

FORM 1

Riparian Areas Regulation - Qualified Environmental Professional - Assessment Report

Riparian Areas Regulation: Assessment Report

Please refer to submission instructions and assessment report guidelines when completing this report.

Date 2009-10-27

I. Primary QEP Information

First Name	Ken	Middle Name	W
Last Name	Bond		
Designation	AScT	Company	GAIA Environmental Consulting Services
Registration #	24880	Email	jkbond@telus.net
Address	1965 Dzini Road		
City	Black Creek	Postal/Zip	V9J 1H1
Prov/state	BC	Country	Canada
		Phone #	250-337-8336

II. Secondary QEP Information (use Form 2 for other QEPs)

First Name	Chris	Middle Name	
Last Name	Hudec		
Designation	Professional Engineer	Company	Lewkowich Engineering Associates Ltd.
Registration #	29249	Email	geotech@lewkowich.com
Address	Suite A-2569 Kenworth Road		
City	Nanaimo	Postal/Zip	V9T 3M4
Prov/state	BC	Country	Canada
		Phone #	250-756-0355

III. Developer Information

First Name	Richard	Middle Name	
Last Name	Schellinck		
Company			
Phone #		Email	rjtimber@telus.net
Address	Box 4		
City	Merville	Postal/Zip	V0R2M0
Prov/state	BC	Country	Canada

IV. Development Information

Development Type	Subdivision:>6 single family		
Area of Development (ha)	64	Riparian Length (m)	340
Lot Area (ha)	64	Nature of Development	new
Proposed Start Date	2009-02-02	Proposed End Date	2010-03-31

V. Location of Proposed Development

Street Address (or nearest town)	Lot 208, Quadra Island		
Local Government	Strathcona Regional District	City	
Stream Name	unnamed		
Legal Description (PID)	027 985 369	Region	Region 1 (Vancouver Island)
Stream/River Type	Stream	DFO Area	South Coast
Watershed Code	n/a		
Latitude	50	04	00
Longitude	125	13	00

Completion of Database Information includes the Form 2 for the Additional QEPs, if needed.
Insert that form immediately after this page.

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Section 1. Description of Fisheries Resources Values and a Description of the Development proposal

(Provide as a minimum: Species present, type of fish habitat present, description of current riparian vegetation condition, connectivity to downstream habitats, nature of development, specific activities proposed, timelines)

District Lot 208, on Quadra Island, is being proposed for a multi-lot subdivision. The property is 59 ha. in size with ocean frontage on Gowland Harbour and Unkak Cove. Portions of the property are covered with old growth forest and portions were logged in 2007 due to windthrow. There are five streams located on the property which all flow directly into Unkak Cove or Gowland Harbour. Stream #2 is the only stream containing fish.

Stream #1:

This stream has an average width of 1.3 meters, a gradient of 5%, and flows into Unkak Cove. It is located within an old growth forest of Douglas fir, Western red cedar, Western hemlock and red alder. The substrate is gravel and fines. The stream was used as a domestic water source in the past and has ponds which were excavated to hold water. A 200 mm steel pipe is providing the water flow to the stream. The only potential fish habitat area that is deep enough to sample with Gee minnow traps is a pond which is approximately 200 square meters by one meter deep.

The pond was sampled with two Gee minnow traps, baited with salted salmon roe, on March 4/5 and March 26/27, 2009. No fish were captured. The potential fish habitat consisted of the pond and the 55-meter section downstream.

Both Coho salmon and Cutthroat trout could potentially use this stream. However, due to the extremely low flow there is no usable habitat for these salmonids.

This stream will be contained within parkland.

Stream #2 (Lone Fish Stream):

This stream has a length of 170 meters within the subject property and has its source within upstream wetlands. The stream is located within a ravine and an old growth forest of Western red cedar, Douglas fir, Western hemlock, red alder and big leaf maple. The substrate consists of boulders, cobbles and gravel.

