CASCADE ENVIRONMENTAL
RESOURCE GROUP LTD

Furry Creek, BC
Preliminary Bio-Inventory

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1 Introduction

1.1 Background

Cascade Environmental Resource Group Ltd. (Cascade) were retained by Fine Peace Holdings (Canada) Ltd. to conduct a Bio-Inventory Assessment of the Oceanside Community lands of Furry Creek particularly the remaining undeveloped lands. The report will form part of the rezoning application to the Squamish Lillooet Regional District (SLRD) to allow commercial and residential development on the subject area.

The Bio-Inventory ensured the SLRD's document *A Guide to Zoning Amendments* (SLRD, 2019) requirements were detailed within the report with attention to the following points:

- *Identification of all lakes, swamps, ponds and watercourses*
- *Brief description and location of all vegetation 2.5 metres high or greater*
- *All applications must be accompanied by an initial environmental review that should specify any "riparian assessment areas"*
- *If any portion of a proposed "development" is within a "riparian assessment area" then a "qualified environmental professional" is to prepare a report*
- *Applicants should ensure that the landscape architect and designer/architect incorporate tree retention and protection measures in the design*

To provide a detailed Bio-inventory of the subject lands for the design team and assessment from other governmental agencies The *Bio-inventory Terms of Reference* (BC Ministry of Environment, 2012a) were followed to identify environmentally valuable resources (EVRs) on or near the study area and, if present, to determine the potential impacts as a result of the proposed development.

This report summarizes the findings of the Bio-Inventory, including a description of the EVRs identified on or near the site, as well as a discussion of the potential impacts of the proposed development to these, and recommendations to mitigate these impacts.

1.2 Project Team

The site investigations were conducted by Simon Fry, B.Sc., P.Biol, David Powe, B.Sc., Ken McNamara, B.Sc., P.Biol, A.Sc.T and Alyssia Jebb Dipl. Tech., B.Env., A.Sc.T. Report writing was completed by Simon Fry, David Powe and Alyssia Jebb, with support and review provided by Mike Nelson, R.P. Bio., and mapping was completed by Todd Hellinga, B.Sc., GIS-AS and Nicola Church, M.Sc., GIS A.S. All project team members have extensive experience conducting environmental inventories, reviews and assessments.

2 Site Description and Development Plans

2.1 Site Description

The lands are part of what are known as the Oceanside Community of Furry Creek. The lands are within Electoral Area D of the SLRD 50 km north of Vancouver and 18 km south of Squamish. The subject area is composed of approximately 408 ha including 3 areas: the Oceanside Lands, the Uplands and the Golf Course. The Oceanside Lands consist of lands to the west of Highway 99 including the constructed Oliver Landing community, remainder of Lot 2 to the south of Furry Creek totaling 6.29 ha and the

remainder of Lot 1 lands to the North of Oliver Landing totaling approximately 18.7 ha. The uplands are located to the east of Highway 99 totaling 263 ha and are split into 15 legal entities (Map 1).

The remainder of Block 1 is located within the north east of the subject area. The remainder of Block 3 is located south of furry creek and north of furry creek west of the Furry Creek Country club parcel. District Lots 4149, 4145, 4144, 4007, 3727 are undivided district lots to the north of furry Creek. DL 2922. D.L. 2924 are undivided district lots south of Furry Creek in the vicinity of the confluence of Phyllis Creek and Furry Creek, all lots have no access to civil services or constructed roads.

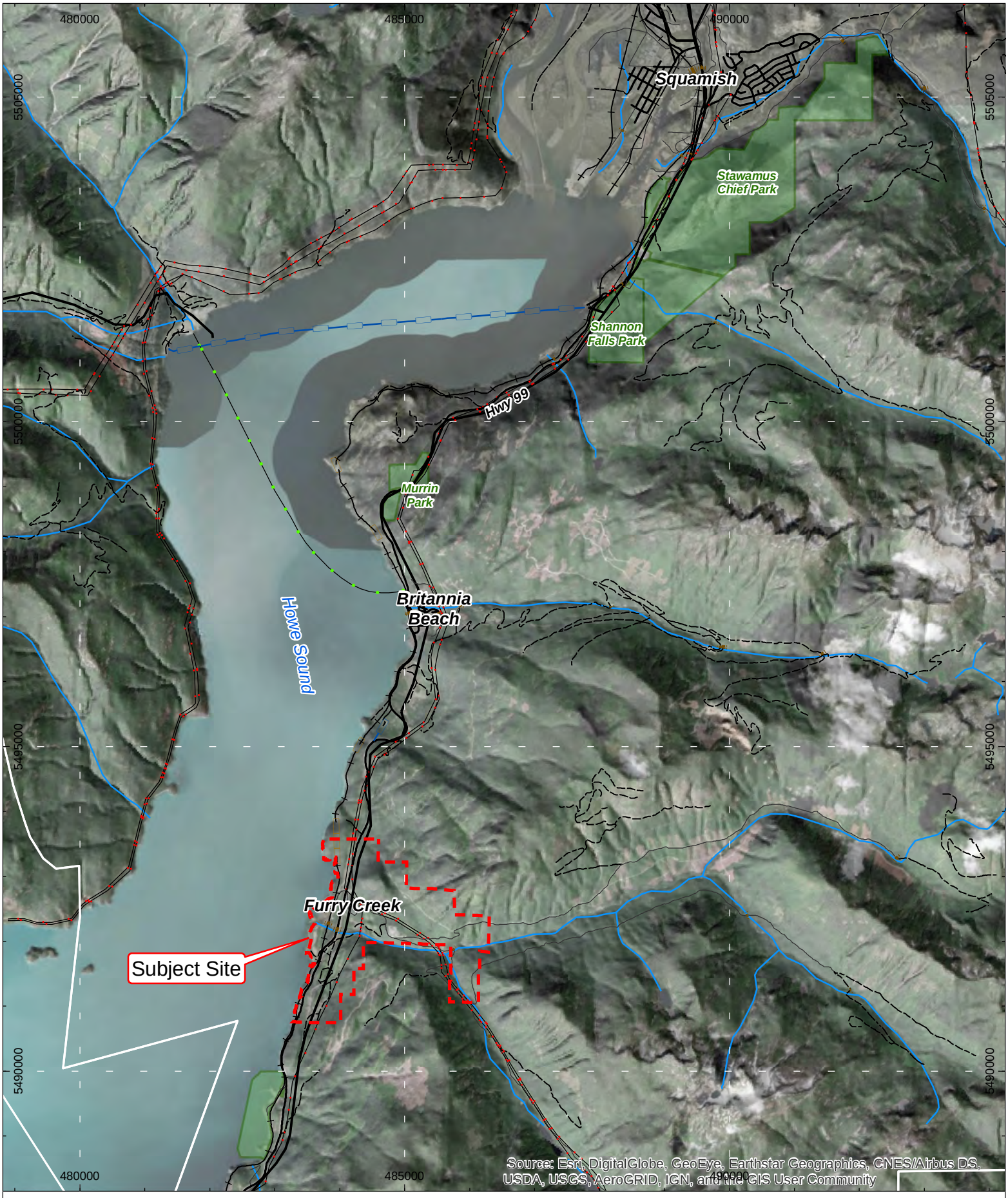
2.2 Proposed Development

The subject lands have been designated into proposed 13 development pods, the development pods are listed below with location displayed on Map 2.

1) Oliver's Landing Phase 2
2) Waterfront Lands
3) Directors Lots
4) Porteau Bluff
5) Northwest Lands
6) Collector Lands
7) Uplands South
8) Uplands North
9) Mountain Lands
10) Upper Benchlands
11) Northeast Lands
12) Highlands
13) Marina

The BIA examines the existing environmental conditions in each development pod and provide mitigation and constraints to development. The Marina development pod will not be detailed in this report as an environmental assessment of the area will be conducted by others.

There are preliminary development designs for each Development Pod, however, it is understood designs will change upon findings of reports conducted on the lands by the consulting team.



GIS Cartographer: Nicola Church
Date: February 25, 2019
CERG File#: 926-01-01
Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov

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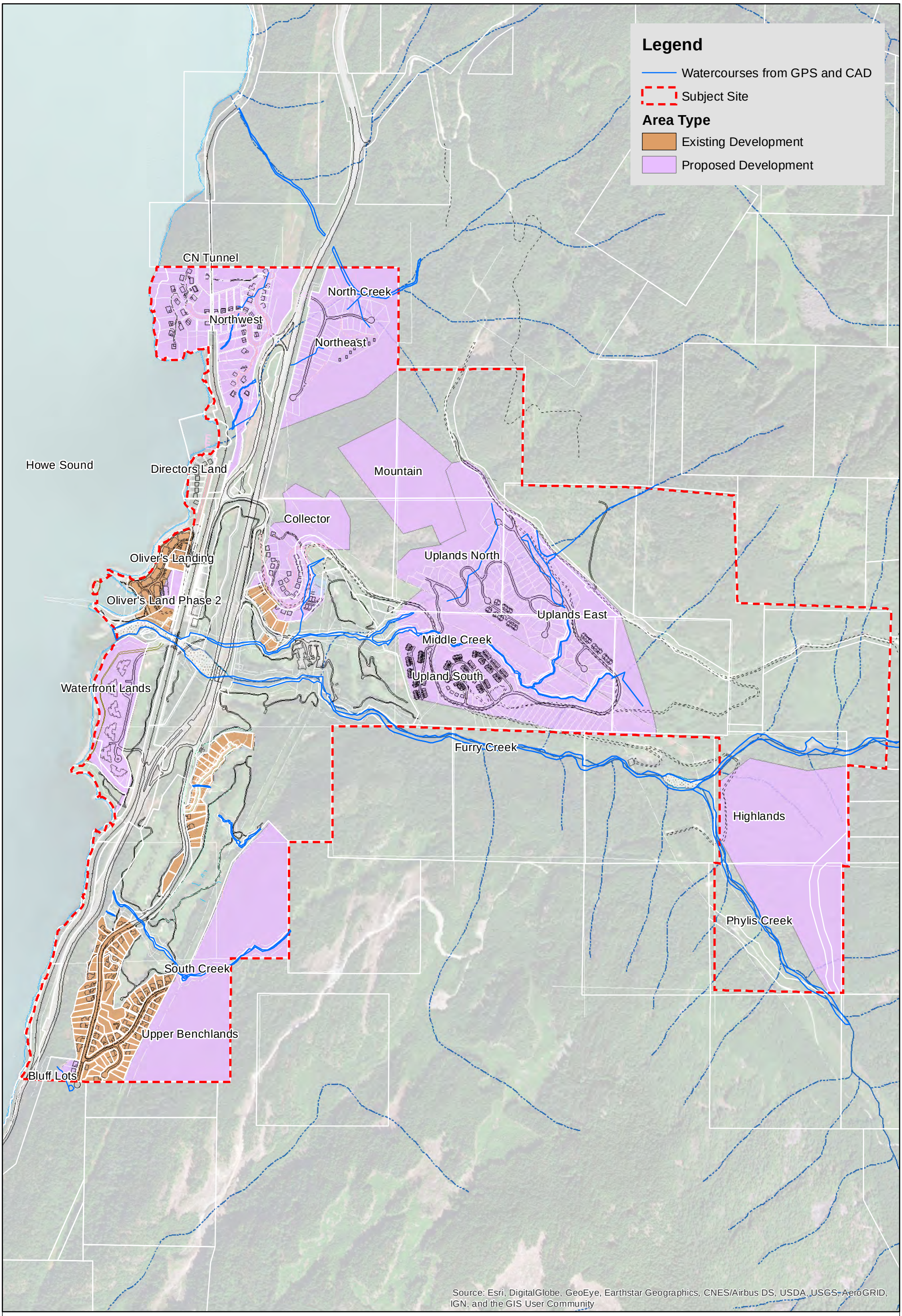
0 1 2 3 4 5
Kilometers

Map 1 - Location

Bio-Inventory
Fine Peace Holdings Ltd.
Furry Creek, British Columbia



GIS Cartographer: Nicola Church
Date: March 05, 2019
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Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov
High Water Maks are not from survey. For reference only and not to be used for development

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N W E S

0 100 200 300 400 500

Meters

Map 2 - Proposed Development

Bio-Inventory
Fine Peace Holdings Ltd.
Furry Creek, British Columbia

3 Methods

3.1 Physical Environment

Information on the physical environment of the subject property (i.e. climate, geology, soils, geomorphology, and hydrology) were collected from a variety of sources including *An Introduction to the Ecoregions of British Columbia* (Demarchi, 1996), *A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region* (Green and Klinka, 1994), Canadian Climate Normals 1981-2010(Environment and Climate Change Canada, 2013), historical and local knowledge, and observations made during site investigations. Soils were further assessed as part of the field investigations for Terrestrial Ecosystem Mapping, discussed in the following section.

3.2 Terrestrial Environment

3.2.1 Terrestrial Ecosystem Mapping

A standard method of ecological land classification used in BC is the Biogeoclimatic Ecosystem Classification system (BEC). This system describes the variation in climate, vegetation, and site conditions occurring within ecosections. BEC is also hierarchal, with separate climate and site levels. There are six levels of organization with increasing specificity: zone, subzone, phase, variant, site association, and site series. At the highest level, biogeoclimatic zones are classed based on broad macroclimatic patterns; at the lowest level, site series describes the vegetation potential of the land area based on its ability to support the same climax plant association and displaying the same soil moisture and nutrient regimes (Resources Inventory Committee et al., 1998).

Terrestrial Ecosystem Mapping (TEM) units are derived by combining BEC unit information (i.e. site series) with terrain feature attributes (i.e. modifiers). Site series in this classification system describe a 'typical' set of environmental conditions focusing specifically on important site, soils, and terrain characteristics. Site series describe all land areas capable of producing the same late seral or climax plant community within a biogeoclimatic subzone or variant. These are usually related to a specified range of soil moisture and nutrient regimes within a subzone or variant, but other factors, such as aspect or disturbance history may influence site series as well. Site modifiers are used to describe atypical conditions for an ecosystem.

Site series classification reflects subtle changes in microclimate and soil conditions, which reflect on the plant species composition within the unit. Generally, site series are further classified into Terrestrial Ecosystem Mapping (TEM) units based on the structural stage of the vegetation and the geomorphology of the site.

The subject area boundaries were projected onto Geographical Information System (GIS) software and Cascade staff analysed BEC Mapping, orthoimages and utilized the Vegetation Resources Inventory (VRI) dataset to delineate preliminary TEM areas. VRI polygons were used to delineate the area as no existing TEM dataset was available for the site. VRI polygons divide the subject area into areas of forest based on differing vegetation components (e.g. forest age, composition, soil features, present tree species) providing a useful preliminary mapping layer for field investigations. TEM data surrounding the subject boundary was also utilized in definition of TEM polygons.

During field investigations, representative plots were studied within potential TEM polygons identified on the subject area. Terrestrial Ecosystem data, including information on soils, hydrology, vegetation, and tree mensuration were collected and described on a Site Visit Form as per the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (B.C. Ministry of Forests and Range, 2010).

3.2.2 Species at Risk

In BC, there are two governing bodies involved with the ranking of species and/or ecological communities at risk. At the national level, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) works under the *Species at Risk Act* (SARA), and at the provincial level, the Conservation Data Centre (CDC) manages the B.C. Status List.

