



Alberni-Clayoquot Regional District

WEST COAST COMMITTEE MEETING

WEDNESDAY, JULY 17, 2013, 11:00 AM

District of Tofino Council Chambers, 121 Third Street, Tofino, BC

AGENDA

	PAGE #
1. <u>CALL TO ORDER</u>	
2. <u>APPROVAL OF AGENDA</u> <i>(motion to approve, including late items requires 2/3 majority vote)</i>	
3. <u>REPORTS</u>	
a. Draft West Coast Multiplex MOU – R. Dyson	2-3
b. Summary Report of Geotechnical Subsurface Assessment Proposed West Coast Multiplex, Pacific Rim Highway, Tofino, BC	4-39
<i>THAT the Reports a-b be received.</i>	
4. <u>OTHER BUSINESS</u>	
5. <u>NEW BUSINESS</u>	
6. <u>ADJOURN</u>	



Memorandum of Understanding June 2013



WEST COAST
· MULTIPLEX ·

The Memorandum of Understanding is agreed to by the following parties:

The Alberni-Clayoquot Regional District, Tla-o-qui-aht First Nation, Ahousaht First Nation, Yuułuʔiłʔatḥ Government, Hesquiaht First Nation, Toquaht First Nation, District of Tofino, and District of Ucluelet.

All parties have agreed to a renewed Memorandum of Understanding (MOU) regarding the West Coast Multiplex. The original MOU was agreed to in 2009.

The West Coast Multiplex will be located at the Long Beach Airport in the Alberni-Clayoquot Regional District. Phase one of the West Coast Multiplex consists of the following:

- NHL size ice surface
- Multipurpose area for fitness and community gathering, with connections to the outside for expanded use
- A warm, friendly atmosphere including the use of wood and other local materials.
- Informal gathering area with seating for the general public and facility users direct visibility from the lobby into the arena
- An accessible facility
- Administration/ centralized reception and control station to accommodate staff and provide controlled entry
- An opportunity for expansion for future communist needs, possibly a aquatic facility

The foregoing parties agree to the following:

- A commitment to fundraise capital costs for Phase One of the West Coast Multiplex until December, 2015
- Request assistance with capital funds from the Government of British Columbia, the Government of Canada, and other funders
- Participate on the committees of the Multiplex society to help fundraising, programming and other planning activities

Together, with renewed commitment to move forward with capital fundraising, we can achieve the goal of having a Multiplex on the West Coast.

Thank you for your commitment.

Alberni-Clayoquot Regional District

Tla-o-qui-aht First Nation

Ahousaht First Nation

Yuułuʔiłʔatḥ Government

Hesquiaht First Nation

Toquaht First Nation

District of Tofino

District of Ucluelet

DRAFT

July 11, 2013
File: SGL13-011

Alberni-Clayoquot Regional District
3008 Fifth Avenue
Port Alberni, BC V9Y 2E3

Attention: Mr. Andy Daniel, A.Sc.T., Manager of Environmental Services

**Re: Summary Report of Geotechnical Subsurface Assessment
Proposed West Coast Multiplex, Pacific Rim Highway, Tofino, BC**

INTRODUCTION

As requested, Simpson Geotechnical Ltd. (SGL) has conducted a geotechnical subsurface assessment for the captioned project in general accordance with our proposal of April 12, 2013 (Our File P215). We understand that the project as currently proposed generally consists of an ice arena facility located immediately westward of the Longbeach Airport near the intersection of Pacific Rim Highway and Grice Bay/Longbeach Golf Course Road as shown on Figure 1.

This report summarizes the encountered geotechnically challenging subsurface conditions and briefly describes the additional work that would be required to pursue development of the proposed multiplex structure at this site, from a geotechnical perspective.

BACKGROUND

A surficial geology map of the site vicinity, published by the BC Ministry of Energy and Mines indicates the subject site to be underlain by undifferentiated marine deposits. Water well logs in the vicinity of the Longbeach Airport obtained from the Provincial water well database indicate a subsurface profile of dense, medium grained sand with clay seams that ranged in thickness from approximately 4 to 10m, overlying soft blue clay to depths in excess of 21m.

Instances of seismic liquefaction and soil slumps in the site vicinity are documented by the Pacific Geoscience Centre to have occurred during the June 2, 1946 earthquake.

SITE ASSESSMENT

The subject area was forested with west coast rain forest vegetation. The ground surface was essentially flat and level. The subject area was bounded by an existing gravel road to the east

and the Pacific Rim Highway to the west. Low berms located adjacent to the gravel road are interpreted to be remnants of stripped materials from the original road construction.

The site investigation was conducted June 12 through June 14, 2013. The subsurface conditions were assessed with four test holes drilled with a track mounted auger drill rig contracted from Drillwell Enterprises Ltd. Subsurface conditions were logged by Lara Fletcher, P.Eng. Representative soil samples were collected from the test holes with some samples selected for laboratory index property testing. All drill holes were backfilled with the drill cuttings. One stand pipe piezometer was installed to measure the groundwater level.

The test hole locations were selected to be at approximately each of the four corners of the proposed building. Two skid trails were constructed the previous week by Gibson Bros. Contracting to provide access to the test hole locations. As the southeast corner of the proposed multiplex site was not readily accessible without a significant additional clearing, the access road and subsequently the southeast test hole location, were shifted northwards. The approximate locations of the test holes are shown on Figure 1.

In general, the test holes encountered a relatively consistent subsurface stratigraphy. Construction of the skid trail resulted in the duff and topsoil having been removed from the drillhole areas. It was noted that the duff and topsoil was typically approximately 0.4m thick. Underlying the topsoil was approximately 4 to 6 m of compact, fine grained sand with a trace of silt. Below the compact sand was loose sand with lenses of soft, high plastic clay to the maximum test hole depth of 25.9m. The observed stratigraphy is considered to be consistent with the surficial geology map.

The subsurface materials were damp to wet with a groundwater level of 2.4m measured in the stand-pipe piezometer installed in DH13-01. Table 1 provides a summary of the stratigraphy encountered in the test holes. Detailed logs of the test holes and the laboratory test results are appended.

Table 1: Generalized Soil Profile

Depth below surface +/- 0.2 m	Soil Profile
0 – 0.4	Forest duff, silty sand, roots.
0.4 – 5	Compact, fine grained sand with trace silt.
5 – 19	Fine grained sand with trace silt, loose with lenses of soft, high plastic clay.

LIQUEFACTION ASSESSMENT

A screening level seismic liquefaction assessment was conducted based on the Seed-Idriss Simplified Equation and the subsurface conditions obtained from the boreholes in general accordance with the recommendations of the Greater Vancouver Liquefaction Task Force Report of May 8, 2007 and the Canadian Foundation Engineering Manual. In accordance with the requirements of the 2012 BC Building Code the liquefaction assessment was based on the peak horizontal ground accelerations (PGA) for the design 2% and 10% in 50 year probability seismic events from a site specific seismic hazard calculation obtained from Natural Resources Canada. The seismic hazard calculation is appended.

The liquefaction screening assessment predicted extensive seismic liquefaction to occur in all test holes for both the 2% and 10% in 50 year probability seismic events. The liquefaction assessment results are appended.

DISCUSSION

In light of the predicted extensive seismic liquefaction that is anticipated to occur at the site, the site is considered to be "Site Class F" in accordance with section 4.1.8.4 of the 2012 BC Building Code. That is the lowest possible site class within the Building Code, and a site specific seismic ground response analysis would be required in order to determine the acceleration and velocity seismic coefficients for the site. Ground response analysis would require mobilization of specialized test equipment to the site from the Lower Mainland, and subsequent finite element modeling of the subsurface conditions.

There may be a simplified approach to the site seismic response, provided that the proposed structure would have a fundamental period of vibration equal to or less than 0.5 s, as described in the BC Building Code sentence 4.1.8.4. (6). A Structural Engineer would be required to determine the fundamental period of vibration of the structure.

In addition to the complications to the seismic response of the site that are imposed by the predicted seismic liquefaction, the predicted extensive and near surface seismic liquefaction may also lead to large vertical and lateral ground displacement during and following a seismic event. Mitigation of those potential ground displacements would require ground improvement prior to foundation construction by means such as vibro-floatation, stone columns, rapid impact compaction or a combination of those or similar methods to create a densified seismic barrier around the structure.

In light of the above, the proposed multiplex site should be considered geotechnically challenging. Those challenging conditions should be expected to lead to a substantial cost premium to the site development, compared to less geotechnically challenging sites. Additional subsurface evaluation, dynamic ground response analysis and consideration of ground improvement methodologies are recommended as early as possible in the design process if this site is to continue to be considered for the multiplex project.

CLOSURE

This report was prepared for the exclusive use of the Alberni Clayoquot Regional District and their appointed agents for the project described herein. Any use or reliance made on this report by an unauthorized third party is the responsibility of that third party. Simpson Geotechnical Ltd. does not accept responsibility for damages suffered, if any, by an unauthorized third party as a result of its use of the information contained in this report. Contractors should make their own assessment of the property for the purposes of bidding on and performing work on the site.

This report has been prepared in accordance with standard geotechnical engineering practice. No other warranty is provided, either expressed or implied. The recommendations contained in this report are based on information obtained from discrete test locations. Subsurface conditions between the boreholes have been inferred; however, actual soil and groundwater conditions may vary. Additional geotechnical assessment of the site is recommended due to the challenging subsurface conditions that were encountered.

We appreciate the opportunity to have been of service on this project. Please contact the undersigned if you require any additional information.

Yours truly,
Simpson Geotechnical Ltd.

Per:
Lara Fletcher, P.Eng.


Richard Simpson, P.Eng.



Attachments: Figure 1 – Site and Test Hole Location Plan
Test Hole Logs (14 pages)
Laboratory Grain Size Analysis (4 pages)
Atterburg Limits Tests (2 pages)
Seismic Hazard Calculation
Liquefaction Screening Results (10 pages)



Longbeach Golf Course Road

Pacific Rim Highway

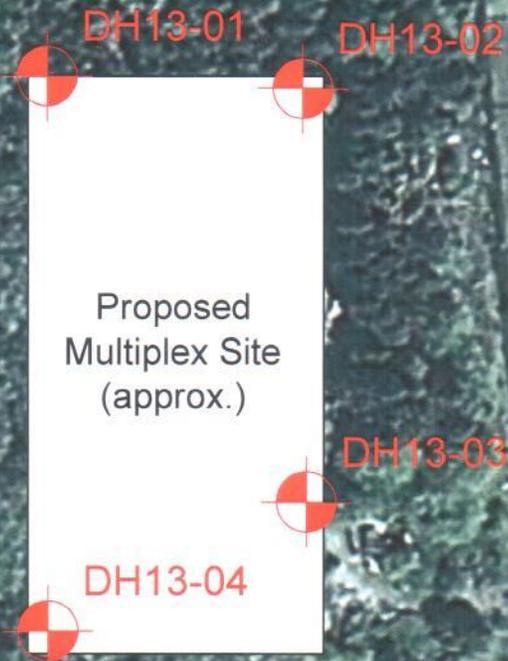


Image © 2013 DigitalGlobe

Project:	Proposed West Coast Multiplex		
Title:	Site and Test Hole Location Plan		
Client:	Alberni-Clayoquot Regional District		
File:	SGL13-011	Drawn by:	RRS

