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Dear Coralie Breen,

Reference: June 02, 2022, Public Information Meeting in Saltair Community Hall: Stantec response to written questions

Introduction

Following the June 02, 2022, public meeting in Saltair, CVRD received several public comments and questions concerned with (in general) the potential impacts of the new recommended setback, requirements for obtaining a geotechnical assessment within the setback, updates to the development permit area (DPA), and the timing and implications of the proposed bylaw 4427 DPA 7 amendment (UDPA 7.2) https://www.cvrd.ca/DocumentCenter/View/103845/2022-04-20-Bylaw-4427.

Some of these questions are within Stantec's purview, and we attempt to address those in this letter. We present paraphrased questions below that intend to address similar questions at once.

In answering the questions, Stantec wishes to be clear that there were two distinct groups of landslide problems addressed in the Coastal Slope Stability Assessment (Stantec and Palmer, 2022). We will refer to each Group, as appropriate, in our answers.

- Group 1 were relatively shallow translational and rotational historic landslides in the over-steepened coastal bluffs. These landslides were related to human development, runoff (including stormwater drainage), local geology, and shoreline (wave) erosion. They represent ongoing maintenance issues for landowners and are generally recognized as such. Specific observations and observed locations of these landslides are provided in Appendices B and C in the report (Stantec and Palmer, 2022).

- Group 2 were deep, low angle, retrogressive landslides, many of which were pre-historic and most of which were previously unmapped or unidentified. These landslides failed along a relatively flat basal shear surface and are located, in some instances, well into the community. There is evidence for some of these landslides occurring or being active in the recent past (≤ 100 years) while others occurred over longer time frames (≤ 500 years). Stantec and Palmer introduced, in the report, a mathematical approach to reducing uncertainty over the return period against which new

landslides, similar to those reported, might be encountered. The resulting annual probability of occurrence for any given location within the proposed setback zone (1:530) helps explain both why most of these landslides were not previously recognized and why so many of them (26) are mappable now.

Questions and Answers

Question 1: In the absence of more analysis (e.g. geotechnical drilling, assessments, modelling) can we trust the results of the study? Are the assumptions valid? Shouldn't we defer any change in the zoning until some future date pending 'better' data? Is extending the zone beyond just the identified landslides into properties where no landslide has yet occurred even appropriate?

Answer 1: This line of questioning seeks to defer restrictions being placed on landowners until such time as there is overwhelming and incontrovertible evidence that those restrictions are necessary for the safe development of the community or the protection of individuals. The questions generally state, implicitly or explicitly, that Stantec and Palmer (2022) were too uncertain about the existing conditions to make such recommendations.

This is not the case.

In 2019 the CVRD, following the guidance and standards of Engineers and Geoscientists of British Columbia (APEGBC, 2010) independently established hazard acceptability thresholds for development approvals that considered the type of development, type of risk, and possible remediation measures (CVRD, 2019). Those thresholds consider a range of development from minor repairs to major rezoning, three general categories where human life is threatened (annual probability for loss of life (PDI) designated as low (< 1:100,000), medium (1:10,000 – 1:100,000), and high (>1:10,000)), and possible responses that are essentially approvable upon building inspectors' discretion, approvable with conditions, and not approvable.

PDI is affected by natural hazards, climate change, and continued growth of communities at the interface within hazard areas. Development that effectively ignores known/identified hazards increases the PDI. These are precisely the problems that the new DPA intends to address.

Within that context, Stantec and Palmer (2022) found overwhelming and incontrovertible evidence that those restrictions are necessary for the safe development of the community or the protection of individuals. Group 2 landslides were found along the coast and up Stocking and Porter Creeks. These landslides occupied, collectively, about 21% of the proposed setback zone. The ground between the mapped landslides is sufficiently like the landslide affected ground to warrant inclusion in a single zone. Both the areas where landslides were mapped and the areas between landslides are comprised of deep deposits of till and glaciomarine sediment, both areas are relatively flat upland slopes, and both areas are framed by an escarpment on at least one side either because of tidal/wave action, or channel incision.