The Canadian government created SARA in 2002 to complement the Accord for the Protection of Species at Risk (a national effort to identify and protect threatened and endangered wildlife and their associated habitats across the country). COSEWIC is the scientific body responsible for assigning the status of species at risk under SARA. This system uses the following terminology:

- Extinct (XX)
- Extirpated (XT)
- Endangered (E)
- Threatened (T)
- Special concern (SC)
- Not at risk (NAR)
- Data deficient (DD)

A species that is listed as Endangered, Extirpated or Threatened is included on the legal list under Schedule 1 of the Act and is legally protected under SARA with Federal measures to protect and recover these species in effect.

The BC CDC designates provincial red or blue list status to animal and plant species, and ecological communities of concerns (BC Conservation Data Centre, 2014).

The red list included indigenous species or subspecies considered to be endangered or threatened. Endangered species are facing imminent extirpation/extinction, whereas threatened groups of species are likely to become endangered if limiting factors are not reversed. The blue list includes taxa considered to be vulnerable because of characteristics that make them particularly sensitive to human activities or natural events. Although blue listed species are at risk, they are not considered endangered or threatened. Yellow listed species are all those not included on the red or blue list and may be species which are declining, increasing, common, or uncommon (BC Ministry of Sustainable Resource Management, 2002).

A search of the BC Species and Ecosystem Explorer was conducted for rare and endangered plants in the relevant Biogeoclimatic zone and Forest District (BC Conservation Data Centre, 2014). A list of potential plant species at risk, including habitat requirements for each, was produced from the results. Potential occurrences were then designated as unlikely or possible based upon species specific habitat requirements and an on-site assessment of those habitats.

3.2.3 Ecological Communities at Risk

The CDC also tracks rare and endangered plant communities for the province of British Columbia. The term "ecological" is a direct reference to the integration of non-biological features such as soil, landform, climate and disturbance factors. The term "community" reflects the interactions of living organisms (plants, animals, fungi, bacteria, etc.), and the relationships that exist between the living and non-living components of the “community”. Currently, the most common ecological communities that are known in BC are based on the Vegetation Classification component of the Ministry of Forests and Range

Biogeoclimatic Ecosystem Classification, which focuses on the terrestrial plant associations of BC's native plants.

A search of the BC Species and Ecosystem Explorer was conducted for Ecological Communities at Risk in the relevant Biogeoclimatic Zone and Subzone, Ecoregion and Ecosection and Forest District further narrowed down to those occurring in the relevant site series. (BC Conservation Data Centre, 2014) A table was produced of the search results.

3.2.4 Invasive Species

Invasive plant species were noted as they were observed during the site investigations.

3.2.5 Additional Environmental Valuable Resources

During site investigations, all additional environmentally valuable resources on site were also noted including wildlife trees, coarse woody debris, riparian areas, rocky outcrops and cliffs, wildlife movement corridors and foreshore beaches. The general abundance and distribution of wildlife trees and coarse woody debris on site were noted.

3.3 Wildlife (Terrestrial and Aquatic)

Lists of wildlife species potentially occurring within the subject area were compiled from available resources and local knowledge of wildlife and habitat use. During site investigations, an assessment of the available wildlife habitat was conducted, and all incidental observations of wildlife species and wildlife signs were recorded. Comprehensive surveys for specific wildlife species were not conducted as part of this assessment.

The list of potential bird species was assembled from data on birds occurring in the nearby Squamish Estuary collected by the Squamish Environmental Conservation Society and Bird Studies Canada regional checklist (Squamish Environment Society, 2019) Bird Studies Canada, n.d.).

Fish occurrence data was collected from the Fisheries Inventory Species Summary database (BC Ministry of Environment, 2017).

3.3.1 Rare and Endangered Wildlife Species

An online search for known species at risk occurrences was conducted (Data BC, 2019) and a search of the British Columbia Species and Ecosystems Explorer (BC Conservation Data Centre, 2018) was conducted to identify all species at risk potentially occurring in the applicable biogeoclimatic zone and Forest District and their habitat requirements. Potential occurrences are then designated as unlikely or possible based upon species specific habitat requirements and an on-site assessment of those habitats.

3.4 Aquatic and Riparian Environment

The area of proposed development contains multiple creeks, drainages and wetlands. Major watercourses on the site include Furry Creek, Middle Creek, North Creek and South Creek. Phylis Creek also runs through the project site but is not in an area of proposed development. A desktop review of data submitted to BC's Fisheries information summary system (FIDQ, MOE, 2019) was conducted using the Habitat Wizard mapping tool (iMap BC, Data BC, 2019a). Previously unsurveyed portions of the four major watercourses as well as four additional watercourses were assessed in the field as per the BC Forest Practices Code Fish-Stream Identification Guidebook (BC Ministry of Environment, 1998) and the Watershed Restoration Program's Fish Habitat Assessment Procedures (MOELP and MOF, 1996).

Location of assessed watercourses are shown on Map 4a - 4d and results can be found in Section 4.3 of this report. Some sections of watercourses found within site were not visited due to extreme topography and adverse field conditions.

Proposed development within 30 m of a waterbody requires a Development Permit application in accordance with the Riparian Projection Development Permit Area in Section 7 of the SLRD Electoral Area D Official Community Plan Bylaw No. 1135.

The Detailed Assessment Methodology for Riparian Area Regulation (RAR) assessment (Ministry of Water, Land and Air Protection & Department of Fisheries and Oceans, 2006) was employed to determine a preliminary Streamside Protection and Enchantment Area (SPEA) of each watercourse. The wetland identified in the Uplands North development pod was flagged for preliminary RAR assessment, with determination of the setback to occur at a later date, pending a survey in non-snowy conditions.

Location of assessed watercourses are shown on Map 4a - 4d and results can be found in Section 4.3 of this report.

3.5 Foreshore Environment

Foreshore beaches were surveyed on two separate field days, one day for identification of habitat types and mapping the extent of low tide shoreline, and a second day to survey habitat types identified the previous day and identifying other possible construction limitations.

Mapping of low tide shoreline began with a search for low tide times using DFO's online tide schedule (Department of Fisheries and Oceans, n.d.), which showed low-tide times for February 7 at 13:41 and a height of 2.9 m.

Two QEP's from Cascade visited the site location prior to low tide to survey upper portions (forested and upper beach areas). Forested areas were surveyed for plant and animal species present, as well as snags or wildlife trees. The foreshore was divided into cross sections by habitat type (visual observation through noticing natural changes in topography, substrate, and changes in dominate vegetation/biota across the beachfront to the low tide water mark). Habitat types were measured across the foreshore using a hip-chain or meter tape; slope and aspect were also taken.

As low tide commenced, foreshore habitats were identified. Habitats were individually described by their abiotic and biotic features. Abiotic features included dominate and sub dominate substrate types (fines, gravels, cobbles and boulders), coarse woody debris, and if anthropogenic disturbances or features were present. Biota was described and surveyed by observing plant/animal communities on rocks and boulders, as well as flipping over rocks for possible aquatic invertebrates inhabiting beneath.

Legend

- Subject Site
- Aproximate Wetland Locations
- Ground Truth
- Wildlife Observation
- Wildlife Tree
- Watercourses from GPS and CAD
- Proposed Development Area
- TEM from Cerg
- Low Tide Pool
- Shoreline at Low Tide
- Cadastre
- Swamp Wetland Area

Mature Occurrences of Ecological Communities at Risk

- Mature Red Listed Communities at Risk
- Predominantly Mature Red, with some Mature Blue Listed Communities at Risk
- Mature Blue Listed Communities at Risk
- Predominantly Mature Blue, with some Mature Red Listed Communities at Risk
- Mature Yellow Listed Communities at Risk

GIS Cartographer: Nicola Church
Date: March 11, 2019
CERG File#: 926-01-01
Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov
High Water Maks are not from survey. For reference only and not to be used for development

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N W E S

0 100 200 300 400 500
Meters

Map 3 - Existing Environmental Conditions

Bio-Inventory
Furry Creek Golf Course
Furry Creek, British Columbia

4 Results

4.1 Physical Environment

4.1.1 Climate

The subject property lies in the Eastern Pacific Range Ecosection, within the Coast Mountains Ecoprovince in southern British Columbia (Demarchi, 1996). The climate is principally influenced by frontal systems moving in from the Pacific Ocean and over the Coast Mountains to the Interior. The Oceanside community of Furry Creek lies within the Coastal Western Hemlock biogeoclimatic zone in the Dry Maritime (dm) variant, in which summers are typically warm and dry and winters are mild with little snowfall (Green and Klinka, 1994). Canadian Climate Normals station data from 1981 to 2010 from the nearest station of Squamish 18 km away from the subject area establishes a mean annual temperature of 10.1 ºC, ranging from a monthly average of 2.5 ºC in December to 17.8 ºC in July and August, while mean annual precipitation is 2230.2 mm, ranging from 59.3 mm in July to 391.3 mm in November (Environment and Climate Change Canada, 2013). Snowfall is not significant, averaging 87.0 cm per year and falling between November and April (Environment and Climate Change Canada, 2013).

4.1.2 Geology

The study area lies within the South Coast Mountain Range and is underlain by granitic bedrock of the Coast Plutonic Complex. The area of the subject site is underlain by quartz dioritic intrusive rocks of the Upper Jurassic Period (157 - 145 million years ago) of the Mesozoic Era (Data BC, 2019). Resting on this granitic bedrock are deposits of surficial material that are mostly colluvial and fluvial in origin.

4.1.3 Soils

The general soil type for the Coast Mountain and Islands physiographic region is of the Podzolic Order, residing in the Humo-Ferric Great Group. These soils overlay igneous intrusive rock which is resistant to weathering, thus retarding soil development. The soils of the subject site area were generally found to be shallow in nature due to the numerous rocky outcrops and steep slopes.

4.1.4 Geomorphology

The subject area lies within the valley of Middle Creek and Furry Creek and their confluence with Howe Sound. Elevations range from sea level to approximately 600 m on the higher topography of the steep valley walls. Frequent bedrock outcrops were noted throughout the subject area with shallow soils on parent bedrock material.

4.1.5 Hydrology

There are a number of creeks (Furry Creek, Middle Creek, North Creek, South Creek and their tributaries, Watercourses 1 to 3) of varying sizes and flow rates that flow through and drain the subject property as well as two wetland areas and one roadside pool. See Section 4.4 for further descriptions of watercourses found on the property.

4.2 Terrestrial Environment

4.2.1 Terrestrial Ecosystem Mapping

The subject area falls mostly within the dry maritime subzone(dm) while the highlands area within the west is located within the submontane very wet Maritime variant 1 (vm1) of the Coastal Western Hemlock Zone (CWH).

The CWHdm occurs at elevations up to 650 m has a coastal climate and extends along the Sunshine Coast, and adjacent islands, to the lower Fraser Valley which, in conjunction with existing soil conditions, results in productive forest growth. Typical tree species of this subzone include western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii*), shore/lodgepole pine (*Pinus contorta*), bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra)* (Green & Klinka, 1994).

The CWHvm1 is the most extensive biogeoclimatic unit in the Vancouver forest region and on the mainland occurs along the windward slopes of the coast mountains its elevational limits range from above CWHdm when present to 650 m. It has a wet, humid climate with cool summers and mild winters featuring relatively little snow. Growing seasons are long. Typical forests in this subzone include sites dominated by western hemlock and amabilis fir (*Abies amabilis*) with lesser amounts western redcedar. The site can be differentiated from CWHdm by more abundant amabilis trees and western hemlock dominant over Douglas fir and the presence of Alaskan blueberry not commonly found within the CWHdm subzone (Green and Klinka, 1994).

4.2.1.1 Definitions and Descriptions

Table 1: TEM code explanations for the subject site

TEM Code Abbreviations					
Decile	**Site Series**	**Site Modifier**	**Structural Stage**	**Stage Modifier**	**Stand Composition**
8	RS	s	5	t	C
2	HM	s	5	t	C

- **8** refers to the proportion of the ecosystem unit out of 10 found within a given polygon (the decile). A homogenous polygon is a 10, while 8 represents 80%.
- **RS** refers to the site series designation which is determined based on soil moisture and nutrient regimes (see Table 2).
- **s** refers to possible site modifiers for atypical conditions (up to 2 letters can describe particular site characteristics such as aspect, slope, and soil; see Table 3).
- **5** refers to the structural stage of the tree cover. Values range from 1 (sparse/cryptogam) – 7 (old forest) (see Table 4).
- **t** refers to possible canopy structure modifiers within a given structural stage (see Table 5) .
- **C** refers to possible stand composition modifiers (see Table 6).

Table 2: TEM codes for the subject site

TEM Code Designation	BEC Site Series	Interpretation (typical conditions – assumed modifiers)
Terrestrial site series within subzone CWHdm		
HM	01 - Hw - Flat moss	Significant slopes; middle slope position; deep medium textured soils
DC	02 - FdPl - Cladina	Gentle slope; crest position; shallow soil
DS	03 - FdHw - Salal	Significant slope, middle to upper slope position; warm aspect; deep medium textured soils
DF	04 - Fd - Sword fern	Significant slopes deep medium - textured soils; richer nutrient regime (use aspect modifiers)
RS	05 - Cw - Sword fern	Significant slope, middle slope position, deep medium textured soils; richer nutrient regime
RF	07 - Cw - Foamflower	Gentle slope; lower slope position; richer nutrient regime, receiving moisture, medium textured soil
RC	12- CwSs - Skunk cabbage	Treed swamp, poorly drained, level to depression, medium - textured mineral soil
Terrestrial sites series within subzone variant CWHvm1		
AB	01 - HwBa - Blueberry, Salal	Gentle slope, middle slope position; deep medium- textured soils (use RG for Salal phase)
AF	05 - BaCw - Foamflower	Significant slope, middle slope position; deep medium-textured soils; richer nutrient regime (use aspect modifiers)
Non-vegetated, sparsely vegetated and anthropogenic		
BE	Beach	The area that expresses sorted sediments reworked in recent time by wave action

CL	Cliff	A steep, vertical or overhanging rock face
GC	Golf Course	Flat to gently rolling grass-covered throughways and open areas set out for the playing of golf.
PD	Pond	A small body of water greater than 2 m deep, but not large enough to be classified as a lake (e.g., less than 50 ha).
RI	River	The area of watercourse formed when water flows between continuous, definable banks.
RM	Reclaimed Mine	A mined area that has plant communities composed of a mixture of agronomic or native grasses, forbs, and shrubs
RN	Railway Surface	A roadbed with fixed rails.
RO	Rock Outcrop	A gentle to steep, bedrock escarpment or outcropping, with little soil development and sparse vegetative cover.
RS	Road Surface	An area cleared and compacted for the purpose of transporting goods and services by vehicles.
UR	Urban	An area in which residences and other human developments form an almost continuous covering of the landscape.

Site series have assumed situations with respect to landscape position, soils, and moisture regimes. If a site series is atypical for any of the possible conditions, site modifiers are assigned. Table 3 describes the atypical conditions that exist on the site.

Table 3: TEM site modifiers for the subject site

Abbreviation	Criteria
x	Drier than typical
c	Coarse-textured soils
s	Shallow Soils

Structural stages in Table 4 describes the existing dominant stand appearance or physiognomy for the ecosystem unit.