SIMPSON BIOTECHNICAL LTD

Scale:	1 : 1000 ±	Date:	July 2013	Dwg. No.:	Figure 1
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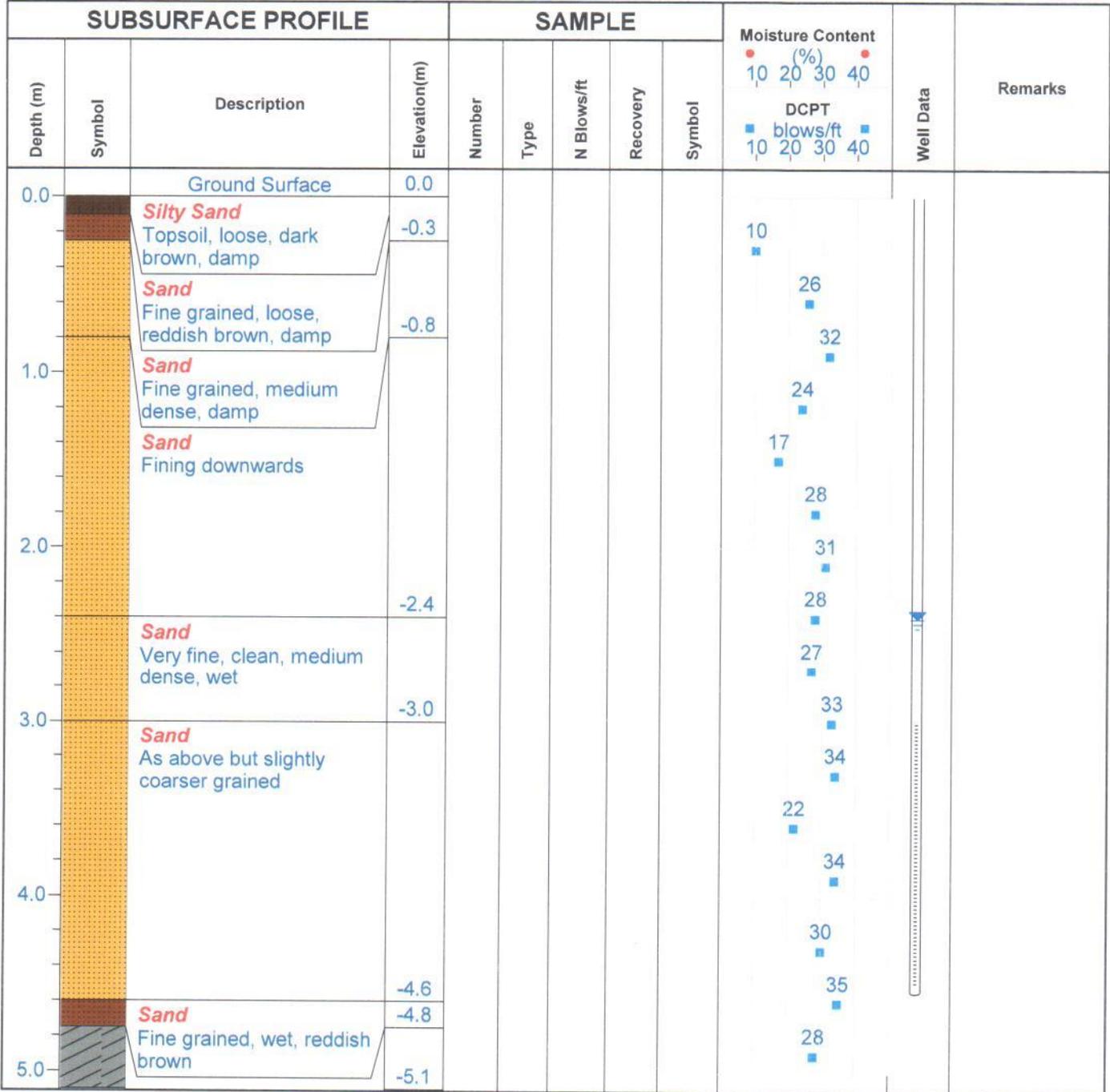
Project No: SGL13-011

Borehole Number: DH13-01

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 12, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 1 of 2

Project No: SGL13-011

Borehole Number: DH13-01



Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino

SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)		Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol	10	20		
6.0	[Symbol]	Clay Soft, possible lenses of fine sand, grey	-6.0						17			
		Sand Fine grained, clean, medium dense							21			
7.0	[Symbol]	Sand/clay Lenses of fine sand and clay, clay lenses about 8cm thick, clay is soft, sand medium dense. Driller comment - easy drilling 6.0-7.5m	-6.7						25			
		Sand Very fine grained, clay lenses or clayey sand, soft							19			
8.0	[Symbol]	Clay Soft	-7.5						15			
		Sand Soft							20			
9.0	[Symbol]	Sand Fine grained, trace silt, loose, wet	-7.8						16			
		Sand Fine grained, trace silt, loose, wet							18			
10.0	[Symbol]	Sand Fine grained, clean, loose to medium dense	-8.5						16			
		Sand Fine grained, clean, loose to medium dense							19			
			-9.1						24			
									24			
											43	

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 12, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 2 of 2

Project No: SGL13-011

Borehole Number: DH13-02

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)	DCPT blows/ft	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol				
0.0		Ground Surface	0.0									
0.0 - 0.5		Silty Sand Fine grained, loose, moist, likely fill from road construction	-0.5						2			
0.5 - 0.9		Sand Fine grained, trace silt, trace gravel, medium dense, reddish brown, damp	-0.9						11			
0.9 - 1.5		Sand Fine grained, trace silt, uniform, medium dense, mottled reddish brown and tan	-1.5						33			
1.5 - 3.0		Sand Fine grained, uniform, clean, loose on auger, moist, tan Hole staying open	-3.0						24			
3.0 - 4.0		Sand Very fine to fine grained, trace silt, wet, tan Silty clay lense 3.85-3.9m, stiff							16			
4.0 - 5.0									20			
									23			
									28			
									29			
									24			
									31			
									42			
									>50			
									38			
									37			
									33			

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 13, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 1 of 4

Project No: SGL13-011

Borehole Number: DH13-02

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)	DCPT blows/ft	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol				
			-5.4						27			
		Sand Fine sand as above with lenses of silty sand and clayey silt, soft. Where silt content higher stained reddish brown. Driller note - 5.5-6.1 easy drilling	-5.8						37			
6.0			-6.1						19			
		Sand/Clay Very fine sand and silty clay lenses, soft, grey	-6.6						17		>50	
			-6.9								49	
7.0		Sand Very fine sand, trace silt, tan with lenses of reddish brown clayey silt	-7.4						25			
			-7.6						16			
		Clay Silty clay, trace sand, soft, coarsening downwards, grey							21			
8.0		Clayey sand Very fine clayey sand, soft, some plasticity, grey							18			
									14			
		Clay Soft							23			
									18			
9.0		Sand/clay Lenses of very fine sand and clay~15cm thick, clay is soft, sand medium dense	-9.1						19			
									20			
											45	
10.0											>50	

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 13, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 2 of 4

Project No: SGL13-011

Borehole Number: DH13-02

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)	DCPT blows/ft	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol				
11.0	[Symbol]	Sand Very fine, some silt, wet, (2) 2cm clay lenses No obvious reason for higher DCPT, driller reported only marginally stiffer	-10.7									
		Sand Fine grained, some silt with lenses of clay ~5cm thick	-11.3 -11.4									
12.0	[Symbol]	Clay Silty, soft										
		Silty sand Switched to hollow stem at 40' (12.2m). Drilled to 50' (15.2m) with SPT's 50'-52'	-12.2									
13.0	[Symbol]	Silty sand and clay Lenses of fine sand, clay, and silt										
14.0	[Symbol]											
15.0	[Symbol]											

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 13, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 3 of 4

Project No: SGL13-011

Borehole Number: DH13-02

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%) 10 20 30 40	DCPT blows/ft 10 20 30 40	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol				
16.0		Clay Medium stiff	-15.8						2			
17.0												
18.0												
19.0			-18.9						0			
20.0												

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 13, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 4 of 4

Project No: SGL13-011

Borehole Number: DH13-03

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%) 10 20 30 40	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol			
0.0		Ground Surface	0.0								
1.6			-1.6								
1.8		Sand Fine grained, clean, medium dense, moist, brown	-1.8						19		
2.0		Sand Very fine grained, clean, moist, tan									
3.2			-3.2								
3.5		Sand Fine to medium grained, clean, uniform, medium dense, wet, tan							21		
4.8			-4.8								
5.0									26		

Drilled By: Drillwell Enterprises	SIMPSON GEOTECHNICAL LTD. 377 Milton Street Nanaimo, BC V9R 2K8	Hole Size:
Drill Method: Tracked Auger		Datum:
Drill Date: June 14, 2013		Sheet: 1 of 6

Project No: SGL13-011

Borehole Number: DH13-03

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content ● 10 20 30 40 (%) ●	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol			
6.0		Sand Fine grained, uniform, wet, trace organics (1-1cm fragment), iron oxide staining at 5.2m	-6.2								
		Sand Fine grained, clean, tan	-6.5						8		
7.0		Sand Silty sand, very fine grained, medium dense, orange/tan									
		Sand Trace silt, tan	-7.8						7		
8.0		Clay Medium stiff, grey	-8.1								
		Sand Very fine grained, clean, grey									
9.0											
10.0											

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 14, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 2 of 6

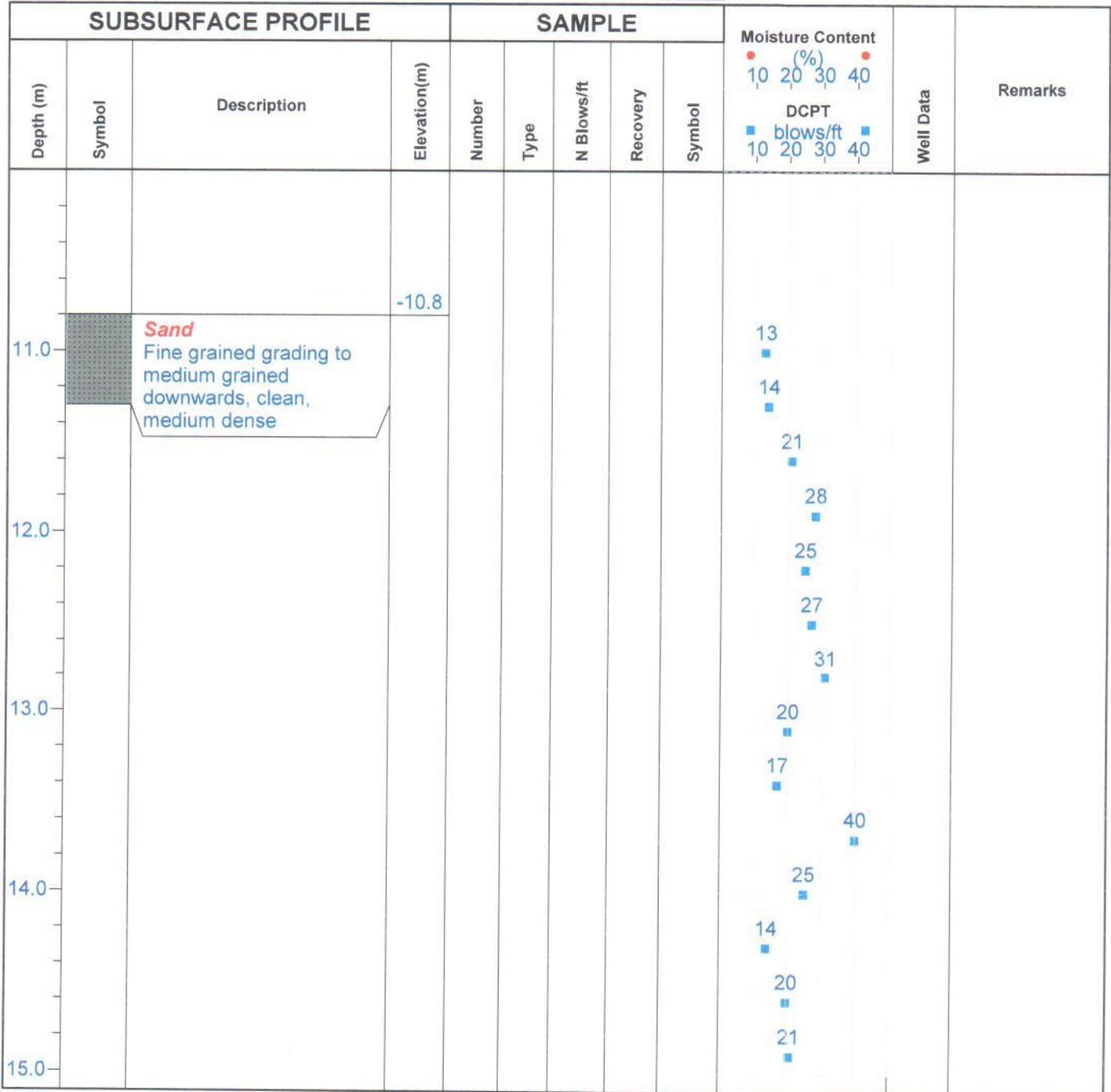
Project No: SGL13-011

Borehole Number: DH13-03

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



Drilled By: Drillwell Enterprises	SIMPSON GEOTECHNICAL LTD. 377 Milton Street Nanaimo, BC V9R 2K8	Hole Size:
Drill Method: Tracked Auger		Datum:
Drill Date: June 14, 2013		Sheet: 3 of 6

