



UBC Infrastructure Development
1100 – 2329 West Mall
Vancouver, BC
V6T 1Z4

October 22, 2018
File: 16428

Attention: Mr. Darren Wong

Re: Geotechnical Report, Cumbria Sculpture – West Mall and University Boulevard, UBC

1.0 INTRODUCTION

We understand that a steel sculpture is proposed to be installed within the landscape area between Ponderosa East and West in UBC Campus. It is further understood that geotechnical recommendations are required in order to design the sculpture foundations. We have been provided conceptual design showing the location of the proposed sculpture.

This report presents the results of our geotechnical investigation of the site and makes recommendations for the design and construction of the proposed sculpture foundation. This report has been prepared exclusively for UBC Infrastructure Development and for the use of others on their design and construction team, although it remains the property of GeoPacific Consultants Ltd.

2.0 SITE DESCRIPTION

The proposed sculpture is to be located within the existing landscape area along University Boulevard, just south of its intersection with West Mall. The site is bounded by West Mall to the east, University Boulevard to the South, Ponderosa building to the north and landscape area to the west.

The site is presently covered turf and concrete pathways surrounding it. The area has been raised above sidewalks grades at about 2 m. In general, University Boulevard is gradually sloping from east to west with elevation differential of about 1 m.

3.0 FIELD INVESTIGATION

3.1 Site Investigation

GeoPacific conducted a geotechnical investigation for the project on October 11, 2018. The investigation consisted of a review of geological maps, visual inspection, and augered test holes supplemented with dynamic cone penetration test (DCPT) soundings.

Prior to drilling, a permit from UBC Campus & Community Planning department was obtained confirming that the proposed test hole location is acceptable. A utility locate was carried out to help ensure the test hole is clear of existing services and utilities.

Two test holes were completed using the subcontracted drilling services of Uniwide Drilling of Prince

George. The test holes were advanced to a depths of 6.1 m below grade. One of the test holes was supplemented with DCPT soundings to help characterize the in-situ density of the soil. The test holes were backfilled following our investigation in accordance with provincial abandonment requirements.

The approximate test hole location is shown on our Drawing No. 16428-01 included with this report.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Profile

The general geology of the region under investigation is described as Vashon glacial drift, overlying Quadra fluvial deposits with reference to the Geological Survey of Canada's map 1484A. The glacial drift is characterized as lodgement and minor flow till with lenses and interbeds of substratified glaciofluvial sand and gravel, including lenses and interbeds of glaciolacustrine stony silt. The Quadra fluvial deposits consist of channel fill and floodplain deposits; crossbedded sand with minor silt and gravel lenses.

A general description of the soils encountered at our test hole locations is given below.

Topsoil

Topsoil was identified in our test hole and found to be about 200 mm thick.

Sand and Gravel (Fill)

The topsoil is underlain by loose to compact fill comprised of sand and gravel with trace silt. The fill extended to a depth of 1.5 m below grade.

Sand

The fill is underlain by a loose layer of sand with trace silt and gravel. This stratum extended to depths of 2.1 and 2.4 m below existing grade at our test hole locations.

Sand (Till)

The topsoil is underlain by till deposits comprised of sand with trace silt and fine gravel. In-situ testing and drill observations indicate that this stratum is dense to very dense. These till-like deposits were found to extend to the full depth of our investigation.

Detailed soil descriptions are included on the test hole log is included in Appendix A.

4.2 Groundwater Conditions

The groundwater table was not encountered during our field investigation. Perched groundwater may be encountered overlying the native soils within the fill and topsoil.

5.0 DISCUSSION

The proposed sculpture is to be constructed within the landscape area along University Boulevard, just west of its intersection with West Mall. It is understood that the sculpture is about 4.5 m high and will be secured onto a raft foundation with a minimum size of 5 m x 5 m. We envisage that the foundations will likely be partially buried and partially exposed above the surrounding pathways grades. It is further understood that recommendations for pile designs are not required.

6.0 RECOMMENDATIONS

6.1 Stripping

Site preparation associated with foundations includes removal of any organic soils or topsoil, and any other material considered to compromise the design recommendations stated herein. We anticipate that up to 1.5 m of stripping will be required to achieve the required raft foundations elevations.

The existing fill materials and sand identified on our logs, overlaying the native dense to very dense sand till, are deemed suitable as “engineered fill” under the proposed raft foundations provided that they are adequately compacted in-situ. These materials should be compacted in maximum 300 mm lifts to a minimum of 95% Modified Proctor maximum dry density at a moisture content that is within 2% of optimum for compaction. GeoPacific should review the compaction of these materials.

6.2 Sculpture Foundations

Footings which is founded on competent dense to very dense till-like sand, as described in Section 4.1, can be designed on the basis of a serviceability limit state (SLS) bearing pressure of 300 kPa for raft foundations.

