SIMPSON GEOTECHNICAL LTD

May 9, 2018
File: SGL18-016

Regional District of Nanaimo
1490 Springhill Road
Parksville, BC V9P 2T2

Attention: Mr. Mark Dobbs, Superintendent of Parks Operations and Capital Projects

Re: Joyce Lockwood Community Park, Gabriola Island
Geotechnical Recommendations for Beach Access Temporary Stair Repair

INTRODUCTION

As requested, Simpson Geotechnical Ltd. (SGL) has conducted a geotechnical review of the damaged beach access stairs at Joyce Lockwood Community Park on Gabriola Island. We understand that the existing beach access stairs were constructed in approximately 2008. The lower portion of the stairs have sustained damage from winter storms and were closed in early 2017 for safety reasons. The approximately location of the stairs is illustrated on Figure 1.

The purpose of our assessment was to provide geotechnical recommendations for temporary repair of the existing beach access stairs. We understand these repairs would be temporary as the Regional District of Nanaimo explores a better long term solution to providing beach access in the area.

SITE DESCRIPTION

We conducted our site review on April 23, 2018. The beach access stairs were located on the southern portion of Joyce Lockwood Park on an eastern facing backshore slope adjacent to the Strait of Georgia, approximately as shown on Figure 1.

The existing stairs were of wooden construction that began at the top of the eastward facing backshore slope as a low wooden boardwalk that progressed to descending the

backshore slope through two flights of stairs with two intermediate landings. The final flight of stairs that would have descended from the lower landing to the beach level was absent and was reportedly removed last year due to storm damage. A cross section of the slope surface through the stair alignment was obtained by laser rangefinder and is shown on Figure 2.

The wooden structure was supported on pairs of 200mm diameter concrete piers bearing on concrete pad footings that bore directly on the ground surface. The stair structure that remained in place was in relatively good condition for its age, with no significant deformation suggestive of slope movement observed.

There was evidence of one of the stair foundation piers having been replaced relatively recently. It appeared that repair was due to erosion from overland water flow and not from slope movement or settlement.

The toe of the backshore slope was eroded by ocean waves to a near vertical 1.2m high slope that exposed soft silt/clay with a trace of fine sand and occasional small gravel. Water seepage was emanating from the eroded slope approximately 0.5m above the beach level. The lowest stair foundation pier was located within 0.3m of the crest of that eroded slope.

The remainder of the slope above the wave eroded toe was vegetated with primarily conifers with trunk diameters up to approximately 400mm and a low brush understory. Most tree trunks on the slope above the slope toe were relatedly straight to slightly tilted downslope, suggestive of minor surficial downhill slope creep. The trees along the slope toe were predominantly pistol-butted and/or severely tilted downslope, indicative of progressive wave erosion undermining the trees along the slope toe.

The beach seawards of the backshore slope comprised low slope gravel and cobbles. The natural boundary with the sea appeared to be approximately at the eroded slope toe.

The stair and backshore slope conditions are illustrated on the attached photo log.

SLOPE STABILITY

The stability of the slope at the stair location was modeled using Slope/w limit equilibrium slope stability software. The stability model was based on the slope

geometry shown on Figure 2, with soil properties and groundwater conditions estimated from the soil exposure at the slope toe.

That slope stability model showed that the existing slope has a minimum factor of safety against circular slope movement of marginally greater than 1.0. Output from the slope stability modelling is appended.

Structures are typically not located in areas with a static slope stability factor of safety of less than 1.5. At the existing factor of safety of 1.0, slope movement may occur from relatively minor changes to the slope conditions such as saturation from heavy rain, erosion of the toe, or seismic events.

DISCUSION AND RECOMMENDATIONS

The damage to the lower portion of the beach access stairs appears to be the result of wave impacts during storm events and not due to slope instability. However, the stability of the slope that the stairs descend should be considered marginal, and future slope instability is possible from relatively minor changes in the slope conditions. In light of the plasticity of the observed soil that comprises the slope, potential slope movement is anticipated to express as gradual downslope creep and deformation. The potential for sudden large scale movement is considered to be low.

Based on our site observations and discussions with you on-site, the lower flight of stairs of the beach access stairway could be restored for temporary use by buttressing the wave eroded slope toe to increase support the lowest existing stair foundation pier and provide stairs from that buttress to the beach level. Those stairs could be designed to retract during storm season to minimize damage from wave impacts.