Project No: SGL13-011

Borehole Number: DH13-03

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content 10 20 30 40 (%)	DCPT blows/ft 10 20 30 40	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol				
16.0									14			
									15			
									10			
									10			
									10			
									10			
17.0									12			
									14			
									14			
18.0									14			
									15			
									19			
									19			
19.0									19			
									18			
									18			
20.0												

Drilled By: Drillwell Enterprises	SIMPSON GEOTECHNICAL LTD. 377 Milton Street Nanaimo, BC V9R 2K8	Hole Size:
Drill Method: Tracked Auger		Datum:
Drill Date: June 14, 2013		Sheet: 4 of 6

Project No: SGL13-011

Borehole Number: DH13-03

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol			
21.0									20		
									19		
									20		
									19		
									20		
									20		
									22		
22.0									22		
									23		
									26		
									27		
									29		
									29		
23.0									27		
									29		
									27		
									28		
24.0											
25.0											

Drilled By: Drillwell Enterprises	SIMPSON GEOTECHNICAL LTD. 377 Milton Street Nanaimo, BC V9R 2K8	Hole Size:
Drill Method: Tracked Auger		Datum:
Drill Date: June 14, 2013		Sheet: 5 of 6

Project No: SGL13-011

Borehole Number: DH13-03

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content 10 20 30 40 (%)	DCPT blows/ft 10 20 28 40	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation(m)	Number	Type	N Blows/ft	Recovery	Symbol				
26.0			-25.9									
27.0												
28.0												
29.0												
30.0												

Drilled By: Drillwell Enterprises	SIMPSON GEOTECHNICAL LTD. 377 Milton Street Nanaimo, BC V9R 2K8	Hole Size:
Drill Method: Tracked Auger		Datum:
Drill Date: June 14, 2013		Sheet: 6 of 6

Project No: SGL13-011

Borehole Number: DH13-04

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N Blows/ft	Recovery	Symbol			
0.0		Ground Surface	0.0								
0.0								1			
0.5								7			
1.0								32			
1.2								36			
1.5								16			
1.8								21			
2.0								24			
2.2								21			
2.5								20			
2.8								22			
3.2								27			
3.5								35			
4.0								17			
4.2								27			
4.5								27			
4.8								32			
5.0											

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 14, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 1 of 2

Project No: SGL13-011

Borehole Number: DH13-04

Project: West Coast Multiplex

Client: Alberni-Clayoquot Regional District

Site Location: Pacific Rim Highway, Tofino



SUBSURFACE PROFILE				SAMPLE					Moisture Content (%)	Well Data	Remarks
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N Blows/ft	Recovery	Symbol			
6.0									16		
									16		
									16		
									15		
									14		
									16		
7.0									16		
									16		
									20		
									16		
									16		
									18		
									19		
									18		
									18		
			-9.4						18		
10.0											

Drilled By: Drillwell Enterprises

Drill Method: Tracked Auger

Drill Date: June 14, 2013

SIMPSON GEOTECHNICAL LTD.

377 Milton Street
Nanaimo, BC
V9R 2K8

Hole Size:

Datum:

Sheet: 2 of 2

Grain Size Analysis

Client: **ACRD**
CC: _____

Project No: **SGL13-011**
Project: **Tofino Multiplex**
Sample Date: **13-Jun-13**
Sample By: **L.F.**
Test Date: **27-Jun-13**
Tested By: **R.S.**

SAMPLE INFORMATION:

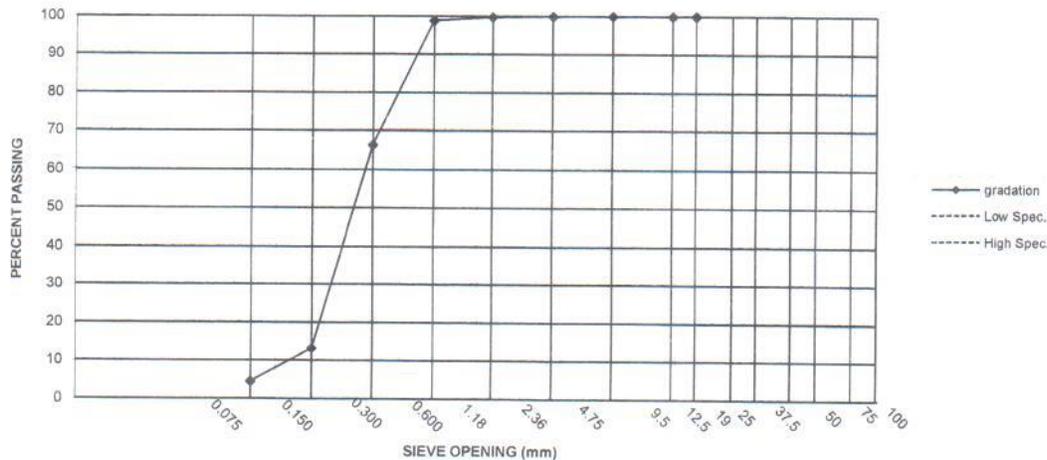
Material Type: Sand
Source: Site
Specification: N/A
Sample Location: DH-2 2.1 - 2.3m
Sample No: 1

Moisture Content: 21.2%
Fracture: N/A
Washed Sieve:
Dry Sieve:

Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	100.0		
1.18	99.7		
0.600	98.8		
0.300	66.3		
0.150	13.2		
0.075	4.4		

Sample Properties	
Gravel (+4.75 mm):	0.0 %
Sand (+0.075 to -4.75 mm):	95.6 %
Silt and / or Clay (-0.075 mm):	4.4 %

AGGREGATE GRADATION:



Comments: _____

per: Richard Simpson, P.Eng.

This report represents a testing service only.
No engineering interpretation opinion is expressed or implied.
Engineering review and interpretation can be provided on written request.

Grain Size Analysis

 Client: ACRD
 CC: _____

 Project No: SGL13-011
 Project: Tofino Multiplex
 Sample Date: 13-Jun-13
 Sample By: L.F.
 Test Date: 27-Jun-13
 Tested By: R.S.

SAMPLE INFORMATION:

 Material Type: Sand
 Source: Site
 Specification: N/A
 Sample Location: DH-2 9.9 - 10.1m
 Sample No: 2

Moisture Content: 26.0%

Fracture: N/A

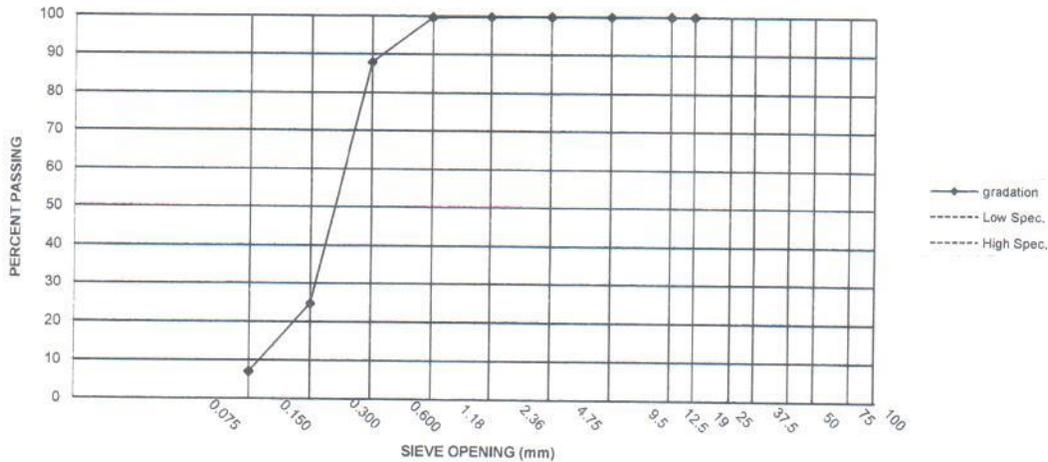
 Washed Sieve:

 Dry Sieve:

Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5	100.0		
9.50	100.0		
4.75	99.9		
2.36	99.9		
1.18	99.8		
0.600	99.7		
0.300	87.8		
0.150	24.6		
0.075	7.1		

Sample Properties

Gravel (+4.75 mm):	0.1 %
Sand (+0.075 to -4.75 mm):	92.8 %
Silt and / or Clay (-0.075 mm):	7.1 %

AGGREGATE GRADATION:


Comments: _____

 per: _____
 Richard Simpson, P.Eng.

This report represents a testing service only.
 No engineering interpretation opinion is expressed or implied.
 Engineering review and interpretation can be provided on written request.

Grain Size Analysis

 Client: ACRD
 CC: _____

 Project No: SGL13-011
 Project: Tofino Multiplex
 Sample Date: 13-Jun-13
 Sample By: L.F.
 Test Date: 28-Jun-13
 Tested By: R.S.

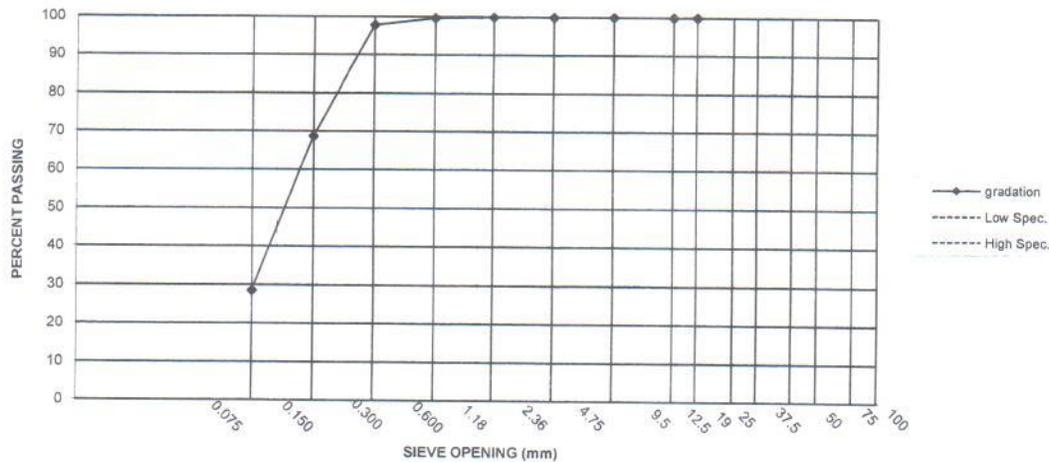
SAMPLE INFORMATION:

 Material Type: Sand
 Source: Site
 Specification: N/A
 Sample Location: DH-2 11.8 - 12.0m
 Sample No: 3

 Moisture Content: 17.3%
 Fracture: N/A
 Washed Sieve:
 Dry Sieve:

Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	100.0		
1.18	99.9		
0.600	99.7		
0.300	97.8		
0.150	68.8		
0.075	28.6		

Sample Properties	
Gravel (+4.75 mm):	0.0 %
Sand (+0.075 to -4.75 mm):	71.4 %
Silt and / or Clay (-0.075 mm):	28.6 %

AGGREGATE GRADATION:

Comments: _____

 per: _____
 Richard Simpson, P.Eng.

