GEOTECHNICAL HAZARD ASSESSMENT

Proposed Single-Family Residence
Lot 15 – 279 Tal Road
Lake Cowichan, BC

Legal Address:
Lot 15, District Lot 13, Cowichan District, Plan VIP88703, PID 028-497-121

Prepared For:
MB4 Contracting Ltd.
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May 28, 2025

File No.: E4424.01
Revision No.: 00
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DISCLAIMER, ACKNOWLEDGMENTS, 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 MB4 Contracting 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. The conclusions and recommendations submitted in this Report are based upon the data obtained from a limited number of subsurface explorations. Subgrade conditions are known only at the locations of the explorations and have been used to infer subgrade conditions throughout the site in preparation of this Report. The nature and extent of subgrade variation throughout the site may not become evident until construction or further investigation.
5. Future construction shall be carried out within the requirements and recommendations of the Environmental Consultant (if applicable), any defined jurisdictional bylaws, or any existing restrictive covenants, whichever is more stringent. Any environmental and/or jurisdictional limitations may supersede the recommendations in this Report.
6. 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, or updates to the BCBC or professional practice guidelines, may impact the validity of this Report.
7. This Report has been prepared by Tennes Hamre, P.Geo., and reviewed by Stuart Crossfield, P.L.Eng., P.Geo. Mr. Hamre and Mr. Crossfield 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, Lot 15 – 279 Tal Road, Lake Cowichan, BC, from this point forward referred to as "the Property," is located on southeastern Vancouver Island within the jurisdictional boundaries of the ToLC. The proposed development for the Property at the time of this Report consists of a new single-family residence.
3. A site-specific hazard assessment was conducted to identify any potential geotechnical hazards for the proposed development. Two hazards were identified and addressed in this Report: flooding from a nearby watercourse and slope stability associated with the watercourse bank.
4. The Report recommends a Flood Construction Level (FCL) of 3.0m above the present natural boundary (PNB) and a setback of 15.0m from the PNB of the watercourse.
5. The Report recommends a safe building setback of 7.0m from the crest of the watercourse bank slope.
6. The Report discusses mitigative measures to maintain stable conditions and to safely site a future residence on the slope.
7. The findings confirm the land is considered safe for the use intended, provided the recommendations in this Report are followed.

List of Abbreviations Used in the Report

Abbreviation	Title
AHJ	Authority Having Jurisdiction
BCBC	British Columbia Building Code
CGVD	Canadian Geodetic Vertical Datum
DPA	Development Permit Area
EGBC	Engineers and Geoscientists of British Columbia
FCL	Flood Construction Level
LEA	Lewkowich Engineering Associates Ltd.
ToLC	Town of Lake Cowichan
TP	Test Pit
PGA	Peak Ground Acceleration
PNB	Present Natural Boundary

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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 single-family residence. This Report provides a summary of our findings and recommendations.

1.2 Background

b. At the time of our assessment, the Property was undeveloped and previously cleared of most treed areas. Refer to the attached survey plan prepared by KWPLS.

c. The Property is located within the jurisdictional limits of the ToLC and is zoned Urban Development (R-2). As per the ToLC Official Community Plan[1], the Property is within the Watercourse and Streamside Protection (DPA 1) and the Floodplain and Steep Slopes (DPA 2) development permit areas. Therefore, an assessment of the potential natural hazards prepared by a professional engineer with experience in geotechnical engineering is required and shall include recommendations or mitigation strategies with respect to the potential natural hazards.

d. We understand the proposed development will consist of a new single-family residence. At the time of this Report, no development plans were available for the new residence. We expect the new residence will be of conventional construction methods and include typical cast-in place concrete foundation systems.

1.3 Assessment Methodology

a. This assessment included a desktop review of relevant background information, including applicable ToLC bylaws, available development plans, registered covenants on title, aerial photographs, and published geology, and topography mapping. Please refer to the list of references at the end of this Report.

b. A subsurface investigation was carried out on April 24, 2025, using a Deere 135 excavator. Eight TPs (TP25-01 to TP25-08) were advanced at locations across the Property to provide good lot coverage and characterize the subsurface conditions. The TPs were backfilled upon completion of the investigation.

c. Our assessment included an evaluation of the global stability of the steep watercourse bank slope under both static and seismic conditions. A two-dimensional slope model was developed and assessed using slope stability analysis software to determine a safe setback from the crest of the slope for the proposed development.

d. This assessment was prepared with consideration of the referenced EGBC professional practice guidelines, Legislated Flood Assessments in a Changing Climate in BC and Landslide Assessments in British Columbia.[2,3]

1.4 Covenant Review

a. As part of our assessment, we have reviewed the legal title of the Property, specifically relative to any restrictive covenants that may impact the conclusions or recommendations made in this Report.

b. Document No. ES65479, 2001, specifies a setback and FCL from the watercourse. The recommendations in this Report supersede this covenant.

2.0 SITE CONDITIONS

2.1 Physical Setting

a. The Property is located approximately 150m south of Lake Cowichan, on the north side of Tal Road. The Property is directly bordered by park land to the north and east, and by similar residential properties to the west. Please refer to Figure 2.1 below.

Figure 2.1 – Location of Subject Property[4]

2.2 Terrain and Features

a. Upon entering the Property from Tal Road, the terrain of the Property is gently to moderately sloping down to the north, with slope angles ranging approximately 9° to 12° from horizontal up to the northern third of the Property where the inclination towards the northern Property line increases to approximately 12° to 15°.

b. A steep watercourse bank is located along the eastern Property boundary. Based on the provided topographic site plan and measurements collected during our field review, the steep slope has average inclinations of 27° to 35° from horizontal with localized slope angles of up to 40° degrees observed during the site reconnaissance.

c. The watercourse enters the neighbouring park land to the east through a 0.6m diameter concrete outlet pipe at the toe of the slope near the southeastern property line. A small drainage channel follows the toe of the bank northwards until it reaches a concrete headwall and inlet pipe northeast of the Property.

d. The Property has been previously cleared and is currently vegetated with grasses across most of the area. The watercourse bank is vegetated with immature Red Alder, blackberries, grasses, and horsetail vegetation.

e. Refer to the following photos for general conditions across the Property.

Photo 2.2.1 – General Property Area, looking southeast.

Photo 2.2.1 – General Property Area, looking southeast.

