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Squamish, BC V8B 0C3
604-898-1093

UBC Properties Trust
3133 Shrum Lane, Suite 200
Vancouver BC, V6S 0C8

September 27, 2019
File: 1322

Attention: Mr. Craig Shirra, Development Manager

**Re: Geotechnical Report, Proposed Student Arts Centre,
Walter Gage Road and East Mall, UBC Campus, Vancouver BC**

1.0 INTRODUCTION

We understand that it is proposed to construct a new Student Art Centre on the University of British Columbia (UBC) Campus in Vancouver BC. This report provides general geotechnical recommendations for the design and construction of the new building based on past geotechnical investigations of the site.

We have reviewed the preliminary design drawings prepared by Leckie Studio Architecture and Design Inc. dated September 26, 2019, in preparation of this report. The building is proposed to be a three storey circular building over a one level underground basement. We expect the basement level will be of reinforced concrete construction with timber or steel frame above. Structural drawings are not yet available.

This report has been prepared exclusively for UBC Properties Trust, for their use, and the use of others on their design team, however, it remains the property of SFA Geotechnical Inc.

2.0 SITE DESCRIPTION

The new building is proposed in the southwestern quarter of the property to the north of the Walter Gage Road and East Mall intersection. The site is currently improved with an at-grade asphalt parking lot and green space.

The site is predominantly flat with surface elevations ranging from 83 to 84 meters geodetic.

3.0 PAST GEOTECHNICAL INVESTIGATIONS

The site was previously investigated in November 2017 and again by SFA in January 2019. Two of the test holes were drilled within the location of the proposed Student Arts Centre. SFA has referenced test holes TH17-07 and TH19-04 in preparing this report.

The test holes were advanced to depths of 4.6 and 6.1 m below existing grade. One of the test holes was supplemented with a dynamic cone penetration test (DCPT) sounding.

The test hole locations are shown on the attached drawing 1322-01 and are included in Appendix A for reference.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Conditions

The Geological Survey of Canada Map File 1486A describes the area as lodgement and minor flow tills up to 25 m thick but in most places less than 8 m thick and overlain by glaciomarine and marine deposits.

In general, the soil profile noted from the surface downwards at the reviewed test holes consists of compact sand and gravel fill, loose to compact sand and/or firm silt overlying very dense glacial till soils. The glacial till was encountered at depths between 2.1 and 3.0 m at the test hole locations.

For a more detailed description of the subsurface conditions refer to the test hole logs in Appendix A.

4.2 Groundwater Conditions

The groundwater table was not encountered in past investigations and is anticipated to be well below the proposed development grades. However, some perched water may be encountered within the more permeable surficial fills overlying the underlying glacial till.

5.0 DESIGN RECOMMENDATIONS

5.1 Site Preparation

5.1.1 Stripping

Prior to construction, all existing vegetation, topsoil, disturbed, loose fill or native surficial soils should be removed from within the construction areas to expose a subgrade consisting of native glacial till. SFA should be asked to review the stripped subgrade prior to filling.

The underlying glacial till soils may be sensitive to water and therefore we recommend a protective blinding layer (i.e. 75 mm of gravel or blinding concrete) be placed to preserve the integrity of the soil.

5.1.2 Engineered Fill

Any grade reinstatement beneath foundations, grade supported slabs, or pavement sections should be completed with “engineered fill”. In the context of this report any “engineered fill” is defined as clean sand to sand and gravel fill, containing less than 8% fines, compacted in lifts to a minimum standard of 95% of its Modified Proctor Maximum Dry Density (ASTM D698) while at a moisture content that is within 2% of its optimum for compaction.

5.2 Excavations

We expect temporary excavations will be up to 4.0 m below grade. We anticipate there will be sufficient room for open sloped cuts and that shoring will not be required. All excavations and trenching must conform to WorkSafeBC requirements or a professional engineer must review any excavations exceeding 1.2 m in depth that require worker entry.