This report represents a testing service only.
 No engineering interpretation opinion is expressed or implied.
 Engineering review and interpretation can be provided on written request.

Grain Size Analysis

Client: ACRD
CC: _____

Project No: SGL13-011
Project: Tofino Multiplex
Sample Date: 13-Jun-13
Sample By: L.F.
Test Date: 28-Jun-13
Tested By: R.S.

SAMPLE INFORMATION:

Material Type: Sand
Source: Site
Specification: N/A
Sample Location: DH-3 4.8 - 5.2m
Sample No: 4

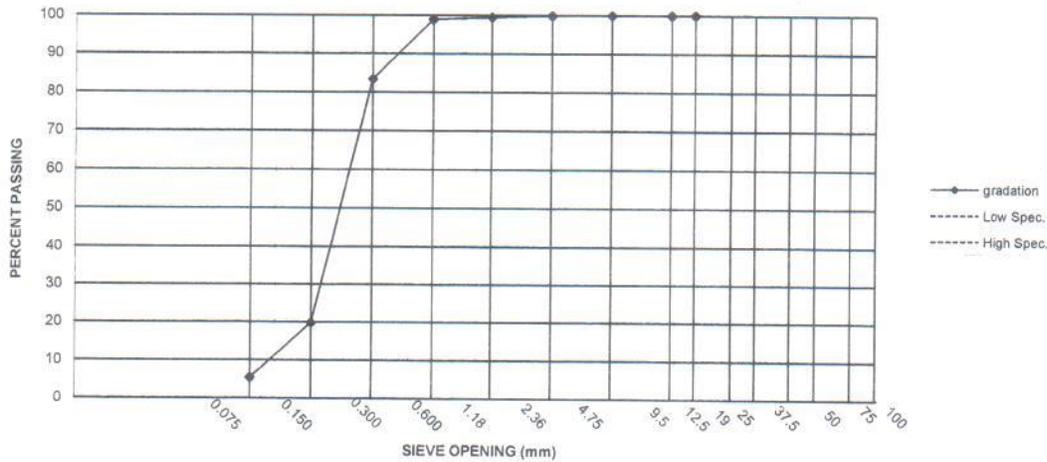
Moisture Content: 24.4%
Fracture: N/A
Washed Sieve:
Dry Sieve:

Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	99.9		
1.18	99.5		
0.600	98.9		
0.300	83.3		
0.150	19.8		
0.075	5.5		

Sample Properties

Gravel (+4.75 mm): 0.0 %
Sand (+0.075 to -4.75 mm): 94.5 %
Silt and / or Clay (-0.075 mm): 5.5 %

AGGREGATE GRADATION:



Comments: _____

per: Richard Simpson, P.Eng.

This report represents a testing service only.
No engineering interpretation opinion is expressed or implied.
Engineering review and interpretation can be provided on written request.

Report of: _____



Atterberg Limits

Client: ACRD

Project No: SGL13-011
 Project: Multiplex
 Sample Date: 13-Jun-13
 Test Date: 26-Jun-13
 Tested By: RRS

Bore No.: DH-1
 Sample No.: 1
 Depth: 6.5m

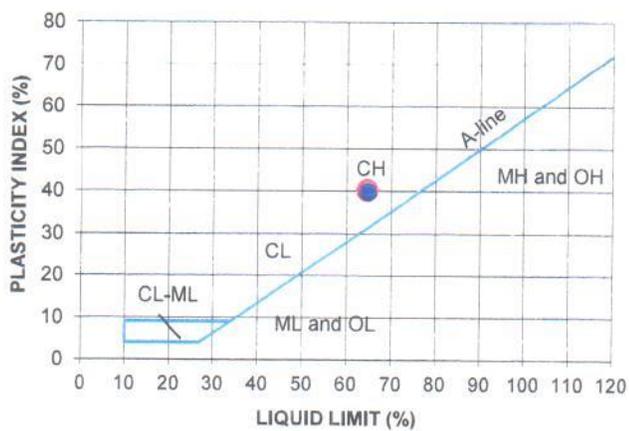
Liquid Limits					
Trial No.	1	2	3	4	5
N	25	44	9		
Tare	19.7	19.7	19.8		
Tare & Wet Weight	29.9	32.7	37.5		
Tare & Dry Weight	25.9	27.9	30.0		
Moisture (%)	64.5%	58.5%	73.5%		

Plastic Limits			
Trial No.	1	2	3
Tare	19.8	19.5	
Tare & Wet Weight	25.7	26.9	
Tare & Dry Weight	24.5	25.5	
Moisture (%)	25.5%	23.3%	

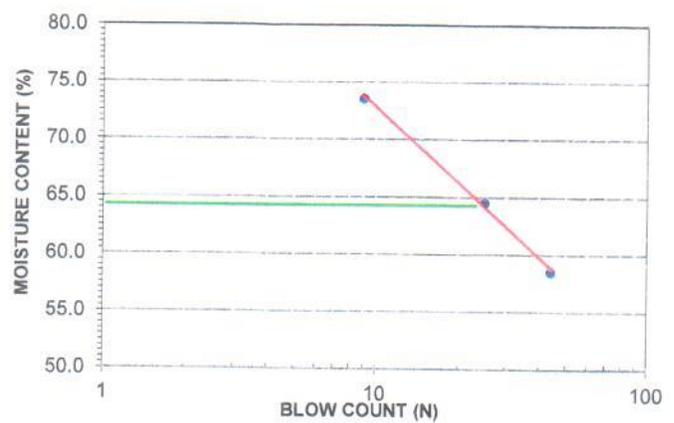
Avg.
24.4%

Summary of Results	
LIQUID LIMIT	64.5 %
PLASTIC LIMIT	24.4 %
PLASTICITY INDEX	40.1 %
NATURAL WATER CONTENT	49.4 %

PLASTICITY CHART



FLOW CURVE



Comments: _____

Report of: _____



Atterberg Limits

Client: ACRD

Project No: SGL13-011
 Project: Multiplex
 Sample Date: 13-Jun-13
 Test Date: 27-Jun-13
 Tested By: RRS

Bore No.: DH-3
 Sample No.: 2
 Depth: 8.0m

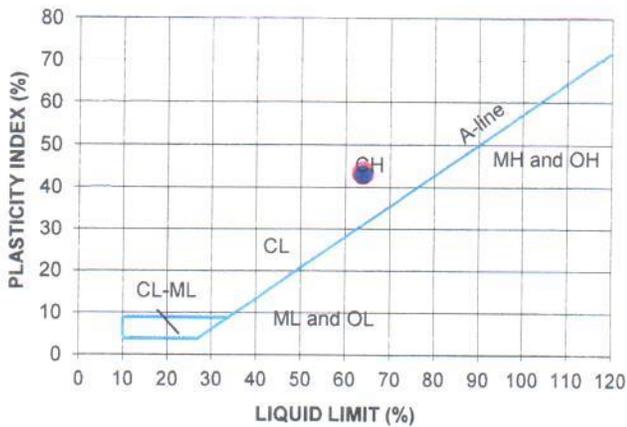
Liquid Limits					
Trial No.	1	2	3	4	5
N	20	13	35		
Tare	19.6	19.5	19.8		
Tare & Wet Weight	28.8	36.7	34.2		
Tare & Dry Weight	25.2	29.6	28.7		
Moisture (%)	64.3%	70.3%	61.8%		

Plastic Limits			
Trial No.	1	2	3
Tare	19.5	19.7	
Tare & Wet Weight	24.7	25.6	
Tare & Dry Weight	23.8	24.6	
Moisture (%)	20.9%	20.4%	

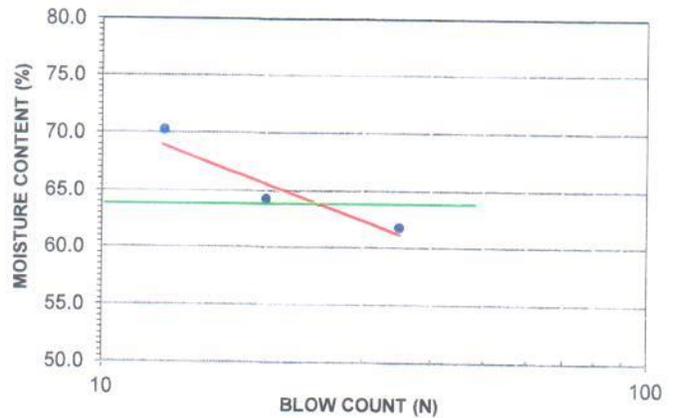
Avg.
20.7%

Summary of Results	
LIQUID LIMIT	63.8 %
PLASTIC LIMIT	20.7 %
PLASTICITY INDEX	43.1 %
NATURAL WATER CONTENT	45.0 %

PLASTICITY CHART



FLOW CURVE



Comments: _____

2010 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Requested by: , Simpson Geotechnical Ltd.

June 27, 2013

Site Coordinates: 49.0814 North 125.7881 West

User File Reference: Tofino Multiplex

National Building Code ground motions:

2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA (g)
1.202	0.936	0.473	0.206	0.522

Notes. Spectral and peak hazard values are determined for firm ground (NBCC 2010 soil class C - average shear wave velocity 360-750 m/s). Median (50th percentile) values are given in units of g. 5% damped spectral acceleration (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are tabulated. Only 2 significant figures are to be used. **These values have been interpolated from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.** Warning: You are in a region which considers the hazard from a deterministic Cascadia subduction event for the National Building Code. Values determined for high probabilities (0.01 per annum) in this region do not consider the hazard from this type of earthquake.