The stream flows into Unkak Cove. This section of stream was sampled with Gee minnow traps, baited with salted salmon roe on March 4/5, 2009. One 80 mm coastal cutthroat trout was captured.

This stream will be contained within parkland.

Stream #3:

This stream is a very shallow, small stream with an average width of 0.8 meters and a gradient of 35%. Due to the lack of water and the 35% gradient, this stream is not considered fish bearing.

Stream #4:

This stream has an average width of 2.4 meters and a gradient of 12% for the first twenty-two meters from Gowland Harbour. The gradient upstream is 23%, which precludes the passage of fish upstream. The substrate consists of boulders, cobbles, and gravel. The riparian consist of old growth forest.

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The stream was sampled for fish in the lower 22-meter section with Gee minnow traps, baited with salted salmon roe. The traps were set on March 4/5 and March 26/27, 2009, with no fish caught.

This stream will be contained within parkland.

Stream #5:

This stream has an average width of 0.7 meters and a gradient of 16% for the first ten meters from Gowland Harbour. At 10 meters, a one meter waterfall precludes any upstream passage of fish. This stream is not large enough to support spawning salmonids, but a Gee minnow trap was set below the waterfall to sample for rearing fish. The trap was set on March 4/5 and March 26/27, 2009. No fish were captured.

This stream is located within an old growth forest and has a substrate of fines and gravel.

This stream will be contained within parkland.

2. Results of Detailed Riparian Assessment

Refer to Chapter 3 of Assessment Methodology

Date: 2009-03-27

Description of Water bodies involved (number, type)

Stream	X
Wetland	
Lake	
Ditch	
Number of reaches	2
Reach #	2

Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)

Channel Width(m)		Gradient (%)	I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: a) I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b) I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>); c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and d) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation.
starting point	2.7		
upstream	2.8		
	2.7	22%	
	3.0		
	3.6		
downstream	2.2		
	2.9		
	5.3		
	3.2	12%	
	2.6		
	3.8		
Total: minus high /low	27.3		
mean	3.0		
	R/P	C/P	
Channel Type		S/P	
		X	

Site Potential Vegetation Type (SPVT)

	Yes	No		
SPVT Polygons		X	Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: a) I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b) I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>); c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and d) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation.	
Polygon No:	1		Method employed if other than TR	
SPVT Type	LC	SH		TR
				X
Polygon No:			Method employed if other than TR	
SPVT Type	LC	SH		TR

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Polygon No:		Method employed if other than TR	
SPVT Type			

Zone of Sensitivity (ZOS) and resultant SPEA

Segment No:	1	If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons					
LWD, Bank and Channel Stability ZOS (m)	10						
Litter fall and insect drop ZOS (m)	10						
Shade ZOS (m) max	9	South bank	Yes	X	No		
Ditch	Justification description for classifying as a ditch (manmade, no significant headwaters or springs, seasonal flow)						
Ditch Fish Bearing	Yes		No		If non-fish bearing insert no fish bearing status report		
SPEA maximum	10	(For ditch use table3-7)					

Segment No:		If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons					
LWD, Bank and Channel Stability ZOS (m)							
Litter fall and insect drop ZOS (m)							
Shade ZOS (m) max		South bank	Yes		No		
SPEA maximum		(For ditch use table3-7)					

Segment No:		If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons					
LWD, Bank and Channel Stability ZOS (m)							
Litter fall and insect drop ZOS (m)							
Shade ZOS (m) max		South bank	Yes		No		
SPEA maximum		(For ditch use table3-7)					

I, Ken Bond (*name of qualified environmental professional*), hereby certify that:

- I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the *Fish Protection Act*;
- I am qualified to carry out this part of the assessment of the development proposal made by the developer Rick Schellinck (*name of developer*);
- I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and
- In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation.

