REPORT ON
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED NEW SUBDIVISION
PARCEL #11 436091 - 4TH LINE
MELANCTHON, ONTARIO

Prepared for:

FLATO DEVELOPMENTS INC.

Prepared By:

SIRATI & PARTNERS CONSULTANTS LIMITED

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Project: SP17-256-10
January 24, 2018

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1. INTRODUCTION

Sirati & Partners Consultants Limited (SPCL) was retained by Flato Developments Inc. to undertake a preliminary geotechnical investigation at the property located at Parcel 11 – 4th Line, in Melancthon, Ontario.

The property under this investigation consisted of an agricultural land approximately 5.38 acres, bounded Parcel 9 to the north, neighboring parcels to the east and west, and Main Street West to the south. The west half of the land is heavily wooded.

The geotechnical investigations of Parcels 5, 6 and 9 which are located north of Parcel 11 were conducted by SPCL and reported as:

[Ref. 1]: "Report on Preliminary Geotechnical Investigation, Proposed Residential Development, 436091, 4th Line, Melancthon, Ontario", prepared for Flato Developments Inc., SPCL Project # SP17-206-10, dated August 17, 2017;

[Ref. 2]: "Draft Report Preliminary Geotechnical Investigation, Proposed New Subdivision, Parcel #9- 436091 4th line, Melancthon, Ontario", prepared for Flato Developments Inc., SPCL Project # SP17-246-10, dated October 25, 2017.

At the time of writing this report no information was provided to SPCL about the type of development, hence this report should be considered preliminary. To this end, we request that such information to be made available to SPCL, in which case a re-evaluation of this report and recommendations made herein will be required.

The purpose of this preliminary geotechnical investigation was to obtain information about the subsurface conditions at borehole locations and from the findings in the boreholes to make preliminary recommendations pertaining to the geotechnical design of underground utilities, subdivision roads and to comment on the foundation conditions for general house construction.

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 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 Flato Developments Inc. and its architects and designers. Third party use of this report without Sirati & Partners Consultants Limited (SPCL) consent is prohibited. The limitation conditions presented in **Appendix B** form an integral part of the report and must be considered in conjunction with this report.

2. FIELD AND LABORATORY WORK

A total of two (2) boreholes (BH1 and BH2, see Drawing 1 for location plan) were drilled to a depth of 8.2 m below the existing grade. Boreholes were drilled with solid stem continuous flight auger equipment by a drilling sub-contractor under the direction and supervision of SPCL personnel. 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. The samples were logged in the field and returned to the SPCL laboratory for detailed examination by the project engineer and for laboratory testing.

In addition to visual examination in the laboratory, all soil samples were tested for moisture content. Selected two (2) soil samples were subjected to grain size analyses and gradation curves are presented in Figure 4. In addition, selected one (1) sample was subjected to Atterberg Limits analysis and the results are presented in the borehole logs.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations.

The elevations at the borehole locations were surveyed by an SPCL personnel using differential GPS system and varied from 491.6 m to 493.9 m.

3. SITE AND SUBSURFACE CONDITIONS

The borehole location plan is shown in Drawing 1. Notes on soil descriptions are presented in Drawing 1A. The subsurface conditions in the boreholes are presented in the individual borehole logs (Encl. 2 to 3 inclusive). The subsurface conditions in the boreholes are summarized in the following paragraphs.

3.1 SOIL CONDITIONS:

Topsoil/Fill Material: a surficial layer of topsoil with 400 mm thickness was found at both borehole locations. The thickness of the topsoil in each borehole was shown in the borehole logs. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the entire site and should not be relied on to calculate the amount of topsoil at the site.

Below the topsoil, fill material was encountered in both boreholes, extending to depth of 0.8 m below the existing ground surface. The fill material mainly consisted of silt and silty sand with trace of clay

and topsoil inclusions. The measured SPT 'N' values in the fill material ranged from 2 to 11 blows for 300 mm penetration, indicating its very loosely to moderately compacted state.

Water Bearing Cohesionless Soils: Similar to what observed in Parcels 5, 6, and 9 (Refs 1,2), a cohesionless stratum comprising silty sand, sandy silt and silt was found below the fill materials, and at the borehole termination in both boreholes. The stratum was found to be in a loose to compact state with SPT 'N' values ranging from 6 to 50 blows for 300 mm penetration.

Grain size analysis of a cohesionless sample (BH1/SS3) was conducted and the results are presented in Figure 4, with the following fractions:

Clay: 10%
Silt: 40%
Sand: 49%
Gravel 1%

Clayey Silt: A cohesive layer comprising clayey silt with interbedded seams of fine sand was observed in both boreholes within the cohesionless stratum extending from 3.0 m to 6.1 m depth in BH1 and from 4.6 m to 7.6 m in BH2. The SPT 'N' values were found ranging between 11 and 30 blows per 300 mm penetration, indicating a stiff to very stiff consistency.