If it is determined that there is insufficient room to slope the excavation or it is preferable to shore the excavation, anchored reinforced shotcrete would be suitable at this site.

5.3 Foundations

5.3.1 Foundation Design

We expect that foundations bearing upon an approved subgrade of very dense glacial till soils can be designed in consideration of a Serviceability Limit State (SLS) bearing pressure of 400 kPa and a factored Ultimate Limit State (ULS) bearing pressure of 800 kPa. The foundation subgrade should be reviewed by SFA prior to placing formwork.

5.3.2 Settlement of Foundations

Post-construction settlements are estimated to be less than 25 mm with differential settlement of less than 1 in 300.

5.3.3 Seismic Design of Foundations

We recommend that the site be classified as 'Site Class C' as defined in Table 4.1.8.4.A of the 2018 British Columbia Building Code (BCBC) for structural design purposes. The underlying soils are not considered to be susceptible to liquefaction or strain softening in the event of a large scale earthquake such as that considered by the BCBC.

5.3.4 Frost Protection

The underside of foundations should be located at least 0.45 m below finished site grades for frost protection.

5.4 Concrete Slabs on Grade

All grade supported concrete slabs should be underlain by a minimum of 150 mm of 19 mm clear crushed gravel, to prevent moisture from accumulating below the slab. The gravel should be compacted in place under review of SFA. We recommend that a poly moisture barrier be placed overlying the gravel beneath the grade supported slabs to help reduce moisture within the concrete.

5.5 Foundation Drainage

A perimeter drainage system should be installed for below-grade portions of the structure to prevent the development of hydrostatic pressure on the foundation walls or below the basement floor slab. The perimeter drain should be hydraulically connected to the underslab gravel. This is typically completed by placing weep holes through the base of the foundation walls or gravel beneath the foundations.

During construction, perched water inflows are expected, but could likely to be managed using conventional drainage methods such site grading and pumped sumps.

5.6 Lateral Earth Pressure

The proposed building includes one level of below grade construction and therefore earth pressure will develop against the buried foundation walls. We assume that foundation walls will be backfilled with free draining material and that the walls would be fully drained. We recommend that the foundation walls be designed in consideration of the following earth pressures:

1. Static: Pa = 5.1*H
   Where;
   Pa = Lateral earth pressure due to static loading (kPa), triangular distribution;
   H = Wall height (m).

2. Seismic: Pe = 3.7*H
   Where;
   Pe = Earth induced earth pressure (kPa), inverted triangular distribution;
   H = Wall height (m).

These lateral pressures are based on unfactored soil parameters and are considered to be unfactored loads. Any additional surcharge loads located near the foundation walls should be added to the earth pressures given.

6.0 FIELD REVIEWS

As is normally required for Letters of Assurance in accordance with the BC Building Code, SFA Geotechnical Inc. should be asked to carry out sufficient field reviews during construction to ensure that the Geotechnical Design recommendations contained within this report have been adequately communicated to the design team and to the contractors implementing the design. These field reviews are not carried out for the benefit of the contractors and therefore do not in any way effect the contractor's obligations to perform under the terms of their contract.

It is the contractors' responsibility to advise SFA Geotechnical Inc. (a minimum of 24 hours in advance) that a field review is required. Geotechnical field reviews are normally required at the time of the following:

1.	Stripping	Review of stripped subgrade prior to any fill placement;
2.	Excavations (>1.2 m)	Review of temporary batter and safety for entry requirements;
3.	Filling	Review of any engineered fill used to raise grades;
4.	Subgrade	Review of prepared foundation subgrade;
5.	Slab-on-grade	Review of slab-on-grade preparation;
6.	Backfill	Review of backfill placement around foundation walls.

It is critical that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also critical that contractors working on the site view this document in advance of any work being carried out so that are familiar with the sensitive aspects of the project. It is the responsibility of our client, or their representative to notify SFA Geotechnical Inc. when conditions or situations not outlined within this report are encountered.

