Final Geotechnical Investigation Report for Proposed Subdivision Development – Stroh Lands

Gerber Road, Wellesley, Ontario

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Strohvest Ontario Inc. (Client) to carry out a geotechnical investigation for the subject lands currently known as “Stroh Lands” (Site) located in the southwest end of Wellesley, Ontario. The proposed development is located on agriculturally used lands north of Gerber Road and west of existing residential lots fronting onto Lawrence Street.

The information provided in this report is specific to the scope of the investigation and the scope of the proposed development as discussed herein and should not be used for any application or purpose other than that stated herein. The scope of this report focuses on the geotechnical aspects of the project and does not include hydrogeological or environmental components. However, a hydrogeological investigation for the overall Site was carried out by Stantec in conjunction with this geotechnical investigation. The results of the hydrogeological investigation are provided under separate cover.

Use of this report is subject to the Statement of General Conditions provided in **Appendix A.**

2.0 SITE DESCRIPTION

2.1 LOCATION AND CURRENT LAND USE

The Site is situated in the southwest end of the village of Wellesley in the Township of Wellesley, Ontario, and is located north of Gerber Road and west of residential properties fronting onto Lawrence Street. The Site is bounded by a residential subdivision to the east, a residence to the north, agricultural lands to the west, and Gerber Road to the south.

The Site is agriculturally used and vacant. The Site topography can be described as relatively flat with gentle undulating rolling hill features. Based on Grand River Conservation Authority topography mapping, the ground surface is highest in the northern portion of the Site near elevation 363 m above mean sea level (AMSL) and slopes down toward Gerber Road in the south near elevation 353 m AMSL. The overall grade change is about 10 m.

3.0 PROPOSED DEVELOPMENT

3.1 OVERVIEW

Based on available conceptual drawings, the Site will be developed for construction of a Stormwater Management (SWM) facility fronting Gerber Street and residential homes and townhouse blocks for the remainder of the Site. It is understood that the development will be serviced by sanitary sewers, storm sewers, and municipal water supply. The development will be accessible by internal roadways connecting to Gerber Road in the south and/or Lawrence Street in the east.

It should be noted that only limited design information was available at the time of this report. No finalized design information such as finished grade elevations, finalized location of building footprints, underside of footing elevations, or servicing details were available at the time of this report.

4.0 REGIONAL GEOLOGY

The Surficial Geology of Southern Ontario data set (Ontario Geological Survey, Miscellaneous Release - Data 128 Revised, 2003) indicates glacial till deposits for the Site, including stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain for the northern and central portions of the Site and clay to silt-textured till for the southern portion of the Site.

Bedrock below the Site is expected near Elevation 300 m AMSL, approximately 50 m to 60 m below current grades (Ministry of Northern Development and Mines, Map P3211, Bedrock Topography of the Stratford Area, 1993).

The Paleozoic Geology of Southern Ontario (Ontario Geological Survey, Miscellaneous Release - Data 219, 2007) indicates that the bedrock underlying the project Site is comprised of limestone and dolostone of the Bois Blanc Formation.

5.0 METHOD OF INVESTIGATION

5.1 FIELD INVESTIGATION

Prior to commencing the field investigation, the various public utility companies were consulted to identify where public utilities crossed the property boundaries. In addition, a private locator was contracted to clear the boreholes of any private on-site services.

The fieldwork for the investigation was carried out on May 5 and 6, 2021. A total of eight (8) boreholes were advanced as part of the geotechnical and hydrogeological scope (BH/MW01-21 to BH/MW06-21 and BH07-21 and BH08-21). The boreholes were advanced to depths between 5.2 m and 6.7 m below ground surface (m BGS). The borehole locations are shown on the Borehole Location Plan, Drawing 1 in **Appendix B**.

The boreholes were advanced using a CME 55 track mounted drill rig equipped with hollow-stem augers operated by a Geo-Environmental Drilling Inc., a specialist drilling subcontractor. Stantec personnel recorded the subsoil and groundwater conditions encountered in the boreholes. The soil samples were recovered at regular 0.76 m and 1.52 m intervals using a 51 mm (outside diameter) split-tube sampler by conducting Standard Penetration Tests (SPTs) in accordance with the procedures outlined in ASTM specification D1586. Handheld pocket penetrometer tests were completed in the field on selected cohesive soil samples.

Soil sample descriptions were recorded for the soil recovered during split spoon sampling. The soil descriptions, SPT N-values, and results of pocket penetrometer testing are provided on the attached borehole logs.

All soil samples recovered from the boreholes were placed in moisture-proof bags and returned to our laboratory for detailed geotechnical classification.

Six (6) groundwater monitoring wells were installed at boreholes BH/MW01-21 to BH/MW06-21 and the water level was measured by Stantec personnel on June 15, 2021. The monitoring wells consisted of 50 mm inside diameter, Schedule 40 PVC pipe, with a No. 10 slot screen (0.01-inch slot) and screen length of 3.1 m. The annular space between the monitoring well screen and surrounding geological formation was backfilled with well sand to 0.3 m above the top of screen, with the remainder of the annular space being filled with a granular bentonite to prevent a hydraulic connection from occurring between the soil layers along the length of the casing. Pedestal covers were installed for the wells and concreted into place.

Well records were prepared and submitted to the Ministry of the Environment, Conservation and Parks by the drilling subcontractor. The wells must be properly decommissioned by a licensed well driller prior to or during construction.

The boreholes without monitoring wells were backfilled with a low-permeability mixture of granular bentonite in accordance with the requirements of Ontario Regulation 903 as amended under the Ontario Water Resources Act.

5.2 BOREHOLE LOCATION AND ELEVATION SURVEY

The coordinates and elevations collected by Stantec's Geomatics division are provided in Table 5.1 below.

Table 5.1: Borehole Elevations and Coordinates

Borehole Number	Elevation (m AMSL)	UTM Coordinates	
		Easting (UTM)	Northing (UTM)
BH/MW01-21	356.7	518277	4812989
BH/MW02-21	361.1	518320	4813350
BH/MW03-21	360.2	518382	4813763
BH/MW04-21	355.6	518544	4813019
BH/MW05-21	362.0	518547	4813323
BH/MW06-21	362.3	518561	4813624
BH 07-21	356.1	518415	4813170
BH 08-21	361.5	518466	4813437

The borehole locations are shown on the Borehole Location Plan Drawing No. 1 in **Appendix B**.

5.3 GEOTECHNICAL LABORATORY TESTING PROGRAM

All samples recovered from the geotechnical investigation were returned to Stantec's geotechnical and materials testing laboratory and were visually examined by a geotechnical specialist. Geotechnical Laboratory testing was completed by Englobe Corp.

The scope of the geotechnical laboratory testing program is outlined below in Table 5.2.

Table 5.2: Geotechnical Laboratory Testing Program

Laboratory Test	Number of Samples Tested
ASTM D2216-10 – Natural Moisture Content	39
ASTM D422-63 (2007) – Grain Size Distribution with Hydrometer	3
ASTM D4318-10 – Atterberg Limits	2

The results of the laboratory tests are discussed in the text of this report. The results of the moisture content tests are shown on the Borehole Records in **Appendix C**. The results of the grain size distribution tests and Atterberg Limits tests are reported on the borehole records and are illustrated on the Figures 1 through 3 in **Appendix D**.

Samples remaining after testing will be placed in storage for a period of three months after issue of this geotechnical report. After the storage period, the samples will be discarded.

6.0 RESULTS OF INVESTIGATION

6.1 SUBSURFACE CONDITIONS

6.1.1 Overview

In general, the soil conditions contacted at the Site consisted of surficial fill and/or topsoil underlain by predominantly glacial tills. Non-cohesive sands and silts were generally found in boreholes advanced in the north and central eastern portions of the Site. Occasional cobbles and boulders were noted within the glacial till deposits. Groundwater levels were measured on June 15, 2021 at 1.4 m BGS to 3.2 m BGS.

Bedrock was not encountered at the boreholes advanced for this investigation. Based on available bedrock mapping and data of the area, bedrock is anticipated at approximate depths of 50 m to 60 m below the project Site.

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

The stratigraphic boundaries shown on the logs are inferred from non-continuous sampling and should be considered approximate only. Variations to the conditions reported and discussed herein must be anticipated.

6.2 SOIL STRATIGRAPHY

The following sections summarize the soil strata encountered in all boreholes completed for the current investigation.

6.2.1 Fill

Fill was contacted at boreholes BH/MW01-21 to BH/MW04-21, BH/MW06-21, and BH07-21 to depths of 0.3 m BGS to 1.2 m BGS. The fill generally consisted of 100 mm to 460 mm topsoil fill underlain by silty sand fill to clay till fill. Nil to some gravel was noted within the fill. Some topsoil inclusions were noted within the fill at borehole BH07-21. At the time of drilling the fill was described as variable moist to saturated. Laboratory determined moisture contents ranged from 21% to 26%. SPT N-values of 3 to 8 blows per 300 mm were recorded for the fill materials.

6.2.2 Topsoil

Topsoil was noted at ground surface at boreholes BH/MW05-21 and BH08-21 and extended to depths of 250 mm and 300 mm. 1.2 m of buried topsoil was noted at borehole BH/MW01-21 underlying the fill and extending to 1.5 m BGS. The topsoil consisted of sandy silt and was described as moist to wet. SPT N-values of 8 and 10 blows per 300 mm were recorded. Laboratory determined moisture content of 26% was reported.

6.2.3 Clay (CL) Till, Clay with Sand (CL) Till, Clayey Silt (CL-ML) Till, Silt (ML) Till

Except for the northern and central-eastern portions of the project Site (i.e., boreholes BH/MW03-21 and BH/MW05-21), glacial till deposits were the predominant soils contacted at the Site. The glacial till ranged in composition from non-cohesive sandy silt (ML) till to cohesive clay (CL) till. The non-cohesive silt (ML) till generally contained trace to some clay, variable sand content (trace sand to sandy), and trace to some gravel. The cohesive clay (CL) till generally contained variable silt content (trace silt to silty) and trace to some sand and gravel. The cohesive clayey silt (CL-ML) till contained nil to some sand and gravel. Occasional cobbles and boulders were noted within the glacial till deposits. Layers and seams of sand, silt, and sand and gravel were noted within the till deposits at variable depths.

The results of two (2) grain size analysis tests completed on samples of the clay till are shown below in Table 6.1, and illustrated on Figures 1 and 3, provided in **Appendix D**.

Table 6.1: Grain Size Distribution – Clay (CL) Till and Clay with Sand (CL) Till

Borehole	Sample	Median Depth (m BGS)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH/MW01-21	SS4	2.6	Clay (CL) Till	2	8	55	35
BH/MW05-21	SS2	1.1	Clay with Sand (CL) Till	5	20	51	24

The results of two (2) Atterberg limits tests completed on samples of the clay till are shown below in Table 6.2 and included on Figures No. 1 to 3 in **Appendix D**.

Table 6.2: Atterberg Limits Test Results – Clay (CL) Till and Clay with Sand (CL) Till

Borehole	Sample	Median Depth (m BGS)	Description	Liquid Limit	Plastic Limit	Plasticity Index	Moisture Content (%)
BH/MW01-21	SS4	2.6	Clay (CL) Till	29	15	14	16
BH/MW05-21	SS2	1.1	Clay with Sand (CL) Till	22	14	8	--

The grain size distribution and Atterberg Limits test results show that the tested soils would be classified as clay (CL) and clay with sand (CL) according to the Unified Soil Classification System (USCS). Based on the Atterberg Limits test and moisture content test results (12% to 27%), the clay till was assessed to vary from drier than the plastic limit to wetter than the plastic limit, predominantly drier than plastic limit to about plastic limit. The non-cohesive silt till was described as moist to wet with laboratory obtained moisture contents of 10% and 16%.

SPT N-values in the cohesive glacial till ranged from 9 to 44 blows per 300 mm, and pocket penetrometer testing indicated approximate undrained shear strengths of 75 to greater than 200 kPa. Based on this, the cohesive till deposits have a stiff to hard consistency, predominantly very stiff to hard. SPT N-values in the non-cohesive silt till of 8 to 23 blows per 300 mm indicated a loose to compact relative density.

