To: Ashbury College
362 Mariposa Avenue

From: Stantec Consulting Ltd.
1331 Clyde Avenue

Project/File: Ashbury College – Supplementary Geotechnical and Hydrogeological Investigation

Date: August 19, 2025

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**Reference: Ashbury College – Supplementary Geotechnical and Hydrogeological Investigation in Support of the Redevelopment of the Outdoor Field**

Ashbury College is planning the redevelopment of their outdoor field at Ashbury College located at 362 Mariposa Avenue, in Ottawa, Ontario. Geotechnical and hydrogeological recommendations are required in support of the redevelopment of the outdoor field that can accommodate football, soccer and rugby, a 9v9 soccer and track & facilities (e.g. sprint track, shot put, jump pits) and three 5-row bleachers.

Stantec has previously completed a geotechnical investigation at the above noted site in 2024[1]. The subsurface information and further geotechnical recommendations were provided in the report entitled "Geotechnical Investigation Report, Ashbury College, 362 Mariposa Avenue, Ottawa, Ontario", dated May 2024. Stantec understands that the design has been updated since then and additional geotechnical and hydrogeological investigative work will be required for the design of the proposed stormwater tank and sprint track on the southwest corner of the site.

This memorandum provides the results of the supplementary investigation consisting of advancing four boreholes, installing groundwater monitoring wells, and conducting laboratory testing on selected soil samples and rock cores. The memo includes a summary of the field investigation program, and the subsurface conditions encountered, as well as associated geotechnical and hydrogeological recommendations for the design of the proposed storm sewer tank and sprint track. This document serves as an addendum to, and should be read in conjunction with, the previous geotechnical investigation report referenced above.

This addendum memo has been prepared specifically and solely for the design team's use for the project described herein and should not be relied upon by other parties or used for other purposes. Limitations associated with this memo and its contents are provided in the Statement of General Conditions included in **Appendix A**.

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[1] Stantec Consulting Ltd. 2024. Geotechnical Investigation Report, Ashbury College, 362 Mariposa Avenue, Ottawa, Ontario. May 2024.

# 1 Background Information

Stantec has previously completed a geotechnical investigation and provided recommendations for the design of for the proposed development of two synthetic turf fields at Ashbury College located at 362 Mariposa Avenue, Ottawa, Ontario.

Based on a preliminary drawing provided by the Stantec design team, the project now requires construction of a new storm sewer tank and a sprint track on the southern portion of the outdoor north field. The invert of the proposed storm tank is at elevation 67.8 m (about 2.5 below the existing grade). The proposed development is located to the southwest of the existing college building on the North outdoor field. The project area is relatively flat with site grade elevations varying between 70.3 m and 70.6 m above mean sea level (AMSL) (based on a survey drawing performed in 2024). A line of trees exists along the southwest perimeter of the field.

Three boreholes, designated as boreholes BH24-08, BH24-09 and BH24-12, were drilled near the proposed storm sewer tank location and sprint track as part of the original geotechnical investigation for the pump station upgrades. These boreholes, whose locations are displayed on Drawing No. 1 in Appendix B, encountered variable fill materials extending to depths of approximately 1.3 m to 2.6 m below ground surface. The fill is underlain by a thin deposit of silty sand till in BH24-08. The overburden materials were inferred to be underlain by bedrock at depths of about 1.3 m to 2.6 m below ground surface (BGS) due to casing refusal (corresponding to elevations of about 67.9 m to 69.2 m AMSL).

# 2 Field Program

The supplementary investigation program consisted of advancing three boreholes identified as BH25-1, BH25-2, and BH25-3 to depths ranging from 3.4 m to 9.2 m below the existing ground surface. An alternate borehole, identified as borehole BH25-1A, located approximately three meters north of BH25-1, was augured to the top of the bedrock to install multi-level monitoring well at this location (i.e., one in the overburden at BH251A and one in the bedrock at BH25-1). Two boreholes (BH25-1, and BH25-2) were located at the proposed stormwater tank, and one borehole (BH25-3) was located near the sprint track. Their locations are shown in Drawing No.1 presented in **Appendix B**.

Standard Penetration Tests (SPT) were performed at regular intervals for soil sample collection in all boreholes except at BH25-1A. The advancement of BH25-1A was solely to install a monitoring well in the overburden.

Drilling was carried out under Stantec's field staff supervision. The supervising technician logged the boreholes and examined the soil and core samples which were then delivered to Stantec's geotechnical laboratory for laboratory testing and further review by a geotechnical engineer. Geotechnical laboratory testing included gradation analyses and moisture content tests. One unconfined compressive strength test was carried out on bedrock core extracted from Borehole BH25-2. The results of the laboratory tests are discussed in the text of this memorandum and are also provided on the Borehole Records and Core Logs in **Appendix C** and the lab testing figures in **Appendix D**.

Table 1 below provides a summary of the borehole locations, ground surface elevation, refusal depth, and total advanced depth at each location.

**Table 1: Summary of Borehole Location Coordinates and Depths**

| Test Pit Location Identification | Location – UTM Coordinate System | | Ground Surface Elevation (m) | Casing Refusal (m) | Auger Refusal (m) | Total Advanced Depth (m) |
|---|---|---|---|---|---|---|
| | Northing | Easting | | | | |
| BH25-1 | 5032792.514 | 447060.619 | 70.3 | 3.6 | 3.7 | 6.3 |
| BH25-1A | 5032794.926 | 447058.403 | 70.3 | N/A | 3.1 | 3.1 |
| BH25-2 | 5032797.601 | 447108.720 | 70.6 | 5.6 | 5.7 | 9.2 |
| BH25-3 | 5032802.182 | 447086.526 | 70.4 | 3.3 | 3.4 | 3.4 |

The geotechnical investigation took place from June 19 to June 20, 2025. A rubber tracked drill rig supplied and operated by Downing Drilling Inc. was used to advance the boreholes. Boreholes BH25-1 and BH25-2 were advanced to refusal depths of 3.7 m to 5.7 m, continuing into bedrock with approximately 3.0 m of coring using a HQ core barrel. Borehole BH25-3 was advanced to refusal depth at 3.4 m BGS.

A monitoring well was installed in each of the boreholes at the proposed stormwater tank location: two in bedrock at boreholes BH25-1 and BH25-2 and one in the overburden at borehole BH25-1A. A summary of the well construction details is presented in Table E.1 (**Appendix E**). Following installation, Stantec purged each monitoring well using dedicated 16 mm (2/3 inch) inside diameter high density polyethylene (HDPE) tubing connected to a D-25 Waterra™ foot valve. Stantec purged 10 standing column volumes from each well to clear out any fine-grained sediments and, subsequently, establish a proper hydraulic connection with the native aquifer material. BH25-1A was not purged as the monitoring well was dry during the initial site visit on June 11, 2025.

Water levels were measured in all three monitoring wells using a battery operated Solinst$^{TM}$ water level meter. Equipped with an electrode connected to a graduated polyethylene tape, Stantec used the meter to measure the depth to water by lowering the electrode into the well until the buzzer sounded, recording measurements to the nearest 0.01 m below the well top-of-casing. A summary of the manual water level measurements obtained by Stantec from the monitoring wells are provided in Table E.2 (**Appendix E**). Data loggers were installed in boreholes BH25-1 And BH25-2 for one year of continuous groundwater level monitoring to capture seasonal groundwater fluctuations and confirm the high-water table condition (i.e., which typically occurs during the spring freshet - March to May). Subsequent manual measurement of groundwater level will be carried out over the year to validate the data logger readings.

Stantec performed in-situ hydraulic response testing on BH25-1 and BH25-2, which are screened at elevations ranging between 65.6 to 61.4 m AMSL in slightly to moderately weathered limestone. The tests consisted of creating an instantaneous change in each monitoring well water level by introducing a slug into the well below the static water level (i.e., falling head test), followed by recording the time taken for the resulting water level to return to its static condition using a combination of manual and continuous (i.e., data logger) water level measurements. After the water level returned to static conditions, the slug was then removed quickly and smoothly to create another instantaneous change in water level (i.e., rising head test), followed by recording the time taken for the water level to return to its static condition again using a combination of manual and continuous water level measurements. Table E.1 (**Appendix E**) presents the calculated horizontal hydraulic conductivity for each tested well, with the analytical solutions for these data being presented in **Appendix F**.

# 3 Results of Investigation

## 3.1 Subsurface Conditions

The subsurface conditions encountered in the boreholes generally consist of topsoil over sand to silty sand fill underlain by a discontinuous layer of glacial till material over limestone bedrock. Bedrock was encountered at depths ranging from 3.4 m to 5.7 m below ground surface.

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

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

### 3.1.1 Topsoil

Topsoil was encountered at ground surface at all borehole locations. The thickness of topsoil ranged from 200 mm to 230 mm.

### 3.1.2 Fill

A layer of fill material generally consisting of brown to light brown sand to silty sand was encountered beneath the topsoil in all boreholes. Trace rootlets were encountered within the sand fill layer at all locations. Few to some gravel was encountered within the fill layer at boreholes BH25-1 and BH25-3. The fill material extends to depths ranging from 1.2 m to 3.1 m.

The moisture content of seven (7) samples of the fill ranges between 5.6 % and 11.5 %.

Two (2) samples of fill were selected for grain size distribution testing. The grain size distribution curve for the fill is provided in Figure D1 in **Appendix D**, and a summary of the test results is provided in Table 2 below.

**Table 2: Summary of Grain Size Analysis of Fill**

| Borehole No. | Sample No. | Depth (m) | Gravel (%) | Sand (%) | Silt and Clay (%) |
|---|---|---|---|---|---|
| BH25-1 | SS3 | 1.5 – 2.1 | 17 | 46 | 37 |
| BH25-2 | SS2 | 0.8 – 1.2 | 0 | 79 | 21 |

### 3.1.3 Glacial Till

A layer of glacial till was encountered beneath the fill material at all borehole locations. The till material extends to depths ranging from 3.1 m to 5.7 m.

The till was described as silty sand with gravel to poorly-graded gravel with silt and sand. Occasional cobbles, boulders, and fractured rock fragments were encountered within the till layer. The till material was described as brown to grey in colour.

The moisture content of nine (9) samples of the till ranges between 3.0 % and 9.0 %.

Four (4) samples of till were selected for grain size distribution testing. The grain size distribution curve for the till is provided in Figure D2 in **Appendix D**, and a summary of the test results is provided in Table 3 below.

**Table 3: Grain Size Analysis of Till**

| Borehole No. | Sample No. | Depth (m) | Gravel (%) | Sand (%) | Silt and Clay (%) |
|---|---|---|---|---|---|
| BH25-1 | SS5 | 3.1 – 3.6 | 72 | 19 | 9 |
| BH25-2 | SS5 | 3.1 – 3.3 | 33 | 43 | 24 |
| BH25-2 | SS8 | 5.3 – 5.6 | 26 | 50 | 24 |
| BH25-3 | SS4 | 2.3 – 2.5 | 18 | 54 | 28 |

In accordance with the Unified Soil Classification System (USCS), the till material selected for testing can be classified as poorly-graded gravel with silt and sand (GP) to silty sand with gravel (SM).

### 3.1.4 Refusal and Bedrock

Auger refusal was encountered at all boreholes at depths ranging from about 3.1 to 5.7 m below the existing ground surface (Elevations 67.2 m to 64.9 m). In general, auger refusal may represent the bedrock surface; however, it could also represent cobbles or a boulder within or on the surface of the glacial till.

Upon encountering auger refusal, boreholes BH25-1 and BH25-2 were extended into the bedrock using rotary diamond drilling techniques while retrieving HQ sized core. Within these boreholes, the drilled lengths in the bedrock ranged between about 2.6 and 3.5 m (i.e., to total depths ranging between about 6.3 and 9.2 m below the existing ground surface). Bedrock was confirmed at depths of 3.7 m and 5.7 m (Elevations 66.7 m to 64.9 m).