7.0 CLOSURE

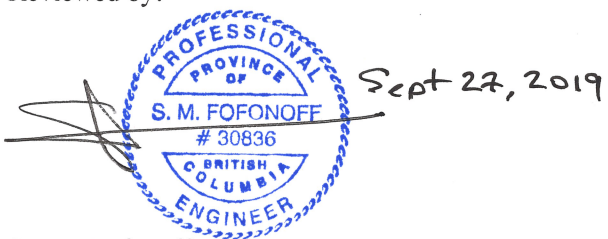
This report is prepared solely for use by our client and their design team for this project as described to the general standards of similar work for similar projects in this area and no other warranty of any kind is expressed or implied. SFA Geotechnical Inc. accepts no responsibility for any other use of this report.

We are pleased to assist you with this project, and we trust this information is helpful and sufficient for your purposes at this time.

For:
SFA Geotechnical Inc.

Jessica Gagne, P.Eng.
Geotechnical Engineer

Reviewed by:



Steven Fofonoff, M.Eng., P.Eng.
Principal

LEGEND

- TEST HOLE LOCATIONS - GEOPACIFIC (NOVEMBER, 2017)
- TEST HOLE LOCATIONS - SFA (JANUARY, 2019)

REVISIONS:
A.
B.
C.

FILE NO.: 1322

DWG. NO.: 1322-01

SFA GEOTECHNICAL ENGINEERING

DATE: SEPT 26, 2019		
DRAWN BY: JG	APPROVED BY: SMF	REVIEWED BY: JG
SCALE: NTS		

PROPOSED STUDENT ART CENTRE
WALTER GAGE ROAD, UNIVERSITY ENDOWMENT LANDS
TEST HOLE LOCATION PLAN

Appendix A: Test Hole Logs

SFA GEOTECHNICAL INC.

PROJECT: Brock Commons 2 - Development
TESTHOLE NO.: TH19-04
LOCATION: Walter Gage Road, University of British Columbia, BC
DATE DRILLED: 1/25/2019
JOB NO.: 1156
DRILLED USING: Truck Mounted Auger
GROUND SURFACE ELEVATION:
LOGGED BY: DS

DEPTH (m)	DESCRIPTION OF STRATA
0	FILL - 150 mm of asphalt and road base over dark brown, compact, sand and gravel
0.5	SAND - grey mottled brown and orange, loose to compact, some silt and trace gravel, moist to wet
1.5	SILT - light grey brown mottled orange, firm, clayey with trace gravel, moist, plastic
2.4	SAND - compact, coarse with trace silt, wet
3	TILL - very dense, silt with some sand and trace gravel, dry
6.1	End of test hole - desired depth

LEGEND

DEPTH (m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0

MOISTURE CONTENT (%)

DCPT blows / 0.3 m
0 10 20 30 40 50

Figure: B.4

Test Hole Log: TH17-07

File: 15467
Project: Proposed Residential and Institutional Development
Client: UBC Properties Trust
Site Location: East Mall and Walter Gage Road, UBC, Vancouver

GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 ft / 0 m		Ground Surface					
0		***Asphalt*** 2" thick Asphalt	0.0				
2		***Sand and Gravel [Roadbase Fill]*** Sand and gravel road base course fill, compact	0.6				
4		***Silty Sand [Fill]*** Dark brown silty sand fill, compact		22.6			
5		***Sandy Silt [Fill]*** Orange brown sandy silt fill, trace gravel, stiff					
7		***Silty Sand with Gravel [Glacial Till]*** Grey brown silty sand to sandy silt with gravel, very stiff, dry to moist	2.1				
13				12.1			
15		End of Borehole	4.6				

Logged: JU
Method: Solid Stem Track Mounted Auger
Date: November 3rd, 2017

Datum: Existing Ground Surface
Figure Number: A.07