

DATE: September 13, 2022

FILE: 3160-20/FR 2C 22

TO: Chair and Directors
Electoral Areas Services Committee

FROM: James Warren
Deputy Chief Administrative Officer

Supported by James Warren Deputy
Chief Administrative Officer

J. Warren

**RE: Site Specific Amendment to Floodplain Management Bylaw Application
8772 Driftwood Road (Mathers/ Deslauriers)
Strata Lot 8, Sections 8 and 17, Township 5, Comox District, and Part of the
Former Bed of the Strait of Georgia, Strata Plan VIS6179, Together with an
Interest in the Common Property in Proportion to the Unit Entitlement of the
Strata Lot as Shown on Form V, PID 026-920-069**

Purpose

To consider a site specific amendment to the Floodplain Management Bylaw to reduce the minimum floodplain setback for a proposed single detached dwelling to 15 metres.

Recommendation from the Deputy Chief Administrative Officer:

THAT the Comox Valley Regional District Board grant an exemption to Bylaw No. 600 being the “Floodplain Management Bylaw No. 600, 2020” to permit a proposed single detached dwelling to be sited at 15 metres from the present natural boundary of the Strait of Georgia (FR 2C 22, Mathers/ Deslauriers) on property described as Strata Lot 8, Sections 8 and 17, Township 5, Comox District, and Part of the Former Bed of the Strait of Georgia, Strata Plan VIS6179, Together with an Interest in the Common Property in Proportion to the Unit Entitlement of the Strata Lot as Shown on Form V, PID 026-920-069 (8772 Driftwood Road);

AND FINALLY THAT, as a condition of the site specific exemption to the Floodplain Management Bylaw, the property owners, at their own expense, register a restrictive covenant under Section 219 of the *Local Government Act* (RSBC, 2015, c. 1), specifying conditions that would enable the land to be safely used for the use intended according to the terms of the engineer report prepared by Tony Williamson, B.Sc., and Chris Hudec, M.A.Sc., P.Eng., of Lewkowich Engineering Associates Ltd., dated July 25, 2022, which will form part of the restrictive covenant, as well as an acknowledgement that no Disaster Financial Assistance funding is available for the building or its contents and releasing and indemnifying the Comox Valley Regional District from liability in the event any damage is caused by flooding or erosion.

Executive Summary

- The applicants propose to construct a single detached dwelling within 100 metres of the Strait of Georgia on an undeveloped property. An engineer’s report is required to determine the minimum flood construction level (FCL) and floodplain setback for the year 2100, which accounts for sea level rise.
- The applicant’s engineer states that the minimum FCL is 5.2 metres geodetic elevation, and the minimum floodplain setback is at Driftwood Road, providing no building envelope on the property. The engineers recommend that a reduction of the minimum floodplain setback to 15 metres, provided their recommendations are followed, is safe for the intended use, being a single detached dwelling. The recommendations include construction design and methods to mitigate the hazard from flooding.

- Staff supports the approval of this application with the engineer’s report registered as a Section 219 Restrictive Covenant against the Land Title of the subject property. The covenant releases and indemnifies the Comox Valley Regional District (CVRD) from liability or damage due to flooding, and state that no Disaster Financial Assistance funding is available for the building or its contents.

Prepared by:

B. Chow

Brian Chow
Planner II

Concurrence:

T. Trieu

Ton Trieu
Manager of Planning Services

Concurrence:

A. Mullaly

Alana Mullaly
General Manager of Planning
and Development Services

Government and Community Interests Distribution (Upon Agenda Publication)

Applicants	✓
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Background/Current Situation

The subject property, located at 8772 Driftwood Road, is approximately 0.134 hectares in size (Figures 1 and 2). This oceanfront property is bound by Driftwood Road to the southwest, Strait of Georgia to the northeast and residential lots in all other directions. Driftwood Marine Park, a regional park, is located approximately 27 metres southwest of the subject property. The applicants wish to construct a single detached dwelling on this property (Figure 3).

Floodplain Management Bylaw Analysis

Bylaw No. 600, being the “Floodplain Management Bylaw No. 600, 2020” (Floodplain Management Bylaw), regulates development of buildings and structures in proximity to watercourses. This bylaw was adopted to be consistent with the provincial *Flood Hazard Area Land Use Management Guidelines*, which was updated on January 1, 2018. The subject property is within 100 metres of the Strait of Georgia. In accordance with Sections 302(3) and 303(2) of bylaw 600, an engineer’s report is required to determine the minimum FCL (horizontal measurement) and floodplain setback for the year 2100 (vertical measurement), respectively. The engineer must assess whether the proposed siting is safe for the intended use now and in the future relative to coastal hazard (e.g. sea level rise and storm surge).

The 2018 provincial guidelines provide two options for calculating siting: have an engineer determine the year 2100 future natural boundary of the sea and be 15.0 metres landward of that boundary, or be landward of the point where the 2100-year FCL meets the natural contour of the land. The year 2100 FCL intersects with the natural contour of the land at Driftwood Road, leaving no buildable area on the property, hence the need for an exemption.

The applicants submitted an engineer’s report prepared by Tony Williamson, B.Sc., and Chris Hudec, M.A.Sc., P.Eng., of Lewkowich Engineering Associates Ltd., dated July 25, 2022 (Appendix A). The engineers have determined the minimum FCL is 5.2 metres geodetic and the minimum floodplain setback to be at Driftwood Road, which prevents the proposed single detached dwelling from being built on the property.

Based on this finding, the applicants submitted a site specific exemption application in accordance with Section 403 of the Floodplain Management Bylaw. Section 403(2) outlines the criteria for the CVRD Board to consider in an exemption application:

- The CVRD Board considers the exemption advisable.

- The exemption is consistent with the *Provincial Flood Hazard Area Land Use Management Guidelines*.
- The applicant has submitted an engineer report that specifies conditions that would enable the land to be safely used for the use intended.
- The engineer has completed a Flood Hazard and Risk Assurance Statement.

The purpose of the application is to reduce the minimum floodplain setback. For the minimum FCL of 5.2 metres geodetic, the applicants confirmed that their proposed dwelling would be able to achieve this requirement.

The engineers have followed the *Provincial Flood Hazard Area Land Use Management Guidelines*, as well as Engineers and Geoscientists of British Columbia's *Legislated Flood Assessment in a Changing Climate in BC*, in their report.

Firstly, the engineers acknowledge that there are wetlands in Driftwood Marine Park, located approximately 27 metres southwest of the subject property. The recommendations to protect the proposed dwelling from the hazards of this wetland would be superseded with the more conservative recommendations related to the Strait of Georgia.

The engineers recommend the minimum floodplain setback to be 15 metres from the present natural boundary of the Strait of Georgia provided the minimum FCL is achieved. They provided detailed recommendation for the foundation design and construction for the applicants to follow. They outline situations that may be encountered during construction in which the engineers would need to get involved for further guidance before development activities could advance.

In the future, they recommend current and future owners to monitor the foreshore for any regression, especially after a significant storm event or winter season. A reassessment from a qualified professional would be required in the event that the shoreline needs to be protected.

They confirm that the land may be used safely for the use intended, being a single detached dwelling. The engineers confirm that there is no disaster financial assistance funding available for the building or its contents.

Planning staff is in support of this Site Specific Exemption to this Floodplain Management Bylaw Application, as the engineers have prescribed land preparation and construction details to safeguard the proposed dwelling from the hazards of flooding. The engineers have followed *Provincial Flood Hazard Area Land Use Management Guidelines*, and they have completed the Flood Assurance Statement with the requirement to register their report as a Section 219 Restrictive Covenant against the Land Title of the subject property.

Regional Growth Strategy Analysis

Bylaw No. 120, being the "Comox Valley Regional District Regional Growth Strategy Bylaw No. 120, 2010" (RGS), designates this property within Settlement Nodes. Policy 1D-2 of the RGS, pertaining to the public costs of housing states, "Direct new housing away from high risk natural hazard areas such as flood plains, areas exposed to sea-level rise..." Policy 8F-6 pertaining to planning for climate change adaption states, "All new development within established floodplains should be discouraged and redevelopment of lands within floodplain areas should only be supported where technical analysis by a qualified professional has been undertaken to ensure that lands are safe for use, development will not impact floodplain functions, and construction levels include safety factors to account for climate change and potential sea level rise and associated extreme storm surges." The proposed reduced floodplain setback, which incorporates climate change impacts, is supported by recommendations from engineers.

Official Community Plan Analysis

Bylaw No. 337, being the “Rural Comox Valley Official Community Plan Bylaw No. 337, 2014” (OCP), designates the subject property within Settlement Nodes. Sections 15 and 16 of the OCP provides objectives and policies regarding development in the vicinity of natural hazards. Section 15(2) states, “To direct new development away from hazard areas” and Section 16(1) states, “Do not permit new development in hazard areas, including mapped floodplains, steep slopes and areas of active erosion.” The proposed development is under guidance and recommendations by engineers. As such, the proposal is consistent with OCP policies.

The OCP contains Development Permit Area Guidelines. The proposed single detached dwelling is within the Aquatic and Riparian Habitat Development Permit Area. The applicants will need to submit a Development Permit Application prior to land alteration and development. The review of this application has been delegated to CVRD Officers.

Zoning Bylaw Analysis

The subject property is zoned Residential One (R-1) in Bylaw No. 520, being the “Rural Comox Valley Zoning Bylaw No. 520, 2019” (Zoning Bylaw). As the design of the proposed single detached dwelling has not been finalized yet, the applicants have been advised of the Zoning Bylaw regulations.

Policy Analysis

Section 524(7) of *Local Government Act* (RSBC, 2015, c. 1) (LGA) states that a local government may exempt an applicant from the minimum floodplain setback or FCL, if the local government considers the exemption is consistent with the Provincial Guidelines or has received an engineer report that certifies the land may be used safely for the used intended.

Section 524(8) of LGA outlines that if the exemption is granted by the local government, then the local government may impose any term or condition, require the submission of an engineer report and require that the applicant enter into a Section 219 Restrictive Covenant to be registered against the Land Title of the subject property.

