



ALBERNI-CLAYOQUOT REGIONAL DISTRICT

3008 Fifth Avenue, Port Alberni BC, CANADA V9Y 2E3

Telephone (250) 720-2700 Fax (250) 723-1327

November 16, 2020

BAMFIELD ADVISORY PLANNING COMMISSION

Please find enclosed the following application for your review and consideration:

- DVA20006 – 422 Burlo Island (Dombi-Sahi)

Please review this application so that your Director can submit your recommendations to the Regional Board on Wednesday, November 25th, 2020.

Your next meeting is scheduled for **Thursday, November 19th at 5:30 pm** using Zoom Video Conferencing. Refer to the email for details and Zoom invitation.

Sincerely,

Alex Dyer
Planner

Enclosures

Cc Applicants



ALBERNI-CLAYOQUOT REGIONAL DISTRICT

3008 Fifth Avenue, Port Alberni, BC, CANADA V9Y 2E3 Telephone (250) 720-2700 Fax (250) 723-1327

DEVELOPMENT VARIANCE APPLICATION

MEETING DATE: November 25, 2020

ACRD FILE NO.: DVA20006

APPLICANTS: Ildiko & Juliu Dombi-Sahi

LEGAL

DESCRIPTION: LOT 1 SECTION 19 TOWNSHIP 1 BARCLAY DISTRICT PLAN VIP68113

LOCATION: 422 Burlo Island, Bamfield

ELECTORAL AREA: "A" (Bamfield)

APPLICANT'S INTENTION: The applicants have applied for a development variance permit for a property in the Bamfield Cottage Residential (BRC) District to reduce the required front yard setback from 40 feet to 24.6 feet and the western side yard from 15 feet to 12.5 feet to accommodate the construction of a single family dwelling.

Recommendation:

THAT the Board of Directors consider issuing development variance permit DVA20006, subject to:

- Confirmation from the Province of BC that the conditions in Restrictive Covenant ET78675 have been satisfied.
- Substantive restoration and planting of the cleared portions of the development permit area, as outlined in the biologist's report, be undertaken prior to the Board making a final decision on this variance.
- Neighbouring properties being notified as per Local Government Act s.499.

Development Variance DVA20006:

- i. Development variance of Section 200 – Schedule No. II – Bulk and Site Regulations of the ACRD Zoning Bylaw to reduce the required front yard setback from 40 feet to 24.6 feet and the western side yard from 15 feet to 12.5 feet for a property in the Bamfield Cottage Residential (BRC) District to accommodate the construction of a single family dwelling.

Procedure: Prior to the issuance of a development variance permit, the Board must first pass a resolution to consider issuing the permit. Staff then notify neighbouring property owners and

DVA20006

tenants to afford them the opportunity to make written or verbal submissions to the Board. At a subsequent meeting, the Board can either issue or deny the development variance permit.

Observations:

- i. **Status of Property:** The +/-0.5 acre property is located on the northernmost tip of Burlo Island in the Bamfield Inlet. The parcel does not include any improvements. Vegetation along the shoreline and within the proposed building footprint has been cleared, but remains along the perimeter of the lot. The irregular lot consists of a lower lying region in the northern half and a much steeper remaining southern portion, with a change in elevation ranging from 11m-12m. The parcel is surrounded by the Bamfield Inlet to the north and east, an existing single family dwelling on the property to the west, and undeveloped residential property to the south.
- ii. **Services**
 - a. **Sewage Disposal:** On-site sewage disposal.
 - b. **Water Supply:** Bamfield Water System. Connection to the water system will require an extension of the water main from the west side of Bamfield Inlet.
 - c. **Fire Protection:** Bamfield Volunteer Fire Department.
 - d. **Access:** Water access only. The applicants have been asked to provide details of a parking and accessibility plan to gain access to the property.
- i. **Existing Planning Policies Affecting the Site**
 - a. **Agricultural Land Reserve:** Not within the Agricultural Land Reserve.
 - b. **Official Community Plan:** The Bamfield Official Community Plan designates the property as "Residential Use".

The property is within DPA I – Riparian Areas Protection, DPA II – Natural Hazard Areas Protection, and DPA IV – Coastal Protection.

DPA I – Riparian Area Protection and DPA IV – Coastal Protection

The applicant engaged DR Clough Consulting as a Qualified Environmental Professional to prepare an Environmental Assessment Report for the proposed development. The report, dated September 4, 2020, provides recommendations for landscaping, best practices for construction, and satisfies the guidelines for DPA I – Riparian Area Protection and DPA IV – Coastal Protection.

DPA II – Natural Hazard Areas Protection

The applicants engaged Lewkowich Engineering Associates Ltd. (LEA) as a Qualified Environmental Professional to prepare a report to assess geotechnical hazards including coastal flooding and steep slopes.

The report, dated September 14, 2020, provides:

- A coastal Flood Construction Level (FCL) of 5.39m geodetic elevation, based

DVA20006

on a combined method of High High Water Large Tide (HHWLT), Sea Level Rise (SLR), Regional Adjustment (RA), Storm Surge (SS), Wave Effect (WE), and Free Board (FB); and

- A development setback of 7.5m (24.6 ft.) from the Present Natural Boundary (PNB) of the property frontage.

The LEA Ltd. report satisfies the guidelines of DPA II – Natural Hazard Areas Protection provided the discussion and recommendations listed in the report are followed.

The proposed variance complies with the goals and policies of the Bamfield Official Community Plan, provided that the recommendations in the environmental reports are followed.

- c. **Zoning:** The property was rezoned in 2001 from Acreage Residential (RA2) District to Bamfield Cottage Residential (BRC) District. Permitted uses include one single family dwelling and one cottage with limitations in floor area and building setbacks.

The applicants' proposal to construct a single family dwelling complies with the permitted uses in the BRC District. However, the irregular parcel shape, setbacks, DPA requirements, variable and steep topography, and proximity to Bamfield Inlet significantly restrict the buildable area. As such, the applicants have applied for a Development Variance to site the proposed dwelling.

Development requirements in the BRC District

	Required	Proposed
Minimum Setbacks		
Front:	40 ft.	24.6 ft.
Rear:	30 ft.	-
Side:	15 ft.	12.5 ft.
Lot Coverage:	30%	-
Building Height:	35 ft.	-

Setback requirements for front yards, rear yards, and side yards are defined based on lot orientation. The subject property is triangular and the setback requirements apply as follows: front yard is defined as the property line meeting the Bamfield Inlet, the western and southern property lines are defined as side yards, and there is no rear yard or associated rear yard setback for this parcel.

LEA's proposed safe development setback of 7.5m (24.6 ft.) from the Present Natural Boundary (PNB) of the property frontage supports this application for a front yard variance.

The applicants are applying for a development variance to reduce the required front yard setback from 40 feet to 24.6 feet and the western side yard from 15 feet to 12.5 feet for a property in the Bamfield Cottage Residential (BRC) District to accommodate

DVA20006

the construction of a single family dwelling.**Comments:**

A 2002 covenant registered to the property title, ET78675, between the owner and the former BC Ministry of Environment, Lands and Parks requires that no building intended for human habitation be constructed within 15 m (49.2 ft.) of the natural boundary of Bamfield Inlet. The covenant further requires that the underside of the floor must be greater than 4m (13.1 ft.) above the natural boundary for a main residence or 3m (9.8 ft.) above the natural boundary for an occasional use building. However, a lesser setback or elevation may be determined by a professional engineer. The LEA report satisfies this requirement. As a condition of approval of this development variance, the Regional District will require confirmation from the Province that the conditions in the restrictive covenant have been satisfied.