The sampled bedrock consisted of grey to black limestone with shale interbeds. The rock has been noted as highly to slightly weathered near the surface and becomes fresh at depth. The Rock Quality Designation (RQD) value ranged from 0% to 31%, indicating a very poor to poor quality rock.

The strength of the intact rock core was determined by conducting Unconfined Compressive Strength (UCS) testing on a select rock core sample. A summary of the results of the laboratory testing carried out on the bedrock is presented in Table 4 below. Based on the UCS test findings, the bedrock was found to be strong.

**Table 4: Laboratory Results on Limestone Bedrock**

| BOREHOLE ID | SAMPLE | DEPTH (m) | RQD AT TEST DEPTH | UNCONFINED COMPRESSIVE STRENGTH (MPa) |
|---|---|---|---|---|
| BH25-2 | RC-11 | 7.9 | 31 % | 71.7 |

A detailed description of the rock core is provided in Field Core Logs in **Appendix C**. Rock core photographs are also provided in **Appendix C**.

## 3.1.5 Hydrogeological Conditions

Preliminary groundwater level monitoring indicates that the water table is positioned at depths of 3.3 m BGS to 3.8 m BGS (66.8 to 67.0 m BGS) (Table E.2, **Attachment E**), with groundwater residing near the bedrock-overburden interface at BH25-1 and within the glacial till (approximately 1.9 m above the bedrock surface) at BH25-2. Stantec notes that these groundwater levels do not represent the high groundwater condition as these measurements were recorded during the summer, a period where the water table is typically at its lowest elevation. As previously mentioned in Section 2, the monitoring wells are equipped with data loggers and will continue to record seasonal groundwater fluctuations for one year to capture the high-water table condition.

A vertical hydraulic gradient could not be calculated at BH25-1 / BH25-1A as the shallow well was dry at the time of the manual water level measurements.

Results of the in-situ hydraulic response testing results completed on BH25-1 and BH25-2 were analyzed using the Bouwer and Rice (1976[2]) solution provided in the software package AQTESOLV$^{TM}$ Pro Version 4.51 (Duffield, 2014[3]) to calculate the horizontal hydraulic conductivity of the aquifer formation in the immediate vicinity of the screened interval of the monitoring well. Table E.1 (**Attachment E**) presents the calculated horizontal hydraulic conductivity, with the analytical solutions for these data. Since hydraulic conductivity in the horizontal direction is generally one order of magnitude higher than hydraulic conductivity in the vertical direction (Todd 1980[4]; Freeze and Cherry 1979[5]), the vertical hydraulic conductivity of the formations screened at the various monitoring well locations are assumed to be one order of magnitude lower than the corresponding in-situ measured horizontal hydraulic conductivity. The Credit Valley Conservation-Toronto and Region Conservation (CVC-TRCA) (2010[6]) method for converting vertical hydraulic conductivity to an infiltration rate was then applied to these data, with the results being presented in Table E.3 (**Attachment E**). For the slightly to moderately weathered bedrock, the vertical hydraulic conductivity estimated at BH25-1 was $3.3 \times 10^{-5}$ m/s, equating to an infiltration rate of 118 mm/hour or 5.1 min/cm. At BH25-2, the estimated vertical hydraulic conductivity for the weathered bedrock was

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[2] Bouwer, H., and Rice, R.C., 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research 12 (3): 423-428.
[3] Duffield, G.M. 2014. AQTESOLVTM for Windows, Version 4.5 Professional. HydroSOLVE Inc., Reston, VA.
[4] Todd, D.K. 1980. Groundwater Hydrology, 2nd Edition. Wiley, New York, 552 p.
[5] Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice Hall, New Jersey, 604 p.
[6] (CVC-TRCA) Credit Valley Conservation - Toronto and Region Conservation Authority, 2010. Low Impact Development Stormwater Management Planning and Design Guide – Version 1.0.

3.5 x $10^{-6}$ m/s, equating to an infiltration rate of 65 mm/hour or 9.2 min/cm. As documented in Stantec (2024) report, a series of Guelph Permeameter tests were completed throughout the site, with the location of these soil permeability testing presented on Figure 1 (**Attachment B**). The results of this testing indicate that the fill (silty sand) material is characterized by vertical hydraulic conductivities ranging from 7.5 x $10^{-8}$ m/s to 2.0 x $10^{-6}$ m/s, equating to infiltration rates ranging from of 23 mm/hour (26.1 min/cm) to 103 mm/hour (5.8 min/cm).

Stantec notes that the silty sand till that is encountered between the fill and bedrock surface beneath the site was not subjected to infiltration testing. If future Low Impact Development (LID) infiltration measures proposed for the site are constructed within this glacial till, Stantec recommends that additional testing be performed on these soils to confirm their infiltration rates.

As per CVC-TRCA (2010), the previously mentioned infiltration rates that are selected for the sizing of proposed LIDs should be adjusted using a Safety Correction Factor of 2.5.

# 4 Discussion and Recommendations

This section of the memo provides geotechnical engineering input related to the design of the proposed storm water management system and sprint track based on our interpretation of the available subsurface information and our understanding of the project requirements. This document serves as an addendum to, and should be read in conjunction with, the above referenced Stantec Geotechnical Report.

The following geotechnical input is based on the information that was available at the time of writing this addendum memo. Where comments are made on construction, they are provided in order to highlight to the design team 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 detailed design provided at the time of tendering, including how it affects their proposed construction techniques, schedule, safety, and equipment capabilities.

## 4.1 Temporary Excavation

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. Care must be taken to protect existing structures and utilities from damage during excavation.

Temporary excavations required for the installation of the proposed storm sewer tank are anticipated to extend to depths of about 3 m below ground surface. These excavations are anticipated to extend through topsoil, fill materials, and/or glacial till soils (consisting of variable amount of gravel, sand, and silt). The till was inferred to contains cobbles and boulders. Conventional hydraulic excavating equipment is considered suitable for developing excavations in the overburden soils noting that increased difficulty may result when cobbles and/or boulders are encountered within the till deposit. Boulders with dimensions larger than 0.3 meters should be removed from the excavation side slopes.

Considering the encountered auger refusal at boreholes BH25-1 and BH25-1A, bedrock excavation may be required if excavation extend below 3.1 m depth. Bedrock excavation, if required, can be completed using mechanical methods such as hydraulic excavators and hoe ramming with pneumatic rock breakers particularly for shallow bedrock excavation.

In accordance with the Occupational Health and Safety Act & Regulations (OHSA) of Ontario, the fill and glacial till materials would generally be classified as Type 3 soil provided these materials are not saturated (i.e. located above the water level and/or dewatered prior to excavation). Unsupported side slopes for excavations developed entirely within Type 3 soils may be sloped at 1 horizontal to 1 vertical (1H:1V) from the bottom of the excavation. Provided that sufficient space is available, these excavations may be carried out using open-cut techniques and/or with the braced trench box support.

The stability of the walls of the excavations can also be affected by:

- Surcharge loads
- Stockpiles
- External loads (e.g. from adjacent buildings foundations)
- Groundwater seepage conditions

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.

Temporary shoring/protection systems may be required if there is insufficient space to develop the excavations in open-cut and/or where ground movements need to be limited to avoid damage to existing structures/facilities (e.g. adjacent buildings located on the west of the proposed storm sewer tank, or existing utilities, etc.). Where excavations do not undermine the zone of influence of adjacent structures/services, no issues would be anticipated. The zone of influence is defined by a theoretical 1 horizontal to 1 vertical surface extending down and away from the underside of the footings or service to the outside edge of the excavation.

Existing services that cross above the proposed excavation will need to be supported. The Contractor should be responsible for designing and providing these supports in accordance with pipe or utility manufacture's specifications. Special attention should be given for pressurized systems, in regard to unconfined or exposed lengths of pipe. Temporary excavation support may need to be modified at these service crossings.

## 4.2 Groundwater Control

The groundwater level measured in the monitoring well were measured at depths of about 3.1 m to 3.8 m below grade. Based on the groundwater conditions observed in the monitoring wells, excavations within the project limit to depth of 3 m are not expected to extend below the groundwater level. However, fluctuations of the groundwater levels due to seasonal variations or precipitation events should be anticipated. Additional groundwater level measurements will be carried out within the monitoring wells installed at the site to provide further information on potential fluctuations for use in planning of construction activities.

The groundwater level may rise, or perched groundwater conditions may develop within the fill material, during and following periods of heavy precipitation or snow melt. As such, some groundwater inflow may be encountered within the planned excavation depths. It should be possible to effectively handle the groundwater inflows into the excavation by pumping from sumps located within the excavation.

Groundwater that is pumped from excavations during construction must be handled and disposed of appropriately.

## 4.3 Re-Use of Site Generated Material

The fill material present at the site consists of silty sand to sand with moderate amount of fines. Additionally, traces of rootlets were noted within the fill material. Hence, all topsoil as well as fill material containing rootlets cannot be used under structures, pavement areas or as backfill for structures or services. The existing fill can be re-used as grading fill in landscaped areas.

Excavated native soils such as till may be reused for general site grading fill or as trench backfill below the frost depth. It is noted that the reuse of site-generated materials will be highly dependent on the materials' moisture contents and the construction techniques at the time of excavation and placement.

All recommendations provided herein regarding material reuse of fill are specific to the geotechnical feasibility of the reuse of existing site fill and do not consider environmental restrictions. The excess soil anticipated to be generated at the site should be characterized in accordance with the Ontario Regulation.

## 4.4 Subgrade Preparation and Design of Sprint Track

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 sprint track. The exposed soil subgrade should be proof rolled with heavy equipment under the supervision of geotechnical personnel prior to subbase or engineered fill placement. Loose or soft areas and presence of any organics and debris identified by proof rolling should be sub-excavated and replaced with additional Granular 'B' type I or II and to at least 95% of the materials SPMDD. Proper drainage is essential to prevent water accumulation. After proof rolling, site grades should be adjusted (cut/fill) to the design subgrade profile with appropriate center crowning to effectively remove surface water.

The pavement structure presented in Table 5 may be considered for the design of sprint track.

**Table 5: Recommended Pavement Design**

| Location | Asphalt Thickness | Base Thickness OPSS Granular A (mm) | Subbase Thickness OPSS Granular B Type II (mm) |
|---|---|---|---|
| Sprint Track | 50 mm SP12.5 (HL-3F)<br>50 mm SP19 (HL8) | 100 | 250 |

The following are recommended for this project:

- The base and subbase layers should extend past the edge of the asphalt surfaces in plan by approximately 150 mm to reduce the risk of edge/shoulder cracking.
- Subsurface drainage must be maintained in all areas of sprint track and should be connected to the perimeter drain.
- Asphalt performance grade should be PG 58-34.
- The compaction of the asphalt layers should be to 92% Maximum Theoretical Relative Density (MTRD) in accordance with OPSS 310.
- All granular materials should be in accordance with the requirements of OPSS Specification. Both the base and subbase layers should be compacted to 100% SPMDD, as per ASTM D698.
- A tack coat is recommended between asphalt layers and along the edges of any cuts in asphalt.
- If 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.
- A non-woven geotextile fabric should be placed between the subgrade and the granular base to prevent soil migration and improve stability.

# 5 Closure

The conclusions in the Memo are Stantec's professional opinion, as of the time of the Memo, and concerning the scope described in the Memo. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. The Memo relates solely to the specific project for which Stantec was retained and the stated purpose for which the Memo was prepared. The Memo is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from the Client and third parties in the preparation of the Memo 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.