Table 4: Vegetation structural stages found on subject site

Structural Stage Code	Interpretation
3b	Tall Shrub: dominated or characterized by shrubby vegetation that is 2-10 m tall; time since disturbance < 40 years for normal forest succession; may be perpetuated indefinitely.
5	Young Forest: self-thinning evident and canopy differentiated into layers; vigorous growth and more open than pole-sapling; 30-80 years depending on tree species and ecological conditions.
6	Mature Forest - Trees established after the last disturbance have matured; a second cycle of shade tolerant trees may have become established; understories become well developed as the canopy opens up; time since disturbance is generally 80–250 years.
7	Old Growth Forest -

Canopy structure modifiers (Table 5) and stand composition modifiers (Table 6) describe the structure and composition of the vegetation in more detail.

Table 5: Canopy structure modifiers for the subject site

Abbreviation	Interpretation
s	Single storied: Closed or open forest stand dominated by the over-storey crown class (dominant and co-dominant trees); intermediate and suppressed trees account for <20% of all crown classes combined.
t	Two-storied – closed or open forest stand co-dominated by distinct overstorey and intermediate crown classes; suppressed crown class is lacking or comprises less than 20% of all crown classes combined.
m	Multistoried - closed forest stand with all crown classes well represented; each of the intermediate and suppressed classes account for greater than 20% of all crown classes combined3; advance regeneration is variable.

Table 6: Stand composition modifiers for the subject site

Abbreviation	Interpretation
B	Broadleaf: Greater than 75 % of total tree cover is broadleaf.
C	Coniferous - > 75 % of total tree cover is coniferous
M	Mixed - neither coniferous or broadleaf account for greater than 75 % of the total tree layer cover

4.2.1.2 Vegetation Associations

The paragraphs below describe the vegetation associations and structural stages of the TEM polygons found within the study area (Map 3). Each development pod was also analysed for existing information which could be potentially affected by development.

4.2.1.2.1 Project Area Site Series

CWHdm Subzone Site Series

Site Series 01 (HM) – Hw – Flat moss

This is the zonal site series of the CWHdm subzone, represented by sites having submesic to mesic soil moisture regimes and very poor to medium soil nutrient regimes and occupies 82 ha. This site series typically occurs on gentle slopes in a mid-slope position having deep medium-textured soils. Within the study area, it occurs on shallower soils than normal due to abundant bedrock parent material.

Dominant species within this site series are Douglas-fir and western hemlock and western redcedar with lesser amounts of red alder in the canopy layer, salal and red huckleberry in the shrub layer, and sword fern in the ground cover layer.

Site Series 02 (DC) – FdPl – Cladina

This is one of the least abundant site series within the study area, occupying 24.9 ha of the subject area This is the driest site series within the study area and CWHdm subzone. It occurs on very xeric sites having very poor to medium soil nutrient regimes. It typically occurs on gentle slopes in crest positions and having shallow soils. Within the study area, this site series was closely associated with rock outcrops. It occurs as matures forests and has a more open canopy associated with woodland habitat.

This site series has a canopy dominated by Douglas-fir and is unique in that it also has the presence lodgepole pine. The shrub layer of the occurrences within the study area consists of salal and red huckleberry with a sparse herb layer, however, with abundant moss and lichen species including red feather moss, species of cladonia including lipstick cladonia and dragon caldonia, and reindeer lichen.

Site Series 03 (DS) – FdHw – Salal

This site series occupies 62.9 ha. The DS site series is between the zonal and DC site series for soil moisture, having subxeric to xeric soils that are very nutrient poor to moderately nutrient rich. This site series typically occurs on significant slopes having warm aspect in middle to upper slope positions on deep, medium-textured soils. Within the study area it occurs in successional stages varying from tall shrub to mature and on shallower soils than normal due to the bedrock parent material

Dominant tree species in this site series are western redcedar, western hemlock, and Douglas-fir, while the understorey is dominated by salal with lesser quantities of red huckleberry, and dull Oregon-grape while the herb layer is sparse.

Site Series DF (04) – Fd – Sword fern

This is the least common site series within the study area, occupying only 5.6 ha of the study area. The DF site series is more nutrient rich than the DS site series. It occurs in subxeric to xeric soils having rich to very rich nutrient regimes. This site series typically occurs on significant slopes having deep medium-textured soils and richer nutrient regimes. This site series is uncommon within the study area, occurring in only one location on the slope to the bank of middle creek in the uplands south development pod. Its occurrence is a mature, multi storied canopied coniferous forest on a gentle slope within the riparian area of Middle Creek intermixed with site series RS.

Dominant tree species in this site series are western redcedar, western hemlock, and Douglas-fir, while the understorey is dominated by salal with lesser quantities of red huckleberry and the herb layer dominated by sword fern.

Site Series 05 (RS) – Cw – Sword fern

This is one of the more common site series within the study area, occupying 67.7 ha of the study area. The RS site series occurs on soils having mesic to submesic moisture regimes and rich to very rich nutrient regimes. It typically occurs in middle slope positions on significant slopes with deep, medium-

textured soils. Within the study area, it occurs in successional stages ranging from shrub to mature and on slopes of varying aspects, including gentle slopes usually within lower slopes in receiving position particularly on the banks surrounding the creeks of the property.

Western redcedar, western hemlock, and Douglas-fir dominate the canopy of this site series, while bigleaf maple and red alder occur are also present. The shrub layer is dominated by salal, red huckleberry, and the herb layer is dominated by sword fern.

Site Series 07 (RF) – Cw - Foamflower

This is site series is less common the within the study area, occupying 2.6 ha. The RF site series occurs on hygric to subhygric soils having rich to very rich nutrient regimes. It typically occurs in lower, water-receiving slope positions having gentle slopes and medium-textured soils. Within the study area, it tends to be associated with lower slope areas with seepage, where it occurs mostly as young occurrences.

The canopy of this site series consists of western redcedar, western hemlock, Douglas-fir, bigleaf maple and red alder, with a shrub layer dominated by salmonberry with lesser extents of red huckleberry and salal. The herb layer is dominated by sword fern.

Site Series 12 (RC) – CWSs – Skunk cabbage

This RF site series occurs on subhydric soil conditions having rich to very rich nutrient regimes and typically occurs as a treed swamp, with poor drainage on a level or depression feature within the landscape. This terrestrial site series can be seen to crossover with the wetland site series Ws54 western redcedar-western hemlock-skunk cabbage (MacKenzie, 1999). It occurs within the subject site within depressions on slopes adjacent to creeks holding surface water or very high water table within the soil. Vegetation occurs on elevated microsites and consists of a western redcedar dominated canopy with salal and huckleberry within the shrub layer and lady fern is present within the herb layer. Skunk cabbage is usually present within the herb layer and would be expected, however, was not observed due to the winter timing of the field study when these plants lie dormant.

CWHvm1 Subzone Site Series

Site Series 01 (AB) –HwBa – Blueberry

This is the zonal site series for the CWHvm1 subzone sites have submesic to mesic soil moisture regimes and very poor to medium soil nutrient regimes. This site series typically occurs on gentle slopes in a mid-slope position having deep medium-textured soils.

This site series occurred within the subject lands within the highlands section the furthest west within the subject land boundaries. Tree canopy was dominated by western hemlock and cedar with the presence of amablis fir. Salal and red huckleberry were within the shrub layer and sword fern was dominant within the herb layer.

Site Series 05 (AF) – BaCw – Foamflower

This site series is normally found within middle slope position with a significant slope with deep medium textured soils. This site series was also found within the highlands section of the subject lands intermixed with site series AB with deep nutrient rich soils.

The tree canopy was dominated by western hemlock and with the presence of Sitka spruce a nutrient rich specific tree. The shrub layer was dominated by dull Oregon grape with lesser amounts of red huckleberry, the herb layer was dominated by sword fern.

Non-Vegetated Site Series

Rock Outcrops and Cliffs

The rock outcrop (RO) code was used to map exposed bedrock scattered throughout the subject area usually in the higher elevation exposed areas. These are areas of exposed bedrock with no soil

development. Vegetation consists largely of bryophytes (mosses) and herbaceous species only. Soil development occurs only in crevices and notches in the rock. A small section of cliffs were observed within the bedrock outcrops and the cliffs TEM code used (CL) to define these areas within the subject lands with steep to near vertical faces.

Other Non-vegetated Sites

Several other non-vegetated site series descriptions were used throughout the subject area their general definitions are explained in Table 2. The Beach (BC) code was used to describe the sand and cobble foreshore area within the waterfront lands area. The Railroad Surface (RN) was used to map the CN rail line within the east of the subject property running north to south, the (RS) road surface code was used to describe Highway 99 and surrounding roads and the golf course (GF) code was used to map the current golf course terrain, the Urban code (UR) was used to map existing residential development and the Reclaimed Mine (RM) code was used to describe the disturbed mined areas within the waterfront and uplands south lands which now contains a low cover of shrub and grass. The River (RI) code was used for the larger water courses including Furry Creek.

4.2.1.2.2 Site Series within Proposed Development Pods

Oliver's Landing Phase 2

Vegetation within the lots for phase 2 of the Oliver's Landing were given an Urban (UR) TEM code as the lots have been previously cleared and graded and fitted with servicing utilities, vegetation consists of grass and small shrub layer.

Waterfront Lands

The Waterfront Lands consist of one vegetated polygon RSx6mC and 2 non-vegetated polygons codes RM and BE. The main clearing in which development is planned is within a disturbed cleared area used for stockpiling fill. Vegetation consists mostly of invasive species, early successional species and a small area of remnant western redcedar trees. The shrub layer is dominated by red alder intermixed with the invasive species including butterfly bush, Himalayan blackberry and Scotch broom and lesser amounts of Douglas-fir. The herb layer is comprised of grass species and invasive plants species including oxeye daisy and orange hawkweed.

The vegetated polygon exists as a thin strip of mature forest adjacent to the beach and foreshore and was classified within the 05- Cw – Sword fern site series but given a drier than normal site modifier due to the presence of sand within the soil layer. The tree layer was estimated to be 25-30 m in height dominated by Sitka spruce and Douglas-fir with lesser amounts of western redcedar, western hemlock and western yew. The shrub species was dominated by salal with lesser amounts of baldhip rose. The herb and moss layer was sparse. Soils were rich and dark within the humus layer and became coarse with a large percentage of sand increasing with depth. The surficial material was seen to be exposed to salt spray and would have been formed by wave action due the proximity to Howe Sound. The foreshore beach area was classified as a Beach TEM code and details of this area is reviewed in section 4.3.2.1

Photo 1: 10RM3b Polygon in cleared disturbed area with high shrub vegetation association. January 30, 2019.

Photo 2: Polygon RSx6mC vegetation association adjacent to the shoreline of the Waterfront Lands. January 30, 2019.

Directors Lands

The Directors Lands consist of two vegetated polygons RSs5tM and HMs6mC. The majority of the area is polygon RSs5tM, recently harvested and disturbed with a young forest association. The stand age is approximately 50 years old with a height of 20 m and is composed of a mix of broadleaf and coniferous species including big leaf maple, red alder, western hemlock and western redcedar. Shrub and herb layer included salmonberry and sword fern associated with mesic and nutrient rich soils. A large patch of invasive English ivy was identified within this polygon adjacent to the walking trail.

Polygon HMs6mC was delineated 15 m from the coastline of Howe sound and represents a remnant mature forest that was not disturbed during harvesting. Forest age was estimated at 100 years with a canopy height of 30 m. Western hemlock was the dominant tree with lesser amounts of western redcedar, Douglas fir, red alder and paper birch. Shrub and herb layer coverage was low with salal, red huckleberry, sword fern and liquorice fern. Step moss was found within the moss layer. Soils were shallow to bedrock at 25 cm and medium in texture. Mature trees were found to have a diameter at breast height (DBH) of up to 92 cm.

Photo 3: Polygon RSs5tM vegetation association with a recently disturbed young mixed forest. January 23, 2019.

Photo 4: Polygon HMs6mC mature forest adjacent to the coastline within the Directors Lands. January 23, 2019.

Bluff Lots

The Bluff Lots consist of one vegetated polygon consisting of two TEM codes 7RS5tC 3HM5tC. The forest is mostly young with remnant mature forest towards the west of the lot adjacent to the bluffs with a slope gradient of 25% with a northwest orientation. Stand age is estimated to be between 60 years old and the canopy was dominated by western hemlock and western redcedar with lesser amounts of Douglas-fir, red alder and bigleaf maple. Salal and dull Oregon grape made up 25% coverage within the shrub layer and sword and bracken fern were found within a sparse herb layer, with step moss and Oregon beaked moss covering 30% of the plot within the moss layer. Soils were deep with a medium texture.

The vegetation, particularly trees, were noted to be have been recently felled on the west of the lot adjacent to Furry Creek Drive.

Photo 5: Polygon 7RS5tC 3HM5tC young forest within the Bluff Lots. February 4, 2019.

Photo 6: Cleared vegetation within lot adjacent to Furry Creek Drive. February 4, 2019.

Northwest Lands

The Northwest Lands consist of 3 vegetated polygons. The polygon delineating the hydro right of way 10HMs3a has been heavily disturbed from regular thinning and consisted of shrub below 2 m in height. The shrub vegetation included dominant salal with western redcedar and Himalayan blackberry and Scotch broom adjacent to the access road, sword fern was found within the herb layer and the soils were shallow to bedrock.

The polygon to the northwest of the hydro right of way 7HMs5tC 3RSs5tC is a young forest showing signs of past harvesting. Forest age was estimated at 60 years old with a stand height between 25-30 m. Western hemlock was the dominant in the canopy layer with lesser extents of bigleaf maple and western redcedar, the herb, shrub and moss layer were sparse. Soils were shallow to rock with various bedrock outcrops with a medium soil texture.

The polygon west on the lands adjacent to the coastline 8DSsc6mV 2DC6mC consists of a mature forest on steeper slopes to 23% grade with rock outcrops which meet Howe Sound on the western border. The forest canopy is dominated by Douglas-fir and western red cedar with lodgepole pine located within the rock outcrops. Salal, red huckleberry and dull Oregon grape are found within the shrub layer with liquorice fern in the herb layer. The soil layer was coarse in texture with shallow soils to bedrock with rapid drainage.

Photo 7: Polygon 10HMs3a beneath the hydro right of way with a low shrub cover. January 22, 2019.

Photo 8: Polygon 7HMs5tC 3RSs5tC vegetation association with young forest previously harvested with undeveloped shrub and herb layer. January 22, 2019.

Photo 9: Polygon 8DSsc6mV 2DC6mC within the Northwest Lands on steep slopes with mature forest and rocky outcrops. January 22, 2019.

Collector Lands

The Collector Lands consist of 2 vegetated polygons, the lands located above of the access road in elevation consist of polygon 8DSs6mC 2DC6mC a mature seral forest on a gentle slope up to 20% with numerous rocky outcrops in a upper slope position. The forest age was estimated to be 80 years old and was dominated by Douglas-fir and western redcedar and lodgepole pine was found on the rocky outcrops. Salal dominated the shrub layer with lesser amounts of red huckleberry and bracken fern and rattlesnake plantain were found within the herb layer. The soils were shallow to bedrock at a soil depth of 23 cm and soil texture was coarse.

The polygon on the slope below the access road 6DSs6mC 4RSs6mC was found to be in a middle to lower slope position on a gradient up to 35% with a mature forest structure. The polygon contained the same DS site series as above however, contained no rocky outcrops and produced a mesic vegetation association of the RS site series due to the lower slope position. The canopy contained Douglas-fir and western redcedar and with the addition of bigleaf maple. Dull Oregon grape and salal were within the shrub layer with sword fern found within the herb layer. Soils were deeper at 35 cm before rock and coarse in texture.