6.2.4 Silty Sand (SM), Sandy Silt (ML), Silt (ML)

Deposits of silty sand (SM), sandy silt (ML), and silt (ML) were predominantly contacted in the northern and central-eastern portions of the project Site at boreholes BH/MW03-21 and BH/MW05-21, as well as interlayered with the predominant glacial till deposits.

SPT N-values ranging from 9 to greater than 50 blows per 300 mm indicate a variable loose to very dense relative density, with most of the blow counts indicating a compact to very dense relative density.

The sandy silt, silty sand, and silt layers/deposits were described as variable moist to wet and laboratory determined moisture content tests ranged from 11% to 35%. Wet portions of the silt were described as slightly dilatant.

One particle size distribution analysis was completed on a representative sample of the silt and the results are summarized in Table 6.3 and illustrated on Figure 2, in **Appendix D.**

Table 6.3: Grain Size Distribution – Silt (ML)

Borehole	Sample	Median Depth (m BGS)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH/MW03-21	SS4	2.6	Silt (ML)	0	2	91	7

6.3 GROUNDWATER CONDITIONS

Wet to saturated layers/deposits were noted at depths of 0.8 m BGS to 1.5 m BGS at boreholes BH/MW01-21 to BH/MW03-21, BH/MW06-21, and BH/MW07-21 and at variable depths interlayered with the glacial till deposits at boreholes BH/MW04-21 and BH/MW05-21. Seasonal perched conditions should be expected within loose layers, fill materials, as well as within soils overlying less permeable deposits.

Groundwater monitoring wells were installed in six of the boreholes to record the groundwater conditions. The groundwater levels were measured by Stantec personnel on June 15, 2021 and the results are summarized in Table 6.4.

Table 6.4: Groundwater Levels – June 15, 2021

Borehole	Ground Surface Elevation (m AMSL)	Depth to Groundwater Below Ground Surface (m BGS)	Groundwater Elevation (m AMSL)
BH/MW01-21	356.7	1.8	354.9
BH/MW02-21	361.1	2.4	358.7
BH/MW03-21	360.2	1.5	358.7
BH/MW04-21	355.6	2.1	353.5
BH/MW05-21	362.0	1.4	360.6
BH/MW06-21	362.3	3.2	359.0

Fluctuations in the groundwater levels should be anticipated throughout the various seasons. The hydrogeological report issued under separate cover should be referred to for additional groundwater and hydrogeological related information, including more recent groundwater level measurements.

7.0 DESIGN DISCUSSION & RECOMMENDATIONS

It should be noted that only limited design information was available at the time of this report. No finalized design information such as finished grade elevations, finalized location of building footprints, underside of footing elevations, or servicing details were available at the time of this report.

It is understood that the development may comprise a SWM facility fronting Gerber Street and residential homes and townhouse blocks with internal roadways for the remainder of the Site. It is understood that the development will be serviced by sanitary sewers, storm sewers, and municipal water supply. The development will be accessible by internal roadways connecting to Gerber Road in the south and/or Lawrence Street in the east.

Fill and topsoil contacted surficially extended to depths of 0.3 m BGS to 1.5 m BGS at the borehole locations. The native soils underlying the fill and topsoil predominantly consisted of stiff to hard / loose to compact glacial tills. Loose to very dense sand and silt deposits were contacted in the northern and central eastern portions of the Site. Cobbles and boulders should be expected within the glacial till deposits at the project Site.

Stabilized groundwater was measured at 1.4 m BGS to 3.2 m BGS in the monitoring wells installed as part of this investigation, equivalent to Elevations 353.5 m AMSL to 360.6 m AMSL.

7.1 GEOTECHNICAL CONSIDERATIONS AND CONSTRAINTS

The following general development considerations and constraints are provided with respect to observations made during the current investigation, the subsurface conditions encountered, and the intended scope of development:

- Fill was contacted at boreholes BH/MW01-21 to BH/MW04-21, BH/MW06-21, and BH07-21 to depths of 0.3 m BGS to 1.2 m BGS. Some topsoil inclusions were noted within the fill at borehole BH07-21. The fill is not considered suitable to remain below buildings, site services, or paved areas; but, may be suitable to remain below landscaped areas, subject to additional inspection at the time of construction. The portion of the fill material that is free of organic material is likely suitable for re-use as engineered fill or subgrade fill. Portions of the fill that are wet or saturated will require drying prior to re-use. Further, portions of the existing fill may not be suitable for reuse onsite and may have to be removed for off-site disposal;
- The topsoil thickness varied from 250 m to 300 mm. 1.2 m of buried topsoil was noted at borehole BH/MW01-21 to a depth 1.5 m BGS. This buried topsoil will require subexcavation;
- Following stripping of fill and topsoil, the exposed native mineral soils on the Site will typically be suitable to support fill to raise grades. Locally, some subexcavation of native mineral soils may be required in the area of boreholes BH/MW03-21 and BH07-21 where loose conditions were encountered to depths of 1.5 m BGS. Geotextile or an initial thick lift of imported Granular 'B' may be required in the area of wet subgrade to accommodate fill placement;
- The native soils from above the water table are generally considered suitable for reuse as engineered fill or subgrade fill for paved areas; however, depending on the moisture content and the time of year construction is completed, moisture conditioning of the soils may be required prior to reuse. Further, the high silt and clay content of the native soils could make it difficult to conduct fill placement operations in wet or cold weather, particularly for the glacial till. Particles greater than 150 mm must be sorted out of native soils intended for re-use on-site;
- Groundwater occurs at depths of 1.4 m BGS to 3.2 m BGS (Elevation 353.5 m AMSL to 360.6 m AMSL). There is potential for localized perched groundwater at shallower depths. Groundwater dewatering may be required as part of the site preparation stage and possibly during the construction of site services. Excavations for sewers and watermains constructed to conventional depths are expected to encounter groundwater inflow in areas of the site; however, since final grades will likely be different than existing, and the servicing has not been designed, the areas where groundwater inflow are likely to be encountered is not know at this time. Where encountered, groundwater inflow may range from minor (glacial till) to moderate to high (sand) depending on the depth of excavation below groundwater table and the soil type encountered;
- The undisturbed native mineral soils, or engineered fill placed as recommended in this report, will generally be suitable to support conventional foundations;
- The predominant cohesive soil conditions (clayey silt and clay till) will generally be suitable for at-source infiltration of precipitation; however, due to the high silt content lower infiltration rates should be expected. Higher infiltration rates would be expected for the non-cohesive sands and silts contacted in the northern and central eastern portion of the Site; however, this would depend on the soils exposed, at the bottom of the infiltration facilities as well as depth to groundwater. Reference is made to the hydrogeological investigation report being prepared by Stantec under separate cover for additional commentary on infiltration rates; and,
- Additional geotechnical investigation is recommended to support final design, including foundation design, for any commercial blocks or apartment buildings.

Additional geotechnical comments, discussion, and recommendations are provided in the following sections with respect to the design and construction of the planned Site development.

7.2 GRADING AND EARTHWORKS

7.2.1 General

Site grading details were not available at the time of this report; however, it is anticipated that area grading activities will be undertaken at the Site to prepare the lands for the proposed development, including cutting material from higher areas and placing it as fill in lower lying areas.

The program for grading and earthworks should be designed in advance, and carefully executed in consideration of the time of year of execution, prevailing weather conditions, construction stormwater management control, and associated issues and concerns, and the intended end-use of the subject property as described herein.

All fill materials imported to the subdivision must meet all applicable municipal, provincial, and federal guidelines and requirements associated with environmental characterization of the materials.

7.2.2 Erosion & Sediment Control and Regulatory Constraints

An erosion and sediment control plan should be developed and implemented prior to commencement of construction, to direct precipitation and ground surface runoff away from the areas of construction. Identification of an outfall/discharge location will be required for this purpose. All erosion sedimentation control should be conducted in accordance to the approved for construction design drawings.

7.2.3 Sub-Excavation and Proof Rolling

Fill was contacted at boreholes BH/MW01-21 to BH/MW04-21, BH/MW06-21, and BH07-21 to depths of 0.3 m BGS and 1.5 m BGS. Topsoil contacted at boreholes BH/MW05-21 and BH08-21 was 250 mm and 300 mm thick. 1.2 m of buried topsoil was noted at borehole BH/MW01-21.

All topsoil, organics, and pre-existing fill must be removed (i.e., stripped) prior to fill placement. Following stripping, the subgrade in areas of proposed fill is to be inspected by geotechnical personnel to ensure that all unsuitable materials are removed. There is potential that loose soils identified during site preparation or during general construction activities may also need to be removed and replaced with approved Engineered Fill, as referenced below. Loose soils were noted at boreholes BH/MW03-21 and BH07-21 to depths of 1.5 m BGS. These loose soil zones may need to be removed from below proposed structures; however, this should be confirmed during final design.

Excavation in the native mineral soils should be straight forward using large tracked excavating equipment, or motor scrapers. Further comments with respect to reuse of the on-site soils are provided Section 7.6.

The exposed subgrade surface should be proof rolled and compacted across the entire area of the planned development. The proof rolling program should be undertaken using large, non-vibratory compaction equipment having a minimum static weight of 10 tonnes. This will provide a uniform, compact surface that will minimize the potential for infiltration of precipitation and ground surface runoff and promote overland drainage at the ground surface. The proof rolling program should consist of a minimum of five passes per unit area to provide a uniform surface for construction. Vibratory compaction is not recommended for silty soils, due to the potential for subgrade pumping that could occur if perched groundwater is present near the surface.

Relatively shallow groundwater conditions below existing grades should be expected at the Site (i.e., generally at depths of 1.4 m BGS to 2.4 m BGS at borehole BH/MW01-21 to BH/MW05-21). Temporary construction dewatering may be required as part of the site grading activities depending on the proposed grades and groundwater conditions contacted at the time of construction. Where required, the soils will need to be dewatered prior to any excavation work. Dewatering must be maintained during construction to a depth sufficient to prevent disturbing (piping/boiling) of the founding subgrade, using sump pumps and/or positive dewatering. It is further recommended that the site preparation is done during the drier months of the year.

7.2.4 Engineered Fill Placement

Prior to engineered fill placement under proposed buildings areas, the subgrade soils must be prepared as described in the preceding section 7.2.3. The engineered fill pad must extend horizontally 1 m beyond the edge of proposed footings, and then downwards and outwards at a slope of 1 horizontal to 1 vertical to competent soil. Geotechnical comments with respect to excavations are provided in Section 7.3.2.

Subsequent to completing the stripping and removal of topsoil and fill materials, the exposed native subgrade surfaces are expected to consist primarily of glacial tills (clay till and clayey silt till) as well as sands and/or silts in the northern and central eastern portions of the Site. The exposed subgrade surface should be inspected to confirm the removal of any deleterious materials, organics, or loose/soft materials or wet zones. Where such materials are identified, they should be removed, and the areas backfilled with engineered fill.

The native soils will be suitable for use as engineered fill, but typically have a variable low to high moisture content. Depending on the moisture contents at the time of construction, drying of these native soils may be required prior to reuse on-site. If work is carried out in dry weather then water may have to be added to aid in compaction of sandy soils. Cobbles or boulders should be separated from the soils considered for reuse. There is potential that some of the subexcavated existing fill may be suitable for re-use as engineered fill or as subgrade fill; and, we refer to Section 7.6.2 of this report for further discussion on this topic.

If additional imported fill materials are required for raising the grade on site, it is recommended that granular materials or materials with characteristics similar to the native soils on site (as described in this report) be imported for this purpose. Additional details with respect to materials recommended for use during periods of poor weather conditions are discussed below. Imported Granular 'B' (recommended) or OPSS SSM are recommended for use as engineered fill below buildings. Other soil types may also be suitable but must be tested and confirmed as acceptable by a geotechnical engineer prior to being imported to site.

Where wet soils and/or soils with low internal strength are exposed at the subgrade level, placement of a woven geotextile followed by placement of imported granular soils such as OPSS.MUNI 1010 Granular B could be considered to create a stable working base for additional fill placement using on-site soils. Additional details can be provided once grading plans become available.

