



STAFF REPORT

TO: CHIEF ADMINISTRATIVE OFFICER
FROM: BRIGID REYNOLDS, CONSULTING TOWN PLANNER
SUBJECT: DP2026-01-01 AMENDMENT – SLOPES PHASE 6 V
MEETING DATE: APRIL 28, 2026
SUBJECT PROPERTY: REMAINDER LOT A, SECTION 6, RENFREW DISTRICT PLAN EPP103677 EXCEPT PART ON PLANS EPP104021 AND EPP109124 AND EPP138345 – P.I.D. 031-159-851

PURPOSE

The applicant is requesting an amendment to DP2026-01-01 pursuant to Natural Hazard Development Permit Area (DPA 2) for steep slopes and wildfire for the proposed subdivision application SD2025-06 Slopes Ph 6 to create 15 lots.

BACKGROUND

The applicant has applied to create 15 lots in phase 6 of the Slopes subdivision of 1.57 ha (3.9 ac) in size. The property is zoned Suburban Residential (R-1) and the required minimum lot size is 600 m². Lot coverage is 30%. Single family dwelling units with one attached or detached accessory dwelling unit are permitted in this zone. Proposed lots range in size from 684 m² to 1353 m².

The subdivision application has been accepted but the preliminary review letter was issued on March 12, 2026. Council approved the original development permit at its February 24, 2026, meeting to permit development within the Watercourse and Streamside Protection Development Permit Area (DPA 1) and to vary Section 6.11 of the Subdivision, Works and Services Bylaw No. 1082-2022 to increase the size of the Streamside Protection and Enhancement Area within five of the proposed lots.

In support of this DP application, the applicant has provided

- Wildfire Hazard Assessment, prepared by Strathcona Forestry Consulting, dated April 7, 2026
- Geotechnical Hazard Assessment, prepared by Lewkowich Engineering Ltd., dated August 26, 2025

DISCUSSION

The Wildfire Hazard Assessment determined the subject proposal currently has a Moderate Fuel Hazard Assessment rating and a Moderate Local Wildfire Threat Rating. Contributing factors include low fuel loading, good accessibility, and moderate slope with a warm aspect. The Assessment concludes that post-development, the threat rating is expected to be low providing the recommendations contained in the report are followed through design planning and construction – and continue after buildout.

A condition of this DP is that this assessment to be registered as a section 219 covenant prior to final approval of the subdivision. This covenant will then inform subsequent property owners of their responsibilities to mitigate for the related wildfire risks.

The Geotechnical Hazard Assessment identifies that the subject area contains average slope angles ranging from 5 to 10 degrees (9 to 18%), with localized areas up to 15 degrees (27%). The Assessment contains recommendations for foundation design, site grading, subgrade preparation, structural fill, foundation drainage, stormwater management, and pavement design.

In particular the flood hazard assessment requires lots adjacent to the drainage channel (proposed lots 1, 2, 13, 14 & 15) shall maintain minimum flood construction level (FCL) of 1.5m above the centerline elevation of the drainage channel for any adjacent development as the minimum elevation of the underside of a wooden floor system or top of a concrete slab for any Habitable Area. This is to be confirmed by qualified surveyor. The report concludes that from a geotechnical point of view, and provided the recommendations in this report are followed, the land is considered safe for the intended use.

A condition of this DP is to require this assessment to be registered as a section 219 covenant prior to final approval of the subdivision. This covenant will then inform subsequent property owners of their responsibilities to mitigate for the related geotechnical and flood risks.

IMPLICATIONS

a. Financial:

Application fees are collected to cover the cost of processing this application.

b. Policy/Legislation:

The subject property is in the Natural Hazard Development Permit Area (DPA 3) pursuant to the Official Community Plan for wildfire hazard and steep slopes.

- c. **Strategic Priority:**
N/A
- d. **Sustainability:**
N/A
- e. **Communication:**
Development Approval Procedure Bylaw No. 1109 does not require notice for DP amendment applications.
- f. **Staffing Implication:**
Processing this application is part of the Planning Department's regular duties.

Options

- 1) Approve the development permit amendment for this application.
- 2) Approve the development permit amendment with additional requirements.
- 3) Deny the development permit for this application.

Recommendation

The Contract Planner recommends that Council approve DP2026-01-01 to permit development within the Natural Hazard Development Permit Area (DPA 3) for steep slopes and wildfire for the property legally described as Remainder Lot A, Section 6, Renfrew District Plan EPP103677 except Part on Plans EPP104021 and EPP109124 and EPP138345 (PID 031-159-851) subject to:

- a. All works being consistent with
 - i. Wildfire Hazard Assessment, prepared by Strathcona Forestry Consulting, dated April 7, 2026 and
 - ii. Geotechnical Hazard Assessment, prepared by Lewkowich Engineering Ltd., dated August 26, 2025
- b. Registration of a section 219 covenant for each assessment prior to final approval of the subdivision to indemnify and hold the Town harmless.

Signed:

Brigid Reynolds

Brigid Reynolds RPP MCIP Contract Planner

Concurrence:

John T

John Thomas Chief Administrative Officer

ATTACHMENT 2
Wildfire Hazard Assessment, prepared by
Strathcona Forestry Consulting, dated April 7, 2026

ATTACHMENT 3
Geotechnical Hazard Assessment, prepared by
Lewkowich Engineering Ltd., dated August 26, 2025



Strathcona Forestry Consulting



Wildfire Hazard Assessment

The Slopes at the Lake - Phase 6

Prepared for: 0697413 BC Ltd.

Section 22 - Disclosure harmful to Personal Privacy

Prepared by: Strathcona Forestry Consulting
PO Box 387 Stn Mn
Duncan BC V9L 3X5
E: strathcona.fc@shaw.ca

7 April 2026

Executive Summary

In accordance with the Town of Lake Cowichan’s Development Permit Area guidelines for the wildfire interface zone, the numbered company 0697413 BC Ltd. retained Strathcona Forestry Consulting to conduct a wildfire hazard assessment of proposed Phase 6 at The Slopes at the Lake, a residential subdivision at Lake Cowichan. The Slopes at the Lake and surrounding area are designated in the interface (“wildland urban interface” or “wui”) – an area where combustible wildland fuels are found adjacent to structures and/or facilities. This report provides an assessment of the current and projected local wildfire threat. The report also contains recommendations on how to minimize the threat of wildfire.

Assessment determined that the wildfire threat at Phase 6 is currently Moderate. Fuel loading (vegetative cover) has been removed from the gently sloped site. The site is generally accessible and is connected to community water. The Slopes at the Lake has been certified since 2017 as a FireSmart Neighbourhood. The threat rating post-development at Phase 6 can be expected to be Moderate or even Lower due to the continued implementation of FireSmart strategies. Under the provincial Wildfire Threat Rating system, ratings must be moderate or low to be considered acceptable.

Strategic deployment of development standards will help protect communities from wildfire (FireSmartCanada.ca; FireSmartBC.ca). FireSmart principles have proven to be effective at reducing losses even during the most extreme wildfire conditions.

In my professional opinion, if the recommendations contained in this report are followed through design planning and construction – and continue after buildout of Phase 6, the risk of wildfire can be reduced to a level acceptable to ensure the safety and resiliency of the intended development.

Fire prevention and protection in the interface zone are ongoing processes. Long-term implementation of FireSmart mitigation is essential to ensure protection for life, property, and ecological processes in Lake Cowichan’s wildfire interface.

Introduction

In accordance with the Town of Lake Cowichan's Development Permit Area for wildfire, the numbered company 0697413 BC Ltd. retained Strathcona Forestry Consulting to conduct a wildfire hazard assessment of The Slopes at the Lake's Phase 6, proposed for single-family residential development. This report provides an assessment of current and projected wildfire risk and hazard rating at the subject proposal, and provides recommendations how to reduce the local wildfire threat.

The interface (wildland urban interface/wildland residential interface) describes any area where combustible wildland fuels are found adjacent to homes or other buildings. Under Section 488 of the Local Government Act, development permits may be designated where protection of Natural Hazard Lands is justified. Natural hazards, including wildfires, may put life and property, and local biodiversity, at risk if development is inappropriately situated and not well planned. Areas assigned at high or extreme risk from wildfire are designated in a Development Permit Area (DPA). The objective of the DPA is to properly manage the risks associated with the hazard (interface wildfires).

Hazard Assessment

This report describes the vegetation, terrain, and infrastructure on and around the subject proposal. Assessment criteria are based on Rating Interface Wildfire Threats in British Columbia (<https://www2.gov.bc.ca/>), FireSmart (FireSmart, Protecting Your Community From Wildfire (Second Edition. Partners in Protection, 2003 (<https://www.firesmartcanada.ca/>), Fuel Management Prescription Guidance 2025 (https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/fire-fuel-management/fuels-management/2025_fuel_management_prescription_guidance.pdf) and the Home Owners FireSmart Manual (BC Edition (<https://www2.gov.bc.ca/assets/gov/public-safety-and.../homeowner-firesmart.pdf>)). Fire behavior modeling is standardized after the Canadian Forest Fire Danger Rating System (CFFDRS). Fuel Types listed in this assessment are customized from the CFFDRS Fuel Type list for applicability in south coastal BC. Wildfire threat assessment was conducted through an analysis of fuel threats in and adjacent to the proposed development, as described in the 2025 Wildfire Threat Assessment Guide and Worksheets (MFLNRO & BCWS, 2025). This process, used by qualified environmental professionals, employs physical and biophysical factors,

combined with fuel hazards, to determine the wildfire threat (low, moderate, high, or extreme). Fire risk is also based on four classes: low, moderate, high, and extreme. Recommendations in this report conform to BC Building Code standards and fire hazard planning authorized by Section 3(2) of the BC Fire Services Act.

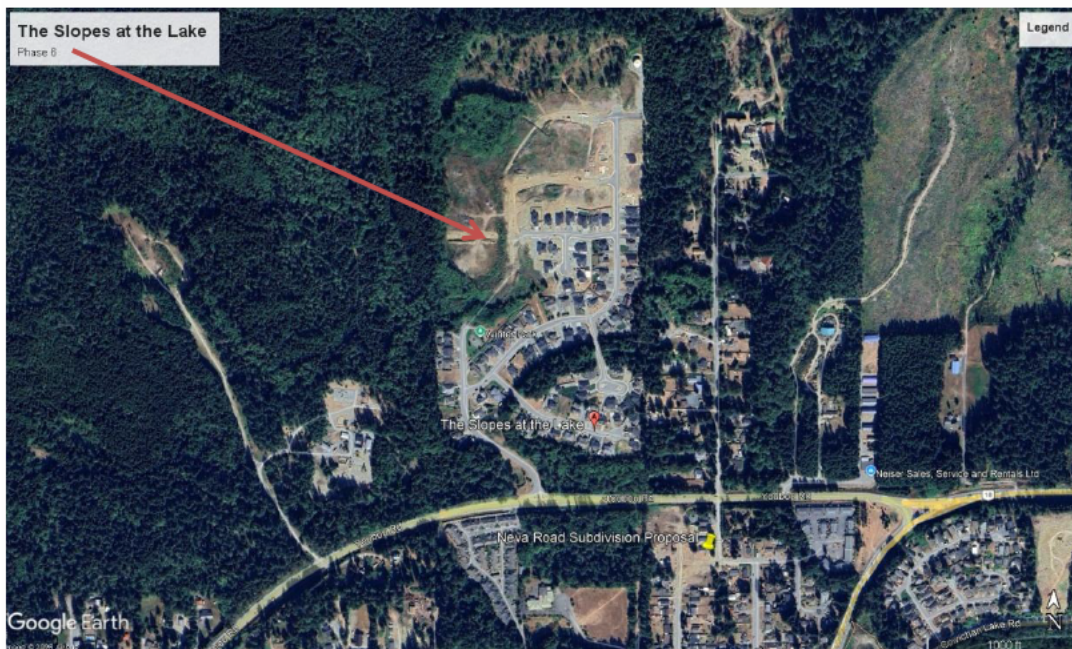
Field Inspection: Field inspection took place in April 2026. Field investigation entailed an analysis of the interface fire hazard that the subject site and surrounding lands are exposed to, from the perspective of the general area and local site, up to 100+ m from property boundaries, where applicable.

