 - 1331 Clyde Avenue
Ottawa, ON, Canada K2C 3G4
www.stantec.com

LEGEND

⊕	BOREHOLE (STANTEC, 2024)
⊕	INFILTRATION TEST (STANTEC 2024)



KEY PLAN 1 : 20 000

NOTES

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18.
1. IMAGERY: © 2024 MICROSOFT CORPORATION © 2024 MAXAR © CNES (2024) DISTRIBUTION AIRBUS DS.

10m 0 10 20m
1 : 1000

FEBRUARY 2024
Project No. 116500966

Client/Project
SPORTS TURF INTERNATIONAL LTD.
GEOTECHNICAL INVESTIGATION
362 MARIPOSA AVENUE, OTTAWA, ONTARIO

Drawing No.
1

Title
BOREHOLE LOCATION PLAN

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Printed: Feb 29, 2024 By: G. Briones

APPENDIX C

C.1 SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

C.2 BOREHOLE AND TEST PIT RECORDS

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization 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 successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

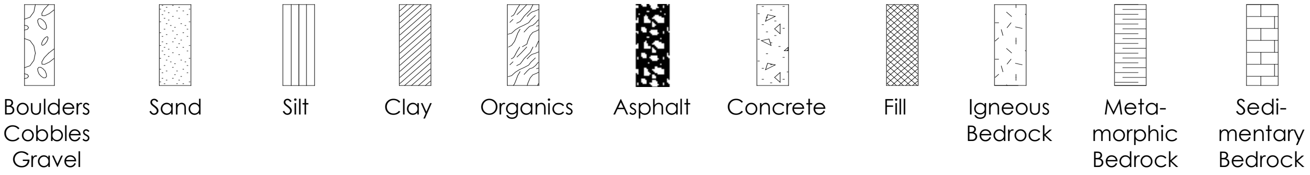
Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

▼	measured in standpipe, piezometer, or well
▽	inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to ‘A’ size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_U	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

Stantec

BOREHOLE RECORD

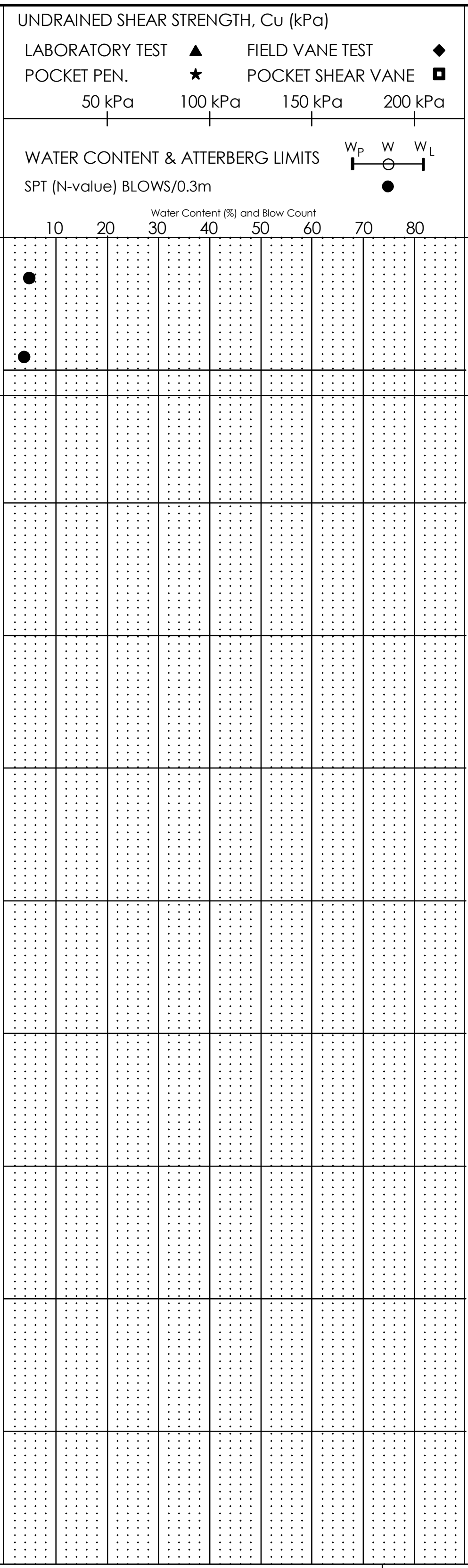
BH24-01

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032909.4N 447041.3E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.52m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER
0	70.5								
	70.3	TOPSOIL - 200 mm							
		FILL: brown Silty SAND (SM), some gravel, moist		SS	1	239	5		
				SS	2	239	4		
1	69.3	Casing and spoon refusal at 1.19 m							



BACKFILL SYMBOL
■ BENTONITE
ASPHALT
▨ DRILL CUTTINGS
GROUT
SAND
CONCRETE
▨ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.19 m	Page 1 of 1

Printed May 16 2024 11:52:53 STANTEC GEO 2016 116500966_ASHBURY_COLLEGE_BOREHOLE_LOGS_.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 5/16/24

Stantec

BOREHOLE RECORD

BH24-02

CLIENT: **Sports Turf Infrastructure Ltd.**

PROJECT: **Ashbury College**

LOCATION: **362 Mariposa Avenue, Ottawa, ON**

DATE BORED: **03/12/2024**

BH COORDINATES

5032912.9N 447076.9E

WATER LEVEL: **N/A**

PROJECT NO. : **116500966**

BH ELEVATION: **70.82m**

DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.8							
	70.6	TOPSOIL - 230 mm						
		FILL: brown Sandy SILT to Silty SAND (ML/SM), some gravel, contains rock fragments and organic matter, moist		SS	1	228	3	
1	69.6			SS	2	406	20	Sieve at 0.6 m G 12% S 58% Fines 31%
	69.3	Grey Sandy Clayey SILT (CL/ML), trace gravel, TILL, moist		SS	3	305	>73/203mm	Sieve at 1.2 m G 7% S 32% Fines 61%
		Casing and spoon refusal at 1.57 m						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

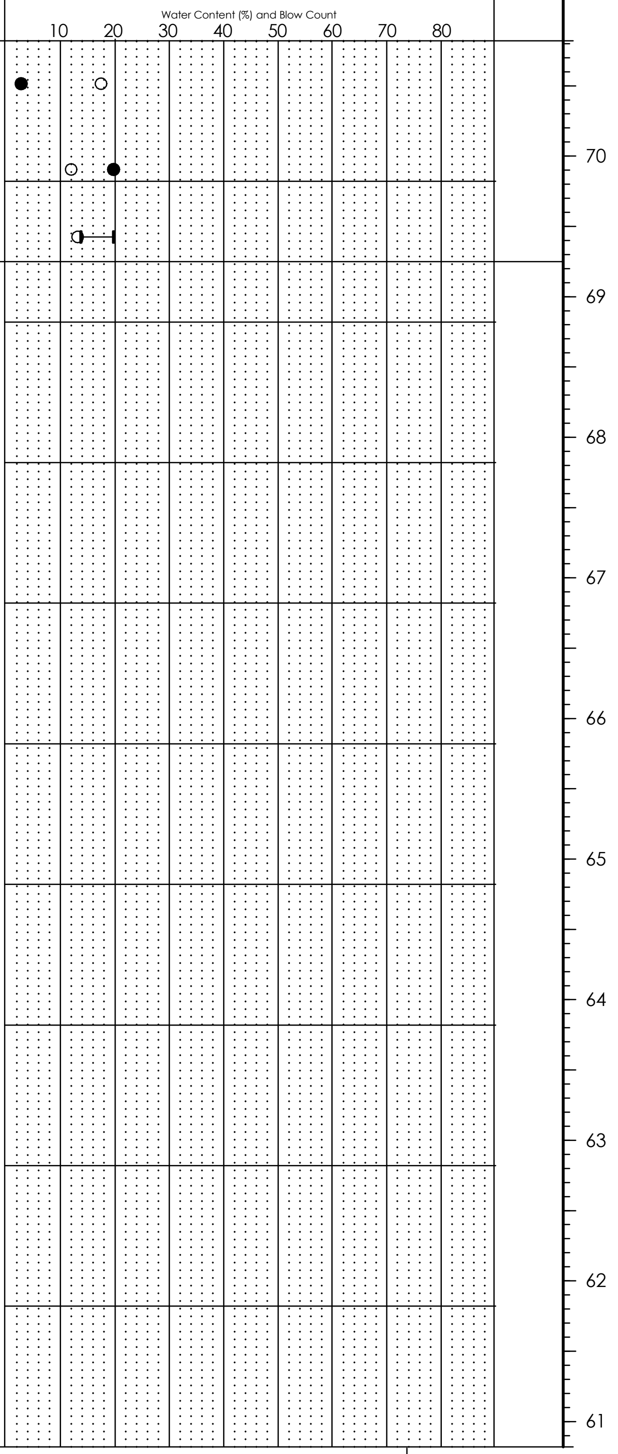
POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

BACKFILL/ MONITOR WELL/ PIEZOMETER



Depth scale (m): 0 1 2 3 4 5 6 7 8 9 10

BACKFILL SYMBOL ▨ ASPHALT ▨ GROUT ▨ CONCRETE

■ BENTONITE ☒ DRILL CUTTINGS ▨ SAND ▨ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.57 m	Page 1 of 1

Printed May 16 2024 11:52:54 STANTEC GEO 2016 116500966_ASHBURY_COLLEGE_BOREHOLE_LOGS_.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 5/16/24

