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CITY OF CAMPBELL RIVER'S
HAZARD CONDITIONS DEVELOPMENT PERMIT AREA

This report summarizes a professional review of the City of Campbell River's (the City's) "*Hazard Conditions Development Permit Area"* (DPA), outlined in Section 11 of the City's *Sustainable Official Community Plan*, *Schedule B: Development Permit Areas.*

1. PURPOSE OF THIS REVIEW

The purpose of the review is to provide comments and recommendations to improve on the DPA and its application, in light of recent landslides within the DPA and development pressures within or adjacent to the DPA.

2. METHODOLOGY

McQuarrie Geotechnical has worked in several municipalities throughout BC and, as such, has experienced various steep slope DPA guidelines. McQuarrie Geotechnical has also worked for several municipalities reviewing hazard reports for proposed developments within the DPAs. This review incorporates this experience and direct references from other similar DPA guidelines.

3. DPA MAP

The steep slopes map is understood to have been created using LiDAR generated 0.5 m topographic contours. Ditches and other minor slope features were filtered out. Overall, the level of detail of the LiDAR data seems adequate for this purpose.

The Hazard Conditions DPA is intended to cover slopes steeper than 30% and 10 m or higher, from crest to toe. For comparison, the District of North Vancouver's (DNV) slope hazard DPA considers slopes steeper than 36% (20°) and higher than 10 m, while the Comox Valley Regional District applies their steep slope DPA to slopes 30% or steeper and 3 m or higher. The City's criteria are consistent with other municipalities.

Conflicts between the DPA map and the intended criteria are inevitable because of the broad range of slope configurations that occur. The slope angle and height criteria are merely guides; the DPA map will, understandably, include some areas that do not fit these criteria. For example, the map includes some slopes as short as 6 m high, but significant slope failures can occur on such slopes, particularly if the proposed development will be cut into the bank. In situations where the DPA map seems to be conservative, the slope hazard report can meet its requirements without being exhaustive and without creating a significant encumbrance to the applicant.

A mechanism can be included to allow the City to override the DPA map if site conditions are obviously benign and the proposed development will not alter the ground conditions. This overriding mechanism should also allow the City to request a slope hazard report in cases where development is proposed on a steep slope not included in the DPA. If several adjacent properties are identified where the DPA map seems to have been either too conservatively applied or has failed to identify hazardous slopes, the City could undertake a review and amend the map accordingly.

If the City wishes to improve on the Steep Slopes Map, they should consider the following:

a. Create a database of all known slope hazards within the City, including all landslides of any magnitude. Plotting these features on the Steep Slopes Map would determine if any additional areas should be added in the future.
b. Retain a terrain specialist to create a slope stability map, using the existing slope map, but incorporating other terrain stability attributes, such as surficial geology and slope drainage. While slope angle is typically the most significant attribute, the other attributes also affect slope stability. For example, a 60% bedrock slope is typically more stable than a 40% clay slope. However, Campbell River does not have much exposed bedrock slopes, and most of the steep slopes are comprised of glacial sediments. These urban and suburban slopes are also greatly affected by development, which is difficult to map. A more detailed slope stability map would likely not improve much on the existing slope map.

Despite the limitations of the Steep Slopes Map, the recent landslides above Park Road and below Treelane Road both occurred within the Hazard Conditions DPA. Other areas of known slope hazards, such as the steep slope above Highway 19A, are also included in the DPA. No major edits to the Steep Slopes Map seem to be required at this time.

4. EXEMPTIONS

4.1 Existing Exemptions

The following comments pertain to the existing exemptions to the steep slope areas.

3) *Development, where a geotechnical report has been received in conjunction with an application for building permit or subdivision approval.*

Standard geotechnical reports mainly address roads, building foundations, and perhaps cutslopes and fillslopes. Such reports may be adequate for developed slopes with low relief; however, more significant slope hazards warrant more detailed effort. All slope hazard reports should meet the standards set forth in: "*Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*,"[a] published by Engineers & Geoscientists BC (EGBC). Geotechnical reports prepared to meet BC Building Code requirements rarely meet these guidelines.

Recommendation: Delete this exemption. Ensure that all reports addressing slope stability meet EGBC's *Guidelines*.