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.2)	0.158	0.627	0.762
Sa(0.5)	0.109	0.489	0.594
Sa(1.0)	0.060	0.247	0.300
Sa(2.0)	0.034	0.097	0.122
PGA	0.077	0.273	0.331

References

National Building Code of Canada 2010 NRCC no. 53301; sections 4.1.8, 9.20.1.2, 9.23.10.2, 9.31.6.2, and 6.2.1.3

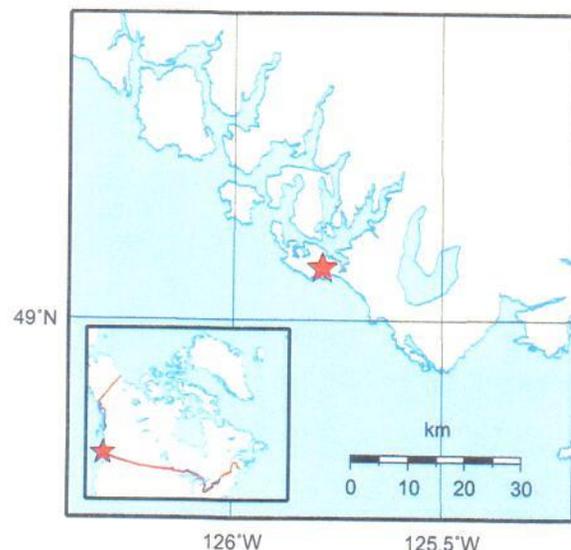
Appendix C: Climatic Information for Building Design in Canada - table in Appendix C starting on page C-11 of Division B, volume 2

User's Guide - NBC 2010, Structural Commentaries NRCC no. 53543 (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File xxxx
Fourth generation seismic hazard maps of Canada: Maps and grid values to be used with the 2010 National Building Code of Canada (in preparation)

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Aussi disponible en français



Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Project: Proposed West Coast Multiplex
 Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
 Date: Jun-13

Depth to Water Table (m) 2.4 $a_{max} = 0.5$ (2% in 50 year)
 Total unit Weight of soil (kN/m³) 20

Depth (m)	Interval (m)	N	C _u	C _r	C _s	(N) ₁₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
2.7	0.3	27	1.194199	0.7	1.2	27.08443	5 - 15%	0.36	1.2	0.432	54	51.057	1	0.343733	1.256788
3	0.3	33	1.158965	0.7	1.2	32.12652	5 - 15%	0.6	1.2	0.72	60	54.114	1	0.36035	1.998055
3.3	0.3	34	1.127093	0.7	1.2	20.82868	5 - 15%	0.25	1.2	0.3	66	57.171	1	0.37519	0.799594
3.6	0.3	22	1.097996	0.7	1.2	31.35876	5 - 15%	0.6	1.2	0.72	72	60.228	1	0.388524	1.853169
3.9	0.3	34	1.071229	0.7	1.2	26.99497	5 - 15%	0.33	1.2	0.396	78	63.285	1	0.400569	0.988594
4.2	0.3	30	1.046447	0.85	1.2	37.35815	5 - 15%	0.6	1.2	0.72	84	66.342	0.997	0.41027	1.754944
4.5	0.3	35	1.023375	0.85	1.2	29.2276	5 - 15%	0.6	1.2	0.72	90	69.399	0.9925	0.418315	1.721192
4.8	0.3	28	1.001793	0.85	1.2	17.37109	5 - 15%	0.21	1.2	0.252	96	72.456	0.988	0.425439	0.592329
5.1	0.3	17	0.98152	0.85	1.2	21.02415	5 - 15%	0.23	1.2	0.276	102	75.513	0.9835	0.431754	0.639253
5.4	0.3	21	0.962406	0.85	1.2	44.17442	5 - 15%	0.6	1.2	0.72	108	78.57	0.979	0.437354	1.646264
5.7	0.3	45	0.944325	0.85	1.2	24.08029	5 - 15%	0.3	1.2	0.36	114	81.627	0.9745	0.44232	0.813891
6	0.3	25	0.927172	0.85	1.2	17.9686	5 - 15%	0.21	1.2	0.252	120	84.684	0.97	0.44672	0.564112
6.3	0.3	19	0.910857	0.95	1.2	15.57565	5 - 15%	0.18	1.2	0.216	126	87.741	0.9655	0.450613	0.479347
6.6	0.3	15	0.8953	0.95	1.2	20.41284	5 - 15%	0.23	1.2	0.276	132	90.798	0.961	0.454051	0.607862
6.9	0.3	20	0.880435	0.95	1.2	16.05914	5 - 15%	0.19	1.2	0.228	138	93.855	0.9565	0.457078	0.498821
7.2	0.3	16	0.866203	0.95	1.2	17.77448	5 - 15%	0.22	1.2	0.264	144	96.912	0.952	0.459733	0.574247
7.5	0.3	18	0.852552	0.95	1.2	15.55054	5 - 15%	0.18	1.2	0.216	150	99.969	0.9475	0.462049	0.467482
7.8	0.3	16	0.839436	0.95	1.2	18.18218	5 - 15%	0.21	1.2	0.252	156	103.026	0.943	0.464059	0.543035
8.1	0.3	19	0.826815	0.95	1.2	22.62167	5 - 15%	0.26	1.2	0.312	162	106.083	0.9385	0.465786	0.669835
8.4	0.3	24	0.814654	0.95	1.2	22.28893	5 - 15%	0.26	1.2	0.312	168	109.14	0.934	0.467257	0.667727
8.7	0.3	24	0.802919	0.95	1.2	39.35909	5 - 15%	0.6	1.2	0.72	174	112.197	0.9295	0.46849	1.536851
9	0.3	43	0.791582	0.95	1.2	36.09614	5 - 15%	0.6	1.2	0.72	180	115.254	0.925	0.469506	1.533525

Total Liquefied Thickness = 4.2 m

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Borehole No.: DH13-1

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4 $a_{max} =$ 0.26 (10% in 50 year event)
 Total unit Weight of soil (kN/m³) 20

Depth (m)	Interval (m)	N	C _N	C _r	C _s	(N ₁) ₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	F _t
2.7	0.3	27	1.194199	0.7	1.2	27.08443	5 - 15%	0.36	1.2	0.432	54	51.057	1	0.178741	2.416889
3	0.3	33	1.158965	0.7	1.2	32.12652	5 - 15%	0.6	1.2	0.72	60	54.114	1	0.187382	3.842414
3.3	0.3	34	1.127093	0.7	1.2	20.82868	5 - 15%	0.25	1.2	0.3	66	57.171	1	0.195089	1.537682
3.6	0.3	22	1.097996	0.7	1.2	31.35876	5 - 15%	0.6	1.2	0.72	72	60.228	1	0.202032	3.563787
3.9	0.3	34	1.071229	0.7	1.2	26.99497	5 - 15%	0.33	1.2	0.396	78	63.285	1	0.208296	1.901142
4.2	0.3	30	1.046447	0.85	1.2	37.35815	5 - 15%	0.6	1.2	0.72	84	66.342	0.997	0.213334	3.374892
4.5	0.3	35	1.023375	0.85	1.2	29.2276	5 - 15%	0.6	1.2	0.72	90	69.399	0.9925	0.217524	3.309885
4.8	0.3	28	1.001793	0.85	1.2	17.37109	5 - 15%	0.21	1.2	0.252	96	72.456	0.988	0.221228	1.139095
5.1	0.3	17	0.98152	0.85	1.2	21.02415	5 - 15%	0.23	1.2	0.276	102	75.513	0.9835	0.224512	1.229333
5.4	0.3	21	0.962406	0.85	1.2	44.17442	5 - 15%	0.6	1.2	0.72	108	78.57	0.979	0.227424	3.165892
5.7	0.3	45	0.944325	0.85	1.2	24.08029	5 - 15%	0.3	1.2	0.36	114	81.627	0.9745	0.230006	1.565175
6	0.3	25	0.927172	0.85	1.2	17.9686	5 - 15%	0.21	1.2	0.252	120	84.684	0.97	0.232294	1.084831
6.3	0.3	19	0.910857	0.95	1.2	15.57565	5 - 15%	0.18	1.2	0.216	126	87.741	0.9655	0.234319	0.971821
6.6	0.3	15	0.8953	0.95	1.2	20.41284	5 - 15%	0.23	1.2	0.276	132	90.798	0.961	0.236106	1.168965
6.9	0.3	20	0.880435	0.95	1.2	16.04914	5 - 15%	0.19	1.2	0.228	138	93.855	0.9565	0.23768	0.959271
7.2	0.3	16	0.866203	0.95	1.2	17.77448	5 - 15%	0.22	1.2	0.264	144	96.912	0.952	0.239061	1.104321
7.5	0.3	18	0.852552	0.95	1.2	15.55054	5 - 15%	0.18	1.2	0.216	150	99.969	0.9475	0.240266	0.899005
7.8	0.3	16	0.839436	0.95	1.2	18.18218	5 - 15%	0.21	1.2	0.252	156	103.026	0.943	0.24131	1.044298
8.1	0.3	19	0.826815	0.95	1.2	22.62167	5 - 15%	0.26	1.2	0.312	162	106.083	0.9385	0.242209	1.288144
8.4	0.3	24	0.814654	0.95	1.2	22.28893	5 - 15%	0.26	1.2	0.312	168	109.14	0.934	0.242974	1.284091
8.7	0.3	24	0.802919	0.95	1.2	39.35909	5 - 15%	0.6	1.2	0.72	174	112.197	0.9295	0.243615	2.955483
9	0.3	43	0.791582	0.95	1.2	36.08614	5 - 15%	0.6	1.2	0.72	180	115.254	0.925	0.244143	2.949087

Total Liquefied Thickness = 0.3 m

Borehole No.: DH13-2

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4
Total unit Weight of soil (kN/m³) 20
 $a_{max} = 0.5$ (2% in 50year)

Depth (m)	Interval (m)	N	C _N	C _r	C _s	(N ₁) ₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
2.7	0.3	29	1.194199	0.7	1.2	29.09068	5 - 15%	0.5	1.2	0.6	54	51.057	1	0.343733	1.745538
3	0.3	24	1.158965	0.7	1.2	23.36474	5 - 15%	0.35	1.2	0.42	60	54.114	1	0.36035	1.165532
3.3	0.3	31	1.127093	0.7	1.2	39.76385	5 - 15%	0.6	1.2	0.72	66	57.171	1	0.37519	1.919027
3.6	0.3	42	1.097996	0.7	1.2	49.8051	5 - 15%	0.6	1.2	0.72	72	60.228	1	0.388524	1.853169
3.9	0.3	54	1.071229	0.7	1.2	34.19363	5 - 15%	0.6	1.2	0.72	78	63.285	1	0.400569	1.797444
4.2	0.3	38	1.046447	0.85	1.2	39.49291	5 - 15%	0.6	1.2	0.72	84	66.342	0.997	0.41027	1.754944
4.5	0.3	37	1.023375	0.85	1.2	34.44681	5 - 15%	0.6	1.2	0.72	90	69.399	0.9925	0.418315	1.721192
4.8	0.3	33	1.001793	0.85	1.2	27.58938	5 - 15%	0.42	1.2	0.504	96	72.456	0.988	0.425439	1.184659
5.1	0.3	27	0.981152	0.85	1.2	37.04256	5 - 15%	0.6	1.2	0.72	102	75.513	0.9835	0.431754	1.667617
5.4	0.3	37	0.962406	0.85	1.2	18.65142	5 - 15%	0.22	1.2	0.264	108	78.57	0.979	0.437354	1.60363
5.7	0.3	19	0.944325	0.85	1.2	16.3746	5 - 15%	0.2	1.2	0.24	114	81.627	0.9745	0.44232	0.542594
6	0.3	17	0.927172	0.85	1.2	50.12294	5 - 15%	0.6	1.2	0.72	120	84.684	0.97	0.44672	1.611749
6.3	0.3	53	0.910857	0.95	1.2	50.88045	5 - 15%	0.6	1.2	0.72	126	87.741	0.9655	0.450613	1.597824
6.6	0.3	49	0.8953	0.95	1.2	25.51605	5 - 15%	0.35	1.2	0.42	132	90.798	0.961	0.454051	0.925007
6.9	0.3	25	0.880435	0.95	1.2	20.7369	5 - 15%	0.24	1.2	0.288	144	96.912	0.952	0.457078	0.525075
7.2	0.3	16	0.866203	0.95	1.2	17.49436	5 - 15%	0.22	1.2	0.264	150	99.969	0.9475	0.462049	0.571367
7.5	0.3	21	0.852552	0.95	1.2	13.3974	5 - 15%	0.18	1.2	0.216	156	103.026	0.943	0.464059	0.465458
7.8	0.3	18	0.839436	0.95	1.2	21.6791	5 - 15%	0.26	1.2	0.312	162	106.083	0.9385	0.465786	0.669835
8.1	0.3	14	0.826815	0.95	1.2	16.7167	5 - 15%	0.23	1.2	0.276	168	109.14	0.934	0.467257	0.590682
8.4	0.3	23	0.814654	0.95	1.2	17.39123	5 - 15%	0.23	1.2	0.276	174	112.197	0.9295	0.46849	0.589126
8.7	0.3	18	0.802919	0.95	1.2	18.04807	5 - 15%	0.23	1.2	0.276	180	115.254	0.925	0.469506	0.587851
9	0.3	19	0.791582	0.95	1.2	40.04565	15 - 35%	0.23	1.2	0.72	186	118.311	0.9205	0.470322	1.530867
9.3	0.3	20	0.780617	0.95	1.2	48.279	15 - 35%	0.23	1.2	0.72	192	121.368	0.916	0.470951	1.528821
9.6	0.3	45	0.77	0.95	1.2	61.49091	15 - 35%	0.6	1.2	0.72	198	124.425	0.9115	0.471409	1.527337
9.9	0.3	55	0.75971	0.95	1.2	34.18754	15 - 35%	0.6	1.2	0.72	204	127.482	0.907	0.471707	1.526373
10.2	0.3	71	0.749727	1	1.2	35.52159	15 - 35%	0.6	1.2	0.72	210	130.539	0.9025	0.471856	1.525889
10.5	0.3	38	0.740033	1	1.2	28.93226	15 - 35%	0.6	1.2	0.72	216	133.596	0.898	0.471867	1.525852
10.8	0.3	40	0.730613	1	1.2	20.77776	15 - 35%	0.6	1.2	0.6	222	136.653	0.8935	0.47175	1.271861
11.1	0.3	33	0.72145	1	1.2	22.231	15 - 35%	0.55	1.2	0.66	228	139.71	0.889	0.471512	1.399753
11.4	0.3	24	0.712532	1	1.2	29.56152	15 - 35%	0.6	1.2	0.72	234	142.767	0.8845	0.471161	1.52814
11.7	0.3	26	0.703846	1	1.2	29.20593	15 - 35%	0.6	1.2	0.72	240	145.824	0.88	0.470704	1.529622
12	0.3	35	0.695379	1	1.2			0.6	1.2	0.72	240				