BOREHOLE RECORD

BH24-03

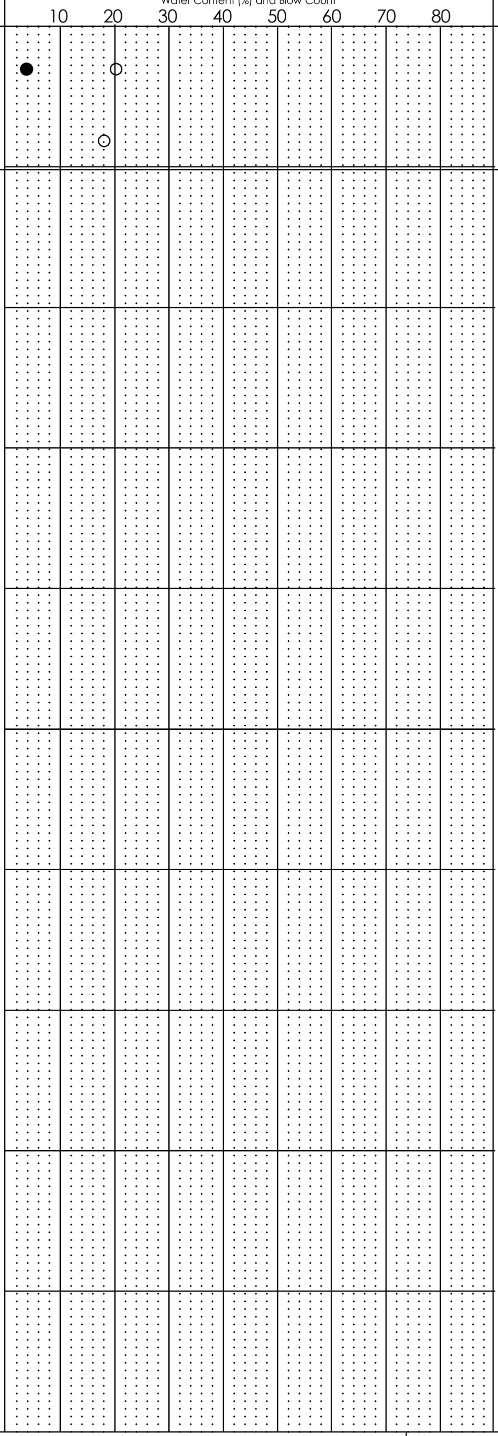
CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032900.6N 447040.5E
WATER LEVEL: **N/A**

PROJECT NO.: **116500966**
BH ELEVATION: **70.56m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
0	70.6	TOPSOIL - 180 mm								
	70.4	FILL: brown Silty SAND (SM), some gravel, moist	▨	SS	1	178	4			70
				SS	2	228	>50/250mm			
1	69.5	Casing and spoon refusal at 1.02 m								69
2										68
3										67
4										66
5										65
6										64
7										63
8										62
9										61
10										

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count



BACKFILL SYMBOL ▦ ASPHALT ▦ GROUT ▨ CONCRETE
■ BENTONITE ▨ DRILL CUTTINGS ▨ SAND ▩ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.02 m	Page 1 of 1

BOREHOLE RECORD

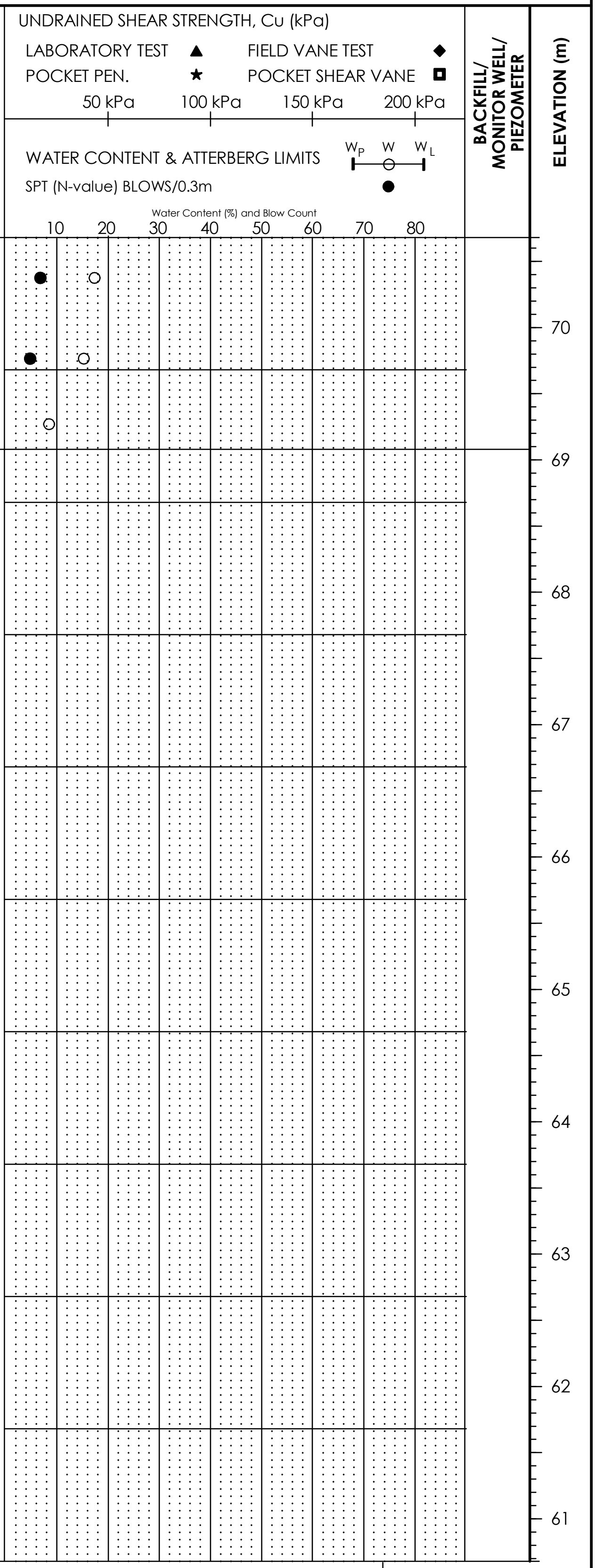
BH24-04

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032885.9N 447062.2E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.68m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.7	TOPSOIL - 460 mm		SS	1	457	7	
	70.2	FILL: brown Silty SAND (SM), trace gravel, moist		SS	2	254	5	Sieve at 0.6 m G S Fines 5% 72% 23%
1	69.5	Grey-brown Silty Gravelly SAND (SP/SM), contains cobbles and boulders, TILL, moist, very dense		SS	3	305	>68/230mm	Sieve at 1.2 m G S Fines 29% 45% 26%
	69.1	Casing and spoon refusal at 1.60 m						



Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.6 m	Page 1 of 1

BACKFILL SYMBOL ▩ ASPHALT ▒ GROUT ◿ CONCRETE
■ BENTONITE ☒ DRILL CUTTINGS ⁘ SAND ▩ SLOUGH

Stantec

BOREHOLE RECORD

BH24-05

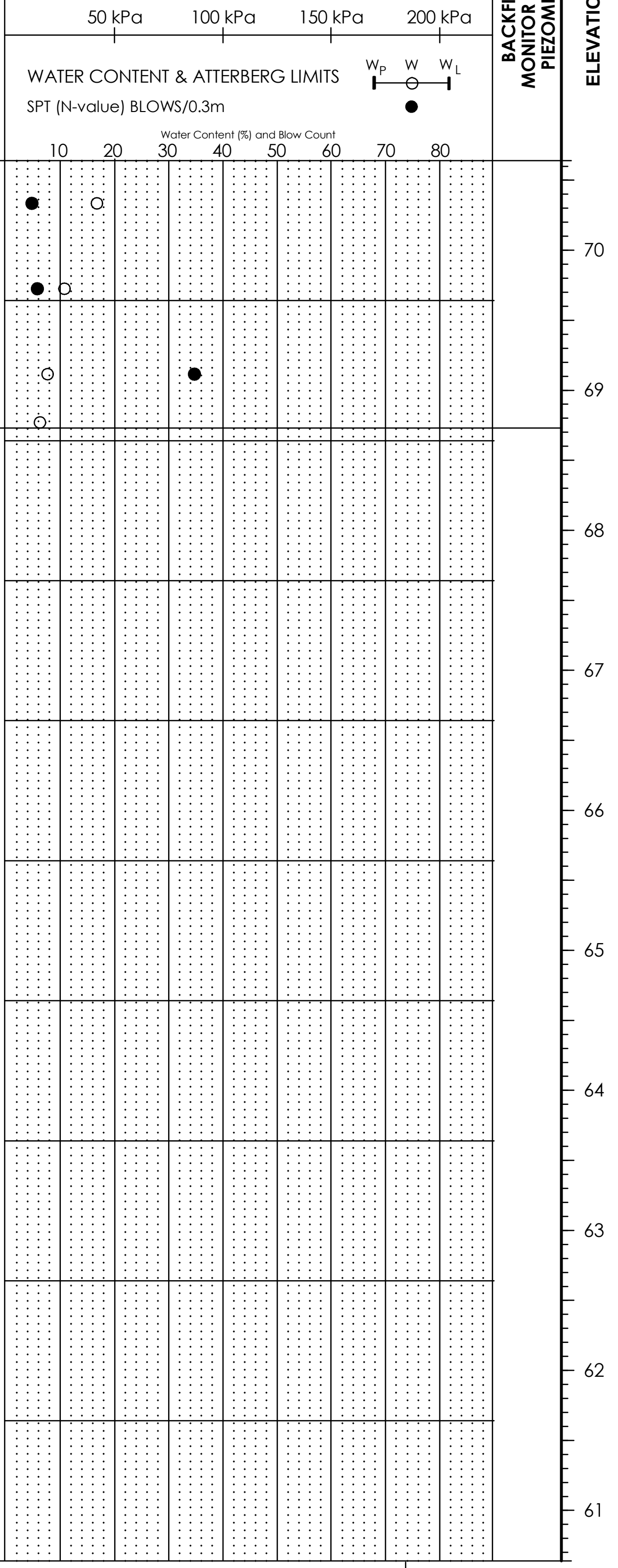
CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032866.7N 447089.4E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.64m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.6	TOPSOIL - 305 mm						
	70.3	FILL: brown Silty SAND with gravel (SM), contains rock and brick fragments, moist		SS	1	457	5	
1				SS	2	203	6	Sieve at 0.6 m G 25% S 58% Fines 17%
				SS	3	508	35	Sieve at 1.2 m G 24% S 54% Fines 22%
	68.7			SS	4	51	>50/51mm	
2		Casing and spoon refusal at 1.91 m						
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●