The property is water access only. The applicants intend to construct a dock to meet their access requirements. A FrontCounter BC application has been submitted to determine if the dock requires Specific Permissions for siting.

The applicants have applied for a development variance permit to allow for a building envelope on the property. The variance would reduce the required front yard setback from 40 feet to 24.6 feet and the side yard from 15 feet to 12.5 feet to accommodate the construction of a single family dwelling. LEA's proposed safe development setback of 7.5m (24.6 ft.) from the Present Natural Boundary of the property frontage supports this application for a front yard variance.

Staff recommend that the Board of Directors consider issuing development variance permit DVA20006 to initiate the neighbour notification process and gather input from the community. Staff support for considering the variance is subject to the Province confirming that the flood setback wording in the existing restrictive covenant has been satisfied and that substantive restoration work and replanting takes place within the previously disturbed riparian area prior to final consideration of the variance.

Submitted by:



 Alex Dyer, MCIP, RPP, Planner

Reviewed by:



 Mike Irg, MCIP, RPP, General Manager of Planning & Development

Approved by:



 Douglas Holmes, BBA, CPA, CA, Chief Administrative Officer
DVA20006



ALBERNI-CLAYOQUOT REGIONAL DISTRICT

3008 Fifth Avenue, Port Alberni, BC V9Y 2E3

Phone: (250) 720-2700 Fax: (250) 723-1327

APPLICATION FOR DEVELOPMENT

- | | |
|--|--|
| <input type="checkbox"/> Official Community Plan Amendment | <input type="checkbox"/> Minimum Parcel Frontage Waiver |
| <input type="checkbox"/> Zoning Map Amendment | <input type="checkbox"/> Board of Variance Application |
| <input type="checkbox"/> Zoning Text Amendment | <input type="checkbox"/> Temporary Commercial Use Permit |
| <input checked="" type="checkbox"/> Development Permit | <input type="checkbox"/> Temporary Industrial Use Permit |
| <input checked="" type="checkbox"/> Development Variance | <input type="checkbox"/> Other: _____ |

Applicant/Property Owner Information	Agent Information (if applicable)
Name: Juliu & Ildiko DOMBI-SAHI	Name: N/A
Mailing Address: 13127 66A AVE, Surrey, B.C., V3W 7S3	Mailing Address:
Telephone: 604-501-1424	Telephone:
Fax:	Fax:
Cell: 604-340-3981 or 604-340-9125	Cell:
Email: kodi_yak@hotmail.com	Email:

• Legal Description: LOT 1 SECTION 19 TOWNSHIP 1 BARCLAY DISTRICT PLAN VIP68113; Civic address 422 Burlo Island

• Particulars of Proposed Development:

- Existing OCP Designation: Residential Use
- Proposed OCP Designation: N/A
- Text Amendment: N/A
- Existing Zone: Bamfield Cottage Residential (BCR)
- Proposed Zone: N/A
- Within the Agricultural Land Reserve (ALR)?: No Yes
- Within a Development Permit Area?: No Yes
- Method of Sewage Disposal: Community System Onsite Septic System Other
- Method of Water Supply: Community System Onsite Water System Other

• Other (explain): N/A

• Describe the existing land use of the subject property: Vacant, water access only, residential lot.

- Describe the existing land use of lands adjacent to the subject property:

North: Bamfield Inlet

South: Vacant, residential land

East: Bamfield Inlet

West: Water access only residential use

- Describe the proposed development of the subject property (attach additional pages if necessary):

Construction of a cottage, location as per attached survey drawing by SIMS survey

- Reasons and comments in support of the application (attach additional pages if necessary):

See attached Survey drawings, Biologist and Geo-tech report

- The following information is required. Failure to provide any of the following may delay the application.
A sketch/plan of the subject property showing:

- the legal boundaries and dimensions of the subject property;
- boundaries, dimensions, and area of any proposed lot (if subdivision is being proposed);
- the location of permanent building and structures on the subject property with distances to property lines;
- the location of any proposed building, structures, or additions hereto, with distances to property lines;
- the location of any existing sewage disposal systems and/or property water source; and
- topographic features (rock outcroppings, etc.).

- Additional or more detailed information may be requested by the Regional District following review or your application.

If the Regional District believes it to be necessary for the property boundaries and the location of buildings and structures to be more accurately defined, a plan prepared by a registered BC Land Surveyor may be required.

I accept responsibility for delays in processing caused by incorrect or insufficient submission. Personal information contained on this form is collected under the *Local Government Act*. Contact the Planning Department if you have any further questions.

I hereby grant Regional District staff full right of access to the subject property, during the hours of 8:00 am until 4:30 pm, Monday to Friday, except statutory holidays, while this application is in effect; and

I/We hereby declare that the information provided in this application is, to the best of my/our knowledge, true and correct in all respects, and I/we enclose the required fee with this application.

NOTE: All items submitted as part of the application will not be returned to the applicant and are subject to the *Freedom of Information and Privacy Act*. All relevant correspondence will be provided to both the applicant and the agent when applicable.

Applicant/Owner Signature: _____

Applicant/Owner Signature: _____

Date: 21 Sept. 2020

Environmental Assessment,
422 Burlo Island
Alberni Clayoquot Regional District

Prepared For:

Julian & Ildiko Dombi

September 4, 2020

By

D. R. Clough Consulting
Fisheries Resource Consultants
6966 Leland Road Lantzville B.C. V0R 2H0
Ph/fax: 1-250-390-2901, email: drclough@shaw.ca

Table of Contents

Table of Contents	2
1.) General Project Description	3
Figure 1: Burlo Island Location	3
Figure 2: Burlo Island Survey Site	4
2.0) Project Objectives	4
3.0) Methods	4
4.0) Results	5
4.1) Ecological Setting	5
Figure 3: Ecological Area; Coastal Western Hemlock, CWH vh1	5
4.2) Vegetation Communities	5
Figure 4: Eel grass map of Burlo Island and surrounding area	6
Figure 5: Foreshore looking southwest along point	7
Figure 6: Looking south at bay and cleared area	8
4.3) Wildlife	8
4.3.1) Amphibians and Reptiles	8
4.3.2) Birds	8
5.0) Rare and Endangered Species	8
5.1) Endangered Species	8
5.2) Ecological Communities	9
6.0) Development Effects Assessment	9
6.1) Vegetation	9
Table 2) Anticipated impacts on local vegetation	9
6.2) Aquatics Resources	9
Table 3) Anticipated impacts on aquatic resources	9
6.3) Wildlife	9
Table 1) Anticipated impacts on local wildlife and habitat	10
7.) Residual Effects	10
8.) Cumulative Effects	10
9.0) Applicable Legislation	10
9.1) Provincial Legislation	10
9.2) Federal Legislation	10
10.) Discussion	10
References:	11
Appendix 1: SARA Species Potentially Occurring within CWH Biogeoclimatic Zone	12
Appendix 2: Rare and Endangered Ecosystems Potentially Occurring within the CWHvh1 Biogeoclimatic Zone and South Island Forestry District	13
Appendix 3: Site Plan	14

1.) General Project Description

The purpose of this report is to review the environmental aspects on the development property. Robert Aston, Project Manager on behalf of the property owners, asked us to provide this report. The project is to build a cabin on the property.

Location: Burlo Island is located within Bamfield Inlet. Lot 1 is on the northeast side of the Island looking at the Bamfield government dock.