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Reach #

1

Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)

Channel Width(m)		Gradient (%)	I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: e) I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i>; f) I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>); g) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and h) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation.
starting point	2.9		
upstream	3.9		
	3.4	9%	
	2.3		
	2.6		
downstream	2.1		
	2.9		
	3.2	12%	
	2.4		
	2.2		
	1.5		
Total: minus high /low	24.0		
mean	2.6		
	R/P	C/P	
Channel Type			X

Site Potential Vegetation Type (SPVT)

	Yes	No		
SPVT Polygons		X	Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: e) I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i>; f) I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>); g) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and h) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation.	
Polygon No:	1		Method employed if other than TR	
SPVT Type	LC	SH		TR
			X	
Polygon No:				Method employed if other than TR
SPVT Type	LC	SH	TR	
Polygon No:				Method employed if other than TR
SPVT Type	LC	SH	TR	

Zone of Sensitivity (ZOS) and resultant SPEA

Segment No:	1	If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons
LWD, Bank and Channel	10	

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Stability ZOS (m)						
Litter fall and insect drop ZOS (m)	10					
Shade ZOS (m) max	7.8	South bank	Yes	X	No	
Ditch	Justification description for classifying as a ditch (manmade, no significant headwaters or springs, seasonal flow)					
Ditch Fish Bearing	Yes		No		If non-fish bearing insert no fish bearing status report	
SPEA maximum	10	(For ditch use table3-7)				

Segment No:		If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons				
LWD, Bank and Channel Stability ZOS (m)						
Litter fall and insect drop ZOS (m)						
Shade ZOS (m) max		South bank	Yes		No	
SPEA maximum		(For ditch use table3-7)				

Segment No:		If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons				
LWD, Bank and Channel Stability ZOS (m)						
Litter fall and insect drop ZOS (m)						
Shade ZOS (m) max		South bank	Yes		No	
SPEA maximum		(For ditch use table3-7)				

I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that:	
e)	I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ;
f)	I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>);
g)	I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and
h)	In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation.

Insert jpg file below

[illegible]

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Section 4. Measures to Protect and Maintain the SPEA

This section is required for detailed assessments. Attach text or document files, as need, for each element discussed in chapter 1.1.3 of Assessment Methodology. It is suggested that documents be converted to PDF before inserting into the assessment report. Use your "return" button on your keyboard after each line. You must address and sign off each measure. If a specific measure is not being recommended a justification must be provided.

1. Danger Trees	Stream #2 will be located within a designated undeveloped park. Accordingly, there will be no development within close proximity to any danger trees that may exist.
I, <u>Ken Bond</u> (name of qualified environmental professional), hereby certify that: i) I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; j) I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (name of developer) ; k) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	
2. Windthrow	Windthrow is not a concern within the SPEA as the surrounding area will be a designated undeveloped park.
I, <u>Ken Bond</u> (name of qualified environmental professional), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (name of developer) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	
3. Slope Stability	See geotechnical report attached.
I, <u>Chris Hudec</u> (name of qualified environmental professional), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (name of developer) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	
4. Protection of Trees	As the surrounding land will be undeveloped park land and given the geotechnical set-back, additional protection for trees is not required.
I, <u>Ken Bond</u> (name of qualified environmental professional), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (name of developer) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	
5. Encroachment	As the surrounding land will be undeveloped park land and given the geotechnical set-back, encroachment will not be an issue.
I, <u>Ken Bond</u> (name of qualified environmental professional), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (name of developer) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods	

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set out in the Schedule to the Riparian Areas Regulation	
6. Sediment and Erosion Control	As the surrounding land adjacent to Stream #2 will remain undeveloped park land, sediment and erosion control will not be a concern.
I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	
7. Stormwater Management	Stormwater management is not applicable.
I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	
8. Floodplain Concerns (highly mobile channel)	There are no floodplain concerns.
I, <u>Ken Bond</u> (<i>name of qualified environmental professional</i>), hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Regulation made under the <i>Fish Protection Act</i> ; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer <u>Rick Schellinck</u> (<i>name of developer</i>) ; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation	

Section 5. Environmental Monitoring

Attach text or document files explaining the monitoring regimen Use your "return" button on your keyboard after each line. It is suggested that all document be converted to PDF *before* inserting into the PDF version of the assessment report. Include actions required, monitoring schedule, communications plan, and requirement for a post development report.