Options

The Board has the following options:

1. Approve the site specific exemption of the floodplain specifications; or
2. Deny the site specific exemption of the floodplain specifications.

Based on the discussions outlined in this report, staff recommends option 1.

Financial Factors

Applicable fees have been collected for this application under the “Comox Valley Regional District Planning Procedures and Fees Bylaw No. 328, 2014.”

Strategic Considerations: Strategic Drivers and Regional Growth Strategy

CVRD Board Strategic Drivers:						
Fiscal Responsibility	✓	Climate Crisis and Environmental Stewardship and Protection	✓	Community Partnerships		Indigenous Relations

Fiscal Responsibility: Careful management of services and assets is essential to providing affordable and reliable services to citizens and businesses in the CVRD.

- A condition of a floodplain exemption is a covenant, registered at the applicant’s expense, to indemnify the CVRD from liability in the event any damage is caused by flooding or erosion.

Climate Crisis and Environmental Stewardship and Protection: The CVRD is committed to reducing our impact on the environment and accelerating our actions to adapt and respond to climate change impacts.

- The development on this property will be guided by conditions within a future application of an Aquatic and Riparian Habitat Development Permit. The engineers confirmed that they considered the effects of climate change in their recommendation as per the Flood Assurance Statement they signed and sealed.

CVRD Regional Growth Strategy Goals:							
Housing		Ecosystems, Natural Areas and Parks		Local economic development		Transportation	
Infrastructure		Food Systems		Public Health & Safety	✓	Climate Change	

Public health and safety: Support a high quality of life through the protection and enhancement of community health, safety and well-being;

- The development has been assessed by professional engineers. The engineers assume liability for this design and the reduced floodplain setback through their statement that the use of the dwelling is considered safe for the intended use, their Flood Assurance Statement. Their professional report will be registered as a Section 219 Restrictive Covenant against the Land Title of the subject property.

Intergovernmental Factors

There are no intergovernmental implications with this application.

Citizen/Public Relations

There are no citizen and/or public relations factors related to this report.

Attachment: Appendix A – Floodplain Report

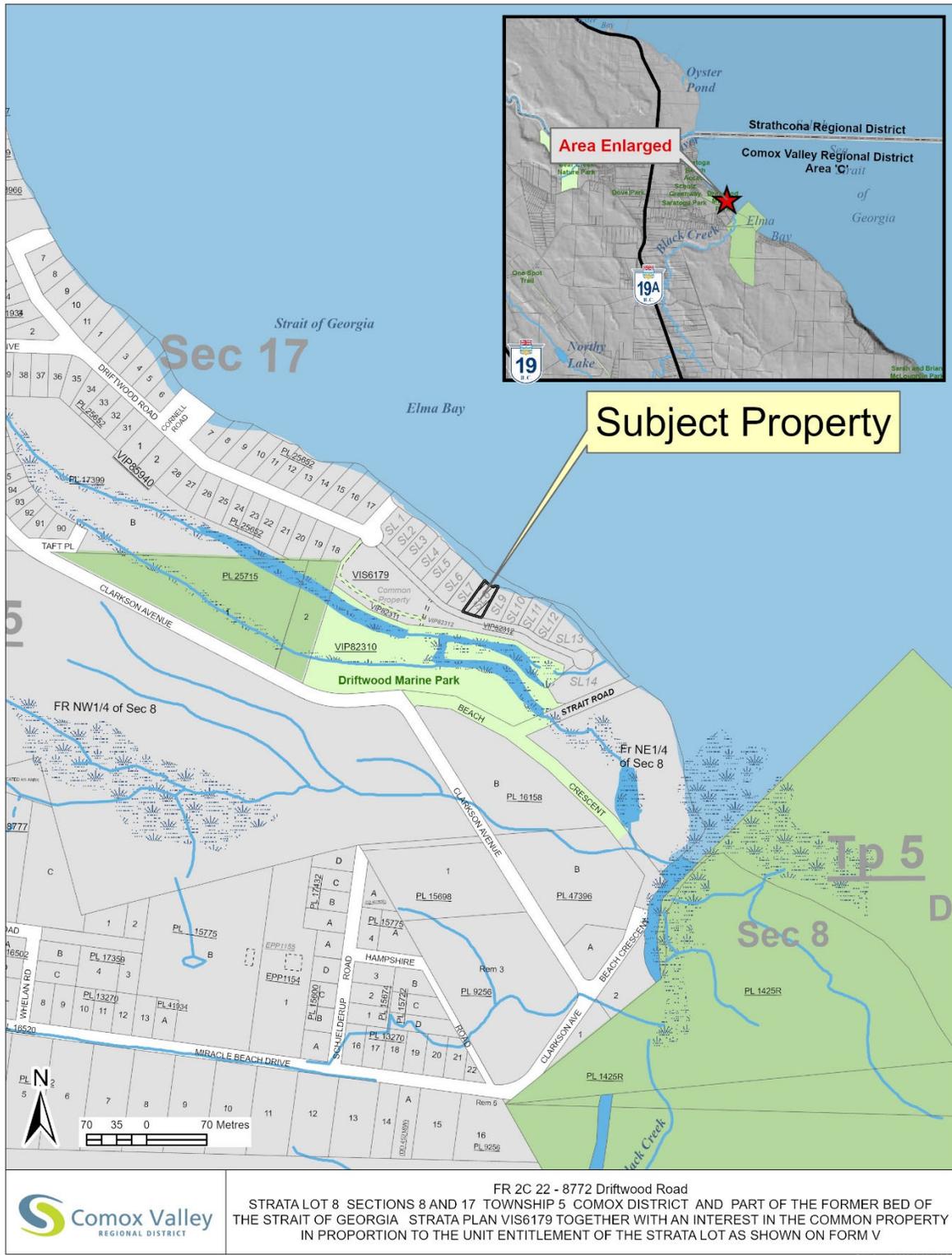


Figure 1: Subject Property Map



Figure 2: Air Photo

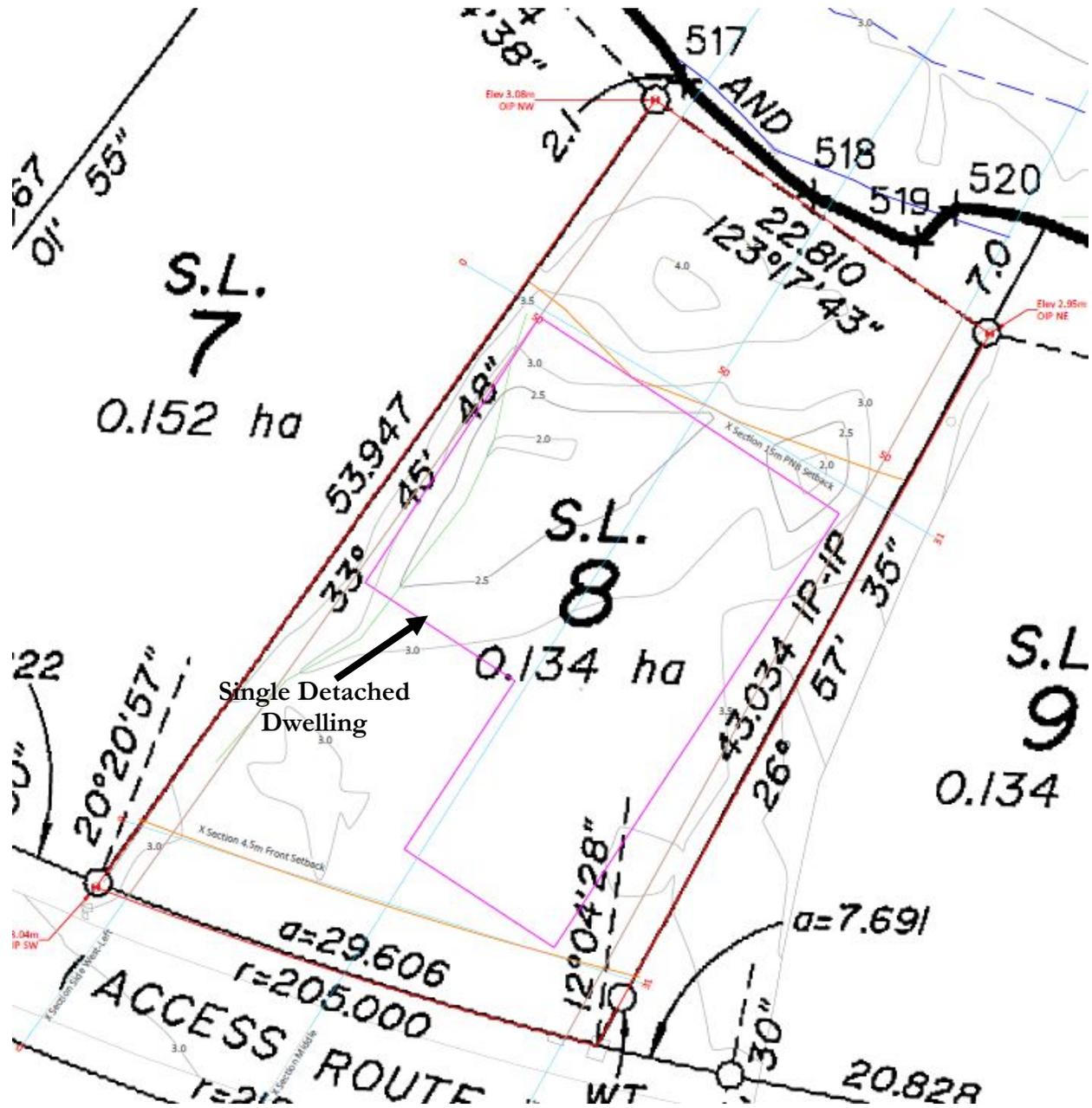


Figure 3: Site Plan of Building Envelope of the Proposed Single Detached Dwelling

GEOTECHNICAL ASSESSMENT

Proposed Single-Family Residence
8772 Driftwood Road,
Black Creek, CVRD, BC

Legal Address:

Strata Lot 8, Plan VIS6179 Section 8, Township 5,
Land District 15 & Sec 17 Together With an
Interest in the Common Property in Proportion to
the Unit Entitlement of the Strata Lot as Shown
on Form 1 or V, as Appropriate

PID: 026-920-069

Prepared For:

Lee Deslauriers
lee@stonecroftengineering.ca

July 25, 2022

File: E0407.01r1

Prepared by:

Tony Wiliamson, B.Sc.
Chris Hudec, M.A.Sc., P.Eng.