4) *Removing or moving soil in quantities below the thresholds identified in the Soil Deposition Bylaw.*

If this refers to the ***Soil Removal and Deposition Bylaw No. 1802, 1989,*** that bylaw does not include a quantity threshold. Also, Bylaw 1802 states under what conditions the Enforcement Officer may refuse to issue a permit, but does not require a slope hazard assessment to verify that slope stability will not be affected.

Recommendation: Whether the slope stability report is to meet the Soil Removal and Deposition Bylaw or the Hazard Conditions DPA, all reports addressing slope stability should meet EGBC's Guidelines. Therefore, either the Soil Removal and Deposition Bylaw should be rewritten or this exemption should be removed.

5) *Erecting Fencing*

Most steep slope bylaws exempt fencing.

6) For Trees:

- *a. Removing dead trees provided the stump remains undisturbed;*
- *b. Planting new trees;*
- *c. Removal of trees where the trunk diameter is less than 5 cm; and*
- *d. Where the tree trunk diameter is greater than 5 cm, pruning, limbing and topping of trees provided a Certified Arborist provides a written opinion stating that the activity will not kill the tree.*

[a] https://www.egbc.ca/getmedia/5d8f3362-7ba7-4cf4-a5b6-e8252b2ed76c/APEGBC-Guidelines-for-Legislated-Landslide-Assessments.pdf.aspx

Contrary to statements made in many geotechnical reports, stumps provide little benefit to slope stability. Most logging-related landslides occur within a few years after logging, clearly demonstrating the role of live trees in maintaining slope stability. The main benefit of live trees is not merely the presence of roots, but soil-matrix suction, which creates adhesion between the roots and soil. Soil-matrix suction is related to evapotranspiration, which ceases once the tree is dead. Also, the micro-rootlets and smaller roots extend far beyond the tree, creating a vast network of reinforcement. These micro-rootlets decay within a few years after cutting, far sooner than the stump and larger roots.

Dead trees often pose a danger and must be eventually removed. Destumping and stump grinding both require equipment access and will usually only be done where the tree is accessible (i.e. not on the steep slope). Destumping will create a depression that must be re-graded to avoid ponding of surface water. Stump grinding does not leave a depression and often creates a mound with the extra mulch, which can be easily spread for erosion control.

Young trees do not provide much root support; the roots are much smaller and do not extend far from the base. It is assumed that the exemption for "planting new trees" does not permit cutting of mature trees and replacing them with new trees.

Exemption 6(d) is common on most steep slope bylaws. It relies on the professionalism of the Certified Arborist, but may occasionally need independent review. For example, topping of large fir trees on steep slopes is often desired to improve the view; however, large conifers do not respond well to topping and the procedure is frowned upon by most Certified Arborists. Aggressive limbing can also kill the tree.

Recommendations:

Exemption 6(a) should allow removal of dead trees provided, if destumped, the depression is regraded to avoid the ponding of surface water.

Ensure that Exemption 6(b) is not interpreted to allow mature conifers to be cut and replaced by seedlings.

"Topping" should be removed from Exemption 6(d) unless an arborist or registered professional forester can explain why topping is necessary.

The City should create a database of arborist-certified tree pruning and limbing. The City should re-inspect some of the trees 1 to 2 years after the work and, if the tree's health was obviously compromised, notify the certifying arborist. Such a database will allow the City to track aggressive arborists, who should then be reported to the arborists' association. The City could also decide not to accept reports from specific arborists whose work is repeatedly found to contravene the objectives of the DPA, or retain an independent arborist to review their work.

7) Domestic yard maintenance, gardening and planting …

These exemptions are common in Steep Slopes DPAs. Removal of dead vegetation allows for new vegetation to grow. The roots are of little benefit if the tree or vegetation is dead; therefore, this proviso is not needed. If the roots are disturbed, the exposed soils merely need to be repacked and regraded, and the area replanted.

Plant size is a difficult parameter to measure and depends on the type of plant. The 5 cm stem limit seems reasonable, although a botanist or landscape architect should provide comment. The more critical component is "… and not resulting in areas of exposed soil on a steep slope."

Recommendation: Edit Exemption 7(b) by deleting "*provided the root structure is not disturbed*".