Grain size analysis of one (1) clayey silt sample (BH1/SS5) was conducted and the results are presented in Figure 4, with the following fractions:

Clay: 21%
Silt: 67%
Sand: 11%
Gravel: 1%

3.2 GROUNDWATER CONDITIONS

During drilling (short-term), water was observed in all boreholes at depths ranging from 0.8 m to 1.5 m below the existing grade. No monitoring well was installed in the subject parcel.

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

4. DISCUSSION AND RECOMMENDATIONS

4.1 GENERAL

It is proposed to develop the site as a residential subdivision. The lots will therefore be serviced by a network of roads, storm and sanitary sewers and watermains.

The groundwater level at the subject site is generally high, at about 0.8 m to 1.5 m below the existing grade. Groundwater control measures will be required during the construction of underground services. The basements for the proposed houses must be kept at least 0.3 m above the seasonally high groundwater table to avoid the permanent (underfloor drainage) groundwater control.

A hydrogeological study is recommended for the subject site to evaluate the type and extent of groundwater control required during the construction and permanent groundwater control upon completion of the construction. The seasonally high groundwater table must be established with a long-term groundwater levels monitoring program.

No information was available at the time of writing this report regarding the proposed development. The following sections retaining to the design and construction recommendations for the proposed development will need to be re-assessed by SPCL upon availability of the plan layout, elevations, loading conditions, and other information pertinent to the proposed development. The following recommendation should therefore be considered as preliminary.

4.1 ROADS

The investigation has shown that the predominant subgrade soil at the site, after stripping the topsoil, fill material and any other organic and otherwise unsuitable material will consist of sandy silt, silty sand, silt, and in some locations clayey silt deposits

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

40 mm HL3 Asphaltic Concrete
80 mm HL8 Asphaltic Concrete
150 mm Granular ‘A’
350 mm Granular ‘B’

These values may need to be adjusted according to the Town of Melancthon Standards. 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 in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.1.1 Stripping, Sub-excavation and Grading

The site should be stripped of all topsoil, weathered/disturbed soils and any organic or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas.

Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes

of a heavy compactor having a rated capacity of at least 10 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be recompacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material must be used.

Any fill required for regrading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, as per Town Standards. The compaction of the new fill should be checked by frequent field density tests.

4.1.2 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.

4.1.3 Drainage

The Town of Melancthon requires the installation of full-length subdrains 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 basins. As discussed in Section 4.1.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.2 SEWERS

As a part of the site development, a network of new storm and sanitary sewers is to be constructed.

4.2.1 Trenching

It is expected that the trenches will be dug through the sandy silt, silty sand and silt deposits at shallow depths and clayey silt deposits with interbedded sand seams at greater depths. Short-term groundwater level was observed at 0.8 m to 1.5 m depth during drilling. Positive dewatering such as well points will be required prior to any trenching/excavation in cohesionless sandy and silty soils below the groundwater table, otherwise it will result into flowing sides and unstable base. Water table must be lowered to 1 m below the lowest excavation level. Further monitoring of the groundwater table is recommended to establish the seasonally high groundwater levels.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the overburden can be classified as Type 3 Soil above the groundwater table and Type 4 Soil below the groundwater table.

4.2.2 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 may, however, have 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.

4.2.3 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. 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 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.

4.3 SITE GRADING AND ENGINEERED FILL

In the areas where earth fill is required for site grading purposes, an engineered fill may be constructed below house/building foundations, roads, boulevards, etc.

Prior to the construction of engineered fill, all topsoil, fill material, weak weathered / disturbed and any other unsuitable materials must be removed in this area. After 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). Recommendations regarding engineered fill placement are provided in **Appendix A** of this report.

To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential by SPCL 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.

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.

4.4 FOUNDATION CONDITIONS

At the time of writing this report no information was provided to SPCL about the type of development, proposed foundations, loading condition and the number of basement levels. As such, when more information becomes available, the analysis and recommendations given below needs to

be re-visited. To this end, additional detailed investigation will be required to address probable use of deep foundations, requirements for shoring and any other parameters pertinent to the design and construction of mid-rise/high-rise buildings. We recommend such information to be provided to SPCL as soon as it becomes available.