Lewkowich Engineering Associates Ltd.

2351B Rosewall Crescent
Courtenay, BC, V9N 8R9
250-334-0384 (Office)
250-334-9601 (Fax)
www.lewkowich.com

Permit to Practice Number: 1001802



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FILE: E0407.01r1
DATE: July 25, 2022



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 Comox Valley Regional District (CVRD) 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 and registered to the title of the subject property at the discretion of the CVRD.
2. This Report has been prepared in accordance with standard geotechnical engineering practice solely for and at the expense of Lee Deslauriers. We have not acted for or as an agent of the CVRD 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 subject property, anticipated and encountered 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 structures becomes available, the recommendations may be altered or modified in writing by the undersigned.
4. This Report was authored, to the best of our knowledge at the time of issuance, with considerations for local requirements specific to the CVRD and their standards for the preparation of such reports, the 2018 British Columbia Building Code (BCBC), and current engineering standards. Updates to municipal bylaws, policies, or requirements of the CVRD, or updates to the BCBC and/or professional practice guidelines may impact the validity of this Report.
5. This Report has been prepared by Tony Williamson, B.Sc., and Chris Hudec, M.A.Sc., P.Eng. Williamson and Hudec are adequately experienced. Hudec is a member in good standing with the Engineers and Geoscientists of British Columbia.

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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, 8772 Driftwood Road, Saratoga Beach, BC, from this point forward referred to as “the Property,” is located on the east coast of Vancouver Island within the jurisdictional boundaries of the CVRD. At the time of this Report, the proposed development for the Property consists of a single-family residence.
3. A site-specific assessment was conducted to identify potential geotechnical hazards for the Property. Our assessment determined that the Property is subject to ocean flooding hazard. A minimum Flood Construction Level of 5.2m geodetic has been determined for the proposed development.
4. The findings confirm the development is considered safe as proposed given the recommendations in the Report are followed.

List of Abbreviations and Acronyms Used in the Report

Abbreviation	Title
ASTM	American Society for Testing and Materials
BCBC	British Columbia Building Code
CFMP	Coastal Flood Mapping Project
CVRD	Comox Valley Regional District
DPA	Development Permit Area
EGBC	Engineers and Geoscientists BC
FCL	Flood Construction Level
FL	Flood Level (CVRD/KWL Term Equivalent to FCL)
FNB	Future Natural Boundary
GD	Geodetic Datum
H	Horizontal
KWL	Kerr Wood Leidal Consulting Engineers
LEA	Lewkowich Engineering Associates Ltd.
NB	Natural Boundary
PNB	Present Natural Boundary
SLR	Sea Level Rise
SLS	Service Limit State
ULS	Ultimate Limit State
V	Vertical

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1.0 INTRODUCTION

1.1 General

As requested, LEA has carried out a geotechnical assessment with respect to the proposed single-family residential development. The assessment includes identification of any geotechnical hazard that might impact the design and construction of the development, and prescribe the geotechnical works and any changes in the standards of the design and construction of the development that are required to ensure the land, buildings, and works and services are developed and maintained safely for the use intended. This Report provides a summary of our findings and recommendations.

1.2 Background

- a. We understand the Property is currently undeveloped. We understand the proposed development would see the construction of a new permanent single-family residence.
- b. We understand the new residence is to employ cast-in-place concrete foundations and will be built using conventional residential wood-framing construction methods.
- c. We understand that the CVRD requires a geotechnical assessment for permitting applications.
- d. This Report does not provide environmental, biological, or archaeological assessments of the Property.
- e. We understand that a biophysical assessment of the Property had been recently conducted but no report was available for review at the time of writing.

1.3 Assessment Methodology

- a. Subsurface geotechnical investigations were carried out on November 4, 2021 using a Bobcat E35i rubber tracked mini excavator supplied by the client. A total of three (3) test pits (TP21-01 to TP21-03) were advanced to refusal at various locations within the subject Property. All test pits (TPs) were backfilled upon completion of our investigation.
- b. Location of the TPs is shown on LEA drawing E0407-01, attached following the text of this report.
- c. This assessment included a desktop review of relevant background information, registered covenants on title, aerial photographs, and published geology and topography. A complete list of references is found at the end of this Report.

2.0 SITE CONDITIONS

2.1 Physical Setting

- a. The Property is located in the Saratoga Beach area of Black Creek, the jurisdictional limits of the CVRD, and

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is identified with the following civic and legal address:

- i. 8776 Driftwood Road, Black Creek; Strata Lot 8, Plan VIS6179 Section 8, Township 5, Land District 15 & Sec 17 Together With an Interest in the Common Property in Proportion to the Unit Entitlement of the Strata Lot as Shown on Form 1 or V, as Appropriate; PID: 026-920-069¹.
- b. The Property is zoned Residential One (R-1)² and is bounded to the northwest and southeast by other R-1 strata lots, in the southwest by Driftwood Road and in the northeast by the Strait of Georgia.
- c. The Property is located near the southeastern end of Driftwood Road, approximately 700m southeast of the Driftwood Road / Maple Road intersection that leads out to Highway 19a. Driftwood Road runs in an approximate northwest-southeast orientation local to the subject Property. The Property has approximately 23m of ocean frontage and is shown below in Figure 2.1 with 2020 airphoto.

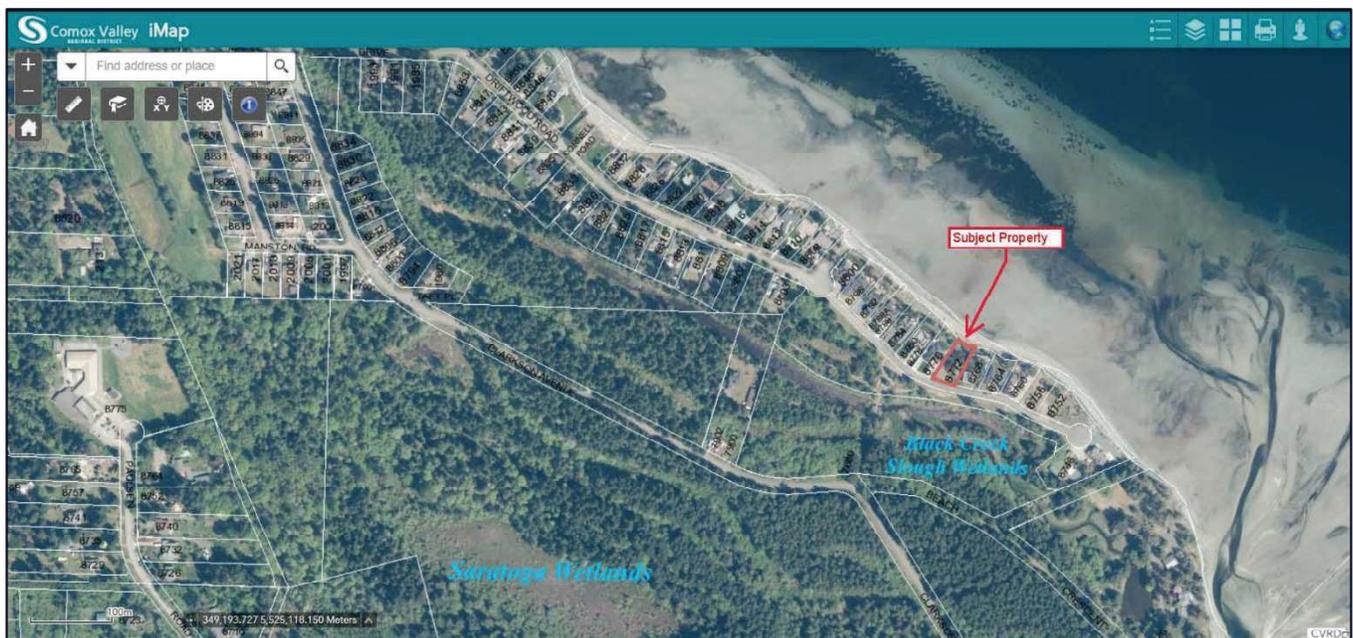


Figure 2.1 – Property Location (from online CVRD iMap³)

- d. Based on a review of the CVRD online geographic information system mapping³, the Property is located partially within a defined DPA for Aquatic and Riparian Habitat Protection as specified in the Rural Comox Valley OCP Bylaw No. 337, 2014 – Schedule ‘A’, Section 80⁴.
- e. The Aquatic and Riparian Habitat Protection DPA is beyond the scope of this Report.

2.2 Terrain and Features

- a. The 0.13 hectare (0.33 acre) Property is undeveloped.
- b. The neighbouring property to the northwest had been built up in the vicinity of that residence with structural fill to a maximum of approximately 2m higher in elevation than the Property.
- c. The neighbouring property to the southeast has had only minor elevation manipulation of the lot topography in the form of a driveway area off of Driftwood Road built up to access the elevated garage.

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- d. On average, the Property is relatively flat lying. However, an approximately 1m deep depression occupies the central portion of the lot. It appears portions of the depression were filled in with the manipulation of the neighbouring lot to the northwest. For more information refer to the Client-authored topographic plan with LEA markups, attached following the text of this report.
- e. A stockpile of import pit run gravel had been placed on the northeastern end (ocean side) of the Property, partially infilling portions of the depression and raising the elevation of the lot in that area by approximately 1m from the average height (2m above the bottom of the depression). The pit run appears to have been placed some time ago as the mound is overgrown with vegetation.
- f. Vegetation within the lot consisted of wild grasses, sparse shrubs, small trees as well as a few mature Douglas Fir trees. The foreshore was vegetated with well-established beach grasses.