Photo 10: Polygon 8DSs6mC 2DC6mC with mature forest with steeper slopes from crest. January 23, 2019.

Photo 11: Polygon 6DSs6mC 4RSs6mC found within the lower slope position of the Collector Lands. January 30, 2019.

Uplands South

The Uplands South Lands consist of one non-vegetated polygon and two vegetated polygons. The non-vegetated polygon RM delineates the mined area which is now comprised of a shrub layer between 2 and 10 m tall dominated by red alder with other invasive species including butterfly bush, Himalayan blackberry, scotch broom and orange hawkweed within the herb layer. Soils were heavily disturbed.

The polygon north of the RM polygon is composed of two vegetated polygons which slope down into middle creek, they are composed of the same site series but differ in structural age class. The polygon to the west 8RS6mC 2DF6mC is older mature forest the polygon to the east 8RS5mc 2DF5mC is the younger more recently disturbed forest. The canopy consisted of western redcedar and western hemlock with lesser extents of bigleaf maple. The herb layer has a land coverage of 50% and was dominated by sword fern. Red-stemmed feather moss, electrified cattail moss and Oregon beaked moss was found within the moss layer. Soils were the deepest observed within the subject area with a rich medium texture and a humic A soil horizon.

The polygon to the southwest and west sloping towards furry creek 8RS5tM 2RF5tM is a young forest previously harvested on a gentle slope of 20% gradient. Bigleaf maple, western redcedar and red alder dominated the tree canopy with lesser extents of western hemlock. Salmonberry, red-osier dogwood and red huckleberry dominated the herb layer while sword fern covered 35% of the land cover within the herb layer. Soils were deep with medium textured soil and were considered to be moderately well drained.

Photo 12: Polygon 10RM3b within the cleared mined area with low shrub and invasive species. January 30, 2019

Photo 13: Polygon 8RS6mC 2DF6mC mature forest association with rich soils sloping to Middle Creek. January 30, 2019.

Uplands North

The Uplands North consists of three vegetated polygons. The polygon north of the residential access road and below the forestry road, 7HMs6mC 3RS6mC, is a mature forest on a 20% grade slope. The forest age is estimated to be 100 years old with the canopy dominated by western hemlock and western red cedar with lesser amounts of red alder. Red huckleberry was within the shrub layer and sword fern within the herb layer. The topography of the land created shelves in which the site series was seen to be more mesic producing the RS site series with bigleaf maple present and a large coverage of sword fern. Soils were shallow to bedrock at 25 cm with a medium texture.

To the south of the proposed residential access road, a depression feature within the topography exists delineated by polygon 6RC5mC 4RF5mC. The lands are subhydric and likely receives water from the unnamed tributary to Middle Creek when flows are high. At the time of visit areas had standing water above ground level were observed although no flow was noted. The forest was observed to be young climax at approximately 80 years old with a stand height of 35 m. Western redcedar dominated the forest canopy and hemlock, red alder and big leaf maple were also present within the higher microtopography of the area. A sparse shrub layer contained salal, red huckleberry and bracken fern, sword fern and liquorice fern were observed in the lower lying areas. Soils were organic in texture and water was observed at 15 cm within the soil pit indicating wetland conditions. The low-lying areas were delineated as the site series RC which crosses over to wetland realm of swamps further discussed in section 4.3.1.2.2 the higher elevated areas on the slopes of the depression were delineated as site series RF.

The polygon 7RSs5tM 3HMs5tM on the slope south of the wetland depression consists of a young forest with submesic-mesic conditions with a 30% slope percentage. The canopy consisted of mixed coniferous and deciduous trees including bigleaf maple, red alder, western redcedar and western hemlock. Shrub species include dull Oregon grape, salal and red huckleberry and herb species include sword fern, liquorice fern and maidenhead fern. Soils were shallow to bedrock at 30 cm with medium texture. A mature forest of the same conditions is located as a polygon below.

Photo 14: Polygon 7HMs6mC 3RS6mC within the HM site series section of the polygon. January 31, 2019

Photo 15: Polygon 7HMs6mC 3RS6mC within the RS site series section of the shelf like topography of the polygon. January 31, 2019

Photo 16: Polygon 6RC5mC 4RF5mC depression topography with wetland swamp soil and vegetation characteristics. January 31, 2019.

Photo 17: Organic soils and high-water table within Polygon Polygon 6RC6mC 4RF5mC. January 31, 2019

Photo 18: Polygon 7RSs5tM 3HMs5tM young forest on south slope south of wetland and depression. January 31, 2019.

Mountain Lands

The Mountain Lands polygons can be seen to be delineated by the north and northwest and south orientated slopes producing different terrestrial vegetation associations. The north and northwest facing slopes contain the polygons 10HMs6mC and 6HMs6mC 4DSs6mC. These polygons were seen to have mature forests dominated by western hemlock and western redcedar with shallow soils. Salal and red huckleberry were within the shrub layer and sword fern was within the herb layer within the 10HMs6mC polygon but not within the more xeric condition of the 6HMs6MC 4DSs6MC polygon. The slope to the south of the mountain lands were more xeric due to slope position and steeper topography and consisted of a mix of cliffs, rocky outcrops and the xeric site series of DC and DS. A logging road leading to an observation deck at the crest were observed during the site visit.

Photo 19: Typical vegetation on the north facing slope of the Mountain Lands within Polygon 10HMs6mC. January 31, 2019

Photo 20: Typical terrain of south facing slope of the Mountain Lands steep rocky outcrops and cliffs. January 31, 2019

Photo 21: View from observation deck on crest of Mountain Lands. January 31, 2019.

Uplands East

The Uplands East were observed to be on significant slopes above the forestry road with a south to southwest orientation producing xeric site series conditions. Forests were seen to be in a mature condition with rocky outcrops producing the DC site series with the presence of lodgepole pine. Between the rocky outcrops the site series DS was observed with the canopy dominated by Douglas-fir up to 40 m in height and a shrub layer with a 50% land cover of almost exclusively salal. Step moss was in abundance covering 40% of the land cover. Soils were shallow to bedrock at 42 cm with a coarse texture.

Photo 22: Typical vegetation within the Uplands East area with steep terrain and Douglas-fir and salal dominating the cover. February 7, 2019

Northeast Lands

The Northeast Lands consist of two vegetated polygons. Polygon 8RSs5tC 2HMs5tC consists of a young forest with signs of previous harvesting and a decommissioned access road traverses the slope. The forest age was thought to be of approximately 70 years old with a canopy height of 35 m. Western redcedar, western hemlock dominated the canopy and red alder, paper birch and bigleaf maple were also present at a lesser extent. Sword fern was observed at land cover of 40% and invasive English holly noted on the access road.

The second polygon 8RSs6mC 2HMs6mC contains the same site series as the first however it has a mature structural stage with a multi-level structure. The forest was the oldest observed within the subject area, however was still considered mature as it lacked the complexity and age of old-growth forest (250 years and older). DBH of the trees in this polygon were recorded up to 85 cm for western redcedars and 63 cm for western hemlocks.

Photo 23: Polygon 8RSs5tC 2HMs5tC young forest association within the Northeast Lands. January 22, 2019

Photo 24: Mature older forest occurrence within Polygon 8RSs6mC 2HMs6mC of the Northeast Lands. January 22, 2019

Highlands

The Highlands were located on the slopes between the confluences of Phylis Creek and Furry Creek. The area is on a significant slope of up to 30% in a west south west orientation. Biogeoclimatic mapping shows the area changes from the CWHdm zone to the CWHvm1 subzone at this point. The forest structure was observed to change to meet these criteria with canopies dominated by western hemlock and the presence of Sitka spruce and amablis fir noted. Vegetation at a lower slope percentage showed signs of recent harvesting containing pole sapling areas dominated by red alder giving use of the structural codes 3 and 4 within the TEM codes. On the steeper grades remnant mature forest was observed with gully like topography within the slopes having a canopy dominated by western hemlock with lesser amounts of western red cedar, Douglas-fir, Sitka spruce and bigleaf maple. Dull Oregon grape and red huckleberry were present in the shrub layer and sword fern within the herb layer. Soils were deep with medium texture and relatively rich soils producing the zonal sites series AB and the richer sites series AF.

Photo 25: Younger pole sapling sections within the background within the highlands from previous harvesting. February 6, 2019.

Photo 26: Typical mature vegetation association of site series AB and AF within steep gradients of the highlands. February 6, 2019.

Upper Benchlands

The Upper Benchlands exist on a west northwest facing steep slope in the south of the lands above Furry Creek Drive in the vicinity of South Creek. The lands consist of vegetated TEM polygons. A hydro right of way trends north south at the lower slope of the area and is defined as Polygon 7DSs3a 3HMs3a. Shrub vegetation was present under 2 m in height from frequent disturbance. The slope above the existing development 7DSs6mC 3HMs6mC consists of a mature forest with steep slopes up to 35% with vegetated rocky outcrops and shallow soils at 13 cm. Douglas-fir dominated the canopy with western redcedar and paper birch, red alder and western hemlock were also present. Salal and red huckleberry were present in the shrub layer with a sparse herb layer consisting of minimal liquorish fern on rocky outcrops and step moss within the moss layer. Douglas firs were large in diameter up to 95 cm at DBH and up to 50 m in height.

The Upper Benchlands to the north of South Creek consists of two vegetated TEM polygons. Polygon 5DC6mC 5HM5tC contained a remnant access road containing a young forest between the steeper terrain. Young successional species were present in the tree layer including red alder and western redcedar and lesser amounts of western hemlock and paper birch. The shrub layer consisted of a low tree layer under 10 m in height, including western redcedar, Douglas-fir and western hemlock. Himalayan Blackberry was also present due to previous disturbance. Sword fern and bracken fern were within the herb layer; this association is defined by the 5HM5tC of the code. The other half of the polygon 5DC6mC represents the steep rocky outcrop terrain within the polygon containing a mature forest. The forest in this section is dominated by Douglas-fir and lodgepole pine with dominant salal and red huckleberry within the shrub layer. The moss layer contained a diverse selection of mosses and lichens on the rocky outcrops including red stemmed feather moss, broom moss and red bryum, lichens included coastal reindeer, false pixie cup, lipstick cladoina and dragon cladoina.

The third vegetated polygon contained the same site series as previously described without the access road being present therefore a mature occurrence was given to the HM site series sections of the polygon.

Photo 27: Polygon 7DSs3a 3HMs3a vegetation association within the hydro right of way. February 4, 2019

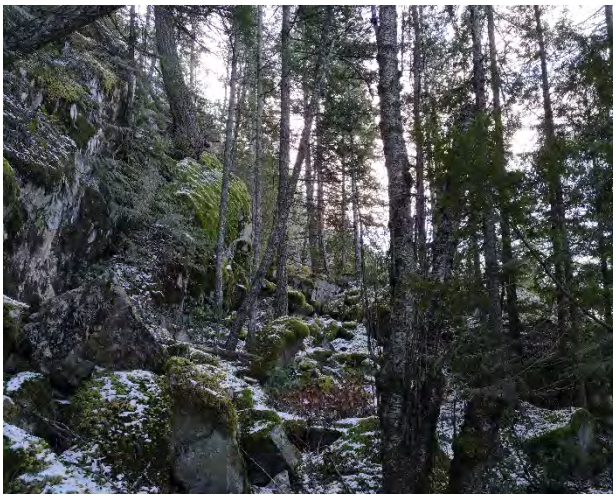


Photo 28: Polygon 7DSs6mC 3HMs6mC within the Upper Benchlands above Furry Cree Drive. February 4, 2019

Photo 29: Polygon 5DC6mC 5HM5tC within the remnant access road. February 6, 2019

Photo 30: 5DC6mC 5HM5tC within the DC site series association on xeric steep slopes. February 6, 2019

Table 7: Vegetation Recorded within Subject Area

Common Name	Scientific Name
Trees	
Douglas-fir	*Pseudotsuga menziesii*
Lodgepole pine	*Pinus contorta var. latifolia*
Bigleaf maple	*Acer macrophyllum*

Black cottonwood	*Populus trichocarpa*
Paper birch	*Betula papyrifera*
Western hemlock	*Tsuga heterophylla*
Western redcedar	*Thuja plicata*
Amabilis fir	*Abies amabilis*
Red alder	*Alnus rubra*
Sitka spruce	*Picea sitchensis*
Shrubs	
Dull Oregon grape	*Mahonia nervosa*
Red huckleberry	*Vaccinium parvifolium*
Salal	*Gaultheria shallon*
Trailing blackberry	*Rubus ursinus*
Himalayan blackberry*	*Rubus armeniacus*
English holly*	*Ilex aquifolium*
English ivy*	*Hedera helix*
Scotch broom*	*Cytisus scoparius*
Salmonberry	*Rubus spectabilis*
Red-osier dogwood	*Cornus sericea*
Western yew	*Taxus brevifolia*
Baldhip rose	*Rosa gymnocarpa*
Butterfly bush*	*Buddleja davidii*
Forbs	
Licorice fern	*Polypodium glycyrrhiza*
Rattlesnake plantain	*Goodyera oblongifolia*
Maiden-hair fern	*Adiantum aleuticum*
Sword fern	*Polystichum munitum*
Oxeye daisy*	*Leucanthemum vulgare*

Orange hawkweed*	*Hieracium aurantiacum*
Bracken fern	*Pteridium aquilinum*
Green spleenwort	*Asplenium viride*
Grass Sp.	
Mosses	
Step moss	*Hylocomium splendens*
Slender beaked moss	*Eurhynchium praelongum*
Oregon beaked moss	*Eurhynchium oreganum*
Juniper haircap moss	*Polytrichum juniperinum*
Electrified cat-tail moss	*Rhytidiadelphus triquetrus*
Plume moss	*Dendroalsia abietina*
Red-stemmed feathermoss	*Pleurozium schreberi*
Broom moss	*Dicranum scoparium*
Red bryum	*Bryum miniatum*
Lichen	
False pixie cup	*Cladonia chlorophaea*
Coastal reindeer	*Cladoina portentosa*
Lipstick cladoina	*Cladonia macilenta*
Dragon cladoina	*Cladonia squamosa*

*denotes invasive plant species

4.2.2 Plant Species at Risk

No listed occurrences of Plant Species at Risk have been recorded within the subject area boundaries on the CDC explorer iMapBC.

The species listed in below are those found in the CWH biogeoclimatic zone within the Squamish Forest District and Squamish-Lillooet Regional District, and which therefore have the potential to occur within the study area. The potential for each species is further assessed based upon species specific habitat requirements and the on-site assessment of those habitats. A targeted survey for each species was not conducted within the study area for this preliminary bio-inventory (see Section 5.2.2 for further recommended species specific surveys).

Table 8: Potential Plant Species at Risk within the Subject Area.

