REPORT
GEOTECHNICAL INVESTIGATION
PROPOSED LOW-RISE RESIDENTIAL SUBDIVISION DEVELOPMENT
AT MCMASTER STREET AND MEAGAN DRIVE
HALTON HILLS, ONTARIO

Prepared for

2147925 ONTARIO INC.

Prepared by

SIRATI & PARTNERS CONSULTANTS LIMITED

SIRATI & PARTNERS
Geotechnical Hydrogeological & Environmental Solutions

Project: SP20-747-00
March 30, 2021

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TABLE OF CONTENTS

1. INTRODUCTION

Sirati & Partners Consultants Limited (SIRATI) was retained by 2147925 Ontario Inc. (the Client) to undertake a geotechnical investigation for the proposed residential development located to the northwest of Georgetown on Part of the West half of Lot 21, Concession 9, Hamlet of Glen Williams, in the Regional Municipality of Halton, Ontario.

The property is currently vacant and generally flat with elevations changing between 275.10 m and 271.86 m at borehole locations drilled by SIRATI. The site location is shown on **Figure 1**.

It is understood that the property is approximately 6.5 hectares and is proposed to be developed with low-rise residential buildings without underground parking.

The purpose of the geotechnical investigation was to obtain information on the general subsurface soil and shallow groundwater conditions at the site by means of boreholes as well as geotechnical laboratory tests, and provide recommendations pertaining to the foundation of the buildings, excavation, backfilling, pavement design for the roads within the property boundaries, underground utilities, and construction considerations.

This report is provided based on the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for the Client and its designers. Third party use of this report without SIRATI consent is prohibited. The limitation conditions presented in **Appendix B** form an integral part of the report and they must be considered in conjunction with this report.

2. FIELD AND LABORATORY WORK

A total of twelve (12) boreholes (BH 1 through BH 12, see **Figure 1** for the borehole location plan) were drilled by SIRATI during November 03 and 04, 2020, extending between 5.0 m and 6.55 m below the existing ground surface (mbgs). The boreholes were drilled with solid stem continuous flight augers. The drilling of all boreholes was conducted by a drilling sub-contractor under the direction and supervision of SIRAT's staff.

The field work was carried out in accordance with ASTM D 1586-11 test method. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing

624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. Soil and bedrock samples were logged in the field and returned to the SIRATI laboratory for detailed examination by the project engineer and for laboratory testing.

Water level observations were made during drilling in the open boreholes, upon completion of the drilling operations. Monitoring wells were installed in four (4) boreholes (BH/MW2, BH/MW4, BH/MW9, and BH/MW11) for long-term (stabilized) groundwater level monitoring. The monitoring wells were constructed in accordance with O. Reg. 903 (as amended) by extending a bentonite seal from above the well screen to the surface.

All soil samples were tested for moisture content and selected six (6) soil samples were tested for grain size, hydrometer and/or Atterberg Limits tests. The results of the laboratory tests are presented in the respective logs and in **Figure 14 to 15.**

The elevations at the borehole locations were surveyed by SIRATI personnel using a differential GPS system and varied from 271.86 m to 275.10 m.

3. SITE AND SUBSURFACE CONDITIONS

The borehole location plan is shown on **Figure 1**. Notes on soil descriptions are presented on **Enclosure 1A**. The subsurface conditions in the boreholes are presented in the individual borehole logs (**Encl. 2 to 13 inclusive**). The subsurface conditions in the boreholes are summarized in the following paragraphs.

3.1 SOIL CONDITIONS

The following presents the soil stratigraphy based on the observations of the boreholes drilled by SIRATI (BH 1 to BH 12).

Topsoil: A 175 mm to 300 mm thick layer of topsoil was encountered at the location of all boreholes at ground surface.

It should be noted that the thickness of the topsoil observed at the borehole locations may not be representative for the entire site and should not be relied on to calculate the amount of topsoil that need to be stripped from the site.

Fill Material: Below the topsoil, a fill layer was encountered in all boreholes, except in BH10. The fill material mainly consists of sandy silt/silty sand with trace to some clay or clayey silt with trace to some sand/gravel. The fill material was found to be moist and generally brown in color. The fill layer extended to 0.8 m to 2.3 m below existing ground surface (mbgs). It should be noted that organics and rootlets were observed in the fill layer.

The measured SPT 'N' values in fill material ranged from 4 to 18 blows per 300 mm of penetration, indicating a loosely to moderately compacted layer.

Grain size and hydrometer analyses of one (1) representative sample of fill material (BH 1/SS3) were conducted, and the results are presented in **Figures 14** with the following fraction:

Clay: 35%
Silt: 46%
Sand: 18%
Gravel: 1%

Glacial Till Deposits: Glacial till deposits were observed in all boreholes underlying fill/topsoil layer, extending 1.5 m to 6.5 m below the existing grade. This layer generally comprises sandy silt/silty sand to clayey silt deposits with different proportions of gravel and in some areas with shale fragments. The glacial till deposit was found to be generally moist and brown to reddish brown in color.

The measured SPT 'N' values in the sandy silt/silty sand till deposit ranged from 15 to over 50 blows per 300 mm penetration, indicating a compact to very dense condition.

The measured SPT 'N' values of 12 to over 50 blows per 300 mm penetration were obtained in the cohesive till deposit, indicating a stiff to hard consistency of the layer.

It should be noted that the stratum is believed to contain cobbles and shale fragments as well as probably boulders which should be taken into consideration by the contractor.

Grain size analysis of one (1) representative sample of a silty sand and gravel till (BH 5/SS3) was conducted and the results are presented in **Figure 14** with the following fractions:

Fine: 20%
Sand: 42%
Gravel: 38%

Grain size and hydrometer analyses three (3) representative samples of sandy silt till and clayey silt till (BH 4/SS4 and BH6/SS3, BH8/SS4) were conducted, and the results are presented in **Figures 14** with the following fraction:

Clay: 12% to 35%
Silt: 28% to 58%
Sand: 7% to 25%
Gravel: 0% to 35%

Atterberg Limits of one (1) representative sample of the till deposit (BH 8/SS4) were conducted and the results are presented in **Figure 15**, as summarized in **Table 1**.

Table 1. Atterberg Limits Test Results

BH #/Sample	Depth (m bgs)	Atterberg Limits		
		Plastic Limits	Liquid Limits	Plastic Index
BH 8/SS4	2.3	17	21	4

Cohesionless Soils: Native cohesionless soils were observed in BH1 and BH10 underlying and sandwiched into the glacial till deposit, respectively. This layer comprises of silt or sand and is found to be brown to reddish brown and moist to wet.

The measured SPT 'N' values in the cohesionless soil deposit ranged from 37 to over 50 blows per 300 mm penetration, indicating a dense to very dense material.

Grain size analysis of one (1) representative sample of the cohesionless soil deposit (BH 10/SS4) was conducted and the results are presented in **Figure 14** with the following fractions:

Clay: 16%
Silt: 82%
Sand: 2%
Gravel: 0%

Queenston Formation – Shale Bedrock: Inferred weathered shale bedrock was observed in boreholes BH 2, BH 3, BH 4, BH 6, BH 7, BH 10, BH 11, and BH 12, upon spoon refusal ranging in Elevations 271.6 m and 268.2 m (Geodetic).