2.3 Streams and Aquatic Habitat

- a. The property lies 500m northwest of the Black Creek outlet, where it drains into the Strait of Georgia at Elma Bay.
- b. The Black Creek Slough Wetlands, donated as parkland, are located directly across Driftwood Road from the Property and form a tributary that drains into Black Creek. The subject property lies just outside of the 15m riparian setback from this waterbody. Refer to the McElhanney *Proposed Bareland Subdivision Plan* attached following the text of this report for more information.
- c. The shoreline of the Strait of Georgia defines the northeastern boundary of the Property. The foreshore is not protected by any natural landform or installed shoreline protection. There is a slight shoreline inflection from northwest/southeast on the Property to west-northwest/east-southeast on the lot to the southeast. This may afford minor shoreline protection of the subject property from wind-blown waves but overall, it has a parallel exposure to the dominant wind direction (from the southeast) and the long-shore drift direction (flowing to the southeast).

2.4 Regional Geology and Aquifers

- a. Local surficial geology mapping indicates fluvial or marine deposits (e.g. recent Salish sediments) over glacio-marine deposits (e.g. varied stoney, gravelly and sandy marine-veneer deposits).^{5,6,7}
- b. Review of groundwater wells and aquifers in the BC Water Resources Atlas⁸ indicates that Aquifer 411 and 412 have been mapped to the area. Aquifer 411 is attributed to the fractured sedimentary bedrock. Aquifer 412 is an unconfined aquifer hosted in the sands and gravels of the Salish Sediments. Well 110230 was drilled on the neighbouring property to the southeast in 2017. It was advanced to a total depth of 9.1m, intersecting gravel and sand to 8.5m followed by hard silt, clay and sands, with a water table was intersected at 3.0m. Well 63555 was drilled to a total depth of 11.3m in 1993 on the other side of

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Driftwood Road at the edge of the Black Creek Slough Wetlands (about 30m southwest of the Property). Brown sand and gravels were intersected to 2.0m followed by slightly silty gravels to 4.9m, followed by red-brown sand and gravel to 8.1m, followed by grey sandy till to 10.4m, followed by silty fine sand to 11.3m. Ground water was intersected at 2.1m and saltiness was detected in waters of the lower-most unit. None of the wells in the vicinity of the Property were drilled deep enough to encounter bedrock.

- c. Bedrock geology for the area is classified as Upper Cretaceous Nanaimo Group Undivided Sedimentary Rocks.⁹ The strata of the Nanaimo Group formation in the Comox/Georgia basin consists of alternating succession of shales, sandstones, conglomerates, and some coal.¹⁰ Depth to bedrock at the Property is undetermined.

2.5 Soil Conditions

- a. The TP investigation revealed soils that were relatively consistent, and generally agree with surficial geology mapping of the area.
- b. The overall strata encountered in the TPs consisted of –
- i. Sand, gravel, cobble, compact, brown damp import pit run gravel from surface with thickness up to 2.3m (in TP21-03 only); overlying,
 - ii. Sand, gravel, organics (fine grained, grass, rootlets) compact, dark grey-brown, moist, from surface with thickness up to 0.3m; overlying,
 - iii. Sand, gravel, roots, compact, grey-brown, moist root horizon up to 0.2m thick; overlying,
 - iv. Sand, gravel, cobble, compact to dense, grey, moist to wet.
- c. Compact to dense sand and gravels were encountered in all TPs, beginning immediately below the root horizon.
- d. All TPs were advanced to machine effective refusal in compact to dense soils. Detailed descriptions of the subsurface conditions are provided on the attached TP logs (TP21-01 to TP21-03).
- e. Depths are referenced to the existing ground surface at the time of our field investigation. Soil classification terminology is based on the Modified Unified Classification System. The relative proportions of the major and minor soil constituents are indicated by the use of appropriate group names as provided in ASTM D2487 and D2488. Other descriptive terms generally follow conventions of the Canadian Foundation Engineering Manual.¹¹

2.6 Groundwater Conditions

- a. Weak to moderate groundwater seepage was observed in 2 of the 3 holes. The third hole likely had ground water at a similar elevation but was dug atop the artificial topographic high of the pit run gravel stockpile and so reached the machine digging limit prior to intercepting ground water.

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- b. Groundwater levels can be expected to fluctuate seasonally with cycles of precipitation. Groundwater conditions at other times and locations can differ from those observed within the TPs at the time of the field investigation.
- c. Due to the PNB with the Strait of Georgia defining the northeast edge of the Property, groundwater levels are expected to be tidally influenced. This is suggested in well 63555 where the lowest unit was reported to be “salty”.
- d. If groundwater flows or conditions are different than those encountered during the field investigations, additional measures may be required during construction. If unanticipated conditions are encountered contact the Geotechnical Engineer for review.
- e. Soil permeability testing was carried out at the same time as the TPs using a Guelph permeameter. Test results are summarized in the table below:

Table 2.6.1 – Summary of Results for Permeameter Testing.

	Total Depth (m)	Soil Type	K_{fs} (cm/s)
PH21-01*	0.45	Native Sands, gravels and cobbles	1.48E-03
* Used double head method (Positive Alpha Value) with 5 & 10cm head heights			

3.0 COVENANT REVIEW

- a. LEA has reviewed a title search printout for the Property (provided by the Client) and reviewed covenants to determine if any required geotechnical considerations.
- b. Covenant FA14505/FA14506 (dated December 13, 2005) speaks to riparian/shoreline protective measures within a 3m setback from the high-water mark, and is not geotechnical in nature.
- c. Covenant FA14507/FA145308 (also dated December 13, 2005) is geotechnical in nature, speaking specifically to FCLs and prescribed setbacks.
 - i. Upon review, however, the covenant does not take SLR and climate change into account, making it out of date by EGBC best practices.
 - ii. One item of note, is Condition 3 which states, in part:

“...Where landfill is used to raise the natural ground elevation, the toe of the landfill slope shall be no closer to the natural boundary than the setback requirement given in Condition (1) above...”

 whereby Condition 1 specifies:

“Hereafter, no building shall be constructed, nor mobile home located, within 15 (fifteen) metres of the highest high-water mark of the Strait of Georgia and 15 (fifteen) meters from the natural boundary of the wetted areas.”

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- iii. The signatory of this covenant (CVRD) was contacted for clarification on what constitutes “landfill”. In an emailed response from the CVRD dated January 21, 2022¹², it was iterated that “landfill” in this context refers to structural fill that supports building construction. Therefore, the covenant does not prohibit non-structural fill within the 15m setback from the PNB.

4.0 FLOOD HAZARD REVIEW

4.1 General

- a. Based on our field reconnaissance and desktop review of available information, it is the opinion of LEA that proximity to the Strait of Georgia is the most significant geotechnical hazard within the subject Property.
- b. Flooding from the nearby Black Creek Slough Wetlands is also a geotechnical hazard within the subject Property. However, any recommendations made to reduce wetland flooding risk would be redundant in that recommendations for mitigation of potential coastal flooding (with incorporated SLR) made later in this report would be far more conservative.
- c. Please note, the comments and recommendations contained herein are current as of the date of this Report, and speak to the condition of the Property and adjacent/adjoining properties. If there are any circumstances, such as a change in elevation, topography, or gradients within the Property or properties in proximity to the subject lot, the comments and recommendations become void, and will require re-evaluation by the undersigned.

4.2 Watercourses

- a. There is a defined watercourse (Strait of Georgia) immediately adjacent to the subject property, as well as the Black Creek Slough Wetland approximately 30m to the southwest of the property. All construction shall be carried out within the requirements and recommendations of the environmental consultant and/or any defined jurisdictional setbacks, including any existing restrictive covenants, whichever is more stringent.
- b. Any building or environmental setbacks, or covenants supersede the geotechnical recommendations made in this report.
- c. Construction elevations are subject to confirmation by qualified survey personnel. All elevations shall be confirmed in the field at the time of construction.

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5.0 FLOOD CONSTRUCTION LEVEL

5.1 Flood Construction Level Determination

- a. CVRD Floodplain Management bylaw No. 600¹³ was reviewed and it does not take SLR and climate change into account, making it out of date by EGBC best practices.
- b. Therefore, the EGBC Professional Practice Guideline: “Legislated Flood Assessments in a Changing Climate in BC”¹⁴ was followed in generating a FCL and setbacks.
- c. A “Coastal Flood Mapping Project” was completed for the CVRD by KWL, with the final report¹⁵ delivered in April, 2021. The report was recently made public by the CVRD and provides detailed flood assessment data on the Property as well as the entire regional district. As per the Guideline, this region-specific study shall be used because it is the best information available.
- d. The “probabilistic method” from the provincial guidelines for floodplain mapping¹⁶ was applied to calculate flood levels and setbacks as part of the CFMP. Calculated Flood Levels (FL, equivalent to FCL) have been incorporated into the CVRD’s “Regulatory Coastal Floodplain Mapping” online map viewer¹⁷, which details FCLs by “Coastal Zones”. The Property is shown to be within Coastal Zone 4, where the FCL (FL) was determined to be 5.2m Geodetic. See Figure 5.1 for more details.