Foundations which are placed on engineered fill, as defined in Section 6.1, may be designed on the basis of an SLS bearing pressure of 100 kPa.

Factored ultimate limit state (ULS) bearing pressures, for transient loads such as those induced by wind and earthquakes, may be taken as 1.5 x the SLS bearing pressures provided above.

All footings should also be buried a minimum of 450 mm below the surface for frost protection.

Post construction settlement of foundations designed as recommended should be less than 25 mm total and 20 mm over 10 m differential.

Stripped subgrades and engineered fill materials and compaction must be reviewed by the geotechnical engineer.

6.3 Seismic Design of Foundations

In accordance with the 2012 BC Building Code the buildings are to be designed for a seismic hazard with 2% probability of exceedance over a 50 year period which equates to an earthquake with a return period of

1 in 2,475 years. The design seismic hazard considers ground motions which would have a peak firm ground horizontal acceleration of 0.46 g at this location.

The soils at this site are not considered susceptible to liquefaction triggering or strain softening in consideration of the seismic hazard defined in the 2012 British Columbia Building Code (BCBC).

The seismic design parameters for this project should be based on “Site Class C” as defined in Table 4.1.8.4.A of the 2012 BC Building Code.

6.4 Excavation and Shoring

We expect that temporary excavations may be required to achieve desired raft foundation elevation. We expect that the excavation can be sloped. We expect that slopes of 1:1 (H:V) in the existing surficial topsoil and loose fill materials can be accomplished.

It should be appreciated that temporary cut slopes are only suitable when located a safe distance away from existing structures, roads and utilities. Where the proposed excavation encroaches onto existing structures, property lines and utilities, shoring or lock blocks could be utilized to support the excavations.

As required by UBC Planning and Infrastructure on all other sites on campus, erosion and sediment control plan and regular site reviews may be required during construction.

Water seepage into the excavation from within the surficial fill and topsoil should be expected. We expect that groundwater inflows could be controlled with conventional sumps and sump pumps.

Temporary cut slopes in excess of 1.2 m in height must be covered in poly sheeting and require inspection by a professional engineer in accordance with Work Safe B.C. guidelines, prior to man-entry.

7.0 DESIGN REVIEWS AND CONSTRUCTION INSPECTIONS

As required for Municipal “Letters of Assurance”, GeoPacific Consultants Ltd. will 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 contractors obligations to perform under the terms of his/her contract.

It is the contractors’ responsibility to advise GeoPacific Consultants Ltd. (a minimum of 48 hours in advance) that a field review is required. Field reviews are normally required at the time of the following activities:

- | | |
|--------------------|---|
| 1. Stripping | Review of stripping depth. |
| 2. Engineered Fill | Review of materials and compaction degree, if required. |
| 3. Foundation | Review of foundation subgrade. |

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 they become familiarised with the sensitive aspects of the works proposed. It is the responsibility of the developer to notify GeoPacific Consultants Ltd. when conditions or situations not outlined within this document are encountered.

8.0 CLOSURE

We are pleased to be of assistance to you on this project and we trust that our comments and recommendations are both helpful and sufficient for your current purposes. If you would like further details or require clarification of the above, please do not hesitate to call.

For:
GeoPacific Consultants Ltd.