The shale bedrock is of the Queenston Formation. The material is reddish brown and features an upper sub-unit. The upper (weak) sub-unit is highly weathered (W4) and fractured, and in a very poor to poor condition. SPT tests carried out in this sub-unit of the weathered shale bedrock measured N-values of more than 50 blows for less than 300 mm sampler penetration.

The highly weathered upper sub-unit of the bedrock can be readily penetrated using solid stem augers which indicates that in all likelihood, the material in upper sub-unit will have the engineering characteristics of a hard clayey till soil.

It should be further noted that the bedrock surface has been inferred from the results of the standard penetration tests, limited samples obtained by the split spoon and observations made on the rock core recovered during coring. These boundaries generally represent transitions from overburden to residual soil or highly weathered shale and should no be inferred to represent an exact plane of the bedrock surface. In general, depths to refusal to further auger, casing, and/or split spoon advancement in

boreholes should not be interpreted as a confirmation of bedrock surface but may be inferred to indicate potential proximity to bedrock surface.

It should be noted that bedrock coring was not carried out in less weathered sub-unit of bedrock at the location of boreholes.

3.2 GROUNDWATER CONDITIONS

During drilling (short-term), groundwater was encountered in several boreholes, the record of which is presented in the borehole logs.

The table below shows the observed stabilized groundwater table on November 20, 2020 and January 28, 2021 in the monitoring wells. The depths of groundwater observed on January 28, 2021 ranged from 0.6 m to 1.8 mbgs, corresponding to elevations 273.2 m and 270.1 m, respectively, as listed on **Table 2**.

Table 2: Groundwater level observations

Borehole/ Monitoring Well	Ground Elevation (mASL*)	Upon Completion		November 20, 2020		January 28, 2021	
		Depth to GW (mbgs)	GW Elevation (mASL*)	Depth to GW (mbgs)	GW Elevation (mASL*)	Depth to GW (mbgs)	GW Elevation (mASL*)
BH/MW 2	274.5	dry	N/A	4.4	270.1	1.3	273.2
BH/MW 4	273.8	dry	N/A	3.2	270.6	0.6	273.2
BH/MW 9	271.9	dry	N/A	6.5	265.4	1.8	270.1
BH/MW 11	273.5	dry	N/A	4.6	268.9	0.8	272.7

**mASL – meters above sea level*

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

4. GEOTECHNICAL ENGINEERING RECOMMENDATIONS

This section of the report provides geotechnical recommendations for the proposed low-rise residential buildings with potential underground basement, at the location shown on **Figure 1**.

The recommendations are based on the subsurface soil and groundwater conditions encountered during the investigation and interpretation of the factual data presented in this report. The soil conditions may vary between and beyond the borehole locations.

At the time of preparing this report, the proposed design grades (i.e. finished floor slab elevation) and foundations were not provided. The following engineering recommendations regarding the geotechnical design aspects of the building foundations should be reviewed once the final design grades and foundations have been finalized.

Where comments are made on construction, they are provided to highlight those aspects which could affect the design of the project, and for which special provision may be required during construction. Those requiring information on aspects of construction should make their own interpretation of the factual information, provided such interpretation may affect selections, proposed construction methods, scheduling and the like.

It should be noted that the glacial till may contain boulders. Possible large obstructions can be anticipated in the fill material. Contractor should be prepared for such conditions during construction.

The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by SIRATI to validate the information for use during the construction stage.

4.1 SITE PREPARATION, GRADING AND ENGINEERED FILL

In the areas where earth fill is required for site grading purposes, an engineered fill may be constructed.

Prior to the construction of engineered fill, all existing topsoil, fill material and any other unsuitable materials must be removed. Following the removal of all unsuitable materials, the excavation base consisting of native soil deposits must be inspected and approved by a qualified geotechnical engineer prior to any placement of engineered fill. The base of the excavation should be compacted and proof-rolled with heavy compactors (minimum 10,000 kg). During proof rolling, spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer. The material for engineered fill should consist of approved inorganic soil, compacted to 100 percent of Standard Proctor Maximum Dry Density (SPMDD).

General guidelines for the placement and preparation of engineered fill are presented in **Appendix A**.

To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential by SIRATI to certify the engineered fill. Despite full time supervision, it has been found that contractors frequently bulldoze loose fill into areas and compact only the surface. The inspector, either busy on other portions of the site or absent during “off hours” will be unaware of this condition. This potential problem must be recognized and discussed at a pre-construction meeting.

The onsite native deposits are considered suitable for use as engineered fill, provided that their moisture content at the time of construction is at or near optimum.

Depending upon the amount of grade raise, there will be consolidation settlement of the underlying soils. Additionally, there will be settlement of the engineered fill under its own weight, approximately 0.5% of the fill height. A waiting period of 3 to 6 months may be required prior to the construction of any structures on engineered fill. This should be confirmed during the detail design stage, once the grading plans for the proposed development are available.

4.2. ROADS

The investigation has shown that the predominant subgrade soil at the site, after stripping the topsoil and any other organic, loose, wet, and otherwise unsuitable material, is capable to support the pavement structure.

Based on the above and assuming that traffic usage will be primary residential load, the following minimum pavement thickness is recommended:

40 mm HL3 Asphaltic Concrete
50 mm HL8 Asphaltic Concrete
150 mm Granular 'A'
300 mm Granular 'B'

The above values may need to be adjusted according to the applicable municipal design specifications. The pavement structure recommended above assumes that the subgrade has sufficient bearing capacity to accommodate the applied pavement structure and local traffic. The site subgrade and weather conditions (i.e., if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer to facilitate the construction. Also, the bottom of the excavations or subgrade should be clear of any reworked soils, organic soil, residual materials (plastics, cardboards, etc.), and loose or soft soils prior to the installation of the pipes and pavement structure. Furthermore, heavy construction equipment may have to be kept off the newly constructed pavement before the placement of asphalt and/or immediately thereafter, to avoid damaging the subgrade by heavy truck traffic.

Backfilling and compaction should be properly monitored to ensure that suitable materials are used, and also the required degree of compaction is met. Also, appropriate supervision should be exercised by a qualified technician during the installation of the pipes and pavement structure. Once the subgrade has been inspected and approved, the granular base course material should beplaced in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or as required by the client. Frequent field density tests should be carried out on both the asphalt and granular base materials to ensure that the required degree of compaction is achieved.

4.2.1 Construction

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.2.2 Drainage

Installation of full-length subdrains is recommended on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basin. Any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.3 SERVICES

As a part of the site development, a network of new storm and sanitary sewers and water is to be constructed. Where the services need to be connected to the municipal infrastructure, trenching and backfilling will be required to be carried out. The following recommendations should be considered for trenching and backfilling for services as well as culvert crossings.

4.3.1 Trenching

It is expected that the trenches will be dug through fill/probable fill and native soil deposits. Groundwater level was observed at 0.8 m to 1.8 m below existing grade, corresponding to geodetic elevations of 270.1 m to 273.2 m. For any trenching below the groundwater level in cohesionless deposits, the water level should be lowered to at least 1 m below the base of the trench. Ingress water in cohesive deposits can be controlled by regular sump pumps.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, fill material can be classified as Type 3 above the groundwater level and Type 4 below the groundwater level. Cohesive till deposits can be classified as Type 1 Soil. Cohesionless soils, including silty sand till deposits, should be classified as Type 3 above the groundwater table and Type 4 below the groundwater table.

