



July 25, 2017

Reference No.: VAN-00241231-A0

Ms. Marianne Wade, BA MCIP RRP  
**City of Campbell River**  
301 St. Ann's Road  
Campbell River, BC  
V9W 4C7

Email: marianne.wade@campbellriver.ca

**RE: Third Party Geotechnical Review  
Proposed 6-level Residential Development  
1430 Island Highway South (Hwy. 19A), Campbell River BC**

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Dear Ms. Wade,

## 1.0 INTRODUCTION

In accordance with your recent authorization, **exp** Services Inc. (**exp**) has prepared this letter for the above-referenced project. The purposes of this letter were to:

- A. Summarize the visual observations made during a recent site reconnaissance completed by the author of this letter;
- B. Complete a technical review of the geotechnical report submitted with the *Development Permit Application* that was prepared by Terran Geotechnical Consultants Ltd. (TerranGeo);
- C. Compare the findings of the report to the relevant and widely accepted geotechnical standards, such as the *APEGBC Guidelines for Legislated Landslide Assessments for Residential Development in BC*; and,
- D. Provide a geotechnical engineering opinion with respect to the proposed development and the geotechnical challenges of the site.

This letter does not address item (D) above, which will be provided upon review of the responses to the requested clarification points discussed in this letter.

Review and use of this letter should be completed in accordance with the attached *Interpretation and Use of Study and Report* document. This document outlines the intended use and interpretation of this letter. It is included as an integral part of this letter and should be read in conjunction with all parts of this letter. This letter does not address any environmental issues related to the proposed project.

It is important to note that the scope of services discussed in this letter are strictly limited to review of the geotechnical aspects of the identified items only and that detailed engineering analysis, calculations, or detailed studies, have not been carried out by **exp** as part of this review.

## 2.0 METHODOLOGY AND SOURCES OF INFORMATION

A site reconnaissance was completed by the author of this letter on July 14<sup>th</sup>, 2017. The site reconnaissance included walking the toe of the slope, part of the slope near the north end of the site, and the crest of the slope bounding the project site and residence located at 1411 Galerno Road. Visual observations were made that were of geotechnical engineering significance. The sources of information reviewed as part of this study include, but are not limited to:

- Meetings with City staff and McElhanney Consulting Services Ltd. on July 14<sup>th</sup>, 2017;
- Discussion with the property owner at 1411 Galerno Road on July 14<sup>th</sup>, 2017;
- Telephone conversations with the *Geotechnical Engineer-of-record* and City staff;
- The drawing set titled *Proposed Residential Building -DP Application* prepared by JM Architecture Inc. dated June 9, 2017;
- The drawing set titled *Proposed Slope Improvement – 1430 South Island Highway* prepared by Terran Geotechnical Consultants Ltd. (TerranGeo) dated June 7<sup>th</sup>, 2017;
- The geotechnical report titled *Geotechnical Investigation & Report – Proposed Residential Building [at] 1430 South Island Hwy – 19A* prepared by TerranGeo dated April 27, 2017;
- Bulletin 65 *Surficial Geology and Sand and Gravel Deposits of Sunshine Coast, Powell River, and Campbell River Areas* prepared by the Ministry of Mines and Petroleum Resources of the Province of British Columbia dated 1977;
- Surficial Geology Map 49-1959 titled *Oyster River – Comox, Nanaimo, and Sayward Districts* prepared by the Geological Survey of Canada dated 1960;
- City of Campbell River's Official Community Plan, specifically as it relates to the *Hazard Conditions Development Permit Area*;
- APEGBC *Guidelines for Legislated Landslide Assessments for Residential Development in BC* (APEGBC Guideline); and,
- The District of North Vancouver's *Natural Hazards Risk Tolerance Criteria*.

### 3.0 UNDERSTANDING OF THE PROJECT

#### 3.1 Proposed Development

It is exp's understanding that it is proposed to construct a 97-unit 6-level residential building, where the first level is comprised of a lobby and covered parking area. The proposed building has a plan dimension of about 114 (north-south direction) by 18m (east-west direction) and is proposed to be located at the toe of the existing slope; however, the southwest corner of the proposed building will need to be cut partially into the toe of the slope. The eastern part of the lot will consist of landscaping and an open parking area.

The property is bounded by a developed multi-unit residential property to the north; South Island Highway to the east with a frontage of about 121m along the highway, and developed single-family residential properties to the west and south.

#### 3.2 Site Conditions

In general, the eastern half of the property is flat. The western half of the property is steeply sloped. The toe of the slope is located at about an average horizontal distance of 50m from the east property boundary. The crest of the slope is located at a horizontal distance ranging from about 10 to 14m to the east of the western property boundary; however, a short segment of the crest of the slope is located beyond the property boundary and on the property at 1411 Galerno Road.