2.3 Regional Geology

a. Surficial geology for the area is classified as shallow fluvial deposits overlying moraine deposits with strongly cemented pans.[5]

b. Bedrock geology for the area 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.[6]

2.4 Soil Conditions

a. Relatively consistent soil strata were encountered during the subsurface investigation. The main soil strata are summarized in Table 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	Depths	
		From	To
1	Silty SAND to SILT and SAND, trace to some gravel, trace cobble, trace debris (wood, roots, matter), loose to compact, dark brown to brown, dry to moist (various fills)	0.00	3.00
2	Sandy SILT, trace gravel, some organics (matter, roots, rootlets), soft, dark brown, moist	3.00	3.20

3	Sandy SILT, trace gravel, soft to firm, light brown, moist to wet	1.70	3.50
4	Sandy (fine) SILT to Silty SAND, trace gravel, hard/dense, light brown to grey, moist	0.60	4.00

Table 2.4.2 – Summary of Encountered Soil Strata

Soil Stratum No.	Depth (m) to Bottom of Stratum per TP No.							
	25-01	25-02	25-03	25-04	25-05	25-06	25-07	25-08
1	1.70	1.70	2.10	1.80	0.60	3.00	3.00	1.00
2	NE	NE	NE	NE	NE	3.20	3.20	NE
3	NE	1.93	NE	NE	NE	3.50	NE	NE
4	2.00	2.20	2.50	2.40	1.10	4.00	3.80	1.50
*NE Denotes Not Encountered								

2.5 Groundwater Conditions

a. No visible groundwater seepage in the TPs was observed during our investigation. A wet stratum was observed in TP25-02 and TP25-06 at depths of 1.7m and 3.2m respectively.

b. Given the encountered conditions, specifically the dense/hard fine-grained silty subgrade, we expect that a shallow "perched" groundwater table is present seasonally. We expect that groundwater flows associated with this perched condition would be related directly to the volume and frequency of storm events.

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 at the time of our assessment.

3.0 WATERCOURSE FLOODING

3.1 Recommendations

a. Based on our field observations of the watercourse to the east of the Property, we expect this watercourse would meet the classification of a smaller stream.

b. Typical FCL values from the Flood Hazard Area Land Use Management Guidelines[7] suggest a minimum FCL of 3.0m above the PNB with a safe building setback of 15.0m from the PNB for smaller streams.

c. Therefore, LEA recommends an FCL of 3.0m above the PNB of the watercourse and a 15.0m setback from the PNB of the watercourse.

3.2 Floodwater and Inundation

a. The recommended FCL applies to any Habitable Area; defined as any room or space within a building or structure that is or can be used for human occupancy, commercial sales, or storage of goods, possessions, or equipment (including furnaces) which would be subject to damage if flooded.

a. The FCL establishes the minimum elevation of the underside of a wooden floor system or top of concrete slab for any Habitable Area. During construction, floor elevations should be confirmed by qualified survey personnel to ensure compliance with FCL requirements.

b. Provided any construction within the Property satisfies the minimum recommended FCL and setback, we do not anticipate any damage to structures as a result of floodwater. However, anything constructed or stored below the recommended FCL, such as crawlspaces, basements, or storage rooms, could be subject damage from flooding.

c. Following best construction practices, 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.

4.0 SLOPE STABILITY ANALYSIS

4.1 General

a. A pseudo-static limit equilibrium slope stability analysis was carried out using GeoStudio 2024 Slope/W software, employing the Morgenstern-Price method. The software was used to evaluate the slope's resistance to slope failure by calculating a range of potential slip surfaces, determining the critical FoS, and the estimated extent of failure. The analysis was performed for both static and 2% in 50 year seismic conditions, with a target FoS of 1.5 for the static condition and 1.0 for the seismic condition.

b. The analysis considered global rotational failures from crest to toe through the full slope height.

c. A single slope profile was modelled, corresponding to a section perpendicular to the slope face, through the steepest portion of the slope. The slope profile was created using topographic data derived from the site survey prepared by KWPLS. We consider this information sufficient for slope modelling purposes and the slope dimensions were checked for accuracy on-site using hand-held inclinometers. A site plan showing the slope section is attached to this Report.

4.2 Soil Parameters

a. The stability analysis was performed using effective stress conditions and frictional soil parameters as estimated based on the encountered soils during the TP investigation, published soil parameters, and based on LEA experience with similar soil conditions.

b. The soil strength parameters are summarized in Table 4.2 below.

Table 4.2: Mohr-Coulomb Soil Parameters

Soil Layer	Unit Weight (kN/m^3)	Effective Friction Angle (degrees)	Effective Cohesion (kPa)
01 Silty sand, loose (fill)	20	32	0
02 Silt and sand, hard	22	38	0

4.3 Piezometric Conditions

a. Groundwater was not encountered during the course of our investigation, nor was any seepage observed along the slope face. The piezometric assumptions adopted for the slope model were based on inferred groundwater conditions based on the encountered soil stratums. The piezometric line is identified on the attached Slope/W Section Plots as a dashed blue line.

b. A single piezometric surface was applied to the upper silt sand fill materials, perched above the hard silt and sand.

4.4 Seismic Slope Analysis Methodology

c. The EGBC Landslide Assessment Guidelines specify that if soil liquefaction or strain softening is not a governing failure mode, the seismic slope stability FoS and magnitude of slope displacement can be estimated by the methods provided by the guidelines.

d. The seismic hazard was first assessed using the k15 slope-displacement based seismic coefficient as initially defined in the 2010 EGBC Landslide Assessment Guidelines, then checked using updated methods by Bray and Macedo (2018, 2019) as per the 2022 EGBC Landslide Assessment Guidelines, to ensure slope displacements do not exceed 15cm for the combined interface and non-interface seismic sources. At the time of this Report, only combined source seismic hazard values were available. As per the guidelines, 15cm is considered an appropriate threshold for the maximum tolerable displacement for conventional residential construction.

e. The k15 coefficient was computed to be 0.390g, based on an earthquake moment magnitude (M) of 7.0 and a spectral response acceleration (Sa(0.5)) of 1.53g, for 2% in 50-year ground motions.

f. Seismic slope displacements were subsequently checked for the governing slip surface using a seismic yield coefficient (ky) corresponding to a FoS of 1.0, as determined with the Slope/W software.

d. The 2020 National Building Code (NBC) of Canada seismic hazard calculation for this Property are attached to this Report.

4.5 Results

a. The results of the slope stability analysis and seismic slope displacement calculations are summarized in Tables 4.5.1 and 4.5.2 below. Detailed Slope/W plots can also be found attached to this Report. The Slope/W plots display computed slip surfaces that have a FoS less than the minimum target value.

b. Table 4.5.1 below summarizes the minimum setbacks from crest of slope that are required to satisfy the design FoS for each condition.

Table 4.5.1: Summary of Slope/W Results

Section	Failure Scenario	Condition	Setback from Crest of Slope (m)
Section A-A'	Rotational Failure	Static	0.0m
Section A-A'	Rotational Failure	Seismic	7.0m

c. Table 4.5.2 below summarizes the results of the seismic slope displacement calculations along the critical slip surface (i.e., the slip surface resulting in the greatest setback) for combined seismic sources.