4.3.2 Bedding

The boreholes show that, in their undisturbed state, native soils will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding, however, may be required to be increased depending on the pipe diameter. The bedding material should consist of well-graded granular material such as Granular 'A' or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly-graded bedding material.

4.3.3 Backfilling of Trenches

Based on visual and tactile examination, and the measured moisture contents of the soil samples, the onsite excavated soils from above the groundwater table will generally need to be brought to ±2% of the optimum moisture content whether by adding water or aerating. Soils excavated from below the groundwater table will be too wet to compact and will require significant aeration prior to their use as backfill material.

Unless the materials are properly pulverized and compacted in sufficiently thin lifts, post-construction settlements could occur. The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at last 95% SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, as per City Standards. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling. Otherwise imported selected inorganic fill will be required for backfilling at this site.

The onsite excavated soils should not be used in confined areas (e.g. around catch basins, manholes and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch basins and manholes.

4.4. FOUNDATION CONSIDERATIONS

As noted previously, the subject site is proposed to be developed with low-rise residential buildings with a potential basement level.

4.4.1. Shallow Foundations - Spread/strip footing

Provided that the foundation soil is undisturbed during the construction, the allowable soil bearing values presented in **Table 3** are feasible in the undisturbed inorganic natural soils at or below the specified depths. The bearing value would be suitable for the use of normal strip or spread footings to support the proposed development.

The foundations designed to the specified allowable bearing capacity at the serviceability limit state (SLS) are expected to settle less than 25 mm total and 19 mm differential.

It should be noted that the bearing capacities were provided based on the soil and groundwater condition at the borehole locations and as such, variability should be anticipated between the boreholes.

Table 3: Recommended bearing capacities and minimum founding depths

BH No.	Material	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Minimum Founding Level at Elevation (m)
BH 1	Sandy Silt Till	300	500	2.3	271.5
BH 2	Sandy Silt Till	300	500	1.5	273.0
BH 3	Clayey Silt Till	300	500	0.9*	274.2
BH 4	Sandy Silt Till	300	500	0.9*	272.9
BH 5	Silty Sand Till	300	500	1.5	271.8
BH 6	Clayey Silt Till	300	500	0.8*	272.9
BH 7	Clayey Silt Till	300	500	0.8*	273.3
BH 8	Clayey Silt Till	300	500	1.5	271.1
BH 9	Clayey Silt Till	300	500	0.8*	271.1
BH 10	Clayey Silt Till	300	500	0.9*	271.8
BH 11	Clayey Silt Till	300	500	0.8*	272.7
BH 12	Clayey Silt Till	300	500	0.8*	272.4

* A minimum frost cover of 1.5 m should be provided for all foundations.

The geotechnical resistances provided above are given for loads that will be applied perpendicular to the surface of the footings. Where the load is not applied perpendicular to the footing, inclination of the load should be taken into account in accordance with Section 6.7.2 of the CHBDC (2014).

4.4.2 General Recommendations on Foundation Construction

The footings should be provided with a minimum 1.5 m of soil cover for frost protection as per OPSD 3090.101 (Frost Penetration Depths for Southern Ontario), as measured vertically and perpendicular from the face of the abutment slope to the edge of the underside of the footing.

All footing bases must be inspected by qualified geotechnical engineer prior to pouring concrete. The excavated foundation bases can be covered with 50 mm thick lean concrete slab immediately after inspection and cleaning in order to avoid disturbance of the founding soil due to construction activity.

If footings are constructed at different founding levels, the difference in elevation between individual footings should not be greater than half the clear distance between the footings. Should this not be possible, SIRATI should be consulted to provide field inspection to ensure that the footings exceeding the above requirement are stable and the bearing for the upper footing is not compromised. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevations of the upper footings can be adjusted accordingly. Stepped strip footings, if required, should be constructed in accordance with the 2012 Ontario Building Code (2012 OBC), Section 9.15.3.9.

Where the grade needs to be raised, the proposed structures can be supported by spread and strip footings founded on engineered fill for an allowable bearing pressure of 150 kPa. The engineered fill supporting footings should be constructed in accordance with the guidelines presented in **Appendix A**. Other requirements of engineered fill are given in **Section 4.1**.

The founding materials are susceptible to disturbance by construction activity especially during wet weather and care should be taken to preserve the integrity of the materials as bearing strata. All footing bases must be inspected by this office prior to pouring concrete, to confirm that the footings are located in a competent bearing stratum, which has been cleaned of ponded water and loosened or softened material. It is suggested that a lean concrete mat slab be placed immediately after the excavation is complete to avoid weathering of the soil, unless the footings are cast immediately after excavation. The bearing soil and fresh concrete must be protected from freezing during cold weather construction.

5. FLOOR SLABS

The floor slab can be supported on grade provided the base is thoroughly proof rolled to detect any soft or unstable areas, which must be removed and replaced with suitably compacted soils, as defined in **Section 5.1** of this report. Once the required subgrade has been developed, SIRATI recommends that the exposed subgrade be inspected and approved by the Geotechnical Engineer prior to the placement of any granular fill or concrete. A granular layer consisting of at least 200 mm of 19 mm Crusher Run Limestone (CRL) or OPSS Granular A should be installed under the floor slab as a bedding layer. The CRL or the OPSS Granular A should be compacted to 100% of its SPMDD.

The completed excavations for floor slabs should not be left open before pouring concrete for any period longer than 24 hours. Particularly, if the floor construction works are being completed during the winter months or wet weather periods. The base of any floor slab excavation that is left exposed longer than 24 hours should be suitably covered and protected from water ponding, and/or protected to prevent degradation of the exposed founding stratum with the construction of a mud mat.

The floor slab should be structurally independent of any load bearing structural elements and should tolerate expected foundation settlements as indicated above.

The perimeter drainage system shown on **Drawing 16** is recommended. Weeping tile systems on he exterior and underfloor drainage systems, should be appropriately designed to effectively discharge water and eliminate hydrostatic pressure build-ups.

6. EARTHQUAKE CONSIDERATIONS

Based on our interpretation of the available geotechnical data, borehole information, and National Building Code Seismic Hazard Calculator table, the proposed structures supported on undisturbed native deposits, the subject site can be classified as “Site Class 'C' for seismic site response according to Table 4.1.8.4.A of Ontario Building Code (OBC) 2012.

7. GENERAL COMMENTS ON REPORT

Sirati & Partners Consultants Limited (SIRATI) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, SIRATI will assume no responsibility for interpretation of the recommendations in the report.

The construction works as part of proposed development may cause ground movement and/or direct transmission of ground vibrations to adjoining structures and building. Considerations should be taken for preconstruction survey of the existing structures to be carried out, along with vibration control plan.

The comments given in this report are intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The limitation conditions presented in **Appendix B** form an integral part of the report and they must be considered in conjunction with this report.