According to local topographical information of the site, the crest of the slope is located at an average elevation between about 27 to 28m geodetic. The slope is steeply inclined at an average inclination of about 1.5H:1V (Horizontal:Vertical). However, over-steepened sections of the slope are noted at the crest and toe of the slope. At the crest of the slope, the ground surface is typically very steep to near-vertical above an elevation of about 16 to 20m geodetic. Sections of the toe of the slope are also very steep to near-vertical and generally noted to occur below an elevation of about 6 to 8m geodetic. Several shallow, but well-defined channels, have been eroded along the face of the slope.

Several trees were noted to be 'tilted' or 'pistol-butted'. In addition, along over-steepened sections of the slope, some raveling and erosion of the soil at the ground surface was noted. A slide-scar that extended from the crest to the toe of the slope was clearly evident at the northern portion of the slope.

According to published surficial geological maps of the area, the general soil profile at the site consists of a thin veneer, typically less than about 1.5m thick, of marine and glacio-marine deposits of stony, gravelly, and sandy soil. This unit is typically underlain by Vashon Drift sediments that consist of sands, gravels, silts, and tills. Pre-vashon Drift sediments occur beneath this unit. As described by others, a stony marine clay is noted to occur near the base of the Yaculta Bank north of the project site. This unit typically strikes to the west and dips about 25 degrees downwards to the north and is overlain by flat-bedded and compact sand and gravel. Shore, deltaic, and fluvial sediments are expected to occur along the flat-lying area near the Natural Boundary of the sea. Soils exposed along the face of the slope appeared to be consistent with the published surficial geology maps of the area.

Flowing water was noted along the face of the lower slope in several areas. It appears that the water is originating from naturally occurring springs that day-light onto the face of the slope at an elevation of about 15m geodetic; however, the elevation could not be confirmed by **exp** due to these areas being inaccessible at the time of the site visit.

The slope was covered by a dense cover of brush and a mixture of small-sized deciduous trees.

### 3.3 Landslide History

It is **exp's** understanding that there is a history of land-sliding on the subject property. This includes a slide that occurred around 1998 at the northern end of the property, as evident by the slide-scar along the face of the slope). Photographic documentation provided by the property owner at 1411 Galerno Road was reviewed by **exp**. Photographs indicate that a significant volume of saturated debris (mud) traveled down the slope and struck the existing hotel at the base of the slope. Mud and debris was deposited in the parking area between the hotel and toe of slope. The top of the 'mud-line' as shown in the photographs is noted to have reached the second level of the building. Significant damage to the hotel was reported. It is **exp's** understanding that this landslide occurred rapidly. Previous land-sliding on the property is also suspected based on the features along the face of the slope and historical aerial imagery.

There were no geotechnical studies or reports related to these events that were available to the author at the time this letter was written.

### 4.0 REVIEW COMMENTS

A technical geotechnical review was completed on the following documents prepared by TerranGeo:

- The drawing set titled *Proposed Slope Improvement – 1430 South Island Highway* prepared by Terran Geotechnical Consultants Ltd. (TerranGeo) dated June 7<sup>th</sup>, 2017; and,
- The geotechnical report titled *Geotechnical Investigation & Report – Proposed Residential Building [at] 1430 South Island Hwy – 19A* prepared by TerranGeo dated April 27, 2017.

The two documents were reviewed and compared to both the APEGBC *Guidelines for Legislated Landslide Assessments for Residential Development in BC* and District of North Vancouver's (District) *Natural Hazards Risk Tolerance Criteria*. Both of which are considered to be relevant and widely accepted guidelines for geotechnical engineering practice as it relates to landslide hazards and evaluations.

The following comments are provided that outline areas where further clarification and information be provided to **exp** for review and comment:

- **Clarification Request No. 1**

According to the geological maps of the area, the anticipated geological sequence consists of a thin veneer of Marine and Glacio-marine Deposits (typically up to about 1.5m thick), underlain by thicker zones of Vashon Drift sediments, underlain by Pre-Vashon Drift sediments. It is noted that the geotechnical evaluation relies on testhole information obtained at the base of the slope and near-surface (shallow) testhole information along the face of the slope.

The sections produced by the slope stability analysis appear to utilize geotechnical strength properties developed from the testhole information obtained at the base of the slope (Pre-Vashon Drift sediments). Further clarification on how the soil profile and associated parameters were developed and used in the analysis should be provided.

Exp could not visually verify the stratigraphy of the slope in detail due to the dense vegetation cover at the time of exp's site reconnaissance which obscured the face of the slope.

- **Clarification Request No. 2**

The slope failure mechanism(s) identified in the report are described to be 'translational' near the toe of the slope and 'progress into the upper rotational slide at the top of the slope'. The report further discusses potential landslide 'runout' distances and reports on landslide debris velocities.