Table 4.5.2: Seismic Displacement Check for the Critical Slip Surface

Section	Site Classification	Initial Fundamental Period of Sliding Mass (sec)	Seismic Yield Coefficient (g)	Median Seismic Slope Displacement (M7) Earthquakes (cm)
A-A'	C	0.045	0.380	3.31

5.0 STEEP SLOPE DISCUSSIONS AND RECOMMENDATIONS

5.1 General

a. Our assessment indicates the slope is primarily comprised of hard glacially consolidated materials with loose fill materials placed near the crest of the slope. These hard soils can maintain steep slopes for lengthy periods of time, however are susceptible to erosion and lose strength when saturated or exposed to heavy rain or concentrated overbank runoff. Over time, continued erosion can cause earth movement and slope instability, which could be accelerated during extreme natural occurrences such as earthquakes or low frequency storms events.

b. There was no evidence of erosion at the toe of the slope due to the watercourse and the slope is well vegetated even within the watercourse channel. We expect this is a result of very low flow velocities and do not expect toe erosion to impact the stability of the slope over the design life of the residence.

c. The steep slope is considered to be in a relatively stable condition, considering there were no visual signs

of imminent global / full slope height instability observed on the Property and slope at the time of our investigation.

5.2 Recommended Setback

a. Based on slope geometry, subsurface conditions, interpreted mechanisms of slope movement described above, and the results of the slope stability analyses, we recommend a minimum setback of 7.0m from the crest of slope.
b. The recommended setback shall be surveyed and marked on-site by qualified personnel prior to construction.
c. This setback is in general agreement with other slope stability assessments completed by LEA in the area and is associated with seismic displacements of 15cm or less. This setback is intended to mitigate catastrophic damage to structures (collapse) and does not propose to provide any mitigation against damage to land.
d. Ponds, swimming pools, and in-ground lawn irrigation systems shall be prohibited within the setback zone.
e. Ancillary structures such as near-grade sundecks, gazebos, and sheds may be located within the setback area, with the understanding that they are not considered occupiable space and are not structurally attached to habitable buildings. Please note that the potential for loss or damage of these less critical ancillary structures due to slope failure increases as the distance to the crest diminishes. Ultimately it is at the discretion of the AHJ whether a specific ancillary structure is considered occupiable space and be constructed in accordance with the BCBC. LEA can provide further recommendations for construction of ancillary structures within the setback area upon request.

5.3 Setback Encroachment

a. In the event the recommended setback restricts the buildable space for a reasonably sized dwelling on the Property, it is possible residential construction could encroach into the setback zone within reason, provided mitigative measures are implemented. Typical mitigative measures include:
    i. Lowering foundations to bear below the potential slip surface. Typically, spread footings are lowered based on a 1:1 ratio (i.e., 1m depth for 1m of encroachment), and up to 2.5m depth/encroachment for feasible construction.
    ii. Utilizing cantilevered foundations as designed by a Structural Engineer for portions of the residence that encroach into the setback zone.
    iii. A combination of the above.
b. LEA can provide further recommendations for these options upon request and should review Structural Foundation Plans to ensure our recommendations are satisfied.

5.4 Slope Maintenance

a. It should be noted that landslides can occur due to human activity (i.e., excavation, placement of fill, removal of vegetation, etc.) or by failure of civil infrastructure (i.e., leakage/rupture of underground water and sewer mains, stormwater disposal from existing developments, etc.).

b. Minimizing infiltration of water into the slope and setback zone is essential to reducing the risk of slope movement. It is important that water does not pond near the crest of slope. Surface water flow across the slope from precipitation events, collected stormwater, or from any other drainage system must be prevented from flowing in a concentrated manner down the slope. The concentrated discharge of collected stormwater can lead to erosion, earth movement, or slope failure.

c. The existing native vegetation cover on the slope should be maintained. The slope should not be cleared of vegetation, although select pruning, spiraling, or limbing of trees as directed by a qualified tree professional or arborist is permissible, subject to bylaw and geotechnical review. Generally, trees should only be cut if their roots are undermined by slope regression or if they are leaning severely. An arborist shall be contacted to direct any topping, pruning, or cutting of trees. Exposed soils should be seeded to encourage new growth.

d. Preserve a healthy natural vegetated buffer zone adjacent to cleared / landscaped areas for runoff attenuation which will assist in maintaining stability of surficial cover.

e. Disposal of fills, yard waste, organic debris or excavation spoils shall not be discharged or dumped onto the slope or placed along the slope crest.

6.0 DESIGN PHASE

6.1 Existing Fill Materials

a. Unsuitable fill materials were encountered in each test pit from surface up to a maximum depth of 3.0m. The thickness of the fill materials varies significantly across the Property. TP25-06 and TP25-07 both have fill depths up to 3.0m and are located within the southern third of the proposed building envelope area. Fill thicknesses are 2.1m or less for all other TPs with an average fill thickness of 1.5m excluding TP25-06 and TP25-07.

b. We expect fill materials were placed on the lot as part of the subdivision development. The deeper fill materials encountered in TP25-06 and TP25-07 appear to coincide with the historical watercourse channel which is now carried by the concrete outlet pipe to the east of the Property.

c. LEA recommends the removal of the unsuitable fill materials within the footprint of the new development to a suitable bearing surface. Following the removal of the materials to an approved bearing stratum,

footings can be founded directly on the bearing stratum, or structural fill can be placed and compacted following our recommendations for structural fill in Section 7.2 of this Report up to the desired finished grade. The zone of material removal should extend a minimum of 2.0m outward from the edge of the footings to provide adequate support if structural fill is being placed.

d. Excavation of the fill materials and lowering of the footings may be desirable should the client wish to encroach into the slope setback area as described in Section 5.3, depending on the final design and location of the new residence.

e. The client may wish to consider siting the new residence within the northern two-thirds of the Property to reduce the volume of fill materials requiring removal.

6.2 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/hard naturally deposited subgrade, an SLS bearing pressure of 125 kPa and a ULS bearing pressure of 175 kPa may be used for design purposes. These values assume a minimum 0.45m footing embedment depth.

   ii. For foundations constructed on a minimum of 0.6m of structural fill, placed and compacted as outlined in Section 6.2 of this Report, 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. Exterior footings should be provided with a minimum 0.45m depth of ground cover for frost protection.

d. The Geotechnical Engineer should evaluate the subsurface conditions at the time of construction to confirm that soil and/or groundwater conditions do not materially differ to those encountered during the subsurface investigation and that footings are based on appropriate and properly prepared founding material.

6.3 Seismic Criteria

a. As per the 2024 BCBC (Division B, Part 4, Table 4.1.8.4-B), the encountered and inferred subsurface conditions would be classified as “Site Class C” (very dense soil and soft rock).

7.0 CONSTRUCTION PHASE

7.1 General Excavation – Future Building Sites

a. Prior to construction, all unsuitable materials should be removed to provide a suitable base of support. Unsuitable materials include any non-mineral material such as vegetation, topsoil, peat, fill, or other materials containing organic matter, as well as any soft, loose, or disturbed soils.

b. The average depth to competent subgrade as encountered within the TPs was 2.0m.

c. Excavation work should conform to Occupational Health and Safety guidelines. Any excavations deeper than 1.2m should be reviewed in the field by a Geotechnical Engineer. For preliminary planning purposes, we expect the loose fill soils may be stable at a 3H:4V slope configuration, assuming no seepage.

d. Ground water ingressing into any excavations should be controlled with a perimeter ditch located just outside of the building areas, connected to positive drainage.

e. Prior to placement of concrete footings, any bearing soils that have been softened, loosened, or otherwise disturbed during the course of construction, should be removed or else compacted following our 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.

f. The Geotechnical Engineer is to confirm the removal of unsuitable materials and approve the exposed competent inorganic subgrade, prior to the placement of any structural fill material.