Scientific Name	Common Name	Habitat Requirements	Potential Occurrence	BC List Status	SARA Status
Vascular Plants					
Bidens amplissima	Vancouver Island beggarticks	Occupies a variety of wetland habitats including ditches, willow wetlands, old riverbeds, pond margins, streamsides, and tidal or non-tidal river edges.	**Potential** – tidal river edges of Furry Creek	Blue	1-SC
Claytonia washingtoniana	Washington springbeauty	Moist to mesic moss rock outcrops and forests in the lowland and montane zones above 250 m; nearest known occurrence is in Horseshoe Bay.	**Potential** – on rocky outcrops	Red	-
Pinus albicaulis	Whitebark pine	Within montane forests and on thin, rocky, cold soils at or near timberline.	Unlikely – subject site elevations do not meet timberline	Blue	1-E
Mosses					
Brachythecium holzingeri	Holzinger's brachythecium moss	Occurs at base of trees and downed woody debris, typically in more mature, un-disturbed forest stands.[2]	**Potential** – within less disturbed forested areas	Blue	-
Brotherella roellii	Roell's brotherella	Rotten wood in cool to moist mixed deciduous and coniferous forest, usually at low elevations along valley margins on slopes, stream terraces and swampy floodplains; often in remnant second growth in city parks.	**Potential -** known populations nearby in Squamish and Anvil Island	Red	-
Bryum schleicheri	-	Wet tundra on the coast and in oceanic interior ranges; wet soil or rocks at alpine elevations. Grows on soil/rocks and stream banks.	Unlikely – low elevation and lack of wet alpine tundra	Blue	-
Callicladium haldanianum	-	Logs and stumps in coniferous and deciduous forests; at low to moderate elevations.[1]	**Potential** – within less disturbed forested areas	Blue	-
Grimmia anomala	Grimmia dry rock moss	On rocks or in crevices of exposed rocks, 4000-7000 ft elevation.	Unlikely – low elevation	Blue	-
Hygrohypnum alpinum	Alpine brook-moss	Along cold, clean swiftly running mountain streams.	Unlikely – low elevation	Blue	-
Pohlia cardotii	-	Found along rills at 6000-8000 ft.	Unlikely – low elevation	Blue	-
Sphagnum contortum	-	Low to mid elevations in rich soils nears streams; shade intolerant[2], only known occurrences in BC are in Peace Region.	Unlikely – shade is abundant where richer soils occur	Blue	-
Tripterocladium leucocladulum	-	Shaded to exposed rocks, cliffs and bark of hardwoods (oaks and maples), occurring mostly at low elevations.	**Potential** – on bark of maple trees and rock outcrops	Blue	-

4.2.3 Ecological Communities at Risk

There are two yellow, five blue and two red listed ecological communities associated with the site series identified within the subject area (See Map 3 for associated Site Series within TEM code polygons). These are summarized in Table 9 below. As the listing of ecological communities at risk refers to large and relatively intact mature and old growth occurrences, the area of mature growth of each of these species is also provided. A small section of old growth was delineated by VRI mapping, however, was unreachable by foot survey due to terrain (Map 3), however, is not proposed or feasible for development.

Table 10-21 summarizes the ecological communities at risk present in each development pod with regards to mature structural stage forest present.

Table 9: Ecological Communities at Risk present within the entire subject lands with forest age class classification

Scientific Name	English Name	TEM Unit	BC List Status	Age Classes Found within Study Area	Area of Mature Growth within Study Area (ha)
CWHdm					
Tsuga heterophylla / Buckiella undulata	western hemlock / flat-moss	HM (01)	Blue	3a,5,6	53.5
Pseudotsuga menziesii - Pinus contorta / Holodiscus discolor / Cladina spp.	Douglas-fir - lodgepole pine / oceanspray / reindeer lichens	DC (02)	Red	3b,5,6	22.5
Pseudotsuga menziesii - Tsuga heterophylla / Gaultheria shallon Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	DS (03)	Blue	3a,6	54.7
Pseudotsuga menziesii / Polystichum munitum	Douglas-fir / sword fern	DF (04)	Blue	5,6	4.0
Thuja plicata / Polystichum munitum Dry Maritime	western redcedar / sword fern Dry Maritime	RS (05)	Red	3,5,6	45.1
Thuja plicata / Tiarella trifoliata Dry Maritime	western redcedar / three-leaved foamflower Dry Maritime	RF (07)	Blue	5	19.3
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	RC (12)	Blue	5	N/A
CWHvm1					
Tsuga heterophylla - Abies amabilis / Vaccinium alaskaense	western hemlock - amabilis fir / Alaskan blueberry	AB (01)	Yellow	31,4,6	16.1
Abies amabilis - Thuja plicata / Tiarella trifoliata Very Wet Maritime	amabilis fir - western redcedar / three-leaved foamflower Very Wet Maritime	AF (05)	Yellow	6	4.3

Table 10: At Risk Ecological Communities within the Waterfront Lands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
RS (05)	Red	6	1.9 ha

Table 11: At Risk Ecological Communities within Directors Lots

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	6	0.4 ha
RS (05)	Red	5	N/A

Table 12: At Risk Ecological Communities within the Porteau Bluffs

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	5	N/A
RS (05)	Red	5	N/A

Table 13: At Risk Ecological Communities within the Northwest Lands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	3a,5,6	4.4 ha
DC (02)	Red	6	0.5 ha
DS (03)	Blue	6	3.4 ha
RS (05)	Red	5	N/A

Table 14: At Risk Ecological Communities within the Collector Lands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
DC (02)	Red	6	0.8 ha
DS (03)	Blue	6	3.6 ha
RS (05)	Red	6	2.6 ha
HM (01)	Blue	6	0.5 ha

Table 15: At Risk Ecological Communities within Uplands South

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
DF (04)	Blue	5, 6	0.7 ha
RS (05)	Red	5, 6	2.9 ha
RF (07)	Blue	5,6	N/A

Table 16: At Risk Ecological Communities within Uplands North

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	5,6	5.6 ha
RS (05)	Red	5,6	5.1 ha
RF (07)	Blue	5	N/A
RC (12)	Blue	5	N/A
DC (02)	Red	6	0.6 ha
DF(03)	Blue	6	0.5 ha

Table 17: At Risk Ecological Communities within the Mountain Lands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	6	4.5 ha
DC (02)	Red	6	1.6 ha
DS (03)	Blue	6	3.4 ha

Table 18: At Risk Ecological Communities within Northeast Lands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	5,6	3.2 ha
RS (05)	Red	5,6	8.0 ha
DS (03)	Blue	6	0.1 ha

Table 19: At Risk Ecological Communities within the Highlands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
AB (01)	Yellow	5,6	10.2 ha
AF (05)	Yellow	5,6	3.3 ha

Table 20: At Risk Ecological Communities within Upper Benchlands

TEM Unit	BC List Status	Age Class within Area	Area of Mature Growth
HM (01)	Blue	3a,5,6	6.5 ha
DC (02)	Red	6	4.75 ha
DS (03)	Blue	6	5.9 ha

4.2.4 Invasive Species

An extensive invasive species survey was not conducted as part of this assessment, however, invasive species were noted and recorded when observed during field visits. Six invasive plant species including Himalayan blackberry, English holly, English ivy, butterfly bush, oxeye daisy and orange hawkweed were noted within the subject area as noted in Table 7 with an asterisk. Notable large areas of invasive species include the cleared, mined areas (RM polygons) within the Waterfront Lands and Uplands South and a large area of English ivy within the Directors Lot Lands. Sporadic invasive plant species were noted in around the active or remnant access roads within the subject area.

4.2.5 Additional Environmental Valuable Resources

4.2.5.1 Wildlife Trees

Wildlife trees include large veteran trees, standing snags, and trees with broken tops or other defects. These are important as perching areas for raptors such as bald eagles and red tailed hawk, nesting sites for woodpeckers, small owls, squirrels, bats and other cavity nesters, and den sites for small and large mammals, including bears. (Ministry of Forests and Range, 2002)

Throughout the study area, wildlife trees were frequently encountered on both wet and dry sites. This is likely due to shallow soils and windthrow (from the proximity to Oceanfront) and shallow soils observed throughout most of the study area and extent of rocky steep terrain. Several examples of notable wildlife trees were identified on site and are shown on Map 3, with examples shown in Photo 31 to Photo 32 below.

Photo 31: Wildlife tree with cavities as evidence of woodpecker activity. November 7, 2019.

Photo 32: Example of a wildlife tree with broken top and woodpecker cavities. November 7, 2019.

4.2.5.2 Coarse Woody Debris

Coarse woody debris (CWD) consists of fallen trees, sloughing bole wood, and other woody material on the forest floor (generally, rotting logs, stumps and branches greater than 10 cm in diameter). Coarse woody debris is an indicator of potential species richness for forested areas. Micro habitats, decay, and nutrient cycling provide a range of life cycle opportunities for wildlife and vegetation. (Ministry of Forests and Range, 2002)

Coarse woody debris within the study area is sparse to moderately abundant and consists of old harvested stumps and older logs in more advanced stages of decay (Photo 33 and Photo 34) especially in riparian or wetter habitats. Dry steep slopes within the project boundary showed abundant coarse woody debris in the form of uprooted trees or freshly fallen trees. The likely cause being large mature trees situated in shallow soils, as well as the proximity of the coast to the study location, which frequently experience high to extreme wind speeds.

Photo 33: Coarse woody debris consisting of freshly fallen mature trees adjacent to young forest (background). February 7, 2019.

Photo 34: Coarse woody debris on steep shallow soils at east end of Highlands development area. February 7, 2019.

4.2.5.3 Wildlife Movement Corridors

Wildlife tend to use routes having particular features when moving across the landscape to forage for food, disperse, find mates, or locate breeding sites. These features can include cover, shade, vegetation, or surface characteristics (Dawson and Bannerman, 1997).

The proposed development location is known to be used by a variety of large mammals, as discussed in Section 4.4.1. Wildlife trails were noticed throughout the study area; however only one trail showed signs of recent wildlife use (located in Upland North block) (Photo 35 and Photo 36). Most of the study area surveyed is located on steep unstable terrain which could restrict wildlife movements in these areas. Much of the subject boundary is located near human developments or activities which may also limit access for wildlife to these areas.

Ungulate winter range (UWR) was noted outside of the study area (300 m northeast from development boundary) (Map 5). An Ungulate Winter Range is defined as an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species and is protected under the *Forest and Range Practices Act* (FRPA)(BC Ministry of Environment, 2018). Future development plans near or within UWR should consider UWR's and the appropriate mitigation measures and/or BMP's should be applied.

Photo 35: Wildlife trail within mature forest through a fern dominated understory. February 7, 2019.

Photo 36: Deer scat discovered on wildlife trail shown in photo 33. February 7, 2019.

4.2.5.4 Riparian Areas

Riparian areas provide valuable habitat to many species of bird, small mammals, reptiles and amphibians. Within the study area, riparian areas are associated with all of the creeks, drainages and wetlands (Discussed in Section 4.3 below). Riparian areas Regulation (RAR) assessments were completed on all watercourses to determine preliminary riparian setbacks; results of these assessments are discussed in Section 5.4.

4.2.5.5 Rock Outcrops and Cliffs

Rock outcrops, areas of exposed bedrock, are abundant and scattered throughout the subject area. They are most abundant within the higher elevation steeper terrain particularly within the Mountain Lands, Uplands East, higher elevations of the Collector Lands, and polygons on the western shore of the Northwest Lands as further detailed in section 4.2.1.2.2 within site series descriptions for the development pods.. One small section of cliffs was also noted within the Mountain Lands that were near to vertical (Photo 38).

Photo 37: Rocky outcrops within the Northwest Lands.

Photo 38: Cliffs within the south facing Mountain Lands

4.2.5.6 Foreshore Beaches

A foreshore beach is located at the south side of Oliver's Landing adjacent to the Waterfront Lands (Furry Creek Beach) from the mouth of Furry Creek to fairway 14. The beach has been altered to provide access to locals and visitors with signs, trails and seating/picnic areas. Previous anthropogenic disturbances were noticed and includes preparations for a pier located at the south end of Furry Beach including large riprap as well as the reminiscent Woodfibre LNG plant located across Howe Sound which can be seen from Furry Creek Beach.

4.3 Aquatic Environment

4.3.1 Freshwater

4.3.1.1 Creeks

4.3.1.1.1 Furry Creek

Furry Creek (Watershed Code 900-085500) flows from east to west through the middle of the subject site and is composed of 3 reaches (Map 4a). Reach 1 extends 700 m upstream from Howe Sound to an impassible waterfalls near the 18th fairway of Furry Creek golf course. Downstream of the falls, Furry Creek supports coho salmon (*Oncorhynchus kisutch*), coastal cutthroat trout (*O. clarki clarkii*), rainbow trout/steelhead (*O. mykiss*), Dolly Varden char (*Salvelinus malma*) and sculpin (*Cottus sp.*) (FIDQ, 2019). The falls poses a formidable fish migration barrier

Reach 2 extends from the waterfalls to Phyllis and Furry Creek confluence, approximately 1200 m upstream, and is the portion of Furry Creek that borders the proposed development. An assessment by Cascade on January 28, 2019 measured stream characteristics at a point in reach 2, just above the Furry Creek Hydro Facility powerhouse (Photo 39 to Photo 42). The channel at this point is confined by steep valley walls on either side and exhibits step-pool morphology with some channel braiding. The bankfull width of reach 2 measured 33.7 m and wetted width measure was 21.76 m. Gradient was 13% and the deepest pool observed at this location had a depth of approximately 1.5 m. Bed material was predominantly boulders and bedrock, with some large cobbles, gravels and some fines near the edge of

the channel. Flow is fast and there is limited instream cover for fish available in this area. Canopy cover was between 5% and 10%, with the riparian vegetation consisting of mature western redcedar and red alder trees. Various ferns and mosses are also present around the edges of the channel. Only coastal cutthroat trout, rainbow trout and Dolly Varden char have been found in reach 2 (HabWiz, 2019) (TRC Biological Consulting, 2006).

Reach 3 of Furry creek is defined as the stretch from the Furry Creek- Phyllis Creek confluence to the headwaters of Furry Creek. Only Dolly Varden char are known to occur within reach 3 (TRC Biological Consulting, 2006).

Photo 39: Looking upstream at reach 2 of Furry Creek from an assessment point just above powerhouse. January 28, 2019.

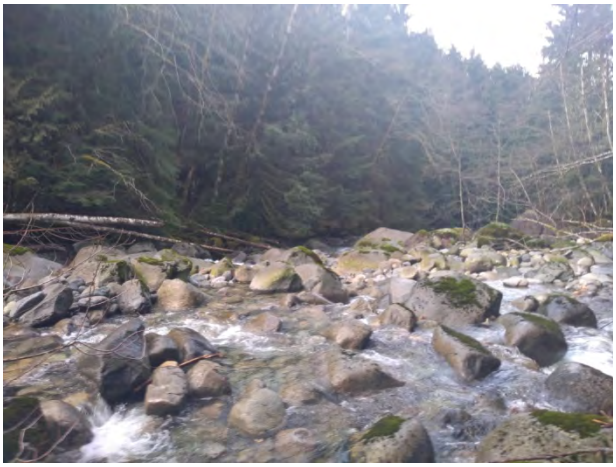


Photo 40: Looking downstream at reach 2 of Furry Creek from an assessment point just above the powerhouse. January 28, 2019.

Photo 41: Looking north east at a side channel at the assessment point of reach 2. January 28, 2019.

Photo 42: Looking upstream along the Furry Creek top of bank. February 5, 2019.

4.3.1.1.2 Middle Creek

Middle Creek (Watershed Code 900-085500-14830) flows through the Uplands development pod of the subject property from east to west before travelling through the golf course property and joining Furry Creek downstream of Highway 99 (Map 4c). Middle Creek is broken into 3 reaches (described below).