The boreholes show that provided the foundation soil is undisturbed during the construction, in general, an allowable soil bearing value of 100 kPa at serviceability limit state and 150 kPa at ultimate limit state are feasible in the undisturbed inorganic natural soils, at or below the depths provided in **Table 2**. The bearing value would be suitable for the use of normal spread footings to support normal low-rise developments.

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 4.3.

Table 2: Bearing Values and Founding Levels of Spread Footings

BH No.	Material	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH1	Silty Fine Sand	100	150	1.5	490.1
BH2	Silty Sand/Silty Fine Sand	100	150	1.5	492.4

A minimum frost cover of 1.7 m should be provided for all footings.

As indicated above, consideration may need to be given to other types of foundation subject to the final layout, type and founding depths of the proposed development.

5. TEMPORARY SHORING

If required, retaining elements designed to resist earth pressure can be calculated based on the following parameters:

1) Earth Pressure Coefficient

   (a) Where movement must be minimal K=0.5

   (b) Where minor movement (0.002H) can be tolerated K=0.3

   (c) Passive earth pressure for soldier piles (unfactored) Kp=3.0

2) For stability check

φ=30

C=0

γ=21

Surcharge is to be determined by shoring contractor.

6. EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed building can be classified as "Class D" for the seismic site response.

7. GENERAL COMMENTS ON REPORT

Sirati & Partners Consultants Limited (SPCL) 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 & Partners will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. 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.