4.2 Additional Exemptions

General Exemptions

Exemptions should be made for emergency management, environmental restoration, and public works and services, similar to the *General Exemptions* under the General Environmental DPA. With respect to emergency management, the City should reserve the right to require a slope hazard assessment after the work is completed to determine if additional measures are needed to manage the slope hazards or risks.

Building Restoration

Exemptions can be made for building restorations where the building footprint or foundation is not to be expanded. A similar exemptions could apply to buildings destroyed by fire, and for replacement or repair of existing decks, provided the location and dimensions do not change.

Minor Structures

Exemptions could apply to ancillary or non-occupied structures below a specific size, such as 10 m^2 (100 ft^2) where no variance is required, provided the building is located outside any potential slope hazard area and at least 10 m back from the crest of any steep slope, and provided no removal of trees or placement of fill will be required.

Overall Setback

The Guidelines apply to properties "whose boundaries lie within 20 m of a slope," which may be conservative with respect to most aspects of development. Stormwater management, however, can affect slope stability beyond this 20 m buffer. Therefore, instead of relaxing the 20 m buffer, an exemption can be created where both of the following criteria are met:

a) All occupied structures and ancillary structures greater than 10 m^2 are located at least 20 m from the crest of the slope; and

b) No tree cutting, clearing, grading or landscaping (other than that covered by the other exemptions) are planned within 10 m of the slope crest.

5. GUIDELINES

The Hazard Conditions Development Permit Guidelines for a "steep slope" merely requires a "*geotechnical report, prepared by a QEP*" that addresses "*all issues related to site drainage, soil slippage (surface and deep seated), seismic constraints, site clearing, vegetation retention, and how this relates to development usage, setbacks and design*."

If the City's objective is to maintain very general guidelines and avoid being prescriptive, the following is recommended.

i. Replace "geotechnical report" with "slope hazard report" to distinguish between reports addressing the slope hazard from those addressing building foundations. The type of assessments and the qualifications of the professionals are quite different.

ii. Require that all reports meet EGBC's "*Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*". These *Guidelines* address the scope, level of effort, hazard analysis, and report requirements.

iii. Many geotechnical engineers do not have the qualifications to conduct slope hazard assessments, particularly in the natural environment or where the slope hazards are significant. Those professionals conducting the assessment should meet the professional registration, education, training and experience outlined in Section 6 of EGBC's *Guidelines*.

Many local governments have more prescriptive guidelines within their DPA. The City should consider the following guidelines.

a. Development should minimize any alterations to steep slopes.

b. Terracing of land should be avoided or minimized and landscaping should follow the natural contours of the land.

c. Buildings, structures, and landscaping should be located as far as reasonably possible from steep slopes and wet areas at the base of slopes.

d. Potential slope hazard areas should remain free of development. Where this is not possible:

- mitigation should be undertaken to reduce risk to an acceptable level for both the subject property and any adjacent or nearby lands; and
- conditions should be imposed as necessary to reduce potential hazards to

acceptable levels,

both as determined by a *Qualified Professional*.

e. Structures, driveways, utilities, drainage facilities (including rock pits), septic fields, swimming pools, hot tubs or ponds should be set back a minimum of 10 m from the top or base of any steep slope, except as otherwise recommended by a *Qualified Professional*. Greater setback may be needed for very steep slopes.

f. No fill, including garden waste, lawn clippings, excavated material, or household refuse, should be placed on the slope, within 10 m of the top of slopes or along pre-existing drainage channels.

g. The base of slopes should not be undercut for building, landscaping or other purposes except in accordance with the recommendations of a *Qualified Professional*.

h. Designs should avoid the need for retaining walls. Where retaining walls are necessary, shorter tiered walls are preferable to a single high wall. Any retaining structures within the DPA must be designed by a *Qualified Professional.*

i. Any slope stabilization measures must be designed by a *Qualified Professional.*

j. Vegetation should be maintained on the slopes and within any buffer zone above the slopes. Where vegetation is disturbed within the DPA, it must be reinstated.

k. Where vegetation is cut, the cut vegetation should be removed from the slope at the time of cutting. However, natural coarse woody debris should be retained on natural slopes. Natural coarse woody debris includes the logs that existed on the forest floor prior to cutting. Their decomposition provides nutrients to plants, habitat for wildlife, and food for insects and other microorganisms.

l. Disturbed slopes should be revegetated, especially where gullied or where bare soil is exposed. Planting should be done in accordance with the recommendations of a Landscape Architect or Registered Professional Forester.

m. On natural slopes, native species, including trees, shrubs and other plants, should be maintained and used for any new planting.

n. Surface water, including roof drains and surface drains, should be diverted away from slopes in a controlled manner, and ponding should be avoided within 10 m of the slope crest.