Total Liquefied Thickness = 3.3 m

Seed/Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Borehole No.: DH13-2

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4
 Total unit Weight of soil (kN/m³) 20
 a_{max} = 0.26 (10% in 50year)

Depth (m)	Interval (m)	N	C _N	C _i	C _s	(N) _{ho}	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
2.7	0.3	29	1.194199	0.7	1.2	29.09068	5 - 15%	0.5	1.2	0.6	54	51.057	1	0.178741	3.356805
3	0.3	24	1.158965	0.7	1.2	23.36474	5 - 15%	0.35	1.2	0.42	60	54.114	1	0.187382	2.241408
3.3	0.3	31	1.127093	0.7	1.2	39.76385	5 - 15%	0.6	1.2	0.72	66	57.171	1	0.195099	3.690436
3.6	0.3	42	1.097996	0.7	1.2	49.8051	5 - 15%	0.6	1.2	0.72	72	60.228	1	0.202032	3.563787
3.9	0.3	54	1.071229	0.7	1.2	34.19363	5 - 15%	0.6	1.2	0.72	78	63.285	1	0.208296	3.456623
4.2	0.3	38	1.046447	0.85	1.2	39.49291	5 - 15%	0.6	1.2	0.72	84	66.342	0.997	0.213334	3.374892
4.5	0.3	37	1.023375	0.85	1.2	34.44681	5 - 15%	0.6	1.2	0.72	90	69.399	0.9925	0.217524	3.309985
4.8	0.3	33	1.001793	0.85	1.2	27.58938	5 - 15%	0.42	1.2	0.504	96	72.456	0.988	0.221228	2.27819
5.1	0.3	27	0.98152	0.85	1.2	37.04256	5 - 15%	0.6	1.2	0.264	102	75.513	0.9835	0.224512	3.206956
5.4	0.3	37	0.962406	0.85	1.2	18.65142	5 - 15%	0.22	1.2	0.264	108	78.57	0.979	0.227424	1.160827
5.7	0.3	19	0.944325	0.85	1.2	16.3746	5 - 15%	0.2	1.2	0.24	114	81.627	0.9745	0.230006	1.04345
6	0.3	17	0.927172	0.85	1.2	50.12294	5 - 15%	0.6	1.2	0.72	120	84.684	0.97	0.232294	3.099518
6.3	0.3	53	0.910857	0.95	1.2	50.88045	5 - 15%	0.6	1.2	0.72	126	87.741	0.9655	0.234319	3.072738
6.6	0.3	49	0.8953	0.95	1.2	25.51605	5 - 15%	0.35	1.2	0.42	132	90.798	0.961	0.236106	1.778859
6.9	0.3	25	0.880435	0.95	1.2	16.05914	5 - 15%	0.2	1.2	0.24	138	93.855	0.9565	0.23768	1.009759
7.2	0.3	16	0.866203	0.95	1.2	20.7369	5 - 15%	0.24	1.2	0.288	144	96.912	0.952	0.239061	1.204714
7.5	0.3	21	0.852552	0.95	1.2	17.49436	5 - 15%	0.22	1.2	0.264	150	99.969	0.9475	0.240266	1.098783
7.8	0.3	18	0.839436	0.95	1.2	13.3974	5 - 15%	0.18	1.2	0.216	156	103.026	0.943	0.24131	0.895112
8.1	0.3	14	0.826815	0.95	1.2	21.6791	5 - 15%	0.26	1.2	0.312	162	106.083	0.9385	0.242209	1.288144
8.4	0.3	23	0.814654	0.95	1.2	16.7167	5 - 15%	0.23	1.2	0.276	168	109.14	0.934	0.242974	1.135926
8.7	0.3	18	0.802919	0.95	1.2	17.39123	5 - 15%	0.23	1.2	0.276	174	112.197	0.9295	0.243615	1.132935
9	0.3	19	0.791582	0.95	1.2	18.04807	5 - 15%	0.23	1.2	0.276	180	115.254	0.925	0.244143	1.130483
9.3	0.3	20	0.780617	0.95	1.2	40.04655	15 - 35%	0.6	1.2	0.72	186	118.311	0.9205	0.244567	2.943975
9.6	0.3	45	0.77	0.95	1.2	48.279	15 - 35%	0.6	1.2	0.72	192	121.368	0.916	0.244895	2.94004
9.9	0.3	55	0.75971	0.95	1.2	61.49091	15 - 35%	0.6	1.2	0.72	198	124.425	0.9115	0.245133	2.937187
10.2	0.3	71	0.749727	1	1.2	34.18754	15 - 35%	0.6	1.2	0.72	204	127.482	0.907	0.245287	2.935332
10.5	0.3	38	0.740033	1	1.2	35.52159	15 - 35%	0.6	1.2	0.72	210	130.539	0.9025	0.245365	2.934402
10.8	0.3	40	0.730613	1	1.2	28.93226	15 - 35%	0.6	1.2	0.72	216	133.596	0.898	0.245371	2.934331
11.1	0.3	33	0.72145	1	1.2	20.77776	15 - 35%	0.5	1.2	0.6	222	136.653	0.8935	0.24531	2.445886
11.4	0.3	24	0.712532	1	1.2	22.231	15 - 35%	0.55	1.2	0.66	228	139.71	0.889	0.245186	2.691833
11.7	0.3	26	0.703846	1	1.2	29.56152	15 - 35%	0.6	1.2	0.72	234	142.767	0.8845	0.245004	2.938732
12	0.3	35	0.695379	1	1.2	29.20593	15 - 35%	0.6	1.2	0.72	240	145.824	0.88	0.244766	2.941581

Total Liquefied Thickness = 0 m

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Borehole No.: DH13-3

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4
 Total unit Weight of soil (kN/m³) 20
 $a_{max} = 0.5$ (2% in 50year)

Depth (m)	Interval (m)	N	C _N	C _r	C _s	(N ₁) ₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
3.3	0.9	21	1.127093	0.7	1.2	19.88192	5 - 15%	0.23	1.2	0.276	66	57.171	1	0.37519	0.735627
4.9	1.6	26	0.994898	0.85	1.2	26.38469	5 - 15%	0.3	1.2	0.36	98	73.475	1	0.433481	0.830487
6.4	1.5	8	0.90559	0.85	1.2	6.465915	5 - 15%	0.1	1.2	0.12	128	88.76	1	0.468668	0.256038
7.9	1.5	7	0.835176	0.95	1.2	12.37731	5 - 15%	0.13	1.2	0.156	158	104.045	1	0.493536	0.316086
10.8	2.9	13	0.730613	0.95	1.2	12.49347	5 - 15%	0.13	1.2	0.156	216	133.596	1	0.525465	0.296888
11.1	0.3	15	0.72145	1	1.2	12.12036	5 - 15%	0.13	1.2	0.156	222	136.653	0.8935	0.47175	0.330684
11.4	0.3	14	0.712532	1	1.2	17.95581	5 - 15%	0.21	1.2	0.252	228	139.71	0.889	0.471512	0.534451
11.7	0.3	21	0.703846	1	1.2	23.64922	5 - 15%	0.29	1.2	0.348	234	142.767	0.8845	0.471161	0.738601
12	0.3	28	0.695379	1	1.2	20.86138	5 - 15%	0.22	1.2	0.264	240	145.824	0.88	0.470704	0.560862
12.3	0.3	25	0.687122	1	1.2	22.26275	5 - 15%	0.28	1.2	0.336	246	148.881	0.8755	0.470149	0.714667
12.6	0.3	27	0.679064	1	1.2	25.26116	5 - 15%	0.33	1.2	0.396	252	151.938	0.871	0.4695	0.843445
12.9	0.3	31	0.671195	1	1.2	16.10867	5 - 15%	0.2	1.2	0.24	258	154.995	0.8665	0.468764	0.511985
13.2	0.3	20	0.663507	1	1.2	13.53554	5 - 15%	0.18	1.2	0.216	264	158.052	0.862	0.467945	0.461593
13.5	0.3	17	0.655992	1	1.2	31.48761	5 - 15%	0.6	1.2	0.72	270	161.109	0.8575	0.467048	1.541598
13.8	0.3	40	0.648642	1	1.2	19.45926	5 - 15%	0.22	1.2	0.264	276	164.166	0.853	0.466078	0.566429
14.1	0.3	25	0.64145	1	1.2	10.77636	5 - 15%	0.12	1.2	0.144	282	167.223	0.8485	0.465038	0.309652
14.4	0.3	14	0.63441	1	1.2	15.22593	5 - 15%	0.18	1.2	0.216	288	170.28	0.844	0.463932	0.465585
14.7	0.3	20	0.627515	1	1.2	15.81337	5 - 15%	0.18	1.2	0.216	294	173.337	0.8395	0.462765	0.46676
15	0.3	21	0.620759	1	1.2	10.42874	5 - 15%	0.12	1.2	0.144	300	176.394	0.835	0.461538	0.312
15.3	0.3	14	0.614136	1	1.2	11.05446	5 - 15%	0.12	1.2	0.144	306	179.451	0.8305	0.460255	0.31287
15.6	0.3	15	0.607643	1	1.2	7.291715	5 - 15%	0.1	1.2	0.12	312	182.508	0.826	0.458919	0.261484
15.9	0.3	10	0.601273	1	1.2	7.215277	5 - 15%	0.1	1.2	0.12	318	185.563	0.8215	0.457533	0.262276
16.2	0.3	10	0.595022	1	1.2	7.140267	15 - 35%	0.1	1.2	0.12	324	188.622	0.817	0.456098	0.263101
16.5	0.3	10	0.588886	1	1.2	7.066635	15 - 35%	0.1	1.2	0.12	330	191.679	0.8125	0.454617	0.263958
16.8	0.3	10	0.582861	1	1.2	8.393194	15 - 35%	0.11	1.2	0.132	336	194.736	0.808	0.453093	0.291331
17.1	0.3	12	0.576942	1	1.2	9.692823	15 - 35%	0.12	1.2	0.144	342	197.793	0.8035	0.451528	0.318917
17.4	0.3	14	0.571126	1	1.2	9.594916	15 - 35%	0.12	1.2	0.144	348	200.85	0.799	0.449922	0.320055
17.7	0.3	14	0.565409	1	1.2	9.498878	15 - 35%	0.12	1.2	0.144	354	203.907	0.7945	0.448279	0.321229
18	0.3	14	0.559789	1	1.2	10.0762	15 - 35%	0.12	1.2	0.144	360	206.964	0.79	0.446599	0.322437
18.3	0.3	15	0.554262	1	1.2	12.63716	15 - 35%	0.13	1.2	0.156	366	210.021	0.7855	0.444885	0.350652
18.6	0.3	19	0.548824	1	1.2	12.51318	15 - 35%	0.13	1.2	0.156	372	213.078	0.781	0.443138	0.352035
18.9	0.3	19	0.543473	1	1.2	12.39119	15 - 35%	0.13	1.2	0.156	378	216.135	0.7765	0.441359	0.353454
19.2	0.3	19	0.538207	1	1.2	11.62527	15 - 35%	0.13	1.2	0.156	384	219.192	0.772	0.439549	0.354909
19.5	0.3	18	0.533022	1	1.2	11.51328	15 - 35%	0.13	1.2	0.156	390	222.249	0.7675	0.43771	0.3564
19.8	0.3	18	0.527917	1	1.2	12.67	15 - 35%	0.13	1.2	0.156	396	225.306	0.763	0.435843	0.357927
20.1	0.3	20	0.522888	1	1.2	11.92184	15 - 35%	0.13	1.2	0.156	402	228.363	0.7585	0.43395	0.359489
20.4	0.3	19	0.517934	1	1.2	12.43041	15 - 35%	0.13	1.2	0.156	408	231.42	0.754	0.43203	0.361086
20.7	0.3	20	0.513052	1	1.2	11.69758	15 - 35%	0.13	1.2	0.156	414	234.477	0.7495	0.430086	0.362718