The on-site silt and clay soils should be placed in 150 mm thick loose lifts, and compacted using a large pad foot roller to ensure proper break-down of any blocky clay lumps. Imported granular soils may be placed using a loose lift thickness of 300 mm. Greater lift thicknesses of granular soils may be permitted in areas of wet soils and/or low internal strength following approval by a geotechnical engineer. Each lift should be uniformly compacted to achieve a minimum of 98% of the material's Standard Proctor Maximum Dry Density (SPMDD).

Engineered fill will need to be benched into any native slopes steeper than 3 horizontal to 1 vertical. The benching should be excavated with heights matching the engineered fill lift thickness.

7.2.5 Subgrade Fill Placement

Subgrade fill placement will also be required to raise grades under proposed roads and paved areas. The preparations of the subgrade prior to subgrade fill placement should be the same as for the engineered fill.

Any fill placed in paved areas should be placed in 150 mm (on-site silt and clay soils) or 300 mm (imported granular soils) thick loose lifts compacted to 98% SPMDD within the upper 1 m of the subgrade immediately below the pavement structure. Subgrade fill placed below 1 m of the pavement structure should be compacted to at least 95% SPMDD.

7.2.6 Adverse Weather Construction

Additional precautions, effort, and measures may be required, when and where construction is undertaken during late fall, winter, and early spring when the temperature and climatic conditions 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 construction conditions may prevail, the following comments are provided:

1. Engineered fill under the buildings should comprise granular materials, such as imported sand or sand and gravel, Granular 'B' or OPSS SSM;
2. The intended area of fill should be clearly identified in the field prior to commencing the work;

3. Temporary ramps or roads for construction access must be constructed outside of the limits of intended fill;
4. 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;
5. Imported materials that contain ice, snow, or any frozen material should not be accepted for use.
6. 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 must be removed prior to placing subsequent lifts of engineered fill. Breaking the frost in-situ is not considered acceptable; and,
7. It may be necessary to stop the placement of engineered fill during periods of cold, where ambient temperatures of -5°C or less, occur.

It should be noted that the placement of engineered fill materials during cold weather conditions requires extra effort beyond that typical when better climatic conditions prevail. At any time where conditions are deemed unfavourable, the engineered fill operation must be suspended. Any frost accumulating in placed fill must be removed prior to re-starting fill operations.

Appropriate scheduling of the work may also require specific consideration and revision from the typical adopted. The scope of work intended may have to be reduced or adjusted, and/or only select construction activities are undertaken during specific climatic conditions. The areas of planned engineered fill may have to be reduced on a daily basis, the extent of excavations may have to be limited, with all excavating and associated backfilling completed without delay.

7.3 SERVICING

7.3.1 General Servicing Overview

Following grading, the subdivision will be serviced to provide water and sewer services to the various lots and blocks. No servicing details were available at the time of this report preparation; however, proposed services are anticipated at conventional depths of up to 3 or 4 m below finished grade throughout the majority of the Site.

The predominant soils expected to be encountered during servicing are glacial tills (clay till, clayey silt till, silt till) in the majority of the Site as well as non-cohesive sands and silts in the northern and central eastern portions of the Site. Seams and layers of sand and gravel, sand, and/or silt should be expected within the predominant glacial tills. Stabilized groundwater was measured at 1.4 m BGS to 3.2 m BGS in the monitoring wells installed as part of this investigation, equivalent to Elevations 353.5 m AMSL to 360.6 m AMSL.

It is noted that groundwater levels have not yet been taken during the Spring, when levels are typically highest; however, based on the soil and groundwater conditions encountered during this investigation, saturated seams and layers within the glacial till can be expected to be encountered within the majority of the Site. Deposits of saturated sand and/or silt should be expected within the northern and central eastern portion of the Site.

It is recommended that Stantec review the proposed servicing plans once available to review the recommendations made as well as provide recommendations for seepage collars.

7.3.2 Excavations

Temporary excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA).

The predominant cohesive glacial till soils (clay till and clayey silt till) encountered in the boreholes can be classified as a Type 2 soil. The maximum excavation side slope for a Type 2 soil is 1:1 (Horizontal: Vertical) and a 1.2 m vertical cut extending from the base of the excavation is permitted, in accordance with the OH&S Act.

Where the native clay till soils are excavated below the water table, these soils can be considered Type 3 soils. The native non-cohesive silt tills, sands and/or silts or fill materials would be classified as a Type 3 soil. The excavation side slopes for a Type 3 soil must be sloped at a maximum inclination of 1:1 (Horizontal: Vertical) from the base of excavation in accordance with the OH&S Act.

Any excavations that extend into very loose soils or below the groundwater level and exhibit seepage should be classified as Type 4 soil. The maximum excavation side slope for a Type 4 soil is 3:1 (Horizontal: Vertical) in accordance with the OH&S Act.

Where an excavation contains more than one soil type, the soil shall be classified as the type with the highest number exposed in the excavation.

The side slopes of the excavations should be protected from exposure to precipitation and associated ground surface runoff, to prevent further softening and loss of strength of native soils and fill materials placed during the area grading activities that could lead to additional sloughing and caving.

Some sloughing and caving must be anticipated for excavations in silts and/or sands, particularly where excess moisture (precipitation, ground surface runoff, and/or presence of groundwater table) is present. Where sloughing and cave-in are encountered in the excavation, the slopes should be flattened to achieve a stable configuration.

If space is restricted such that the side slopes cannot be safely cut back in accordance with the OH&S Act, temporary shoring must be provided.

The potential for the presence of saturated seams should be expected in the predominant glacial till. Free groundwater should be expected within the sands and silts contacted in the northern and central eastern portions of the Site. Any localized seepage encountered during the proposed construction should be handled by pumping from sumps using conventional submersible pumps provided the excavations remain open for a short period of time, less than 48 hours.

Excavations more than 0.5 m below the groundwater table in sand or silt deposits will likely require a designed dewatering system.

7.3.3 Bedding

Bedding for services should consist of OPSS Granular ‘A’ material. In general, a minimum of 150 mm of bedding and 300 mm of cover material is recommended. The portion of bedding below the pipe may comprise clear stone in place of Granular ‘A’ if needed for groundwater control provided the clear stone is fully wrapped in filter fabric.

The bedding and cover material should be compacted to achieve a minimum of 100% of the material’s SPMDD.

These recommendations should be confirmed with the pipe manufacturer and care must be taken to avoid incurring damage to the services. Pipe manufacturers may have additional/alternative requirements that should be reviewed by the Designer and Contractor prior to installation of the services.

7.3.4 Trench Backfill

Backfill for service trenches may consist of the on-site native soils, subject to the constraints and limitations stated with respect to reuse of these soils. Cobbles and boulders greater than 150 mm in diameter should be sorted out and removed from of the excavated soils prior to reuse as trench backfill.

All trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% SPMDD for the full thickness of the backfill. Thinner lifts and heavy padfoot rollers may be needed to properly break-down blocky clay lumps to ensure no inter-lump voids are left in the backfill.

7.3.5 Municipal Infrastructure Backfilling

Where manholes and catch basins are required, these components should be constructed and backfilled in accordance with specifications outlined in OPSS 407: Construction Specification for Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation.

Settlements around manholes are common, and the settlements can be reduced by backfilling immediately around the manhole structure using OPSS Granular ‘B’ Type I material.

7.3.6 Dewatering

A hydrogeological investigation is being completed in conjunction with the geotechnical investigation. Results of the hydrogeological investigation report will be provided under separate cover and should be referred to for details related to groundwater at the Site.

The finalized invert elevations for the proposed services, once available, should be reviewed by Stantec to provide additional comments pertaining to dewatering requirements during construction.

7.4 ROAD DESIGN AND CONSTRUCTION

Following area grading as well as installation of site services in accordance with the recommendations provided in the previous sections of this report, the Site will be suitable for construction of local roads. The pavement structures in Table 7.1 are recommended based on the anticipated subgrade conditions (i.e., predominantly clay till) for local roadways without bus traffic.

Table 7.1: Recommended Pavement Structures for Local Roadways

Material	Design Pavement Structure Thicknesses (mm)	
	Local Roads (Light Duty)	Car Parking
HL3 Top course	35	35
HL4 or HL8 Base course	65	55
OPSS 1010 Granular ‘A’ Base	150	150
RWSSP 1010 Granular ‘B’ Type I Subbase	400	350

These structures should provide a typical pavement service life, provided regular maintenance is carried out during the life cycle of the pavements. The above pavement structure recommendations are based on typical expected use along with anticipated subgrade conditions. It should be noted that no design traffic data was provided to Stantec at the time of this design, and thus a detailed pavement design analysis was not carried out. The pavement design recommendations should be reviewed once the development concept has been finalized to ensure that the provided pavement designs are sufficient for the proposed traffic and encountered subgrade conditions.

The pavement subgrade must be proof rolled under the supervision of geotechnical personnel prior to Granular ‘B’ placement to identify any soft areas where thickened subbase is warranted.

The base and subbase materials should be compacted to a minimum of 100% SPMDD. The asphaltic concrete should be compacted to a minimum of 92% of Maximum Relative Density (MRD). Asphalt compaction must be carried out as specified in OPSS 310.

Depending on the composition of the subgrade soils, installation of continuous pavement subdrains or subdrain stubs may be required. Silty/clayey subgrade soils will require installation of continuous pavement subdrains placed under the curb lines and connected to the catch basins. For sandy subgrade conditions, 3 m long subdrain stubs should be provided on the uphill side of each catchbasin. The subdrains should comprise 150 mm diameter perforated corrugated pipe with filter sock bedded in concrete sand. The top of pipe should be below the lower limit of the granular sub-base, and the subgrade below the sub-base should slope toward the subdrains.

7.5 BUILDING CONSTRUCTION

It is understood that residential homes and townhouse blocks are being considered. The provided recommendations are considered preliminary and should be reviewed once additional geotechnical data, type of structure including foundation type, as well as site grading plan become available.

It is recommended that the engineered fill be allowed to sit for at least 3 months after placement to ensure all consolidation under the fill's own weight is completed prior to building construction. The following provides preliminary input on building design following grading.

Engineered fill placed as outlined in Section 7.2.4 will be suitable to support conventional footings proportioned as per Part 9 of the Ontario Building Code. Alternatively, the geotechnical bearing resistances for factored Ultimate Limit States (ULS) and Serviceability Limit States (SLS) in Table 7.2 can be utilized for sizing conventional shallow footings for residential houses and for preliminary sizing of footings for the proposed commercial/apartment building block, for footings constructed on undisturbed native mineral soils or on approved engineered fill.

Table 7.2 Geotechnical Bearing Resistances

Factored ULS Bearing Resistance (kPa)	SLS Bearing Resistance (kPa)
225	150

The Ultimate Limits States (ULS) values provided above include a resistance factor of 0.5. The Serviceability Limits States (SLS) reaction values have been evaluated to provide a total settlement of 25 mm (or less) and differential settlement of 19 mm.

The footings must be provided with a minimum of 1.2 m of soil cover for frost protection. Where construction is undertaken during winter conditions, the footing subgrade must be protected from freezing.

Foundation walls should be backfilled with free-draining granular material such as OPSS Granular 'B' Type I, or a manufactured drainage layer should be provided. The exterior (perimeter) wall backfill should be placed in loose lifts having a maximum thickness of 300 mm. Each lift should be uniformly compacted using suitable compaction equipment for the purpose intended, to achieve a minimum of 95% of the material's SPMDD.

The National Building Code specifies that structures should be designed to withstand forces due to earthquake. For the purpose of earthquake design the relevant geotechnical information required based on the conditions at this Site is the “Site Class”. For shallow spread or strip footing foundations, we recommend that Site Class D be applied to this site, in accordance with Table 4.1.8.4.A of the National Building Code (2015).

7.6 SITE MATERIALS REUSE

7.6.1 Topsoil

The existing topsoil will need to be stripped from below proposed fill areas, proposed building, pavement, and site servicing areas. The topsoil can either be removed from site or re-used in landscaped areas. The excavated topsoil is not suitable for reuse as engineered fill, trench backfill, granular base and sub-base materials.

7.6.2 Fill

The existing fill contacted at boreholes BH/MW01-21 to BH/MW04-21, BH/MW06-21, and BH07-21 generally consisted of 100 mm to 460 mm topsoil fill underlain by silty sand fill to clay till fill. Some topsoil inclusions were noted within the fill at borehole BH07-21.