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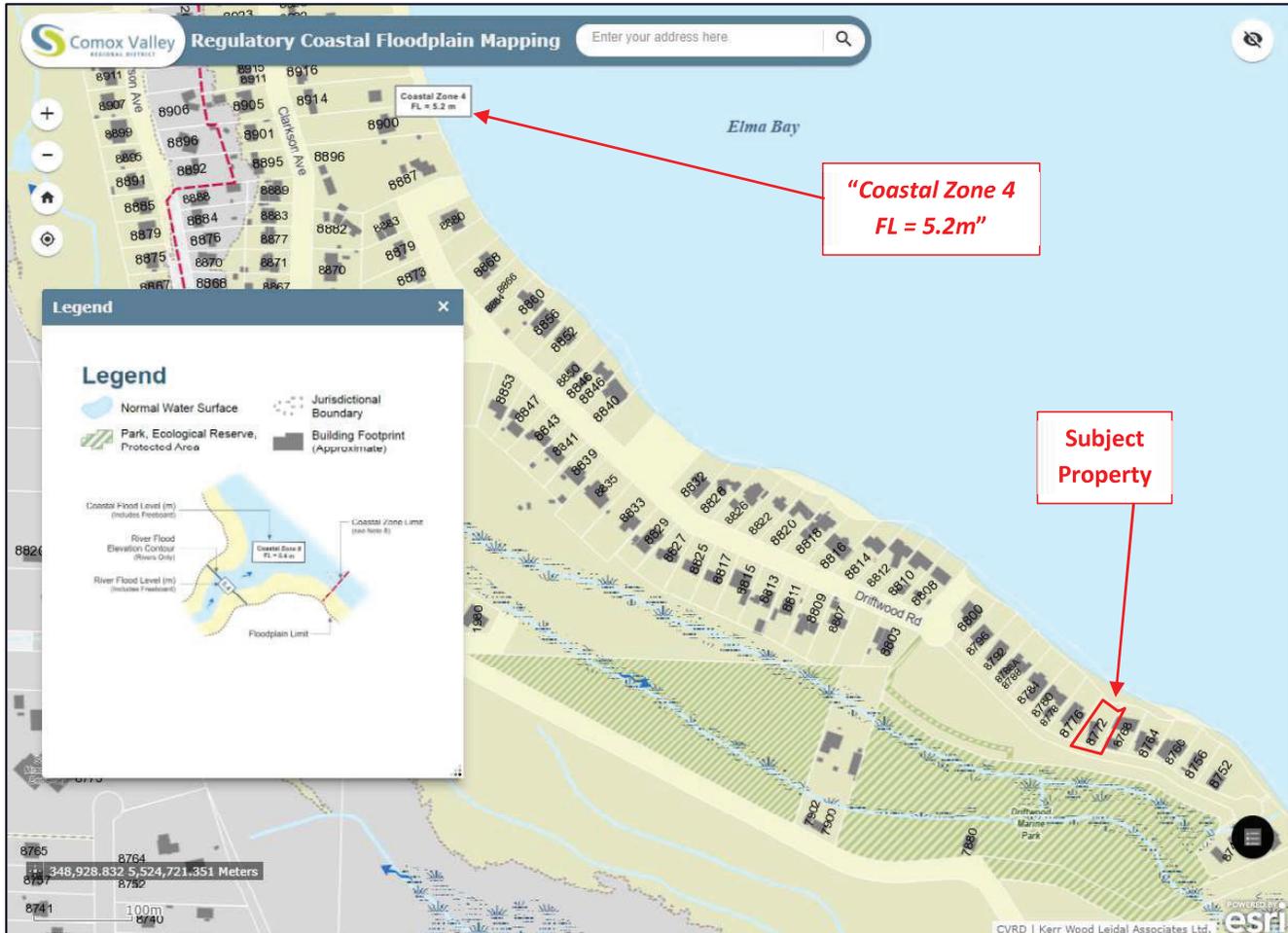


Figure 5.1– CVRD Regulatory Coastal Floodplain Mapping online viewer.¹⁷

6.0 FLOOD HAZARD RECOMMENDATIONS

6.1 Recommended FCL

- We recommend using the coastal FCL value of 5.2m Geodetic (or higher) for the proposed single-family residence as determined by the CFMP¹⁷. This minimum FCL elevation is typically defined as the top of the finished concrete slab-on-grade, or the underside of wooden floor joists.
- In order to achieve the FCL, we recommend either:
 - Structural methods: increasing the height of the foundation walls.
 - Fill methods: Building up the topography of the building area of the lot with structural fill.
 - A combination of the above methods.
- We recommend the placement and compaction of any structural fill as described in Section 8.2 of this Report where required to support footings inside the perimeter footing, or pavements.
- Engineered fill should be placed around the foundation walls with a slope no greater than 2H:1V. This fill

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should be protected against scour, erosion from flood flows, ice, and other debris.

- e. Building materials that would be resistant to damage by flood water should be used up to the FCL, at a minimum.
- f. Any property (e.g. equipment, goods, etc.) stored below the calculated FCL are subject to damage by flood waters. All mechanical, HVAC, electrical panels or other systems damageable by flood water must be located above the FCL.

6.2 Floodplain and Setback Requirements

- a. All construction shall be carried out within the requirements and recommendations of the environmental consultant (if applicable) and/or any defined jurisdictional setbacks, including any existing restrictive covenants, whichever is more stringent.
- b. Any building or environmental setbacks, or covenants supersede the geotechnical recommendations made in this Report.
- c. Though the CFMP final report¹⁵ makes mention of PNB setback distance calculations, that information had not been made public at the time of writing.
- d. We recommend a minimum setback of 15m from the PNB for any residential construction, which aligns with the PNB setback prescribed in Covenant FA14507/FA145308. A setback of 15m is also the minimum requirement of the *Flood Hazard Area Land Use Management Guidelines*¹⁶ and the CVRD Floodplain Management Bylaw, No. 600, 2020.¹³
- e. Due to future sea level rise, the setback is typically measured from the location of the FNB. However, the Property is low lying, and there is no location on the property where a setback from the FNB is possible. The CVRD allows Site Specific Exemptions for properties where meeting Guideline and/or Bylaw requirements would prevent development of the lot. Therefore, a flood plain bylaw exemption, under the Local Government Act (Section 524) is required. The land may be used safely for the use intended.
- f. Construction setbacks and FCL are subject to confirmation by qualified survey personnel. All setbacks and FCL shall be confirmed in the field at the time of construction.
- g. It is noted that CVRD Bylaw 600¹³ states that structural fill may not be used to support building foundations within a setback area.
- h. We understand the Client wishes to encroach on the PNB setback area with non-structural fill in order to slope foundation backfill of the proposed residence, as well as provided space for a small stone patio. With the clarification of Covenant FA14507/FA145308 by the CVRD¹² mentioned above, the encroachment of non-structural fill on the PNB setback area would be acceptable from a geotechnical standpoint only. However, it should be noted that a build-out of fill in the setback area could have the undesired effect of directing flood waters onto neighboring properties, and if they do not have an FCL that takes into account



sea level rise, it could put those buildings at increased risk of flooding.

6.3 Floodwater Discussion and Recommendations

- a. In the event of a design flood, it is possible that floodwaters from the ocean would inundate the Property. The general risk of flooding and the degree or severity of the floodwater increases as the sea level rises.
- b. A design storm event may affect or alter the present natural boundary and/or surrounding terrain in proximity to the Property. Severe wave action or flooding may manipulate the granular nature of the shoreline, in turn increasing the potential for future flooding and damage to the Property during major storm events.
- c. Provided any construction within the Property satisfies the minimum recommended FCL, we do not anticipate any damage to structures as a result of floodwater. However, any areas constructed below the recommended FCL, such as crawlspaces, could be subject to flooding during less than design flood events. In addition, while there is the possibility of damage to existing or future structures from debris carried by floodwaters, future single-family residential and/or ancillary building construction does not pose a significant added risk to the surrounding areas.
- d. Given sufficient notice, temporary flood protection measures such as sand bag protection to reduce floodwater intrusion onto the Property could be employed to reduce the potential of flood damage to the Property.
- e. Please refer to the attached *Appendix I: Flood Assurance Statement* from EGBC guidelines version 2.1¹⁴ for additional information.

7.0 DESIGN PHASE DISCUSSION AND RECOMMENDATIONS

7.1 Foundation Design and Construction

- a. Prior to construction, the new building area should be stripped to remove all unsuitable materials to provide an undisturbed natural subgrade for the footing support.
- b. Foundation loads should be supported on natural undisturbed material approved for use as a bearing stratum by our office or structural fill and may be designed using the following values. These values assume a minimum 0.5m depth of confinement or cover.
 - i. For foundations constructed on non-cohesive soils classified as compact to dense sand or gravel an SLS bearing pressure of 100 kPa, and a ULS bearing pressure of 135 kPa may be used for design purposes.
 - ii. For foundations constructed on a minimum thickness of 0.6m engineered fill, as outlined in Section 8.2 of this Report, an SLS bearing pressure of 150 kPa, and a ULS bearing pressure of 200 kPa may be used for design purposes.

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- c. The Geotechnical Engineer should evaluate the bearing soils at the time of construction to confirm that footings are based on appropriate and properly prepared founding material.
- d. Exterior footings should be provided with a minimum 0.5m depth of ground cover for frost protection purposes.
- e. Provided the recommendations in this report are followed, we expect that total building settlement will not exceed 25mm, with total differential movement not exceeding 15mm between column spacing.

7.2 Seismic Criteria

- a. No compressible or liquefiable soils were encountered during the soil investigation.
- b. Based on the BCBC 2018, Division B, Part 4, Table 4.1.8.4.A, *Site Classification for Seismic Site Response*, the soils and strata encountered during the soil investigation would be “Site Class D” (Stiff Soil).
- c. A peak ground acceleration of 0.295 g may be used for design purposes for a 1 in 2475 year seismic event (2% in 50 year return period) as recommended in BCBC 2018. Refer to the attached site-specific Seismic Hazard Calculation, from Natural Resources Canada.

7.3 Aquifer Discussion

Based on our review of the site, construction works are expected to be limited in depth (approximately 0.5m depth below existing ground), therefore will not have a significant impact on any shallow aquifer. However, residential construction does not typically impact an aquifer, and any potential impact to the aquifer from a residence has little consequence on oceanfront property, because of saltwater intrusion into the aquifer and the lack of downgradient use of groundwater.

7.4 Foundation Drainage

It is LEA’s opinion that perimeter drains are not required on this property. Due to the free draining nature of the soil, all water will flow vertically down to the water table. If the water table rises due to significant storms or SLR, the perimeter drain would not be able to drain anywhere. Flooding of the crawlspace when the water table rises due to flooding is expected, and should not damage the structure or contents of the building.