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Borehole No.: DH13-3

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m)	a_{max} =	0.5 (2% in 50year)													
Total unit Weight of soil (kN/m ³)	2.4	20													
21	0.3	19	0.50824	1	1.2	12.19776	15 - 35%	0.13	1.2	0.156	420	237.534	0.745	0.428118	0.364386
21.3	0.3	20	0.503497	1	1.2	12.08392	15 - 35%	0.13	1.2	0.156	426	240.591	0.7405	0.426127	0.366088
21.6	0.3	20	0.498819	1	1.2	13.16883	15 - 35%	0.14	1.2	0.168	432	243.648	0.736	0.424113	0.39612
21.9	0.3	22	0.494207	1	1.2	13.04706	15 - 35%	0.14	1.2	0.168	438	246.705	0.7315	0.422079	0.39803
22.2	0.3	22	0.489657	1	1.2	13.51453	15 - 35%	0.14	1.2	0.168	444	249.762	0.727	0.420024	0.399977
22.5	0.3	23	0.485168	1	1.2	15.13725	15 - 35%	0.2	1.2	0.24	450	252.819	0.7225	0.41795	0.574232
22.8	0.3	26	0.480739	1	1.2	15.57594	15 - 35%	0.2	1.2	0.24	456	255.876	0.718	0.415856	0.577123
23.1	0.3	27	0.476368	1	1.2	16.57759	15 - 35%	0.2	1.2	0.24	462	258.933	0.7135	0.413744	0.580069
23.4	0.3	29	0.472053	1	1.2	16.42743	15 - 35%	0.2	1.2	0.24	468	261.99	0.709	0.411615	0.58307
23.7	0.3	29	0.467793	1	1.2	15.15648	15 - 35%	0.2	1.2	0.24	474	265.047	0.7045	0.409468	0.586127
24	0.3	27	0.463586	1	1.2	16.1328	15 - 35%	0.2	1.2	0.24	480	268.104	0.7	0.407305	0.58924
24.3	0.3	29	0.459432	1	1.2	14.8856	15 - 35%	0.2	1.2	0.24	486	271.161	0.6955	0.405125	0.592409
24.6	0.3	27	0.455329	1	1.2	15.28905	15 - 35%	0.2	1.2	0.24	492	274.218	0.691	0.402931	0.595636
24.9	0.3	28	0.451275	1	1.2	15.70438	15 - 35%	0.2	1.2	0.24	498	277.275	0.6865	0.400721	0.598892
25.2	0.3	29	0.44727	1	1.2	15.02829	15 - 35%	0.2	1.2	0.24	504	280.332	0.682	0.398497	0.602262
25.5	0.3	28	0.443313	1	1.2	15.95926	15 - 35%	0.2	1.2	0.24	510	283.389	0.6775	0.39626	0.605663
25.8	0.3	30	0.439402	1	1.2	15.81846	15 - 35%	0.2	1.2	0.24	516	286.446	0.673	0.394008	0.609124
30															

Total Liquefied Thickness =

23.1 m

Borehole No.: DH13-3

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4
Total unit Weight of soil (kN/m³) 20
 $a_{max} = 0.26$ (10% in 50year)

Depth (m)	Interval (m)	N	C _N	C _r	C _s	(N ₁) ₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
3.3	0.9	21	1.127093	0.7	1.2	19.88192	5 - 15%	0.23	1.2	0.276	66	57.171	1	0.195099	1.414667
4.9	1.6	26	0.994898	0.85	1.2	26.38469	5 - 15%	0.3	1.2	0.36	98	73.475	1	0.22541	1.59709
6.4	1.5	8	0.90559	0.85	1.2	6.465915	5 - 15%	0.1	1.2	0.12	128	88.76	1	0.243713	0.492382
7.9	1.5	7	0.835176	0.95	1.2	12.37731	5 - 15%	0.13	1.2	0.156	158	104.045	1	0.256639	0.607858
10.8	2.9	13	0.730613	0.95	1.2	12.49347	5 - 15%	0.13	1.2	0.156	216	133.596	1	0.273242	0.570923
11.1	0.3	15	0.72145	1	1.2	12.12036	5 - 15%	0.13	1.2	0.156	222	136.653	0.8935	0.24531	0.63593
11.4	0.3	14	0.712532	1	1.2	17.95581	5 - 15%	0.21	1.2	0.252	228	139.71	0.889	0.245186	1.027791
11.7	0.3	21	0.703846	1	1.2	23.64922	5 - 15%	0.29	1.2	0.348	234	142.767	0.8845	0.245004	1.420387
12	0.3	28	0.695379	1	1.2	20.86138	5 - 15%	0.22	1.2	0.264	240	145.824	0.88	0.244766	1.07858
12.6	0.3	25	0.687122	1	1.2	22.26275	5 - 15%	0.28	1.2	0.336	246	148.881	0.8755	0.244477	1.37436
12.9	0.3	31	0.671195	1	1.2	25.26116	5 - 15%	0.33	1.2	0.396	252	151.938	0.871	0.24414	1.62202
13.5	0.3	20	0.663507	1	1.2	16.10867	5 - 15%	0.2	1.2	0.24	258	154.995	0.8665	0.243757	0.984587
13.8	0.3	40	0.648642	1	1.2	13.53554	5 - 15%	0.18	1.2	0.216	264	158.052	0.862	0.243331	0.887679
14.1	0.3	25	0.64145	1	1.2	31.48761	5 - 15%	0.6	1.2	0.72	270	161.109	0.8575	0.242865	2.964611
14.4	0.3	14	0.63441	1	1.2	19.45926	5 - 15%	0.12	1.2	0.264	276	164.166	0.853	0.24236	1.089287
14.7	0.3	14	0.63441	1	1.2	15.22583	5 - 15%	0.12	1.2	0.144	282	167.223	0.8485	0.24182	0.595485
15	0.3	20	0.627515	1	1.2	15.81337	5 - 15%	0.18	1.2	0.216	288	170.28	0.844	0.241245	0.895356
15.3	0.3	21	0.620759	1	1.2	10.42874	5 - 15%	0.12	1.2	0.144	294	173.337	0.8395	0.240638	0.897615
15.6	0.3	14	0.614136	1	1.2	11.05446	5 - 15%	0.12	1.2	0.144	300	176.394	0.835	0.24	0.600001
15.9	0.3	10	0.601273	1	1.2	7.291715	5 - 15%	0.1	1.2	0.144	306	179.451	0.8305	0.239333	0.601673
16.2	0.3	10	0.595022	1	1.2	7.215277	5 - 15%	0.1	1.2	0.12	312	182.508	0.826	0.238638	0.502854
16.5	0.3	10	0.588886	1	1.2	7.140267	15 - 35%	0.1	1.2	0.12	318	185.565	0.8215	0.237917	0.504378
16.8	0.3	10	0.582861	1	1.2	8.393194	15 - 35%	0.11	1.2	0.12	324	188.622	0.817	0.237171	0.505964
17.1	0.3	12	0.576942	1	1.2	9.692523	15 - 35%	0.12	1.2	0.144	330	191.679	0.8125	0.236401	0.507612
17.4	0.3	14	0.571126	1	1.2	9.594916	15 - 35%	0.12	1.2	0.144	336	194.736	0.8035	0.234794	0.613302
17.7	0.3	14	0.559789	1	1.2	9.498878	15 - 35%	0.12	1.2	0.144	342	197.793	0.8035	0.234794	0.613302
18	0.3	14	0.554409	1	1.2	10.0762	15 - 35%	0.12	1.2	0.144	348	200.85	0.799	0.23396	0.615491
18.3	0.3	15	0.554262	1	1.2	12.63716	15 - 35%	0.13	1.2	0.156	360	206.964	0.79	0.232232	0.62007
18.6	0.3	19	0.548824	1	1.2	12.51318	15 - 35%	0.13	1.2	0.156	366	210.021	0.7855	0.23134	0.674331
18.9	0.3	19	0.543473	1	1.2	11.62527	15 - 35%	0.13	1.2	0.156	372	213.078	0.781	0.230432	0.67699
19.2	0.3	19	0.538207	1	1.2	12.39119	15 - 35%	0.13	1.2	0.156	378	216.135	0.7765	0.229506	0.67972
19.5	0.3	18	0.533022	1	1.2	11.51328	15 - 35%	0.13	1.2	0.156	384	219.192	0.772	0.228565	0.682518
19.8	0.3	18	0.527917	1	1.2	12.67	15 - 35%	0.13	1.2	0.156	390	222.249	0.7675	0.227609	0.685385
20.1	0.3	20	0.522888	1	1.2	11.92184	15 - 35%	0.13	1.2	0.156	396	225.306	0.763	0.226638	0.688321
20.4	0.3	19	0.517934	1	1.2	12.43041	15 - 35%	0.13	1.2	0.156	402	228.363	0.7585	0.225654	0.691325
20.7	0.3	20	0.513052	1	1.2	11.69758	15 - 35%	0.13	1.2	0.156	408	231.42	0.754	0.224656	0.694396
											414	234.477	0.7495	0.223645	0.697535