	Drilling Contractor: Downing	Logged By: OE
BACKFILL SYMBOL ▩ ASPHALT ▨ GROUT ◪ CONCRETE	Drilling Method: Direct Push	Reviewed By: SS
■ BENTONITE ⊠ DRILL CUTTINGS ⁘ SAND ▩ SLOUGH	Completion Depth: 1.91 m	Page 1 of 1

Printed May 16 2024 11:52:57 STANTEC GEO 2016 116500966_ASHBURY_COLLEGE_BOREHOLE_LOGS_.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 5/16/24

Stantec

BOREHOLE RECORD

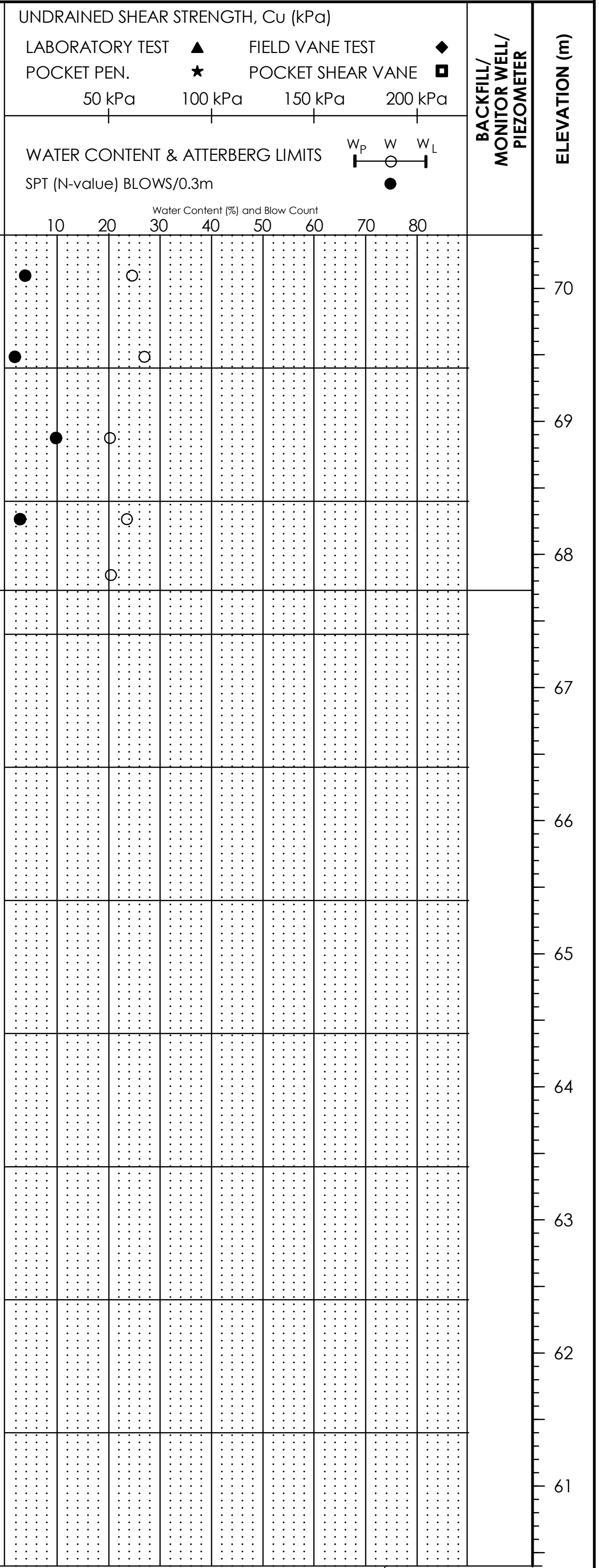
BH24-06

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032854.3N 447053.4E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.40m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.4	TOPSOIL - 510 mm		SS	1	533	4	
	69.9	FILL: brown Silty SAND (SM), contains rock fragments and organic matter, moist		SS	2	203	2	
1				SS	3	254	10	
2				SS	4	203	3	
	68.0	Grey, Silty Clayey SAND (SM/SC), some gravel, TILL, moist, very dense		SS	5	127	>50/76mm	
	67.7	Casing and spoon refusal at 2.67 m						
3								
4								
5								
6								
7								
8								
9								
10								



Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 2.67 m	Page 1 of 1

BACKFILL SYMBOL ▦ ASPHALT ▩ GROUT ◸ CONCRETE
■ BENTONITE ☒ DRILL CUTTINGS ⁘ SAND ▩ SLOUGH

Printed May 16 2024 11:52:58 STANTEC GEO 2016 116500966_ASHBURY_COLLEGE_BOREHOLE_LOGS_.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 5/16/24

Stantec

BOREHOLE RECORD

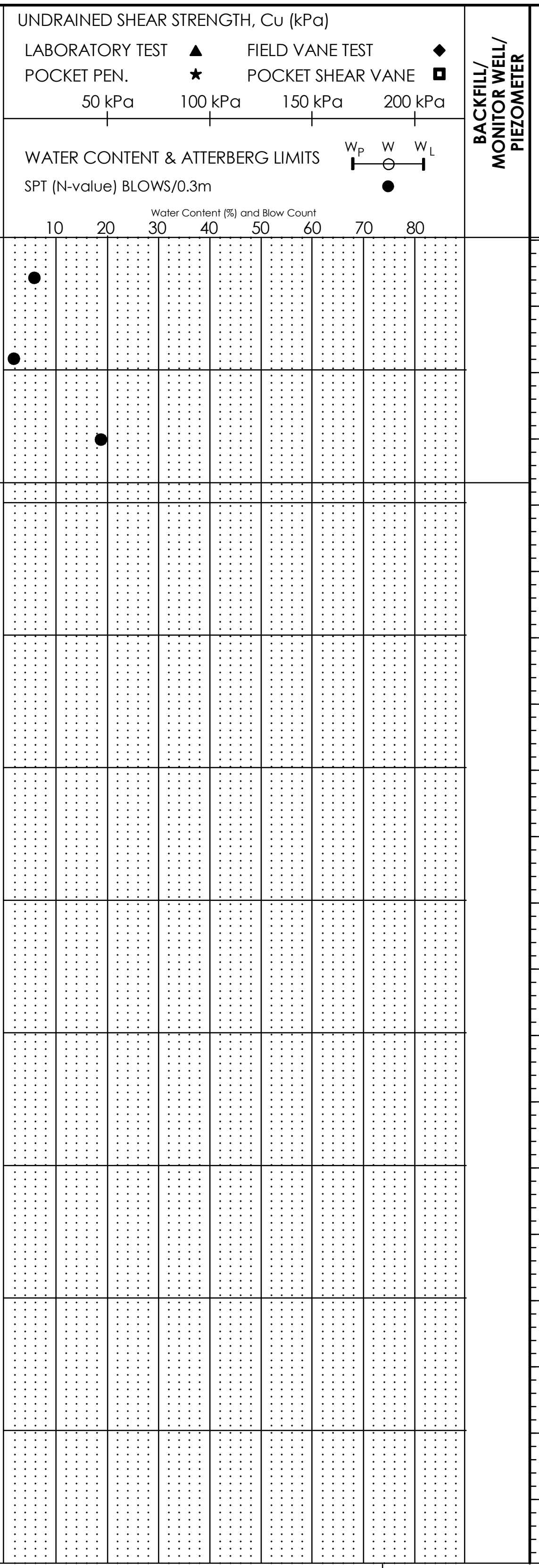
BH24-07

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032838.0N 447070.2E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.52m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.5	TOPSOIL - 410 mm		SS	1	406	6	
	70.1	FILL: brown SAND (SP) mixed with topsoil, moist		SS	2	254	2	
	69.3	FILL: brown Silty SAND (SM), some gravel, moist		SS	3	254	19	
	68.7	Casing and spoon refusal at 1.85 m		SS	4	25	>50/25mm	



BACKFILL SYMBOL
■ BENTONITE
▨ ASPHALT
☒ DRILL CUTTINGS
▩ GROUT
⛶ SAND
◹ CONCRETE
▩ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.85 m	Page 1 of 1