As there will be no development in or adjacent to Stream #2, environmental monitoring will not be required.

Section 6. Photos

Provide a description of what the photo is depicting, and where it is in relation to the site plan.



Stream #2 – Upper Reach



Stream #2 – Lower Reach



Lewkowich Engineering Associates Ltd.
geotechnical • health, safety & environmental • materials testing

File: G7203.01
August 31, 2009

Richard and Cheryl Schellinck
P.O.Box 4, Merville, B.C.
Merville, B.C.
V0R 2M0

Attn: Mr. Richard Schellinck

**PROJECT: STRATA DEVELOPMENT OF DISTRICT LOT 208,
SAYWARD DISTRICT, QUADRA ISLAND, B.C.**

SUBJECT: PRELIMINARY GEOTECHNICAL ASSESSMENT

Dear Mr. Schellinck:

1. Introduction

- a. At your request, Lewkowich Engineering Associates Ltd. (LEA) has carried out a preliminary geotechnical assessment of the above site. This report provides a summary of our findings and recommendations. Specifically, our evaluations have taken into account those natural hazards, which may affect the safe development of the land.
- b. We examined the Official Community Plan (OCP) to determine whether the proposed development lies within any Environmentally Sensitive Area (ESA), Natural Hazard Area (NHA) or Development Permit Area (DPA). We note that this site is located within three development permit areas including Environmentally Sensitive Area, Steep Slope Area, and Water Course, as shown on the Site Plan by Thorconsult Ltd. (their drawing number BT09-B dated March, 2009).

2. Background

We understand that the 64 hectare, country residential development will include a mixed use of residential buildings that may include up to two-three storey structures of typical construction consisting of a steel or wood-framed superstructure supported on a concrete footing foundation. Our steep slope assessment will supplement the RAR completed by Mr. Ken Bond (QEP Technician).

Suite A - 2569 Kenworth Road, Nanaimo, B.C., Canada V9T 3M4 • Tel: (250) 756-0355 Fax: (250) 756-3831
www.lewkowich.com

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3. Assessment Objectives

Our assessment, as summarized within this report, is intended to meet the following objectives:

- i. Determine whether the land is geotechnically safe and suitable for the intended purpose, where "safe" is defined as a probability of a failure of 10 percent in 50 years, with the exception of a slope failure related to a 'design' seismic event where a probability of occurrence of 2 percent in 50 years is considered safe;
- ii. Identify any geotechnical deficiency that might impact the design and construction of the development with attention to designated OCP areas, and prescribe the geotechnical works and any changes in the standards of the design and construction of the development that are required to ensure the land, buildings, and Works and Services are developed and maintained safely for the use intended; and
- iii. Acknowledge that approving officers may rely on this report when making a decision on applications for the development of the land.

4. Assessment Methodology

A site reconnaissance was carried out on May 13, 2009 to gather information on the topography and the stability of the rock formations as it relates to the latest conceptual plans. Sub-surface soils and bedrock geology maps were also referenced by our office in the area of the subject property. The report is preliminary in nature due to the visual only site investigation and the conceptual nature of the development.

5. Site Conditions

5.1. General

- a. The site of the proposed country residential development consists of a 65 hectare lot located near the southern end of Quadra Island. The site is bordered by a partially developed commercial (C-2) property to the west, by partially developed rural (RU-1) properties to the east, by Gowland Harbour to the north and by partially developed residential (R-1) properties to the south.
- b. Topography within this development is complex, with varying foreshore slopes in both degree (20 to 80 deg from horizontal) and height (4m to 30m) throughout. A relatively flat plateau

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exists in the northern portion of the subject site with a moderately inclined section surrounding a small cove in the southern half of the property. The topography also includes a seasonal creek (Lone Fish Creek) at the bottom of a deep ravine located just south of Union Road that flows toward the small cove noted above. Overall the terrain can be described as gently rolling with some outcroppings of bedrock. The southwest and northwest extent of the property culminated at the foreshore by sheer cliffs in excess of 10m high.