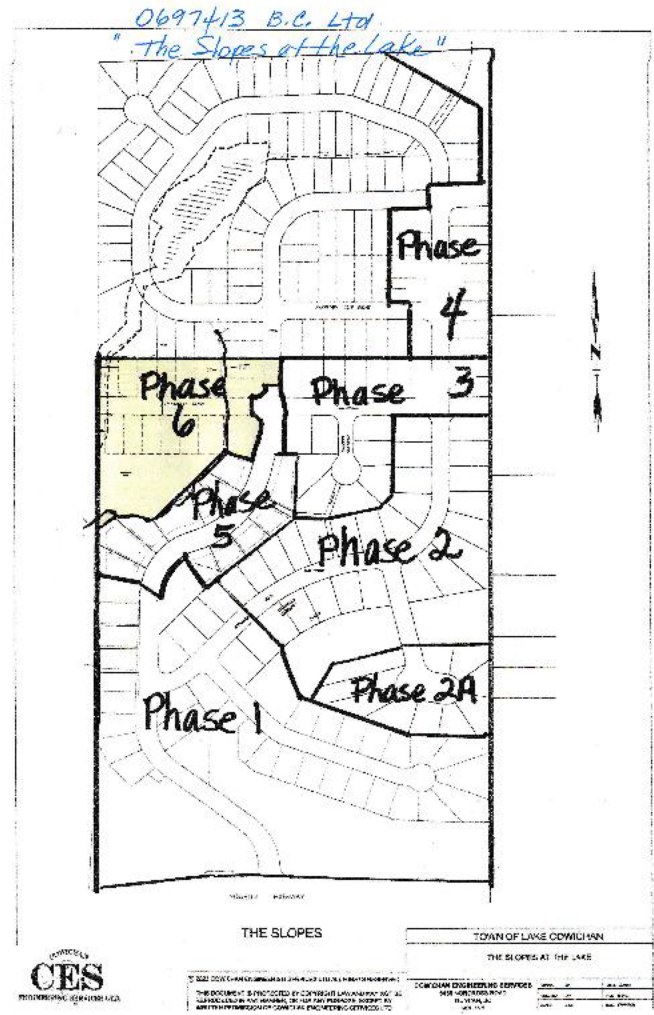
Location and Description of Proposal:

The 5.83 acre Phase 6 contains 15 lots in the central eastern portion of The Slopes at the Lake (see location map, site plan, and photos below and following pages). Existing development at The Slopes consists of well-maintained single-family and properties accessed by a looping roadway system and serviced by community water.

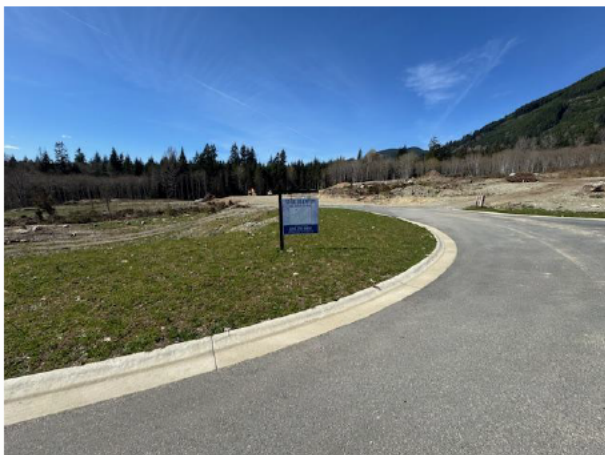
Approximately 25.3 acres remain undeveloped at the Slopes. The Slopes at the Lake has been certified as a FireSmart Neighbourhood (now known as a FireSmart Collective - 2026) since 2017.

Phase 6 will be built around a western extension of Greenwell Drive. Tree cover has been removed from the site itself. The site borders a forested riparian buffer area in the east.





Phase 6 is located in the central eastern area of The Slope at the Lake.



View of Phase 6 looking west.



View of Phase 6 looking southwest from Winter Drive.



View of Phase 6 looking west from Winter Drive.

Wildfire Hazard and Risk

Wildfire hazard is a process, a phenomenon or a human activity that may cause loss of life, injury, or other health impacts, property damage, social and economic disruption or environmental degradation. Wildfire hazard can be described qualitatively as a fire environment—fuel, weather, topography, and ignitions.

Risk assessment for wildfire and its impacts to communities considers both the likelihood of a wildfire and the potential consequence associated with that likelihood. For example, if the fuel (i.e., the hazard) ignites and the fire spreads towards the community (probability), the wildfire can become a threat to life and property (consequence) with an associated risk of loss.

Determination of the wildfire hazard and risk involves a detailed assessment of potential fire behaviour, field-reviewed fuel characteristics, proximity of fuel to the community, local fire spread patterns, topographical considerations and local factors. Wildfire behaviour targets aimed at reducing wildfire risk are based on conditions reflecting the 90th percentile of the Forest Fire Weather Index (FFWI) values.

Values at Risk (e.g., subject proposal) are assessed for their vulnerability to wildfire. Priority values must be strategically located to ensure sufficient defensible space. Ideally, structures should align with FireSmart principles, which include practices such as reducing flammable vegetation, maintaining clear access routes, and ensuring non-combustible zones around structures.

Fire Behaviour. Fire behaviour has three components: weather, topography, and fuel. Fire behavior predicts how forest and wildland vegetation (fuel) will burn under different conditions. Weather and topography cannot be changed; alteration of fuels across the landscape is the only way to lower fire intensity and change fire behaviour.

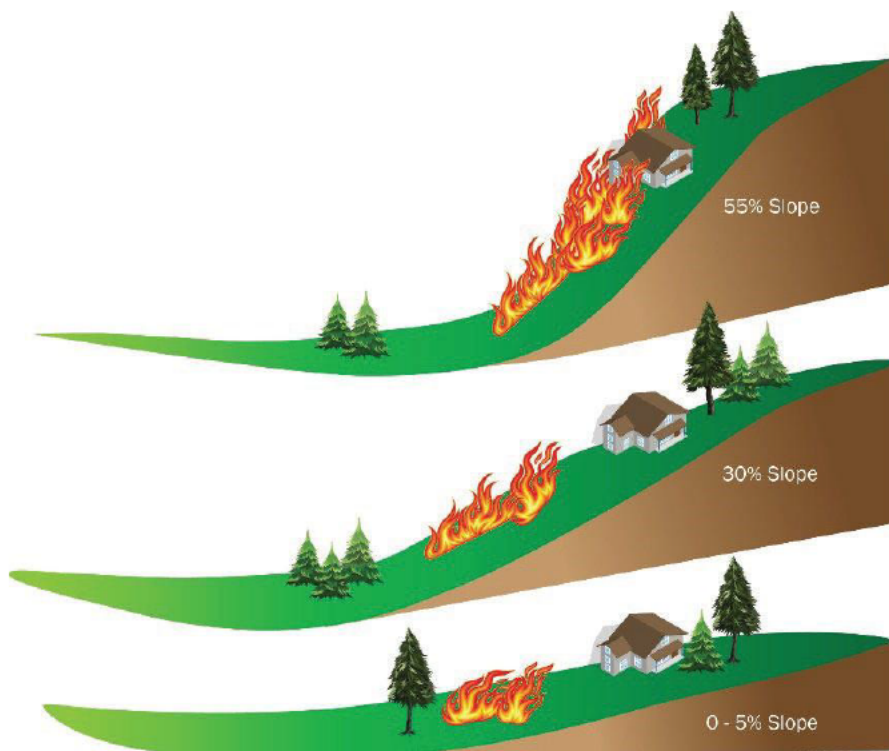
Biogeoclimatic Classification. The Biogeoclimatic Ecosystem Classification (BEC) System divides British Columbia into 12 forested biogeoclimatic or ecological zones. Each zone is divided into subzones based on differences in regional climate. Subzones are further differentiated into variants.

The subject proposal is designated in the very dry Coastal Western hemlock (CWHxm) biogeoclimatic subzone. Summers are warm and dry; winters are moist and quite mild. Growing seasons are long, and often feature pronounced water deficits on zonal

(average) and drier sites. Fire Danger Ratings (i.e., the risk of a fire starting) tend to reach High and Extreme for extended periods during the fire season.

Prevailing and critical wind patterns significantly influence wildfire trajectory and rate of spread. Factors such as topography, cold fronts, and diurnal winds can alter wind patterns, crating localized wind vectoring. Prevailing winter winds are generally southeasterly; high-pressure systems in summer can bring strong northerlies (and westerlies). Typical winds in summer are south westerlies off Lake Cowichan.

Topography. Physical site characteristics impact fire behavior by affecting ignition potential and the rate of fire spread. Potential wildfire behavior can be exacerbated by steeper terrain.



Wildfires typically burn uphill. Warmer (western and southerly) aspects (especially those with steeper slopes) tend to burn “hotter.”

Phase 6 occupies a moderate gradient with a southerly (warm) aspect. Fuel loading (vegetative forest fuels) has been removed immediately south of Phase 6. Mature forest extends westward.

Vegetation. Fire behavior predicts how forest and wildland fuels (vegetation) will burn under different conditions. Fuel hazard means the potential fire behaviour, without regard to the state of weather or topography, based on the physical fuel characteristics, including fuel arrangement, fuel load, condition of herbaceous vegetation and the presence of ladder fuels.

Benchmark vegetative fuel types developed by the Canadian Forest Fire Danger Rating System Fire Behavior System (CFFDRS) are used to forecast how a wildfire will react (cwfis.cfs.nrcan.gc.ca) (refer to Appendix 2).

To be effective under 90th percentile fire weather conditions, surface fuels should be managed to generate a fire intensity of less than 2,000 kW/m.

The vegetation complex at the subject property reflects recent and historical land use: second-growth timber at the area was logged approximately 30+ years ago; more recently Phase 6 was cleared of brush in preparation for development. There is no forest cover at Phase 6; invasive blackberry was recently removed.

Surface fuels are the primary driver of fire behaviour. Surface fuels, comprising all the combustible materials lying above the duff layer and below ladder fuels, typically consist of:

- Litter (fallen leaves, tree needles, etc.)
- Herbaceous vegetation (small plants, grasses)
- Low and medium shrubs
- Woody debris (fine and coarse)

Surface and ground fuels at the subject proposal comprise a discontinuous low brush.

Ladder fuels are combustible materials that provide vertical continuity between surface fuels and crown fuels in a forest stand. Ladder fuels contribute to the potential for torching and crowning, allowing fire to advance from the forest floor up into the tree canopy. Examples of ladder fuels include:

- Tall shrubs
- Small-sized trees
- Branches
- Tree lichens

Ladder fuel loading at the subject proposal is non-existent, except at the western border with the riparian forested buffer.

Crown fuels describe aerial fuels (vegetation) at the tree level and canopy at the stand level.

There is no forest stand at Phase 6.

To the west, outside of the property boundary, a mature conifer stand grows along a riparian buffer.

Main Fuel Types at subject proposal (Phase 6):

Fuel Types	Description	Forest Floor & Surface Fuels	Ladder Fuels	Wildfire Behaviour <i>(why and how a fire spreads)</i>
Scattered, modified 0-1/2 with C-2/C-3 scattered shrubs	Tree cover was previously removed from Phase 6; more recently brush was cleared in preparation for development.	Low level of surface fuel loading : scattered brush (invasive and native), and patchy grass	Low to nil (no trees or tall plants)	Fire start during warm dry weather will likely produce low to moderate rate of spread at subject site due to lack of fuel loading; embers from an advancing wildfire would have slow spread due to low fuel load.

Risk of Ignition. Risk of ignition represents the potential for fire starts. Fire starts could come from activities related to construction or from activities of residents in the local area.

Risk of ignition is rated low.

Fire Spread and Intensity. Head fire intensity is a numerical ranking of difficulty of control for specific fuel types. Flame length is a main visual manifestation. Head fire intensity is a major determinant of certain fire effects and difficulty of control. Numerically, it is equal to the product of the net heat of combustion, quantity of fuel consumed in the flaming front, and the linear rate of spread. If a fire started in the forested area west of Phase 6, fire would have a slow start at Phase 6 due to the lack of fuel loading (vegetative fuels). HeadFire Intensity at the subject site is rated Low to Moderate.

The goal of Wildfire Risk Reduction (WRR) is to reduce HeadFire Intensity to less than 2000 kW/m (< 3, HFI column Moderate) (see chart following).