Reach 1 extends between the Furry Creek – Middle Creek confluence and Highway 99. MOE habitat wizard and FIDQ databases show coho salmon and coastal cutthroat trout presence in this reach. Habitat assessment and riparian analyses were not conducted for this reach, as it lies within an area of existing development.

Reach 2 of Middle Creek extends from the golf course 370 m upstream to a point where the creek is confined to a ravine approximately 50 m wide. Bed material in this section composed predominantly of boulder and bedrock. The channel morphology varied in this section exhibiting a step-pool morphology with an average slope of 27%, with field measurements of 37% in steeper sections, a bankfull width of 8.35 m and a wetted width of 5.21 m. Canopy cover was approximately 40% and instream cover between 15% and 20% mainly consisted of overhanging vegetation. No pool larger than 0.25 m depth was noted in this section. Approximately 190 m from the edge of the golf course are two distinct small waterfalls (Photo 45), and is deemed as an impassible fish barrier for upstream fish passage (unless deemed otherwise from a QEP). Middle Creek Tributary 2 joins Middle Creek right before the golf course property (Photo 46). Riparian vegetation in reach 2 consisted of mature western red cedar, Douglas fir and red alder dominating the tree layer. Sword fern, licorice fern, trailing blackberry and various moss species made up vegetated ground cover in the riparian area

Reach 3 of Middle Creek extends from the point where the creek enters the ravine to the creek's headwaters, a distance of approximately 580 m. The headwaters consist of two seepage areas (Photo 43) located upstream of the Uplands East development pod. The gradient in reach 3 ranged from 10% to 19%. Middle Creek's third reach had an average bankfull width of 4.1 m and an average wetted width of 2.19 m. Trace amounts of cover, consisting mainly of small woody debris and overhanging vegetation were noted in the creek. The reach had gradually sloping banks with the dominant bed material consisting of gravels and fines. Middle Creek Tributary 3 (Photo 44) as well as a number of seepages were noted to join the creek in this reach. Riparian vegetation in this reach was similar to that described for reach 2.

Photo 43: Looking downstream at Middle Creek in reach 3, upstream of the proposed development, at headwaters. January 25, 2019.

Photo 44: A 1 m deep pool near confluence of Middle Creek Tributary 3 and Middle Creek in reach 3. January 25, 2019.

Photo 45: Looking upstream at a small waterfall/ vertical barrier to fish passage in Middle Creek reach 2. January 25, 2019.

Photo 46: Confluence of Middle Creek Tributary 2 and Middle Creek near golf course bridge in reach 2. January 25, 2019.

4.3.1.1.3 Middle Creek Tributary 1

Middle Creek Tributary 1 is, as the name suggests, a tributary to Middle Creek with headwaters above the BC Hydro right-of-way. The watercourse collects water from a ditch along the north side of the Furry Creek Forest Service Road (FSR) before flowing under the FSR through a 1 m Ø CSP culvert and flowing southward through the Collector Lands (Map 4c). No records for this drainage could be found on MOE habitat wizard or FIDQ databases.

Middle Creek Tributary 1 had gradients ranging from 21% in its upstream section to 60% downstream. Limited flow was observed and the watercourse was discontinuous with many patches completely dry. Bed material is dominated by boulders and cobbles (Photo 47). The bankfull width ranged from 3.07 m upstream to 5.49 m downstream with wetted widths of 1.02 m upstream and 3.34 m downstream. The canopy cover was estimated to be around 20%, consisting primarily of red alder and western hemlock,

with ground cover composed predominantly of sword fern (Photo 48). Less than 10% woody debris was noted in the channel bed. No pools greater than 0.25 m were observed during the assessment. A small wetland area (Photo 49) was observed approximately 50 m upstream from the tributary's confluence with Middle Creek. Gradient of the watercourse at the confluence with Middle Creek presents a barrier to any fish passage upstream (Photo 50).

Photo 47: Looking downstream from top of bank at substrate of Middle Creek Tributary 1 in its upper sections. February 5, 2019.

Photo 48: Looking west at forestry road from the top of bank along river left of Middle Creek Tributary 1. February 5, 2019.

Photo 49: Skunk cabbage in wetland area along lower section of Middle Creek tributary 1. February 5, 2019.

Photo 50: Looking upstream at large boulders in lower section of Middle Creek Tributary 1. February 5, 2019.

4.3.1.1.4 Middle Creek Tributary 2

Middle Creek Tributary 2 flows from northeast to southwest between the Mountain and Uplands North development pods. The watercourse originates from a number of small drainages coming off the upper Britannia Forest Service Road (Map 4c). The unconfined channel has a cascade pool morphology with a gradient of 20% near its origin, and steepens downstream. The bankfull widths ranged from 1.18 m to 3.4 m and the wetted width was 2.32 m. Dominant bed material in the watercourse was boulders and

cobbles with a moderate to abundant amount of instream cover comprised of large and small woody debris (Photo 51). A cave and metal wiring were noted also beside the channel (Photo 52 and Photo 53). Moving downstream multiples small seepages were noted to join the watercourse. Near the lower culverted crossing of the Britannia FSR, the channel morphology switches to step-pool and a few small waterfall features were observed (Photo 54). The waterfall features observed, and the watercourses steep gradients would preclude fish presence within Middle Creek Tributary 2.

Photo 51: Moderate to abundant large and small woody debris were noted in Middle Creek Tributary 2. February 28, 2019.

Photo 52: Cave and metal wiring observed along the side of Middle Creek Tributary 2. February 28, 2019.

Photo 53: Metal wiring noted alongside of Middle Creek Tributary 2. February 28, 2019.

Photo 54: Waterfall feature near end of assessed area of Middle Creek Tributary 2. February 28, 2019.

4.3.1.1.5 Middle Creek Tributary 3

A number of small drainages coming off the Upper Britannia Forest Service Road form the headwaters of Middle Creek Tributary 3 (Photo 54). The tributary flows under the Forest Service Road through a culvert from the northeast southward through the Uplands East development pod, flowing through the area of the Uplands North wetland before joining Middle Creek approximately 320 m from Middle Creeks headwaters (Map 4c). Three reaches make up Middle Creek Tributary 3. . Riparian vegetation surrounding all 3 reaches consists of mixed deciduous and coniferous forest.

Reach1 of Middle Creek Tributary 3 extends from the confluence of Middle Creek to the wetland (Photo 55). This reach had varied morphology with a gradient between 15% and 19%, overall cascade-pool morphology and a dominant bed material consisting of bedrock and large cobbles. A large amount of snow was present at the time of assessment and sections of this reach were hard to assess. A pool larger than 1 m in depth was noted at the confluence of Middle Creek Tributary 3 and Middle Creek.

Reach 2 of Middle Creek Tributary 3 is defined as the area where the tributary flows into the wetland (Photo 56) (see Section 4.3.1.2.2). The gradient in this reach is 5% and bankfull width was 1.59 m. The channel has a riffle-pool morphology with bed material dominated by gravels.

Reach 3 of Middle Creek Tributary 3 is the area above the wetland (Photo 57). This section has a step-pool morphology, a measured gradient of 25% and bed material consisting predominantly of boulders with some fines and gravels.

Photo 54: Looking north across the Upper Brittanie Forest service Road at the headwaters of Middle Creek Tributary 3. March 12, 2019.

Photo 55: Middle Creek Tributary 3, Reach 1. March 12, 2019.

Photo 56: Looking downstream where Middle Creek Tributary 3 flows through wetland area. March 12, 2019.

Photo 57: Middle Creek tributary 3, Reach 3 looking upstream, 2019.

4.3.1.1.6 North Creek

North Creek (Watershed Code 900-86300) (Photo 58 and Photo 59) flows from the northeast through the Northeast development pod of the subject property west toward and under Highway 99 (Map 4b).

North creek is a braided, meandering cascade-pool stream channel with an average gradient of 12% and bed material composed predominantly of cobble and small boulders. Bankfull channel width at areas where measurements were taken ranged from 5.11 m to 15 m. A mixture of large and small woody debris covered approximately 10-20% of the stream channel. Mature deciduous forest with a canopy cover between 21 and 40 % made up the riparian vegetation on both sides of the creek. The deepest pool measured in the area of the creek assessed was approximately 0.75 m (Photo 60). Ground cover noted during the field assessment included a large amount of sword ferns and various mosses. Old water intake equipment was noted in and around the creek in multiple spots (Photo 61).

The area assessed was determined to be suitable habitat for fish, and surveys for the Sea to Sky Highway upgrades in 2002 found cutthroat trout in North Creek at the Highway 99 crossing (HabWiz, 2009; FIDQ, 2019).

Two tributaries to North Creek in the area of the proposed development were noted and assessed during the field visit. Refer to Sections 4.4.1.1.5 and 4.4.1.1.6 for details.

Photo 58: Looking downstream at North Creek February 6, 2019.

Photo 59: Looking upstream from a channel bar in North Creek. February 6, 2019.

Photo 60: A deep pool in North Creek. February 6, 2019.

Photo 61: Looking downstream at crib bridge and water intake equipment in North Creek. February 6, 2019.

4.3.1.1.7 North Creek Tributary 1

This tributary was created from old machine tracks (Photo 62 and Photo 63). Water collects and flows through the channel from the south northward into North Creek (Map 4b). Channel gradient was around 5%, bankfull width in the tributary did not exceed 2.0 m and bed material consisted of small cobbles and gravels.

Photo 62: Looking downstream at North Creek Tributary 1, likely created by old machine tracks. February 6, 2019.

Photo 63: Looking upstream at North Creek Tributary1 from its confluence with North Creek. February 6, 2019.

4.3.1.1.8 North Creek Tributary 2

This steep tributary with step-pool morphology (Photo 64) begins outside the area of proposed development, presumably from collection of drainages near the hydro easement to the east. The drainage flows northward to its confluence with North Creek Tributary 1 (Map 4b). The gradient ranged between 30% and 40% upstream before dropping to 9% near the confluence with North Creek Tributary 1. Bankfull width was between 2 m and 4 m and bed substrate was predominantly small boulders and cobbles in the upper section and cobbles and gravels as the drainage approached the confluence with North Creek Drainage 1 (Photo 65). Riparian vegetation surrounding the drainage consisted of a mature forest of deciduous and coniferous tree species having a canopy cover of about 30%. Sword ferns and various moss species made up the ground cover in the riparian area.

Photo 64: Looking upstream at step pool morphology of North Creek Tributary 2. February 6, 2019.

Photo 65: Bed material in the lower section of North Creek Tributary 2 near it's confluence with Tributary 1. February 6, 2019.

4.3.1.1.9 South Creek

South Creek enters the subject property from the east and flows through the Upper Benchlands development pod west through a culvert towards the golf course and Highway 99, and Howe Sound beyond (Map 4d).

A 155 m section of South Creek was surveyed during this assessment, extending from the golf course to a waterfall/cliff face, impassible on foot (Photo 66). Riparian vegetation consisted of mature western redcedar dominating the tree layer with red alder and western hemlock also present. The shrub layer consisted mainly of salal, with various ferns and (sword fern, bracken fern) and mosses making up the herb layer. Channel morphology within this section varied.

Upstream of the golf course, the gradient averaged 36% (Photo 69), had an average bankfull width ranging from 6.37 m to 7.99 m, and an average wetted width was 4.55 m. Bed material was dominated by large cobbles and small boulders, with a step pool and a cascade pool morphology. Crown cover varied between 20 and 60%, with a substantial amount of woody debris present in clumps. No pools greater than 0.25 m in depth were noted.

The creek levels off before the waterfall, with the creek being confined in a 17 m wide ravine for a short length (Photo 68). Gradients ranging from 6 to 10%, and a substrate composed predominantly of cobbles and gravels with some fines (Photo 67). There was trace to moderate amounts of instream cover in the form of small woody debris and overhanging vegetation present.

The gradient in the lower reaches of this watercourse near the golf course likely acts as a barrier to any upstream fish passage. No pertinent fish sampling records could be found on the MOE habitat wizard, EcoCat or FIDQ databases for South Creek.

Photo 66: Impassible waterfall on South Creek. January 28, 2019.

Photo 67: Bed substrate downstream of the impassible waterfall. January 28, 2019.

Photo 68: Looking upstream at the ravine section of South Creek. January 28, 2019.

Photo 69: Looking upstream at South Creek near where the creek meets the golf course. January 28, 2019.

4.3.1.1.10 Watercourse 1

Watercourse 1 flows west and then south through the Northeast and Northwest development pods, discharging to Howe Sound. It has been divided into two reaches, split by the 1 m Ø CSP culvert under Highway 99 with a second 1 m Ø CSP culvert under the Fury Creek off ramp (Map 4b). Watercourse 1 is joined by its tributary, Watercourse 1A (see section 4.3.1.1.9), immediately upstream of the CN rail tracks, before flowing through a culvert (Photo 64) into Howe Sound.

Reach 1 Howe Sound to Highway 99

Downstream of Highway 99, Watercourse 1 (Photo 70 to Photo 73) flows southward through the Northwest development pod. The field assessment on February 22, 2019 found the watercourse had a gradient of 45%, and a cascade-pool channel morphology with an unconfined channel over a boulder and cobble substrate. Instream cover was approximately 30%, composed mainly of large woody debris, and to a lesser extent overstream vegetation. Shrubs and mature forest made up the riparian vegetation along the watercourse. Crown closure in the area was estimated to be between 40% and 70%. Due to its steep gradient, Watercourse 1 is unlikely to support fish.

Photo 70: Looking upstream from a point in Watercourse 1. February 22, 2019.

Photo 71: Culverts leading under the railway line in Watercourse 1. February 22, 2019.

Photo 72: Looking downstream of Unnamed Watercourse 1. February 22, 2019.

Photo 73: Bed material and vegetation in Watercourse 1. February 22, 2019.

Reach 2 Upstream of Highway 99

Watercourse 1, reach 2, originates from various ephemeral drainages upslope of the Northeast development pod. The drainages collect in a depression (Photo 74 and Photo 75) before flowing west, downslope toward Highway 99. The average bankfull width at areas measured was 1.5 m. Wetted areas on the channel were intermittent, and a measurement of 0.98 m was recorded for wetted width at a one of the points assessed. Gradient of the channel is between 10% and 15% and the bed substrate is dominated by fines, with some cobbles and gravels also observed. The watercourse is surrounded by a mixed deciduous and coniferous forest. Riparian vegetation consisted mainly of sword fern. Water intake equipment was noted in the channel (Photo 76). At Highway 99 (Photo 77), Watercourse 1 drains through a culvert to connect with its downstream reach. Due to its intermittent nature and the steep

gradients downstream which would preclude fish movements the second reach of Watercourse 1 is unlikely to be fish bearing.

Photo 74: Depression at the origin of Watercourse 1. March 4, 2019.

Photo 75: Looking downstream at a wetted area of Watercourse 1. March 4, 2019.

Photo 76: Water intake equipment noted in Watercourse 1. March 4, 2019.

Photo 77: Looking west to where Watercourse 1 meets Highway 99. March 4, 2019.

4.3.1.1.11 Watercourse 1A

Watercourse 1A flows from north to south through the south west development pod adjacent to its confluence with Watercourse 1 immediately upstream of the culvert under the CN tracks (Map 4b). This watercourse has a cascade-pool channel morphology with an unconfined channel and an average gradient of 26 %. Bed substrate is dominated by gravels with some bedrock and boulders. Bankfull width was between 2.4 m and 2.73 m and wetted width was between 0.98 m and 2.73 m during the assessment on February 22, 2019. Residual pool depths were shallow (0.13 m). Instream cover was composed

mainly of large woody debris (30%). Shrubs and mature forest made up the riparian vegetation along the watercourse. Crown closure in the area was estimated to be between 40% and 70%. As with Watercourse 1, the gradient of Watercourse 1A makes it unlikely to support fish.