7.2 Structural Fill

a. Where fill is required to raise areas that will support buildings, slabs, or pavements, structural fill should be used. The Geotechnical Engineer should first approve the exposed subgrade in fill areas, to confirm the removal of all unsuitable materials.

b. Structural fill should not be placed on sloping ground; sloping ground should first be benched and leveled prior to the placement of structural fill.

c. 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.

d. Structural fill should be compacted to a minimum of 95% of Modified Proctor maximum dry density (ASTM D1557) in foundation and floor slab areas, as well as in paved roadway and parking areas.

e. Structural fills under foundations (including any isolated pad footings), roadways, and pavements should include the zone defined by a plane extending down and outward a minimum 0.5m from the outer edge of the foundation at an angle of 45 degrees from horizontal to ensure adequate subjacent support. This

support zone is shown in Figure 7.2 below.

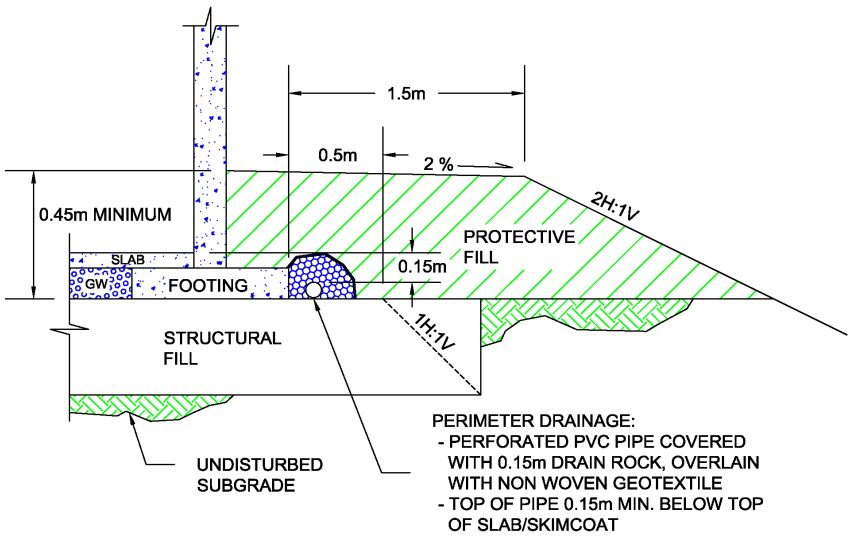

Figure 7.2 – Typical Section, Structural Fill

f. Compaction of fill should include moisture conditioning as needed to bring the soils to the optimum moisture content and compacted using vibratory compaction equipment in lift thicknesses appropriate for the size and type of compaction equipment used.

g. 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.

h. It should be emphasized that the long-term performance of buildings and slabs is highly dependent on the correct placement and compaction of underlying structural fills. Consequently, we recommend that structural fills be observed and approved by the Geotechnical Engineer. This would include approval of the proposed fill materials and performing a suitable program of compaction testing during construction.

7.3 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. We assume the installed foundation and site drainage measures will be inspected and approved by Others (i.e., the Plumbing Inspector for the AHJ) during construction.

7.4 Stormwater Management

a. Runoff from paved areas, roof drains and perimeter foundation drains should be collected and piped to the municipal storm sewer system.

b. In the absence of a municipal storm sewer, collected stormwater could be discharged through solid UV resistant conduit to the base of slope if permissible. The conduit should be anchored to the slope to prevent rupture and should include flexible couplings and a tear-away connection at or near the building. The conduit should be discharged at the toe of slope into a dispersion chamber, armoured splash pad or an approved outlet area where erosion can be managed. The conduit must be regularly inspected for leakage by current and future property owners, and immediately repaired if required.

c. Any stormwater infiltration measures (rock pits or similar) should be located outside of the recommended slope setback area and at a minimum distance of 5.0m from any structure.

d. LEA can provide a detailed Stormwater Management Plan upon request.

8.0 CONCLUSIONS

8.1 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 new single-family residence), 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 year flood event; and

iii. 10% in 50 years for all other geotechnical hazards.

8.2 Geotechnical and Quality Assurance Statement

a. The 2024 BCBC requires that a Geotechnical Engineer be retained to provide Geotechnical Assurance services for the construction of buildings that are outside of Part 9 of the BCBC. Geotechnical Assurance services include review of the geotechnical components of the plans and supporting documents, and responsibility for field reviews of these components during construction.

9.0 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.

Tennes Hamre, P.Geo.
Project Geoscientist

Stuart Crossfield, P.Geo., P.L.Eng.
Engineering Geologist

10.0 ATTACHMENTS

1. Kenyon Wilson Professional Land Surveyors, Topographic Survey of – Lot 15, District Lot 13, Cowichan Lake District, Plan VIP88703, File No. 25-9312, dated April 2, 2025.
2. E4424-01, Test Pit Site Plan, dated May 15, 2024.
3. LEA, Test Pit Logs, TP 25-01 and TP 25-08.
4. LEA, Slope/W plots (2 plots).
5. 2020 National Building Code Seismic Hazard Calculation sheet.
6. EGBC Appendix D.
7. EGBC Appendix I.

11.0 REFERENCES

1. ToLC – Official Community Plan, adopted March 26, 2024.
2. Engineers and Geoscientists British Columbia, Legislated Flood Assessments in a Changing Climate in BC, Version 2.1, dated August 28, 2018.
3. Engineers and Geoscientists of British Columbia, Landslide Assessments in British Columbia, Version 4.1, published March 1, 2023.
4. Cowichan Valley Regional District Web Map, accessed May 2025.
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 web-map, iMapBC, accessed September 2024.
7. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Flood Hazard Area Land Use Management Guidelines, amended January 1, 2018.

TOPOGRAPHIC SURVEY OF
LOT 15, DISTRICT LOT 13, COWICHAN LAKE DISTRICT, PLAN VIP88703.

SCALE 1 : 200 — 5 0 5 10 metres

All distances and elevations are in metres.

Elevations are referred to RB 600 with an assumed elevation of 100.0 metres.

Contour Interval is 1.0 metres.

Parcel boundaries are derived from Plan VIP88703.

Lot 15 is subject to the following non–financial charges and interests that may affect the positioning of structures on the property:
Statutory Right–of–Ways FB400258, FB400260, FB400272 & FB400273.
Covenant ES65479.