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

Yours truly,

SIRATI & PARTNERS CONSULTANTS LIMITED

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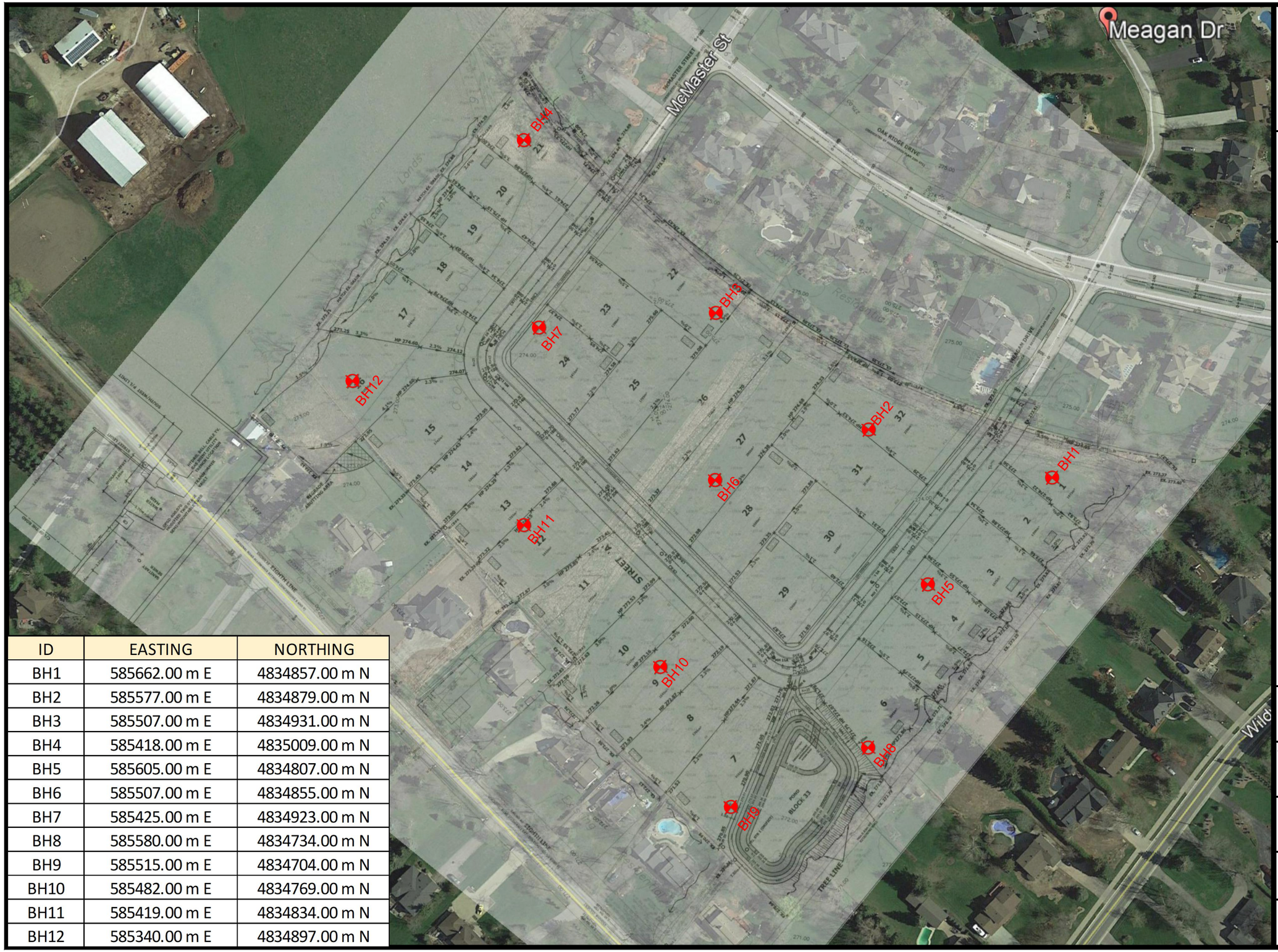
Drawings/Enclosures



ID	EASTING	NORTHING
BH1	585662.00 m E	4834857.00 m N
BH2	585577.00 m E	4834879.00 m N
BH3	585507.00 m E	4834931.00 m N
BH4	585418.00 m E	4835009.00 m N
BH5	585605.00 m E	4834807.00 m N
BH6	585507.00 m E	4834855.00 m N
BH7	585425.00 m E	4834923.00 m N
BH8	585580.00 m E	4834734.00 m N
BH9	585515.00 m E	4834704.00 m N
BH10	585482.00 m E	4834769.00 m N
BH11	585419.00 m E	4834834.00 m N
BH12	585340.00 m E	4834897.00 m N

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North:

Legend:

Proposed BH

Project Title:

Geotechnical Investigation
Subdivision Section

Site Location:

Eden Oak (McMaster Street & Meagan Drive), Halton Hills

Figure Title:

Proposed Boreholes Location Plan within property boundaries

Scale: 0m 30m

Project Number:

Date: October 2020

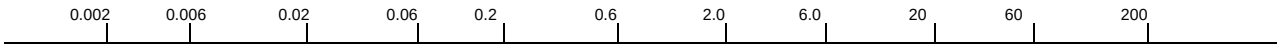
Figure Number: 1

Enclosure 1A: Notes on Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by Sirati & Partners Consultants Limited also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

LOG OF BOREHOLE BH 1

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834857.751 E 585662.142

DRILLING DATA

Method: Hollow Stem Auger

Diameter: 184 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
273.8												
273.6 0.0	**TOPSOIL:**200 mm											
0.2	**FILL:** sandy silt, some clay, trace gravel, brown, moist, loose		1	SS	7							
273.1												
0.8	**FILL:** clayey silt, trace to some sand, brown, moist, soft to stiff		2	SS	9		273					
1			3	SS	4		272					1 18 46 35
271.5												
2.3	**SANDY SILT TILL:** trace to some gravel, trace clay, brown, moist, dense to very dense		4	SS	36		271					
3			5	SS	55							
4	- inferred cobbles/boulders at 3.81m						270					- auger grinding at 3.81 m
	- inferred cobbles/boulders at 4.57m		6	SS	50/125mm		269					
5												
6 267.7							268					
6.1	**SAND:** trace silt, brown, wet, dense		7	SS	37							
267.3												
6.6	**END OF BOREHOLE:**											

Note:

1. Borehole was open upon completion of drilling.
2. Borehole water level was 5.64 m bgs upon completion of drilling.

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

SIRATI & PARTNERS

LOG OF BOREHOLE BH/MW 2

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834879.642 E 585577.395

DRILLING DATA

Method: Holloe Stem Auger

Diameter: 184 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
274.5												
274.3 0.0	**TOPSOIL:** 200 mm											
0.2	**FILL:** clayey silt, trace sand, trace gravel, trace organic matter, oxidation stains, brown, moist, stiff to very stiff		1	SS	9		274					
1			2	SS	18							
273.0						W. L. 273.2 m Jan 28, 2021						
1.5	**SANDY SILT TILL:** trace gravel, some clay, brown, moist, compact		3	SS	28							
2												
272.2												
2.3	**CLAYEY SILT TILL:** trace sand, trace gravel, reddish brown, moist, very stiff to hard		4	SS	22		272					
3	- some gravel to gravelly at 3.05 m		5	SS	48							
4	- inferred cobbles/boulders at 3.81 m						271					- auger grinding at 3.81 m
	- trace to some gravel, trace shale fragments		6	SS	90/ 250mm	W. L. 270.1 m Nov 20, 2020						- spoon bouncing at 4.57 m
5							269					
6												
268.4												
6.1 268.1	**INFERRED BEDROCK, HIGHLY WEATHERED SHALE:** queenston formation, reddish brown		7	SS	50/ 125mm							
6.4	**END OF BOREHOLE:**											