4.3.1.1.12 Watercourse 2

Watercourse 2 is located on the west side of Highway 99 in the Northwest development pod. The watercourse flows from the north east in a southward direction (Map 4b). Watercourse 2 has a cascade-pool channel morphology and the bed material was composed predominantly of cobbles with some boulders and gravels. The gradient of the watercourse was between 30% and 45%. Bankfull width was between 2 m and 3 m while wetted width was 1.6 m during the field work conducted on February 22, 2019. Limited instream cover was observed in the watercourse, predominantly by large woody debris and boulders. The watercourse is surrounded by both young and mature forest; crown closure was estimated to be between 40%and 70%. Watercourse 2's steep gradient would preclude the presence of fish.

Photo 78: Looking downstream of Watercourse 2. February 22, 2019.

Photo 79: Looking upstream of Unnamed Watercourse 2... February 22, 2019.

4.3.1.1.13 Watercourse 3

Watercourse 3 is located in the Upper Benchlands development pod. The watercourse originates from a depression that collects water (Photo 80). The water flows from the depression in a westward direction towards Highway 99 (Map 4d). A field assessment of the watercourse was conducted on February 28, 2019. The unconfined channel exhibits a cascade-pool morphology with a gradient of 10%. Measured bankfull widths were between 0.98 m and 3.16 m, with a wetted width of 2.32 m. Fines and gravels are the dominant material in the upper reach, which had a moderate amount of instream cover comprised of both large and small woody debris (Photo 81). The watercourse was surrounded by mature forest, providing a crown closure between 40% and 70% (Photo 82). As the stream flows westward the channel morphology changes from cascade-pool to step-pool, with a gradient of 60%. Approximately 60 m from its origin the watercourse drops steeply, the assessment ended at this point (Photo 83).

Watercourse 3 eventually flows into Howe Sound via culverts under Highway 99 and the CN tracks. The steep gradient upstream of Highway 99 is a barrier to any upstream fish passage, which would preclude the presence of fish within the Bluff development pod.

Photo 80: Origin of Watercourse 3. February 28, 2019.

Photo 81: Instream cover comprised of large and small woody debris. February 28, 2019.

Photo 82: View of Crown Closure in Watercourse 3. February 28, 2019.

Photo 83: Looking downstream (from end of assessment area) at steep drop in Watercourse 3. February 28, 2019.

4.3.1.1.14 Watercourse 4

Watercourse 4 is located in the Upper Benchlands development pod, and flows from the north east to the south west towards a culvert under Highway 99 (Map 4d). There is no district channel downstream of Highway 99. Since the watercourse does not lie in an area of currently proposed potential development, it was not assessed during this study.

4.3.1.2 Ditches, Ponds and Wetlands

4.3.1.2.1 Ditches

A manmade ditch/ roadside swale runs along portions of the Furry Creek FSR (Photo 84). Portions of the ditch were assessed as part of Middle Creek Tributary 1 (Refer to Section 4.3.1.1.3). The area of the ditch above Middle Creek Tributary 2 had limited connectivity and flow and was not assessed or flagged during this study.

Photo 84: Looking east at Roadside swale along the Furry Creek FSR above Middle Creek Tributary 1. March 4, 2019.

4.3.1.2.2 Ponds and Wetlands

Polygon 6RC5mC 4RF5mC within Uplands North was found to contain a depression topography (Photo 85 and Photo 86) which forms the second reach of Middle Creek Tributary 2. The low lying sections of the polygon was classified as a wetland swamp as detailed in section 4.2.1 due to the sub-hydric organic soil conditions with a water present less than 30 cm below the soil surface. Skunk cabbage was not observed within this section, possibly due to the timing of the survey, however, it was found in the wetland area identified below.

A small wetland area was observed approximately 50 m upstream of the confluence of Middle Creek Tributary 1 and Middle Creek. Riparian vegetation included skunk cabbage (Photo 50), salal, sword fern and bracken fern. Substrate of the wetland consisted of leaf litter and organics. The assessment of Middle Creek Tributary 1 concluded that the watercourse was unlikely to support fish however the wetland area provides important habitat for amphibians in the area. For the purposes of the Riparian Areas Regulation assessment, this wetland is an extension of the creek channel.

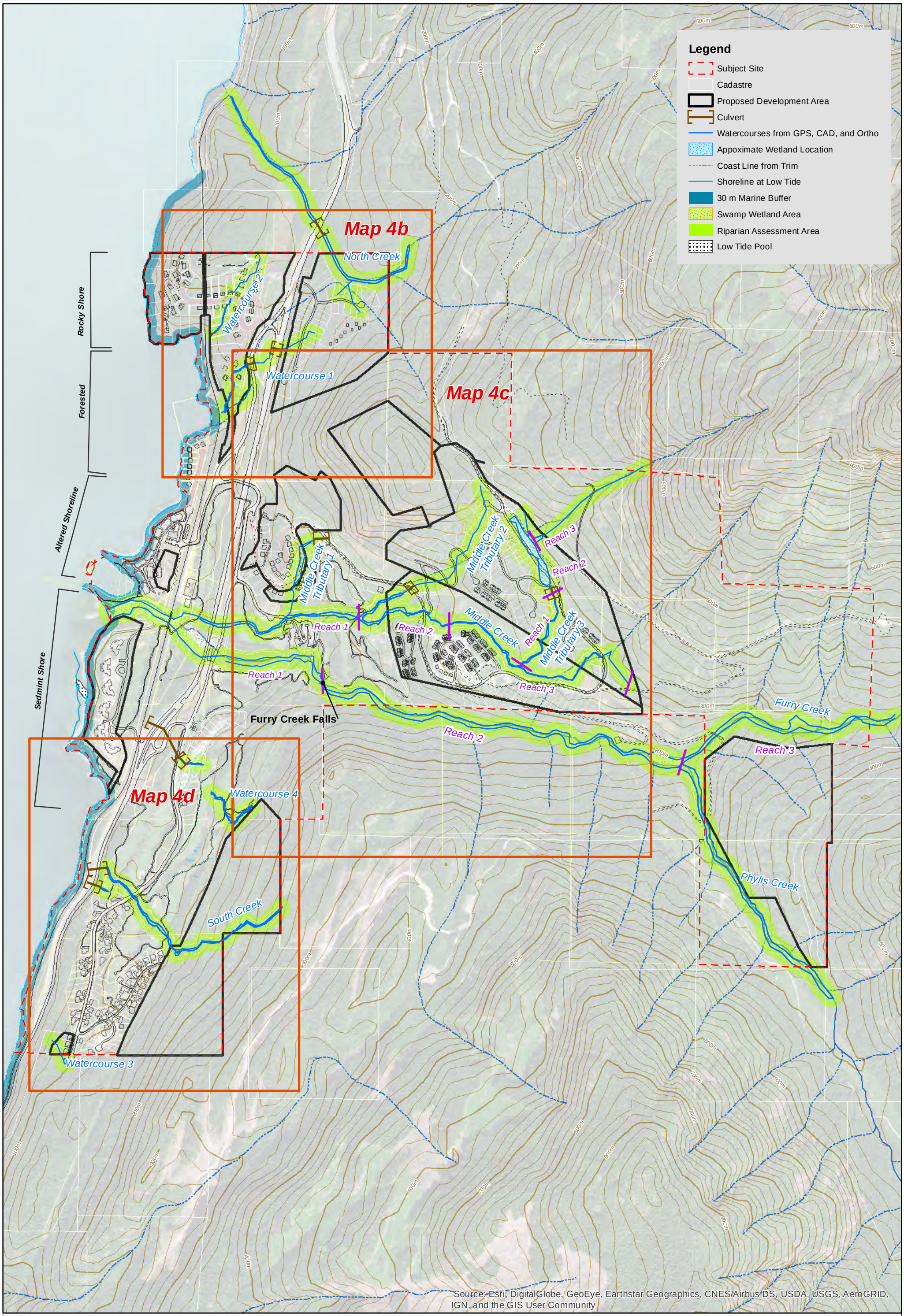
A small roadside pool (Photo 87 and Photo 88) was observed along the Furry Creek FSR. The pool was less than 1 m deep and connects to a ditch running north along the FSR. The ditch has no connectivity to any other watercourses. Vegetation surrounding the pond consists of sword fern and deciduous tree species, the substrate of the pool included leaf litter and organics. Due to its lack of connectivity the pool is unlikely to support fish populations however it acts as potential habitat for amphibians in the area.

Photo 85: Uplands North Wetland area (Middle Creek Tributary 3, Reach 2). March 12, 2019.

Photo 86: Uplands North Wetland area (Middle Creek Tributary 3, Reach 2. March 12, 2019.

Photo 87: Looking east at the pond along the Furry Creek FSR. January 25, 2019.

Photo 88: Looking north at the ditch draining from the small ponds along the Furry Creek FSR. January 25, 2019.



GIS Cartographer: Nicola Church
Date: March 15, 2019
CERG File#: 926-01-02
Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov
High Water Maks are not from survey. For reference only and not to be used for development
Riparian setback locations to be determined following completion of legal survey of high water mark locations.

CASCADE ENVIRONMENTAL RESOURCE GROUP LTD

N W E S

0 100 200 300 400 500

Meters

Map 4a - Watercourses and Foreshore

Bio-Inventory
Fine Peace Holdings Canada
Furry Creek, British Columbia

North Creek

North Creek Trib 1

North Creek Trib 2

Watercourse 2

Watercourse 1

Watercourse 1a

North West

North East

Highway 99

100m

200m

300m

Subject Site

Cadastre

Proposed Development Area

Culvert

Watercourses from GPS and CAD

Riparian Assessment Area

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

GIS Cartographer: Nicola Church
Date: March 15, 2019
CERG File#: 926-01-02
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Riparian setback locations to be determined following completion of legal survey of high water mark locations.

N
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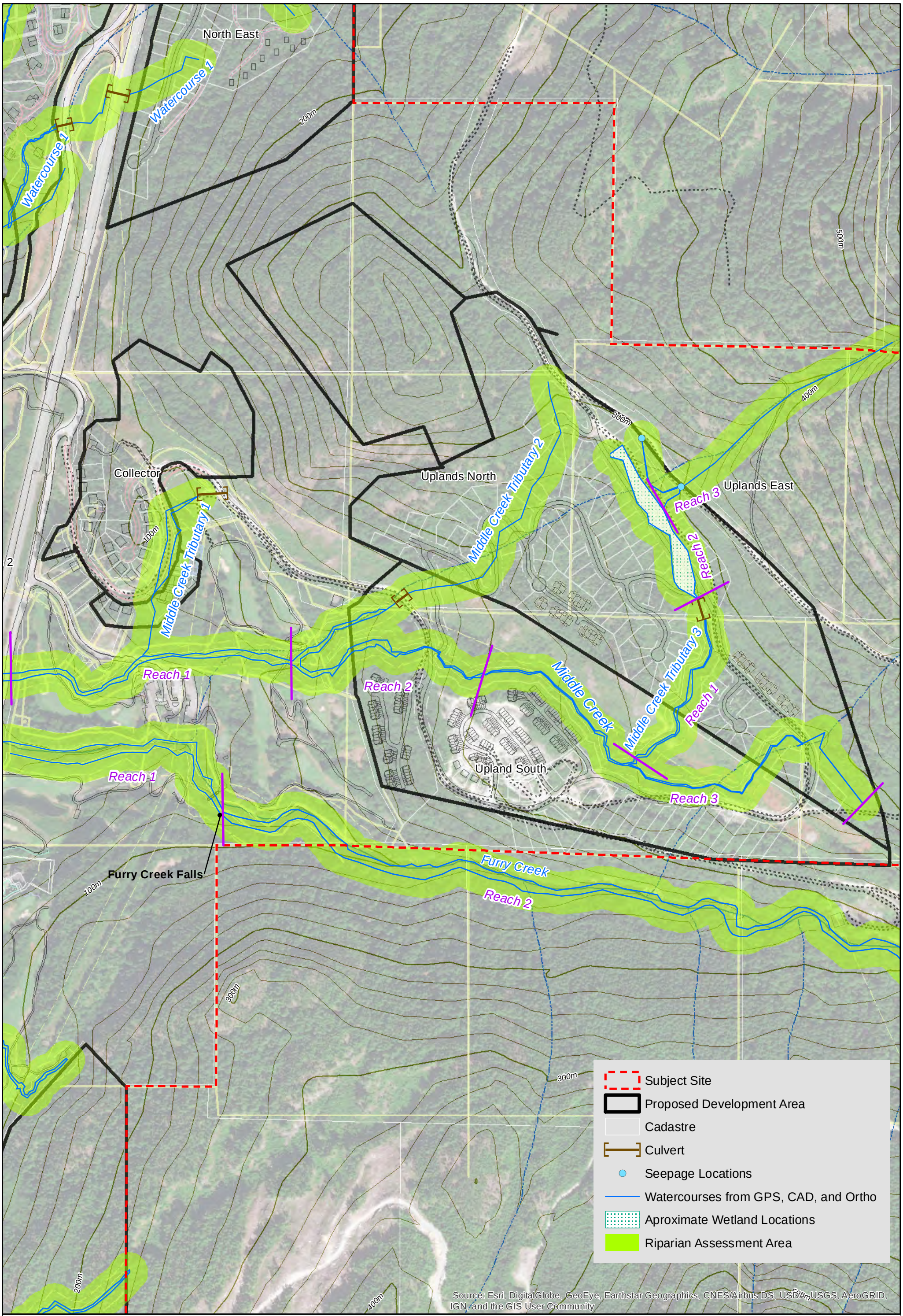
0 50 100 150 200 250

Meters

CASCADE ENVIRONMENTAL RESOURCE GROUP LTD

Map 4b - Riparian Assessment - North

Bio-Inventory
Fine Peace Holdings Canada
Furry Creek, British Columbia



GIS Cartographer: Nicola Church
Date: March 15, 2019
CERG File#: 926-01-02
Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov
High Water Maks are not from survey. For reference only and not to be used for development.
Riparian setback locations to be determined following completion of legal survey of high water mark locations.

CASCADE ENVIRONMENTAL RESOURCE GROUP LTD.

N W E S

0 50 100 150 200 250

Meters

Map 4c - Riparian Assessment - Middle

Bio-Inventory
Fine Peace Holdings Canada
Furry Creek, British Columbia

Watercourse 4

100m

South Creek

Area of South Creek Asessed

Upper Benchlands

Bluff Lots

Watercourse 3

300m

200m

Legend

- Subject Site
- Cadastre
- Proposed Development Area
- Culvert
- Watercourses from GPS and CAD
- Riparian Assessment Area

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

GIS Cartographer: Nicola Church
Date: March 15, 2019
CERG File#: 926-01-02
Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov
High Water Maks are not from survey. For reference only and not to be used for development.
Riparian setback locations to be determined following completion of legal survey of high water mark locations.