Note: Lot 15 lies within the Town of Lake Cowichan and is Zoned R–2.
Bylaw setback requirements are as follows:
Residential and Accessory Buidings

Front	7.5 m
Side (Interior)	1.5 m
Side (Exterior)	3.0 m
Rear	4.5 m

Inlet Headwall 0.60 dia Concrete and 0.30 dia PVC
89.99
88.78
91.13
91
Sanitary Manhole 700 SMH
91.38
91.38+
PARK
Drain Manhole
92
91.70
91.70
91.85+
92.33+ 24.02
92.57+
4.60
Top of Bank
DMH 691
1.60
SRW
93.12
93.26
93.42
94.59
95.01
SCO 0.20 PVC 739
19.89
Line of Riparian Flagging
93.18
93.72
94
95.02
95.73
95.97
95.92
94.71
96.32
96.41
96.63
Location of Spot Elevation
96.81
15
95.79
96
16
48.14
97.22
97.07
97.34
97.23
VIP88703
Line of Wood Stakes and Riparian Flagging by Bob Crandall, QEP
96.93
97
97.85
97.86
98.06+
37.32
PLAN
Limits of Riparian Assessment Area
98
98.25+
98.63
98.78
98.63
L 94.16
Outlet 0.60 Concrete Pipe
Pathway
99
99.55
Gravel
99.77
99.63
99.80
Proposed Building Envelope
1.60
PARK
14
7.60
VIP88704
PLAN
Bollard
Service Connection
99.96
100
11.87
Iron Survey Post Found (typical)
Cleanout
18.32
1.11
1.17
Telus Box
Shaw Box
Hydro Box
Water Meter W
600 RB
Back of Sidewalk
Catch Basin
99.70
99.87
100.14
100.43
Gutterline
620 MH Unmarked Manhole
TAL ROAD
Sanitary Manhole 623 SMH
621 DMH ← Drain Manhole → 624 DMH

Note: The building envelope shown, has not been reviewed or approved, and is therefor subject to approval by the Town of Lake Cowichan's Building Inspection Department.

Note: Foundation footing, roof eaves, decks or other projections may Not project into any Statutory Right of Way, Easement or Covenant Area.

KENYON WILSON
PROFESSIONAL LAND SURVEYORS

FILE: 25–9312_TOPO_MYKLE.dwg
DATE: April 2, 2025.

221 Coronation Avenue
Duncan, B.C. V9L 2T1 (250)746–4745

Legend

- Test Pit
- Subject Property
- Property Lines

PROJECT NAME Lot 15 - 279 Tal Road, Lake Cowichan, BC	Drawing No. E4424-01	Lewkowich Engineering Associates Ltd.
DRAWING TITLE Test Pit Site Plan	Date: 2025-05-15 / Drawn By: TH	
LEGAL DESCRIPTION Lot 15, District Lot 13, Cowichan Lake District, Plan VIP88703, PID 028-497-121		0 5 10 15 Meters

Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-01
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.816991N, 124.06715W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery
0.0		Ground Surface			
		0.0-0.1m Silty SAND, some gravel, trace organics (roots, rootlets) loose, brown, dry (fill)			
		0.1-0.8m Silty SAND, some gravel, trace cobble, trace debris (branches), trace organics (roots, rootlets), loose, brown, most (fill)			
0.5					
		0.8-1.0m SILT and SAND, trace gravel, trace organics (matter), soft, dark brown to reddish brown, moist (fill)			
1.0		1.0-1.7m Silty SAND, some gravel, trace cobble, trace debris (branches), loose, light brown, moist (fill)			
1.5					
		1.7-2.0m SAND and SILT, some gravel, dense, blocky, light brown, moist	■	GS1	
2.0		Fill materials to 1.7m No observed groundwater seepage End of test pit at 2.0m (target depth reached)			
2.5					
3.0					

Sample Type: ☒ SPT ■ Grab ▤ Bulk ▥ Shelby Tube ◧ Core ▨ No Recovery

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 1 of 1
Digging Method: Deere 135 Excavator

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

Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-02
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81708 N, 124.0673W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery
		Ground Surface			
0.0		0.0-1.7m Silty SAND (medium to fine), some gravel, trace cobble, trace debris (logs), trace organics (roots, rootlets), occasional boulder, loose to compact, light brown, moist (fill)			
0.5					
1.0					
1.5			Grab	GS1	
		1.7-1.93m Sandy (fine), SILT, trace gravel, soft to firm, light brown, wet			
2.0		1.93-2.2m Sandy (fine), SILT, trace gravel, interbedded with oxidized sand (medium to fine), slow dilatancy, very stiff to hard, blocky, light brown, moist	Grab	GS2	
		Fill materials to 1.7m No observed groundwater seepage End of test pit at 2.2m (target depth reached)			
2.5					
3.0					

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 1 of 1
Digging Method: Deere 135 Excavator

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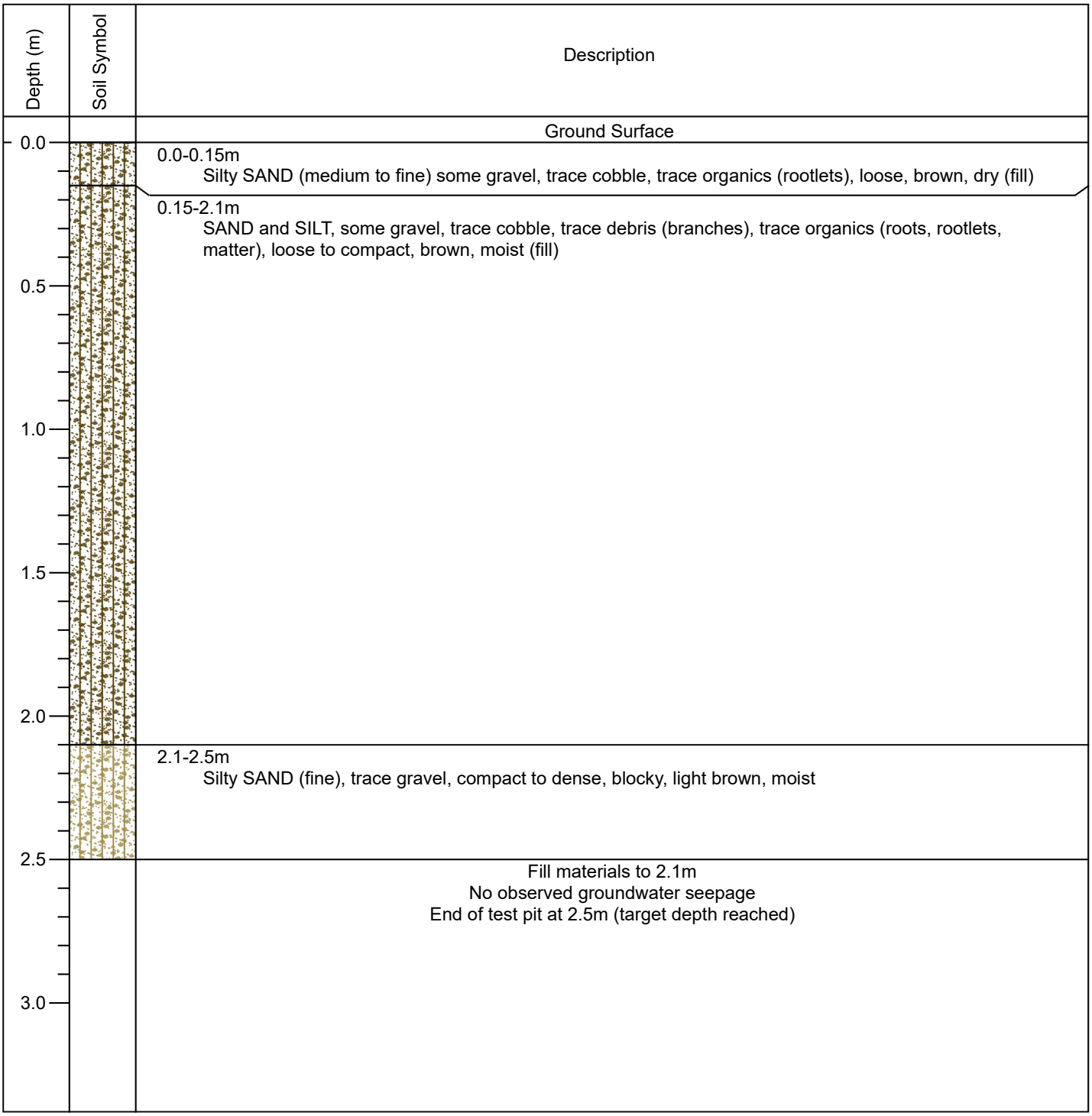
Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-03
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81698N, 124.06738W