Legal Description:

Owners:

Julian & Ildiko Dombi
Home: (604) 501-1424

Legal:

Lot 1, Section 19, Township 1, Barclay District, Plan VIP68113
Civic: 422 Burlo Island Bamfield, B.C.
PID: 024330485

Figure 1: Burlo Island Location

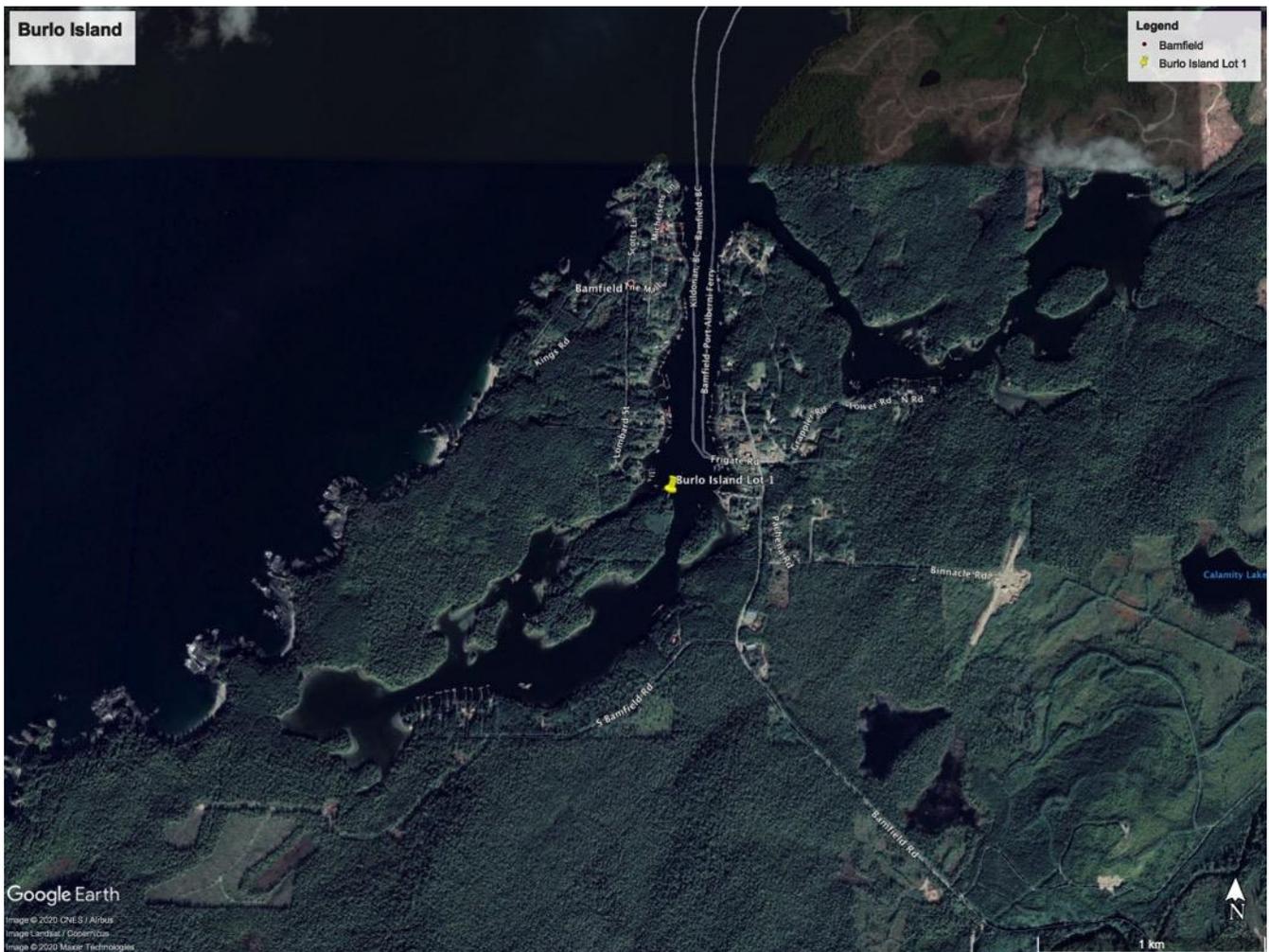


Figure 2: Burlo Island Survey Site



2.0) Project Objectives

The purpose of this document is to provide an environmental assessment and determine compliance of the building plan within the Development Permit Area:

1. Assessment of the aquatic and terrestrial resources within the property area;
2. Determine the potential impacts of the proposed structures;
3. Review potential mitigative measures to avoid causing negative impacts caused from the proposed work.

3.0) Methods

The methodology for this assessment included:

1. An assessment of potential environmental impacts;
2. Review of development plans and measures to protect the environment
3. Preparation of a mitigation plan (if required);

The method and presentation of this assessment follows the *Canadian Environmental Assessment Act* (CEAA) guidelines that follow federal standards for review of environmental attributes. This assessment focused primarily on the aquatic resources of the foreshore directly in the vicinity of the proposed work area as these were the identified environmental resources most likely to be impacted.

The report was prepared using the following references to describe the environmental resources and to identify any potential environmental issues within the work area.

1. Committee on the Status of Endangered Wildlife in Canada (COSEWIC) database reports. (www.cosewic.gc.ca)
2. BC Ecosystem Explorer. Database reports. (<http://www.env.gov.bc.ca/atrisk/toolintro.html>)

A site inspection was conducted on July 24, 2020 by Brad Remillard, RPBio. Results are below.

4.0) Results

The site assessment results are presented below. It describes the environmental setting and the results of the review of information on rare and endangered communities, plants or wildlife. The second part of the report describes the site inspection and local features.

4.1) Ecological Setting

The Burlo Island ecological setting is representative of the Coastal Western Hemlock (CWH) biogeoclimatic zone¹. The CWH zone occurs at low to middle elevations along the west coast of Vancouver Island. The CWH is the dominant biogeoclimatic zone on western Vancouver Island. The Bamfield area is in the CWHvh1 variant of “very wet hypermaritime, southern”.

Figure 3: Ecological Area; Coastal Western Hemlock, CWH vh1.



4.2) Vegetation Communities

Vegetation communities within the proposed work site were grouped into one of the two types:

1. Marine foreshore
2. Coastal rain forest

Marine Foreshore:

The northeast facing foreshore features primarily gravels and fines with some cobbles. The foreshore is a moderate gradient gradual slope that has been disturbed. During the survey, very limited vegetation

¹ <https://www.for.gov.bc.ca/hre/becweb/resources/maps/DistrictScaleMaps.html>

was observed, there was no vegetation in the small bay. There was some Rockweed (*Fucus distichus*) and Acorn Barnacles (*Balanus glandula*) on the bedrock points on either side of the bay. The bedrock and rockweed continues along the northwest side of the island past the existing dock. There was eel grass observed during the survey and mapped just out from the shore of the northern end of Burlo island (See Fig 4).

Figure 4: Eel grass map of Burlo Island and surrounding area



Figure 5: Foreshore looking southwest along point.



Coastal Rain Forest:

The CWH forest site had an overstory of mature Western Hemlock (*Tsuga heterophylla*), Western Red Cedar (*Thuja plicata*), and younger Red Alders (*Alnus rubra*). The brush and understory is composed of Salal (*Gaultheria shallon*), Pacific Crabapple (*Malus fusca*) and Sword Ferns (*Polystichum munitum*).

The building area has previously been cleared within the DP area. The site is partially cleared as seen in Figure 6 below.