The topsoil inclusions, as well as any cobbles greater than 150 mm will need to be separated from the fill materials prior to reuse on-site. The inorganic fill material may be considered for re-use as subgrade fill below paved areas or as structural fill below buildings, subject to further inspection and testing by geotechnical personnel at the time of site preparation. Fill considered suitable for re-use may require some moisture conditioning, such as drying or blending.

7.6.3 Clay Till and Silt Till

These soils may be considered for reuse as subgrade fill and engineered fill; however, the silt and clayey materials could be difficult to work with, depending on their moisture levels, and the climatic conditions at the time of use. The results of the gradation analyses on these materials indicate that the soils consist of mainly silt and clay size particles, with some to trace sand and gravel. The high percentage of clay and silt will make these soils difficult to handle, place, and compact, in any “less-than-ideal” weather conditions. Disturbance and loss of strength in the presence of excess moisture and/or construction traffic is a concern. It is recommended that reuse of this soil be limited to prevailing “dry” conditions and during favourable seasons. Particles in size larger than 150 mm should be separated from these soils prior to reuse on-site.

This material should be placed with moisture contents that are within +/- 2.0% of the optimum moisture content level. It is recommended that the material be approved at the time of placement by qualified geotechnical personnel. Depending on the in-situ moisture content of the clay materials, scarifying and drying may be required prior to placement.

This material is assessed as having moderate to high frost susceptibility in accordance to Section 3.1.5 of the MTO's Pavement Design and Rehabilitation Manual.

This material should not be considered as free draining. Therefore, this soil should not be used as backfill in any application requiring the use of free draining material, such as for drainage layers, foundation wall backfill, service pipe bedding, or sub-base and base layers in pavements.

7.6.4 Silt, Sandy Silt and Silty Sand

These soils are considered suitable for reuse as subgrade fill, engineered fill, and as backfill in trenches to the finished sub-grade level. Sands and silts excavated from below the groundwater table will require drying prior to reuse.

This material should be placed with moisture contents that are within +/- 2.0% of the optimum moisture content level. It is recommended that the material be approved at the time of placement by qualified geotechnical personnel.

The sandy silt, silty sand, and silt are assessed as having a moderate to high frost susceptibility in accordance to Section 3.1.5 of the MTO's Pavement Design and Rehabilitation Manual.

These soils should not be considered as free draining unless additional laboratory testing is carried out at the time of construction to confirm low levels of fines are present. Therefore, these soils should not be used as backfill in any application requiring the use of free draining material, such as for drainage layers, service pipe bedding, or sub-base and base layers in pavements.

7.7 SURFACE WATER MANAGEMENT

7.7.1 Stormwater Management Facility

A stormwater management (SWM) facility for the proposed development is considered in the central and southern portion along Gerber Road. Information on proposed finished grades was not available at the time of report preparation. The recommendations provided are considered preliminary and should be reviewed once site grading details become available.

The predominant soils contacted at borehole locations completed in the vicinity of the proposed stormwater management block (boreholes BH/MW01-21 and BH/MW04-21) comprise clay till. A layer of sandy silt till was contacted interlayered with the clay till at borehole BH/MW04-21. Saturated seams of sand and gravel were noted interlayered with the clay till. Stabilized groundwater levels were measured on June 15, 2021 at 1.8 m BGS (Elevation 354.9 m AMSL at borehole BH/MW01-21) and 2.1 m BGS (Elevation 353.5 m AMSL at borehole BH/MW04-21).

The clay till is not considered conducive for stormwater infiltration; however, the pond areas could be used for stormwater storage and siltation control. If infiltration of water from the pond into the underlying soils or infiltration of groundwater into the pond is not desired, a pond liner should be considered due to the presence of non-cohesive silt seams, layers, and deposits. A liner may not be required where clay deposits are exposed at the pond bottom; however, this should be confirmed by additional laboratory testing and inspection at the time of construction.

Preliminary ranges of permeability coefficients by soil type are summarized in Table 7.3. Reference is further made to the hydrogeological report for additional detail on groundwater conditions and infiltration potential within the area of the stormwater management block. Additional recommendation can be provided once site grading details become available.

Preliminary design of side slopes should include inclinations of 3.0H to 1.0V above and below the permanent pond level. Steeper side slopes may be available; but, should be confirmed through additional geotechnical assessment once the pond elevations are determined.

The native inorganic soils are generally considered suitable for construction of berms; however, depending on the moisture contents at the time of construction significant drying of the native soils may be required prior to reuse on-site, such as spreading fill over large areas. If additional imported fill materials are required for raising the grade on site, it is recommended that materials with characteristics similar to the native soils on site (as described in this report) be imported for this purpose. Berm fill should be free of lenses, pockets, or layers of material differing substantially in texture or gradation from the surrounding material.

The on-site silt and clay soils should be placed in 150 mm thick loose lifts. Each lift should be uniformly compacted to achieve a minimum of 95% of the material's Standard Proctor Maximum Dry Density (SPMDD) using non-vibratory compaction equipment.

Earth grading operations should only be carried out during the dry summer months to minimize the exposure to rain and promote drying of soil. Reference is made to Section 7.2.6 for comments regarding adverse weather conditions.

Recommendations for geotechnical bearing resistances for design of outlet structures can be provided once additional design details become available.

7.7.2 Preliminary Infiltration Potential

It is anticipated that stormwater management methods/infiltration features will be implemented at the Site; however, preferred methods or design details were not known at the time of report preparation. It is noted that the infiltration potential will depend on the soils exposed below the selected stormwater management control/infiltration feature. The provided recommendations in this section are considered preliminary and should be reviewed once site grading is finalized.

At source infiltration of the on-site native soils (glacial tills, silts and sands) may be considered; however, lower infiltration rates should be expected and will depend on the gradation of the soils and the distance to groundwater. Infiltration through the existing fill is not recommended.

Table 7.3 below provides preliminary ranges of coefficients of permeability based on soil types observed in the current borehole program as per guidelines presented in the Supplementary Standard SB-6 of the Ontario Building Code. It is recommended that additional laboratory testing of representative soils is completed once site grades are established to confirm the soil type and composition as well as available infiltration potential of the on-site soils. Alternatively, field testing of the soil permeability at the infiltration feature subgrade with double ring permeameter equipment may be considered. It is noted that the distance to the groundwater table will affect the coefficient of permeability. Due to the variable silt and clay content of the native soils, infiltration facilities should be designed and constructed to ensure that they are provided with subsurface overflows connected to suitable frost-free outlets, such as a storm sewer.

Table 7.3: Preliminary Ranges of Coefficients of Permeability

Soil Type	Coefficient of Permeability, K (cm/sec)
CL (Inorganic clays or low to medium plasticity, gravelly clays, candy clays, silty clays, lean clays)	10^{-6} and less
ML (Inorganic silts and very fine sands, silty or clayey fine sands, clayey silts with slight plasticity)	10^{-5} to 10^{-6}
SM (Silty sands, sand-silt mixtures)	10^{-3} to 10^{-5}

Additional recommendations can be provided once additional design details become available. We refer to the hydrogeological investigation report, being prepared by Stantec under separate cover, for additional commentary on infiltration rates.

8.0 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of Strohvest Ontario Inc. who is identified as “the Client” within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report;
- Basis of the report;
- Standard of care;
- Interpretation of site conditions;
- Varying or unexpected site conditions; and,
- Planning, design or construction.

This report has been prepared by Karen Thrams and reviewed by Jeff Dietz.

Respectfully Submitted,

STANTEC CONSULTING LTD.

APPENDIX A

A.1 STATEMENT OF GENERAL CONDITIONS

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'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 of the investigation or study. 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 Consulting Ltd. 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.

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.

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 Consulting Ltd. at the time of the 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 behavior. 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 locations, Stantec Consulting Ltd. 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 Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec Consulting Ltd., sufficiently ahead of initiating the next project stage (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 (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.

APPENDIX B

B.1 DRAWINGS

Stantec

100-300 Hagey Boulevard
Waterloo ON N2L 0A4
www.stantec.com

LEGEND

- – – PROPERTY BOUNDARY
- ⊕ APPROXIMATE BOREHOLE LOCATION

NOTES

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. CONCEPTUAL DRAFT PLAN OF SUBDIVISION PREPARED BY STANTEC, DWG. No. DP-1, DATED 2021-06-14.
3. IMAGERY: © 2021 MICROSOFT CORPORATION © 2021 MAXAR © CNES (2021) DISTRIBUTION AIRBUS DS.

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1 : 3000

JUNE 2021
Project No. 161413217

Client/Project
STROHVEST ONTARIO INC.
PROPOSED DEVELOPMENT - STROH LANDS
GERBER ROAD, WELLESLEY, ONTARIO

Drawing No.
1

Title
BOREHOLE LOCATION PLAN

C:\CAD Drawings\Acad2019 Drawings\2021\161413217\161413217_Borehole Locations_Final.dwg
2021/06/23 4:13 PM By: Briones, Gliceria

APPENDIX C

C.1 SYMBOLS & TERMS USED ON BOREHOLE RECORDS

C.2 BOREHOLE 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:

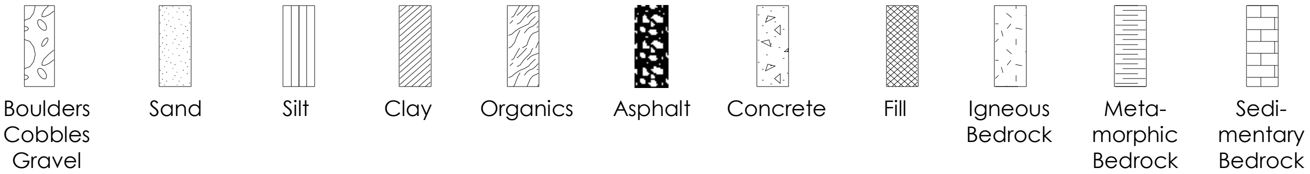
Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

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

N: 4 812 989 E: 518 277

Sheet 1 of 1

BH/MW01-21

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

LOCATION Stroh Properties, Wellesley

DATUM

DATES: BORING May 6, 2021

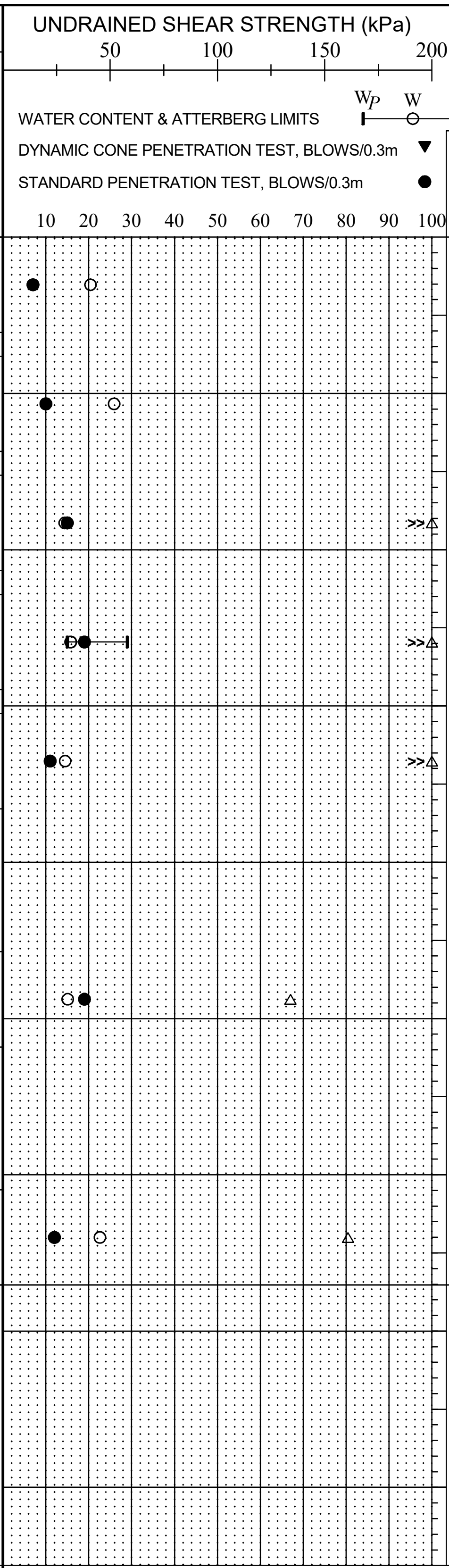
WATER LEVEL June 15, 2021

TPC ELEVATION

ELEVATION (m)	STRATA DESCRIPTION
356.7	**Edge of Plowed Field**
356.6	Dark brown to black, sandy silt topsoil FILL - moist
356.4	Brown, silty sand FILL
	Dark brown to black, sandy silt TOPSOIL - moist
355.2	Compact, brown, silty SAND (SM) - wet - slightly dilatant
355.1	Hard to very stiff, brown, silty CLAY (CL) TILL - trace sand and gravel - DTPL to APL - grey below 3.1 m BGS - coarse grained sand and gravel seam/layer, saturated
350.0	Borehole terminated at 6.7 m BGS. 50 mm diameter PVC well installed with 3.1 m screen across 3.1 - 6.1 m BGS. Sand from 6.1 m up to 2.7 m, and bentonite from 2.7 m to 0.3 m BGS. Concrete and above ground casing. MECP Well Tag # A313918