Logged By: Tyler Anderson, B.Sc.
Reviewed By:
Digging Method: Deere 135 Excavator

Date: April 24, 2025
Page 1 of 1

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Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-04
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81694N, 124.06726W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery
0.0		Ground Surface			
		0.0-0.1m SAND, some gravel, some silt, trace organics (rootlets), loose, brown, dry			
		0.1-1.1m Silty SAND (medium to fine), some gravel, trace debris (branches), trace organics (roots, rootlets), loose, brown, moist (fill)			
0.5					
1.0					
		1.1-1.3m gravelly SAND, some silt, trace cobble, loose to compact, reddish brown, moist (fill)			
		1.3-1.8m SAND and SILT, some gravel, trace cobble, loose to compact, light brown, moist (fill)			
1.5					
		1.8-2.4m Silty SAND (medium to fine), some gravel, trace cobble, dense to very dense, blocky, grey brown with oxidation staining, moist			
2.0			■	GS1	
2.5		Fill materials to 1.8m No observed groundwater seepage End of test pit at 2.4m (target depth reached)			
3.0					

Sample Type: ☒ SPT ■ Grab ▤ Bulk ▥ Shelby Tube ◧ Core ⧄ No Recovery

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 1 of 1
Digging Method: Deere 135 Excavator

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Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-05
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81688N, 124.06745W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery
0.0		Ground Surface			
		0.0-0.15m Silty SAND, some gravel, trace cobble, trace organics (rootlets), loose, brown, dry (fill)			
		0.15-0.6m Silty SAND (medium to fine), some gravel, trace cobble, trace organics (roots, rootlets), loose, brown to reddish brown, moist (fill)			
0.5					
		0.6-1.1m Sandy (fine), SILT, trace gravel, interbedded with oxidized sand (m-f), very stiff to hard, blocky, light brown, moist			
1.0			■	GS1	
		Fill materials to 0.6m No observed groundwater seepage End of test pit at 1.1m (target depth reached)			
1.5					
2.0					
2.5					
3.0					

Sample Type: ☒ SPT ■ Grab ▤ Bulk ▥ Shelby Tube ◧ Core ⊘ No Recovery

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 1 of 1
Digging Method: Deere 135 Excavator

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Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-06
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81682N, 124.06732W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery
		Ground Surface			
0.0		0.0-0.1m Silty SAND, some gravel, trace cobble, trace organics (rootlets), loose, brown, dry (fill)			
		0.1-3.0m Silty SAND, some gravel, trace cobble, trace debris (logs, plastic), trace organics (roots, rootlets, matter), loose, brown, moist (fill)			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tyler Anderson, B.Sc.
Reviewed By:
Digging Method: Deere 135 Excavator

Date: April 24, 2025

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Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-06
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81682N, 124.06732W

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery
		Continued From Page1			
3.0		3.0-3.2m Sandy SILT, trace gravel, some organics (matter, roots, rootlets), soft, dark brown, moist			
		3.2-3.5m Sandy (fine) SILT, trace gravel, firm, moist to wet, medium brown			
3.5		3.5-4.0m SILT, sandy to some sand (fine), interbedded with sand lenses (medium to fine), very stiff to hard, blocky, light brown, moist			
			■	GS1	
4.0		Fill materials to 3.2m No observed groundwater seepage End of test pit at 4.0m (target depth reached)			
4.5					
5.0					
5.5					
6.0					

Sample Type: ☒ SPT ■ Grab ▤ Bulk ▥ Shelby Tube ◧ Core ⊘ No Recovery

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 2 of 2
Digging Method: Deere 135 Excavator

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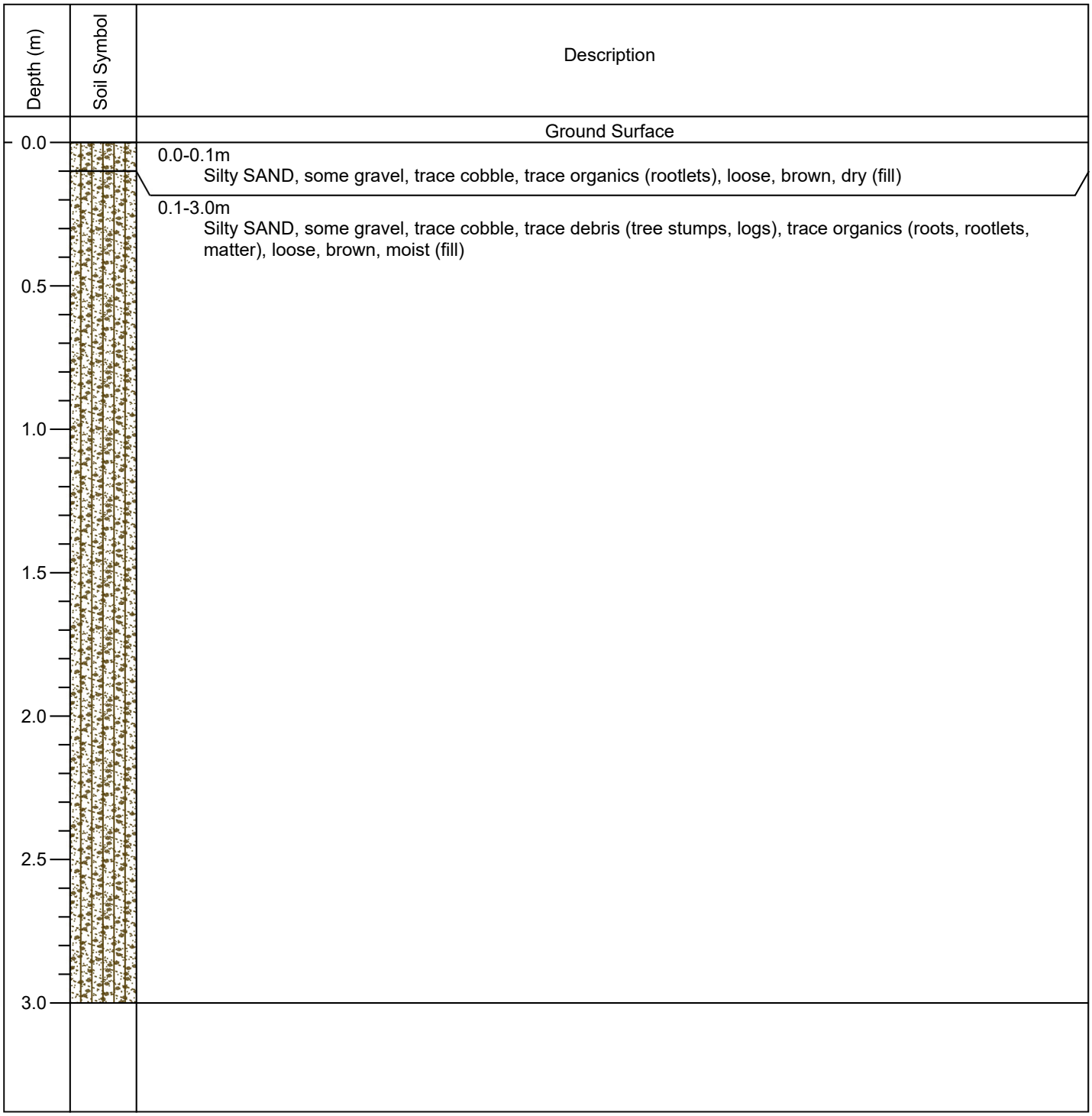
Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-07
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC