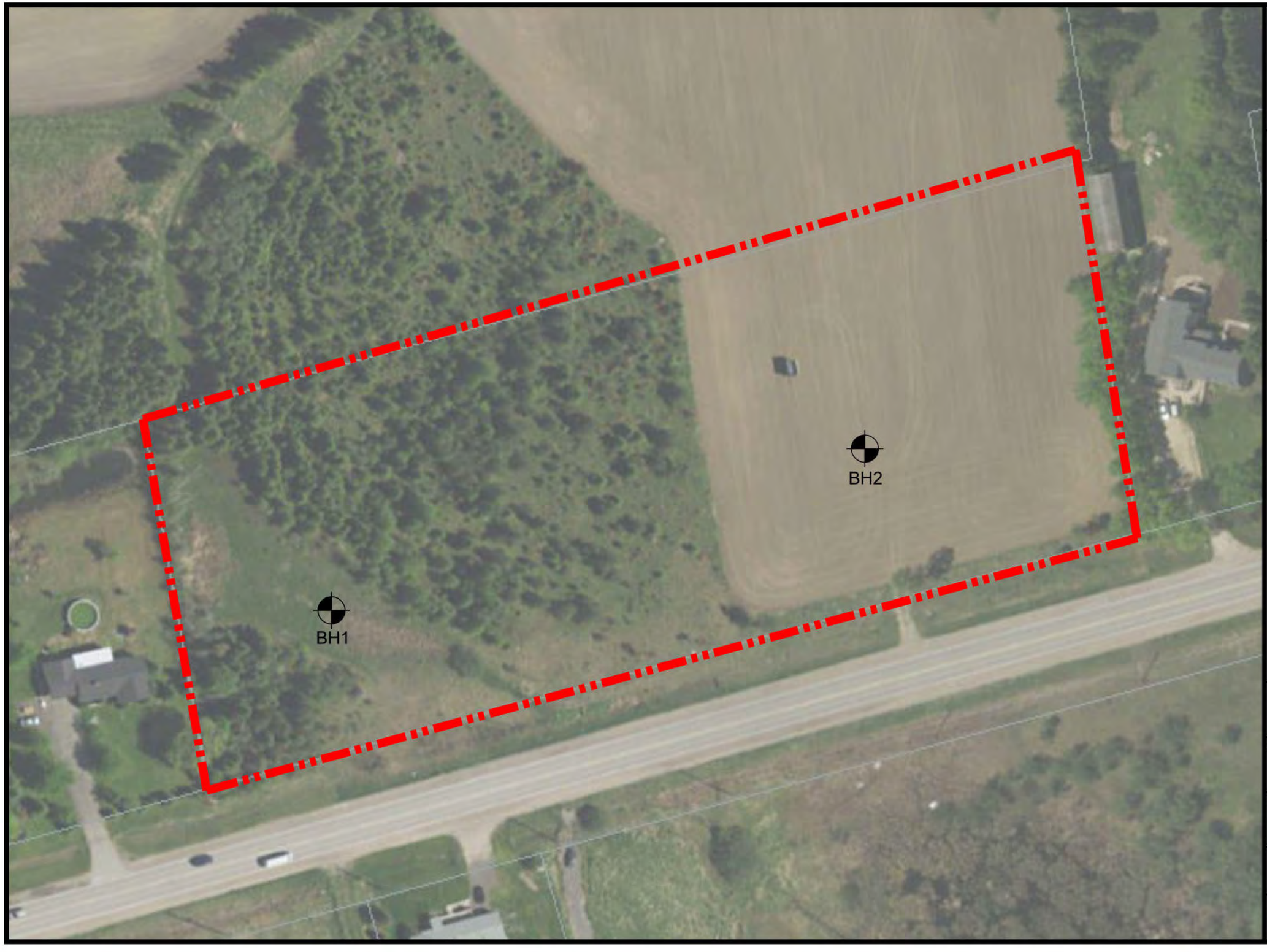
Yours truly,

SIRATI & PARTNERS CONSULTANTS LIMITED

Meysam Najari, Ph.D., E.I.T.

Archie Sirati, Ph.D., P.Eng.

Drawings



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North:

N

Legend:

Property Boundary

Project Title:

Geotechnical Investigation

Site Location:

Parcel 11, 4th Line, Melancthone, ON

Figure Title:

Site Plan

Scale:	Project Number:
0m 10m 20m	SP17-256-10
Date:	**Figure Number:**
November 2017	1

Drawing 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		

0.002	0.006	0.02	0.06	0.2	0.6	2.0	6.0	20	60	200

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.

Appendix A:

Guidelines for Engineered Fill

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LOG OF BOREHOLE BH1

PROJECT: Parcel 11
CLIENT: Flato Developments
PROJECT LOCATION: Parcel - 4th Line, Melanchton (Shelburne), Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method:
Diameter: 150mm
Date: Oct/27/2017
Drilling Contractor: Pontil Drilling

REF. NO.: SP17-256-10
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
491.6							
0.0 / 491.2	**TOPSOIL:** 400mm, topsoil		1	SS	2		
0.4 / 490.8	**FILL:** silt, trace fine sand, trace clay, trace topsoil, brown, wet, very loose					▽	
0.8	**SILTY FINE SAND:** brown, wet, loose to compact		2	SS	6		
489.3			3	SS	15		490
2.3 / 488.6	**SILT:** trace clay, trace sand, trace gravel, grey, wet, loose		4	SS	8		489
3.0	**CLAYEY SILT WITH INTERBEDDED LAYERS OF FINE SAND:** trace sand, grey, very moist to wet, stiff to very stiff		5	SS	11		488
485.5			6	SS	26		487
6.1	**SANDY SILT:** trace clay, grey, moist, compact to dense		7	SS	27		486
483.4			8	SS	50		485
8.2	**END OF BOREHOLE:**						484

Notes:
1. Groundwater level was observed to be at 0.7 m on 27 October 2017
2. Borehole caved-in at 3.7 m

W. L. 491.0 m
Oct 27, 2017

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)

CHEMICAL ANALYSIS AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
3	1	49	40	10
5	1	11	67	21

SPCL SOIL LOG SP17-256-10,20.GPJ SPCL.GDT 11/27/17

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

Sirati & Partners Consultants Ltd.
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Engineering Solutions

LOG OF BOREHOLE BH2

PROJECT: Parcel 11
CLIENT: Flato Developments
PROJECT LOCATION: Parcel - 4th Line, Melanchton (Shelburne), Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method:
Diameter: 150mm
Date: Oct/27/2017
Drilling Contractor: Pontil Drilling

REF. NO.: SP17-256-10
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
493.9							
0.0 / 493.5	**TOPSOIL:** 400mm, topsoil		1	SS	11		
0.4 / 493.1	**FILL:** silty sand, trace clay, trace gravel, brown, moist, compact						
0.8	**SILTY SAND TO SILTY FINE SAND:** trace clay, brown, moist to very moist, compact		2	SS	9		493
			3	SS	18		492
491.6							
2.3 / 490.5	**SILT:** trace clay, trace gravel, brown, moist, compact		4	SS	18		
			5	SS	25		491
3.4 / 489.3	**SILTY SAND:** brown, very moist, compact						490
4.6	**CLAYEY SILT WITH INTERBEDDED LAYERS OF FINE SAND:** trace clay, brown to grey, very moist to wet, compact		6	SS	12		489
	at 6.1 m, becoming grey		7	SS	30		488
486.3							487
7.6 / 485.7	**SILT TO SILTY SAND:** trace gravel, brown to grey, wet, stiff to very stiff		8	SS	25		486
8.2	**END OF BOREHOLE:**						

Notes:
1. Borehole dry upon completion of drilling
2. Borehole caved-in at 2.1 m

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)