WATER LEVEL ∇ (approx. 1.8 m)

DEPTH (ft)	TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	1	610/610	7	
3.5	SS	2	100/610	10	
6	SS	3	610/610	15	
8.5	SS	4	610/610	19	2 8 55 35
11	SS	5	610/610	11	
16	SS	6	460/610	19	
21	SS	7	510/610	12	



□ Field Vane Test, kPa

◘ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 350 E: 518 320

Sheet 1 of 1

BH/MW02-21

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

LOCATION Stroh Properties, Wellesley

DATUM

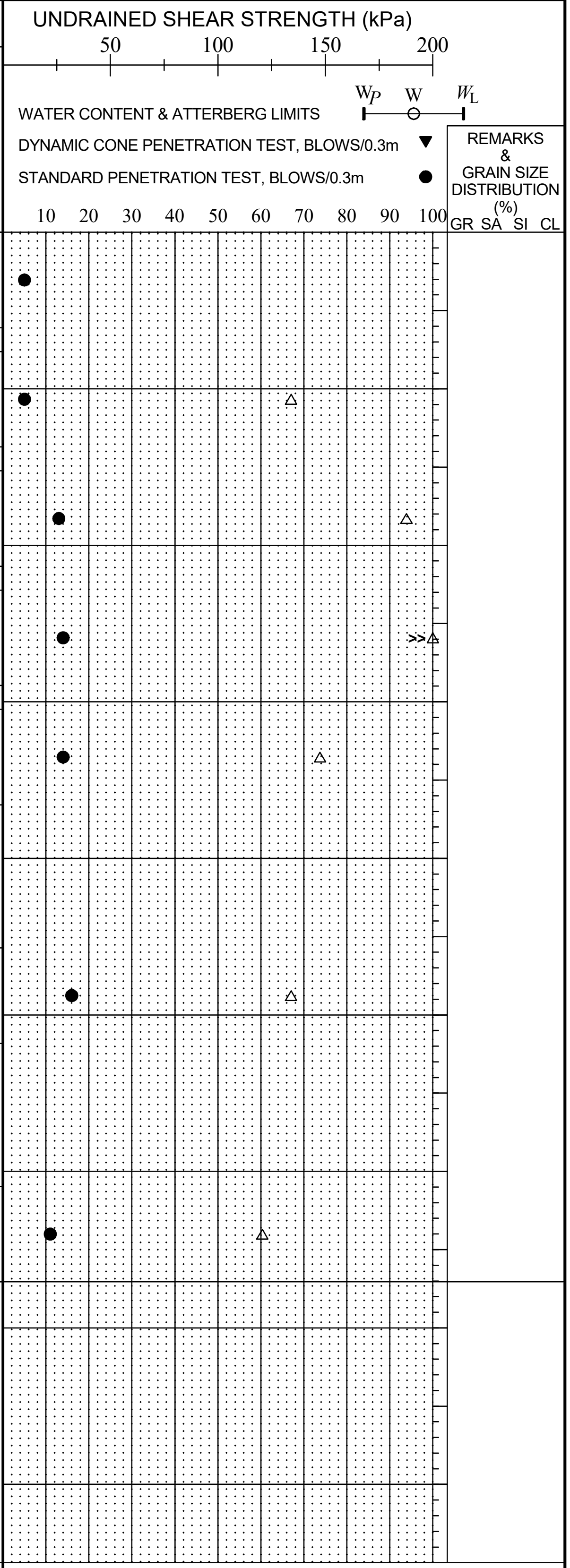
DATES: BORING May 5, 2021

WATER LEVEL June 15, 2021

TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	WATER LEVEL
0	**361.1**	**Grassed**	
0.0 – 0.3	360.8	Dark brown, sandy silt topsoil FILL - wet	
0.3 – 0.9	360.2	Brown, sandy silt FILL - trace gravel - wet	
0.9 – 1.2	359.9	Brown, silty sand FILL - some gravel - saturated	
1.2 – 4.5	356.6	Very stiff to hard, brown, clayey SILT (CL-ML) TILL - some to trace gravel - APL to DTPL - grey below 3.5 m BGS	▽ (approx. 8 ft)
4.5 – 6.7	354.4	Very stiff to stiff, grey, CLAY (CL) TILL - trace gravel - occasional cobbles and boulders - APL - wet gravelly pocket	
6.7		Borehole terminated at 6.7 m BGS. 50 mm diameter PVC well installed with 3.1 m screen across 3.1 - 6.1 m BGS. Sand from 6.1 m up to 2.7 m, and bentonite from 2.7 m to 0.3 m BGS. Concrete and above ground casing. MECP Well Tag # A313723	

DEPTH (ft)	TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
0 – 2	SS	1	$\frac{610}{610}$	5
2.5 – 4.5	SS	2	$\frac{610}{610}$	5
5 – 7	SS	3	$\frac{610}{610}$	13
7.5 – 9.5	SS	4	$\frac{610}{610}$	14
10 – 12	SS	5	$\frac{610}{610}$	14
15 – 17	SS	6	$\frac{610}{610}$	16
20 – 22	SS	7	$\frac{610}{610}$	11



☐ Field Vane Test, kPa

◘ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 763 E: 518 382

Sheet 1 of 1

BH/MW03-21

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

LOCATION Stroh Properties, Wellesley

DATUM

DATES: BORING May 5, 2021

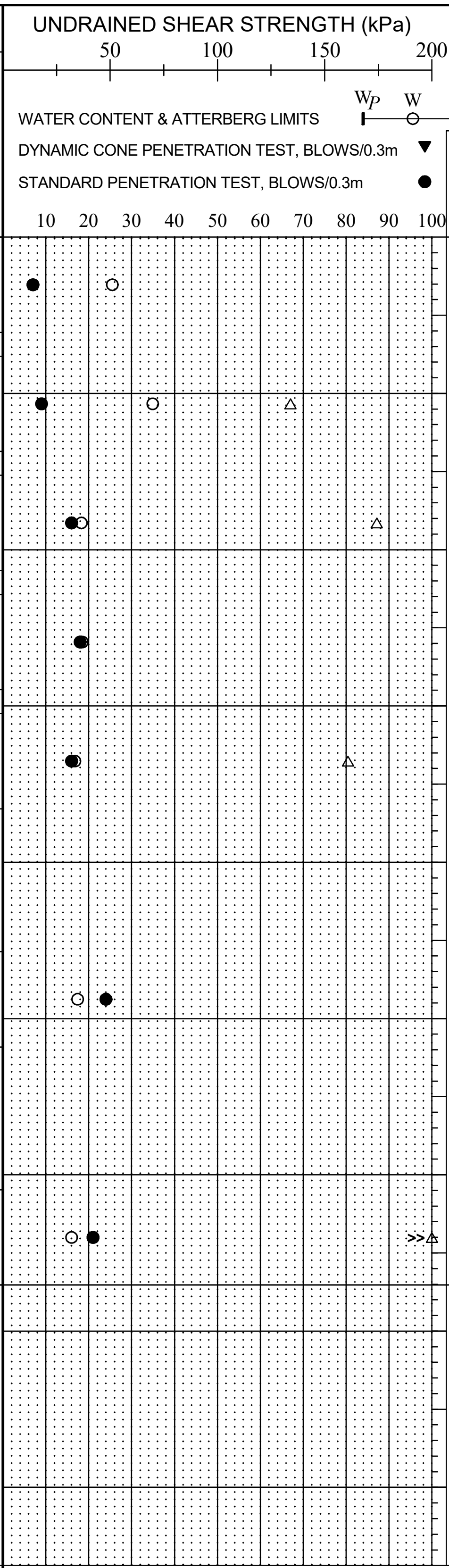
WATER LEVEL June 15, 2021

TPC ELEVATION

ELEVATION (m)	STRATA DESCRIPTION
360.2	**Grassed**
359.9	Dark brown, sandy silt topsoil FILL - some clay, trace gravel - wet
359.4	Brown, sandy silt FILL - some clay, trace gravel - wet
358.7	Loose, mottled brown, sandy SILT (ML) - trace to some clay - wet
357.9	Compact, brown, silty SAND (SM) - wet - very stiff, brown, sandy silt, some clay layers, APL
	Compact, brown to grey, SILT (ML) - trace sand and clay - wet - slightly dilatant - grey below 3.4 m BGS - very stiff, grey, clayey silt layer, APL - slightly dilatant seam
353.8	Very stiff, grey, clayey SILT (CL-ML) TILL - DTPL
353.5	Borehole terminated at 6.7 m BGS. 50 mm diameter PVC well installed with 3.1 m screen across 3.1 - 6.1 m BGS. Sand from 6.1 m up to 2.7 m, and bentonite from 2.7 m to 0.3 m BGS. Concrete and above ground casing. MECP Well Tag # A069634

WATER LEVEL: ∇ at approx. 4.8 ft

DEPTH (ft)	TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0 - 2	SS	1	610/610	7	
2.5 - 4.5	SS	2	610/610	9	
5 - 7	SS	3	610/610	16	
7.5 - 9.5	SS	4	510/610	18	0 2 91 7
10 - 12	SS	5	610/610	16	
15 - 17	SS	6	560/610	24	
20 - 22	SS	7	610/610	21	