- c. Vegetation consists of forested areas, including mature specimens along the outer perimeter, but the inland areas above union road have been extensively logged. Tree growth is a combination of fir, hemlock, western red cedar, and deciduous trees (maple and alder), with an undergrowth of ferns, berry vines and salal. Cleared areas include a thick growth of tall grasses with some low shrubs, blackberry bushes as well as immature tree growth.

5.2 Subsurface Conditions

- a. Typical subsurface conditions throughout the site include portions of exposed/shallow bedrock interrupted by areas of deep moraine sediments (which are generally thicker than 1m) over bedrock. The moraine sediments include pockets of colluvium and perched glaciofluvial materials. The bedrock is described as a dark grey, basaltic volcanic rock with an aphanitic surface texture. An examination of exposures indicates that the rock here is somewhat modified by tectonic action resulting in localized shear zones. The rock is characterized as strong and slightly weathered. The degree of jointing is rated as moderate, but with no dominant pattern. Where overburden soils overlie the bedrock, there is relatively little weathering of the bedrock surface. However, the bedrock surface can be described as having intricate and strong relief due to differential weathering along shears and localized joints. Much of the exposed bedrock areas include steep gradients to the foreshore below ranging in height from 10 to 30m.
- b. Much of the subject area has thicker deposits of soil. These soils are predominantly post-glacial soils typically granular in texture. An underlying formation of glacial till - identified as a mixture of silt, sand and gravel with traces of clay and frequent cobble to boulder sized materials - are typically thin in nature where exposed and/or inferred. Some testpits have been excavated for the soils investigation to determine septic design. These testpits, located on the upper plateau area showed a primarily sand based material to a depth in excess of 2m.

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5.3 Groundwater

Ground water conditions within anticipated building envelope areas are generally expected to be favorable for site development. We did not observe any water seepage or evidence of a shallow water table. In general, we expect that the ground water table will have a strong seasonal component, with ground water flows resulting from "perched" conditions notably above glacial till soils, as well as bedrock. 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.

6 Conclusions & Recommendations

6.1 General

- a. Based on the investigation in the preceding Section 5, the site is considered geotechnically safe and suitable for the intended purpose (residential development), provided the recommendations in this report are followed.
- b. Site development for the study area is understood to require area grading (excavation and embankment construction) to establish proposed roadway and service line installations. Therefore, lots are subject to re-examination during and after area grading but prior to development registration. We have taken this issue into account in formulating our recommendations.
- c. Building areas within the study area are subject to a number of controls, including coastline buffers and riparian setbacks, which we have taken into account in establishing "no build" areas for geotechnical reasons. That is, we have assumed that construction would not be permissible in these areas and have not considered development further. Controls pertaining to wildlife protection areas or vegetation controls have not been discounted, since such areas could be considered in future.
- d. We recommend that setbacks from steep slope crests be provided for proposed structures as a precautionary measure against slope degradation due to erosion from extreme storm events or from seismic action. In general, since this site has portions that consist of shallow or exposed bedrock, slopes that require setbacks are considered to have an inclination exceeding 30 degrees

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from horizontal. Based on an examination of slopes within this development site, we conclude that there are natural slopes within the property that require setbacks from slope crests. Where buildings are set above rock slopes such as in Areas 1 and 2 (Drawing BT 09-B-02, Rev 1), a minimum setback of 8m is recommended. Where buildings are to be set above glacio-marine sediment slopes as noted on Drawing BT 09-B-02, Rev 1 (Area 3) a minimum set back equal to the height of the foreshore or ravine slope is required. The Geotechnical Engineer may consider modification of the setback distances, subject to an evaluation of site-specific condition.