**Reference: Ashbury College – Design Services in Support of the Redevelopment of the Outdoor Field**

This Memo is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Memo may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The Memo may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

Regards,

**Stantec Consulting Ltd.**

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Attachments: Appendix A - Statement of General Conditions

Appendix B - Borehole Location Plan

Appendix C - Symbols and Terms Used on Borehole Records

- Borehole Records

- Rock Core Photographs

Appendix D – Laboratory Testing Results

Appendix E – Hydrogeological Tables

Appendix F – Hydraulic Conductivity Analytical Solutions

# 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 Borehole Location Plan

**Stantec**

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Ottawa, ON, Canada K2C 3G4
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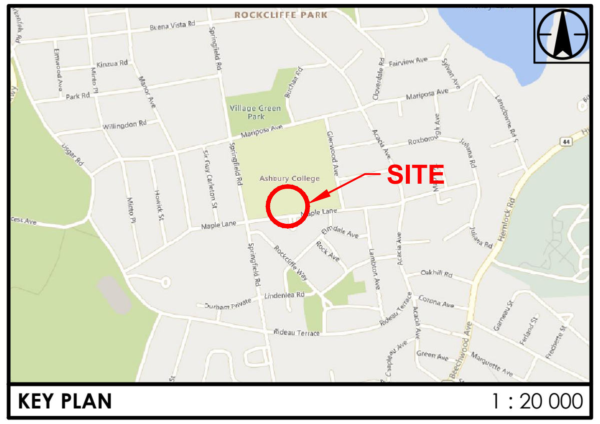
**LEGEND**

- ⊕ BOREHOLE (STANTEC, 2024)
- ⊕ INFILTRATION TEST (STANTEC 2024)
- ⊕ BOREHOLE (STANTEC, 2025)



**KEY PLAN** 1 : 20 000

**NOTES**

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

10m 0 10 20m
1 : 1000

JULY 2025
Project No. 116501019.500

Client/Project
ASHBURY COLLEGE
ASHBURY COLLEGE - DESIGN SERVICES
362 MARIPOSA AVENUE, OTTAWA, ONTARIO

Drawing No.
1

Title
**BOREHOLE LOCATION PLAN**

C:\Users\gbriones\appdata\local\temp\AcPublish_5236\116501019_Borehole Locations_250718.dwg
Printed: Jul 18, 2025 By: G. Briones

# Appendix C

## C.1 Symbols and Terms Used on Borehole Records

## C.2 Borehole Records

## C.3 Rock Core Photographs

# 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:**

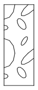
| Strength Classification | Grade | Unconfined Compressive Strength (MPa) |
|---|---|---|
| *Extremely Weak* | R0 | <1 |
| *Very Weak* | R1 | 1 – 5 |
| *Weak* | R2 | 5 – 25 |
| *Medium Strong* | R3 | 25 – 50 |
| *Strong* | R4 | 50 – 100 |
| *Very Strong* | R5 | 100 – 250 |
| *Extremely Strong* | R6 |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

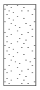
**Terminology describing rock weathering:**

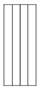
| Term | Symbol | Description |
|---|---|---|
| *Fresh* | W1 | No visible signs of rock weathering. Slight discoloration along major discontinuities |
| *Slightly* | W2 | Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored. |
| *Moderately* | 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. |

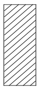
## STRATA PLOT

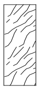
Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.


Boulders
Cobbles
Gravel

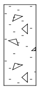

Sand

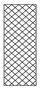

Silt

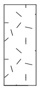

Clay


Organics

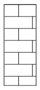

Asphalt


Concrete


Fill


Igneous
Bedrock


Meta-
morphic
Bedrock


Sedi-
mentary
Bedrock

## 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

## BH25-1

CLIENT: **Ashbury College**

PROJECT: **Ashbury College**

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

DATE BORED: **06/19/2025**

BH COORDINATES 5032792.5N 447060.6E

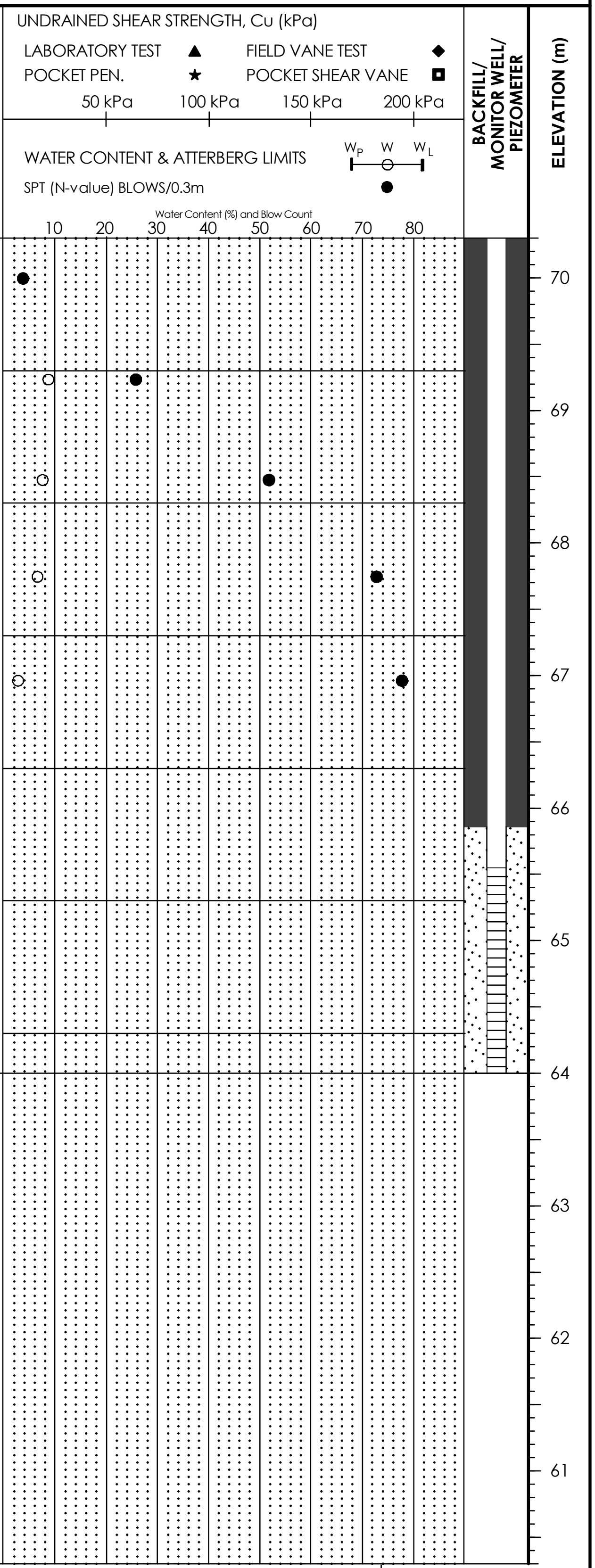
WATER LEVEL: **N/A**

PROJECT NO. : **116501019**

BH ELEVATION: **70.3 m**

DATUM: **Geodetic**

| DEPTH (m) | ELEVATION (m) | SOIL DESCRIPTION (USCS) | SAMPLES TYPE | NUMBER | RECOVERY (mm) or TCR % | N-VALUE or RQD % | OTHER TESTS / REMARKS |
|---|---|---|---|---|---|---|---|
| 0 | 70.3<br>70.1 | TOPSOIL (200 mm) - Brown SAND, contains organic material and trace rootlets, moist | SS | 1 | 51 | 4 | |
| | | FILL: Brown SAND, contains trace roots, moist | | | | | |
| | 69.5 | FILL: Brown SAND and gravel, contains some cobbles, moist | SS | 2 | 330 | 26 | |
| | 68.8 | FILL: Brown Silty SAND with gravel, contains some cobbles, moist | SS | 3 | 381 | 52 | Sieve<br>G 17% S 46% Fines 37% |
| | | | SS | 4 | 457 | 73 | |
| 3 | 67.3 | TILL: Very dense grey poorly-graded GRAVEL with silt and sand, contains cobbles, boulders, and fractured rock fragments | SS | 5 | 330 | 78 | Sieve<br>G 72% S 19% Fines 9% |
| | 66.7 | Casing refusal at 3.63 m.<br>Auger refusal at 3.65 m.<br>Grey to dark grey LIMESTONE SHALE interbeds, slighly to highly weathered, very poor to poor quality | RC | 6 | 70 | 10 | |
| | 65.5 | | RC | 7 | 83 | 0 | |
| | 64.6 | | RC | 8 | 88 | 12 | |
| | 64.0 | Highly weathered core at 6.1 m<br>End of Borehole at 6.3 m | | | | | |



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

Drilling Contractor: Downing
Drilling Method: HSA / HQ
Completion Depth: 6.3 m

Logged By: OE
Reviewed By: SS

Printed Aug 18 2025 13:9:32 STANTEC GEO 2016 116501019_ASHBURY_COLLEGE.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 8/18/25

Stantec

# BOREHOLE RECORD

## BH25-1A

CLIENT: **Ashbury College**
PROJECT: **Ashbury College**
LOCATION: **362 Mariposa Avenue, Ottawa, ON**
DATE BORED: **06/19/2025**

BH COORDINATES
5032794.9N 447058.4E
WATER LEVEL: **N/A**

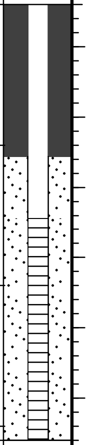
PROJECT NO. : **116501019**
BH ELEVATION: **70.3 m**
DATUM: **Geodetic**

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

| 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 | Refer to borehole BH25-1 for stratigraphy | | | | | | |
| 3.1 | 67.2 | Auger refusal at 3.1 m<br>End of Borehole at 3.1 m | | | | | | |

BACKFILL/ MONITOR WELL/ PIEZOMETER



| | | |
|---|---|---|
| Drilling Contractor: Downing | | Logged By: OE |
| Drilling Method: HSA | | Reviewed By: SS |
| Completion Depth: 3.1 m | | Page 1 of 1 |