BOREHOLE RECORD

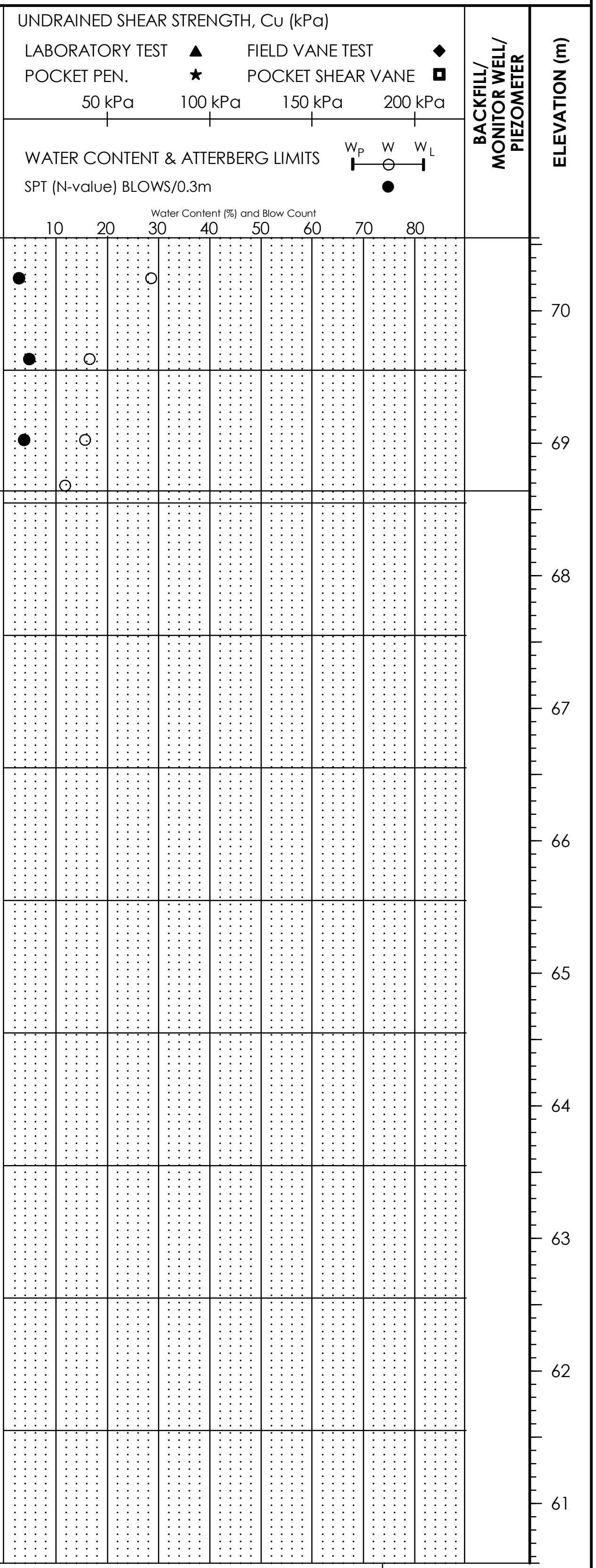
BH24-08

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032817.3N 447098.6E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.55m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.6	TOPSOIL: 180 mm					
	70.4	FILL: brown Silty SAND (SM), trace gravel, contains rock fragments, moist	SS	1	178	3	
1			SS	2	381	5	Sieve at 0.6 m G 5% S 72% Fines 23%
	69.3	FILL: brown Silty SAND (SM), moist - trace gravel below 1.52 m	SS	3	228	4	
	68.7		SS	4	76	>50/76mm	
2	68.6	TILL: brown-grey, Silty SAND (SM), some gravel, moist Casing and spoon refusal at 1.93 m					



Drilling Contractor: Downing		Logged By: OE
Drilling Method: Direct Push		Reviewed By: SS
Completion Depth: 1.91 m		Page 1 of 1

BACKFILL SYMBOL
▨ ASPHALT
▨ GROUT
▨ CONCRETE
■ BENTONITE
☒ DRILL CUTTINGS
▨ SAND
▩ SLOUGH

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BOREHOLE RECORD

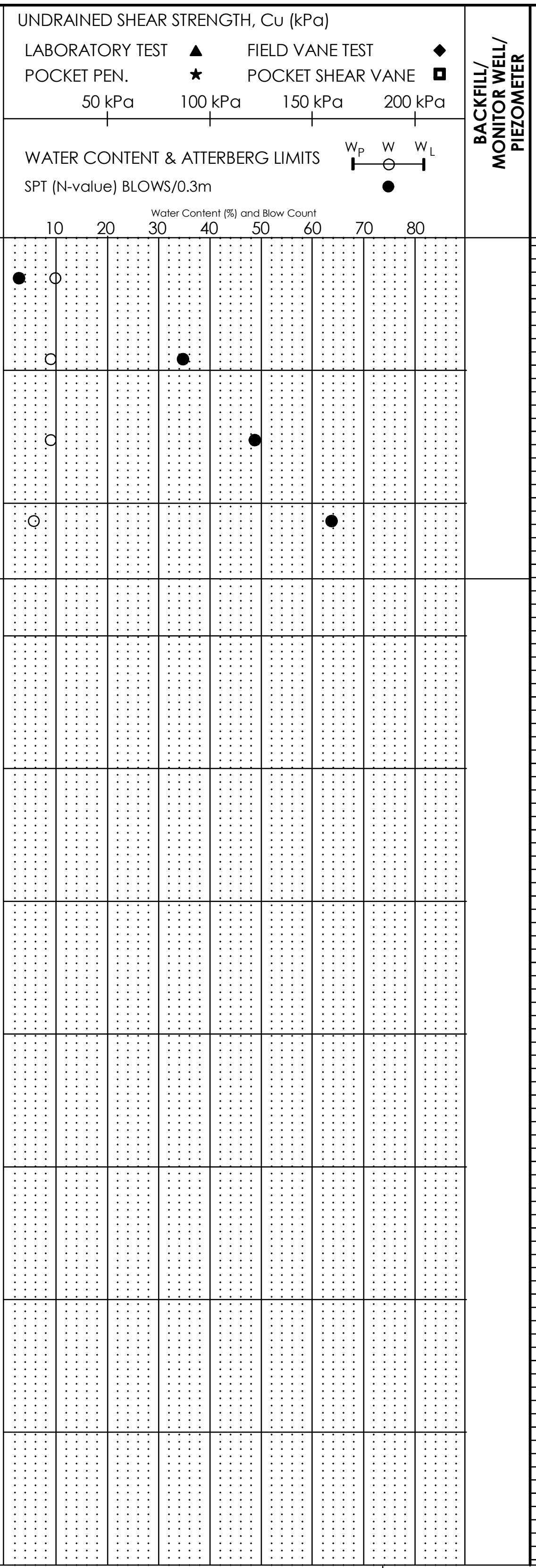
BH24-09

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/12/2024**

BH COORDINATES
5032796.2N 447091.3E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.46m**
DATUM: **Geodetic**

Elevation (m)	Soil Description (USCS)	Samples: Type	Samples: Number	Samples: Recovery (mm) or TCR %	Samples: N-Value or RQD %	Other Tests / Remarks
70.5	TOPSOIL - 200 mm					
70.3	FILL: brown, SAND (SP), contains rock fragments, moist	SS	1	381	3	
		SS	2	305	35	
69.2	FILL: brown Silty SAND (SM), some gravel, moist	SS	3	533	49	
		SS	4	559	64	
		SS	5	127	>50/127mm	
67.9	Casing and spoon refusal at 2.57 m					



BACKFILL SYMBOL ▩ ASPHALT ▨ GROUT ▧ CONCRETE
■ BENTONITE ☒ DRILL CUTTINGS ⬚ SAND ▦ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 2.57 m	Page 1 of 1

BOREHOLE RECORD

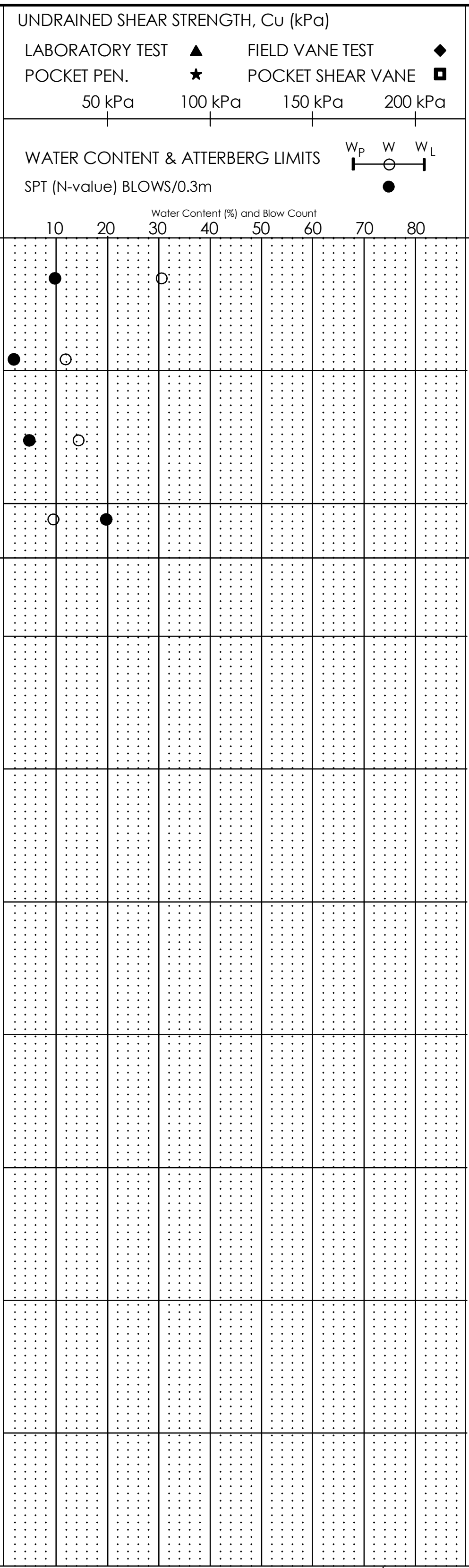
BH24-10

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/13/2024**

BH COORDINATES
5032831.8N 447129.4E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.40m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.4	TOPSOIL - 310 mm		SS	1	305	10	
	70.1	FILL: brown Silty SAND (SM), some gravel, contains rock fragments, moist		SS	2	203	2	Sieve at 0.6 m G 17% S 62% Fines 21%
				SS	3	152	5	
	68.6	Grey Silty Sandy GRAVEL (GM), TILL, moist, compact		SS	4	356	20	Sieve at 1.8 m G 46% S 34% Fines 20%
	68.0	Casing and spoon refusal at 2.41 m						