7.5 Stormwater Considerations

- a. The bearing grade is comprised of free draining sandy soil, the property is close to the ocean.
- b. Rainwater collected from the roof or hard surfaces may be directed to an infiltration system, or discharged to the ground surface.
- c. Final lot grading should direct water away from the buildings to a suitable discharge area. LEA recommends a minimum slope of 2% for a minimum distance of 2m from the building.



7.6 Future Development

- a. Over the required 100-year design life of the development SLR will likely expose the existing shoreline to increased wave action that may result in erosion of the foreshore area.
- b. Evaluation of the rate and/or extent of erosion along the foreshore area of the Property is beyond the scope of this Report. It should be noted however, that intertidal zones consisting of sand and gravels are typically susceptible to erosion or accretion by wave action and flooding, and we expect the alignment of the PNB will slowly shift over time.
- c. SLR is expected to be 1.0m by the year 2100. Provincial guidelines require that a 15.0m setback from the NB be maintained for the lifespan of the building¹⁶. This is referred to as the FNB. Given the low-lying nature of the Property, the FNB in a 100-year timeframe that considers 1.0m of SLR would end up close to the Driftwood Road frontage, effectively sterilizing the Property. However, the land may be used safely for the use intended (a single family residence), and a flood plain bylaw exemption is required under the Local Government Act (Section 524).
- d. It was noted that the PNB as shown on the attached recent Client-generated Topographic Site Plan has moved seaward of its location shown on the attached 2005 Proposed Bareland Subdivision Plan, indicating that the NB location is not stationary. LEA recommends the prescribed 15m setback from the NB be confirmed prior to pouring footings, to ensure that the residences meets setback requirements at the time of construction.
- e. If the Client wishes to address the issue of potential erosion along the NB within the foreshore area, then further investigation and analysis into the use and installation of mitigative measures is required.
- f. As a minimum, we recommend the foreshore and alignment of the NB be regularly monitored by the current and future property owners. Any notable regression of the NB, specifically following a significant storm event or winter season or otherwise, would require a reassessment of the foreshore conditions and construction of a revetment to maintain the NB in its approximate current location.

8.0 CONSTRUCTION PHASE

8.1 General Excavation – Future Building Sites

- a. Prior to construction, all unsuitable materials should be removed to provide a suitable base of support. Unsuitable materials include any non-mineral material such as vegetation, topsoil, peat, fill or other materials containing organic matter, as well as any soft, loose, or disturbed soils.
- b. Prior to placement of concrete footings, any bearing soils that have been softened, loosened, or otherwise disturbed during the course of construction should be removed, or else compacted following our

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recommendations for structural fill. Compaction will only be feasible if the soil has suitable moisture content and if there is access to heavy compaction equipment. If no structural fill is placed, a smooth-bladed clean up bucket should be used to finish the excavation.

- c. The Geotechnical Engineer is to confirm the removal of unsuitable materials and approve the exposed competent inorganic subgrade.
- d. Groundwater entering into any excavations should be controlled with a perimeter ditch located just outside of the building areas, conveying water away from the excavation.
- e. Trench and bulk excavation work should conform to Occupational Health and Safety guidelines. In general, excavations into fills, silt, clay or sands at depths greater than 1.2m may be subject to sloughing or caving that would be considered hazardous. Excavations deeper than 1.2m should be reviewed in the field by the Geotechnical Engineer. For preliminary design purposes, we expect the near surface soils may be stable at a 3H:4V slope configuration, assuming no seepage. Dewatering should be implemented as needed.

8.2 Structural Fill

- a. Where fill is required to raise areas that will support buildings, slabs, or pavements, structural fill should be used. The Geotechnical Engineer should first approve the exposed subgrade in fill areas, to confirm the removal of all unsuitable materials.
- b. Structural fill should be inorganic sand and gravel. If structural fill placement is to be carried out in the wet season, material with a fines content limited to 5% passing the 75µm sieve should be used, as such a material will not be overly sensitive to moisture, allowing compaction during rainy periods of weather.
- c. Structural fill should be compacted to a minimum of 95% of Modified Proctor maximum dry density (ASTM D1557) in foundation and floor slab areas, as well as in paved roadway and parking areas.
- d. Structural fills under foundations, roadways, and pavements should include the zone defined by a plane extending down and outward a minimum 0.5m from the outer edge of the foundation at an angle of 45° from horizontal to ensure adequate subjacent support. This support zone is shown below in Figure 8.2.

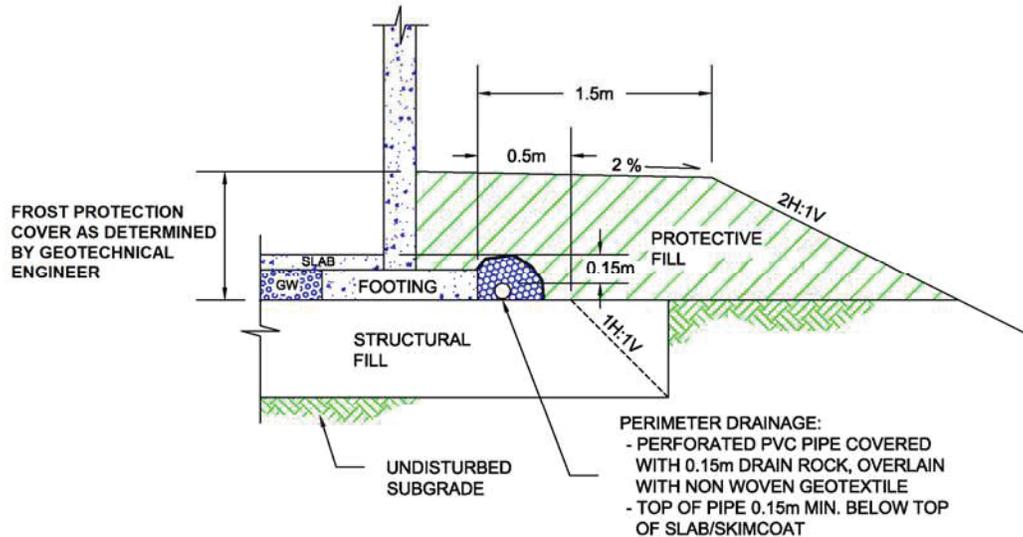


Figure 8.2 – Typical Section, Structural Fill

- e. Compaction of fill should include moisture conditioning as needed to bring the soils to the optimum moisture content and compacted using vibratory compaction equipment in lift thicknesses appropriate for the size and type of compaction equipment used.
- f. A general guideline for maximum lift thickness is no more than 100mm for light hand equipment such as a “jumping-jack,” 200mm for a small roller and 300mm for a large roller or heavy (>500 kg) vibratory plate compactor or a backhoe mounted hoe-pac or a large excavator mounted hoe-pac, as measured loose.
- g. It should be emphasized that the long-term performance of buildings, slabs, and pavements is highly dependent on the correct placement and compaction of underlying structural fills. Consequently, we recommend that structural fills be observed and approved by the Geotechnical Engineer. This would include approval of the proposed fill materials and performing a suitable program of compaction testing during construction.

9.0 CONCLUSIONS

9.1 Local Government Conformance Statement

- 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 a permanent single-family residence of conventional construction methods. Additionally, for flood plain bylaw exemption, as required by the *Local Government Act* (section 524), “the land may be used safely for the use intended” (single family residence). This conclusion considers the probability of a geotechnical failure resulting in property damage of less than:
 - i. 1 in 200 year flood event, accounting for sea level rise until the year 2100;

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- ii. 10% in 50 years for all other geotechnical hazards, and
- iii. 2% in 50 year for seismic events.

9.2 Geotechnical and Quality Assurance Statement

The BCBC 2018 requires that a geotechnical engineer be retained to provide Geotechnical Assurance services for the construction of buildings that are outside of Part 9 of the BCBC. Geotechnical Assurance services include review of the geotechnical components of the plans and supporting documents, and responsibility for field reviews of these components during construction.

9.3 Acknowledgements

- a. We acknowledge that this Report has been prepared for, and at the expense of Lee Deslauriers. Lewkowich Engineering Associates Ltd. acknowledges that this Report has been prepared for the Comox Valley Regional District as a precondition to the issuance of: A Site Specific Exemption under Section 910 of the *Local Government Act*, and any conditions in this report will be included in a Restrictive Covenant under Section 219 of the *Land Title Act* and files against the title of the subject property, or a building or development permit.
- b. 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, and that NO Disaster Financial Assistance Funding is available for the building or its contents.
- c. We have not acted for or as an agent of the Comox Valley Regional District in the preparation of this Report. We acknowledge the Comox Valley Regional District and the Approving Officer(s) are authorized users of this Report. We acknowledge that this Report may be registered against the title of the Property as a restrictive covenant.

9.4 Limitations

The conclusions and recommendations submitted in this Report are based upon data obtained from a limited number of widely spaced subsurface explorations and surface observations. The nature and extent of variations in subsurface soils may not become evident until construction or further investigation. The recommendations given are based on the subsurface soil conditions encountered, current construction techniques, and generally accepted engineering practices. No other warrantee, expressed or implied, is made. Subgrade conditions are known only at the test hole locations and have been used to infer conditions throughout the site in preparation of this Report. 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.

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10.0 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.

Tony Williamson, B.Sc.
 Intermediate Technician



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

11.0 ATTACHMENTS

1. LEA, drawing titled Test Pit Location Plan, drawing number E0407-01, dated January 11, 2022.
2. Client, Topographic Site Plan (with LEA markups), dated January 7, 2022.
3. McElhanney Consulting Services Ltd., drawing titled Proposed Bareland Subdivision Plan, dated May 20, 2005.
4. LEA, Test Pit Logs TP21-01 to TP21-03, dated November 5, 2021
5. EGBC, Appendix I: Flood Assurance Statement.
6. 2015 National Building Code Seismic Hazard Calculation, Site: 49.857N 125.105W, accessed January 11, 2022.