Fire Weather Indices

Hazard Rating	FFMC Fine Fuel Moisture Code	DMC Duff Moisture Code	DC Drought Code	ISI Initial Spread Index	BUI Build Up Index	FWI Fire Weather Index	HFI Head Fire Intensity
Low	0-76	0-21	0-79	0-1.5	0-24	0-4.5	1-2
Moderate	77-84	22-27	80-189	2-4	25-40	4.5-10.5	3
High	85-88	28-40	190-299	5-8	41-60	10.5-18.5	4
Very High	89-91	41-60	300-424	9-15	61-89	18.5-29.5	5
Extreme	92+	61+	425+	16+	90+	29.5+	6

Spotting Potential. Spotting is a fire behavior characteristic in which sparks or embers are carried up by the wind and/or convective column and fall into other downwind fuels to ignite additional fires beyond the zone of direct ignition by the main fire (Firewise.org). Fire spotting is one of the major ways that fires spread, and vegetation and structures are ignited and destroyed in wildland/urban interface fires. Firebrands can come down on and ignite combustible vegetation, roofs of structures, combustible items stored adjacent to structures, and other nearby combustible fuels. The resulting spot fires may go unnoticed and thus unsuppressed when an area has been evacuated of residents, when firefighters are spread too thin, or when spot fires are too numerous.

The maximum spotting distance in a particular fire varies according to several factors, including overall fire intensity, wind speed, fuel type, initial size of the ember when lofted up, and how rapidly it is burning (Firewise.org). If a fire start occurred during warm, wind, dry weather (High/Extreme Fire Danger Ratings), there is a moderate potential for spotting at the subject site.

Fire Protection Area (FPA): The subject site is located within the service area of Lake Cowichan Fire Department, a volunteer fire department with a Fire Chief, Training Officer, and about 30 on-call members. The firehall is at 3 North Shore Road, a driving distance of approximately 2 km from the subject site. Response will vary depending on time of day, road/traffic conditions, and distance of volunteers from the hall. Fire department response time is the elapsed time, in minutes, from when the first firefighting unit is dispatched to when the first fire fighting unit arrives at the emergency scene. Fire department intervention time is crucial in determining the

consequences of a fire in terms of deaths, injuries, and loss of property and damage to the environment. An early aggressive and offensive primary interior attack on a working fire is usually the most effective strategy to reduce the loss of lives and property damage.

The British Columbia Building Code addresses situations where the firefighter response time 'exceeds 10 minutes in 10% or more of all calls' by requiring higher levels of noncombustible construction and reductions on allowable areas of unprotected openings.

Mutual Aid Fire Departments within the Cowichan Valley Regional District operate under a mutual aid agreement with other fire departments within (and outside) the region. In the case of a serious fire, mutual aid from adjoining fire departments can benefit fire suppression by pooling manpower and resources (water supply, water tenders, etc.,). Mutual aid, however, may not always be available.

Wildfires The Lake Cowichan Fire Department automatically responds to structure fires and small, easily accessible bush fires inside the fire service protection area (FPA). The Wildfire Management Branch generally responds to forested areas outside a FPA. The subject area lies within the LFR FPA.

Water Supply An adequate and reliable water supply for firefighting is an essential part of a community's fire protection system. The Fire Underwriters Survey (FUS) Guidelines outline water specifications for fire protection. The BC Building Code governs the minimum water requirements for buildings. In fire protection areas served by a community water system, water supply for fire protection generally consists of a piped system in common with domestic potable water. The local area is hydranted. Site servicing connections would be required for the proposed construction.

Water Supply An adequate and reliable water supply for firefighting is an essential part of a community's fire protection system. The Fire Underwriters Survey (FUS) Guidelines outline water specifications for fire protection. The BC Building Code governs the minimum water requirements for buildings. In fire protection areas served by a community water system, water supply for fire protection generally consists of a piped system in common with domestic potable water.

The subject proposal will be fully serviced.

Access. Safe access increases safety for both residents and firefighters, and also facilitates quick response by firefighters.

The subject proposal will be accessed via Greenwell Drive connecting to the looping road system comprised of Mountain View Drive and Winter Drive.

Wildfire Threat Assessment Results

Assessment determined the subject proposal currently has a Moderate Fuel Hazard Assessment rating (see chart next page), and a Moderate Local Wildfire Threat Rating (below). Contributing factors include the low fuel loading, good accessibility, and moderate slope with a warm aspect. Ideally, threat ratings must be low/moderate to ensure an area and/or structure(s) are safe. Post-development, the threat rating is expected to be low.

Integration of development plans with the recommendations contained in this report will help to decrease the wildfire threat and increase resiliency.

LOCAL WILDFIRE THREAT SUMMARY: Phase 6 – The Slopes at the Lake			
System:	Subcomponents	CURRENT ratings	Projected Ratings post-development*
MFLNRO Wildfire Threat Assessment	Fire Behaviour: Fuel, Weather, Topography	Fuel Assessment Class: Moderate (see chart next pg.)	Low
	Structural (incl vicinity)	Moderate	Low
Overall Rating:		Moderate	Low
HIRV Model	Hazard Impact Risk Vulnerability	Moderate	Low
		Moderate	Low
		Moderate	Low
		Moderate	Low
Wildfire Risk	Likelihood Intensity Susceptibility	Moderate	Low

*Projected ratings conditional upon compliance with recommendations contained in this report.



Wildfire risk triangle. (Scott et al. 2013).

Generalized Descriptions of the “Fuel Assessment Rating” classes:

Low	Fires may start and spread slowly. There will be minimal involvement of deeper fuel layers or larger fuels.
Moderate	Forest fuels are drier and there is an increased risk of surface fires starting. There will be involvement of the organic layer but larger dead material will not readily combust.
High	Forest fuels are very dry, new fires may start easily, burn vigorously; aerial fuel will be engaged in the flaming front. Most fuel in the organic layer will be consumed and larger dead fuel will be consumed in the smoldering combustion.
Extreme	Extremely dry forest fuel, new fires will start easily, burn vigorously; all aerial fuel will be engaged in the flaming front. Most fuel in the organic layer will be consumed and larger dead fuel will be consumed in the smoldering combustion.

FMC (Fuel Moisture Content) 95% value based on 90th percentile drought conditions.

Fuel reduction targets should be sufficient to be effective to meet treatment objectives of reduced fire behaviour under 90th Percentile Fire Weather Index (FWI) Conditions (FFMC, ISI, BUI) from the BCWS weather network.

Recommendations

Vegetation Management

General Precautions During Land Clearing and Construction

Ensure any land clearing activities are conducted in compliance with BC's Wildfire Act local bylaws.

As per the BC Wildfire Act, if a high-risk activity (i.e., land clearing) is taking place between 1 April and 31 October, the operator must keep at the activity site fire fighting hand tools, in a combination and type to properly equip each person who works at the site with a minimum of one fire fighting hand tool, and an adequate fire suppression system (onsite portable water tanker and fire fighting tools – shovels, pulaskis, portable water backpacks). In addition, efforts must be made to maintain an adequate fire break between any high risk activity and areas of continuous forest to ensure a fire originating at the site does not escape the site.

- During construction, develop an Emergency Plan of Action, listing key contact information in case of fire and/or another emergency at the site.
- Hazard abatement (removal of slash/disposal of debris piles) must take place in compliance with local area bylaws.
- Ensure construction workers are made aware of the risk of fire in the interface zone, especially during dry summer weather (e.g., no smoking).

(Hazard abatement is planned for a slash pile of logs located on the east side of the proposed development site.)

Structures:

FireSmart Zones – (see Appendix 1)

- **Immediate Zone 1a: 0-1.5 m**

A noncombustible surface should extend for 1.5 m around structures and any auxiliary buildings. Avoid storing flammable outdoor items, such as garbage cans without lids and fuel tanks, which are places where embers can land and start a fire, in this critical area adjacent to structures.

- New landscaping should employ noncombustible landscaping materials, such as gravel, brick, or concrete
- Avoid woody shrubs, trees, or tree branches in this immediate zone
- Thin out and remove dead/dying understory trees.
- Regularly rake up and remove tree needles and small branches within this zone.
- Create a noncombustible zone underneath and for 1.5 m around any vehicles parked beside structures.

- **FireSmart Intermediate Zone 1: 1.5 - 10 m**

Establish and maintain an environment around structures that will not support fire. Focus on fuel removal, conversion, and reduction.

- Maintain landscaping with a low density of fire resistant (preferably native) plants and shrubs.

- Maintain landscape with regular irrigation, mowing, pruning, raking, weeding and dead plant removal.
 - Limb (prune) trees 1.5 to 2m from the ground. Create space between trees and shrubs – a general rule is twice the height of what the plant will be at maturity. Remove tree limbs closer than 15-feet from power lines and any touching structures.
 - Avoid using woody debris, including bark mulch, as it provides potential places for fires to start.
 - Store items such as construction materials, and tools at least 10 m from structures.
- **FireSmart Extended Zone 2: 10-30 m** (where applicable re: property boundaries)

Make efforts to extend the fuel modified area 10-30 m around structure(s). Regularly conduct FireSmart activities: thinning, pruning, and fuel reduction strategies in this zone to reduce fuel loading.

- Thin and prune evergreen trees to reduce hazard in this area
- Within 30 m of any structures and auxiliary buildings, remove lower branches of conifers to a height of at least 2.5 m from the ground. (For smaller evergreen trees; general rule of thumb is prune branches up to a third the height of the tree)
(The exception is along forested stream buffers, where forest cover must be retained.)
- Regularly clean up accumulations of fallen branches, any dry grass and leaves, and conifer needles from the ground to eliminate potential surface fires

General Principles of FireSmart Landscaping (where applicable)

- Plan to incorporate FireSmart landscaping by using fire-resistive, widely spaced trees, native shrubs and groundcover in combination with stone and/or water features. See FireSmart Guide to Landscaping. Native plant species are ideal.
<https://www.firesmartcanada.ca/resources-library/firesmart-guide-to-landscaping>
- Use fire-resistive plants with:
 - moist, supple leaves
 - minimal accumulation of dead vegetation
 - water-like sap that produces little odour
 - low amount of sap or resin material
- Promptly re-vegetate any areas of soil disturbed during clearing and construction with approved landscaping materials and/or native plant species to minimize spread of invasive plant species (i.e., Himalayan blackberry, Scotch broom, daphne, etc.).
- Any powerlines should be clear (3m+) of branches and other vegetation.

Site Maintenance:

- Regularly maintain effective vegetation management treatments (e.g., brush cutting, trimming and pruning).

Construction (General Guidelines for Structures)

The roof is the most vulnerable component of a structure. Sparks and burning embers from a wildfire can travel long distances and quickly ignite flammable roofing material. Roofs also contain many areas in which debris and embers may collect. Regular roof cleaning should be done to remove combustible materials such as leaves and branches.

Siding materials are also vulnerable to wildfire. Combustible debris can accumulate at the vents and openings on the home and be ignited by embers during a wildfire.

- **Use fire-retardant roof covering assemblies** rated Class A, B, or C (i.e., metal, tile, ULC-rated asphalt) and non-combustible siding materials (i.e., stucco, metal siding, brick, cement shingles or cementitious materials, poured concrete, or ULC-rated wood siding) on new structures. Refer to the manufacturer's guidelines to maintain the fire resistance of your roof. Metal, clay tile, and rated asphalt shingles are the most fire-resistant roofing materials.
- **Use fire-resistant siding.** Siding materials such as stucco, hardiboard, metal, brick and concrete offer superior fire resistance to wildfire. Logs and heavy timbers are less effective, while wood and vinyl siding offer very little protection.
- **Ensure a minimum of 15 cm ground-to-siding fire-resistant clearance.**
- **Follow FireSmart guidelines for design, construction, and maintenance of window and door glazing, eaves and vents, and decking.** Install noncombustible material for all vents (should be 3 mm screening or ASTM fire rated vents). Metal products are recommended for vents and vent flashing. <https://www.firesmartcanada.ca/>
- **Ensure structures are equipped with working smoke alarm(s).**
- **Sheath in the base of structures** with fire-resistant material to reduce the risk of sparks and embers igniting the home. Install fire-resistant windows.
- **Ensure all doors are fire-rated and have a proper seal.** This is applicable to garage doors in addition to all other doors.

Maintenance

- Regularly inspect siding for locations where embers could accumulate and lodge.
- Maintain and remove combustible debris near exterior walls to reduce a building's vulnerability to ignition during a wildfire.
- Regularly remove debris from gutters – sparks and easily ignite these dry materials.
- Inspect vents and openings regularly to ensure vents are in good repair, and remove any accumulated combustible debris.
- Regularly maintain and clean corners and crevices of the structure and surrounding area.

Water Supply / Fire Protection

- Ensure water main, fire hydrant capabilities and servicing meet Town of Lake Cowichan Engineering specifications.