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

# BOREHOLE RECORD

**Stantec**

## BH25-2

CLIENT: **Ashbury College**

PROJECT: **Ashbury College**

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

DATE BORED: **06/20/2025**

BH COORDINATES: 5032797.6N 447108.7E

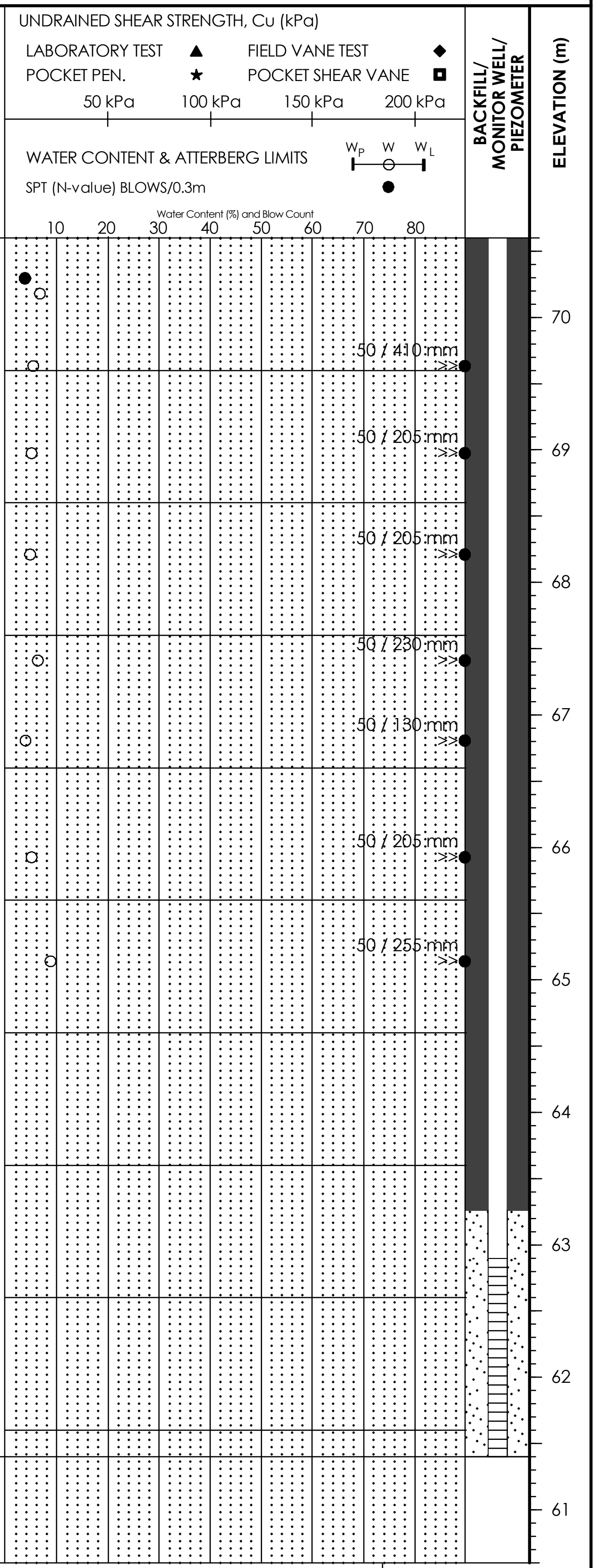
WATER LEVEL: **N/A**

PROJECT NO.: **116501019**

BH ELEVATION: **70.6 m**

DATUM: **Geodetic**

| ELEVATION (m) | SOIL DESCRIPTION (USCS) | TYPE | NUMBER | RECOVERY (mm) or TCR % | N-VALUE or RQD % | OTHER TESTS / REMARKS |
|---|---|---|---|---|---|---|
| 70.6 | TOPSOIL (230 mm) - Brown SAND, contains organic material and trace rootlets, moist | SS | 1 | 432 | 4 | |
| 70.4 | FILL: Light brown SAND, moist | | | | | |
| 69.8 | FILL: Light brown Silty SAND, moist | SS | 2 | 51 | 50 | Sieve G 0% S 79% Fines 21% |
| 69.4 | TILL: Very dense brown SAND with gravel, contains few to some cobbles, moist | SS | 3 | 127 | 50 | |
| | | SS | 4 | 153 | 50 | |
| 67.6 | TILL: Very dense brown Silty SAND with gravel, contains some cobbles, moist | SS | 5 | 203 | 50 | Sieve G 33% S 43% Fines 24% |
| 66.8 | TILL: Very dense grey Silty SAND with gravel, moist, becoming wet at 5.3 m<br>Casing refusal at 5.6 m.<br>Auger refusal at 5.7 m. | SS | 6 | 229 | 50 | |
| | | SS | 7 | 203 | 50 | |
| | | SS | 8 | 102 | 50 | Sieve G 26% S 50% Fines 24% |
| 64.9 | Grey to dark grey LIMESTONE with SHALE interbeds, highly weathered to fresh, very poor to poor quality | RC | 9 | 58 | 28 | |
| 64.4 | | RC | 10 | 4 | 0 | |
| 63.1 | | RC | 11 | 45 | 31 | |
| 61.4 | End of Borehole at 9.2 m | | | | | |



BACKFILL SYMBOL: ▩ ASPHALT, ▒ GROUT, ◸ CONCRETE, ■ BENTONITE, ☒ DRILL CUTTINGS, ⋰ SAND, ▦ SLOUGH

| | |
|---|---|
| Drilling Contractor: Downing | Logged By: OE |
| Drilling Method: HSA / HQ | Reviewed By: SS |
| Completion Depth: 9.2 m | Page 1 of 1 |

# BOREHOLE RECORD

## BH25-3

CLIENT: **Ashbury College**

PROJECT: **Ashbury College**

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

DATE BORED: **06/20/2025**

BH COORDINATES: 5032802.2N 447086.5E

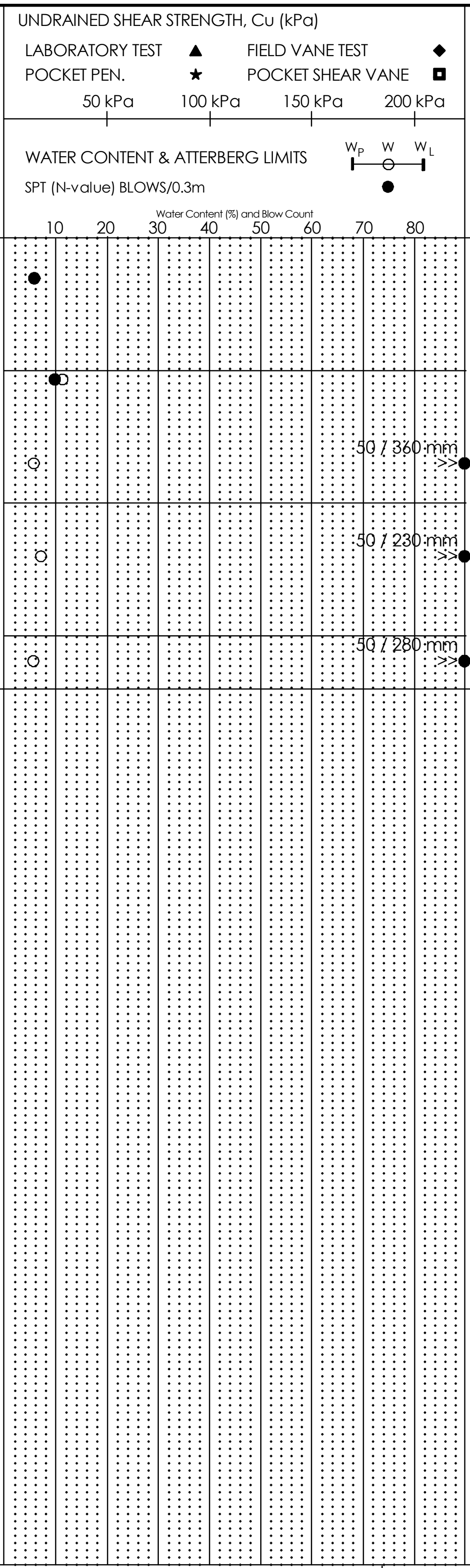
WATER LEVEL: **N/A**

PROJECT NO.: **116501019**

BH ELEVATION: **70.4 m**

DATUM: **Geodetic**

| ELEVATION (m) | SOIL DESCRIPTION (USCS) | TYPE | NUMBER | RECOVERY (mm) or TCR % | N-VALUE or RQD % | OTHER TESTS / REMARKS |
|---|---|---|---|---|---|---|
| 70.4 | | | | | | |
| 70.2 | TOPSOIL (200 mm) - Brown SAND, contains organic matter and trace rootlets, moist | SS | 1 | 203 | 6 | |
| | FILL: Brown SAND, contains trace rootlets, moist | | | | | |
| 69.6 | FILL: Brown SAND, few gravel, moist | SS | 2 | 280 | 10 | |
| | | SS | 3 | 203 | 50 | |
| 68.1 | TILL: Very dense brown Silty SAND with gravel, contains trace cobbles, moist | SS | 4 | 203 | 50 | Sieve<br>G 18%<br>S 54%<br>Fines 28% |
| 67.4 | TILL: Very dense brown SAND with gravel, contains some cobbles, moist | SS | 5 | 203 | 50 | |
| 67.0 | Fractured rock fragments encountered at 3.1 m<br>Casing refusal at 3.3 m<br>Auger refusal at 3.4 m<br>End of Borehole at 3.4 m | | | | | |