Drainages: There are no drainages or fresh water features within the property.

Figure 6: Looking south at bay and cleared area.



4.3) Wildlife

There was no observed sign of large mammals on the island during the site inspection of the property. There may be occasional visits due to the short distance to Bamfield and the channel between the two dries during low tide. There may be occasional visits by the most common local species; Black Bear (*Ursus americanus*), and Black Tail Deer (*Odocoileus hemionus*). Local residents mentioned no observations. There were no dens on the property due to the lack of habitat.

4.3.1) Amphibians and Reptiles

The island habitat limits the possibility of species. None were observed during the visit none were expected. The island has no freshwater lakes or no wetlands. It is suspected they did not frequent this area before clearing due to the lack of fresh water sources.

4.3.2) Birds

Bald Eagle, Great Blue Heron and various Gull species were observed on the boat ride to the site. Purple Martin, House Sparrow, Brown-headed Cowbird and Cliff Swallow are all observed locally on the website Ebird from a station in Bamfield approximately 650m away from the lot. The birds may use the adjacent forest as perching and nesting habitat. Lot 1 had been recently cleared of a stand of second growth trees. The adjacent forest had no observed stick (raptors and herons) nests. No further clearing is expected.

5.0) Rare and Endangered Species

5.1) Endangered Species

According to the Conservation Data Center (CDC) resources, there are 69 SARA species listed (Appendix 1) which are potentially present within the property. This list of plants and animals is area

based to the west coast. Among the list there are 27 bird species, 6 mammals, a bivalve and 8 insects. On the development property the incidence potential is much less due to specific limited and altered habitat of the small site. Some of the listed nearby incidences include Western Screech Owl, Marbled Murrelet and Dromedary Jumping Slug. None were observed during the site visit and given the limited habitat none expected on terrestrial habitat.

5.2) Ecological Communities

According to the Conservation Data Center (CDC) resources, there are 24 potential communities of concern within the large scale of CWHvh1 Biogeoclimatic Zone and the ACRD (Appendix 2), none of which are SARA listed.

6.0) Development Effects Assessment

The proposed building was designed by Linwood Custom Homes. The construction diagram shows the building to be in the back southwest corner of the lot with the sewage system located directly east from the building. The present natural boundary (PNB) is shown in the Appendix 3 along the green line. The proposed works are above the

6.1) Vegetation

There has been complete removal of trees along the shoreline and building area. There is still trees and vegetation around the perimeter of the lot as well as the north outcropping and the southeast corner. The bay on the east side of the lot has been previously disturbed and does not have much aquatic plants. The foreshore plants are less disturbed due to the barren bedrock aspect on the high tide line. There were no significant impacts or noticeable marine plants.

Permanent loss of habitat: The footprint of the building is relatively small but is a permanent loss of habitat and treed area. The removal of all the terrestrial riparian area was the highest impact.

Table 2) Anticipated impacts on local vegetation

	Marine Foreshore	Coastal Rain Forest	Rare Plant Species at Risk	Rare or endangered ecosystems
Habitat Risk	Low*	High	Negligible	Low

* Low owners wish to improve the foreshore habitat once building is completed.

6.2) Aquatics Resources

The proposed cabin is above the high water mark. Currently, there are no plans for works below the high tide mark, it will be in at the building footprint (Appendix 3). There is eel grass documented in the area, however, there are no planned works within the water. The expected habitat impacts are summarized below:

Table 3) Anticipated impacts on aquatic resources

	Habitat Effects	Anticipated Environment Effects			
	Marine Aquatic Invertebrates	Marine Pelagic Fishes	Salt Water Salmonid Rearing	Eel Grass	Subtidal Habitats
Habitat Risk	Low	Low	Low	N/a	N/a

6.3) Wildlife

The proposed cabin is located on a tree and shrub dominated area upland of the beach. The expected habitat impacts of development on wildlife are summarized below:

1. Permanent loss of habitat: Around the building footprint and the sewage system. Construction clearing removed the existing trees in adjacent area. Wildlife are likely to continue to use the area for grazing of grass or shrubs similar to clear cut openings adjacent other forested areas.

2. Temporary habitat avoidance by wildlife can be expected during the work period on building the deck due to increased noise and other building activities.

Table 1) Anticipated impacts on local wildlife and habitat

	Habitat Effects	Anticipated Environment Effects		
	Mammalian habitat	Reptile and amphibian habitat	Bird Habitat	Species at Risk
Habitat Risk	Low	Low	Low	Low

The impacts on potential wildlife habitat and populations include temporary loss of use of habitat. The cabin is expected to have some limited effects on wildlife that have used the area in the past and for those that use it to access the foreshore. The secondary impact of the adjacent clearing is recommended to be landscaped with native plants to improve the riparian area.

Noise and other construction related activity is expected to result in a temporary exclusion from the area of the work site. This impact is expected to be short term and should not alter any wildlife habitats within the riparian areas.

7.) Residual Effects

It is anticipated that the long-term impacts of this project will have no net loss of habitat with respect to the function of the DPA

8.) Cumulative Effects

Upon a review of the BC Environmental Assessment Office registry there are no active projects within 1km of the proposed site. The adjacent sites feature similar residential lots.

9.0) Applicable Legislation

9.1) Provincial Legislation

Wildlife Act: The *Wildlife Act* protects all wildlife and endangered species from human related disturbance. The Act covers amphibian, birds, mammals, reptiles and their nesting habitat. The Act also reduces the seasonal window, which certain vegetation can be removed (April 1- July 31) to protect surrounding bird nests.

9.2) Federal Legislation

Fisheries Act: The *Fisheries Act* protects all fisheries resources in Canada including fish habitat and migration. It is anticipated that any negative impacts during the construction period can be minimized by following an Environmental Management Plan guided by the “Develop With Care: Environmental Guidelines for Urban and Rural Land Development in B.C.”

Migratory Bird Convention Act: The *Migratory Bird Convention Act* protects all migratory bird nesting habitat from disturbance. The Act also reduces the window which certain vegetation can be removed (April 1- July 31) to protect surrounding bird nests.

10.) Discussion

The location of the cabin is with DP area of a small coastal island. The tideline and sub-tidal areas consist of bedrock on either side of the bay, with boulder and cobble angular shaped rock on the gradual sloping beach. The plant community is relatively diverse adjacent the lot. At the tideline and below are barnacles and rockweed with very limited ground coverage. The cabin development effect on the site is low impact. Along the upland area where the cabin and sewer is to go was cleared of all vegetation. This is an area identified as important for environmental contribution.

All construction is recommended to follow the “Develop With Care Guidelines” for protection of adjacent features during construction. This includes careful application of concrete, avoidance of spills and introduction of debris into the water. The construction was underway during the inspection. The crew were taking appropriate measures to limit construction impacts; materials were stored away from the water, and there were no spills or debris evident.

Yours truly

Brad Remillard, RPBio

References:

B.C. Conservation Data Centre. 2020. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed Aug, 2020).

Fisheries Information Summary System (FISS). 2020. Found at Fisheries Inventory Data Queries Ministry of Environment website <http://srmapps.gov.bc.ca/apps/fidq/>. Accessed 2020.

Ministry of Environment, Land and Parks & Ministry of Forests (MoF). 1998. Field Manual for Describing Terrestrial Ecosystems. Ministry of Environment, Lands and Parks & Ministry of Forests.