□ Field Vane Test, kPa

◘ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 019 E: 518 544

Sheet 1 of 1

BH/MW04-21

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

LOCATION Stroh Properties, Wellesley

DATUM

DATES: BORING May 6, 2021

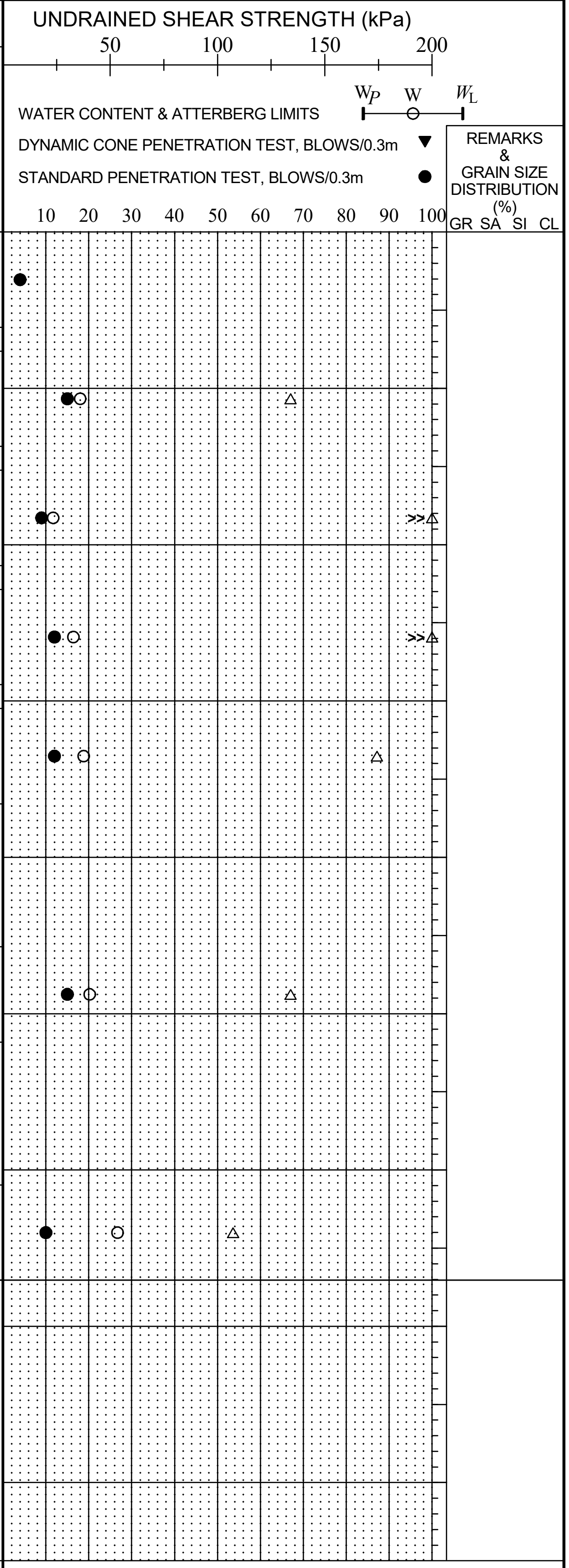
WATER LEVEL June 15, 2021

TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION
0	355.6	**Grassed**
		Dark brown, sandy silt topsoil FILL - moist
	355.0	Dark brown, sandy silt FILL - moist
	354.8	Brown, clay till FILL - trace gravel - DTPL
		Hard, brown, CLAY (CL) TILL - trace sand and gravel - occasional silt seams - APL to DTPL
2	353.6	Compact, brown, sandy SILT (ML) TILL - trace to some clay - some gravel - wet - 100 mm thick silty sand and gravel seam, saturated
	353.0	Hard to very stiff, brown, CLAY (CL) TILL - trace gravel - DTPL to APL - some silt seams - grey below 3.1 m BGS - WTPL
	348.9	Borehole terminated at 6.7 m BGS. 50 mm diameter PVC well installed with 3.1 m screen across 3.1 - 6.1 m BGS. Sand from 6.1 m up to 2.7 m, and bentonite from 2.7 m to 0.3 m BGS. Concrete and above ground casing.MECP Well Tag # A074962

WATER LEVEL: ▽ at approx. 6.5 ft

DEPTH (ft)	TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
1	SS	1	460/610	4
3.5	SS	2	560/610	15
6	SS	3	560/610	9
8.5	SS	4	460/610	12
11	SS	5	610/610	12
16	SS	6	610/610	15
21	SS	7	410/610	10



☐ Field Vane Test, kPa

◘ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 323 E: 518 547

Sheet 1 of 1

BH/MW05-21

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

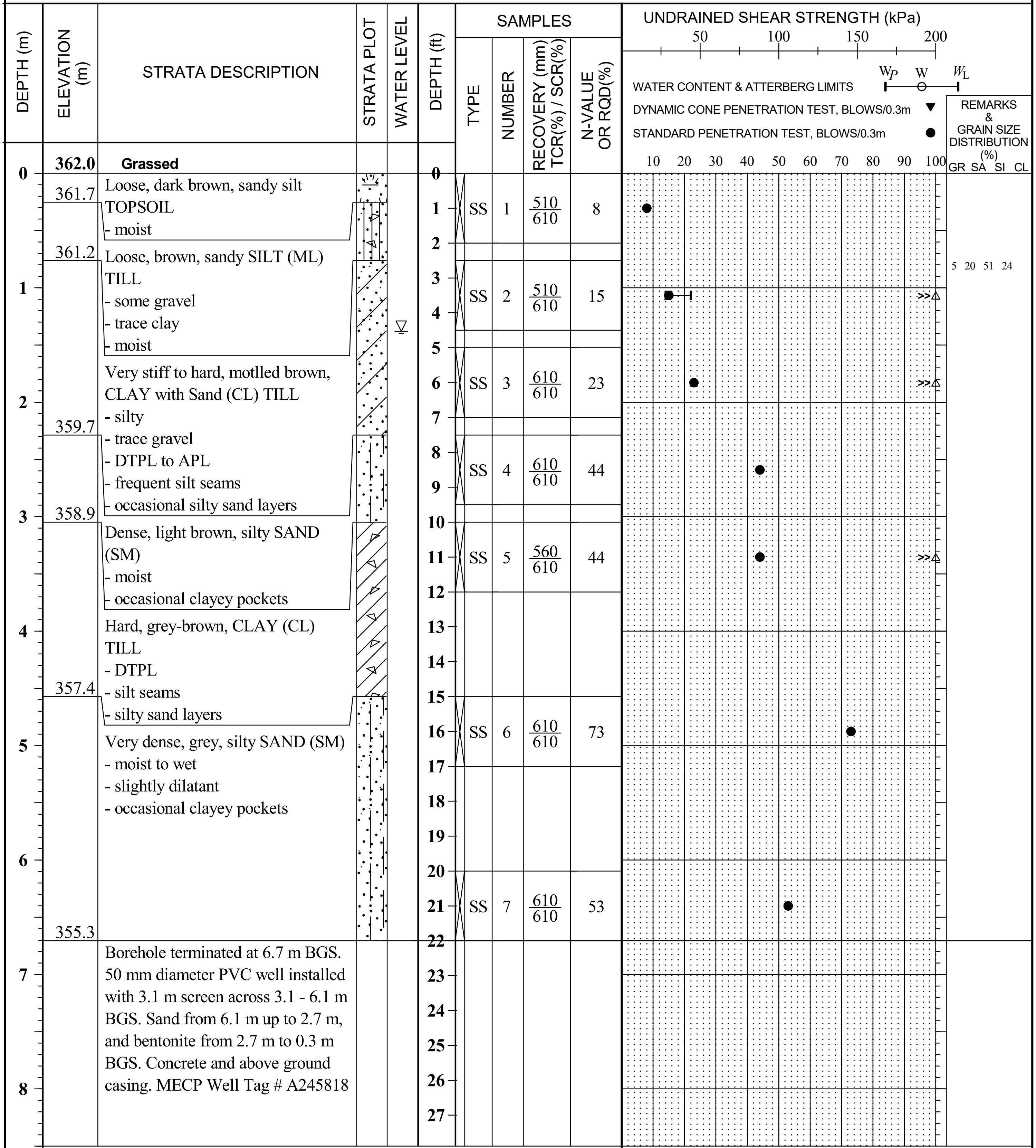
LOCATION Stroh Properties, Wellesley

DATUM

DATES: BORING May 6, 2021

WATER LEVEL June 15, 2021

TPC ELEVATION



DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION
0	362.0	**Grassed**
0 – 0.3	361.7	Loose, dark brown, sandy silt TOPSOIL - moist
0.3 – 0.8	361.2	Loose, brown, sandy SILT (ML) TILL - some gravel - trace clay - moist
0.8 – 2.3	359.7	Very stiff to hard, motlled brown, CLAY with Sand (CL) TILL - silty - trace gravel - DTPL to APL - frequent silt seams - occasional silty sand layers
2.3 – 3.1	358.9	Dense, light brown, silty SAND (SM) - moist - occasional clayey pockets
3.1 – 4.6	357.4	Hard, grey-brown, CLAY (CL) TILL - DTPL - silt seams - silty sand layers
4.6 – 6.7	355.3	Very dense, grey, silty SAND (SM) - moist to wet - slightly dilatant - occasional clayey pockets

Borehole terminated at 6.7 m BGS. 50 mm diameter PVC well installed with 3.1 m screen across 3.1 - 6.1 m BGS. Sand from 6.1 m up to 2.7 m, and bentonite from 2.7 m to 0.3 m BGS. Concrete and above ground casing. MECP Well Tag # A245818

WATER LEVEL: ∇ at approx. 4.4 ft

DEPTH (ft)	TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0 – 2	SS	1	510/610	8	
2.5 – 4.5	SS	2	510/610	15	5 20 51 24
5 – 7	SS	3	610/610	23	
7.5 – 9.5	SS	4	610/610	44	
10 – 12	SS	5	560/610	44	
15 – 17	SS	6	610/610	73	
20 – 22	SS	7	610/610	53	

☐ Field Vane Test, kPa

◘ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 624 E: 518 561

Sheet 1 of 1

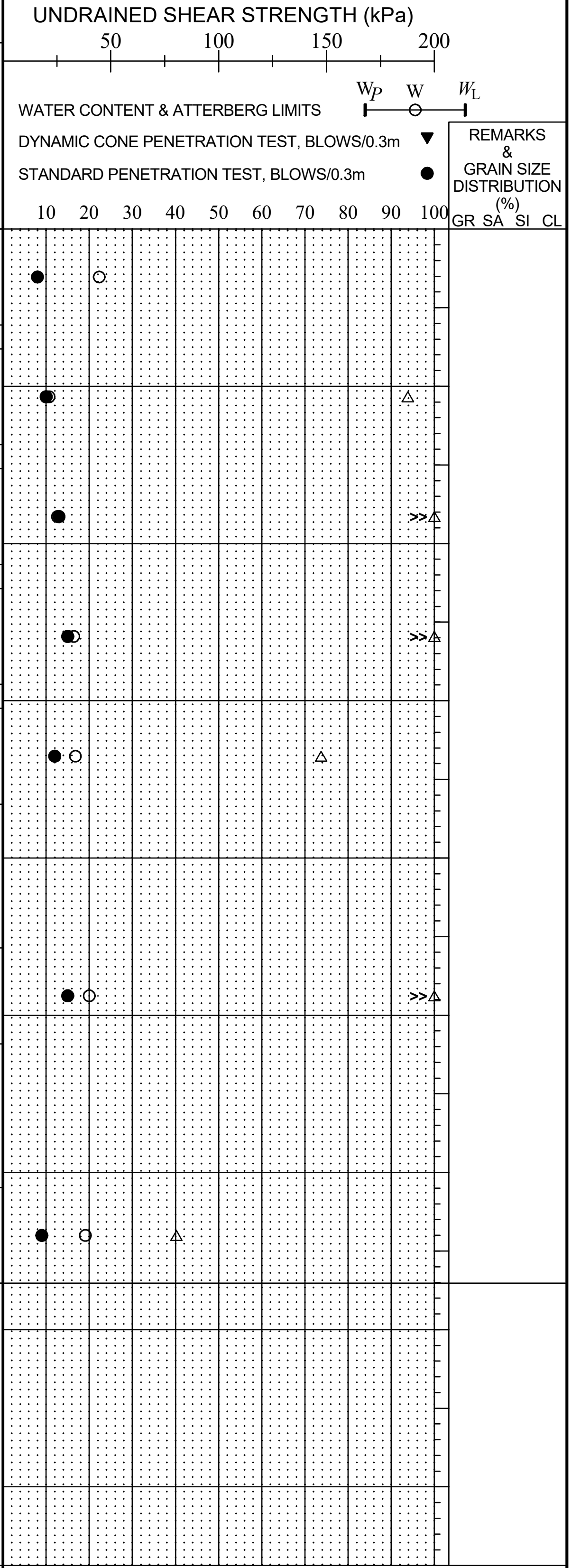
BH/MW06-21

CLIENT Strohvest Ontario Inc.
PROJECT No. 161413217
LOCATION Stroh Properties, Wellesley
DATUM
DATES: BORING May 5, 2021
WATER LEVEL June 15, 2021
TPC ELEVATION

ELEVATION (m)	STRATA DESCRIPTION	WATER LEVEL
362.3	**Grassed**	
	Dark brown, sandy silt topsoil FILL - moist	
361.8	Brown, sandy silt FILL - some clay - wet	
361.5		
361.0	Compact, mottled brown, sandy SILT (ML) - some gravel - wet	
360.3	Very stiff, mottled brown, clayey SILT (CL-ML) TILL - occasional cobbles - DTPL - silty sand layer, wet	
	Hard to very stiff, brown, CLAY (CL) TILL - trace sand and gravel - APL - occasional sand seams -grey below 3.4 m BGS - occasional silt seam - occasional cobbles - stiff	∇
355.6	Borehole terminated at 6.7 m BGS. 50 mm diameter PVC well installed with 3.1 m screen across 3.1 - 6.1 m BGS. Sand from 6.1 m up to 2.7 m, and bentonite from 2.7 m to 0.3 m BGS. Concrete and above ground casing.MECP Well Tag # A313952	