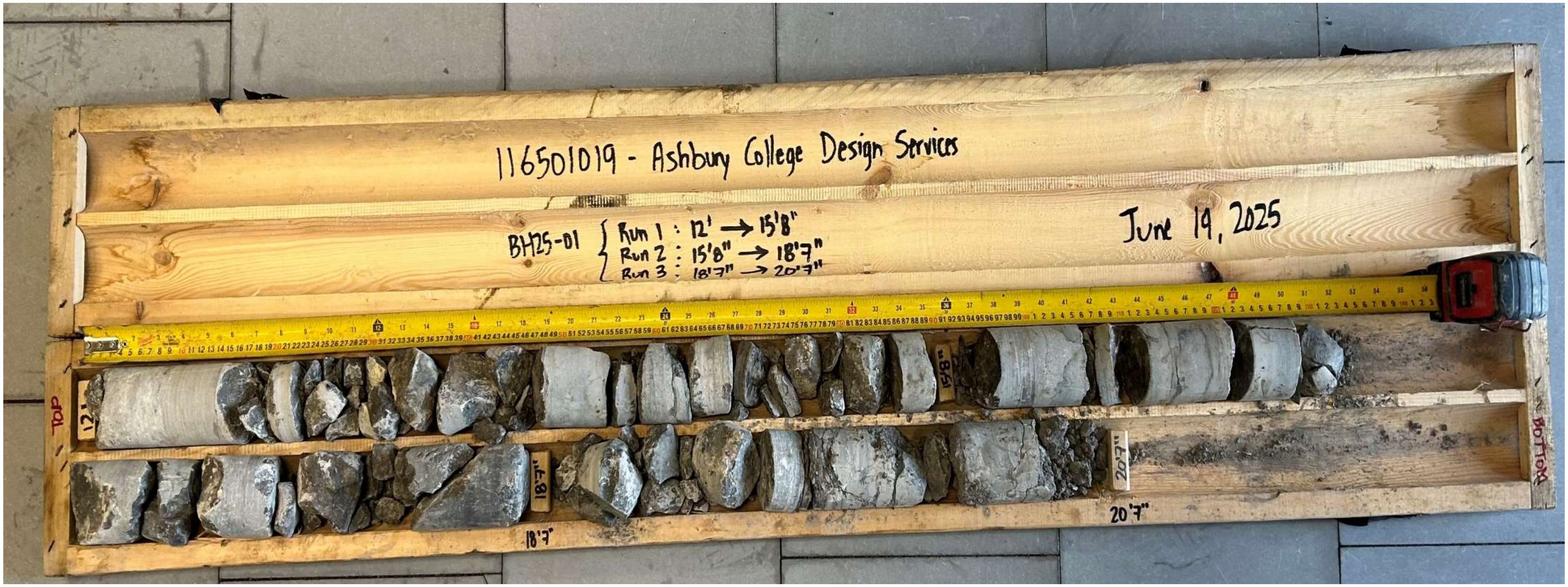
BACKFILL/ MONITOR WELL/ PIEZOMETER

DEPTH (m): 0–10; ELEVATION (m): 70–61

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

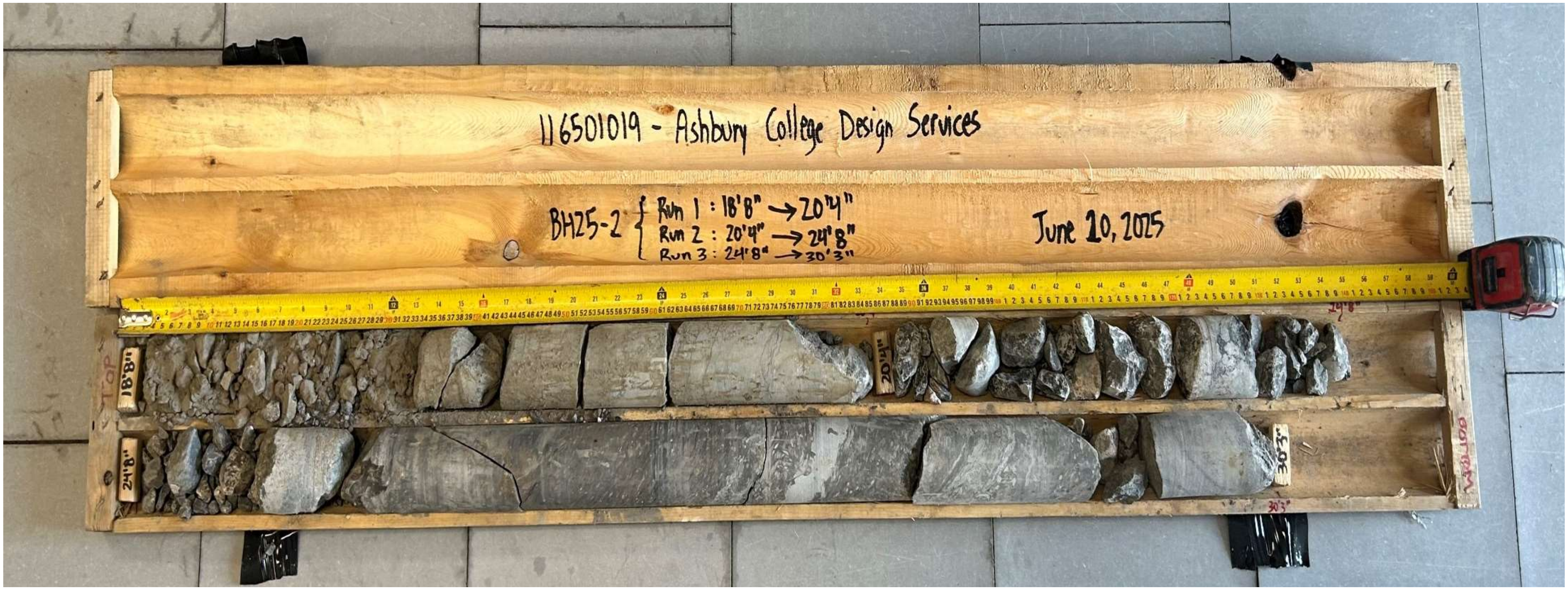
| | |
|---|---|
| Drilling Contractor: Downing | Logged By: OE |
| Drilling Method: HSA | Reviewed By: SS |
| Completion Depth: 3.4 m | Page 1 of 1 |

| | | |
|---|---|---|
| Stantec | Project No.: 116501019<br>Project Name: Ashbury College – Design Services | Rock Core Photograph |



| | | |
|---|---|---|
| Rock Core Photo No.: 1 | Borehole: BH25-1 | Depth: 3.7 m to 6.3 m |

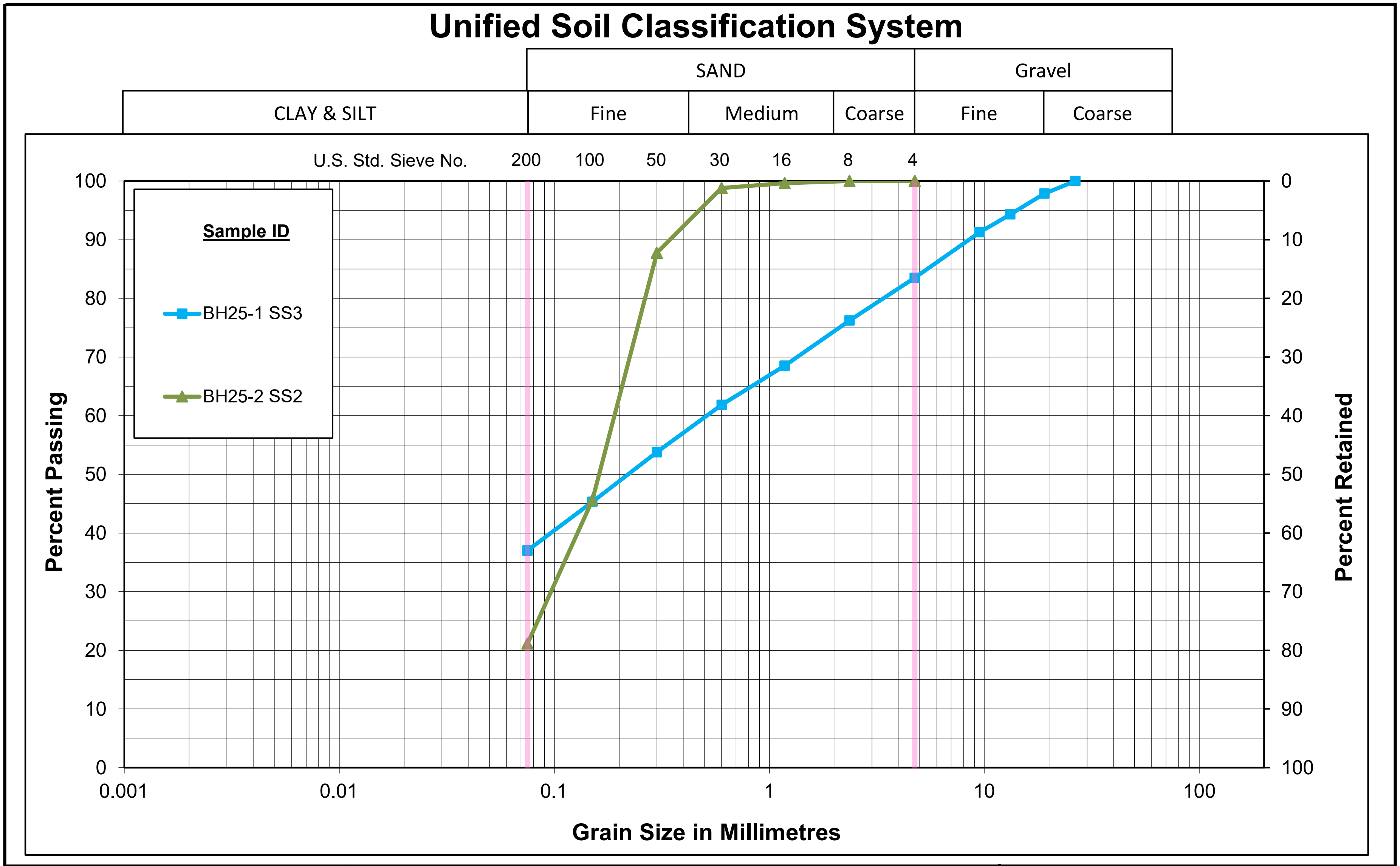
| | | |
|---|---|---|
| Stantec | Project No.: 116501019<br>Project Name: Ashbury College – Design Services | Rock Core Photograph |



| | | |
|---|---|---|
| Rock Core Photo No.: 2 | Borehole: BH25-2 | Depth: 5.7 m to 9.2 m |

# Appendix D

## D.1 Laboratory Testing Results



## GRAIN SIZE DISTRIBUTION

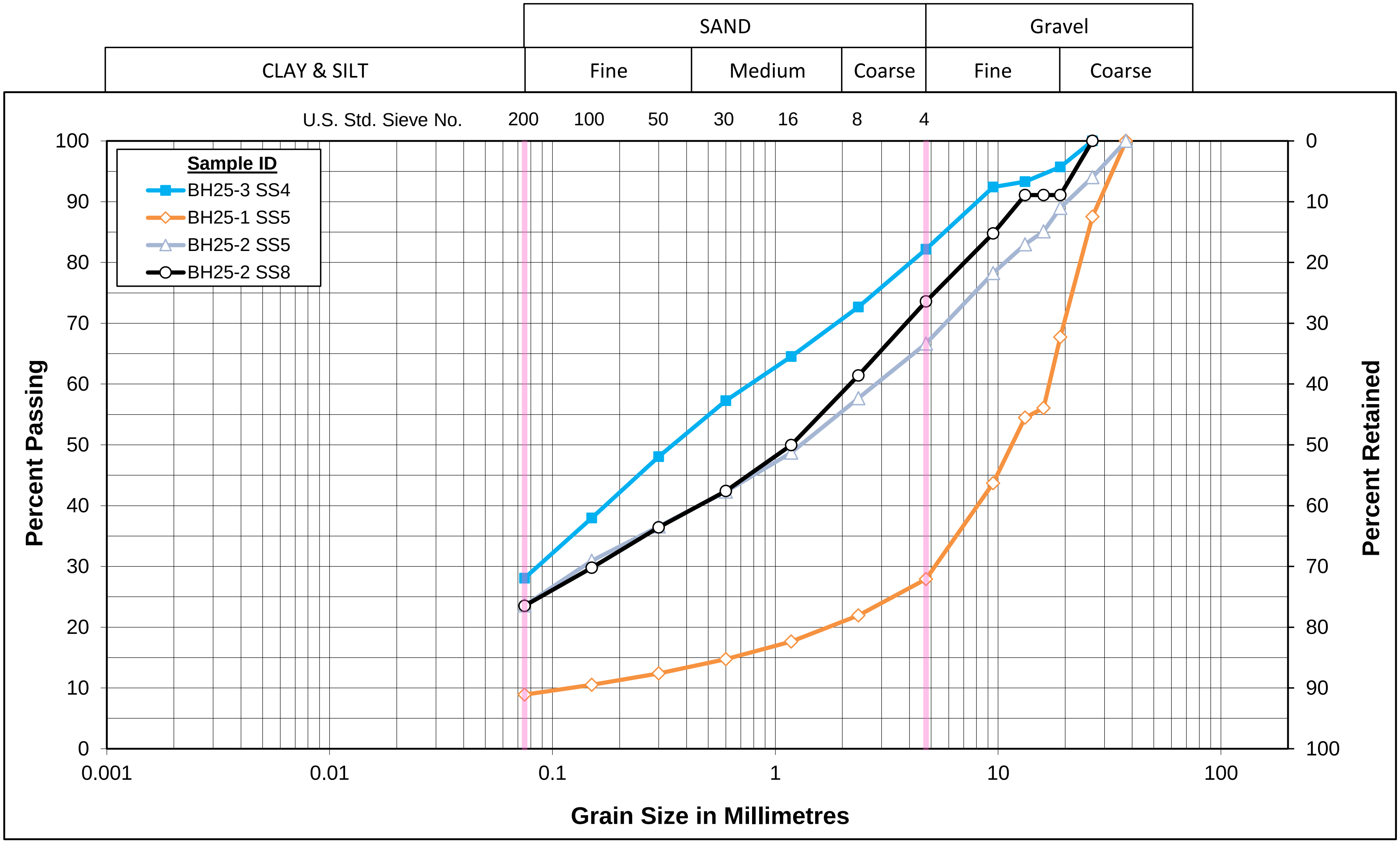
Fill Material

Ashbury College

Figure No. D1

Project No. 116501019

# Unified Soil Classification System



Stantec

## GRAIN SIZE DISTRIBUTION

Glacial Till

Ashbury College

Figure No. D2

Project No. 116501019

**Stantec**

# Compressive Strength & Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures

## Method C

## ASTM D7012 & D4543

| | | | |
|---|---|---|---|
| Client: | Ashbury College | Project No.: | 116501019 |
| Project: | Ashbury College - DesignServices | | |
| Material Type: | Rock Core; Diameter ≥ 47.0 mm | Date Received: | June 23, 2025 |
| Sampled By: | OE | Tested By: | Sagar Khatri |
| Date Sampled: | June 19 - 20, 2025 | Date Tested: | July 8, 2025 |

| Sample Information | | | | |
|---|---|---|---|---|
| Borehole Location | **BH25-2** | **0** | **0** | **0** |
| Sample Number | CR 11 | 0 | 0 | 0 |
| Sample Depth | 26'-26'9.5" | 0 | 0 | 0 |
| **Compressive Strength Test Data** | | | | |
| Physical Description | As per Geotechnical Report | As per Geotechnical Report | As per Geotechnical Report | As per Geotechnical Report |
| Average Sample Diameter (mm) (≥47.0) | 63 | | | |
| Average Sample Length (mm) | 154 | | | |
| Density (kg/m$^3$) | 2712 | | | |
| Unit Weight (kN/m$^3$) | **26.6** | **#VALUE!** | **#VALUE!** | **#VALUE!** |
| L/D Ratio (2.0-2.5) | 2.46 | #VALUE! | #VALUE! | #VALUE! |
| Failure Load (lbs) | 49790 | 0 | 0 | 0 |
| Compressive Strength (MPa) | **71.7** | **#VALUE!** | **#VALUE!** | **#VALUE!** |
| Straightness by Procedure S1 (≤0.02inch) | <0.02 | <0.02 | <0.02 | <0.02 |
| Flatness by Procedure FP2 (≤0.001inch) | <0.001 | <0.001 | <0.001 | <0.001 |
| Parallelism by Procedure FP2 (≤0.25°) | -0.047 | #N/A | #N/A | #N/A |
| Perpendicularity by Procedure P2 (≤0.0043) | <0.0043 | <0.0043 | <0.0043 | <0.0043 |
| Moisture Condition | As-Received | As-Received | As-Received | As-Received |
| Description of Break D7012/11.1.13 | Cone formed on one end, vertical cracks running through caps. | 0 | 0 | 0.00 |
| Note | 0 | 0 | 0 | 0.00 |