GEOTECHNICAL HAZARD ASSESSMENT

New Residence, 422 Burlo Island,
Bamfield, BC
Lot 1, Section 19, Township 1,
Barclay District, Plan VIP68113
District, PID NO. 024-330--485

Prepared For:
Julian & Ildiko Dombi

Attention: Julian & Ildiko Dombi

September 14th, 2020

File No.: F8478.01
Revision No.: 00
Prepared by: John Hessels, ASCT
Chris Hudec, M.A.Sc, P.Eng

Lewkowich Engineering Associates Ltd.
1900 Boxwood Road
Nanaimo, BC, V9S 5Y2
250-756-0355 (Office)
250-756-3831 (Fax)
www.lewkowich.com
geotech@lewkowich.com

LEA Lewkowich
Engineering
Associates Ltd.



ENGINEERS &
GEOSCIENTISTS
BC
BCP1211 COL 93.2 A

OQM
CERTIFIED

DISCLAIMER

1. Lewkowich Engineering Associates Ltd. (LEA) acknowledges that this report, from this point forward referred to as “the Report,” may be used by the Alberni Clayoquot Regional District (ACRD) as a precondition to the issuance of a development and/or building permit and that this Report and any conditions contained in the Report may be included in a restrictive covenant under Section 56 of the Community Charter and registered against the title of the Property at the discretion of the ACRD.
2. This Report has been prepared in accordance with standard geotechnical engineering practice solely for and at the expense of Julian & Ildiko Dombi. We have not acted for or as an agent of the ACRD in the preparation of this Report.
3. The conclusions and recommendations submitted in this Report are based upon information from relevant publications, a visual site-assessment of the Property, anticipated and observed subsurface soil conditions, current construction techniques, and generally accepted engineering practices. No other warranty, expressed or implied, is made. If unanticipated conditions become known during construction or other information pertinent to the development becomes available, the recommendations may be altered or modified in writing by the undersigned.
4. Future construction shall be carried out within the requirements and recommendations of the Environmental Consultant (if applicable), any defined jurisdictional bylaws, or any existing restrictive covenants, whichever is more stringent. Any environmental and/or jurisdictional limitations may supersede the recommendations in this Report.
5. The conclusions and recommendations issued in this Report are valid for a maximum of two (2) years from the date of issue. The 2-year term may be reduced as a result of updated bylaws, policies, or requirements by the authority having jurisdiction, or by updates to the British Columbia Building Code (BCBC). Updates to professional practice guidelines may also impact the 2-year term. If no application of the findings in this Report have been made to the subject development within the 2-year term, the conclusions issued in this Report become void and re-assessment of the Property will be required.
6. This report has been prepared by Mr. John Hessels, ASCT, and by Mr. Chris Hudec, M.A.Sc., P.Eng. Messrs. Hessels and Hudec are both adequately experienced and are also members in good standing with their respective professional associations; Applied Science Technologists and Technicians of British Columbia (ASTT) and Engineers and Geoscientists of British Columbia (EGBC).

EXECUTIVE SUMMARY

1. The following is a brief synopsis of the Property, assessment methods, and findings presented in the Report. The reader must read the Report in its entirety; the reader shall not rely solely on the information provided in this summary.
2. The subject property, 422 Burlo Island, Bamfield, BC, from this point forward referred to as “the Property,” is located on the west coast of Vancouver Island within the jurisdictional boundaries of the ACRD. The proposed development for the Property at the time of this report consists of a small residential dwelling.
3. A site-specific hazard assessment was conducted to identify potential geotechnical hazards for the Property. Two primary geotechnical hazards are addressed in the Report; Coastal flooding, and Steep Slope.
4. The findings in the Report determined the probability of flooding would be governed by coastal flooding. The Report established a coastal FCL of 5.39m GD elevation, and a development setback of 7.5m from the PNB of the property frontage. Protection from a Tsunami event in excess of the FCL elevation is met by immediate access (pathway) to the upland portion (rear) of the lot (12m GD).
5. The Report concludes that the steep slope located at the rear of the property is globally stable bedrock with minor surficial raveling to be remedied with slope armoring and revegetation program of the lower bare areas in concert with Environmental Consultants findings and recommendations.
6. The findings confirm that there is safe and suitable buildable area within the proposed lot as depicted on the attached survey.

List of Abbreviations Used in the Report

Abbreviation	Title
DPA	Development Permit Area
EGBC	Engineers and Geoscientists of British Columbia
FB	Free Board
FCL	Flood Construction Level
FNB	Future Natural Boundary
GD	Geodetic Datum
KWL	Kerr Wood Leidal Associates Ltd.
LEA	Lewkowich Engineering Associates Ltd.
MFLNRO	BC Ministry of Forests, Lands, and Natural Resource Operations
PNB	Present Natural Boundary
RA	Regional Adjustment
ACRD	Alberni Valley Regional District
SLR	Sea Level Rise
SS	Storm Surge
WE	Wave Effect

TABLE OF CONTENTS

DISCLAIMER.....	I
EXECUTIVE SUMMARY	II
TABLE OF CONTENTS.....	III
1.0 INTRODUCTION	1
1.1 General	1
1.2 Background	1
1.3 Assessment Methodology.....	1
2.0 SITE CONDITIONS.....	2
2.1 Physical Setting	2
2.2 Terrain and Features.....	2
2.3 Regional Geology	3
2.4 Soil Conditions	3
2.5 Groundwater.....	3
3.0 COASTAL FLOOD COMPONENTS.....	4
3.1 General	4
3.2 Tides.....	4
3.3 Sea Level Rise.....	4
3.4 Regional Adjustment – Isostatic Rebound	5
3.5 Storm Surge	5
3.6 Wave Effect.....	6
3.7 Freeboard.....	6
4.0 COVENANT REVIEW	7
5.0 DISCUSSIONS AND RECOMMENDATIONS.....	7
5.1 Coastal Flooding.....	7
5.1.1 Coastal FCL.....	7
5.1.2 Coastal Natural Boundary Setback	7
5.1.3 Floodwater and Inundation	8
5.1.4 Scour and Erosion Protection	8
5.1.5 Site Grading	8
5.2 Steep Slope	8
5.3 Seismic Tsunami.....	9
5.4 Building Design Criteria.....	9
6.0 CONCLUSIONS	9
7.0 ACKNOWLEDGEMENTS.....	10
8.0 LIMITATIONS.....	10

PROJECT: 422 Burlo Island, Bamfield, BC
FILE NO.: F8478.01
DATE: September 14th, 2020



9.0	CLOSURE	10
10.0	ATTACHMENTS	11
11.0	REFERENCES.....	11

1.0 INTRODUCTION

1.1 General

As requested, LEA has carried out a Geotechnical Hazard Assessment of the subject Property. This Report provides a summary of our findings and recommendations.

1.2 Background

- a. We understand that the proposed development consists of a new residential dwelling on a rural undeveloped lot.
- b. LEA understands as per the *Community Charter, (SBC2003), Chapter 26, Part 3, Division 8, Section 56* (as referenced in *Section 695 of the Local Government Act*) the Alberni-Clayoquot Regional District (ACRD) requires a Qualified Professional (Geotechnical Engineer) to determine whether the land may be used safely for the use intended. The Geotechnical Report is required to assess the suitability of geotechnical conditions for the proposed development, stating what (if any) natural hazards exist, and to provide comments and recommendations for the safe and suitable development of the land.¹
- c. LEA also understands the subject property falls within the Alberni-Clayoquot Regional District (ACRD) - Bamfield Official Community Plan (BOCP) area marked on BOCP Map No. 1. The property is shown on BOCP Map No. 3 to be in a Development Permit Area; specifically: DPA-I Riparian; DPA-II Natural Hazard; and, DPA-IV Coastal Protection.
- d. LEA understands the primary concern regarding hazards relates to the ocean frontage and steep slope areas. Therefore, a review of the subject lot is required to determine a safe buildable area and recommended Flood Construction Level (FCL).
- e. We also understand a Professional Biologist has been acquired to review the DPA-I & IV requirements for the site.