BACKFILL/ MONITOR WELL/ PIEZOMETER

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
ELEVATION (m): 70, 69, 68, 67, 66, 65, 64, 63, 62, 61

BACKFILL SYMBOL ▨ ASPHALT ▨ GROUT ▨ CONCRETE
■ BENTONITE ☒ DRILL CUTTINGS ▨ SAND ▩ SLOUGH

Drilling Contractor: Downing
Drilling Method: Direct Push
Completion Depth: 2.41 m

Logged By: OE
Reviewed By: SS
Page 1 of 1

Printed May 16 2024 11:53:3 STANTEC GEO 2016 116500966_ASHBURY_COLLEGE_BOREHOLE_LOGS_.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 5/16/24

Stantec

BOREHOLE RECORD

BH24-11

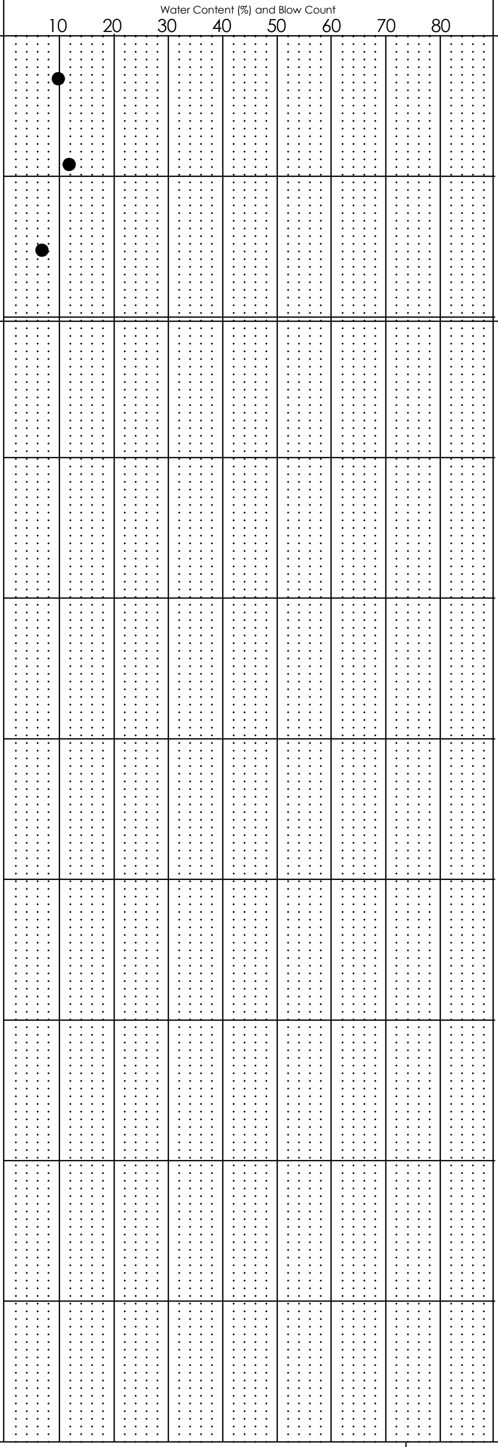
CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/13/2024**

BH COORDINATES
5032815.7N 447142.3E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.46m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES				OTHER TESTS / REMARKS
				TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	
0	70.5							
	70.3	TOPSOIL - 200 mm						
		FILL: brown Silty SAND (SM), some gravel, moist		SS	1	457	10	
	69.9	FILL: brown SAND (SP), moist		SS	2	102	12	
	69.2	FILL: dark brown, Silty SAND (SM), some gravel, contains rock fragments, moist		SS	3	305	7	
				SS	4	203	>50/76mm	
2	68.4	Casing and spoon refusal at 2.03 m						

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●



BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 70, 69, 68, 67, 66, 65, 64, 63, 62, 61

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

BACKFILL SYMBOL ▩ ASPHALT ▒ GROUT ◸ CONCRETE
■ BENTONITE ☒ DRILL CUTTINGS ⁘ SAND ▩ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 2.03 m	Page 1 of 1

Printed May 16 2024 11:53:4 STANTEC GEO 2016 116500966_ASHBURY_COLLEGE_BOREHOLE_LOGS_.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 5/16/24

BOREHOLE RECORD

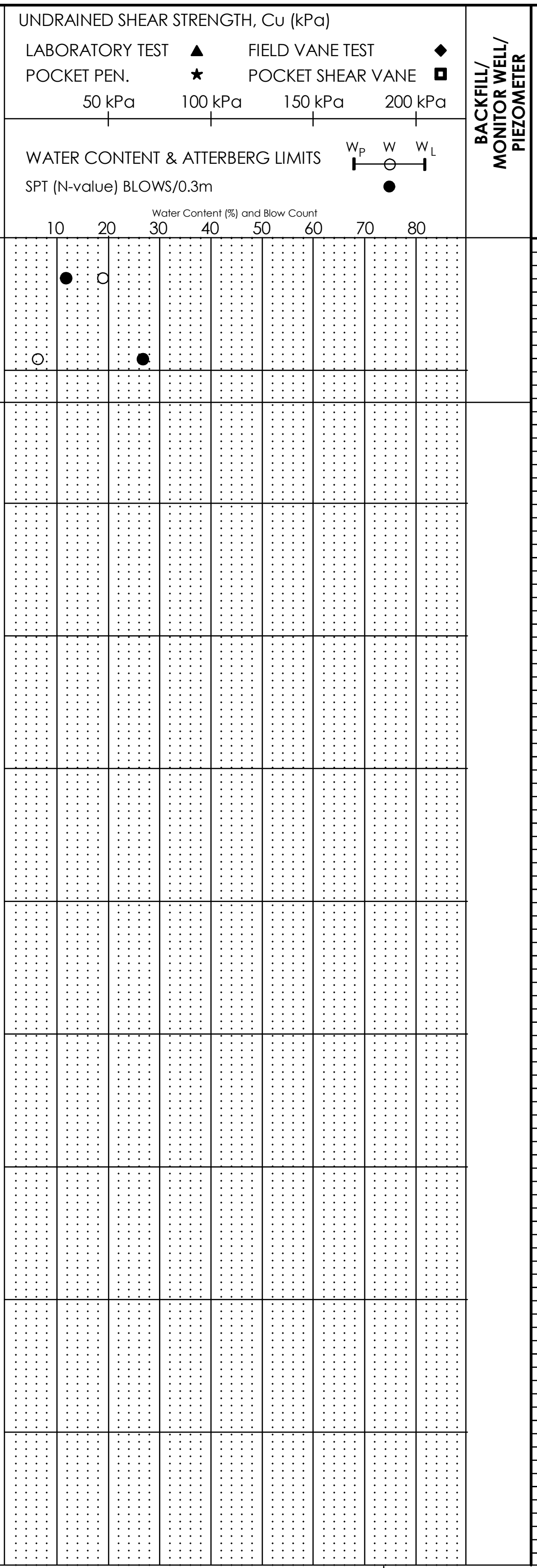
BH24-12

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/13/2024**

BH COORDINATES
5032800.3N 447139.7E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.41m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.4	TOPSOIL - 360 mm		SS	1	356	12	
	70.1	FILL: brown Silty SAND with gravel (SM), contains rock fragments, moist		SS	2	203	27	Sieve at 0.6 m G 28% S 48% Fines 24%
1	69.2	Casing and spoon refusal at 2.41 m		SS	3	25	>50/25mm	



DEPTH (m): 0 1 2 3 4 5 6 7 8 9 10

Drilling Contractor: Downing		Logged By: OE
Drilling Method: Direct Push		Reviewed By: SS
Completion Depth: 1.24 m		Page 1 of 1