Remarks:

Reviewed by: ____________ Date: July 8, 2025

# Appendix E

## E.1 Hydrogeological Tables

# TABLE E.1
# WELL CONSTRUCTION DETAILS

| Well ID | UTM Coordinates | | Elevations | | Casing Diameter (mm) | Well Stick-up (m) | Well Depth (m BTOC) | Well Depth (m BGS) | Well Base Elevation (m AMSL) | Screened Interval | | | | Screened Material Description (% of screened interval) | Hydraulic Conductivity (m/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Northing | Easting | Top of Casing (m AMSL) | Ground Surface (m AMSL) | | | | | | Top Elevation | | Bottom Elevation | | | |
| | | | | | | | | | | (m BGS) | (m AMSL) | (m BGS) | (m AMSL) | | |
| BH25-1 | 5032793 | 447061 | 70.2 | 70.3 | 50 | -0.1 | 6.3 | 6.4 | 63.9 | 4.9 | 65.4 | 6.4 | 63.9 | Moderately weathered, very poor quality LIMESTONE (100%) | 3.3E-04 |
| BH25-1A | 5032795 | 447058 | 70.3 | 70.3 | 50 | 0.0 | 3.1 | 3.1 | 67.2 | 1.6 | 68.7 | 3.1 | 67.2 | Silty SAND with gravel FILL (100%) | - |
| BH25-2 | 5032798 | 447109 | 70.5 | 70.6 | 50 | -0.1 | 9.2 | 9.3 | 61.3 | 7.8 | 62.8 | 9.3 | 61.3 | Slightly weathered, poor quality LIMESTONE (100%) | 3.5E-05 |

**Notes:**

m AMSL = meters above mean sea level
m BGS = meters below ground surface
m BTOC = meters below top of well casing

## TABLE E.2
## GROUNDWATER LEVEL DATA - MONITORING WELLS

| Well ID | UTM Coordinates | | Date | Time | Well Depth | | | Screen Separation(1) | Top of Casing Elevation (m AMSL) | Ground Surface Elevation (m AMSL) | Pipe Stick-up (m) | Groundwater Level | | | Vertical Hydraulic Gradient (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Northing | Easting | | | (m BTOC) | (m BGS) | (m AMSL) | (m) | | | | (m BGS) | (m BTOC) | (m AMSL) | (+) = Upward<br>(-) = Downward |
| BH25-1 | 5032793 | 447061 | 11-Jun-25<br>3-Jul-25 | 8:18 AM<br>- | 6.3 | 6.4 | 63.9 | 3.3 | 70.2 | 70.3 | -0.1 | 3.3<br>3.4 | 3.2<br>3.3 | 67.0<br>66.9 | - |
| BH25-1A | 5032795 | 447058 | 11-Jun-25<br>3-Jul-25 | 8:05 AM<br>- | 3.1 | 3.1 | 67.2 | | 70.3 | 70.3 | 0.0 | -<br>- | DRY<br>DRY | -<br>- | |
| BH25-2 | 5032798 | 447109 | 11-Jun-25<br>3-Jul-25 | 9:32 AM<br>- | 9.2 | 9.3 | 61.3 | - | 70.5 | 70.6 | -0.1 | 3.8<br>3.8 | 3.7<br>3.7 | 66.8<br>66.8 | |

**Notes:**

(1) Vertical distance between the mid-point of the shallow and deep monitoring well screens.
(2) Vertical hydraulic gradient calculated based on the distance between the mid-point of the shallow and deep monitoring well screens.

m BGS = meters below ground surface
m BTOC = meters below top of casing
DRY = no groundwater or surface water was observed in the piezometer or watercourse, respectively
- = measurement not available

# TABLE E.3
# INFILTRATION POTENTIAL

| Testing Location ID | Horizontal Hydraulic Conductivity | Vertical Hydraulic Conductivity (2) | | Infiltration Rate (1) | Pit Depth | Screened Interval | Soil Substrate Tested |
|---|---|---|---|---|---|---|---|
| | (m/s) | (cm/s) | (m/s) | (mm/hr) | (m BGS) | (m BGS) | |
| **In-situ Hydraulic Response Testing** | | | | | | | |
| BH25-1 | 3.3E-04 | - | 3.3E-05 | 118 | - | 7.7 - 9.2 | Moderately weathered, very poor quality LIMESTONE (100%) |
| BH25-1A | - | - | - | - | - | 6.1 - 7.6 | Silty SAND with gravel FILL (100%) |
| BH25-2 | 3.5E-05 | - | 3.5E-06 | 65 | - | 9.1 - 10.6 | Slightly weathered, poor quality LIMESTONE (100%) |
| **Guelph Permeameter Testing (Stantec, 2024[3])** | | | | | | | |
| IT-No.1 | - | 7.5E-07 | 7.5E-08 | 23 | 0.30 | - | FILL (Silty Sand) |
| IT-No.2 | - | 8.4E-07 | 8.4E-08 | 24 | 0.40 | - | FILL (Silty Sand) |
| IT-No.3 | - | 2.0E-05 | 2.0E-06 | 103 | 0.45 | - | FILL (Silty Sand) |
| IT-No.4 | - | 1.1E-05 | 1.1E-06 | 58 | 0.30 | - | FILL (Silty Sand) |
| IT-No.5 | - | 1.1E-05 | 1.1E-06 | 95 | 0.30 | - | FILL (Silty Sand) |
| IT-No.6 | - | 9.2E-05 | 9.2E-06 | 84 | 0.25 | - | FILL (Silty Sand) |
| | | **Geomean (Fill) =** | **7.2E-07** | **42** | | | |
| | | **Geomean (Bedrock) =** | **1.1E-05** | **88** | | | |

**Notes:**

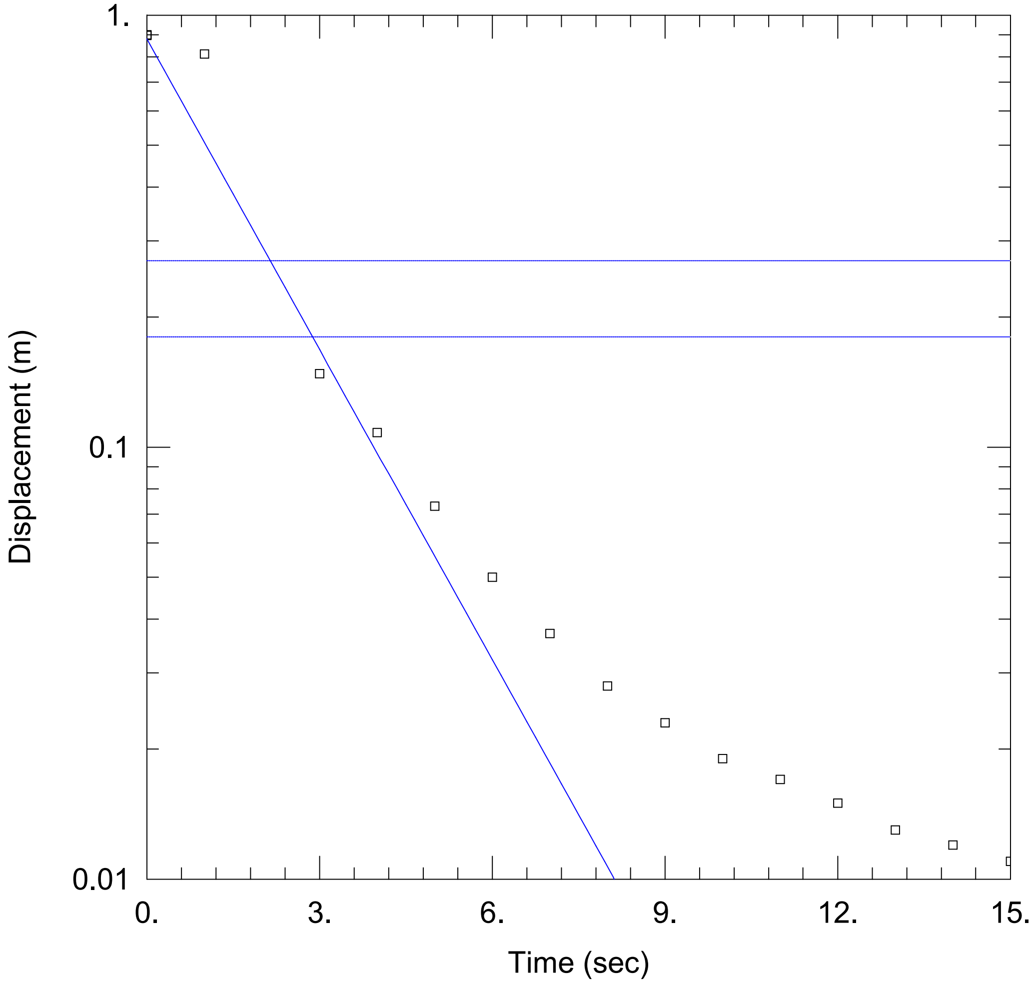
(1) Infiltration rate calculated based on established relationship between vertical hydraulic conductivity and infiltration rate presented in *Credit Valley Conservation and Toronto and Region Conservation (2010) Low Impact Stormwater Management Planning and Design Guideline - Version 1.0.*

(2) Vertical hydraulic conductivities assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities.

(3) Stantec Consulting Ltd. 2024. Geotechnical Investigation Report, Ashbury College, 362 Mariposa Avenue, Ottawa, Ontario. May 2024.