1.3 Assessment Methodology

- a. This assessment included a desktop review of relevant background information, including ACRD Bylaws, available development plans, registered covenants on title, aerial photographs, and published geology, topography and coastal flooding criteria. Please refer to the list of references at the end of this Report.
- b. A site reconnaissance was conducted on July 24, 2020 to visually assess the current site conditions throughout the Property and along the ocean foreshore. The lot was accessed via boat from the East Bamfield HFN Fisheries Dock approximately 300m to the southeast.

- c. This assessment was prepared with consideration of the referenced EGBC *Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia*,² and *Legislated Flood Assessments in a Changing Climate in BC*.³ Please refer to the attached EGBC assurance statements.

2.0 SITE CONDITIONS

2.1 Physical Setting

- a. The subject Property is located on the west coast of Vancouver Island within the community of Bamfield at the northern tip of Burlo island, which is located at the approximate mid-point of Bamfield Inlet. The Property is immediately bordered to the north and west by Bamfield Inlet, to the east by a developed residential property and by undeveloped rural residential properties to the south. Refer to Figure 2.1 below (ACRD Map).

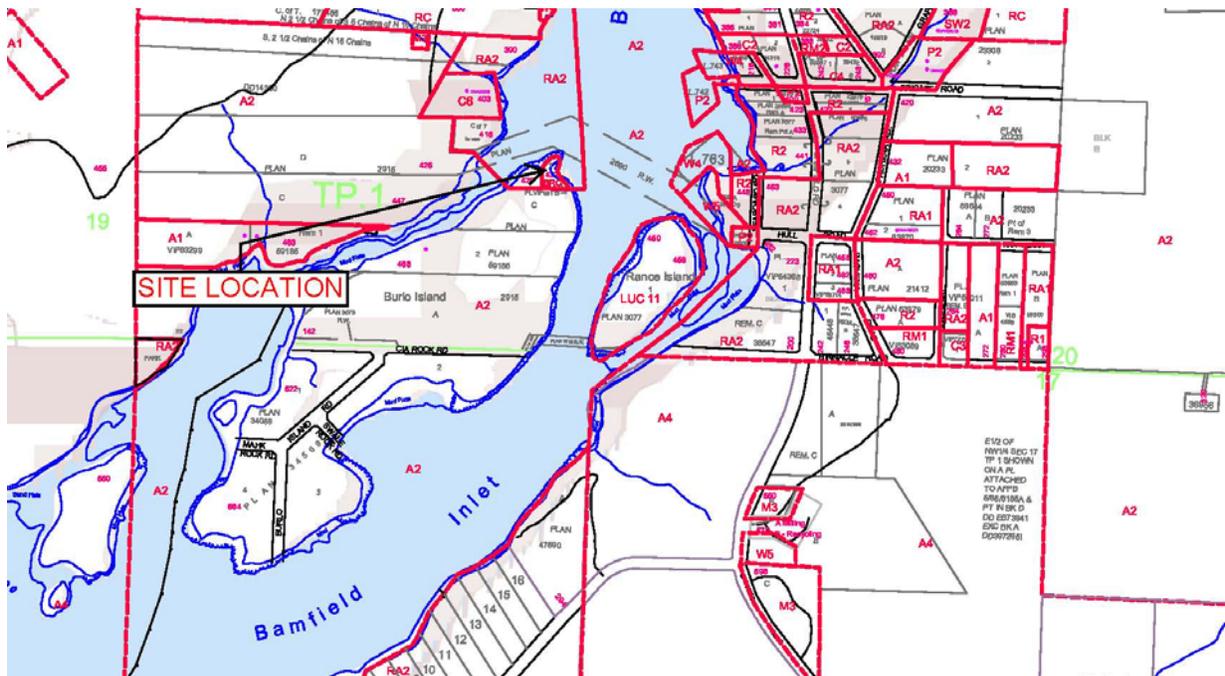


Figure 2.1: Property Location

2.2 Terrain and Features

- a. The lot is an irregular shaped lot that consists of a lower lying region in the northern half that includes a small bay like feature and a much steeper portion of land in the remainder to the south. The two areas are separated by an incised 4m wide bench and 2m wide pathway to gain access to the upper reaches.
- b. Based on the recent and historic surveys, the slope is approximately 11 to 12m in height, with average (i.e. crest to toe) slope angles between 23 to 27 degrees from horizontal. However, localized slope angles of approximately 40-45 degrees were observed on the slope to the upper 6m high bench during our site

reconnaissance.

- c. Below the slope, a relatively flat area of approximately 6m (west) to 30m (east) in width and less than 3m of vertical relief separates the toe of slope from the PNB of the ocean. The level area transitions into a low bank foreshore with a gently sloping (approximately 10 degree) intertidal zone facing the open waters of the Bamfield Inlet.
- d. At the time of our field review, the Property was undeveloped. In general, the slope is moderately vegetated with immature mixed trees and low-lying vegetation. The lower level, proposed building area has undergone some recent ground work and general devoid of any vegetation.

2.3 Regional Geology

- a. Bedrock geology for the area is classified as granodioritic intrusive rocks, and date back to the early to middle Jurassic period.⁴
- b. There are no known fault lines that cross the subject Property.

2.4 Soil Conditions

- a. A subsurface investigation was not included as part of this Geotechnical Hazard Assessment. Visual inspection of the site allowed for observations of minor soil exposures within the Property.
- b. At the time of our field review, there had been some land clearing and manipulation of thin surficial soils to create a suitable building area, pathway and upper bench area. These soils consisted of rock rubble with inclusions of sand, gravel and trace organics. In general, observed conditions were consistent with published geology mapping and consisted of moderately fractured exposed bedrock or loose to compact rock rubble, sand and gravel mixture cover over bedrock. We anticipate less than 1.0m fills are present over the anticipated building area.
- c. Observations of minor soil exposures on the slope faces indicate primarily near surface bedrock with a thin cover of rock rubble fills on the slopes that are less than 45 degrees.

2.5 Groundwater

- a. There was no ponded water, nor evidence of abnormal groundwater conditions observed during our visual reconnaissance of the Property.
- b. Groundwater levels can be expected to fluctuate with tides and seasonally with cycles of precipitation. Groundwater conditions at other times and locations can differ from those observed at the time of our assessment.

3.0 COASTAL FLOOD COMPONENTS

3.1 General

- a. In the past, in ACRD areas without published Floodplain Mapping, the convention has been to establish the minimum Flood Construction Level (FCL) as 3.0m (since 2000) above the Natural Boundary (4.94 GD). However, coastal communities are adopting a model for establishing minimum floor elevations to account for future sea level rise.
- b. The referenced KWL report provides the methodology for the Combined Method to determine an adequate FCL that incorporates the issue of sea level rise and other mitigating factors.⁶ This method has been adopted by provincial guidelines⁷ and is recommended practice by EGBC. The methodology includes the sum of the following variables determined through recent studies to have implications regarding potential coastal flooding.

3.2 Tides

- a. The nearest tidal station to the subject property is Bamfield Station No. 8545. A summary of published tide elevations, current as of January 2020, are presented in Table 4.2 below.