SAMPLES

TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
SS	1	560/610	8
SS	2	610/610	10
SS	3	610/610	13
SS	4	610/610	15
SS	5	610/610	12
SS	6	610/610	15
SS	7	510/610	9



☐ Field Vane Test, kPa
◘ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 170 E: 518 415

BH07-21

Sheet 1 of 1

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

LOCATION Stroh Properties, Wellesley

DATUM

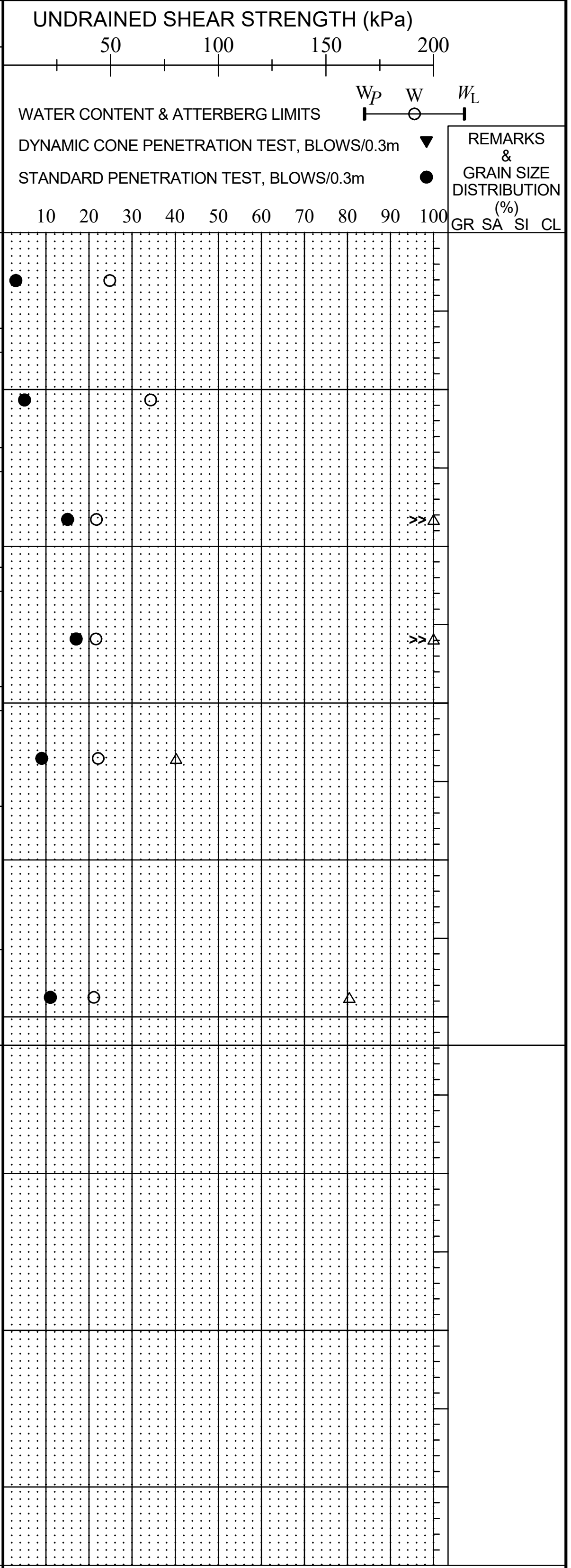
DATES: BORING May 5, 2021

WATER LEVEL

TPC ELEVATION

ELEVATION (m)	STRATA DESCRIPTION
356.1	**Plowed Field**
355.8	Dark brown, sandy silt topsoil FILL - wet
355.2	Brown, sandy silt FILL - trace gravel - some topsoil inclusions - wet
354.9	Loose, brown, sandy SILT (ML) - trace clay and gravel - wet - occasional silty sand seams
354.6	Very stiff, mottled brown, clayey SILT (CL-ML) TILL - APL
	Hard to stiff, brown, CLAY (CL) TILL - some gravel - DTPL to APL - occcasional silt seams, wet
350.9	Borehole terminated at 5.2 m BGS. Borehole open and dry. Backfilled with bentonite and cuttings to surface.

TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
SS	1	410/610	3
SS	2	510/610	5
SS	3	610/610	15
SS	4	610/610	17
SS	5	610/610	9
SS	6	610/610	11



□ Field Vane Test, kPa

▣ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

BOREHOLE RECORD

N: 4 813 437 E: 518 466

BH08-21

Sheet 1 of 1

CLIENT Strohvest Ontario Inc.

PROJECT No. 161413217

LOCATION Stroh Properties, Wellesley

DATUM

DATES: BORING May 5, 2021

WATER LEVEL

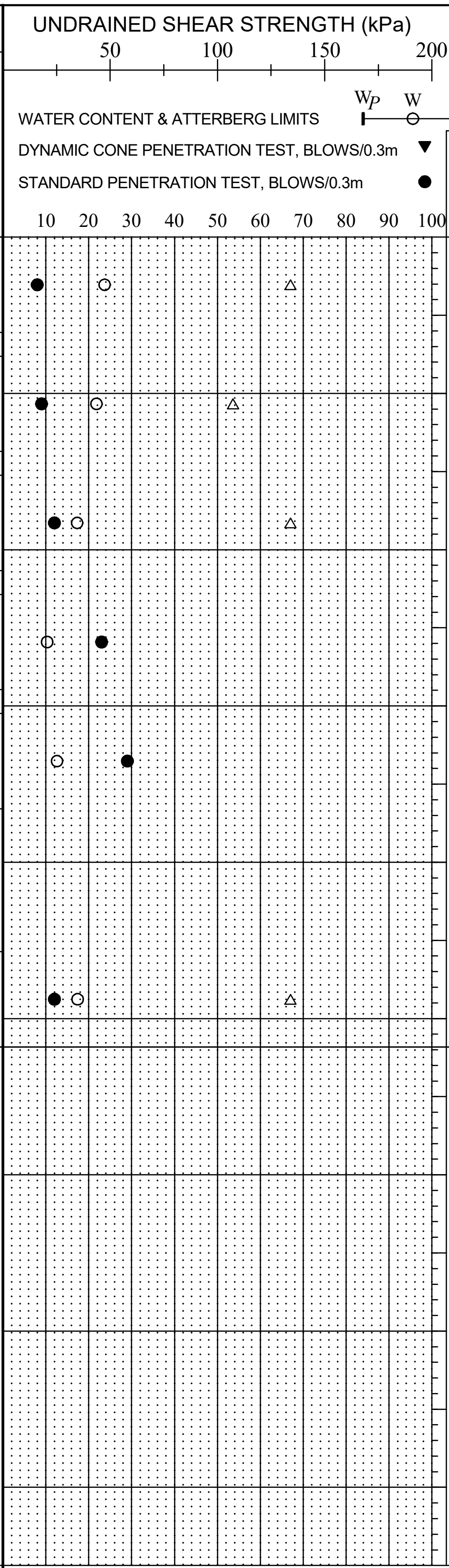
TPC ELEVATION

ELEVATION (m)	STRATA DESCRIPTION
361.5	**Plowed Field**
361.2	Loose, dark brown, sandy silt TOPSOIL - trace clay - wet
359.1	Very stiff, mottled brown, clayey SILT (CL-ML) TILL - some sand - trace gravel - rootlets to 1.4 m BGS - APL
358.4	Compact, brown, SILT (ML) TILL - trace to some clay - trace sand and gravel - moist - frequently laminated with silt seams
358.3	Compact, grey, silty SAND (SM) - moist
356.9	Hard, grey, clayey SILT (CL-ML) TILL - DTPL - silty fine sand layers, moist
356.3	Very stiff, grey, CLAY (CL) TILL - trace gravel - occasional silt seams - APL

Borehole terminated at 5.2 m BGS. Borehole open and dry. Backfilled with bentonite and cuttings to surface.

SAMPLES

TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
SS	1	610 / 610	8
SS	2	460 / 610	9
SS	3	610 / 610	12
SS	4	610 / 610	23
SS	5	610 / 610	29
SS	6	610 / 610	12



REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

☐ Field Vane Test, kPa

◘ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

APPENDIX D

E.1 LABORATORY TEST RESULTS

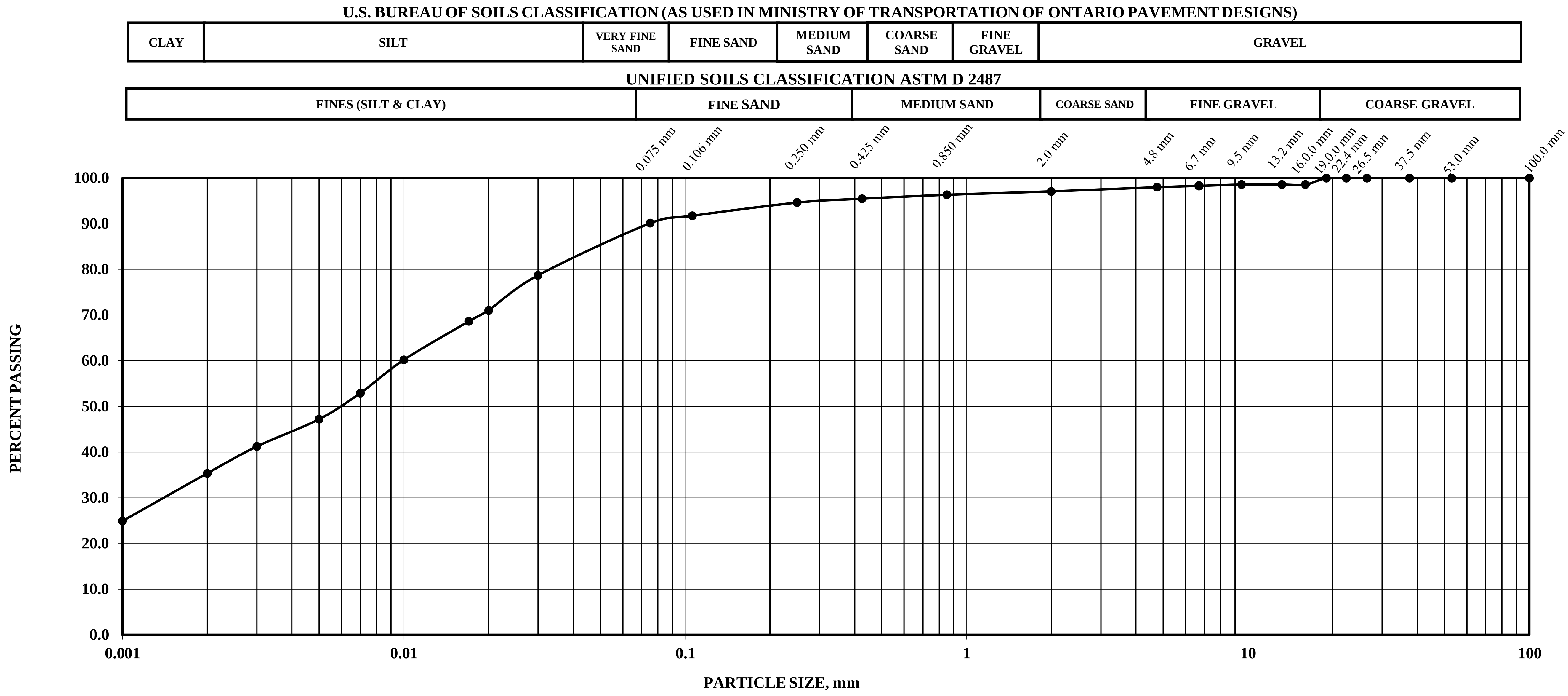
GRAIN SIZE AND HYDROMETER ANALYSIS REPORT
LS-602, 702 & 703/704

PROJECT NUMBER: 04.P19533.500 **PROJECT NAME:** Wellesley (161413217.700) **CLIENT:** Stantec