BACKFILL SYMBOL ▩ ASPHALT ▨ GROUT ▧ CONCRETE
■ BENTONITE ☒ DRILL CUTTINGS ⬚ SAND ▩ SLOUGH

Stantec

BOREHOLE RECORD

BH24-13

CLIENT: **Sports Turf Infrastructure Ltd.**

PROJECT: **Ashbury College**

LOCATION: **362 Mariposa Avenue, Ottawa, ON**

DATE BORED: **03/13/2024**

BH COORDINATES

5032806.5N 447185.6E

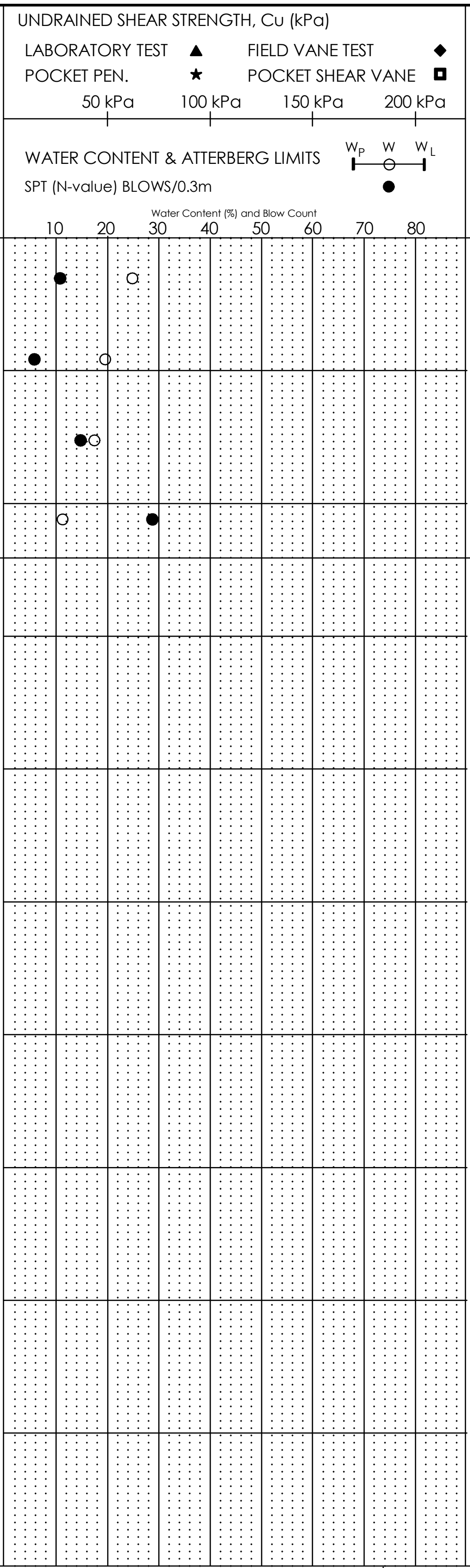
WATER LEVEL: **N/A**

PROJECT NO.: **116500966**

BH ELEVATION: **70.30m**

DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.3	TOPSOIL - 200 mm						
	70.1	FILL: brown Silty SAND (SM), some gravel, moist		SS	1	203	11	
1				SS	2	203	6	
				SS	3	406	15	
2	67.9			SS	4	457	29	
		Casing and spoon refusal at 2.41 m						
3								
4								
5								
6								
7								
8								
9								
10								



BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 70, 69, 68, 67, 66, 65, 64, 63, 62, 61

BACKFILL SYMBOL ASPHALT GROUT CONCRETE

BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Downing

Drilling Method: Direct Push

Completion Depth: 2.41 m

Logged By: OE

Reviewed By: SS

Page 1 of 1

Stantec

BOREHOLE RECORD

BH24-14

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/13/2024**

BH COORDINATES
5032844.8N 447197.6E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.55m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.6							
	70.4	TOPSOIL - 180 mm						
		FILL: brown Silty SAND with gravel (SM), contains rock fragments, moist	▩	SS	1	381	11	
				SS	2	127	11	Sieve at 0.6 m G 16% S 59% Fines 25%
				SS	3	381	>50/102mm	
	68.8	Casing and spoon refusal at 1.78 m						

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

Depth (m): 0 1 2 3 4 5 6 7 8 9 10
ELEVATION (m): 70 69 68 67 66 65 64 63 62 61

BACKFILL SYMBOL ▩ ASPHALT ▨ GROUT ◩ CONCRETE
■ BENTONITE ⊠ DRILL CUTTINGS ⁘ SAND ▩ SLOUGH

Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.78 m	Page 1 of 1

BOREHOLE RECORD

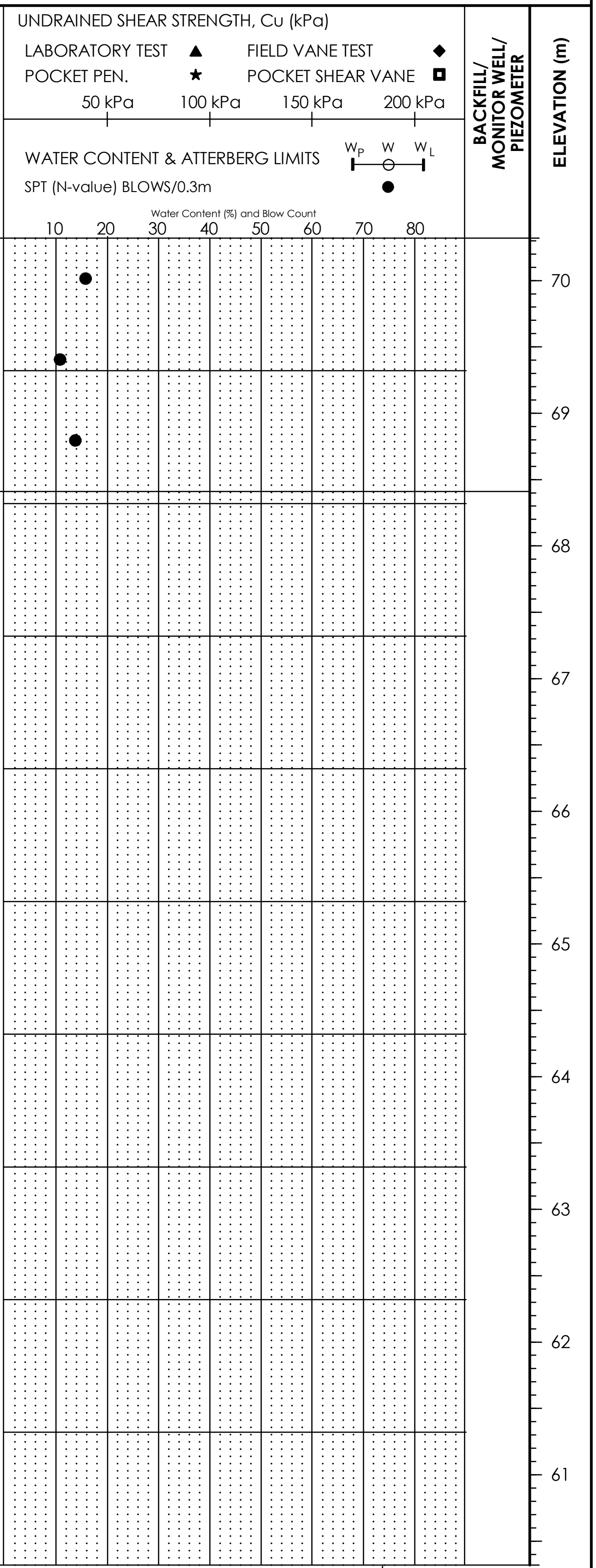
BH24-15

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/13/2024**

BH COORDINATES
5032821.0N 447197.3E
WATER LEVEL: **N/A**

PROJECT NO.: **116500966**
BH ELEVATION: **70.32m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.3							
	70.1	TOPSOIL - 230 mm						
		FILL: brown Silty SAND (SM), contains rock fragments, moist		SS	1	406	16	
1				SS	2	432	11	
				SS	3	203	14	
	68.5	FILL: brown Silty SAND (SM), dry		SS	4	51	>50/76mm	
2	68.4	Casing and spoon refusal at 1.91 m						



Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 1.91 m	Page 1 of 1

BACKFILL SYMBOL ▩ ASPHALT ▨ GROUT ◪ CONCRETE
■ BENTONITE ⊠ DRILL CUTTINGS ⁘ SAND ▩ SLOUGH

Stantec BOREHOLE RECORD

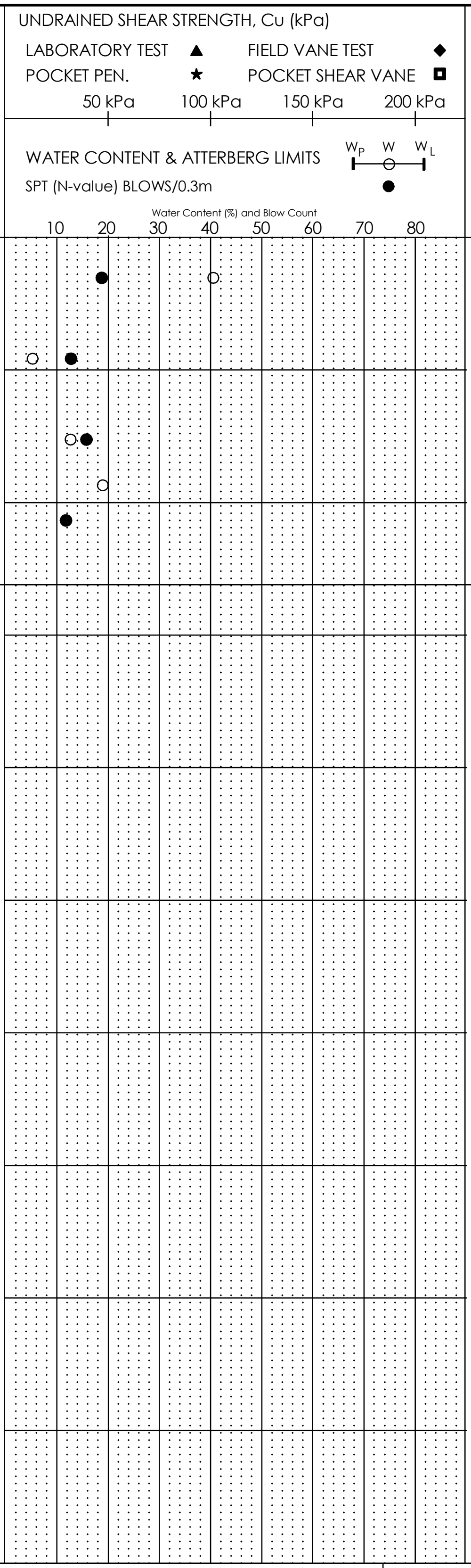
BH24-16

CLIENT: **Sports Turf Infrastructure Ltd.**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **03/13/2024**