Note:

1. Borehole was caved to 5.79 m bgs upon completion of drilling.
2. Borehole was dry upon completion of drilling.
3. Monitoring well installed in the borehole from 3.33 m to 6.38 m bgs.
4. Groundwater level observations:

Date	Depth (mbgs)
2020-11-20	4.4
2021-01-28	1.3

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH 3

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834931.783 E 585507.052

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-04-2020

REF. NO.: SP20-747-00

ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
275.1							275
0.0 / 274.8	**TOPSOIL:**300 mm		1	SS	7		
0.3 / 274.2	**FILL:** clayey silt, trace to some sand, trace gravel, trace organic matter, brown, moist, firm		2	SS	22		274
0.9	**CLAYEY SILT TILL:** trace to some sand, trace gravel, brown, moist, very stiff to hard		3	SS	19		273
	- trace shale fragments at 3.05 m		4	SS	36		272
270.5			5	SS	62		271
4.6 / 269.0	**INFERRED BEDROCK, HIGHLY WEATHERED TO MODERATELY WEATHERED SHALE:** queenston formation, reddish brown		6	SS	50/ 75mm		270
6.2	**END OF BOREHOLE:**		7	SS	50/ 50mm		269

Note:

1. Borehole was open and dry upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
- ○ UNCONFINED
- ● QUICK TRIAXIAL
- + FIELD VANE & Sensitivity
- × LAB VANE

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH/MW 4

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4835009.852 E 585418.468

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-04-2020

REF. NO.: SP20-747-00

ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
273.8							
0.0 / 273.5	**TOPSOIL:**280 mm						
0.3 / 272.9	**FILL:** clayey silt, trace organic matter, trace rootlests, brown, moist, firm	1	SS	7			
0.9	**SANDY SILT TILL:** trace to some clay, trace gravel, brown, moist, compact to very dense	2	SS	27			
		3	SS	26		272	
	- gravelly, reddish brown, inferred cobbles/boulders at 2.3 m	4	SS	83		271	- auger grinding at 1.83 m 35 25 28 12
270.8							- auger grinding at 2.74 m
3.1 / 269.2	**CLAYEY SILT TILL:** trace sand, some gravel, reddish brown, moist, hard	5	SS	62		270	
4.6 / 267.5	**INFERRED BEDROCK, HIGHLY WEATHERED TO MODERATELY WEATHERED SHALE:** queenston formation, reddish brown	6	SS	50/ 50mm		269	
		7	SS	50/ 75mm		268	
6.3	**END OF BOREHOLE:**						

Note:

1. Borehole was open and dry upon completion of drilling.
2. Monitoring well installed in the borehole from 2.13 m to 5.18 m bgs.
3. Groundwater level observations:

Date	Depth (mbgs)
2020-11-20	3.2
2021-01-28	0.6

W. L. 273.2 m Jan 28, 2021

W. L. 270.6 m Nov 20, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH 5

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834807.39 E 585605.254

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
273.3								
273.0 0.0	**TOPSOIL:**230 mm							
0.2	**FILL:** sandy silt, trace clay, trace gravel, brown, moist, loose to compact		1	SS	6		273	
			2	SS	14			
271.8							272	
1.5	**SILTY SAND AND GRAVEL TILL:** brown, moist, compact to dense - inferred cobbles/boulders from 1.83 m to 3.81 m - gravelly at 2.29 m		3	SS	33			38 42 (20) - auger grinding from 1.83 m to 3.81 m
			4	SS	15		271	
			5	SS	31		270	
268.7							269	
4.6	**CLAYEY SILT TILL:** some sand, trace gravel, reddish brown, moist, hard		6	SS	70			
							268	
266.9	- with shale fragments at 6.1m		7	SS	50/ 75mm		267	- spoon bouncing at 6.1 m
6.3	**END OF BOREHOLE:**							

Note:

1. Borehole was open and dry upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$: Numbers refer to Sensitivity ○ $^{\varepsilon}$=3% Strain at Failure

SIRATI & PARTNERS

LOG OF BOREHOLE BH6

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834855.444 E 585507.715

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 7

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
273.6								
0.0 / 273.4	**TOPSOIL:**255 mm							
0.3 / 272.9	**FILL:** clayey silt, trace sand, trace gravel, brown, moist, firm		1	SS	8		273	
0.8	**CLAYEY SILT TILL:** trace sand, trace gravel, reddish brown, moist, very stiff to hard		2	SS	27			
			3	SS	36		272	0 7 58 35
			4	SS	38		271	
270.6								
3.1	**INFERRED BEDROCK, HIGHLY WEATHERED TO MODERATELY WEATHERED SHALE:** queenston formation, reddish brown		5	SS	96/ 250mm		270	
			6	SS	50/ 50mm		269	- spoon bouncing at 4.57 m auger grinding at 4.88m
267.4							268	
6.2	**END OF BOREHOLE:**		7	SS	50/ 75mm			

Note:

1. Borehole was open upon completion of drilling.
2. Borehole water level was 5.64 m bgs upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
(20 40 60 80 100)

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH 7

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834923.626 E 585425.4

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-04-2020

REF. NO.: SP20-747-00

ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
274.0							
0.0 / 273.8	**TOPSOIL:**255 mm						
0.3 / 273.3	**FILL:** clayey silt, some sand, trace gravel, trace rootlets, brown, moist, stiff		1	SS	10		
0.8	**CLAYEY SILT TILL:** trace to some sand, trace gravel		2	SS	29		273
			3	SS	65		272
271.6	- trace shale fragments at 2.29 m		4	SS	50/ 125mm		
2.4	**INFERRED BEDRCOK, HIGHLY WEATHERED SHALE:** queenston formation, reddish brown		5	SS	50/ 125mm		271
	- reddish brown to grey at 4.57m		6	SS	50/ 125mm initial		270 / 269
267.9							268
6.2	**END OF BOREHOLE:**		7	SS	50/ 75mm initial		

Note:

1. Borehole was open upon completion of drilling.
2. Borehole water level was 5.64 m bgs upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT — 20 40 60 80 100

SHEAR STRENGTH (kPa) — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT — w_P w w_L

WATER CONTENT (%) — 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

auger grinding at 3.81 m

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH 8

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834734.804 E 585580.026

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
272.6							
0.0 / 272.4	**TOPSOIL:**230 mm						
0.2 / 271.9	**FILL:** sandy silt, trace gravel, trace rootlets, brown, moist, loose		1	SS	6		272
0.8	**CLAYEY SILT TILL:** trace to some sand, trace to some gravel, reddish brown, moist, compact to very desne - auger grinding, inferred cobbles below 1.5 m		2	SS	21		
			3	SS	40		271
			4	SS	44		270
			5	SS	65		
			6	SS	45		269
							268
							267
266.2			7	SS	50/ 125mm		
6.4	**END OF BOREHOLE:** Note: 1. Borehole was open and dry upon completion of drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
- ○ UNCONFINED
- ● QUICK TRIAXIAL
- + FIELD VANE & Sensitivity
- × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