Access

- Ensure access/driveways meet BC Building Code and municipal Engineering requirements.
- Ensure address signage is clearly evident during the construction phase and at build-out. Letters, numbers, and symbols should be at least 10 cm high, with a 12 mm stroke, contrast with the background colour of the sign, and be reflective.

Appendix 1. FireSmart Zones

In interface areas, FireSmart advocates the establishment and maintenance of Fuel Management Zones* extending outward from structures and along access routes:

Zone 1 a (0-1.5m)

Zone 1 (0-10 m).

Zone 2 (10-30 m).

(FireSmart, 2003; updated 2024)

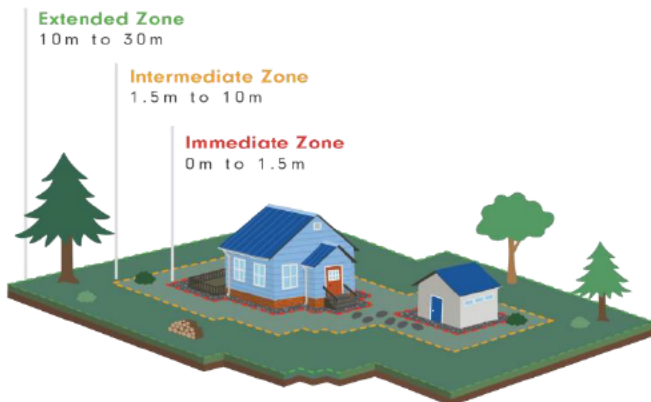
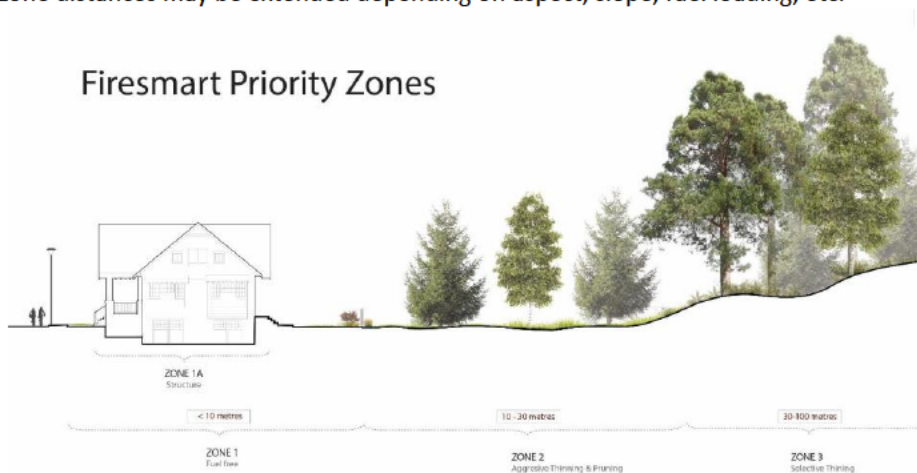
Immediate Zone 1a (0-1.5 m): This is the noncombustible zone, where it is very important not to have any combustibles next to buildings.

Intermediate Zone 1 (0-10 m): The main objective of vegetation management is to create an environment that will not support fire. Vegetation management focuses on fuel removal, conversion, and reduction.

Extended Zone 2 (10-30 m): Where treatment in PZ 1 is not sufficient to significantly reduce the fire hazard due to fuel loading, extend the fuel modified area with a variety of thinning and pruning actions.

*Setback Zone distances may be extended depending on aspect, slope, fuel loading, etc.

Firesmart Priority Zones



Appendix 2. Generic Fuel Types (adopted from CFFDRS).

Fuel Type	Description	Wildfire Behaviour Under High Wildfire Danger
Coniferous:		
C1	Terrestrial herbaceous ecosystem: mossy rock outcroppings. Lichen. Organic layer absent or shallow. Uncompacted.	High potential for surface fire, esp. where dense clumps dried moss, lichen
C2	Dense regeneration to pole-sapling (immature) forest with crowns almost to ground; continuous moss, compacted organic layer; continuous shrubs; low to moderate ladder fuels	High potential for crown fires; low to very high fire intensity and rate of spread
C3	Fully stocked, mature conifer stands, crowns separated from ground; sparse understorey	Surface and crown fire, low to very high fire intensity and rate of spread
C4	Dense, pole-sapling (immature) forest, heavy standing dead and down, dead woody fuel; continuous needle litter; continuous vertical crown fuel continuity	High potential for crown fires, high to very high fire intensity and rate of spread
C5	Moderately well-stocked, mature forest, moderate dense understorey crowns well separated from ground; continuous needle litter	Low to moderately fast-spreading, low to moderate intensity surface fire
C6	Fully stocked conifer plantation; absent understorey; tree crowns separated from ground; continuous needle litter	Surface fire may spread rapidly to become high intensity fire with high rate of spread
C7	Open, mature coniferous stand; uneven-aged; discontinuous understorey; tree crowns mostly separated from ground	Surface, torching, rarely crowning (except on steeper slopes), mod - high intensity/ ROS
D (Deciduous)	Moderately well-stocked deciduous stands; moderate medium to tall shrubs and herb layers D-1 Leafless D-2 In leaf	Typically a surface fire; low to moderate rate of spread and fire intensity
M (Mixed Forest)	Moderately well-stocked mixed stand of conifers and deciduous tree species; moderate shrub understorey; conifer crowns extend nearly to ground M-1 Leafless M-2 in Leaf	Surface, torching and crowning; moderate to very high intensity and spread rate (varies with slope and % vegetation cover)
S-3 (Slash)	Slash from logging and land clearing Coastal cedar-hemlock-Douglas-fir slash May have high foliage retention; moderate loading and depth; moderate shrub and herb coverage	Fine fuel % and cedar foliage retention will result in faster ignition and spread
01-Long	Continuous standing grass – fuel loading is 0.3 kg/m ² ; scattered trees 01-a Matted 01-b Tall	Rapid spreading, moderate to high intensity surface fire
02-Short	Continuous human modified short grass	The taller, and more cured the grass, the more rapid spread; low to moderate intensity surface fire Short grass typically has low rate and spread and low fire intensity.

Appendix 3. Fire Risk Classes.

RELATIVE WILDFIRE RISK
Low
Moderate
High
Extreme

Fire Risk Classes

Low (Green): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns, and known local wildfire threat factors make it a lower potential for threatening a community. These stands will support surface fires, single tree or small groups of conifer trees could torch/ candle in extreme fire weather conditions. Fuel type spot potential is very low, low risk to any values at risk.

Moderate (Yellow): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns and known local wildfire threat factors make it possible that a wildfire in this area would threaten the community. Areas of matted grass, slash, conifer plantations, mature conifer stands with very high crown base height, and deciduous stands with 26 to 49% conifers. These stands will support surface fires, single tree or small groups of conifer trees could torch/ candle. Rates of spread would average between 2-5 meters/ minute. Forest stands would have potential to impact values in extreme weather conditions. Fuel type spot potential is unlikely to impact values at a long distance (<400m).

High (Orange): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns, and known local wildfire threat factors make it likely that a wildfire in this area would threaten the community. This includes stands with continuous surface/ crown fuel that will support regular torching/ candling, intermittent crown and/or continuous crown fires. Rates of spread would average 6 -10 meters/ minute. Fuel type spot potential is likely to impact values at a long distance (400 -1 000m).

Extreme (Red): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns, and known local wildfire threat factors make it very likely that a wildfire in this area would threaten the community. Stands with continuous surface/ crown fuel and fuel characteristics that tend to support the development of intermittent or continuous crown fires. Rates of spread would average >10 meters/ minute. Fuel type spot potential is probable to impact values at a long distance (400 -1 000m or greater). These forest stands have the greater potential to produce extreme fire behaviour (long range spotting, fire whirls and other fire behaviour phenomena).

Limitations

This report provides an assessment of site conditions. Evaluation is based on professional judgment. The investigation involved field observation. Recommended treatment pertains only to the particular site as disclosed at the time of inspection. The report was prepared considering site-specific circumstances and conditions. It is intended only for use by the client for the purpose for which it was commissioned and for use by local government regulating the activities to which it pertains.

GEOTECHNICAL HAZARD ASSESSMENT

**The Slopes Phase 6
15-Lot Residential Subdivision**

**Greenwell Drive
Lake Cowichan, BC**

Legal Address:
Lot A, Section 6, Renfrew District,
Plan EPP103677, Except Part on Plans
EPP104021, EPP109124, and EPP138345,
PID 031-159-851

Prepared For:
0697413 B.C. Ltd.

Section 22 - Disclosure harmful to Personal Privacy

August 26, 2025



File No.: E1213.Ph6.01
Revision No.: 01
Prepared by: Jeff Scott, P.Eng.
Reviewed by: 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

Permit to Practice No.: 1001802

LEA Lewkowich
Engineering
Associates Ltd.

DISCLAIMER, ACKNOWLEDGEMENTS, AND LIMITATIONS

1. Lewkowich Engineering Associates Ltd. (LEA) acknowledges that this report, from this point forward referred to as “the Report,” may be used by the Town of Lake Cowichan (ToLC) as a precondition to the issuance of a subdivision and/or development permit. It is acknowledged that Approving Officers and/or Building Officials of the ToLC may rely on this Report when making a decision on application for development of the land. It is acknowledged 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 ToLC.
2. This Report has been prepared in accordance with standard geotechnical engineering practice solely for and at the expense of 0697413 B.C. Ltd. We have not acted for or as an agent of the ToLC 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, encountered and inferred subsurface 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 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 Authority Having Jurisdiction (AHJ) and their standards for the preparation of such reports, the 2024 British Columbia Building Code (BCBC), and current engineering standards. Updates to bylaws, policies, or requirements of the AHJ, and updates to the BCBC or professional practice guidelines, may impact the validity of this Report.
5. This Report has been prepared by Jeff Scott, P.Eng., and reviewed by Chris Hudec, M.A.Sc., P.Eng. Mr. Scott and Mr. Hudec are both adequately experienced and are also members in good standing with the 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, Remainder Lot A Plan EPP103677, from this point forward referred to as “the Property,” is located on Vancouver Island within the jurisdictional boundaries of the ToLC. The proposed development for the Property at the time of this Report consists of a 15-lot residential subdivision.
3. A site-specific assessment was conducted to identify any potential geotechnical hazards for the proposed development. Our assessment addresses two potential geotechnical hazards: nearby slopes and drainage channels.
4. The findings confirm the land is considered safe for the use intended, provided the recommendations of this Report are followed.

List of Abbreviations Used in the Report

Abbreviation	Title
AHJ	Authority Having Jurisdiction
BCBC	British Columbia Building Code
CVRD	Cowichan Valley Regional District
DPA	Development Permit Area
EGBC	Engineers and Geoscientists of British Columbia
FCL	Flood Construction Level
LEA	Lewkowich Engineering Associates Ltd.
SLS	Service Limit State
ToLC	Town of Lake Cowichan
TP	Test Pit
ULS	Ultimate Limit State



TABLE OF CONTENTS

DISCLAIMER, ACKNOWLEDGEMENTS, AND LIMITATIONS	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
1.4 Covenant Review	2
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 Conditions	4
3.0 SLOPE HAZARD ASSESSMENT	4
3.1 Debris Slides, Debris Flows, and Debris Floods.....	4
3.2 Slope Discussions	5
4.0 FLOOD HAZARD ASSESSMENT	5
4.1 Drainage Channel.....	5
4.2 Beadnell Creek	6
5.0 DESIGN PHASE	6
5.1 Foundation Design	6
5.2 Seismic Criteria	7
6.0 CONSTRUCTION PHASE.....	7
6.1 Site Grading.....	7
6.2 Subgrade Preparation	8
6.3 Structural Fill.....	8
6.4 Foundation Drainage	9
6.5 Stormwater Management	9
6.6 Pavement Design – Private Works.....	10
7.0 CONCLUSIONS	11
7.1 Local Government Conformance Statement	11
7.2 Geotechnical and Quality Assurance Statement	11
8.0 CLOSURE	11
9.0 ATTACHMENTS	12
10.0 REFERENCES.....	12

1.0 INTRODUCTION

1.1 General

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

1.2 Background

- a. We understand the proposed development consists of a 15-lot residential subdivision. We further understand that future residential buildings will be of conventional construction methods, including cast-in-place concrete foundations and wood-frame superstructures.
- b. The Property is located within the jurisdictional limits of the ToLC. The Property is zoned R-1 Suburban. The Property is located within two DPAs: Watercourse and Streamside Protection (DPA 1) and Natural Hazard Lands (DPA 2). Therefore, we understand a Geotechnical Assessment and report is required to assist in determining what conditions or requirements shall be included in the development permit so that the proposed development is protected from any identified natural hazards and no increase in hazard is posed to existing development on or near the Property. This Report addresses DPA 2 requirements for steep slopes and flooding.