12.0 REFERENCES

1. BC Assessment, Property Assessment Search,
 < <https://www.bcasessment.ca/Property/AssessmentSearch?bcalogin=1&act=>>, accessed January 11, 2022
2. Comox Valley Regional District, Bylaw No. 520, titled *Rural Comox Valley Zoning Bylaw, No. 520, 2019*, amended September 15, 2020.
3. Comox Valley Regional District, online map viewer *iMap*, 49.857N 125.105W,
 <<https://mapviewer.imaptoo.ca/secure/>>, accessed January 11, 2022.
4. Comox Valley Regional District, Bylaw No. 337, titled *Rural Comox Valley Official Community Plan*,

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 DATE: July 25, 2022



amended November 24, 2020.

5. Fyles JG, Geologic Survey of Canada – Department of Mines and Technical Surveys, map titled *Surficial Geology Oyster River – Comox, Nanaimo and Sayward Districts, Vancouver Island, British Columbia*, map 49-1959, sheets 92 F/14, date of mapping 1956-1957.
6. Jungen J, prepared for British Columbia Ministry of Environment, map titled *Soils of South Vancouver Island, British Columbia, Soil Survey Report No. 44, Sheet 6*, date of mapping 1975-1978.
7. Guthrie RH and Penner CR, prepared for British Columbia Ministry of Environment, map titled *Vancouver Island Surficial Geology*, dated 2005.
8. British Columbia Ministry of Environment and Climate Change Strategy, online map viewer *BC Water Resources Atlas*, 49.857N 125.105W, <<https://maps.gov.bc.ca/ess/hm/wrbc/>>, accessed January 11, 2022.
9. British Columbia Geological Survey, online map viewer *MapPlace 2, Bedrock Geology*, 49.857N 125.105W, <<https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/mapplace>>, accessed December 2, 2021.
10. Usher JL, Geological Survey of Canada – Department of Mines and Technical Surveys, Bulletin 21, titled *Ammonite Faunas of the Upper Cretaceous Rocks of Vancouver Island, British Columbia*, dated 1952.
11. Canadian Geotechnical Society, titled *Canadian Foundation Engineering Manual 4th Edition*, dated 2006.
12. Chow B (CVRD); Email to: Williamson T, Hudec C, Deslauriers L, Mathers J; Dated January 21, 2022.
13. Comox Valley Regional District, Bylaw No. 600, titled *Floodplain Management Bylaw No. 600, 2020*, adopted April 28, 2020.
14. Engineers and Geoscientists British Columbia, professional practice guidelines titled *Legislated Flood Assessments in a Changing Climate in BC*, version 2.1, updated August 28, 2018.
15. Kerr Wood Leidal Consulting Engineers, report titled *Coastal Flood Mapping Project Final Report*, dated April 23, 2021.
16. British Columbia Ministry of Water, Land and Air Protection, report titled *Flood Hazard Area Land Use Management Guidelines*, amended by British Columbia Ministry of Forest, Lands, Natural Resource Operations and Rural Development, January 1, 2018.
17. Comox Valley Regional District, online map viewer *Regulatory Coastal Floodplain Mapping*, <<https://cvrld.maps.arcgis.com/apps/webappviewer/index.html?id=66ecab2d84c04195a4018096aa4ab9c8>>, accessed January 5, 2022.



REV No.	DATE	BY	P.Eng.	REVISION DESCRIPTION

DRAWING TITLE		TEST PIT LOCATION PLAN	
PROJECT NAME		8772 DRIFTWOOD ROAD, SARATOGA BEACH, BC	
LEGAL DESCRIPTION		<small>STRATA LOT 8, SECTIONS 8 AND 17, TOWNSHIP 6, COMOX DISTRICT AND PART OF THE FORMER BED OF THE STRAIT OF GEORGIA STRATA PLAN V87078, TOGETHER WITH AN INTEREST IN THE COMMON PROPERTY IN PROPORTION TO THE UNIT ENTITLEMENT OF THE STRATA LOT AS SHOWN ON FORM V</small>	

ENGINEER'S SEAL	
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NOTE: LOT LINES AND STRUCTURE LOCATIONS ARE APPROXIMATE

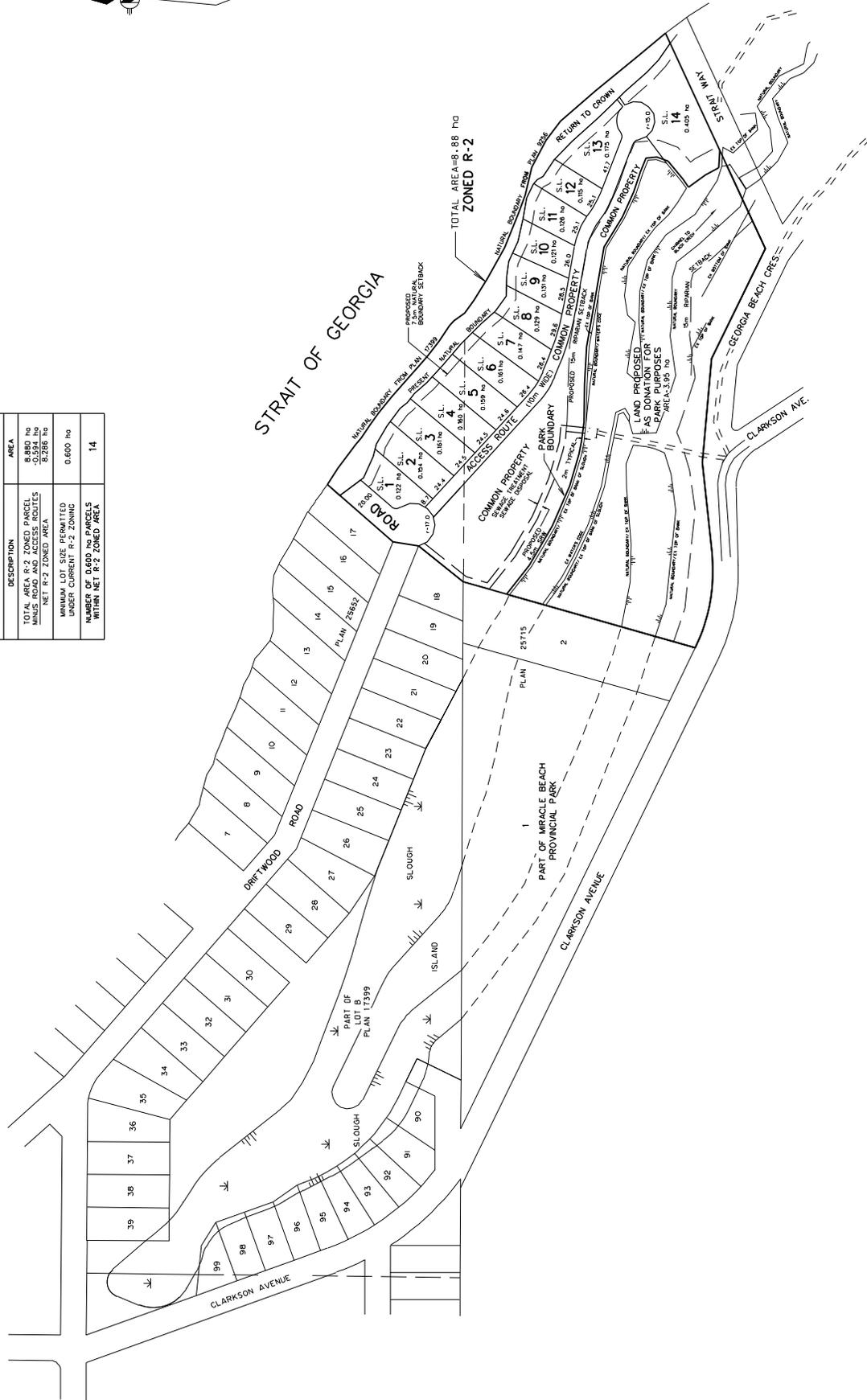
PLOT DATE	2022-01-12
REVIEWED BY	JB
SCALE	1:500
DRAWING No.	E0407
PROJECT No.	E0407
DRAWN BY	NV
DRAWING No.	E0407-01



**Lewkovich
Engineering
Associates Ltd.**



SCHEDULE OF LOT DENSITY CALCULATION	
DESCRIPTION	AREA
TOTAL AREA R-2 ZONED PARCEL MINUS ROAD AND ACCESS ROUTES	8,880 ha
NET R-2 ZONED AREA	8,288 ha
MINIMUM LOT SIZE PERMITTED UNDER CURRENT R-2 ZONING	0.600 ha
NUMBER OF 0.600 ha PARCELS WITHIN NET R-2 ZONED AREA	14



		TRI NATIONAL REAL ESTATE INC PLA-4 PART OF LOT B, PLAN 17398 AND LOT 4, PLAN 9256 SECS 8 AND 17, TP 5, CONDOX DISTRICT SPROUTER BEACH, B.C.	
McElhanney Consulting Services Ltd. 485 SIXTH STREET COURTENAY, B.C. V9N 6V4 FAX: (250) 336-7700 PH: (250) 336-5495		SCALE 1:1500 ALL DIMENSIONS ARE SHOWN IN METERS	
Date: _____ Drawn by: _____ Checked by: _____ Approved by: _____	Date: _____ Drawn by: _____ Checked by: _____ Approved by: _____	Date: _____ Drawn by: _____ Checked by: _____ Approved by: _____	Date: _____ Drawn by: _____ Checked by: _____ Approved by: _____

McElhanney Consulting Services Ltd. is a company of McElhanney Consulting Services Ltd. and is not a separate legal entity. All dimensions are shown in meters.