- auger grinding at 1.83 m

2 18 52 28

- auger grinding at 3.81 m

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SIRATI & PARTNERS

LOG OF BOREHOLE BH/MW 9

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834704.658 E 585515.29

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
271.9 / 0.0	**TOPSOIL:**200 mm						
0.2 / 271.1	**FILL:** silty sand, trace to some gravel, trace rootlets, reddish brown, moist, compact		1	SS	12		
0.8	**CLAYEY SILT TILL:** trace to some sand, trace to some gravel, reddish brown, moist, hard		2	SS	40		271
			3	SS	39	W. L. 270.1 m Jan 28, 2021	
			4	SS	32		269
			5	SS	44		268
			6	SS	50/ 125mm		267
	- trace shale fragments at 6.1 m		7	SS	90/ 255mm		266
265.4 / 6.5	**END OF BOREHOLE:**					W. L. 265.4 m Nov 20, 2020	

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Note:

1. Borehole was caved to 5.79 m bgs upon completion of drilling.
2. Borehole was dry upon completion of drilling.
3. Monitoring well installed in the borehole from 3.5 m to 6.51 m bgs.
4. Groundwater level observations:

Date	Depth (mbgs)
2020-11-20	6.5
2021-01-28	1.8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH 10

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834769.616 E 585482.871

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-03-2020

REF. NO.: SP20-747-00

ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
272.7												
272.6	**TOPSOIL:** 175 mm											
0.2	**CLAYEY SILT TILL:** trace to some sand, trace gravel, reddish brown, moist, stiff to hard		1	SS	12		272					
1			2	SS	50							
			3	SS	45		271					
2												
270.5												
2.3	**SILT :** some clay. trace sand, reddish brown, moist, very dense		4	SS	72							0 2 82 16
269.7							270					
3.1	**CLAYEY SILT TILL:** trace sand, trace gravel, reddish brown, moist, hard		5	SS	50/ 125mm							
4							269					
268.2												
4.6	**INFERRED BEDROCK, HIGHLY WEATHERED TO MODERATELY WEATHERED SHALE:** queenston formation, reddish brown		6	SS	50/ 50mm		268					- auger grinding at 5.18 m
5												
							267					
6												
266.5												
6.2	**END OF BOREHOLE:**		7	SS	50/ 100mm							

Note:

1. Borehole was open and dry upon completion of drilling.

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SIRATI & PARTNERS

LOG OF BOREHOLE BH/MW 11

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834834.473 E 585419.413

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-04-2020

REF. NO.: SP20-747-00

ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
273.5												
273.3 0.0	**TOPSOIL:** 175 mm											
0.2	**FILL:** sandy silt, trace clay, trace rootlest, trace organic material, brown, moist, compact		1	SS	13		273					
272.7 0.8	**CLAYEY SILT TILL:** trace to some sand, trace gravel, reddish brown, moist, very stiff to hard		2	SS	35	W. L. 272.7 m Jan 28, 2021	272					
			3	SS	26							
			4	SS	33		271					
	- trace shale fragments at 3 m		5	SS	47		270					
268.9 4.6	**INFERRED BEDROCK, HIGHLY WEATHERED TO MODERATELY WEATHERED SHALE:** queenston formation, reddish brown		6	SS	50/ 75mm	W. L. 268.9 m Nov 20, 2020	269 / 268					
267.3 6.2	**END OF BOREHOLE:**		7	SS	50/ 75mm							

Note:

1. Borehole was caved to 5.79 m bgs upon completion of drilling.
2. Borehole was dry upon completion of drilling.
3. Monitoring well installed in the borehole from 3.2 m to 6.2 m bgs.
4. Groundwater level observations:

Date	Depth (mbgs)
2020-11-20	4.6
2021-01-28	0.8

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

SIRATI & PARTNERS

LOG OF BOREHOLE BH12

PROJECT:

CLIENT: Neuhaus Developments Ltd.

PROJECT LOCATION:

DATUM: Geodetic

BH LOCATION: See Drawing 1 N 4834897.94 E 585340.576

DRILLING DATA

Method: Solid Auger

Diameter: 150 mm

Date: Nov-04-2020

REF. NO.: SP20-747-00

ENCL NO.: 13

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
273.2 / 0.0	**TOPSOIL:**255 mm						273
272.9 / 0.3	**FILL:** clayey silt, trace to some gravel, some sand, reddish brown, moist, stiff		1	SS	14		
272.4 / 0.8	**CLAYEY SILT TILL:** some sand, some gravel to gravelly, with shale fragments, reddish brown, moist, hard		2	SS	61		272
271.6 / 1.5	**INFERRED BEDROCK, HIGHLY WEATHERED TO MODERATELY WEATHERED SHALE:** queenston formation, reddish brown		3	SS	50/ 100mm		
			4	SS	50/ 125mm		271
			5	SS	50/ 125mm		270
	- reddish brown to grey at 4.57m		6	SS	50/ 50mm		269
							268
267.0 / 6.2	**END OF BOREHOLE:**		7	SS	50/ 100		267

Note:

1. Borehole was open and dry upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
- ○ UNCONFINED
- ● QUICK TRIAXIAL
- + FIELD VANE & Sensitivity
- × LAB VANE

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

- spoon bouncing and auger grinding at 4.88 m

SPCL SOIL LOG /DRAFT SP20-747-00.GPJ SPCL.GDT 21-2-5

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+3, ×3: Numbers refer to Sensitivity