Stantec and Palmer (2022) were able to use morphometrics readily observable on the LiDAR imagery to determine an appropriate hazard zone that captured the landslides and identified portions of the community

that could be affected by future (similar) hazards[1]. The method deployed is well documented in other studies around the world including those referenced in the report.

Opportunities for knowledge refinement exist at the site level. For example: The depth of bedrock (below the ground surface) may vary locally, and should it be shallow, the setback zone could be adjusted as a result. Bedrock identified in existing well records occurs at depths that would not change the analysis (Figure 12 in the report).

Similarly, local variations in subsurface sedimentary geology (particularly the absence of clay) could result in increased site stability.

The DPA provides allowance for site level geotechnical investigations.

Question 2: Why don't we continue to use a 30 m DPA rather than extending it to 200 m? The extension is an unacceptable impact to landowners.

Answer 2: The DPA intends to protect properties and lives within the CVRD by requiring a geotechnical assessment or limiting the type of developments where known hazards exist. Prior to the study (Stantec and Palmer, 2022), Group 1 landslides were generally known. Following the study, we are now aware of Group 2 landslides and, while less common, these landslides affect more area.

The DPA is not a 200 m setback, but instead it varies according to the local topography and is based on the inland limit of observed retrogressive landslides.

Question 3: Could Stantec and Palmer have mistaken landslides for other features (roads, cut and fill etc…). Note: there was a specific question about Landslide 8 and cross-section 26

Answer 3: The mappers have a very high degree of expertise in this type of mapping. Four landslides of 26 (see Table 3 in the report) were identified as having uncertain origin (they may be fluvial terraces instead of landslides). One of the four landslides identified as having uncertain origin was Landslide 8. While this doesn't affect the zoning results, a geotechnical visit to these sites may be warranted.

Question 4: Isn't drilling required to "prove" that a landslide hazard exists within the expanded DPA? Where's the proof?

Answer 4: This is equivalent to **Question 1**. Stantec and Palmer (2022) found overwhelming and incontrovertible evidence (proof) of a material hazard (landslides) with potential to impact the community of Saltair at return intervals sufficient to warrant special consideration under CVRD's risk tolerance policy (CVRD, 2019).

With respect to the evidence required: Drilling represents a form of geotechnical data collected at a point that includes considerable subsurface information. Data is inferred, extrapolated, or assumed, between points. Geomorphological interpretation of imagery and LiDAR represents a form of geotechnical data collected at the surface that provides continuous spatial information. Subsurface conditions are inferred or

[1] Includes provision for 1 m sea level rise.

interpreted (in this case) by the features and landforms identified in combination with prior geotechnical knowledge (e.g. a low angle landslide with a headscarp several meters high requires certain subsurface conditions to exist). This study has both. Within the proposed DPA change, Stantec and Palmer identified 22 landslides with a high degree of confidence, occupying approximately 21% of the DPA, and 4 additional landslides that need field verification to confirm (Table 3 in the report).

Existing geotechnical boreholes and observed geological stratigraphic sections provide insight to subsurface conditions and corroborate the report. Opportunities for knowledge refinement exist at the site level. For example: The depth of bedrock (below the ground surface) may vary locally, and should it be shallow, the setback zone could be adjusted as a result. A dashed setback line north of Stocking Creek Falls (Appendix D in the report) represents an area where site level investigation for bedrock depth may be warranted (Stantec and Palmer, 2022).

Local variations in subsurface surficial geology (particularly the absence of clay) could result in increased site stability. The DPA provides allowance for site level geotechnical investigations.

Question 5: Ladysmith and Chemainus have similar shoreline and bluffs, why were they not considered?

Answer 5: Ladysmith and Chemainus were out of the scope of work and are not under CVRD's jurisdiction. We understand that the results of this study have been shared with them.