TEST PIT LOG

File Number: E0407
 Client: Lee Deslauriers
 Project: 8772 Driftwood Road
 Location: Black Creek, BC

TP21-01

Water Level	Depth (m)	Soil Symbol	Description
			Ground Surface
	0.0		0.0-0.1m Sand, gravel, organics (fine-grained, grass, rootlets), compact, dark grey-brown, damp.
			0.1-0.3m Sand, gravel, roots, compact, grey-brown, moist.
	0.5		0.3-1.4m Sand, gravel, cobble, compact, grey, moist.
	1.0		
	1.5		1.4-1.7m Sand, cobble, gravel, compact to dense, grey, moist.
			1.7-2.1m Sand, cobble, gravel, compact, grey, wet.
	2.0		
			Moderate seepage encountered at 1.7m End test pit at 2.1m
	2.5		
	3.0		

Logged By: Tony Williamson, B.Sc. Date: November 4, 2021
 Reviewed By: Chris Hudec, M.A.Sc., P.Eng. Page 1 of 1
 Digging Method: Bobcat E35i Mini-Excavator

2351B Rosewall Crescent
 Courtenay, British Columbia, V9N 8R9
 Phone: 250-334-0384
 Fax: 250-334-9601
 Email: geotech@lewkowich.com



TEST PIT LOG

File Number: E0407 TP21-02
 Client: Lee Deslauriers
 Project: 8772 Driftwood Road
 Location: Black Creek, BC

Water Level	Depth (m)	Soil Symbol	Description
			Ground Surface
	0.0		0.0-0.2m Sand, gravel, organics (fine-grained, grass, rootlets), compact, dark grey-brown, damp.
			0.2-0.4m Sand, gravel, roots, compact, grey-brown, moist.
	0.5		0.4-1.6m Sand, gravel, cobble, compact, grey, moist.
	1.0		
	1.5		
			1.6-2.1m Sand, cobble, gravel, compact, grey, wet.
	2.0		
			Weak to moderate seepage encountered at 1.7m End test pit at 2.1m
	2.5		
	3.0		

Logged By: Tony Williamson, B.Sc. Date: November 4, 2021
 Reviewed By: Chris Hudec, M.A.Sc., P.Eng. Page 1 of 1
 Digging Method: Bobcat E35i Mini-Excavator

2351B Rosewall Crescent
 Courtenay, British Columbia, V9N 8R9
 Phone: 250-334-0384
 Fax: 250-334-9601
 Email: geotech@lewkowich.com



TEST PIT LOG

File Number: E0407
 Client: Lee Deslauriers
 Project: 8772 Driftwood Road
 Location: Black Creek, BC

TP21-03

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
0.0-0.1m		0.0-0.1m Sand, gravel, organics (fine-grained, grass, rootlets), compact, dark grey-brown, damp.
0.1-2.4m		0.1-2.4m Sand, gravel, some cobble, compact, brown, damp (import pit run gravel).
0.5		
1.0		
1.5		
2.0		
2.5		2.4-2.6m Sand, gravel, cobble, compact, grey, moist.
2.5		
3.0		No seepage encountered End test pit at 2.6m

Logged By: Tony Williamson, B.Sc. Date: November 4, 2021
 Reviewed By: Chris Hudec, M.A.Sc., P.Eng. Page 1 of 1
 Digging Method: Bobcat E35i Mini-Excavator

2351B Rosewall Crescent
 Courtenay, British Columbia, V9N 8R9
 Phone: 250-334-0384
 Fax: 250-334-9601
 Email: geotech@lewkowich.com

FLOOD ASSURANCE STATEMENT

Note: This statement is to be read and completed in conjunction with the current Engineers and Geoscientists BC *Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC* ("the guidelines") and is to be provided for flood assessments for the purposes of the *Land Title Act*, Community Charter, or the *Local Government Act*. Defined terms are capitalized; see the Defined Terms section of the guidelines for definitions.

To: The Approving Authority

Date: July 25, 2022 LEA File# E0407.01r1

Comox Valley Regional District

600 Comox Road, Comox, BC, V9N 3P6

Jurisdiction and address

With reference to (CHECK ONE):

- Land Title Act* (Section 86) – Subdivision Approval
- Local Government Act* (Part 14, Division 7) – Development Permit
- Community Charter (Section 56) – Building Permit
- Local Government Act* (Section 524) – Flood Plain Bylaw Variance
- Local Government Act* (Section 524) – Flood Plain Bylaw Exemption

For the following property ("the Property"):

SL8, PL, VIS6179, Sec. 8, TP. 5, LD 15 & Sec 17, Together With an Interest in the Common Property in Proportion to the Unit Entitlement of the SL, as Shown on Fm. 1 or V; 8772 Driftwood Road

Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a Qualified Professional and is a Professional Engineer or Professional Geoscientist who fulfils the education, training, and experience requirements as outlined in the guidelines.

I have signed, sealed, and dated, and thereby certified, the attached Flood Assessment Report on the Property in accordance with the guidelines. That report and this statement must be read in conjunction with each other. In preparing that Flood Assessment Report I have:

[CHECK TO THE LEFT OF APPLICABLE ITEMS]

- 1. Consulted with representatives of the following government organizations:
Comox Valley Regional District
- 2. Collected and reviewed appropriate background information
- 3. Reviewed the Proposed Development on the Property
- 4. Investigated the presence of Covenants on the Property, and reported any relevant information
- 5. Conducted field work on and, if required, beyond the Property
- 6. Reported on the results of the field work on and, if required, beyond the Property
- 7. Considered any changed conditions on and, if required, beyond the Property
- 8. For a Flood Hazard analysis I have:
 - 8.1 Reviewed and characterized, if appropriate, Flood Hazard that may affect the Property
 - 8.2 Estimated the Flood Hazard on the Property
 - 8.3 Considered (if appropriate) the effects of climate change and land use change
 - 8.4 Relied on a previous Flood Hazard Assessment (FHA) by others
 - 8.5 Identified any potential hazards that are not addressed by the Flood Assessment Report
- 9. For a Flood Risk analysis I have:
 - 9.1 Estimated the Flood Risk on the Property
 - 9.2 Identified existing and anticipated future Elements at Risk on and, if required, beyond the Property
 - 9.3 Estimated the Consequences to those Elements at Risk

FLOOD ASSURANCE STATEMENT

10. In order to mitigate the estimated Flood Hazard for the Property, the following approach is taken:
- 10.1 A standard-based approach
 - 10.2 A Risk-based approach
 - 10.3 The approach outlined in the guidelines, Appendix F: Flood Assessment Considerations for Development Approvals
 - 10.4 No mitigation is required because the completed flood assessment determined that the site is not subject to a Flood Hazard
11. Where the Approving Authority has adopted a specific level of Flood Hazard or Flood Risk tolerance, I have:
- 11.1 Made a finding on the level of Flood Hazard or Flood Risk on the Property
 - 11.2 Compared the level of Flood Hazard or Flood Risk tolerance adopted by the Approving Authority with my findings
 - 11.3 Made recommendations to reduce the Flood Hazard or Flood Risk on the Property
12. Where the Approving Authority has not adopted a level of Flood Hazard or Flood Risk tolerance, I have:
- 12.1 Described the method of Flood Hazard analysis or Flood Risk analysis used
 - 12.2 Referred to an appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk
 - 12.3 Made a finding on the level of Flood Hazard or Flood Risk tolerance on the Property
 - 12.4 Compared the guidelines with the findings of my flood assessment
 - 12.5 Made recommendations to reduce the Flood Hazard or Flood Risk
13. Considered the potential for transfer of Flood Risk and the potential impacts to adjacent properties
14. Reported on the requirements for implementation of the mitigation recommendations, including the need for subsequent professional certifications and future inspections.

Based on my comparison between:

[CHECK ONE]

- The findings from the flood assessment and the adopted level of Flood Hazard or Flood Risk tolerance (item 11.2 above)
- The findings from the flood assessment and the appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk tolerance (item 12.4 above)

I hereby give my assurance that, based on the conditions contained in the attached Flood Assessment Report:

- For subdivision approval, as required by the *Land Title Act* (Section 86), "that the land may be used safely for the use intended":

[CHECK ONE]

- With one or more recommended registered Covenants.
- Without any registered Covenant.
- For a development permit, as required by the *Local Government Act* (Part 14, Division 7), my Flood Assessment Report will "assist the local government in determining what conditions or requirements it will impose under subsection (2) of this section [Section 491 (4)]".

- For a building permit, as required by the *Community Charter* (Section 56), "the land may be used safely for the use intended":

[CHECK ONE]

- With one or more recommended registered Covenants.
- Without any registered Covenant.
- For flood plain bylaw variance, as required by the *Flood Hazard Area Land Use Management Guidelines* and the *Amendment Section 3.5 and 3.6* associated with the *Local Government Act* (Section 524), "the development may occur safely".
- For flood plain bylaw exemption, as required by the *Local Government Act* (Section 524), "the land may be used safely for the use intended".

FLOOD ASSURANCE STATEMENT

I certify that I am a Qualified Professional as defined below.

July 25, 2022

Date

Chris Hudec

Prepared by

Chris Hudec

Name (print)

Chris Hudec

Signature

Reviewed by

Name (print)

Signature

1900 Boxwood Road

Address

Nanaimo, BC, V9S 5Y2

(250) 756 0355

Telephone

chudec@lewkowich.com

Email



(Affix PROFESSIONAL SEAL here)

If the Qualified Professional is a member of a firm, complete the following:

I am a member of the firm Lewkowich Engineering Associates Ltd.

and I sign this letter on behalf of the firm.

(Name of firm)

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 49.857N 125.105W

User File Reference: 8772 Driftwood Road, Saratoga Beach, BC

2022-01-11 19:59 UT

Requested by: Tony Williamson, Lewkowich Engineering Associates Ltd.

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.324	0.213	0.144	0.053
Sa (0.1)	0.509	0.336	0.227	0.081
Sa (0.2)	0.630	0.423	0.289	0.110
Sa (0.3)	0.649	0.434	0.294	0.114
Sa (0.5)	0.613	0.398	0.262	0.098
Sa (1.0)	0.427	0.267	0.167	0.060
Sa (2.0)	0.276	0.168	0.100	0.033
Sa (5.0)	0.098	0.057	0.032	0.009
Sa (10.0)	0.035	0.020	0.011	0.004
PGA (g)	0.295	0.195	0.131	0.047
PGV (m/s)	0.506	0.323	0.203	0.065

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s²). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information