1.3 Assessment Methodology

- a. This assessment included a desktop review of relevant background information, including applicable ToLC bylaws,¹⁻² available development plans, registered covenants on title, aerial photographs, and published geology and topography mapping. We also reviewed published regional-scale natural hazard assessments as commissioned by the CVRD. Please refer to the list of references at the end of this Report.
- b. A site reconnaissance was conducted on August 5, 2025, to visually assess site conditions throughout the development area.
- c. A test pit investigation was carried out on August 7, 2025, using a Hyundai 210 excavator provided by the client. A total of eight TPs (TP25-01 to TP25-08) were excavated at locations throughout the development area. The TPs included visual logging of the soil profile, qualitative measure of soil density, and collection of soil samples for possible laboratory index testing.
- d. This assessment was prepared with consideration of the referenced EGBC professional practice guidelines, *Landslide Assessments in British Columbia* and *Legislated Flood Assessments in a Changing Climate in BC*.^{3,4} Please refer to the attached EGBC assurance statements.

1.4 Covenant Review

- a. As part of our assessment, we have reviewed the legal title of the Property, specifically related 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 related to geotechnical hazards registered against the title of the Property.

2.0 SITE CONDITIONS

2.1 Physical Setting

- a. The Property is located near the northern limits of the ToLC. The Property is directly bordered by similar R-1 properties to the north, east, and south, and a CVRD F-1 Forest Resource property to the west.
- b. Please refer to Figure 2.1 below.



Figure 2.1 – Location of the Property (CVRD Maps)

2.2 Terrain and Features

- a. In general, the terrain within the Property and surrounding area gently declines from north-northeast to south-southwest. Based on available topographic information, average natural slope angles range from 5 to 10 degrees from horizontal, with localized areas up to 15 degrees.
- b. A drainage channel flows north to south across the Property through proposed Lots 15, 14, and 1. The drainage channel flows through a 760mm diameter culvert under Greenwell Drive. At the time of our site reconnaissance, the drainage channel was dry and filled with dense vines. We understand this drainage channel is man-made.

- c. Earthworks were underway at the time of our site reconnaissance. The Property was grubbed and leveled by cut and fill operations.

2.3 Regional Geology

- a. Surficial geology mapping for the area indicates the Property falls within an area of predominately moraine deposits consisting of well-drained gravelly sandy loam, with minor fluvial deposits consisting of rapidly-drained very gravelly loamy sand.⁵
- b. Bedrock geology mapping for the area indicates the Property falls near the boundary of two rock formations. To the south, the rock is classified as the Nanaimo Group, comprised of undivided sedimentary rocks from the upper Cretaceous period, generally consisting of boulder, cobble, and pebble conglomerate, coarse to fine sandstone, siltstone, shale, and/or coal. To the north, the rock is classified as the Sicker Group, Nitinat Formation, comprised of calc-alkaline volcanic rock from the middle to upper Devonian period, generally consisting of pyroxene-feldspar phyric agglomerate, breccia, lapilli tuff, massive and pillowed flows, massive tuffite, laminated tuff, jasper, and chert.⁶

2.4 Soil Conditions

- a. Soil conditions differ on the north and south sides of Greenwell Drive. On the north side, surficial fill and overburden are relatively thin and very dense glacial till is encountered at shallow depth (<1m depth). On the south side, surficial fill and overburden are thicker and very dense glacial till is deeper (up to 2.5m depth). All TPs refused in very dense glacial till.
- b. The main soil strata are shown in Tables 2.4.1 and 2.4.2 below. Detailed descriptions of the subsurface conditions are provided on the attached TP logs (TP25-01 to TP25-08).

Table 2.4.1 – Summary of encountered soil strata

Soil Stratum No.	Soil Description	Depth Range (m)	
		From	To
1	Silty, gravelly, SAND, trace organics (roots, rootlets, matter), compact, light brown, dry to moist (FILL)	0.0	0.7
2	Sandy SILT, some gravel, some organics (roots, matter), trace debris (logs), soft, black to dark brown, moist to wet, organic odour (FILL)	0.0	2.5
3	Gravelly SAND, some silt, compact, orange-brown, dry to moist	0.1	1.1
4	Silty, gravelly, SAND, trace cobble, very dense, light brown, moist (TILL)	0.1	3.0 (refusal)



Table 2.4.2 – Depth to bottom of soil strata per TP

Soil Stratum No.	Maximum Encountered Depth of Soil Strata per TP (m)							
	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08
1	0.5	0.4	0.7	0.1	NE	0.1	NE	NE
2	2.3	2.5	NE	NE	0.6	NE	0.2	NE
3	NE	NE	1.1	0.3	0.9	0.5	0.9	NE
4	2.7	3.0	1.2	0.4	1.0	0.6	1.0	0.2

2.5 Groundwater Conditions

- a. There was no groundwater seepage encountered within the TPs during the investigation. However, in areas of thicker fill materials, the fill was moist to wet near the fill and glacial till interface.
- b. Considering the shallow glacial till subgrade, we expect a shallow perched groundwater table will be seasonally present.
- c. 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 time of our investigation.

3.0 SLOPE HAZARD ASSESSMENT

3.1 Debris Slides, Debris Flows, and Debris Floods

- a. The Property is located down-slope of the north slope of Cowichan Lake. Therefore, as part of our assessment, we reviewed the referenced regional-scale natural hazard assessments, as commissioned by the CVRD, to determine if the Property is within a mapped debris slide, debris flow, and/or debris flood area, which would necessitate further study. A detailed debris slide, debris flow, and/or debris flood assessment was not completed and is beyond the scope of this Report.
- b. We reviewed the referenced ebbwater/Palmer report entitled *Geohazard Risk Assessment North Slope of Cowichan Lake* report,⁷ as well as the more recent Stantec/Palmer report entitled *Debris Flow Runout Model: North Shore Cowichan Lake*.⁸ The Stantec/Palmer report predicts the maximum runout limits of modeled debris flows from upslope landslides using LABS software.
- c. Based on these assessments, the Property is not within any predicted debris flow runout extents.
- d. Based on our review of the aforementioned publications, we conclude the chance of a life-threatening / catastrophic debris slide, debris flow, or debris flood event impacting the proposed development area is low, and no further assessment is required.

3.2 Slope Discussions

- a. Detailed slope stability analyses are generally required when development is proposed near the top, bottom, or on soil slopes that are steeper than 2H:1V (27 degrees or 50%), or where indicators of global instability are present.
- b. The slopes within the Property and the immediate surrounding areas gently decline at average slope angles ranging from 5 to 10 degrees (9 to 18%), with localized areas up to 15 degrees (27%). Subsurface conditions consist of surficial compact to dense granular overburden, overlying very dense glacial till at shallow depth. Groundwater was not encountered during our investigation. The slopes were inspected for indicators of global instability and none were observed.
- c. Considering the slopes within and immediately surrounding the Property are less than 2H:1V and there were no indicators of global instability, global slope stability is not a hazard for the Property and proposed development.
- d. It should be noted that landslides can be triggered by human activity (i.e. excavation, placement of fill, removal of vegetation, etc.) or by failure of civil infrastructure (i.e. leakage or rupture of water and sewer mains, stormwater disposal from existing development, etc.). The concentrated discharge of collected stormwater can lead to erosion, earth movement, or slope failure.

4.0 FLOOD HAZARD ASSESSMENT

4.1 Drainage Channel

- a. A drainage channel crosses the Property through proposed Lots 15, 14, and 1. The channel flows through a 760mm diameter culvert under Greenwell Drive. At the time of our site reconnaissance, the channel was dry and filled with dense vines. We understand this channel is man-made.
- b. As per provincial flood hazard guidelines,⁹ the drainage channel would likely be classified as a “very small stream”, due to its seasonal nature and limited drainage area.
- c. Considering provincial guidelines, we recommend a minimum setback of 10.0m from the natural boundary of the drainage channel and a minimum FCL of 1.5m above the centerline elevation of the drainage channel for any adjacent development.
- d. The FCL 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 which would be subject to damage if flooded. The FCL establishes the minimum elevation of the underside of a wooden floor system or top of a concrete slab for any Habitable Area. During construction, all floor elevations shall be confirmed by qualified survey personnel to ensure the constructed floor grade is at or

above the minimum FCL elevation. Areas below the FCL should not be used for the installation of furnaces, major electrical switchgear, or other fixed equipment susceptible to damage by floodwater.

- e. The culvert under Greenwell Drive should be maintained free of debris to ensure the culvert does not become obstructed in times of flood and cause ponding upstream of the culvert, overtopping of Greenwell Drive, or a complete failure/washout.

4.2 Beadnell Creek

- a. The nearest natural watercourse is Beadnell Creek, located an estimated 50m west of the property limits. The creek originates on the north slope of Cowichan Lake and flows south into the Cowichan River. Adjacent to the Property, the creek is well confined within a relatively wide and approximately 5 to 6m deep ravine. The ravine and adjacent property are densely forested. At the time of our site reconnaissance, which occurred the day after a night of rain, the creek had moderate flow. Hydrometric data is not available for Beadnell Creek.
- b. Considering the significant separation between the creek and the Property, both in terms of distance and elevation, the Property will not be impacted by potential flooding of Beadnell Creek. No detailed flood hazard assessment is warranted.

5.0 DESIGN PHASE

5.1 Foundation Design

- a. Prior to construction, the foundation areas should be stripped to remove all unsuitable materials to provide an undisturbed natural subgrade for footing support.
- b. Foundation loads should be supported on natural undisturbed material or structural fill, approved for use as a bearing stratum by our office, and may be designed using the following values.
 - i. For foundations constructed on dense, naturally deposited, glacial till subgrade, an SLS bearing pressure of 250 kPa and a ULS of 375 kPa may be used for design purposes. These values assume a minimum 0.45m footing embedment depth.
 - ii. For foundations constructed on greater than 0.3m thickness of structural fill, placed and compacted as outlined in Section 6.3 below, an SLS bearing pressure of 150 kPa and a ULS bearing pressure of 225 kPa may be used for design purposes. These values assume a minimum 0.45m footing embedment depth.
- c. As the elevation of the glacial till is expected to vary throughout the building areas, we recommend the Structural Engineer use the design values for structural fill provided above. This will prevent conflict where the glacial till soils are not present at a “practical” building elevation. The design values provided above for

structural fill can be achieved through the conventional placement and compaction of engineered fill over an approved naturally deposited subgrade.

- d. Exterior footings should be provided with a minimum 0.45m depth of ground cover for frost protection.
- e. 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.

5.2 Seismic Criteria

- a. Based on the 2024 BCBC (Division B, Part 4, Section 4.1.8.4.), the encountered and inferred subsurface conditions would be designated as “Site Class C” (very dense soil or soft rock).

6.0 CONSTRUCTION PHASE

6.1 Site Grading

- a. Considering the gently sloping topography of the land, we expect that some land terracing, cut/fill operations, and/or retaining walls may be required as part of the development.
- b. Any permanent soil slopes, created through either cut or fill operations, should not exceed 2H:1V for maintenance-free slopes, subject to geotechnical review. Steeper slopes are possible with the use of engineered fill or geosynthetic reinforcement, subject to design by a Geotechnical Engineer.
- c. Any permanent slopes should be finished with erosion control measures. Acceptable erosion control measures include vegetation, rock armouring, and/or erosion control blankets. Other methods of erosion control may be considered upon request.
- d. Adequate setback / subjacent support shall be reviewed by a Geotechnical Engineer for any foundations in proximity to slopes.
- e. Any proposed retaining walls exceeding 1.2m in height must be designed by a Structural and/or Geotechnical Engineer. Setbacks and/or deepened foundations are generally required for buildings in proximity to downslope retaining walls. As a rule of thumb, buildings should be set back a minimum of 1.5x the wall height from the top of wall.
- f. Stacked rock walls could present a rockfall hazard for downslope development. Therefore, all stacked rock walls shall include a level (flat) “no-build” rockfall zone along the base of the wall with a minimum lateral distance equal to the wall height.
- g. LEA shall be consulted prior to the re-use of any on-site materials, for re-use as structural fill, permanent slopes, retaining wall backfill, or otherwise.