Question 6: The main issue is the shoreline stability. What practical solutions are provided? What about the successful measures taken by homeowners to improve slope issues on their properties? Why even consider the zone beyond 30 m?

Answer 6: Group 1 landslides are indeed part of the story. The report (Stantec and Palmer, 2022) details conditions along the shoreline including 27 observations of Group 1 landslides (some related to streams, others to seepage, and others to steep slopes). The reader is directed to Appendices B and C for specifics and to Section 5.2 for recommendations.

Note that stabilization efforts for Group 1 landslides are not expected to have a measurable impact on Group 2 landslides. The expanded zone is based on the presence of Group 2 landslides (including a provision for 1 m sea level rise).

Question 7: The landslide risk is extremely low to non-existent (less than 0.2% probability of occurring in a year, less than 20% in 100 years). I've lived here for a long time, why isn't the existing DPA sufficient?

Answer 7: CVRD, following the guidance and standards of Engineers and Geoscientists of British Columbia (APEGBC, 2010) independently established hazard acceptability thresholds for development approvals that considered the type of development, type of risk, and possible remediation measures, in 2019 (CVRD, 2019). Those thresholds consider a range of development from minor repairs to major rezoning, three general categories where human life is threatened (annual probability for loss of life (PDI) designated as low (< 1:100,000), medium (1:10,000 – 1:100,000), and high (>1:10,000)), and possible responses that are essentially approvable upon building inspectors' discretion, approvable with conditions, and not approvable.

In comparison, a hazard recurrence interval of 1:530 is high. It is similar, for example, to the return interval for a Cascadia megathrust earthquake. For reference the last M9 Cascadia megathrust earthquake took place on January 26, 1700 CE, and there is evidence for 13 great earthquakes in the last 6000 years.

We build structures to last, and communities that occupy those structures persist longer than even a few decades. Densification (subdividing land to allow for more structures, people, and occupation) without providing some measure of protection to future residents and generations fundamentally increases the potential consequences of a hazard. The proposed DPA represents CVRD's commitment to the ongoing safety of the community.

Question 8: Stormwater, ditches, and surface water drainage issues are the main threats to slope stability. What is being done about them?

Answer 8: Surface water flow is a common problem in growing communities. It can contribute to slope instability, particularly Group 1 landslides. Stantec and Palmer (2022) made several recommendations to help manage surface water flow (Section 5.2).

Question 9: What is the cost of a geotechnical assessment?

Answer 9: The unfortunate answer is "It depends". Some questions may be answerable with a simple field visit, others may require a subsurface investigation. Prices can vary, depending on the level of effort, from a few thousand to tens of thousands of dollars.

We suggest that individual landowners with site specific questions get a quote from a qualified professional who has read the Coastal Slope Stability report (Stantec and Palmer, 2022) and can advise what level of effort will be required to answer a specific question at a specific property.

Closure

Finding evidence for a previously unknown landslide hazard that has potential to affect the community may pose considerable inconvenience to residents and to the CVRD who are tasked with implementing legislation and policy that intends to protect the current and future community.

Stantec's interprets the DPA as intending to allow continued growth of the community while protecting future generations from foreseeable losses by requiring additional diligence on the side of those who wish to develop.

Group 1 hazards are likely to be (relatively) easy to manage and Group 2 hazards are likely to be more difficult. While Group 2 hazards may not be realized in a particular decade, or indeed for several decades, planning for them is consistent with CVRD's existing policies (CVRD, 2019) and prevents future damages that could be prohibitively expensive (dollars or lives).

The evidence supporting the hazard zone is compelling and sufficient to warrant an expansion of the DPA under CVRD's policies (CVRD, 2019). Opportunities for knowledge refinement, as specifically allowed by the DPA, exist at the site level. Stantec recommends that individual landowners with site specific questions get a quote from a qualified professional who has read the Coastal Slope Stability report (Stantec and

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Palmer, 2022) and can advise what level of effort will be required to answer a specific question at a specific property.

Sincerely,

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