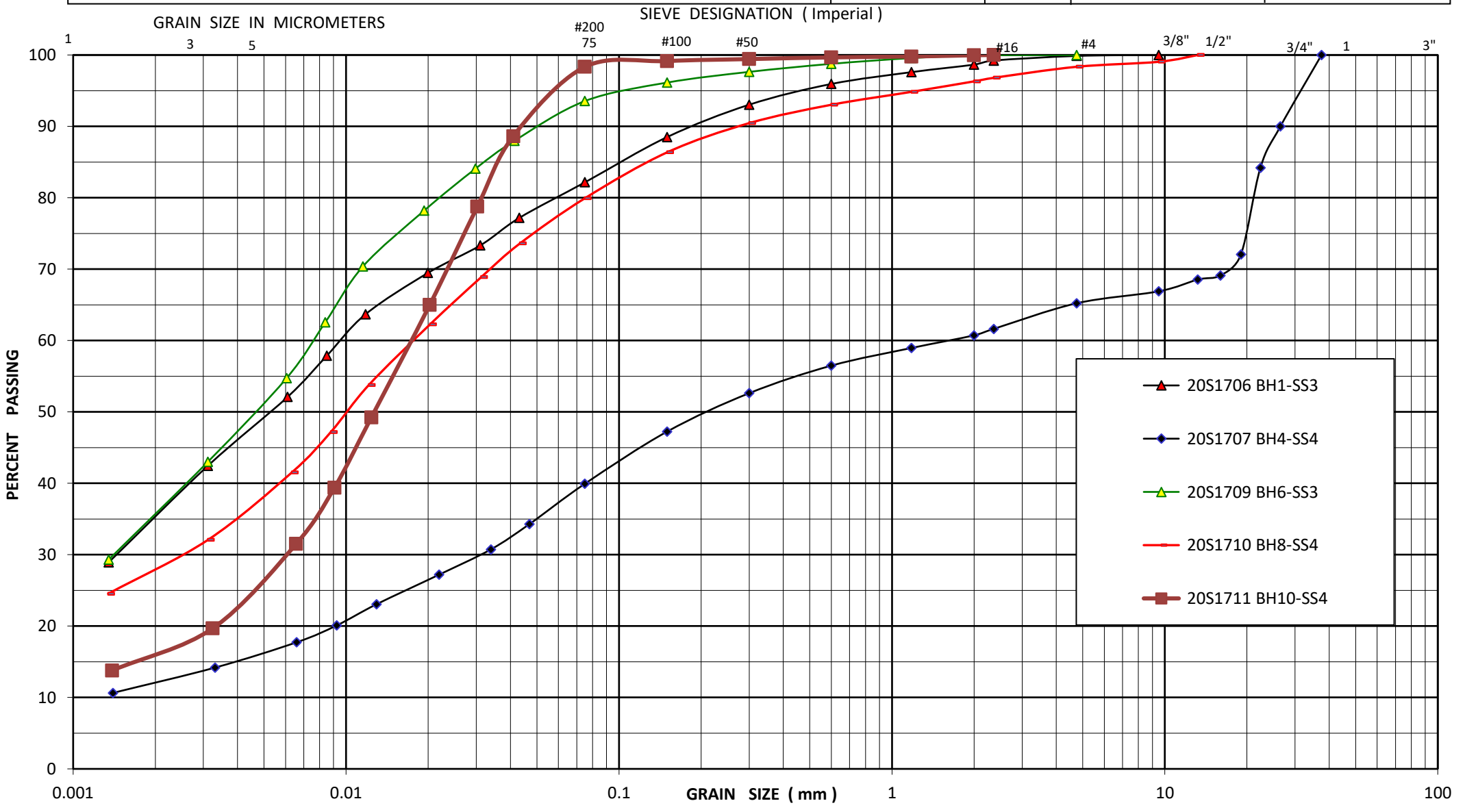
○ ε=3% Strain at Failure

SIRATI & PARTNERS

GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM

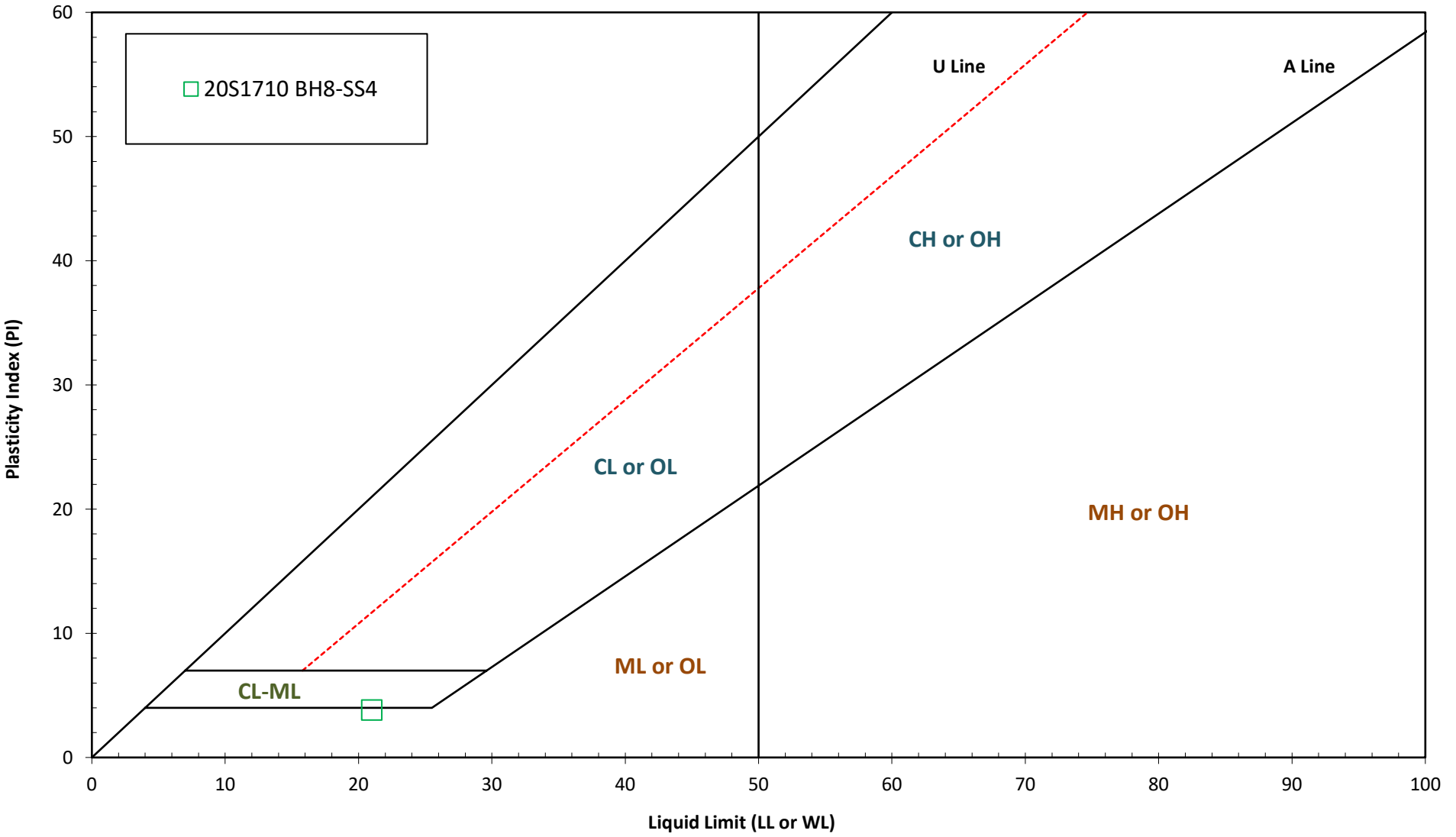
CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Project No.	:	SP20-747-00
Date	:	25 January 2021
Figure No.	:	14