LAB NUMBER: S-482 / 483 **SAMPLE ID:** Borehole 01-21 Sample 4 **SAMPLE DEPTH:** 7.5 - 9.5'

SAMPLED BY: Client **DATE RECEIVED:** May 7, 2021 **DATE COMPLETED:** May 14, 2021

PARTICLE SIZE DISTRIBUTION, MTO LS-702



COEFFICIENTS

D60	0.010	D30	0.001	D10		Cc		Cu	

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	% PASSING
53	100.0
37.5	100.0
26.5	100.0
22.4	100.0
19	100.0
16	98.6
13.2	98.6
9.5	98.6
6.7	98.3
4.75	98.0
2.00	97.1
0.850	96.3
0.425	95.5
0.250	94.6
0.106	91.7
0.075	90.1

HYDROMETER ANALYSIS	
DIAMETER mm	% PASSING
0.030	78.7
0.020	71.1
0.017	68.6
0.010	60.2
0.007	52.9
0.005	47.2
0.002	35.4
0.001	24.9

ATTERBERG LIMITS	
Liquid Limit	29
Plastic Limit	15
Plastic Index	14

GRAIN SIZE PROPORTIONS, %		
% GRAVEL (> 4.75 mm):		2.0
% SAND (75 µm to 4.75 mm):		7.9
% SILT (2 µm to 75 µm):		54.7
% CLAY (<2 µm):		35.4
SOIL DESCRIPTION:	CL	CLAY
SUSCEPTIBILITY TO FROST HEAVING:		MODERATE

REMARKS

Figure: 1

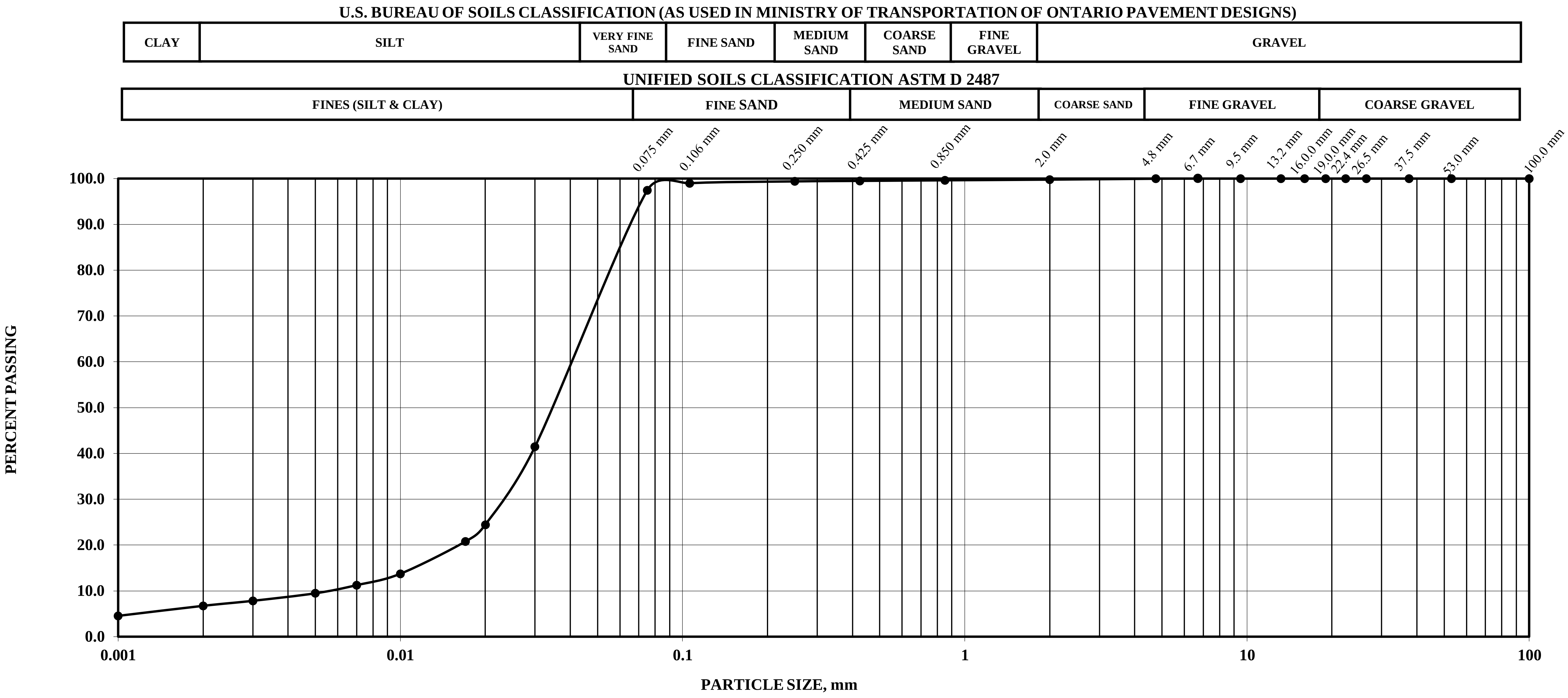
TESTED BY: Kevin Frank
Laboratory Technician

REVIEWED BY David McBay, C.Tech.
Laboratory Supervisor

GRAIN SIZE AND HYDROMETER ANALYSIS REPORT
LS-602, 702 & 703/704

PROJECT NUMBER:	04.P19533.500	**PROJECT NAME:**	Wellesley (161413217.700)	**CLIENT:**	Stantec
LAB NUMBER:	S-484	**SAMPLE ID:**	Borehole 03-21 Sample 4	**SAMPLE DEPTH:**	7.5 - 9.5'
SAMPLED BY:	Client	**DATE RECEIVED:**	May 7, 2021	**DATE COMPLETED:**	May 14, 2021

PARTICLE SIZE DISTRIBUTION, MTO LS-702



COEFFICIENTS

D60	0.045	D30	0.023	D10	0.006	Cc	2.154	Cu	8.03

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53	100.0	0.030	41.5
37.5	100.0	0.020	24.5
26.5	100.0	0.017	20.8
22.4	100.0	0.010	13.7
19	100.0	0.007	11.2
16	100.0	0.005	9.5
13.2	100.0	0.002	6.7
9.5	100.0	0.001	4.5
6.7	100.0	ATTERBERG LIMITS	
4.75	100.0		
2.00	99.8	Liquid Limit	
0.850	99.6		
0.425	99.5	Plastic Limit	
0.250	99.4		
0.106	99.0	Plastic Index	
0.075	97.4		

GRAIN SIZE PROPORTIONS, %		
% GRAVEL (> 4.75 mm):		
% SAND (75 µm to 4.75 mm):		2.6
% SILT (2 µm to 75 µm):		90.7
% CLAY (<2 µm):		6.7
SOIL DESCRIPTION:	ML	SILT
SUSCEPTIBILITY TO FROST HEAVING:		HIGH

REMARKS

Figure: 2

TESTED BY: Kevin Frank
Laboratory Technician

REVIEWED BY David McBay, C.Tech.
Laboratory Supervisor

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Brantford

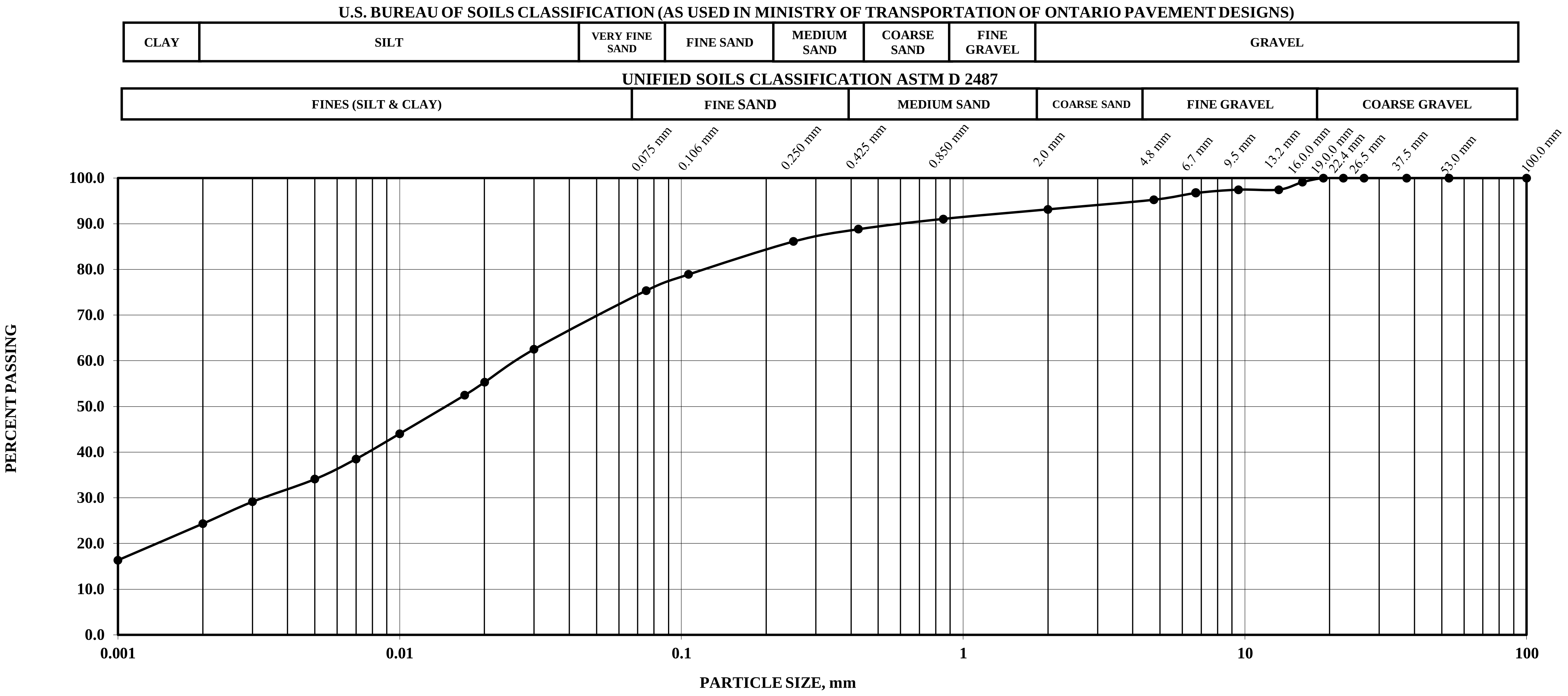
GRAIN SIZE AND HYDROMETER ANALYSIS REPORT
LS-602, 702 & 703/704

PROJECT NUMBER: 04.P19533.500 **PROJECT NAME:** Wellesley (161413217.700) **CLIENT:** Stantec

LAB NUMBER: S-485 / 486 **SAMPLE ID:** Borehole 05-21 Sample 2 **SAMPLE DEPTH:** 2.5 - 4.5'

SAMPLED BY: Client **DATE RECEIVED:** May 7, 2021 **DATE COMPLETED:** May 14, 2021

PARTICLE SIZE DISTRIBUTION, MTO LS-702



COEFFICIENTS

D60	0.027	**D30**	0.003	**D10**		**Cc**		**Cu**	

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
53	100.0
37.5	100.0
26.5	100.0
22.4	100.0
19	100.0
16	99.1
13.2	97.5
9.5	97.5
6.7	96.7
4.75	95.2
2.00	93.1
0.850	91.0
0.425	88.8
0.250	86.1
0.106	78.9
0.075	75.4

HYDROMETER ANALYSIS	
DIAMETER mm	**% PASSING**
0.030	62.5
0.020	55.3
0.017	52.4
0.010	44.0
0.007	38.5
0.005	34.1
0.002	24.3
0.001	16.3

ATTERBERG LIMITS	
Liquid Limit	22
Plastic Limit	14
Plastic Index	8

GRAIN SIZE PROPORTIONS, %		
% GRAVEL (> 4.75 mm):		4.8
% SAND (75 µm to 4.75 mm):		19.8
% SILT (2 µm to 75 µm):		51.1
% CLAY (<2 µm):		24.3
SOIL DESCRIPTION:	CL	CLAY with Sand
SUSCEPTIBILITY TO FROST HEAVING:		MODERATE

REMARKS

Figure: 3

TESTED BY: Kevin Frank
Laboratory Technician

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