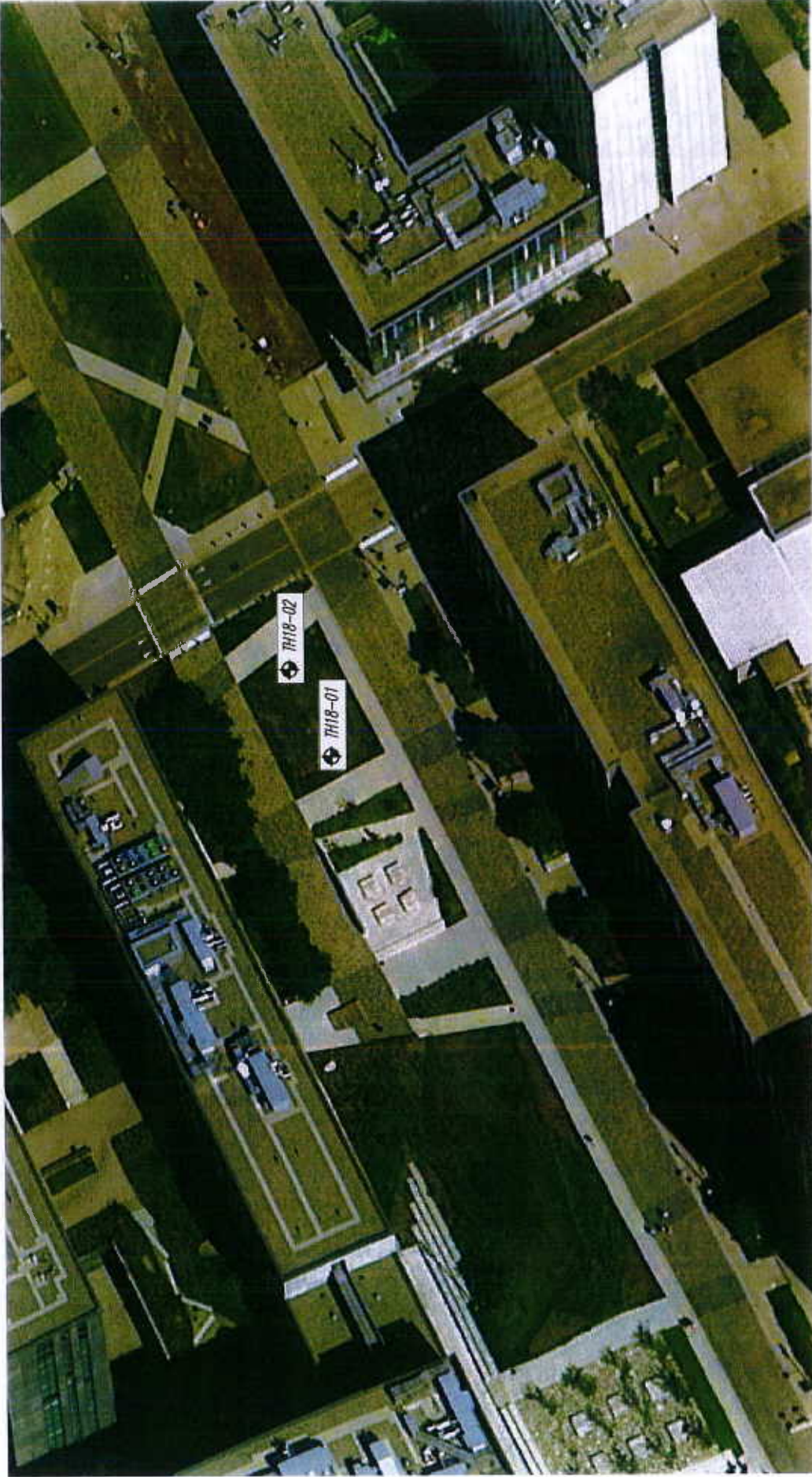
Arye Lipshitz
Project Manager

Reviewed by:

OCT 23 2018

Marian Letavay, M. Sc., P.Eng
Senior Project Engineer





LEGEND:

⊕ - TEST HOLE (TH) LOCATIONS

SITE PLAN

SCALE = NTS



UTM REFERENCE:

UTM REFERENCE:

16428

01

UTM NO. 16428
EPR. NO. 01

Cumbria Sculpture
West Mall and University Boulevard, UBC
TEST HOLE LOCATIONS

DATE: October 11, 2018

APPROVED BY: [Signature]

REVIEWED BY: [Signature]

SCALE: SEE ABOVE

8779 W. 75th Avenue
Vancouver, BC V6P 4R2
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APPENDIX A

TEST HOLE LOGS

Test Hole Log: TH18-01

File: 16428

Project: Cumbria Statue

Client: UBC Infrastructure Development

Site Location: West Mall and University Boulevard, UBC



GEOPACIFIC
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P
BP2
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE										
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot)				Groundwater / Well	Remarks
					10	20	30	40		
0		Ground Surface								
0.2		Topsoil Grass on top, loose sand	0.2							
1.5		Sand and gravel (Fill) Loose to compact, trace silt, medium grained sand, brown, moist	1.5	13.8						
2.4		Sand Loose, trace to some silt, trace gravel, brown, wet	2.4							
6.1		Sand (Till) Dense to very dense, trace silt, trace fine gravel, medium grained sand, grey, moist to wet	6.1	20.6						
6.1		End of Borehole	6.1							

Logged: AL
Method: Solid stem auger
Date: October 11, 2018

Datum: Ground surface
Figure Number: A.1.
Page: 1 of 1

Test Hole Log: TH18-02

File: 16428

Project: Cumbria Statue

Client: UBC Infrastructure Development

Site Location: West Mall and University Boulevard, UBC



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INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface					
0.2		Topsoll Grass on top, loose sand	0.2				
1.5		Sand and gravel (Fill) Loose to compact, trace silt, medium grained sand, brown, moist	1.5		20		
2.1		Sand Loose, trace to some silt, trace gravel, brown, wet	2.1		39		
2.1		Sand (Till) Dense to very dense, trace silt, trace fine gravel, medium grained sand, grey, moist	2.1		37		
6.1			6.1		5		
6.1			6.1	11.9	6		
6.1			6.1		>50		DCPT refusal at 7'
6.1		End of Borehole	6.1				
7							
7							

Logged: AL
Method: Solid stem auger
Date: October 11, 2018

Datum: Ground surface
Figure Number: A.2.
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