6.2 Subgrade Preparation

- a. Prior to construction, all unsuitable materials should be removed beneath building areas 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. Unsuitable material was encountered within the test pits, ranging from 0.0m to 0.9m on the north side of Greenwell Drive and 0.3m to 2.5m on the south side of Greenwell Drive.
- c. Ground water ingressing into any excavations should be controlled with a perimeter ditch located just outside of the building areas, connected to positive drainage.
- d. Prior to placement of concrete footings, any bearing soil that has been softened, loosened, or otherwise disturbed during the course of construction, should be removed or else compacted following our 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.
- e. The Geotechnical Engineer is to confirm the removal of all unsuitable materials and approve the exposed competent inorganic subgrade, prior to the placement of any structural fill materials.

6.3 Structural Fill

- a. Where fill is required to raise areas that will support buildings, foundations, 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 during 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 slab areas, as well as in pavement areas.
- d. Structural fill under foundations, slabs, 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 degrees from horizontal to ensure adequate subjacent support. This support zone is shown in Figure 6.3 below (next page).
- e. Compaction of fill should include moisture conditioning as needed to bring the fill 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 foundations, slabs, and pavements is highly dependent on the correct placement and compaction of underlying structural fill. Consequently, we recommend that structural fill 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.

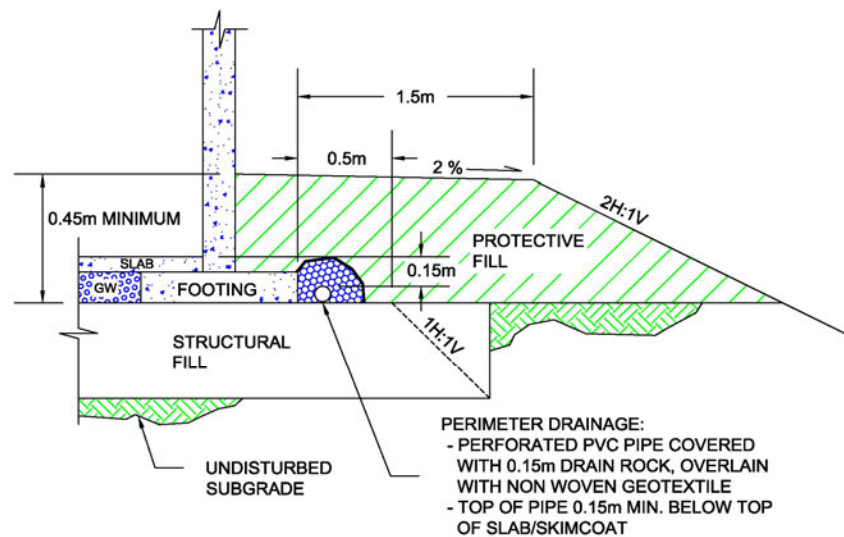


Figure 6.3 – Typical section for structural fill

6.4 Foundation Drainage

- a. Our assessment did not identify any abnormal groundwater conditions that would necessitate special foundation drainage measures outside of Part 9 of the 2024 BCBC. Conventional requirements of the 2024 BCBC pertaining to building drainage are considered suitable at this site.
- b. In addition to BCBC requirements, a layer of non-woven geotextile with a minimum weight of 140 g/m² shall be placed between the 150mm thick drain rock layer and the foundation backfill in order to prevent the migration of fine-grained soil particles into the drainage system.

6.5 Stormwater Management

- a. As part of the geotechnical investigation, field observations of the subgrade conditions with respect to potential on-site infiltration and disposal of stormwater were carried out.
- b. Subgrade soil conditions consist of granular overburden or fill materials overlying dense glacial till soils at shallow depth. Groundwater seepage was not encountered.



- c. Based on the subgrade conditions encountered during the investigation, it is the opinion of LEA that site conditions are not conducive to the installation of on-site stormwater infiltration measures.
- d. Site conditions may be conducive to the installation of storm water detention measures. The proposed detention measures can be reviewed by the Geotechnical Engineer to determine if the design methods and locations pose a hazard to the Property or any adjacent or adjoining properties.
- e. We assume stormwater management and site drainage systems will be designed, inspected, and approved by the Civil Consultant. LEA can provide geotechnical parameters for the design of stormwater management upon request.

6.6 Pavement Design – Private Works

- a. Any organic or deleterious material should be removed from beneath the designated roadway, driveway, or parking areas prior to subgrade preparation. If fill is required to bring the subgrade up to the desired elevation, structural fill should be used.
- b. The subgrade should be proof rolled after final compaction and any areas showing visible deflections should be inspected and repaired. The Geotechnical Engineer shall review the pavement subgrade conditions during the course of excavation.
- c. The subgrade and pavement should be sloped to provide adequate drainage as per the design and direction of the Civil consultant.
- d. An estimated soaked California Bearing Ratio of 30% and a 20-year design life have been used in the following pavement designs. See Tables 6.6.1 and 6.6.2 below.

Table 6.6.1 – Pavement design recommendations for light traffic / low volume areas

Areas Subject to Cars and Small Trucks	
Estimated Equivalent Single-Axle Load: 2×10^4	
Asphaltic Concrete Pavement	50mm
19mm Well-Graded Granular Base Course	100mm
75mm Select Granular Subbase (SGSB)	250mm

Table 6.6.2 – Pavement design recommendations for heavy traffic / high volume areas

Areas Subject to Large Trucks	
Estimated Equivalent Single-Axle Load: 2×10^5	
Asphaltic Concrete Pavement	75mm
19mm Well-Graded Granular Base Course	150mm
75mm Select Granular Subbase (SGSB)	300mm

- e. It is recommended that a reinforced concrete slab be utilized where garbage dumpsters are located. The slab should be large enough to contain the disposal unit and front tires of the garbage truck during disposal operations.
- f. The above recommendations for subgrade preparation and pavement structure are in accordance with current best practices. If the recommendations provided here prove cost-prohibitive or restrictive, alternative options may be considered, through a balance of reduced preparation efforts with a corresponding reduction in pavement design life.

7.0 CONCLUSIONS

7.1 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 15-lot residential subdivision), with the probability of a geotechnical failure resulting in property damage of less than:
 - i. 2% in 50 years for geotechnical hazards due to seismic events, including slope stability;
 - ii. 1 in 200 years watercourse flood event; and,
 - iii. 10% in 50 years for all other geotechnical hazards.

7.2 Geotechnical and Quality Assurance Statement

- a. The ToLC may request a Geotechnical Engineer to provide professional assurance services during the course of construction. 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.

8.0 CLOSURE

- a. Lewkowich 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,
Lewkowich Engineering Associates Ltd.

Reviewed By:



August 26, 2025

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

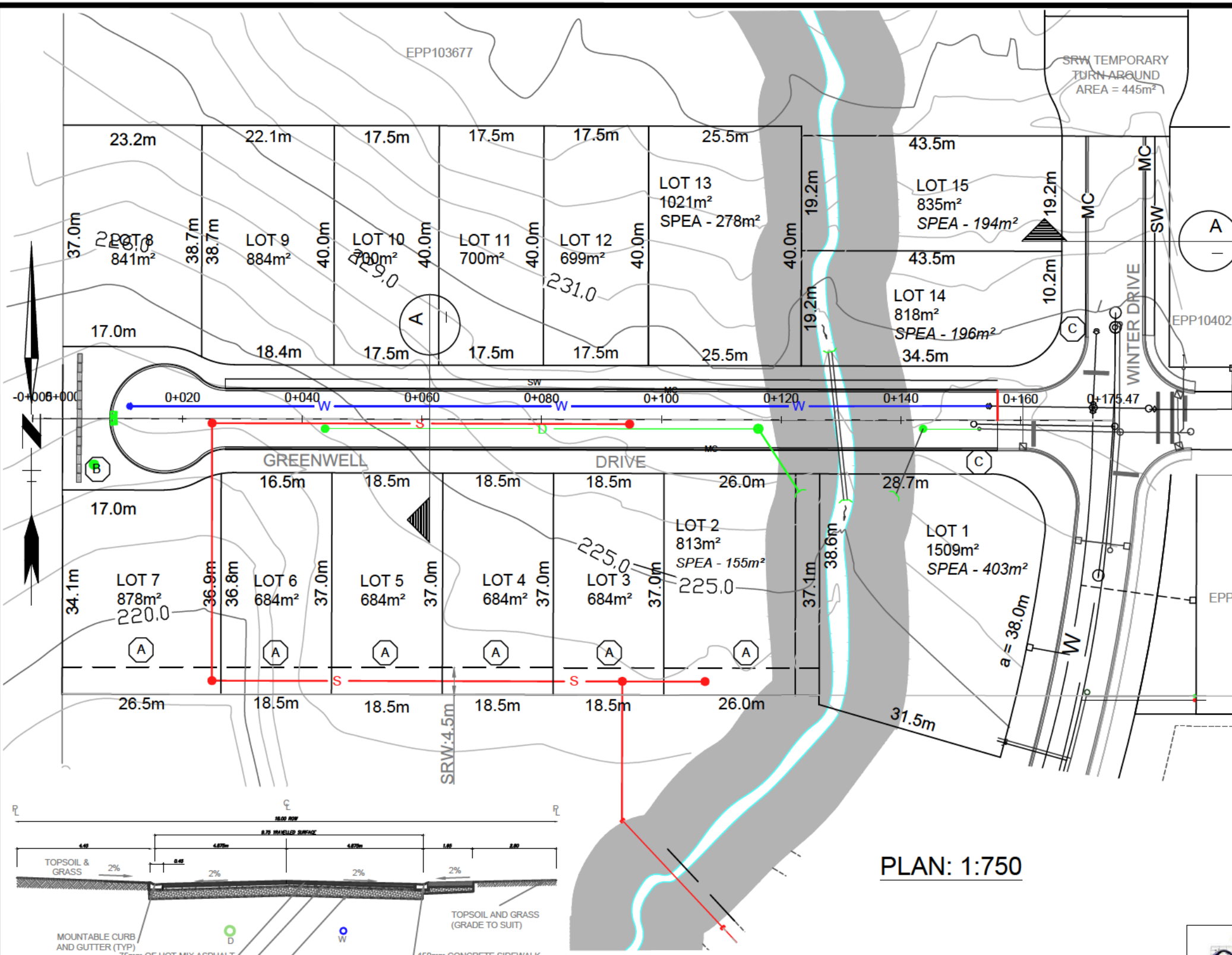
Jeff Scott, P.Eng.
Geotechnical Engineer

9.0 ATTACHMENTS

1. Cowichan Engineering Services Ltd., The Slopes Phase 6, Remainder Lot A Plan EPP103677, Dwg No. 1537-C-PLA, dated April 28, 2025.
2. LEA, Test Pit Location Plan, Dwg No. E1213.Ph6-01, dated August 8, 2025.
3. LEA, Test Pit Logs, TP25-01 to TP25-08, dated August 7, 2025.
4. EGBC, Landslide Assurance Statement.
5. EGBC, Flood Hazard Assurance Statement.

10.0 REFERENCES

1. Town of Lake Cowichan, Official Community Plan, Bylaw No. 1097-2023, adopted March 26, 2024.
2. Town of Lake Cowichan, Zoning Bylaw No. 1055-2021, consolidated November 26, 2024.
3. EGBC, Landslide Assessments in BC, Ver 4.1, dated March 1, 2023.
4. EGBC, Legislated Flood Assessments in a Changing Climate in BC, Ver 2.1, published August 28, 2018.
5. BC Ministry of Environment, Soils of South Vancouver Island British Columbia, Soil Survey Report No. 44, Sheet 2, 1986.
6. Province of BC, interactive GIS web-map, iMapBC, accessed August 2025.
7. ebbwater Consulting, with geohazard analysis by Palmer Environmental Consulting, Geotechnical Risk Assessment North Slope of Cowichan Lake, Proj No. P099, dated May 7, 2019.
8. Palmer Environmental Consulting and Stantec Consulting, Debris Flow Runout Model: North Shore Cowichan Lake, dated April 14, 2020.
9. Province of British Columbia, Ministry of Water, Land, and Air Protection, Flood Hazard Area Land Use Management Guidelines, amended by the Ministry of Forests, Lands, Natural Resource Operations, and Rural Development, dated January 1, 2028.