We currently envision that buttress and landing for retractable stairs could be provided with Lock Block®-type 0.75m x 0.75m x 1.5m segmental concrete blocks placed two high and two deep against the eroded slope toe adjacent to the existing stairs. Details of the proposed arrangement are shown on the attached Figure 3.

Rip rap armor around the three sides of the buttress blocks and keyed into and below the beach level should be provided to reduce wave impact forces on the blocks, provide transition from the blocks to the beach gravel, and reduce the potential for waves to undermine the blocks.

The buttress blocks and rip rap foreshore armor should be installed under review of Simpson Geotechnical Ltd. Installation of the foreshore armor will require excavation below the existing beach grade to provide appropriate scour protection. The armor system may otherwise be placed against and around the existing vegetation and trees to minimize disturbance of the slope and to maintain the natural stabilization the vegetation provides as much as practical.

The rip rap material should be a hard, durable material of blocky and angular shape with sharp edges and flat faces approved by the geotechnical engineer.

The gradation of the rip rap should be in accordance with the table shown on Figure 3. The rip rap should be individually machine placed (not end dumped) under review of the geotechnical engineer to minimize void space between pieces.

Native plants should be encouraged to reestablish within the rip rap armor and any disturbed areas inland of the armor.

DISCUSSION

The temporary beach access stair repair described above is intended to reduce wave erosion of the backshore slope at the stair location and provide additional support to the existing portion of the stairs. However, periodic maintenance may be required, especially following major storm events. Maintenance may consist of restoring dislodged rip rap pieces and concrete blocks.

Slope instability at the stair location may occur. That deformation may displace and damage the stairs and foundation piers.

All work should be conducted in accordance with the recommendations of an environmental consultant and best management practices for shoreline work. Appropriate permits may be required from the Regional District of Nanaimo and the Islands Trust prior to commencing installation of the shoreline buttress and stairs.

CLOSURE

SGL appreciates the opportunity to be of service on this project and looks forward to working with you as the project progresses. This report was prepared for the exclusive use of the Regional District of Nanaimo for the proposed temporary stair repair described above. Any use or reliance made on this report by an unauthorized third party is the responsibility of that third party. Contractors should make their own

assessment of the property for the purposes of bidding on and performing work on the site.

No subsurface assessment was conducted in the preparation of this report. Geotechnical field reviews during construction are recommended and the geotechnical recommendations may be modified as required to suit the actual encountered site conditions.

This report has been prepared in accordance with standard geotechnical engineering practice. No other warranty is provided, either expressed or implied.
Yours truly,

Simpson Geotechnical Ltd.

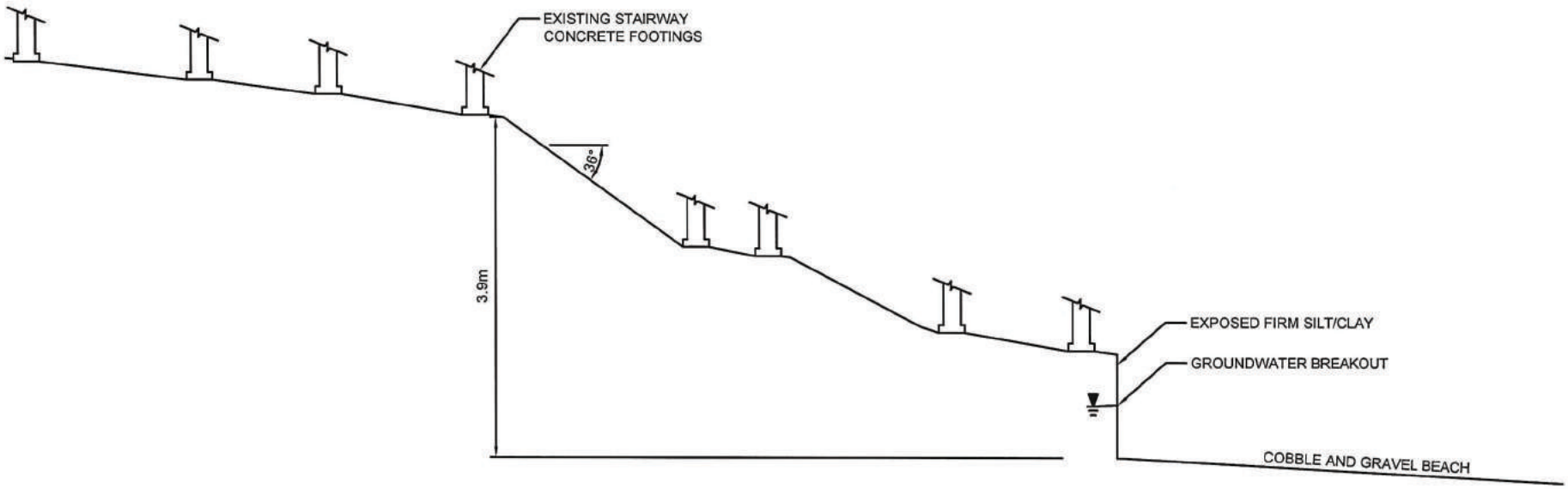
Per:
Richard Simpson, P.Eng.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R.R. SIMPSON
May 9, 2018