- e. Subgrade conditions within those areas inside of the geotechnical "build" areas are considered to be favorable for residential building construction. In general we expect that an allowable bearing pressure of 150 kPa would be available for building design and construction. This would be suitable either for naturally deposited soils, bedrock, or structural fill. If foundations consist of intact bedrock, a higher allowable bearing pressure should be available. Site preparation shall include removal of any organic (topsoil) materials or unengineered fill soils.
- f. Settlements for foundations constructed on the combination of bedrock, native undisturbed soil, or compacted structural fill should be within those ranges considered to be normal and tolerable for wood frame residential housing, being: 20 to 25 mm total and 10 to 15 mm differential between typical column spacings. This is contingent on removals of any loosened or disturbed soils within footing areas, according to conventional and good construction practice.
- g. Fill, if required to raise building areas above existing grades, should consist of freely draining imported sand and gravel. Rock rubble fill material may also be used, but is not considered practicable except in areas of bulk filling, since its compaction requires relatively heavy equipment for adequate densification. Granular fill, where required for structural support, shall be compacted to a minimum of 95 percent of the maximum Modified Proctor dry density (ASTM D 1557).
- h. Fills may be created to establish building levels that differ from existing conditions. In this case, a setback of 3.0 metres shall be established for fills ranging from 1.5 to 3.0 metres high,

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and 5.0 metres where the fill exceeds 3.0 metres thick. Fill slopes shall not exceed an inclination of 2.0 Horizontal: 1.0 Vertical. Fill shall be compacted to achieve a uniform and dense relative density. Structural fill shall be evaluated and be approved by the Geotechnical Engineer for the project.

- i. Natural soil cut faces shall not be undercut without subsequent support by permanent retaining walls designed and constructed to support the slope face. In general, retaining wall back slopes should be flattened to a configuration no steeper than 2 H: 1 V to allow for disturbance such as from temporary excavation. The Geotechnical Engineer for the project should review temporary sub cutting such as for retaining or foundation walls deeper than 1.5 metres. A more detailed geotechnical analysis on a lot by lot basis may be necessary at the time of construction this may be accomplished using a standard BC Building Code Quality Assurance Schedule's B and C.

6.3 Erosion Control

Since the site consists of some erodible surfaces, erosion control is expected to be an issue of significance during the development of this property. Overland storm water controls should take into account the potential impact of concentrated runoff as it may impact adjacent sensitive areas. This should generally take the form of runoff from construction activities being directed to retention areas prior to entry to sensitive areas. Erosion control plans can be provided by our office prior to any construction activities to ensure appropriate BMP's are documented.

6.5 Seismic Issues

No liquefiable soils have been identified at this site, nor are any expected below the investigation depth. Consequently, no unusual seismic design requirements have been identified for this site. Much of the site includes areas of shallow bedrock, which would then fall under Site Class A as applicable to Table 4.1.8.4.A of the 2006 B.C. Building Code for structures directly supported by bedrock. However, other areas of the site include competent naturally deposited soils which would fall under Site Class C as applicable to Table 4.1.8.4.A of the 2006 Building Code, for the purposes of foundation design and construction, unless detailed site observations confirm that the site class can be upgraded.

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6.6 Permanent Dewatering

- a. Considering the nature of the subject area subgrade materials, we currently expect that no special precautions are required beyond conventional perimeter drainage tile as outlined in the current B.C. Building Code. Piping entering buildings established at elevations below roadways should be installed in a manner that precludes excess moisture injection to building subgrades. These details include providing trench dams for municipal service piping installed with granular bedding, and drains on electrical or other conduits. Conventional requirements of the B.C. Building Code pertaining to building drainage are considered suitable at this site. Once final plans and tentative elevations are determined, the Geotechnical Engineer should be consulted and provide further dewatering data
- b. Ground surfaces should be graded to direct surface water well away from buildings. Any settlement of backfill around foundations will create undesirable low areas for collection of surface water next to the building, and should be immediately corrected by placement of additional backfill to restore proper surface drainage away from buildings. Settlement of backfill should not be a problem if backfill is placed and compacted following our recommendations regarding structural fill.