Table 4.2 – Summary of Bamfield Tide Elevations, Station No. 8545

Tidal Condition	Tidal Water Level (local datum)
HHWLT	3.95 m
HHWMT	3.25 m
MWL	2.01 m
LLWMT	0.66 m
LLWLT	-0.10 m

- b. The design tidal elevation in GD is calculated as follows: HHWLT (3.95m) – MWL (2.01m) = 1.94 m GD

3.3 Sea Level Rise

- a. Information prepared by the provincial government in 2011 regarding policy for coastal floodplain mapping assumes a 1.0m rise in sea level over a 100 year span from the year 2000 to 2100. See figure 4.3 below.

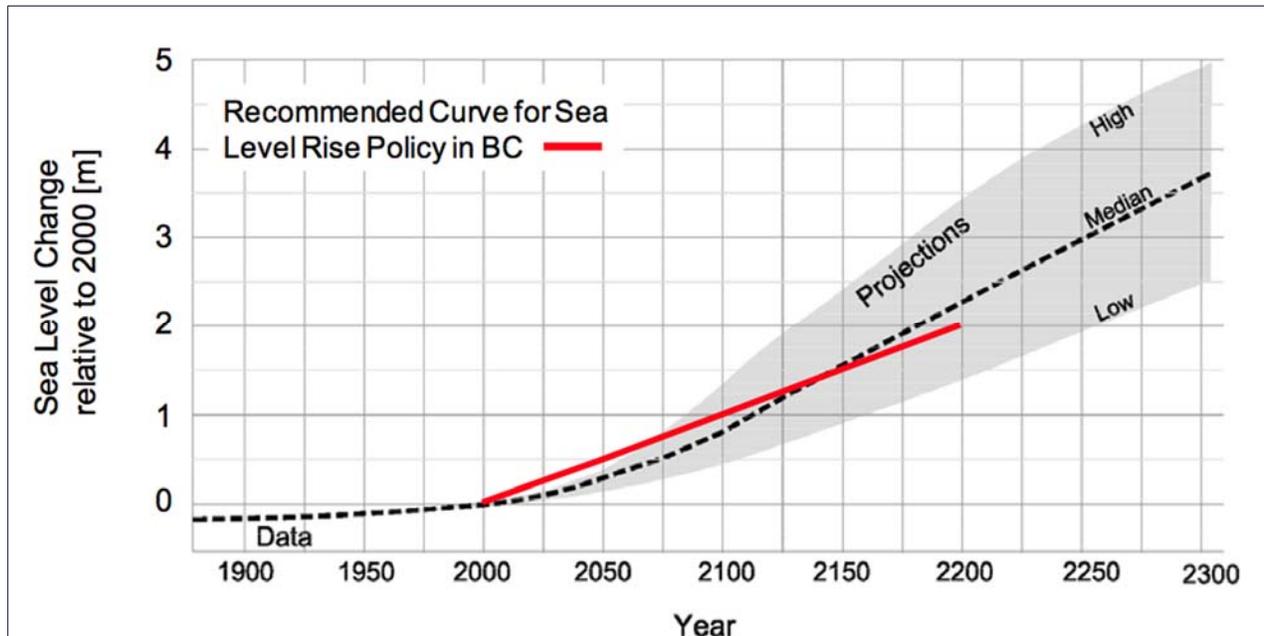


Figure 4.3 – Recommended Global SLR Curve for Planning and Design in BC

- b. The assumed amount of SLR is based on current information and will be evaluated in the future as more information becomes available. It should be noted that a 1.0m SLR estimate by the year 2100 is a conservative projection and has been used in the preparation of this report. Whereas the 2.0m SLR estimate by the year 2200 would be considered a mid to low range projection.
- c. Forecasting this far into the future carries significant uncertainties. Monitoring changes of SLR is beyond the scope of this report. We expect local authorities to remain informed in order to adjust their flood management plans/guidelines accordingly.

3.4 Regional Adjustment – Isostatic Rebound

- a. Future sea level is also affected by vertical land movement due to tectonic shifting. Calculations in SLR reflect changes in the regional rebound or subsidence of the land surface. Areas where the land elevation is increasing (rebound) should decrease the allowance for SLR, while areas where the land elevation is decreasing (subsidence) should increase the allowance for SLR.
- b. As per Figure 2-3 of the MFLNRO report prepared by KWL, uplift rates for this area of western Vancouver Island range from 3.6 to 4.0 mm/year.⁷ Considering a 100-year design life for the Cabin, we have selected an RA value of -0.40m for the calculation of coastal FCL.

3.5 Storm Surge

- a. Sea levels along the BC coast are not only affected by astronomical tide cycles but also by storms. Storms may affect water levels due to:

- i. Changes in atmospheric pressure.
 - ii. Strong winds acting on the water surface generating waves.
 - iii. Changes in ocean currents or temperature.
- b. The combined effect of all these factors is termed “storm surge” (SS).
- c. As per Table 2-1 and 2-4 of the MFLNRO report prepared KWL, we have selected a SS value of 1.30m GD considering the 1:200-year design storm event with a margin of safety for highly developed areas.⁷ This SS allowance includes allowances for local wind setup.

3.6 Wave Effect

- a. Breaking waves during the design storm event must also be considered, as breaking waves may further increase the depth of water along the shoreline, as well as increase risk of runup and overtopping leading to flooding.
- b. We note that wave effect is site specific and dependent on local bathymetry, oceanography, wind conditions, the presence of shoreline structures (revetment, dikes, etc.), as well as water levels at the time of the designated storm, which all contribute to the estimated wave runup and/or wave overtopping. Provincial guidelines suggest for coastal flooding hazard management, the wave runup is taken as 50% of the calculated runup elevation on the natural shoreline.⁸
- c. Wave effects are limited to the area immediately adjacent to the shoreline, estimated wave heights for the Bamfield inlet are known to be approximately 1.3m during storm events even though it is a well-protected inlet.
- d. Foreshore conditions at this Property consist of a natural, gently sloping (approx. 10% slope), shallow, sand-pebble-cobble shoreline underlain by bedrock. Major waves generally break offshore in normal sea state for these conditions, leaving only waves created by the local winds and fetch distances within the safe harbour of Bamfield inlet.
- e. Considering the development will be setback a minimum 7.5m from the Natural Boundary, as discussed further below, nominal WE values as presented in the MFLNRO report prepared by KWL⁷ which are 0.65m have been changed to 1.3m to account for conditions normally found at this area.

3.7 Freeboard

- a. A nominal FB value is typically added when calculating an FCL. The FB value accounts for uncertainties associated with value estimations used.
- b. Given the conservative nature of the Combined Method, which assumes the design storm occurs in conjunction with a high tide, provincial guidelines suggest a minimum FB of 0.3m shall be applied.⁷

4.0 COVENANT REVIEW

- a. As part of our assessment we have reviewed the legal title of the subject property, specifically relative to any restrictive covenants that may impact the conclusions or recommendations made in this report.
- b. At the time of this report, there were no restrictive covenants registered against the title of the property.

5.0 DISCUSSIONS AND RECOMMENDATIONS

5.1 Coastal Flooding

5.1.1 Coastal FCL

- a. We have used the Combined Method approach in order to determine a suitable FCL for the Property. The CM was established by KWL as part of the MFLNRO report on Coastal Floodplain Mapping Guidelines and Specifications.⁷ At the time of this report it is the recommended method for determining a coastal FCL for this Class of assessment (Class 0) and is supported by EGBC.
- b. The CM takes into account the effects of HHWLT, SLR, RA, SS, WE and FB, and the FCL is the sum of those components.
- c. Based on SLR projections for 100 years, the minimum FCL using the CM is derived in Table 7.2.1 below.