Attachments:

Figure 1 – Site location plan
Figure 2 – Cross Section A-A
Figure 3 – Proposed temporary buttress and stair repair
Photo Log
Slope/w Output

Project: Joyce Lockwood Park Gabriola Island Temporary Stair Repair				SIMPSON GEOTECHNICAL LTD	
Title: Site Location Plan					
Client: RDN Parks					
File: SGL18-016	**Drawn by:** RRS	**Scale:** 1 : 1500	**Date:** May 9, 2018	**Dwg. No.:** Figure 1	



Looking Northwards

Project: Joyce Lockwood Park Gabiola Island Temporary Stair Repair					
Title: Cross Section A-A through Existing Stairs					
Client: RDN Parks					
File: SGL18-016	**Drawn by:** RRS	**Scale:** 1 : 75	**Date:** May 9, 2018	**Dwg. No.:** Figure 2	

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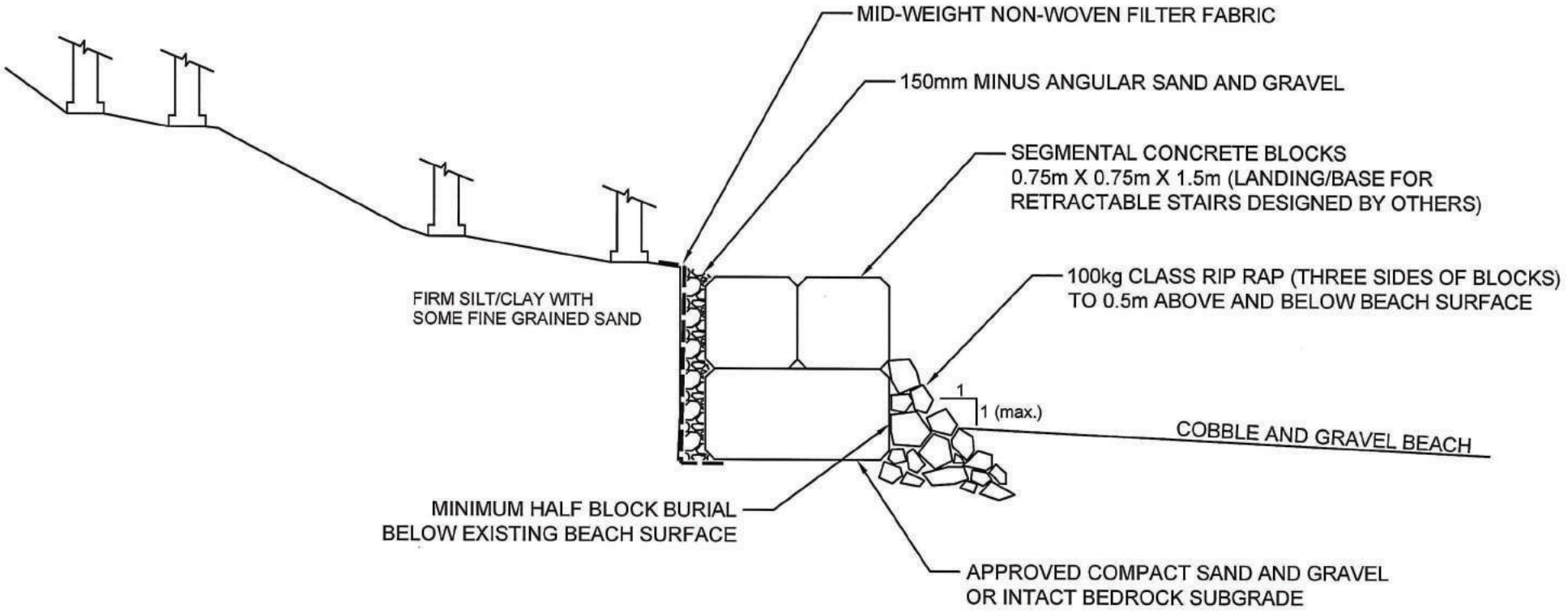
Table 1 - 100 kg Class Rip Rap