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Borehole No.: DH13-3

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4 **a_{max}** = 0.26 (10% in 50year)

Depth to Water Table (m)	Total unit Weight of soil (kN/m ³)	a_{max}	1	1.2	1.2	1.2	0.13	1.2	0.156	420	237.534	0.745	0.222621	0.700742	
21	0.3	19	0.50824	1	1.2	12.18776	15 - 35%	0.13	1.2	0.156	420	237.534	0.745	0.222621	0.700742
21.3	0.3	20	0.503497	1	1.2	12.08392	15 - 35%	0.13	1.2	0.156	426	240.591	0.7405	0.221586	0.704016
21.6	0.3	20	0.498819	1	1.2	13.16883	15 - 35%	0.14	1.2	0.168	432	243.648	0.736	0.220539	0.706177
21.9	0.3	22	0.494207	1	1.2	13.04706	15 - 35%	0.14	1.2	0.168	438	246.705	0.7315	0.219481	0.705442
22.2	0.3	22	0.489657	1	1.2	13.51453	15 - 35%	0.14	1.2	0.168	444	249.762	0.727	0.218413	0.709186
22.5	0.3	23	0.485168	1	1.2	15.13725	15 - 35%	0.2	1.2	0.24	450	252.819	0.7225	0.217334	1.104292
22.8	0.3	26	0.480739	1	1.2	15.57594	15 - 35%	0.2	1.2	0.24	456	255.876	0.718	0.216245	1.109851
23.1	0.3	27	0.476368	1	1.2	16.42743	15 - 35%	0.2	1.2	0.24	462	258.933	0.7135	0.215147	1.115516
23.4	0.3	29	0.472053	1	1.2	15.16448	15 - 35%	0.2	1.2	0.24	468	261.99	0.709	0.21404	1.121288
23.7	0.3	29	0.467793	1	1.2	16.1328	15 - 35%	0.2	1.2	0.24	474	265.047	0.7045	0.212923	1.127167
24	0.3	27	0.463586	1	1.2	14.8856	15 - 35%	0.2	1.2	0.24	480	268.104	0.7	0.211798	1.133153
24.3	0.3	29	0.459432	1	1.2	15.29905	15 - 35%	0.2	1.2	0.24	486	271.161	0.6955	0.210665	1.139248
24.6	0.3	27	0.455329	1	1.2	15.70438	15 - 35%	0.2	1.2	0.24	492	274.218	0.691	0.209524	1.145453
24.9	0.3	28	0.451275	1	1.2	15.02829	15 - 35%	0.2	1.2	0.24	498	277.275	0.6865	0.208375	1.151769
25.2	0.3	29	0.44727	1	1.2	15.95926	15 - 35%	0.2	1.2	0.24	504	280.332	0.682	0.207219	1.158197
25.5	0.3	28	0.443313	1	1.2	15.81846	15 - 35%	0.2	1.2	0.24	510	283.389	0.6775	0.206055	1.164737
25.8	0.3	30	0.439402	1	1.2	15.81846	15 - 35%	0.2	1.2	0.24	516	286.446	0.673	0.204884	1.171393

Total Liquefied Thickness = 15.2 m

Borehole No.: DH13-4

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Project: Proposed West Coast Multiplex
 Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
 Date: Jun-13

Depth to Water Table (m) 2.4
 Total unit Weight of soil (kN/m³) 20
 $a_{max} = 0.5$ (2% in 50year)

Depth (m)	Interval (m)	N	C _N	C _t	C _s	(N ₁) ₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
2.7	0.3	20	1.194199	0.7	1.2	20.06254	5 - 15%	0.23	1.2	0.276	54	51.057	1	0.343733	0.802948
3	0.3	22	1.158965	0.7	1.2	21.41768	5 - 15%	0.24	1.2	0.288	60	54.114	1	0.36035	0.799222
3.3	0.3	27	1.127093	0.7	1.2	33.13654	5 - 15%	0.6	1.2	0.72	66	57.171	1	0.37519	1.919027
3.6	0.3	35	1.097996	0.7	1.2	15.67938	5 - 15%	0.19	1.2	0.228	72	60.228	1	0.388524	0.586637
3.9	0.3	17	1.071229	0.7	1.2	24.29548	5 - 15%	0.32	1.2	0.384	78	63.285	1	0.400569	0.958637
4.2	0.3	27	1.046447	0.85	1.2	28.81915	5 - 15%	0.5	1.2	0.6	84	66.342	0.997	0.41027	1.462453
4.5	0.3	27	1.023375	0.85	1.2	33.40297	5 - 15%	0.6	1.2	0.72	90	69.399	0.9925	0.418315	1.721192
4.8	0.3	32	1.001793	0.85	1.2	16.34926	5 - 15%	0.19	1.2	0.228	96	72.456	0.988	0.425439	0.535917
5.1	0.3	16	0.98152	0.85	1.2	16.0184	5 - 15%	0.19	1.2	0.228	102	75.513	0.9835	0.431754	0.528079
5.4	0.3	16	0.962406	0.85	1.2	15.70646	5 - 15%	0.18	1.2	0.216	108	78.57	0.979	0.437354	0.493879
5.7	0.3	16	0.944325	0.85	1.2	14.44818	5 - 15%	0.17	1.2	0.204	114	81.627	0.9745	0.44232	0.461205
6	0.3	15	0.927172	0.85	1.2	13.24002	5 - 15%	0.16	1.2	0.192	120	84.684	0.97	0.44672	0.4298
6.3	0.3	14	0.910857	0.95	1.2	16.61402	5 - 15%	0.19	1.2	0.228	126	87.741	0.9655	0.450613	0.505978
6.6	0.3	16	0.8953	0.95	1.2	16.33027	5 - 15%	0.19	1.2	0.228	132	90.798	0.961	0.454051	0.502147
6.9	0.3	16	0.880435	0.95	1.2	16.05914	5 - 15%	0.19	1.2	0.228	138	93.855	0.9565	0.457078	0.498821
7.2	0.3	16	0.866203	0.95	1.2	19.74942	5 - 15%	0.22	1.2	0.264	144	96.912	0.952	0.459733	0.574247
7.5	0.3	20	0.852552	0.95	1.2	15.55054	5 - 15%	0.21	1.2	0.252	150	99.969	0.9475	0.462049	0.545396
7.8	0.3	16	0.839436	0.95	1.2	17.22523	5 - 15%	0.2	1.2	0.24	156	103.026	0.943	0.464059	0.517176
8.1	0.3	18	0.826815	0.95	1.2	17.90882	5 - 15%	0.2	1.2	0.24	162	106.083	0.9385	0.465786	0.515258
8.4	0.3	19	0.814654	0.95	1.2	16.7167	5 - 15%	0.19	1.2	0.228	168	109.14	0.934	0.467257	0.487954
8.7	0.3	18	0.802919	0.95	1.2	16.4759	5 - 15%	0.19	1.2	0.228	174	112.197	0.9295	0.46849	0.486669
9	0.3	18	0.791582	0.95	1.2	16.24327	5 - 15%	0.19	1.2	0.228	180	115.254	0.925	0.469506	0.485616

Total Liquefied Thickness = 5.7 m +

Seed-Idriss Liquefaction Screening

Based on Greater Vancouver Liquefaction Task Force Report, May 8, 2007

Borehole No.: DH13-4

Project: Proposed West Coast Multiplex
Client: Alberni-Clayoquot Regional District

Project No.: SGL13-011
Date: Jun-13

Depth to Water Table (m) 2.4
 Total unit Weight of soil (kN/m³) 20
 $a_{max} = 0.26$ (10% in 50year)

Depth (m)	Interval (m)	N	C _N	C _i	C _s	(N ₁) ₆₀	Fines	CRR ₁	k _m	CRR	Sigma vt	Sigma vo	r _d	CSR	Ft
2.7	0.3	20	1.194199	0.7	1.2	20.06254	5 - 15%	0.23	1.2	0.276	54	51.057	1	0.178741	1.54413
3	0.3	22	1.158965	0.7	1.2	21.41768	5 - 15%	0.24	1.2	0.288	60	54.114	1	0.187382	1.536966
3.3	0.3	27	1.127093	0.7	1.2	33.13654	5 - 15%	0.6	1.2	0.72	66	57.171	1	0.195099	3.690436
3.6	0.3	35	1.097996	0.7	1.2	15.67938	5 - 15%	0.19	1.2	0.228	72	60.228	1	0.202032	1.128533
3.9	0.3	17	1.071229	0.7	1.2	24.29548	5 - 15%	0.32	1.2	0.384	78	63.285	1	0.208296	1.843532
4.2	0.3	27	1.046447	0.85	1.2	28.81915	5 - 15%	0.5	1.2	0.6	84	66.342	0.997	0.21334	2.81241
4.5	0.3	27	1.023375	0.85	1.2	33.40297	5 - 15%	0.6	1.2	0.72	90	69.399	0.9925	0.217524	3.309985
4.8	0.3	32	1.001793	0.85	1.2	16.34926	5 - 15%	0.19	1.2	0.228	96	72.456	0.988	0.221228	1.03061
5.1	0.3	16	0.98152	0.85	1.2	16.0184	5 - 15%	0.19	1.2	0.228	102	75.513	0.9835	0.224512	1.015536
5.4	0.3	16	0.962406	0.85	1.2	15.70646	5 - 15%	0.18	1.2	0.216	108	78.57	0.979	0.227424	0.949768
5.7	0.3	16	0.944325	0.85	1.2	14.44818	5 - 15%	0.17	1.2	0.204	114	81.627	0.9745	0.230006	0.866933
6	0.3	15	0.927172	0.85	1.2	13.24002	5 - 15%	0.16	1.2	0.192	120	84.684	0.97	0.232294	0.826538
6.3	0.3	14	0.910857	0.95	1.2	16.61402	5 - 15%	0.19	1.2	0.228	126	87.741	0.9655	0.234319	0.973034
6.6	0.3	16	0.8953	0.95	1.2	16.33027	5 - 15%	0.19	1.2	0.228	132	90.798	0.961	0.236106	0.965666
6.9	0.3	16	0.880435	0.95	1.2	16.05914	5 - 15%	0.19	1.2	0.228	138	93.855	0.9565	0.23768	0.959271
7.2	0.3	16	0.866203	0.95	1.2	19.74942	5 - 15%	0.22	1.2	0.264	144	96.912	0.952	0.239061	1.104321
7.5	0.3	20	0.852552	0.95	1.2	15.55054	5 - 15%	0.21	1.2	0.252	150	99.969	0.9475	0.240266	1.048839
7.8	0.3	16	0.839436	0.95	1.2	17.22523	5 - 15%	0.2	1.2	0.24	156	103.026	0.943	0.24131	0.994569
8.1	0.3	18	0.826815	0.95	1.2	17.90882	5 - 15%	0.2	1.2	0.24	162	106.083	0.9385	0.242209	0.99088
8.4	0.3	19	0.814654	0.95	1.2	16.7167	5 - 15%	0.19	1.2	0.228	168	109.14	0.934	0.242974	0.938374
8.7	0.3	18	0.802919	0.95	1.2	16.4759	5 - 15%	0.19	1.2	0.228	174	112.197	0.9295	0.243615	0.935903
9	0.3	18	0.791562	0.95	1.2	16.24327	5 - 15%	0.19	1.2	0.228	180	115.254	0.925	0.244143	0.933877

Total Liquefied Thickness = 3.3 m +