Table 7.2.1: FCL Determination using the CM to the Year 2120

FCL Component	Contributing Value (GD)
HHWLT	1.94 m
SLR	1.0 m
RA	-0.4 m
SS	1.25 m
WE	1.30 m
FB	0.30 m
Calculated FCL:	5.39 m GD

- d. Therefore, we recommend an FCL elevation of 5.39m GD for any Habitable Area, as defined by ACRD DPA 2 Natural Hazard.

5.1.2 Coastal Natural Boundary Setback

As per the Flood assessment guidelines a building can be sited a minimum of 7.5m from the natural

boundary as long as there are is a non-erodible shoreline present. The subject site shoreline consists of igneous bedrock with a thin layer of sand and gravels over some portions. A desktop review of old pictures and a survey dating back to 1993 indicates no significant change in the shoreline (PNB) position to date. This was confirmed by the recent survey completed by Sims Associates date and appended to this report

5.1.3 Floodwater and Inundation

- a. The recommended coastal FCL and setback applies to any Habitable Area; defined as any room or space within a building or structure which can be used for human occupancy, commercial sales, or storage of goods, possessions or equipment (including furnaces) which would be subject to damage if flooded.
- b. The FCL establishes the minimum elevation of the underside of a wooden floor system or top of concrete slab for any Habitable Area. During construction, all footing and floor elevations should be confirmed by qualified survey personnel to ensure the finished floor grade is at or above the recommended minimum FCL geodetic elevation.
- c. In the event of a design flood, it is possible that floodwaters from the ocean would inundate the subject Property. The general risk of flooding and the degree or severity of the floodwater increases as the sea level rises.
- d. Provided any construction within the subject property satisfies the minimum recommended FCL and setback to PNB, we do not anticipate any damage to structures as a result of floodwater. However, anything constructed or stored below the recommended FCL, such as crawlspaces, basements or storage rooms, could be subject to flooding during less than design flood events.

5.1.4 Scour and Erosion Protection

We recommend that all foundation elements for the proposed building be founded on bedrock and pinned in place as a protective measure against possible inundation of flood waters over the next fifty years (estimated lifespan of the building). Specific pinning details can be provided once design plans are in place should be completed in concert with the building designer.

5.1.5 Site Grading

Yard areas between the proposed residence and the Titled Boundary should be sloped as to direct surface water away from the proposed house and toward the foreshore area.

5.2 Steep Slope

- a. The property contains a steep slope that declines from the rear of the property towards the foreshore. Based on the 1993 survey, the slope is approximately 11-12m in height, with average (crest to toe) slope angles between 23 to 27 degrees from horizontal. However, localized over-steepened areas with slope

angles of approximately 40 to 45 degrees were observed on the slope below the upper bench and pathway during our site reconnaissance.

- b. The steep slope is considered to be in a stable condition. There were no visual signs of potential global / full slope height instability (ponding water, tension cracks, seepage, slump blocks, toe erosion, etc.) observed on the subject property and slope.
- c. However, minor sloughing of surficial soils on the steeper sections upland of the proposed building area could occur. Therefore, it is recommended that the steep section of the pathway adjacent to the proposed building be armoured with rock rubble from the toe to the crest with a maximum 45 degree slope.

5.3 Seismic Tsunami

Based on the desktop review of available information, the ACRD's recommended FCL of 10.0m above the PNB (approx. 12.0GD) and 30.0m set horizontal setback is not attainable at this site. Therefore, we recommend evacuation to the highest point of land (12m GD) which is available at the southern extent of the property when the tsunami warning has been given.

5.4 Building Design Criteria

- a. No liquefiable or compressible soils were encountered during our field review. We anticipate bedrock within 1.0m of the current ground surface. A bearing capacity for the bedrock would be 400 kPa (SLS) and 533 kPa (ULS).
- b. Based on the 2018 British Columbia Building Code, Division B, Part 4, Table 4.1.8.4.A, "Site Classification for Seismic Site Response," the observed and inferred subsurface soil conditions would be classified as "Site Class C" (very dense soils, soft rock).

6.0 CONCLUSIONS

- a. From a geotechnical point of view, and provided the recommendations in this report are followed, the land is considered safe for the use intended (defined for the purposes of this report as new single family residence), with the probability of a geotechnical failure resulting in property damage of less than:
 - i. 2% in 50 years for seismic events, including slope stability;
 - ii. 1 in 200 year flood event, accounting for 50 years of sea level rise;
 - iii. 10% in 50 years for all other geotechnical hazards;

7.0 ACKNOWLEDGEMENTS

Lewkovich Engineering Associates Ltd. acknowledges that this report may be requested by the Planners and/or Building Officials (or equivalent) of the ACRD, as a precondition to the issuance of a development and/or building permit. It is acknowledged that the Approving Officers and Building Officials may rely on this report when making a decision on application for development of the land. We acknowledge that this report has been prepared solely for, and at the expense of Julian & Ildiko Dombi. We have not acted for or as an agent of the ACRD in the preparation of this report.

8.0 LIMITATIONS

The conclusions and recommendations submitted in this report are based upon the information available at the time of this assessment. The recommendations given are based on the anticipated subsurface soil conditions, current construction techniques, and generally accepted engineering practices. No other warrantee, expressed or implied, is made. If unanticipated conditions become known during construction or other information pertinent to the development become available, the recommendations may be altered or modified in writing by the undersigned.

9.0 CLOSURE

Lewkovich Engineering Associates Ltd. appreciates the opportunity to be of service on this project. If you have any comments, or additional requirements at this time, please contact us at your convenience.

Respectfully Submitted,
Lewkovich Engineering Associates Ltd.

:



John Hessels, ASCT
Senior Technologist



Chris Hudec, M.A.Sc., P.Eng.
Senior Project Engineer

10.0 ATTACHMENTS

1. Sims Associates Land Surveying Ltd. *Plan of Lot 1, Section 19, Township 1, Barclay District, Plan VIP68113*, Dated September 3, 2019.
2. EGBC, Appendix D: Landslide Assessment Assurance Statement, signed September 14th, 2020.
3. EGBC, Appendix I: Flood Assurance Statement, signed September 14th, 2020.

11.0 REFERENCES

1. Alberni Clayoquot Regional District Electoral Area “A”, Official Community Plan, Bylaw No. P1309, Oct, 2014.
2. Engineers and Geoscientists of British Columbia, *Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*, dated May 2010.
3. Engineers and Geoscientists of British Columbia, *Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC*, Version 2.1, dated August 28, 2018.
4. BC Ministry of Environment, *Soils of South Vancouver Island, British Columbia*, Soil Survey Report No. 44, Sheet 3, dated 1986.
5. Province of BC, interactive web-map, iMapBC, accessed May 2020.
6. Kerr Wood Leidal Associates Ltd., BC Ministry of Forests, Lands, Natural Resource Operations, *Coastal Floodplain Mapping – Guidelines and Specifications*, dated June 2011.
7. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, *Flood Hazard Area Land Use Management Guidelines*, Amended January 1, 2018.
8. Ausenco Sandwell, BC Ministry of Environment, *Guidelines for Management of Coastal Flood Hazard Land Use*, Proj No. 143111, dated January 27, 2011.