# Appendix F

## F.1 Hydraulic Conductivity Analytical Solutions



## BH25-01 - FALLING HEAD TEST

Data Set: \...\BH25-01 - Falling Head Test_ST_JK.aqt
Date: 07/16/25 Time: 14:05:16

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-01
Test Date: July 11, 2025

## AQUIFER DATA

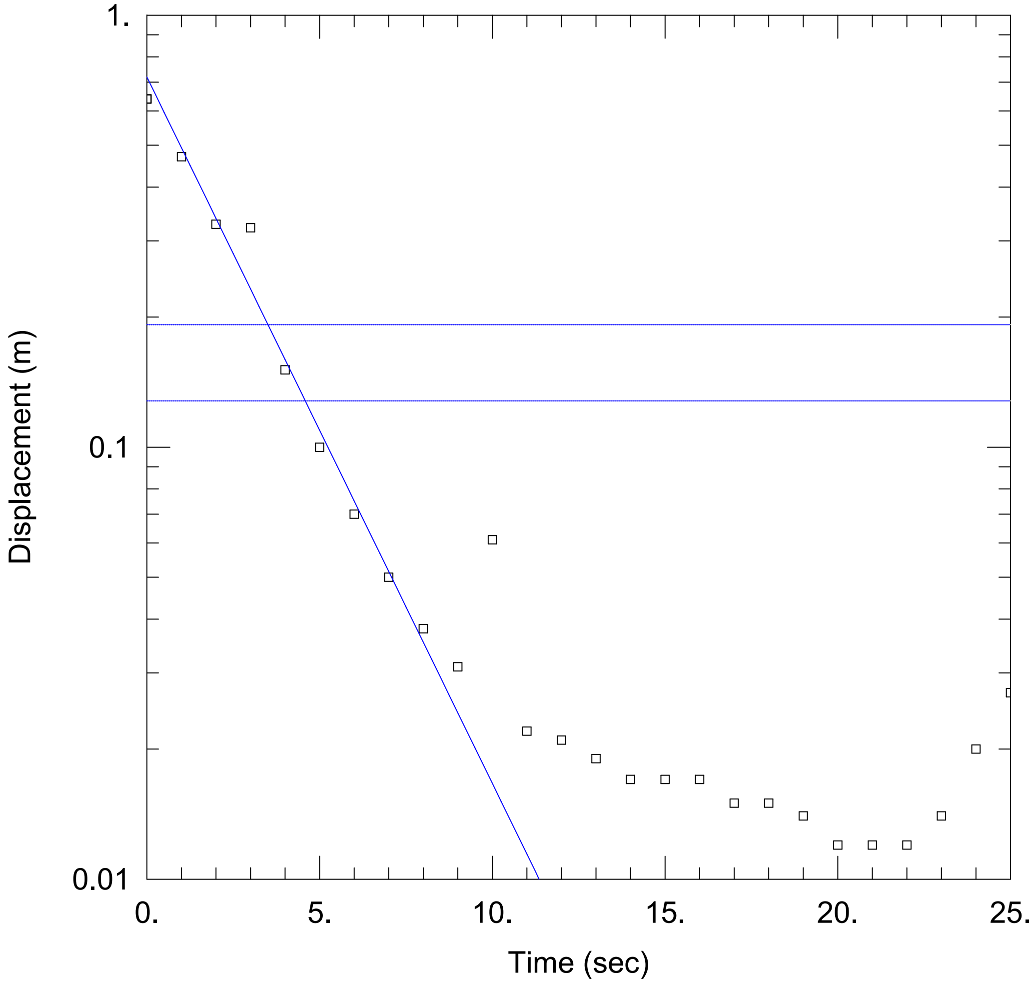
Saturated Thickness: 2.92 m
Anisotropy Ratio (Kz/Kr): 0.5

## WELL DATA (BH25-01)

Initial Displacement: 0.9 m
Total Well Penetration Depth: 2.92 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.92 m
Screen Length: 1.52 m
Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00041 m/sec
y0 = 0.8799 m



## BH25-01 - RISING HEAD TEST 2

Data Set: \...\BH25-01 - Rising Head Test 2_ST_JK.aqt
Date: 07/16/25 Time: 14:07:51

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-01
Test Date: July 11, 2025

## AQUIFER DATA

Saturated Thickness: 2.92 m
Anisotropy Ratio (Kz/Kr): 0.5

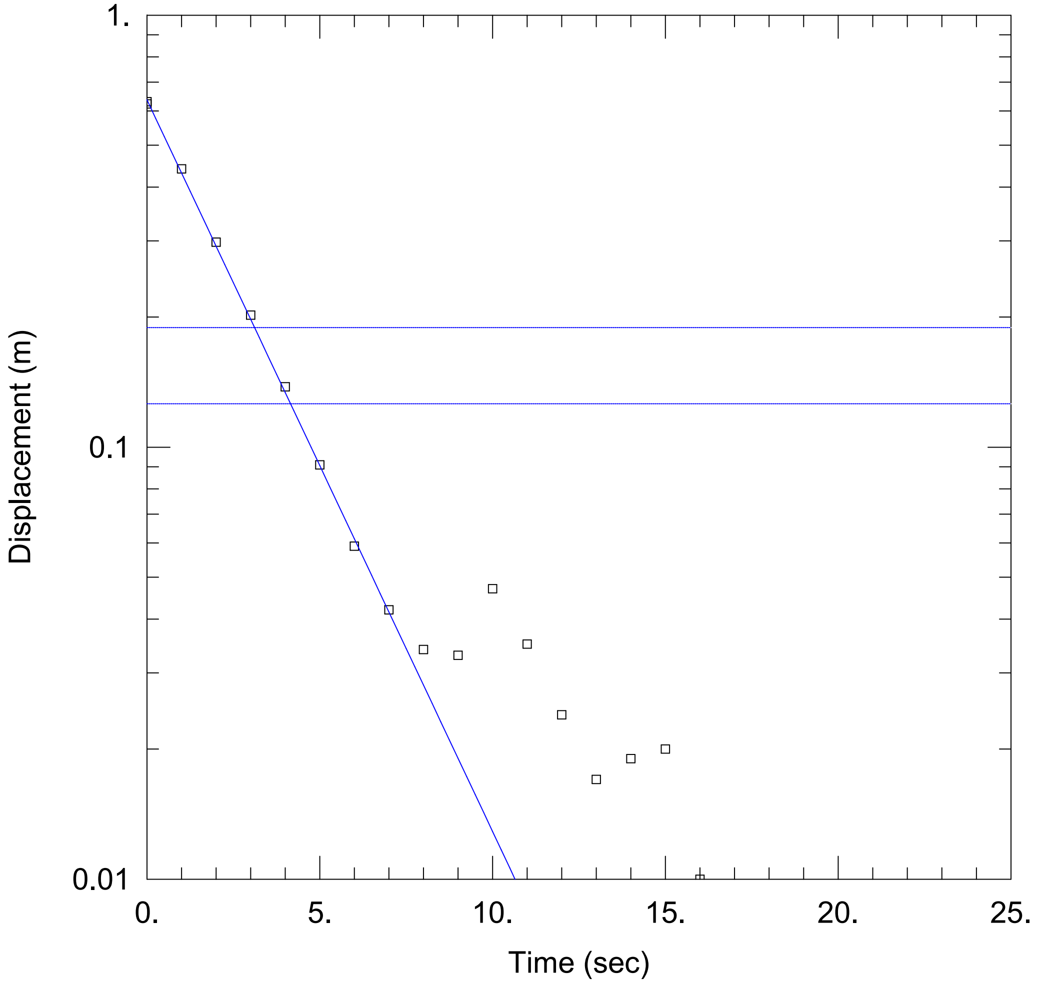
## WELL DATA (BH25-01)

Initial Displacement: 0.64 m
Total Well Penetration Depth: 2.92 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.92 m
Screen Length: 1.52 m
Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.00028 m/sec
y0 = 0.7187 m



## BH25-01 - RISING HEAD TEST 3

Data Set: \...\BH25-01 - Rising Head Test 3_ST_JK.aqt
Date: 07/16/25 Time: 14:10:05

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-01
Test Date: July 11, 2025

## AQUIFER DATA

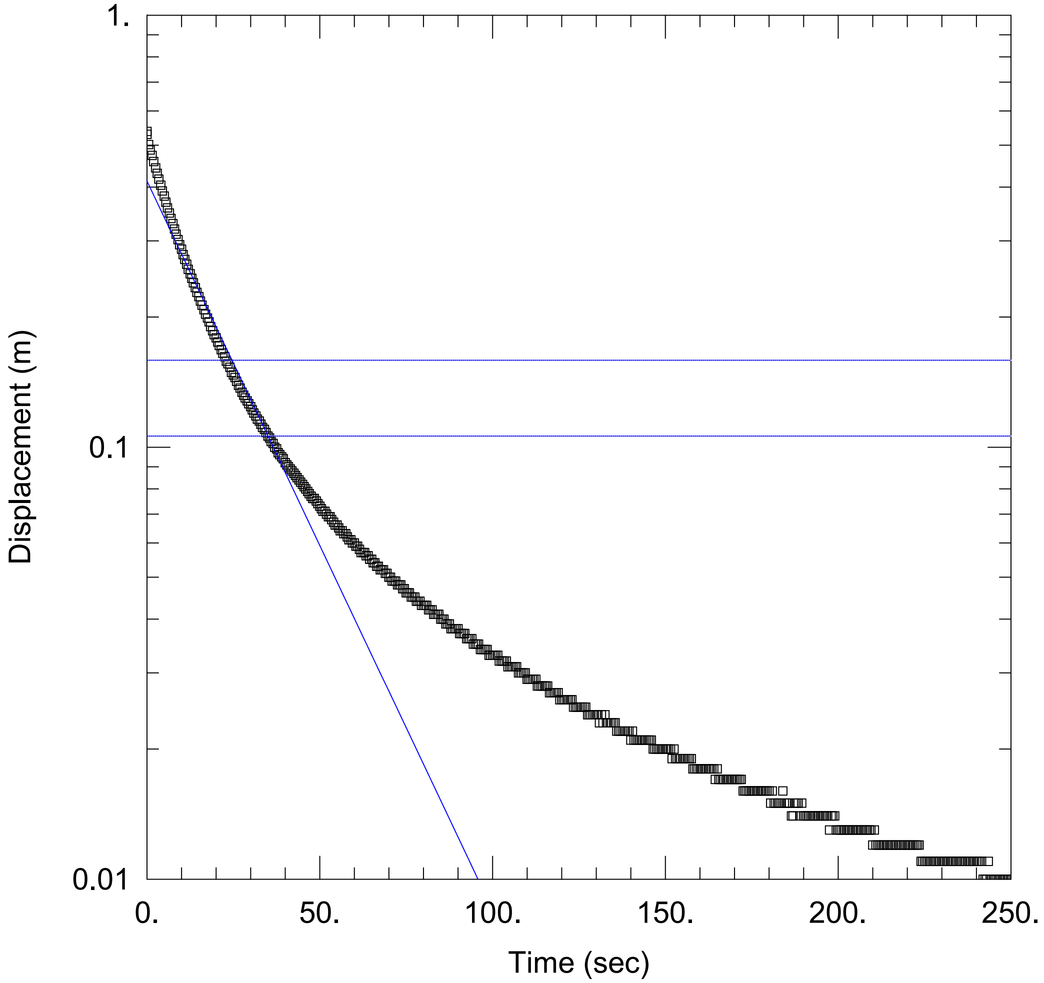
Saturated Thickness: 2.92 m
Anisotropy Ratio (Kz/Kr): 0.5

## WELL DATA (BH25-01)

Initial Displacement: 0.63 m
Static Water Column Height: 2.92 m
Total Well Penetration Depth: 2.92 m
Screen Length: 1.52 m
Casing Radius: 0.0254 m
Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00029 m/sec
y0 = 0.6365 m



## BH25-02 - FALLING HEAD TEST 1

Data Set: \...\BH25-02 - Falling Head Test 1_ST_JK.aqt
Date: 07/16/25 Time: 14:28:33

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-02
Test Date: July 11, 2025