Logged By: Tyler Anderson, B.Sc.
Reviewed By:
Digging Method: Deere 135 Excavator

Date: April 24, 2025

1900 Boxwood Road
Nanaimo, BC, V9S 5Y2
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Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-07
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Depth (m)	Soil Symbol	Description
		Continued From Page1
3.0		3.0-3.2m Sandy SILT, some organics (matter, roots, rootlets), loose, dark brown, moist
		3.2-3.8m SILT, sandy to some sand (fine), interbedded with sand lenses (medium to fine), very stiff to hard, blocky, light brown, moist
3.5		
		Fill materials to 3.2m No observed groundwater seepage End of test pit at 3.8m (target depth reached)
4.0		
4.5		
5.0		
5.5		
6.0		

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 2 of 2
Digging Method: Deere 135 Excavator

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Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: E4424 TP25-08
Client: Mike Bazinet
Project: Lot 15, 287 Tal Road
Location: Lake Cowichan, BC

Coordinates: 48.81693N, 124.06739W

Depth (m)	Soil Symbol	Description
0.0		Ground Surface
		0.0-0.1m Silty SAND, some gravel, trace cobble, trace organics (rootlets), loose, brown, dry (fill)
		0.1-1.0m Silty SAND, some gravel, trace cobble, trace debris (branches), trace organics (roots, rootlets), loose, brown, moist (fill)
1.0		1.0-1.5m Sandy SILT, trace gravel, very stiff to hard, blocky, light brown, moist
1.5		Fill materials to 1.0m No observed groundwater seepage End of test pit at 1.5m (target depth reached)
2.0		
2.5		
3.0		

Logged By: Tyler Anderson, B.Sc. Date: April 24, 2025
Reviewed By: Page 1 of 1
Digging Method: Deere 135 Excavator

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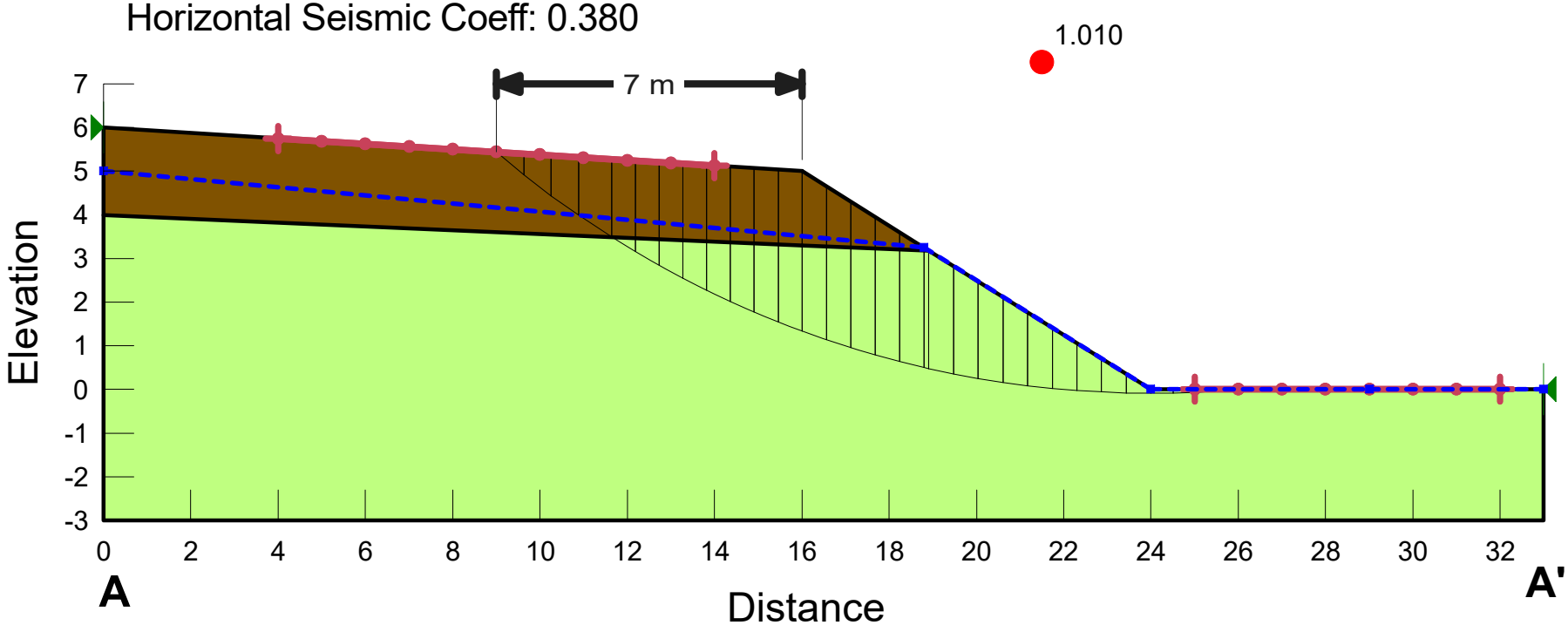
E4424
Lot 15 - 279 Tal Road
Seismic

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	01 Silty Sand, loose (fill)	Mohr-Coulomb	20	0	32	1
	02 Silt and sand, hard	Mohr-Coulomb	22	0	38	