Atterberg's Limits Test Report

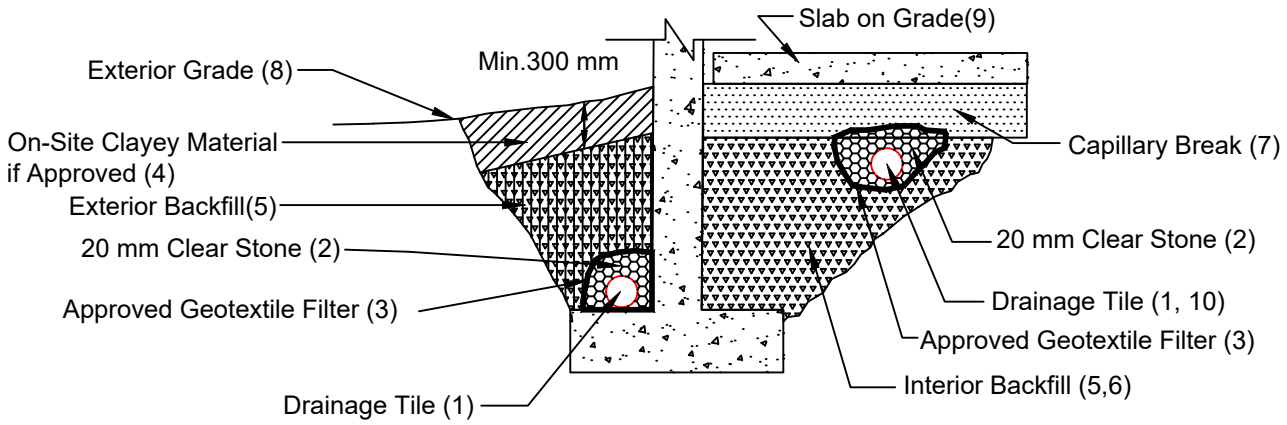
ASTM D4318-10



SIRATI & PARTNERS

Geotechnical Hydrogeological & Environmental Solutions

Date	:	25 January 2021
Project No.	:	SP20-747-00
Figure No.	:	15



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved geotextile filter (Terrafix 270R or equivalent).
4. The on-site clayey material, if approved, can be used as backfill in the upper 300 mm.
5. The interior and exterior fill adjacent to foundation walls should be OPSS Granular 'B' Type I. Compact to at least 98% SPMDD.
6. Do not use heavy compaction equipment within 450 mm (18") of the wall. Do not fill or compact within 1.8 m (6') of the wall. Place fill on both sides simultaneously.
7. Capillary break to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors (consult with architect).
8. Exterior grade to slope away from building at min. 2%.
9. Slab on grade should not be structurally connected to the wall or footing.
10. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab. Drain tile placed in parallel rows 6 to 8 m (12' to 25') centres one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Cover stone with filter fabric as noted in (3).
11. Do not connect the underfloor drains to perimeter drains.
12. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Slab on Grade Construction With Underfloor Drainage

(not to scale)

APPENDIX A

GUIDELINES FOR ENGINEERED FILL

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and Sirati & Partners Consultants Limited. Without this confirmation, no responsibility for the performance of the structure can be accepted by Sirati & Partners Consultants Limited (SIRATI). Survey drawing of the pre-and post-fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a SIRA -TI engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by SIRATI during placement of engineered fill is required. Workcannot commence or continue without the presence of the SIRATI representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

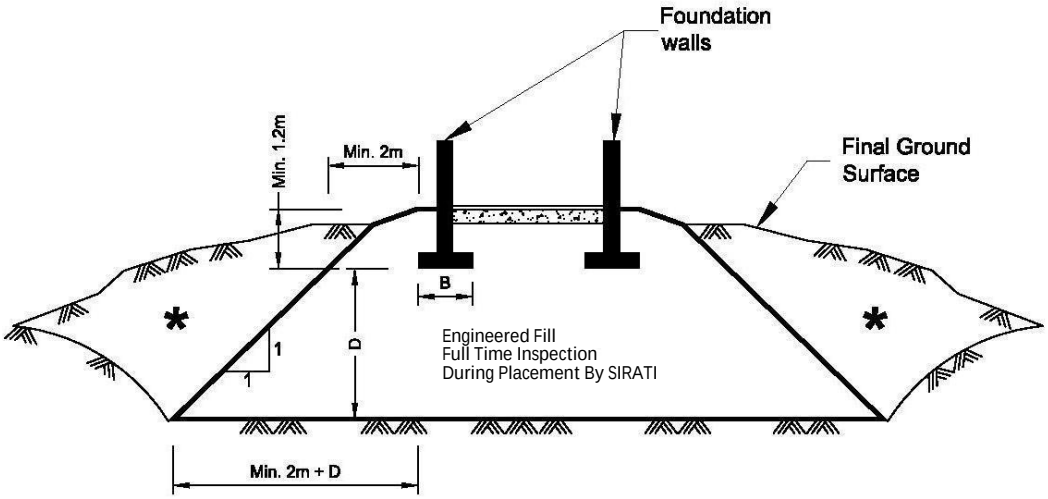
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from SIRATI prior tofooting concrete placements. All excavations must be backfilled under full time supervision bySIRATI to the same degree as the engineered fill pad. Surface water cannot be allowed to pond inexcavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with theapproval of SIRATI.

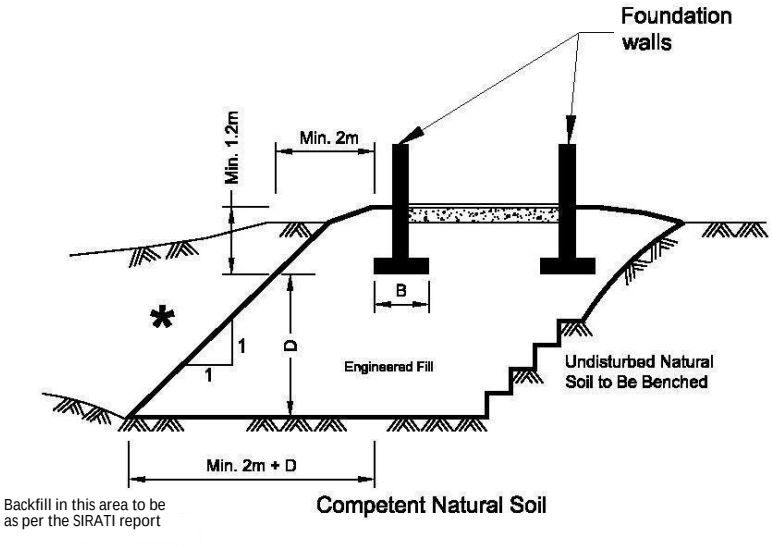
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with Sirati & Partners Consultants Limited (SIRA TI) report attached.


Foundation walls
Final Ground Surface
Min. 1.2m
Min. 2m
B
D
1
1
Engineered Fill
Full Time Inspection
During Placement By SIRATI
Min. 2m + D
Competent Natural Soil To Be Confirmed By SIRATI


Foundation walls
Min. 1.2m
Min. 2m
B
D
1
1
Engineered Fill
Undisturbed Natural Soil to Be Benched
Min. 2m + D
Backfill in this area to be as per the SIRATI report
Competent Natural Soil

APPENDIX B

LIMITATION AND USE OF THE REPORT

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

The conclusions and recommendations given in this report are based on information determined at the borehole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the borehole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc. Professional judgement was exercised in gathering and analyzing data and formulation of recommendations using current industry guidelines and standards. Similar to all professional persons rendering advice, SIRATI cannot act as absolute insurer of the conclusion we have reached. No additional warranty or representation, expressed or implied, is included or intended in this report other than stated herein the report.

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

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

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

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time. Any user of this report specifically denies any right to claims against the Consultant, Sub-Consultants, their officers, agents and employees in excess of the fee paid for professional services.

SIRATI engagement hereunder is subject to and condition upon, that SIRATI not being required by the Client, or any other third party to provide evidence or testimony in any legal proceedings pertaining to this finding of this report or providing litigations support services which may arise to be required in respect of the work produced herein by SIRATI. It is prohibited to publish, release or disclose to any third party the report produced by SIRATI pursuant to this engagement and such report is produced solely for the Client own internal purposes and which shall remain the confidential proprietary property of SIRATI for use by the Client, within the context of the work agreement. The Client will and does hereby remise and forever absolutely release SIRATI, its directors, officers, agents and shareholders of and from any and all claims, obligations, liabilities, expenses, costs, charges or other demands or

requirements of any nature pertaining to the report produced by SIRATI hereunder. The Client will not commence any claims against any Person who may make a claim against SIRATI in respect of work produced under this engagement.