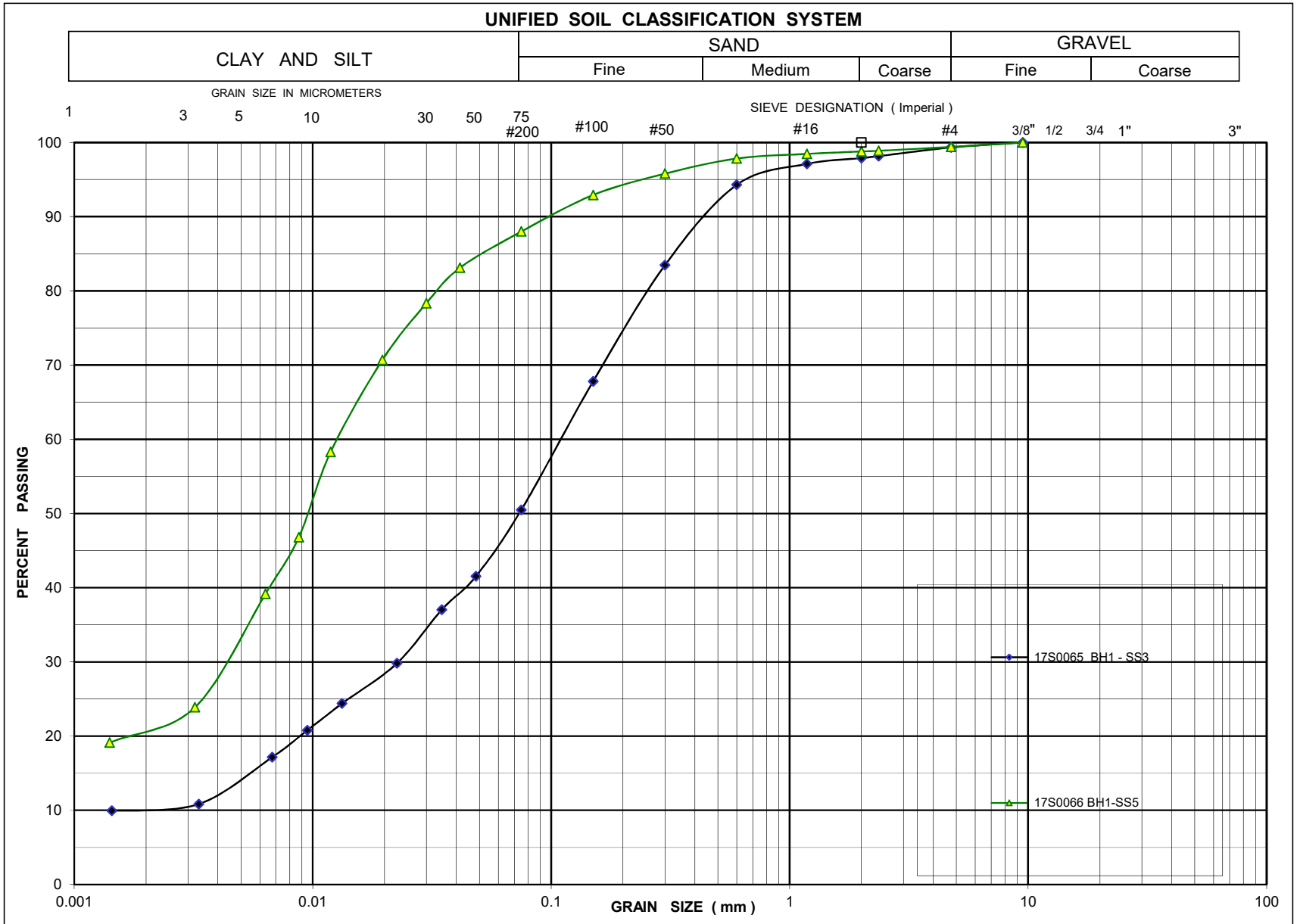
NATURAL UNIT WT (kN/m³)

CHEMICAL ANALYSIS 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_f=3% Strain at Failure

SPCL SOIL LOG SP17-256-10,20.GPJ SPCL.GDT 11/27/17



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GRAIN SIZE DISTRIBUTION

Fig: 4

Project: SP17-256-10

Date: November 2017

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 (SPCL) at the time of preparation. Unless otherwise agreed in writing by SPCL, 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, SPCL 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. SPCL 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.

SPCL engagement hereunder is subject to and condition upon, that SPCL 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 SPCL. It is prohibited to publish, release or disclose to any third party the report produced by SPCL 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 SPCL for use by the Client, within the context of the work agreement. The Client will and does hereby remise and forever absolutely release SPCL, 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 SPCL hereunder. The Client will not commence any claims against any Person who may make a claim against SPCL in respect of work produced under this engagement.