6. SLOPE HAZARD REPORT

All reports should meet EGBC's "*Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*". Section 3.7 of these *Guidelines* outlines the general content of such reports. Some local governments expand on the report requirements to ensure they receive the information needed to evaluate the application. The following report requirements should be considered by the City and can either be written directly into the Hazard DPA guidelines or in a separate, stand-alone document.

a. The assessment must be conducted in accordance with EGBC's "*Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*", and the report include the items listed in Section 3.7 of the *Guidelines*.

b. The assessment and report should address the potential for landslips, rockfalls, slope failures, debris slides, debris flows, and any other relevant geohazard, and should consider any such geohazards that could affect the proposed development regardless of whether the geohazard originates on or beyond the development property boundaries.

c. The report should clearly describe the site topography, geology, hydrology, hydrogeology, and other relevant terrain conditions.

d. The report should describe any past slope failures or hazard events on the development property and on the adjacent slopes, and the types of slope hazards within the general vicinity of the development property.

e. The report should include a detailed plan(s) showing the existing ground topography, the proposed development (i.e. final grades, structures, driveways, roads, site clearing, stormwater detention areas, retaining walls, etc.), natural features, surface hydrology, and clearly delineate the location(s) of any potential hazard areas. All plans must be scaled and dated.

f. The report should identify the potential impacts of the proposed development on the slope hazards both on the development property and beyond the property boundaries.

g. The report should clearly describe any hazard or risk mitigation measures recommended, and show such measures on a detailed site plan, including building setback lines, covenant areas, retention or deflection structures, etc.

h. The report should describe long-term maintenance of any development or mitigative works proposed on the site, as well an estimate of the costs for all recommended and essential measures.

i. The report should clearly describe the assumptions, methodology, and rationale used in the hazard or risk analysis, and the potential magnitude, frequency, and runout of any potential hazard events.

j. The assessment should describe any climate data and modeling used in the assessment, and should consider the potential impacts of climate change, including sea level rise.

k. The report must state if proposed mitigative works could transfer risk to other properties and, if so, broaden the assessment to include the entire area that could be affected by the mitigative works.

l. The report must provide a professional opinion, subject to conditions and qualifications contained in the report, that the land may be safely used for the purpose intended and meets provincial guidelines (where applicable).

m. The report must include the completed "Landslide Assessment Assurance Statement," available in Appendix D of EGBC's *Guidelines*.

The City may choose to add a time limit to the Slope Hazard Report, requiring that the report be completed within a specific time period prior to the development permit application.

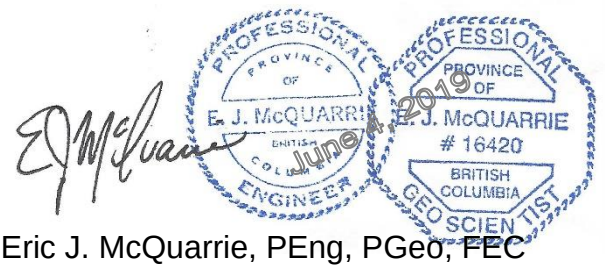
7. PROFESSIONAL QUALIFICATIONS

Slope hazard reports differ significantly from conventional geotechnical engineering reports, and so do the qualifications of the *Qualified Professional* conducting the assessment. The City should require that:

> The *Qualified Professional* or team of professionals conducting the Slope Hazard Assessment must meet the professional registration, education, training, and experience outlined in Section 6 of EGBC's *Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*.

8. CLOSING

I trust this report will assist the City with amendments to the Hazard Conditions DPA. Please contact me if you have any questions or can be of further assistance.



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