## AQUIFER DATA

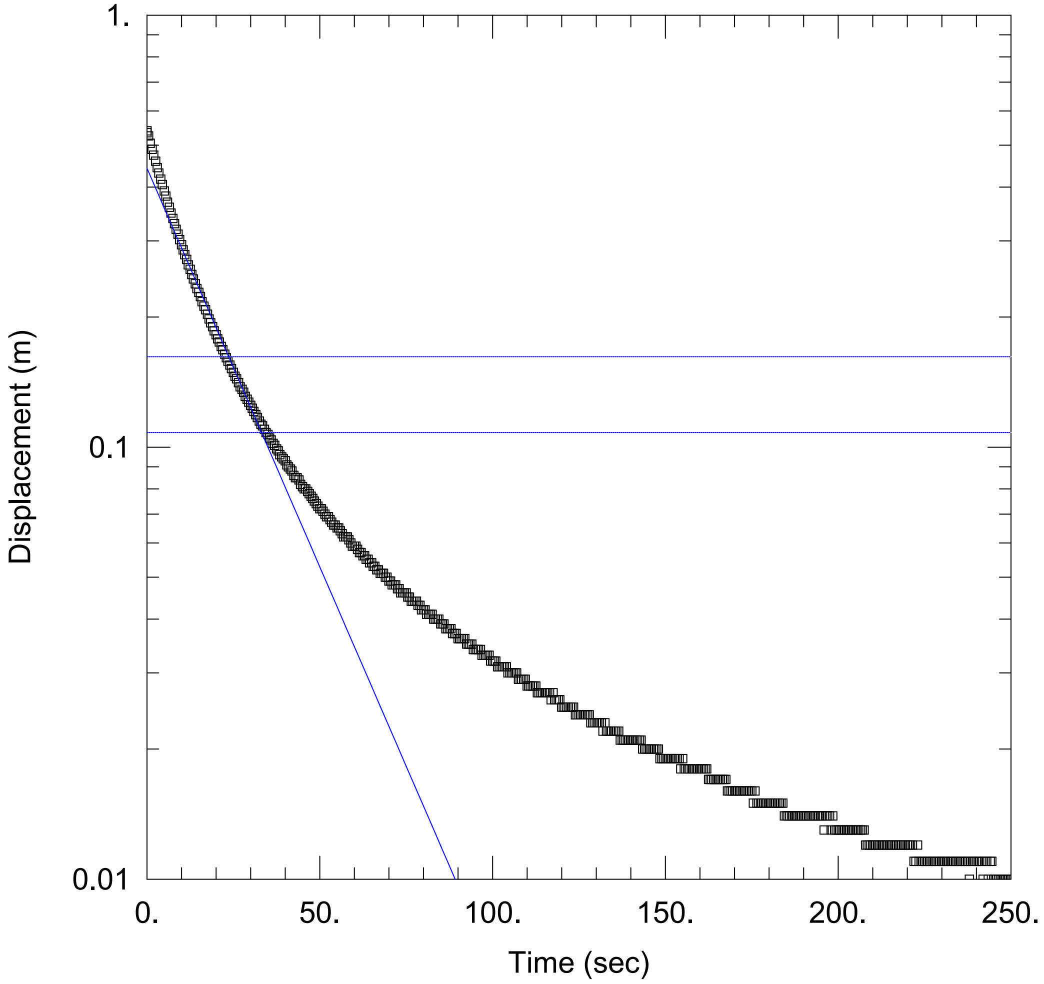
Saturated Thickness: 5.47 m
Anisotropy Ratio (Kz/Kr): 0.5

## WELL DATA (BH25-02)

Initial Displacement: 0.53 m
Static Water Column Height: 5.47 m
Total Well Penetration Depth: 5.47 m
Screen Length: 1.52 m
Casing Radius: 0.0254 m
Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.2E-5 m/sec
y0 = 0.4129 m



## BH25-02 - FALLING HEAD TEST 2

Data Set: \...\BH25-02 - Falling Head Test 2_ST_JK.aqt
Date: 07/16/25 Time: 14:40:04

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-02
Test Date: July 11, 2025

## AQUIFER DATA

Saturated Thickness: 5.47 m
Anisotropy Ratio (Kz/Kr): 0.5

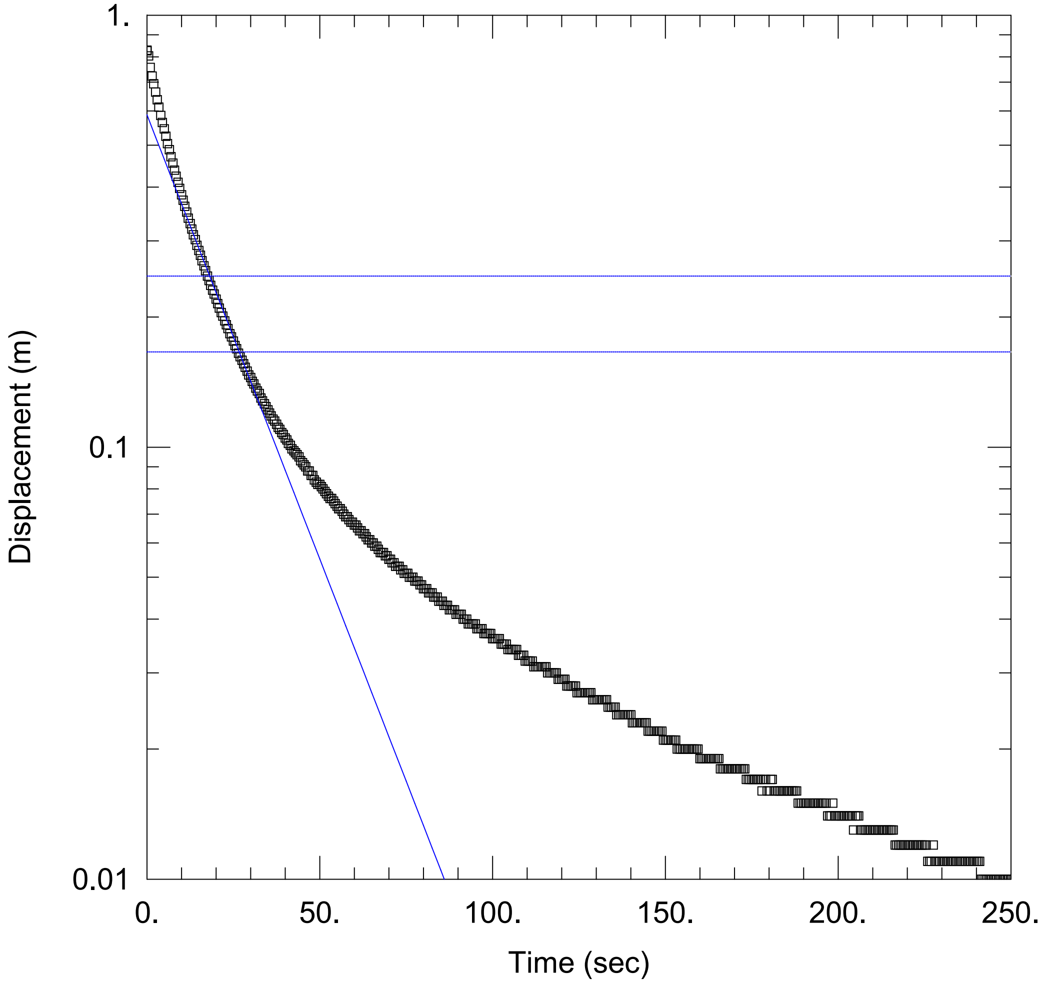
## WELL DATA (BH25-02)

Initial Displacement: 0.54 m
Static Water Column Height: 5.47 m
Total Well Penetration Depth: 5.47 m
Screen Length: 1.52 m
Casing Radius: 0.0254 m
Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 3.5E-5 m/sec
y0 = 0.4421 m



## BH25-02 - RISING HEAD TEST 1

Data Set: \...\BH25-02 - Rising Head Test 1_ST_JK.aqt
Date: 07/16/25 Time: 14:35:28

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-02
Test Date: July 11, 2025

## AQUIFER DATA

Saturated Thickness: 5.47 m
Anisotropy Ratio (Kz/Kr): 0.5

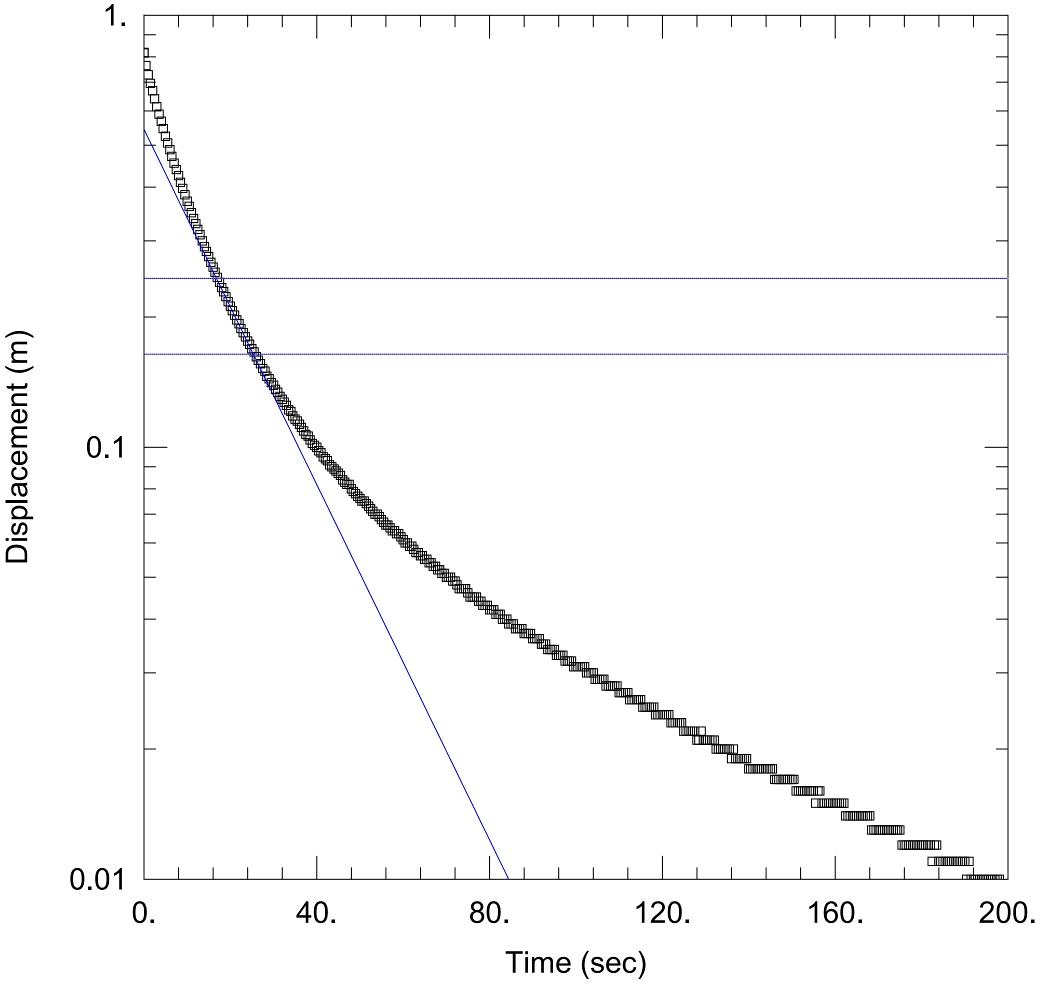
## WELL DATA (BH25-02)

Initial Displacement: 0.83 m
Static Water Column Height: 5.47 m
Total Well Penetration Depth: 5.47 m
Screen Length: 1.52 m
Casing Radius: 0.0254 m
Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 3.9E-5 m/sec
y0 = 0.5874 m



## BH25-02 - RISING HEAD TEST 2

Data Set: \...\BH25-02 - Rising Head Test 2_ST_JK.aqt
Date: 07/16/25 Time: 14:42:06

## PROJECT INFORMATION

Company: Stantec
Client: Ashbury College
Project: 116500966
Location: 362 Mariposa Avenue, Ottawa
Test Well: BH25-02
Test Date: July 11, 2025

## AQUIFER DATA

Saturated Thickness: 5.47 m Anisotropy Ratio (Kz/Kr): 0.5

## WELL DATA (BH25-02)

Initial Displacement: 0.82 m Static Water Column Height: 5.47 m
Total Well Penetration Depth: 5.47 m Screen Length: 1.52 m
Casing Radius: 0.0254 m Well Radius: 0.038 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.9E-5 m/sec y0 = 0.544 m