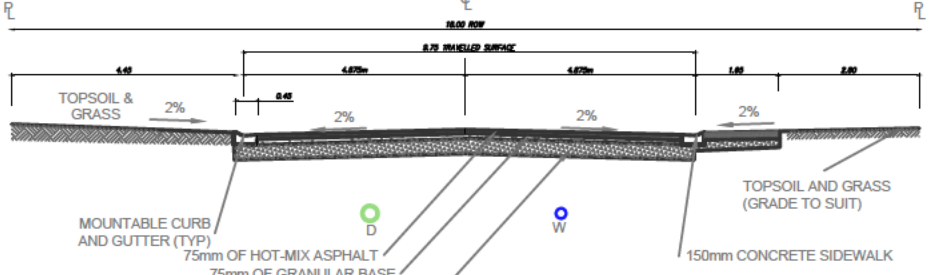


R-3 - MULTI FAMILY RESIDENTIAL ZONE

RESIDENTIAL MINIMUM AREA (SF)	600 sq.m
MINIMUM AREA (DUPLEX)	780 sq.m
MULTI-FAMILY MINIMUM AREA (SF)	780 sq.m
MINIMUM REAR YARD (RY) SETBACK	4.5m
MINIMUM SIDE YARD (SY) SETBACK	2.0m
MINIMUM (MF) SIDE YARD (SY) SETBACK	4.5m
MINIMUM (SF) FRONT YARD (FY) SETBACK	7.5m
MINIMUM (MF) FRONT YARD (FY) SETBACK	9.0m
MINIMUM SITE COVERAGE	40%

- LEGEND:**
- DENOTES EXISTING MANHOLE.
 - DENOTES SANITARY MANHOLE
 - DENOTES STORM MANHOLE
 - ◆ PROPOSED WATER VALVE.
 - ◇ DENOTES EX. WATER VALVE.

- CONSTRUCTION NOTES:**
- (A) LOTS 2-7 TO HAVE DRAIN ROCK PITS THROUGH SRW TO THE SOUTH
 - (B) 1200mm EXFILTRATION MANHOLE
 - (C) EXTEND ROAD AS PER SECTION A TO TURNAROUNDS

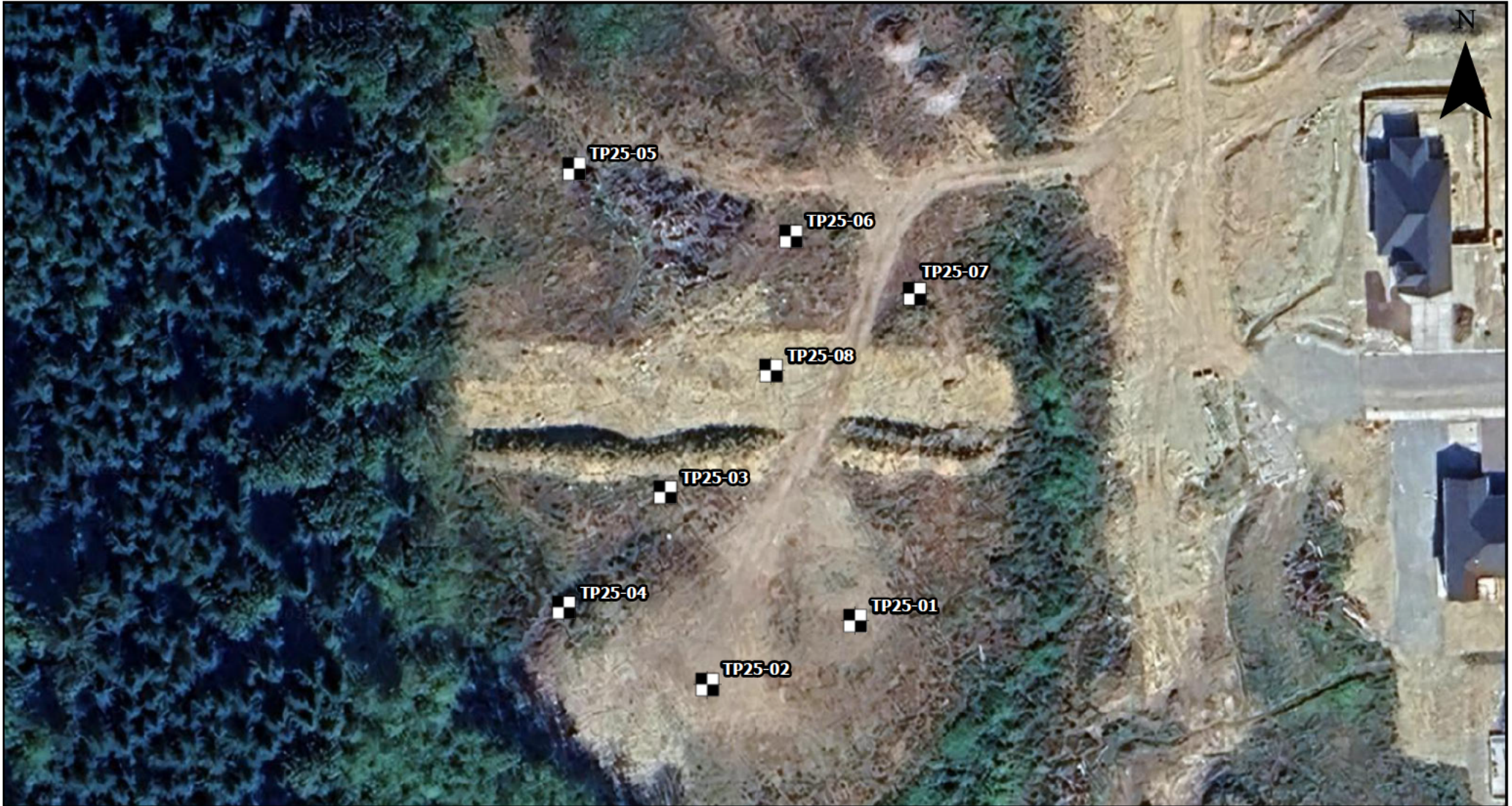





PLAN: 1:750



© 2025 COWICHAN ENGINEERING SERVICES LTD ALL RIGHTS RESERVED
 THIS DOCUMENT IS PROTECTED BY COPYRIGHT LAW AND MAY NOT BE REPRODUCED IN ANY MANNER, OR FOR ANY PURPOSE, EXCEPT BY WRITTEN PERMISSION OF COWICHAN ENGINEERING SERVICES LTD

TOWN OF LAKE COWICHAN		
PROJECT:	THE SLOPES PHASE 6	
SHEET TITLE:	REMAINDER LOT A PLAN EPP103677	
COWICHAN ENGINEERING SERVICES LTD. 6468 NORCROSS ROAD DUNCAN, BC cowichanengineering@shaw.ca	DRAWN: CW/TE CHECKED: CW SCALE: 1:750	DATE: APRIL 28 2025 FILE: 1537-C DWG: 1537-C-PLA



Legend  Test Pit	PROJECT NAME The Slopes Residential Development - Phase 6	Drawing No. E1213.Ph6-01		
	DRAWING TITLE Test Pit Location Plan	Date: 2025-08-08	Drawn By: KL	
	LEGAL DESCRIPTION Lot A, Section 6, Renfrew District, Plan EPP103677, PID: 031-159-851			0 10 20 30  Meters

TERMS, ABBREVIATIONS, SYMBOLS USED IN SOIL LOGS

SOIL DESCRIPTION SEQUENCE OF TERMS – grading/plasticity, MAJOR, minor, consistency, colour, moisture, additional, (ORIGIN)

TYPE	COARSE						FINE		ORGANIC	ROCK	
	Boulder	Cobble	Gravel		Sand			Silt	Clay	Peat	Bedrock
Size Range (mm)	200	75	19	4.75	2	0.475	0.075	0.002			
Graphic Symbol											

DENSITY OF GRANULAR SOILS	
Description	SPT N-Value
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	> 50

CONSISTENCY OF FINE-GRAINED SOILS		
Description	SPT N-Value	Undrained Shear Strength (kPa)
Very Soft	0 - 2	< 12
Soft	2 - 4	12 – 25
Firm	4 - 8	25 – 50
Stiff	8 - 15	50 – 100
Very Stiff	15 - 30	100 – 200
Hard	>30	> 200

MOISTURE CONDITION	
Description	Field Identification
Dry	Absence of moisture, dusty, dry to touch.
Moist	Damp but no visible water.
Wet	Visible free water, usually soil is below water table.

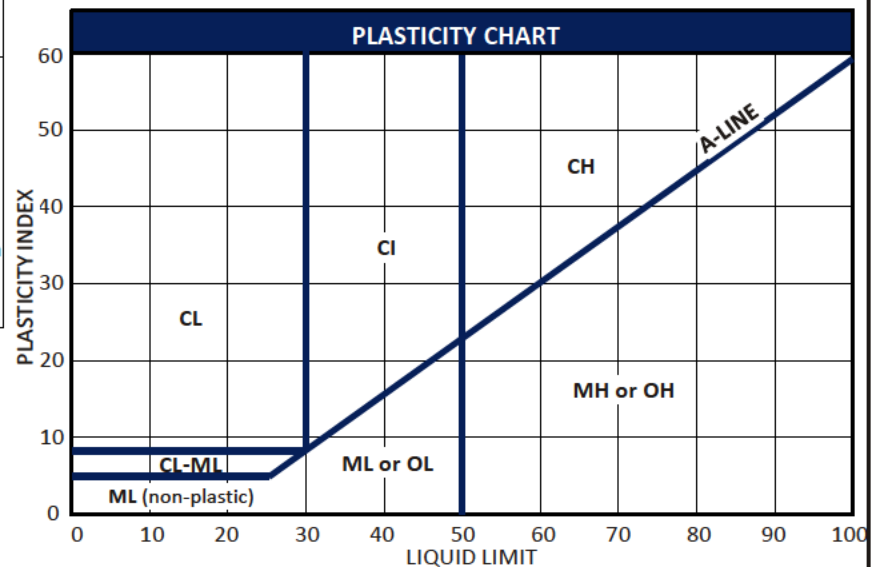
PROPORTIONAL MODIFIERS			
Fraction	Modifier	% Fraction	Example
Major	and	> 35%	SAND and GRAVEL
Subordinate	y / ey	20 – 35%	silty, clayey
Minor	some	10 – 20%	some sand
	trace	< 10%	trace gravel
	occasional	one or two	occasional boulder

GRADING TERMS	
Description	Definition
Well graded	A wide range of particle sizes
Poorly graded	A limited range of particle sizes
Uniformly graded	Essentially one particle size
Gap graded	Missing a particle size within a range

FINE-GRAINED SOIL DESCRIPTION			
Group Symbol	Liquid Limit	A-Line Plot	Example Type
ML	<50	Below	Silt of low plasticity.
MH	>50	Below	Silt of high plasticity.
CL	<30	Above	Clay of low plasticity.
CI	30-50	Above	Clay of intermediate (medium) plasticity.
CH	>50	Above	Clay of high plasticity.
OL	<50	Below	Organic silt or clay of low to medium plasticity.
OH	>50	Above	Organic silt of clay of high plasticity.

SAMPLE LEGEND	
	Grab
	SPT
	Bulk
	Shelby Tube
	Core
	No Recovery

WATER LEVEL	
	Inferred
	Measured



Notes:

- Soil classification based on and in accordance with the Canadian Foundation Engineering Manual (2006 and 2023) and ASTM D2487 standard practice for classification of soils for engineering purposes (Unified Soil Classification System).
- The graphic symbols used above are combined for mixed soils.
- SPT N-values on logs are uncorrected field values.



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-01

Elevation: 226m

Coordinates: 48.83778°N, -124.05333°W

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
0.0-0.5m		Silty, gravelly, SAND, trace organics (roots, rootlets, matter), compact, light brown, dry to moist (FILL)
0.5-2.3m		Sandy SILT, some gravel, some organics (roots, matter), trace debris (logs), soft, black to dark brown, moist to wet, organic odour (FILL)
2.3-2.7m		Silty, gravelly, SAND, trace cobble, compact to very dense, light brown, wet to moist (TILL) Density increases at 2.6m and becomes moist
3.0		Fill materials to 2.3m. No observed groundwater seepage. End of test pit at 2.7m (refusal).