7.0 Geotechnical Assurance and Quality Assurance

The BC Building Code requires that a Geotechnical Engineer be retained to provide Geotechnical Assurance services for the construction of buildings. 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 Acknowledgements

Lewkowich Engineering Associates Ltd. acknowledges that this report may be requested by the building inspector (or equivalent) of the Regional District of Strathcona as a precondition to the issuance of a development permit. It is acknowledged that the approving officers and building officials may rely on this report when making a decision on application for development of the land.

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We acknowledge that this report has been prepared solely for, and at the expense of Rick & Cheryl Shellinck. We have not acted for or as an agent of the Regional District of Strathcona in the preparation of this report.

9.0 Limitations

The conclusions and recommendations submitted in this report are based upon the data obtained from a limited subsurface investigation (visual). The nature and extent of variations within this subsurface exploration may not become evident until construction or further investigation. The recommendations given are based on the subsurface soil conditions encountered during the site investigation, current construction techniques, and generally accepted engineering practices. No other warrantee, expressed or implied, is made. Due to the geological randomness of many soil formations, no interpolation of soil conditions between or away from the areas identified has been made or implied. If unidentified soils are encountered, unanticipated conditions become known during construction or other information pertinent to the structures become available, the recommendations may be altered or modified in writing by the undersigned.

10.0 Closure

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.

A handwritten signature in black ink, appearing to read 'John Hessels'.