BH COORDINATES
5032808.8N 447212.7E
WATER LEVEL: **N/A**

PROJECT NO. : **116500966**
BH ELEVATION: **70.03m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	70.0							
	69.8	TOPSOIL - 230 mm						
		FILL: brown Silty SAND (SM), moist		SS	1	483	19	
	69.4	FILL: light brown SAND (SP), some silt, dry		SS	2	203	13	Sieve at 0.6 m G 0% S 87% Fines 13%
1	68.8	FILL: brown Gravelly SILT AND SAND (ML/SM), moist		SS	3	203	16	
2				SS	4	381	12	Sieve at 1.8 m G 22% S 36% Fines 42%
	67.4			SS	5	178	>50/25mm	
		Casing and spoon refusal at 2.62 m						



BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 70, 69, 68, 67, 66, 65, 64, 63, 62, 61

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

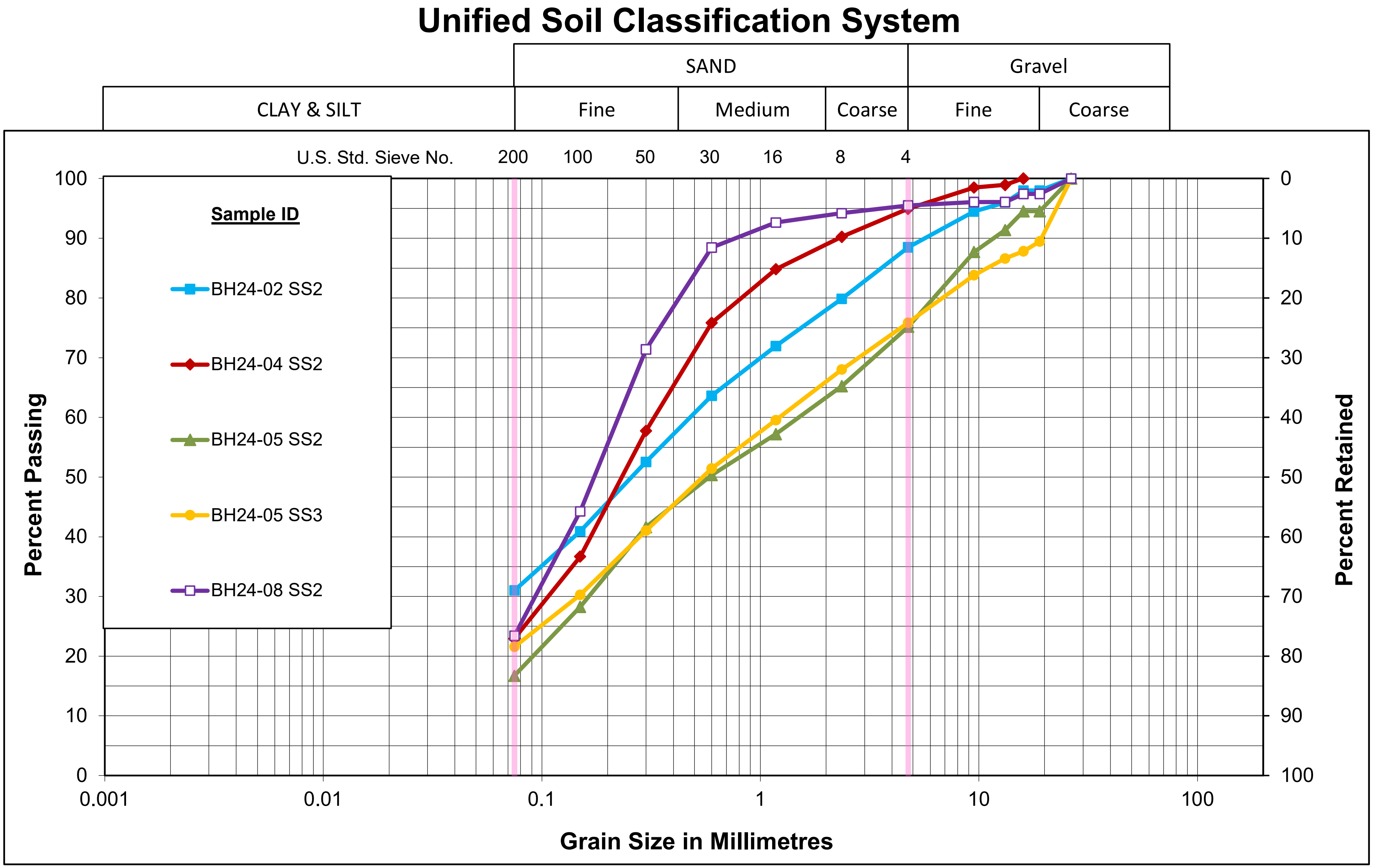
Drilling Contractor: Downing	Logged By: OE
Drilling Method: Direct Push	Reviewed By: SS
Completion Depth: 2.62 m	Page 1 of 1