Logged By: Knut Lokken, EIT, GIT
 Reviewed By: Jeff Scott, P.Eng.
 Digging Method: Hyundai 210 LC-9

Date: August 7, 2025
 Page 1 of 1

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-02

Elevation: 224m

Coordinates: 48.83768°N, -124.05368°W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.
0.0		Ground Surface		
0.0-0.4m		Silty, gravelly, SAND, trace organics (rootlets, matter), compact, light brown, dry (FILL)		
0.4-2.5m		Sandy SILT, some organics (roots, rootlets, matter), trace debris (logs, metal), firm, black to dark brown, moist, organic odour (FILL)		
2.5-3.0m		Silty, gravelly, SAND, compact to very dense, grey, wet to moist (TILL) Density increases at 2.8m and becomes moist		GS-01
3.0		Fill materials to 2.5m. No observed groundwater seepage. End of test pit at 3.0m (refusal).		

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Knut Lokken, EIT, GIT Date: August 7, 2025
 Reviewed By: Jeff Scott, P.Eng. Page 1 of 1
 Digging Method: Hyundai 210 LC-9

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-03

Elevation: 227m

Coordinates: 48.83798°N, -124.05378°W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.
0.0		Ground Surface		
0.0-0.7m		0.0-0.7m Sandy, gravelly, SILT, some organics (roots, rootlets, matter), firm, brown, dry (FILL)		
0.5			■	GS-02
0.7-1.1m		0.7-1.1m Gravelly SAND, some silt, compact, orangish brown, dry		
1.0			■	GS-03
1.1-1.2m		1.1-1.2m Silty, gravelly, SAND, very dense, light brown, moist (TILL)		
1.5		Fill materials to 0.7m. No observed groundwater seepage. End of test pit at 1.2m (refusal).		
2.0				
2.5				
3.0				

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Knut Lokken, EIT, GIT Date: August 7, 2025
 Reviewed By: Jeff Scott, P.Eng. Page 1 of 1
 Digging Method: Hyundai 210 LC-9

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-04

Elevation: 224m

Coordinates: 48.8378°N, -124.05402°W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.
0.0		Ground Surface		
0.0-0.1m		Sandy SILT, some organics (rootlets, roots, matter), trace gravel, soft, brown, moist (TOPSOIL / FILL)		
0.1-0.3m		Silty, gravelly, SAND, trace organics (rootlets, roots), loose to compact, orangish brown, moist	Grab	GS-04
0.3-0.4m		Silty, gravelly, SAND, trace cobble, very dense, light brown to grey, moist (TILL)		
Fill materials to 0.1m. No observed groundwater seepage. End of test pit at 0.4m (refusal).				
1.0				
1.5				
2.0				
2.5				
3.0				

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Knut Lokken, EIT, GIT
 Reviewed By: Jeff Scott, P.Eng.
 Digging Method: Hyundai 210 LC-9
 Date: August 7, 2025
 Page 1 of 1

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-05

Elevation: 235m

Coordinates: 48.83853°N, -124.05391°W

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
0.0-0.6m		Sandy SILT, some organics (rootlets, roots, matter), trace gravel, soft, black, moist (FILL)
0.6-0.9m		Gravelly SAND, some silt, compact, orangish brown, moist
0.9-1.0m		Silty, gravelly, SAND, very dense, light brown to grey, moist (TILL)
		Fill materials to 0.6m. No observed groundwater seepage. End of test pit at 1.0m (refusal).
1.5		
2.0		
2.5		
3.0		

Logged By: Knut Lokken, EIT, GIT
 Reviewed By: Jeff Scott, P.Eng.
 Digging Method: Hyundai 210 LC-9

Date: August 7, 2025
 Page 1 of 1

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-06

Elevation: 236m

Coordinates: 48.83846°N, -124.054°W

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
0.0-0.1m		Sandy SILT, some organics (rootlets, roots, matter), trace gravel, soft, brown, moist (TOPSOIL / FILL)
0.1-0.5m		Silty, gravelly, SAND, trace organics (rootlets, roots), compact, orangish brown, moist
0.5-0.6m		Silty, gravelly, SAND, very dense, light brown, moist (TILL)
		Fill materials to 0.1m. No observed groundwater seepage. End of test pit at 0.6m (refusal).
1.0		
1.5		
2.0		
2.5		
3.0		

Logged By: Knut Lokken, EIT, GIT
 Reviewed By: Jeff Scott, P.Eng.
 Digging Method: Hyundai 210 LC-9

Date: August 7, 2025
 Page 1 of 1

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com



TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-07

Elevation: 234m

Coordinates: 48.83829°N, -124.05319°W

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
0.0-0.2m		Sandy SILT, some organics (rootlets, roots, matter), trace gravel, soft, black, moist (TOPSOIL / FILL)
0.2-0.9m		Gravelly SAND, some silt, trace cobble, compact, orangish brown, dry
0.9-1.0m		Silty, gravelly, SAND, trace cobble, very dense, light brown, moist (TILL)
		Fill materials to 0.2m. No observed groundwater seepage. End of test pit at 1.0m (refusal).
1.5		
2.0		
2.5		
3.0		

Logged By: Knut Lokken, EIT, GIT
 Reviewed By: Jeff Scott, P.Eng.
 Digging Method: Hyundai 210 LC-9

Date: August 7, 2025
 Page 1 of 1

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com




TEST PIT LOG

File Number: E1213.PH6
 Client: 0697413 B.C. LTD.
 Project: The Slopes Residential Subdivision
 Location: Greenwell Drive, Lake Cowichan, BC

TP25-08

Elevation: 232m

Coordinates: 48.83817°N, -124.05353°W

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
0.0-0.2		0.0-0.2m Silty, gravelly, SAND, trace cobble, very dense, light brown, dry to moist (TILL)
		No observed groundwater seepage. End of test pit at 0.2m (refusal).
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		

Logged By: Knut Lokken, EIT, GIT
 Reviewed By: Jeff Scott, P.Eng.
 Digging Method: Hyundai 210 LC-9

Date: August 7, 2025
 Page 1 of 1

1900 Boxwood Road
 Nanaimo, British Columbia, V9S 5Y2
 Phone: 250-756-0355
 Fax: 250-756-3831
 Email: geotech@lewkovich.com

LANDSLIDE ASSESSMENT ASSURANCE STATEMENT

Notes: This statement is to be read and completed in conjunction with the Engineers and Geoscientists BC *Professional Practice Guidelines – Landslide Assessments in British Columbia* (“the guidelines”) and the current *BC Building Code (BCBC)*, and is to be provided for Landslide Assessments (not floods or flood controls), particularly those produced for the purposes of the *Land Title Act*, *Community Charter*, or *Local Government Act*. Some jurisdictions (e.g., the Fraser Valley Regional District or the Cowichan Valley Regional District) have developed more comprehensive assurance statements in collaboration with Engineers and Geoscientists BC. Where those exist, the Qualified Professional is to fill out the local version only. Defined terms are capitalized; see the Defined Terms section of the guidelines for definitions.

To: The Approving Authority (or Client)

File No.: E1213.Ph6

Town of Lake Cowichan

Date: August 15, 2025

39 South Shore Road, PO Box 860, Lake Cowichan, BC V0R 2G0

Jurisdiction/name and address

With reference to (CHECK ONE):

- A. *Land Title Act* (Section 86) – Subdivision Approval
- B. *Local Government Act* (Sections 919.1 and 920) – Development Permit
- C. *Community Charter* (Section 56) – Building Permit
- D. Non-legislated assessment

For the following property (the “Property”):

Remainder Lot A Plan EPP103677 ; Greenwell Drive, Lake Cowichan

Civic address of the Property

The undersigned hereby gives assurance that they are a Qualified Professional and a professional engineer or professional geoscientist who fulfils the education, training, and experience requirements as outlined in the guidelines.

I have signed, authenticated, and dated, and thereby certified, the attached Landslide Assessment Report on the Property in accordance with the guidelines. That report must be read in conjunction this statement.

In preparing that report I have:

[CHECK TO THE LEFT OF APPLICABLE ITEMS]

- 1. Collected and reviewed appropriate background information
- 2. Reviewed the proposed Residential Development or other development on the Property
- 3. Conducted field work on and, if required, beyond the Property
- 4. Reported on the results of the field work on and, if required, beyond the Property
- 5. Considered any changed conditions on and, if required, beyond the Property
- 6. For a Landslide Hazard analysis or Landslide Risk analysis, I have:
 - 6.1 reviewed and characterized, if appropriate, any Landslide that may affect the Property
 - 6.2 estimated the Landslide Hazard
 - 6.3 identified existing and anticipated future Elements at Risk on and, if required, beyond the Property
 - 6.4 estimated the potential Consequences to those Elements at Risk
- 7. Where the Approving Authority has adopted a Level of Landslide Safety, I have:
 - 7.1 compared the Level of Landslide Safety adopted by the Approving Authority with the findings of my investigation
 - 7.2 made a finding on the Level of Landslide Safety on the Property based on the comparison
 - 7.3 made recommendations to reduce Landslide Hazards and/or Landslide Risks

LANDSLIDE ASSESSMENT ASSURANCE STATEMENT

8. Where the Approving Authority has **not** adopted a Level of Landslide Safety, or where the Landslide Assessment is not produced in response to a legislated requirement, I have:

- 8.1 described the method of Landslide Hazard analysis or Landslide Risk analysis used
- 8.2 referred to an appropriate and identified provincial, national, or international guideline for Level of Landslide Safety
- 8.3 compared those guidelines (per item 8.2) with the findings of my investigation
- 8.4 made a finding on the Level of Landslide Safety on the Property based on the comparison
- 8.5 made recommendations to reduce Landslide Hazards and/or Landslide Risks

9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections

Based on my comparison between:

[CHECK ONE]

- the findings from the investigation and the adopted Level of Landslide Safety (item 7.2 above)
- the appropriate and identified provincial, national, or international guideline for Level of Landslide Safety (item 8.4 above)

Where the Landslide Assessment is not produced in response to a legislated requirement, I hereby give my assurance that, based on the conditions¹ contained in the attached Landslide Assessment Report:

A. SUBDIVISION APPROVAL

For subdivision approval, as required by the *Land Title Act* (Section 86), "the land may be used safely for the use intended"
[CHECK ONE]

- with one or more recommended additional registered Covenants
- without an additional registered Covenant(s)

B. DEVELOPMENT PERMIT

For a development permit, as required by the *Local Government Act* (Sections 488 and 491), my report will "assist the local government in determining what conditions or requirements it will impose under subsection (2) of [Section 491]"
[CHECK ONE]

- with one or more recommended additional registered Covenants
- without an additional registered Covenant(s)

C. BUILDING PERMIT

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 additional registered Covenants
- without any additional registered Covenant(s)

¹ When seismic slope stability assessments are involved, Level of Landslide Safety is considered to be a "life safety" criteria, as described in Commentary JJJ of the *National Building Code of Canada (NBC) 2015, Structural Commentaries (User's Guide – NBC 2015: part 4 of division B)*. This states:

"The primary objective of seismic design is to provide an acceptable level of safety for building occupants and the general public as the building responds to strong ground motion; in other words, to minimize loss of life. This implies that, although there will likely be extensive structural and non-structural damage, during the DGM (design ground motion), there is a reasonable degree of confidence that the building will not collapse, nor will its attachments break off and fall on people near the building. This performance level is termed 'extensive damage' because, although the structure may be heavily damaged and may have lost a substantial amount of its initial strength and stiffness, it retains some margin of resistance against collapse."

LANDSLIDE ASSESSMENT ASSURANCE STATEMENT

Jeff Scott, P.Eng

Name (print)

August 15, 2025

Date

1900 Boxwood Road

Address

Nanaimo, BC V9S 5Y2

250-756-0355

Telephone

jscott@lewkowich.com

Email

(Affix PROFESSIONAL SEAL and signature here)

The Qualified Professional, as a registrant on the roster of a registrant firm, must complete the following:

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

(Print name of firm)

with Permit to Practice Number **1001802**

(Print permit to practice number)

and I sign this letter on behalf of the firm.

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

LEA File No.: E1213.Ph6

Town of Lake Cowichan

Date: August 15, 2025

39 South Shore Road, PO Box 860, Lake Cowichan, BC V0R 2G0

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”):

Lot A, Section 6, Renfrew District, Plan EPP103677, Except Part on Plans EPP104021, EPP109124, and EPP138345 ; Greenwell Drive, Lake Cowichan

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:

- 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.

August 15, 2025

Date

Jeff Scott, P.Eng.

Prepared by

Chris Hudec, M.A.Sc., P.Eng.

Reviewed by

Name (print)

Jeff Scott

Signature

Name (print)

Chris Hudec

Signature

1900 Boxwood Road

Address

Nanaimo, BC V9S 5Y2

250-756-0355

Telephone

jscott@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. - Permit to Practice No. 1001802

and I sign this letter on behalf of the firm.

(Name of firm)