Percent Smaller than Approximate Average Dimension (mm)			
100%	85%	50%	15%
<700	600	400	200



Looking Northwards

Project: Joyce Lockwood Park Gabiola Island Temporary Stair Repair				
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Photo 1 – Looking southeastward at beach access stairs

Photo 2 – Concrete pier foundation on upper slope

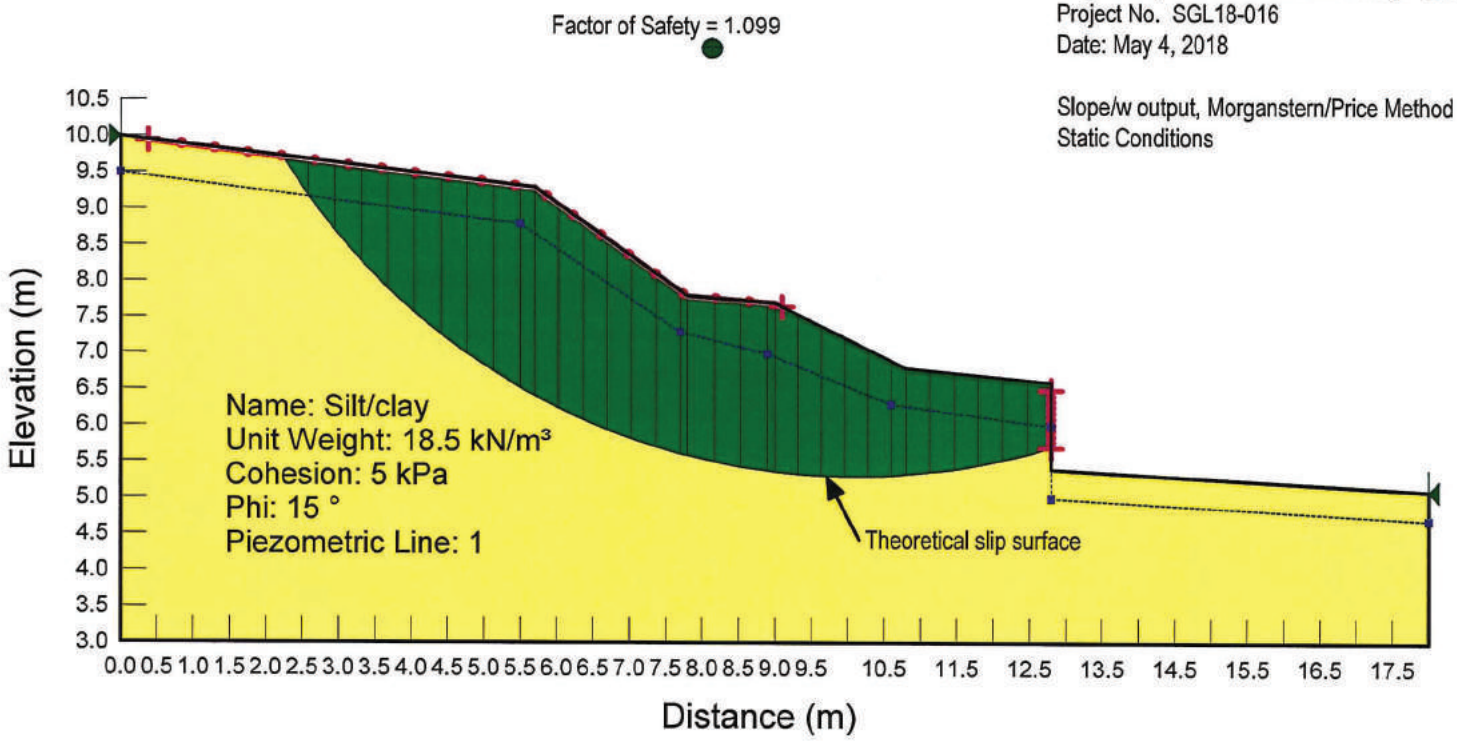
Photo 4 – concrete pier foundation on lower slope

Photo 5 – eroded slope toe and tilted trees below remaining portion of beach access stairs

Photo 6 – eroded slope toe and tilted trees below remaining portion of beach access stairs

Project: Joyce Lockwood Community Park Stairway Repair
Project No. SGL18-016
Date: May 4, 2018

Slope/w output, Morganstern/Price Method
Static Conditions



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