John Hessels, ASCT
Senior Technologist

Reviewed by,

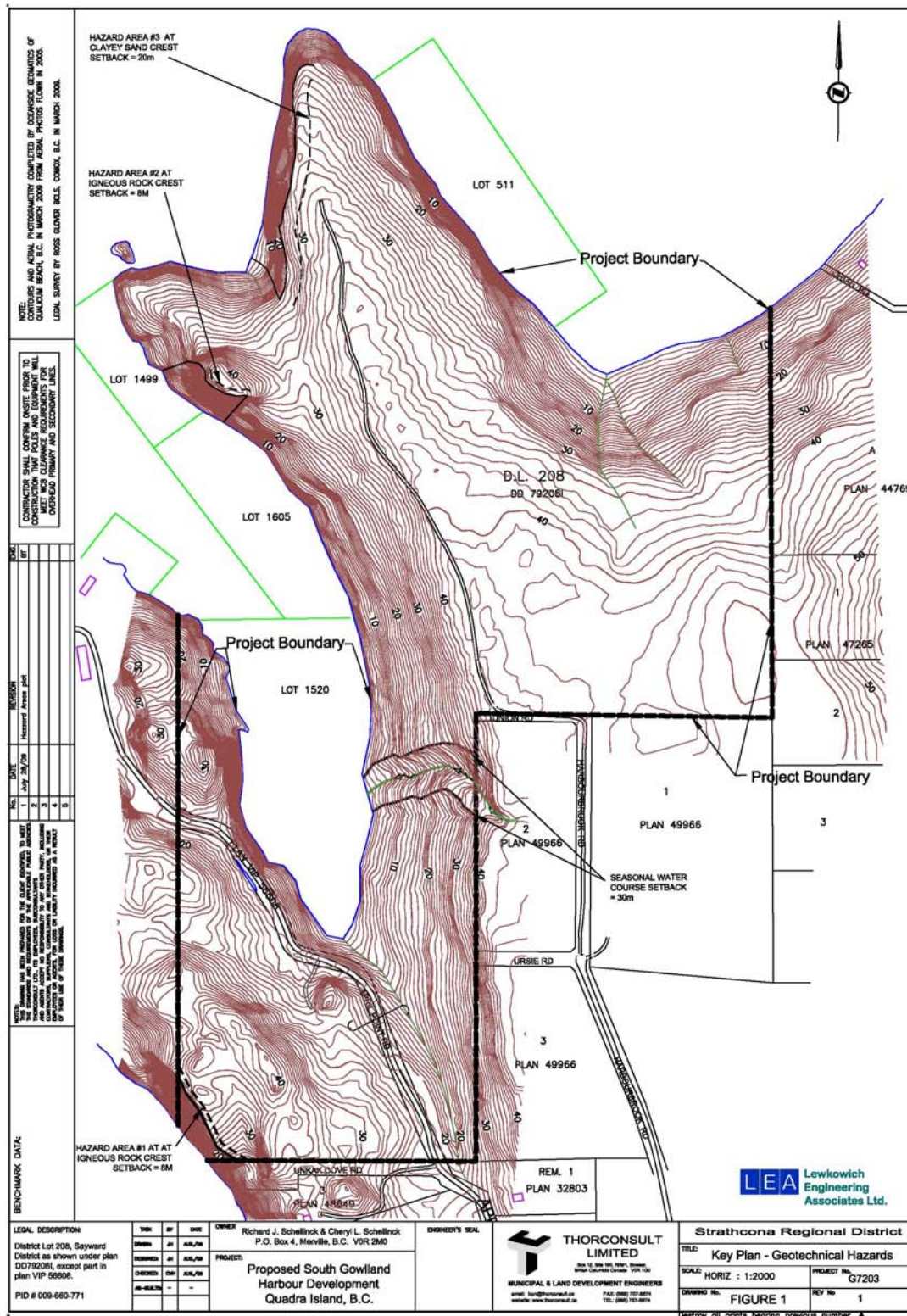


Chris Hudec, M.A.Sc., P.Eng
Project Engineer

Attachment; Thorconsult Limited Drawing BT09-B-02 Rev 1

Lewkowich Engineering Associates Ltd.

FORM 1
Riparian Areas Regulation - Qualified Environmental Professional - Assessment Report



Section 7. Professional Opinion**Assessment Report Professional Opinion on the Development Proposal's riparian area.**Date 2009-10-271. I/We Ken Bond, ASCT and Chris Hudec, P.Eng.Please list name(s) of qualified environmental professional(s) and their professional designation that are involved in assessment.)

hereby certify that:

- a) I am/We are qualified environmental professional(s), as defined in the Riparian Areas Regulation made under the *Fish Protection Act*;
- b) I am/We are qualified to carry out the assessment of the proposal made by the developer Rick Schellinck (*name of developer*), which proposal is described in section 3 of this Assessment Report (the "development proposal");
- c) I have/We have carried out an assessment of the development proposal and my/our assessment is set out in this Assessment Report; and
- d) In carrying out my/our assessment of the development proposal, I have/We have followed the assessment methods set out in the Schedule to the Riparian Areas Regulation; AND

2. As qualified environmental professional(s), I/we hereby provide my/our professional opinion that:

- a) ☐ if the development is implemented as proposed by the development proposal there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area in which the development is proposed, **OR**
(Note: include local government flex letter, DFO Letter of Advice, or description of how DFO local variance protocol is being addressed)

- b) ☒ if the streamside protection and enhancement areas identified in this Assessment Report are protected from the development proposed by the development proposal and the measures identified in this Assessment Report as necessary to protect the integrity of those areas from the effects of the development are implemented by the developer, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area in which the development is proposed.

[NOTE: "qualified environmental professional" means an applied scientist or technologist, acting alone or together with another qualified environmental professional, if

(a) the individual is registered and in good standing in British Columbia with an appropriate professional organization constituted under an Act, acting under that association's code of ethics and subject to disciplinary action by that association,

(b) the individual's area of expertise is recognized in the assessment methods as one that is acceptable for the purpose of providing all or part of an assessment report in respect of that development proposal, and

(c) the individual is acting within that individual's area of expertise.