Based on photographic information and TerranGeo's discussion on runout distances and landslide velocities, it appears that landslide debris has the potential to very rapidly move down the slope and behave more like a mud-flow. Comments and recommendations to characterize this type of landslide and/or measures to mitigate a mud-flow are not discussed in the geotechnical report.

Further clarification and discussion on the potential slope failure mechanisms should be provided and include relevant comments and recommendations to mitigate these other potential failure mechanisms.

- **Clarification Request No. 3**

The analysis discussed in the report has been compared to the District's *Natural Hazard Risk Tolerance Criteria*. The criteria states for new developments, that *Factors of Safety* against land-sliding under static and seismic conditions should be at least 1.5 and 1.0 (or where predicted ground displacements are less than 0.15m for a 1 in 2,475-year earthquake), respectively.

The slope stability analysis indicates a *Factor of Safety* of about 1.4 to 1.5 and less than 1.0 for static and seismic conditions, respectively, for a mitigated slope. Further clarification is required as it appears that the proposed mitigation measures for the current building design and layout/location do not meet the criteria set out by the District.

- **Clarification Request No. 4**

Also, the District's criteria states for new developments, that a maximum 1 in 100,000 risk of fatality per year should be achieved for naturally occurring hazards, such as landslides. Based on methodology presented by the District for a partial risk analysis, it appears that the proposed building is located within a zone defined as having a *Moderate* to *High* likelihood of landslide debris impacting the 'element at risk' (i.e. proposed building). The runout distances calculated by TerranGeo are significantly less than those suggested by the District's partial risk analysis methodology. Further clarification on how the runout distances were calculated should be provided. Discussion on how a reduced runout distance was deemed appropriate should also be provided.

Details related to foundation design of the building have not been reviewed at this stage since the governing geotechnical challenges associated with this site at the Development Permit stage are related to Landslide and slope stability. **Exp** will provide additional comments related to the building foundation during the final stages of the review process since they are more related to the Building Permit Application.

## 5.0 CLOSURE

The comments and recommendations presented in this letter are based on the referenced information and **exp's** understanding of the project as described herein. If subsurface conditions or project parameters differ from those described in this report, **exp** should be notified promptly in order to review the geotechnical aspects of the project and modify them if necessary.

This letter has been prepared for the exclusive use of *City of Campbell River* and/or their designated consultants or agents. Any use of the materials contained in this letter for other than its intended purpose or by any other party must first be verified in writing by **exp Services Inc.** **Exp** does not accept any responsibility or damages as a result of any other party relying on or using the information and recommendations contained in this letter.

**Exp** trusts that this meets your current requirements. Should you have any concerns or questions, please do not hesitate to contact the undersigned.

Sincerely,

exp Services Inc.

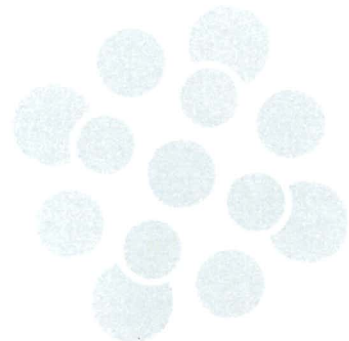
  
July 25, 2017  
Matthew Yip, P.Eng., M.Eng.  
Project Manager | Geotechnical Engineer

Reviewed by:



Yoshi Tanaka, P.Eng.  
Geotechnical Engineer

Enclosed: Interpretation and Use of Study and Report





## INTERPRETATION & USE OF STUDY AND REPORT

### 1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering consulting practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental consulting unless specifically stated in the engineering report.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF THE REPORT

The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

### 5. INTERPRETATION OF THE REPORT

- a. Nature and Exactness of Descriptions: Classification and identification of soils, rocks, geological units, contaminant materials, building envelope assessments, and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations, or building envelope descriptions, utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b. Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.
- c. To avoid misunderstandings, **exp Services Inc. (exp)** should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings, and specifications relative to engineering issues pertaining to consulting services provided by **exp**. Further, **exp** should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with **exp's** recommendations. Any reduction from the level of services normally recommended will result in **exp** providing qualified opinions regarding adequacy of the work.

### 6.0 ALTERNATE REPORT FORMAT

When **exp** submits both electronic file and hard copies of reports, drawings and other documents and deliverables (**exp's** instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by **exp** shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by **exp** shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of **exp's** instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except **exp**. The Client warrants that **exp's** instruments of professional service will be used only and exactly as submitted by **exp**.

The Client recognizes and agrees that electronic files submitted by **exp** have been prepared and submitted using specific software and hardware systems. **Exp** makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.