BACKFILL SYMBOL: ▩ ASPHALT, ▨ GROUT, ▨ CONCRETE, ■ BENTONITE, ☒ DRILL CUTTINGS, ▨ SAND, ▩ SLOUGH

APPENDIX D

D.1 LABORATORY RESULTS

D.2 RESULTS OF INFILTRATION TESTING



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GRAIN SIZE DISTRIBUTION

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Figure No. 1

Project No. 116500966

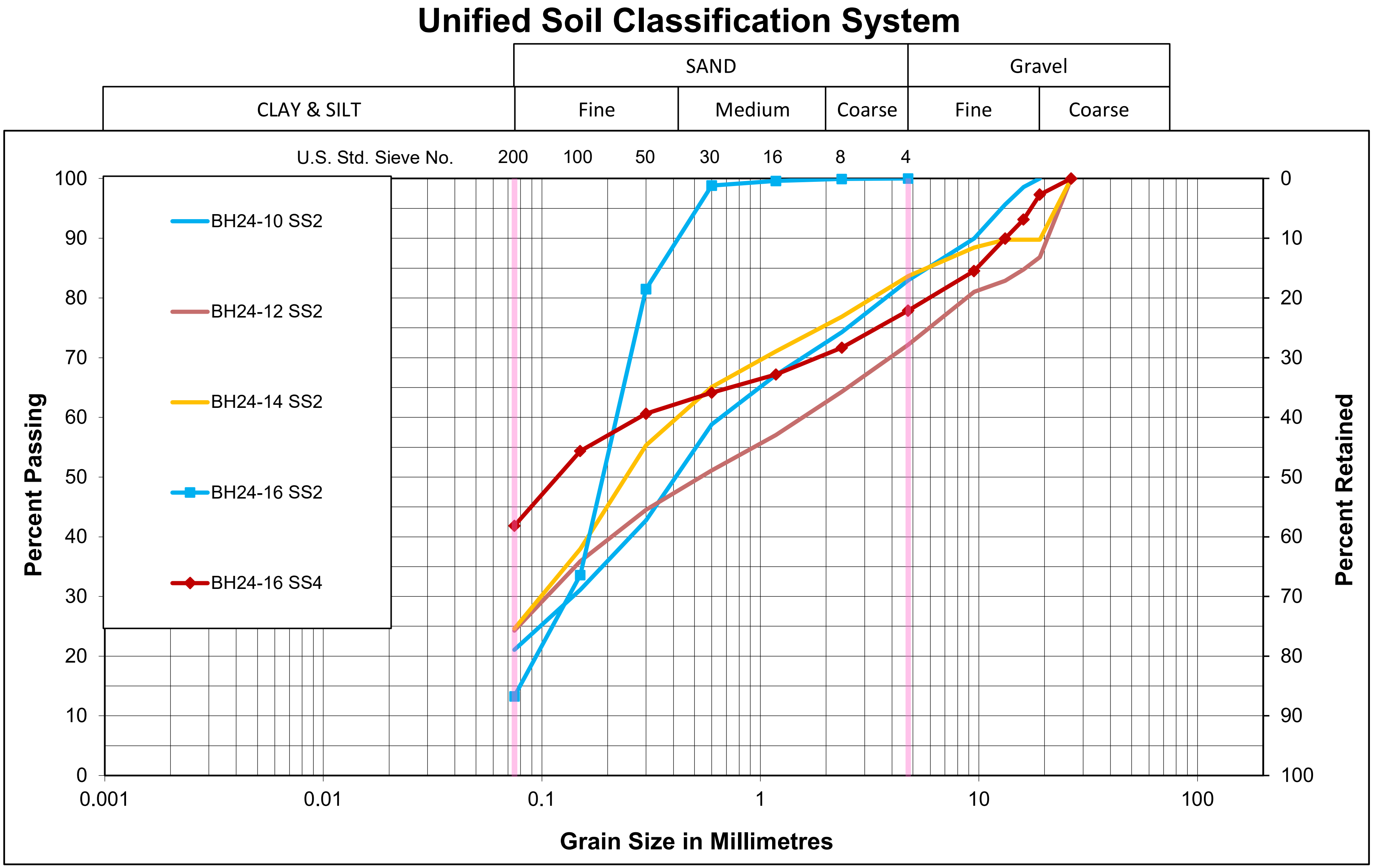

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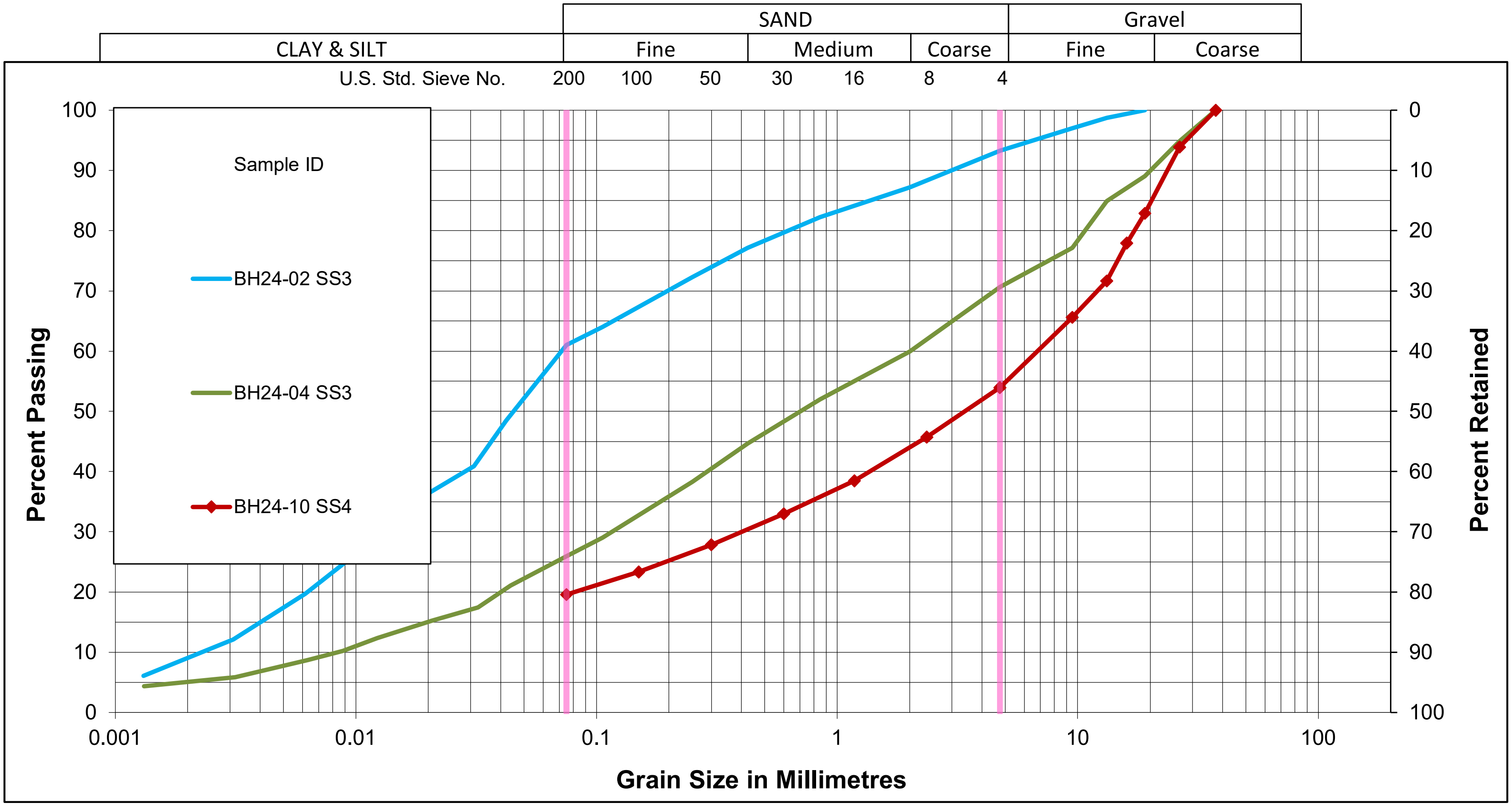
Figure No. 2

Project No. 116500966

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH24-02 SS3	4'-6'	6.7	32.3	53.0	8.0
BH24-04 SS3	4'-6'	29.4	44.7	20.9	5.0
BH24-10 SS4	6'-8'	46.0	34.4	19.6	

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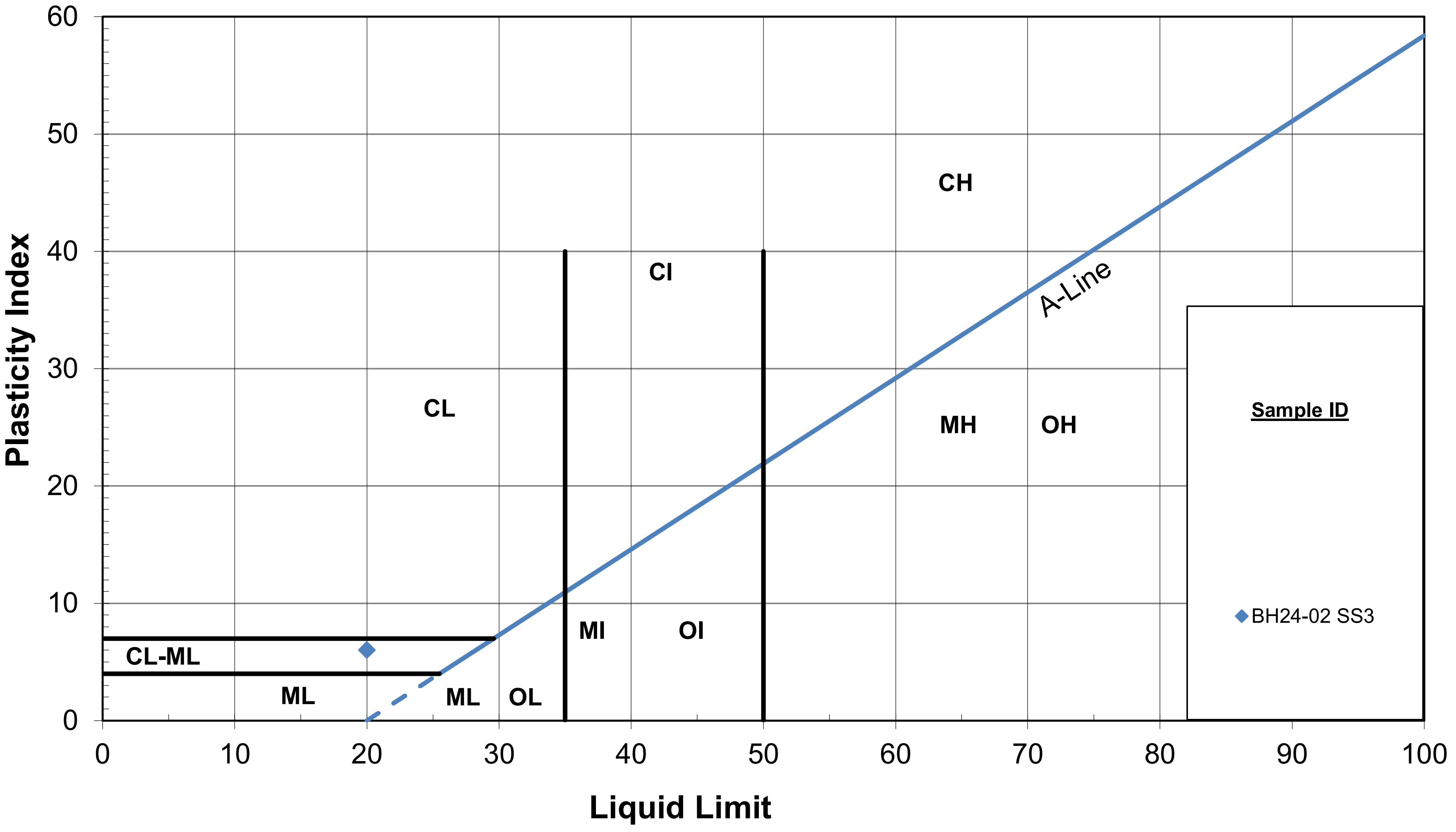
Figure No. 3

Project No. 116500966



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PLASTICITY CHART

Figure No. 4

Project No. 116500966

Table 1: Results of Infiltration Testing

Testing Location ID (test number)	Test Depth (m BGS)	Soil Substrate Tested		Vertical Hydraulic Conductivity Range of Results[1]		Infiltration Rate[2] Range of Results		Comments
		Description During Permeameter Testing	Nearby Borehole Log Description	High (m/s)	Low (m/s)	High (mm/hr)	Low (mm/hr)	
IT-No.1	0.3	Silty Sand	Fill	8.4 x 10-8	7.5 x 10-8	24	23	
IT-No.2	0.4	Silty Sand	Fill	2.7 x 10-7	8.4 x 10-8	33	24	Head levels 10 and 15 cm indicate failed test, 15-20 and 10-20 head levels show successful tests.
IT-No.3 (1)	0.45	Silty Sand	Fill	Unsuccessful		Unsuccessful		Negative result was generated indicating soil heterogeneity. Refer to test number 2.
IT-No.3 (2)	0.45	Silty Sand	Fill	2.0 x 10-5		103		
IT-No.4	0.3	Silty Sand	Fill	2.3 x 10-6	1.1 x 10-6	58	48	
IT-No.5	0.3	Silty Sand	Fill	1.5 x 10-5	4.6 x 10-6	95	70	Head levels of 10 and 15cm indicated failed test, 5 and 10, 5 and 15 show successful tests.
IT-No.6	0.25	Silty Sand	Fill	9.2 x 10-6		84		

Notes:

[1] Range of results presented when 3 or more head levels available for analysis.

[2] Determined using established relationships between hydraulic conductivity and infiltration rates as presented in Appendix C of the Low Impact Development Stormwater Management Planning and Design Guide (CVC and TRCA, 2010).