Horizontal Seismic Coeff: 0.380



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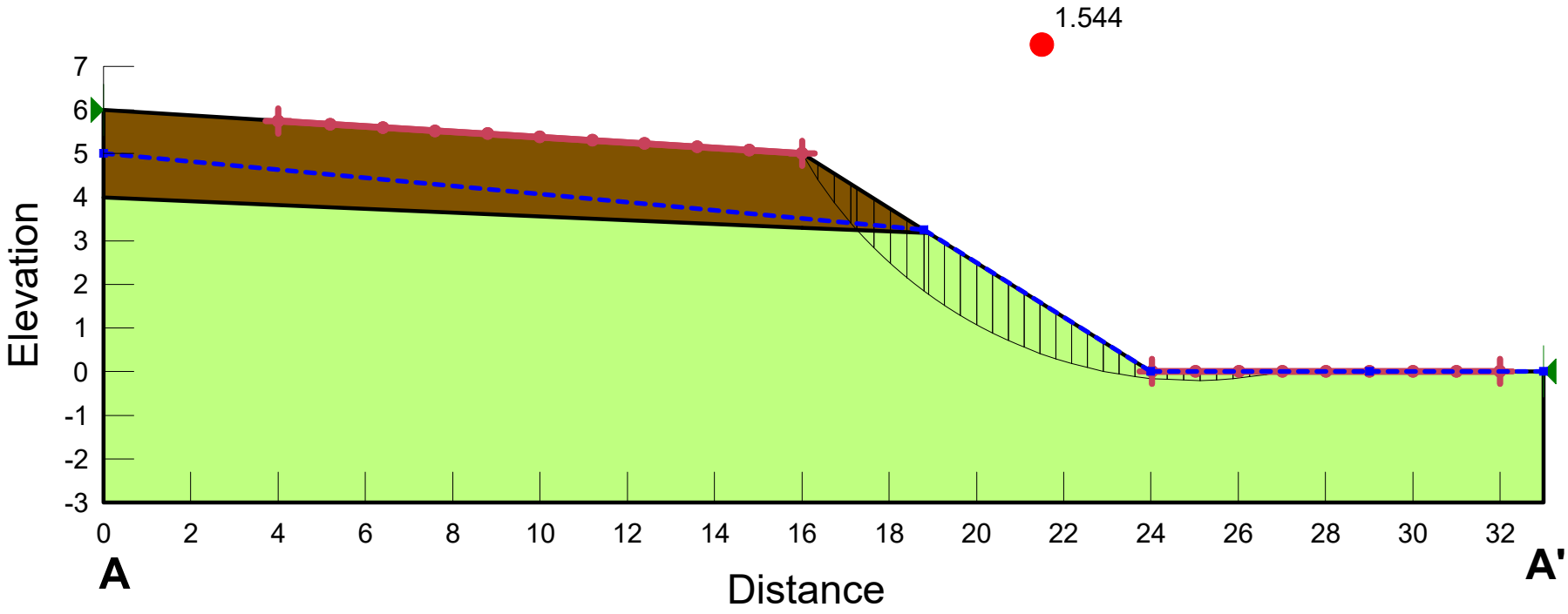
E4424
Lot 15 - 279 Tal Road
Static

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	01 Silty Sand, loose (fill)	Mohr-Coulomb	20	0	32	1
	02 Silt and sand, hard	Mohr-Coulomb	22	0	38	



1:151

Government of Canada / Gouvernement du Canada

2020 National Building Code of Canada Seismic Hazard Tool

This application provides seismic values for the design of buildings in Canada under Part 4 of the National Building Code of Canada (NBC) 2020 as prescribed in Article 1.1.3.1. of Division B of the NBC 2020.

Seismic Hazard Values

User requested values

Code edition	NBC 2020
Site designation X_S	X_C
Latitude (°)	48.817
Longitude (°)	-124.067

Please select one of the tabs below.

NBC 2020 | Additional Values | Plots | API | Background Information

The NBC 5% damped spectral acceleration values can be viewed in the NBC tab. Additional hazard values for your site can be found below.

The 5%-damped spectral acceleration ($S_a(T)$, where T is the period, in s) and peak ground acceleration (PGA) values are given in units of acceleration due to gravity (g, 9.81 m/s^2). Peak ground velocity (PGV) is given in m/s. Probability is expressed in terms of percent (%) exceedance in 50 years.

By default, all probabilities for the user-specified site designation are shown. Other site designations can be selected from the respective drop-down menu in the table. In low hazard regions, a minimum value of 0.001g for T ≤ 2.0s and of 0.0001g for T > 2.0s is assigned. Further information on the calculation of seismic hazard is provided in the *Background Information* tab.

Site Designation XC	**Probability** All	**S_a(0.05)**	**S_a(0.1)**	**S_a(0.2)**	**S_a(0.3)**	**S_a(0.5)**	**S_a(1.0)**	**S_a(2.0)**	**S_a(5.0)**	**S_a(10.0)**	**PGA**	**PGV**
X_C	2	0.923	1.35	1.63	1.78	1.53	0.914	0.581	0.145	0.0553	0.698	0.873
X_C	2.5	0.85	1.25	1.5	1.62	1.38	0.824	0.513	0.125	0.046	0.645	0.784
X_C	3.5	0.746	1.09	1.31	1.4	1.19	0.697	0.419	0.0988	0.035	0.565	0.661
X_C	5	0.645	0.935	1.12	1.18	0.993	0.572	0.329	0.0753	0.0264	0.487	0.543
X_C	7	0.554	0.804	0.963	1	0.823	0.464	0.253	0.057	0.0201	0.42	0.443
X_C	10	0.465	0.675	0.806	0.821	0.661	0.361	0.184	0.0414	0.0147	0.351	0.351
X_C	14	0.388	0.563	0.669	0.67	0.526	0.278	0.133	0.0298	0.0107	0.292	0.276
X_C	20	0.312	0.454	0.537	0.528	0.402	0.206	0.0933	0.0208	0.00736	0.234	0.209
X_C	30	0.233	0.341	0.401	0.387	0.286	0.142	0.0623	0.0137	0.0047	0.174	0.148
X_C	40	0.182	0.266	0.315	0.3	0.219	0.107	0.0461	0.0101	0.00335	0.135	0.112

Download CSV

← Go back to the seismic hazard calculator form

Date modified: 2021-04-06

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.: E4424

Date: May 28, 2025

Town of Lake Cowichan

39 South Shore Road, 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"):

Lot 15 - 279 Tal Road, Lake Cowichan, PID 028-497-121

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

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 conditions[1] 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."

Tennes Hamre, P.Geo.
Name (print)

May 28, 2025
Date

1900 Boxwood Road
Address

Nanaimo, BC V9S 5Y2

250-756-0355
Telephone

thamre@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.: E4424

Town of Lake Cowichan

Date: May 28, 2025

39 South Shore Road, 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 15, District Lot 13, Cowichan District, Plan VIP88703, PID 028-497-121; 279 Tal Road, 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

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 of 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".

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

May 16, 2025
Date

Tennes Hamre, P.Geo.
Prepared by

Tennes Hamre
Name (print)

Signature

Stuart Crossfield, P.L.Eng., P.Geo
Reviewed by

Stuart Crossfield
Name (print)

Signature

1900 Boxwood Road
Address

Nanaimo, BC V9S 5Y2

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Telephone

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(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)