CASCADE ENVIRONMENTAL RESOURCE GROUP LTD

N W E S

0 50 100 150 200 250

Meters

Map 4d - Riparian Assessment - South

Bio-Inventory
Fine Peace Holdings Canada
Furry Creek, British Columbia

4.3.2 Marine

4.3.2.1 Marine Foreshore

During marine foreshore site investigation, four unique habitat types were identified within the proposed development boundaries (Map 4a) and include, 1) Sediment Shore, Furry Creek Beach (described in section 4.3.2.2 and 5.2.4), 2) Altered Shoreline, Oliver's Landing developments (and trail), 3) Forested, a forested section within the proposed Directors Land's (described in section ¬4.3.2.2), and 4) Rocky Shore, a rock shoreline to the north extent of the proposed development boundary.

The foreshore (Furry Creek Beach) is described in detail within section 4.3.2.2 and 5.2.4 and extends from the southern extent of the proposed Waterfront Lands to Oliver's Landing (mouth of Furry Creek).

Oliver's Landing is segmented from Furry Creek Beach by Furry Creek and extends to Director Lands to the North. Oliver's Landing is an altered shoreline that includes a well-developed trail and landscaped vegetation.

The forested section within Directors Lands is described above in section 4.2.1.2.2 (Directors land) and extends to the rocky shoreline to the north.

North of Directors Lands, a rocky shoreline extends to the northern extent of the proposed development boundary. The rocky shore habitat consisted of steep rocky outcrops with pockets of mature conifers and bryophytes growing at higher elevations (4-5 meters). Rocky shorelines are defined as a rocky solid bench across the intertidal zone with minimal to no sediment supply (Government of British Columbia and Government of Canada, 2004). Rocky shorelines like the one found at Furry Creek support diverse algal and invertebrate communities, provide cover for marine vertebrates, have high species diversity (compared to areas receiving greater wave action), and can include species such as rockfish, kelp, rock crab, oystercatchers, pelagic cormorant, sea urchins, and prawns (Government of British Columbia and Government of Canada, 2004).

4.3.2.2 Intertidal Area

The foreshore survey included a description of the different habitat types found across the intertidal area (terrestrial or forested areas to the low tide waterline) (Figure 1).

A retaining wall and riprap were observed in the developed section of the project (Oliver's Landing) (Photo 89), providing flood protection to the Waterfront Lands and the Furry Creek Golf Course located behind the study location. A gravel walking trail also runs parallel to the retaining wall and riprap which is used by local and visiting pedestrians, providing access to Furry Creek Beach. Beyond the retaining wall a small patch of alders was also noted.

The forested section measured 8.5 m wide (from the gravel trail toward the waterline) (Figure 1) and ran the length of Furry Creek beach. Forest composition consisted of mature Sika spruce intermixed with western redcedar and western hemlock. Shrubs noted within this section included salal, wild rose and immature western redcedar.

The coarse woody debris section measured 4.5 m wide (Figure 1) and consisted of large stumps and logs that likely washed up during higher tide (Photo 90). The average DBH of coarse woody debris on site ranged between 25 cm to 46 cm in diameter and average lengths between 5 m to 20 m. The area not defined by coarse woody debris (70% of overall cover) consisted of fine sand (60%), stone (5%), detritus (5%) and biotic components (seashells= 1-2% cover).

The fine gravels section measured 4.2 m wide (Figure 1) and consisted mostly of fines (sand: < 2.0 mm in diameter). Other substrate material included, small gravels (10%), cobble (10%), seashells or other biotic components (5%). This section was classified by its transitional function from a terrestrial sand

environment to an intertidal rock or hard surface environment which is evident from the even distribution of sand and rock within this section.

The cobble section (Photo 91) of the foreshore is classified by the dominate cobble substrate (45%), additional material found here includes, small gravels (30%), fines (20%), boulders (15%), and biotics (5%) which began to include live items such as barnacles and water fleas. A pacific wren (*Troglodytes pacificus*) was identified on site giving alarm calls near a washed-up stump while surveying this section.

The kelp/boulder section measured 16.5 m (Figure 1) was distinguished by the extent of living plant and animal biota noticed (Photo 92 to Photo 94). Some species noted within this section included live, mussels, clams, water fleas, amphipods (shrimp-like invertebrates), kelp, and shells. Additional cover noticed were cobbles (30%), boulders (25%) and some fines (25%). A resident in the area confirmed sightings of blue herons and whales in the area, as well as a confirmed sighting of black oystercatchers using the foreshore to forage for invertebrates and oyster/clams.

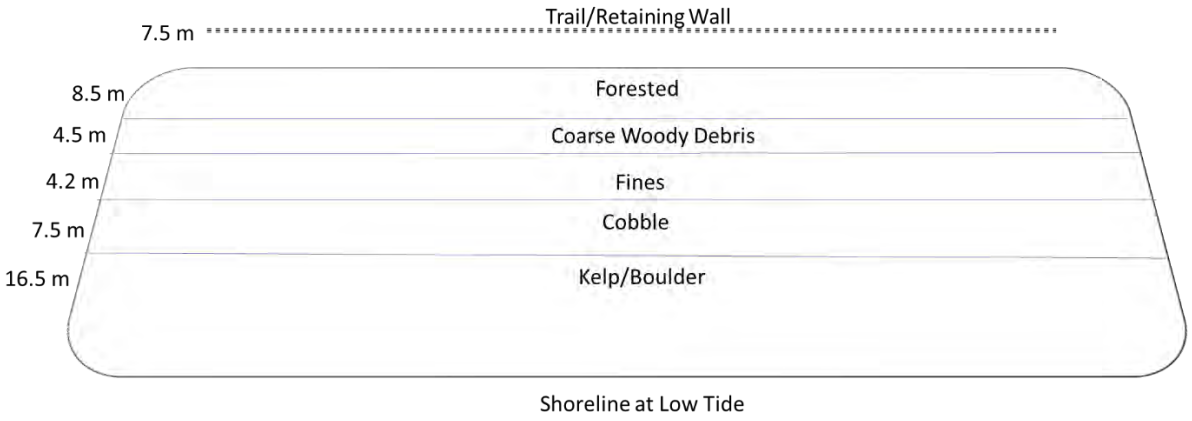


Figure 1: Schematic showing foreshore environment surveyed during two site visits on February 16 and 17, 2019. Sections identified by eye and distinguished from abiotic and biotic substrates found (rock size, seashells, and invertebrates).

Photo 89: Trail and retaining wall located adjacent to Furry Creek foreshore. February 7, 2019.

Photo 90: Coarse woody debris section of Furry Creek Beach Foreshore survey. February 7, 2019.

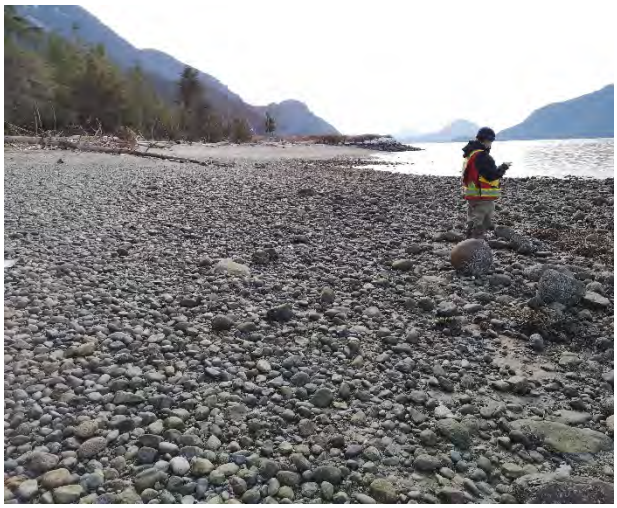


Photo 91: Cascade field tech surveying cobble section of foreshore at Furry Creek Beach. February 7, 2019.

Photo 92: Kelp and barnacles growing on boulder, distinguishing characteristic of low tide (kelp/boulder) habitat during foreshore assessment at Furry Creek Beach. February 7, 2019.

Photo 93: Live small crabs were seen in the kelp/boulder section of foreshore survey. February 7, 2019.

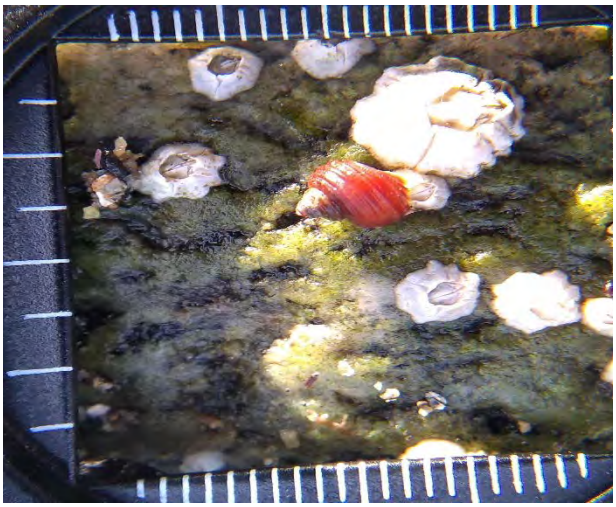


Photo 94: Barnacles and snails under a field scope for identification of biota in kelp/boulder section at Furry Creek foreshore. February 7, 2019.

4.4 Wildlife (Terrestrial and Aquatic)

In general, preserving or rehabilitating the environmentally valuable resources, as discussed in the sections above, will serve to protect wildlife values and mitigate development impacts. However, additional factors to consider are discussed in the sections below.

4.4.1 Mammals

Black bears (*Ursus americanus*), cougars (*Puma concolor*), and coyotes (*Canis latrans*), are reported frequently in the study area and grey wolves (*Canis lupus*) are known to occur in the vicinity. Signs of bobcat (*Lynx rufus*), black-tailed deer (*Odocoileus hemionus columbianus*) (see photo) and squirrels (*Tamiasciurus* spp.) were seen throughout the study area. Raccoons (*Procyon lotor*), spotted skunks (*Spilogale gracilis*), chipmunks (*Tamias* spp.), mice (*Peromyscus* spp.), voles (*Microtus* spp.), and bats (*Myotis* spp.) are also common and likely to occur within the property boundary.

4.4.2 Amphibians and Reptiles

While no amphibians or reptiles were observed during the site visits (due to the timing of the site visit), coastal tailed frogs (*Ascaphus* truei) have been found within the area of Furry Creek. northwestern salamanders (*Ambystoma gracile*), boreal chorus frogs (*Pseudacris maculate*), Northern Pacific tree frogs (*Pseudacris regilla*), garter snake (*Thamnophis* spp.) are known to occur in Shannon Falls Provincial Park, located approximately 5 km north of the study area, and have potential to occur within the study area. Additional amphibian species typically found in the CWH biogeoclimatic zone are rough skinned newt (*Taricha granulose*), and long toed salamander (*Ambystoma macrodactylum*) (Green and Campbell, 1984). Reptiles expected to occur on site include northern alligator lizard (*Elgaria coerulea*) and northern rubber boa (*Charina* bottae) There is potential habitat for the sharp-tailed snakes (*Contia tenuis*), although the closest known occurrence is 100 km north of the project location (Data BC, 2019).

4.4.3 Birds

A cursory raptor survey was conducted during the site visits and no nests were observed. Portions of the property may, however, be of particular value to raptor species.

Species of songbirds found during the site visit include, stellar jay (Cyanocitta stelleri), black capped chickadees (*Poecile atricapillus*), dark-eyed juncos (*Junco hyemalis*), pine siskins (*Spinus pinus*), white winged crossbills (*Loxia leucoptera*), chestnut-backed chickadees (*Poecile rufescens*), downy woodpecker (*Picoides pubescens*), Pacific wrens (*Troglodytes pacificus*), and northern flicker (*Colaptes auratus*).

Species of waterfowl or shorebirds noticed on site included common and Barrow's goldeneye (*Bucephala clangula* and *B. islandica,* respectively), harlequin ducks (*Histrionicus histrionicus*), tufted ducks (*Aythya fuligula*), black oystercatchers (*Haematopus bachmani*), red-breasted mergansers (*Mergus serrator*), double-crested cormorants (*Phalacrocorax auritus*), mallards (*Anas platyrhynchos*), gulls (Laridae) and Canada goose (*Branta canadensis*).

Two birds of prey and a gamebird were also noticed during the site visit and included several bald eagles (*Haliaeetus leucocephalus*), a peregrine falcon (*Falco peregrinus*) which was observed along the foreshore forested area, and signs of grouse (Phasianidae).

4.4.4 Fish

Furry Creek, the primary watercourse running through the development boundary is fish bearing; however low concentrations of phosphorus and nitrogen, low abundance and diversity of invertebrates and steep gradients near headwaters may block fish passage and/or creating low productivity (BC Ministry of Environment, 2017). Fish known to occur in Furry Creek include:

- Coastal cutthroat Trout (*Oncorhynchus clarkia*)
- Coho Salmon (*O. kisutch*)
- Steelhead / Rainbow trout (*O. mykiss*)
- Dolly Varden char (*Salvelinus malma*)
- Sculpin (General)

All of these species are known for Furry Creek's 1st reach, while only cutthroat trout, rainbow trout and Dolly Varden char are known from the 2nd reach, with only Dolly Varden char found in the creek's 3rd reach.

Middle Creek is known to have cutthroat trout and coho downstream of Highway 99, and North Creek is known to have cutthroat trout in the vicinity of Highway 99. The other watercourses on site are too steep and lack the necessary habitat to support fish.

4.4.5 Marine Invertebrates

BC's coasts are species rich and supported by an estimated 6,555 species of marine invertebrates, with the Amphipods taxa contributing the majority of species (600+). The reasons for BC's coastal diversity have been suggested to be the result of age (compared to the Atlantic coast, BC is geologically older), warmer temperatures and the physically diverse nature of BC's coastline (possessing many coves, inlets, etc.) (Klinkenberg, n.d.). Marine invertebrates found during the foreshore survey include:

- Little Brown Barnacles (*Chthamalus dalli*)
- Crabs (*Cancer sp.*)
- Periwinkles (*Littorina sp.*)
- Water fleas (*Daphnia sp.*)
- Shrimps (*Hippolytidae sp.*)

- Amphipods
- Other vacant clam, oyster and periwinkle shells were also noted

4.4.6 Wildlife Species at Risk

The table below includes CDC listed (i.e. red and blue listed) species that have the potential to occur on or near the subject site; species designated at SARA Schedule 1 are also noted. This potential is based on broad habitat preferences delineated by forest district and biogeoclimatic zone and site conditions observed during field investigations.

Table 21: Potential Rare and Endangered Wildlife Species within the Subject Area

Scientific Name	Common Name	Habitat Requirements	Potential Occurrence	BC List Status	SARA Status
Amphibians and Reptiles					
Anaxyrus boreas	Western Toad	Various aquatic and terrestrial habitats including riparian areas around ponds, lakes, reservoirs and slow-moving rivers/streams.	**Potential** – in riparian areas, known to occur in Alice Lake Provincial Park	Yellow	1-SC
Ascaphus truei	Coastal Tailed Frog	Clear, cold swift moving mountain streams with coarse substrates in older forest sites.	**Potential** – Cold mountain streams along staggered old growth present. Closest known report in Mashiter Creek.	Yellow	1-SC
Charina bottae	Northern Rubber Boa	Woodlands, meadows and clearings, not far from water, often under rotting logs or stumps, rocks or bark of dead fallen trees, from sea level to about 3,500 m.	**Potential** – Forested areas.	Yellow	1-SC
Contia tenuis	Sharp-tailed Snake	Moist pastures, meadows, oak woodlands, broken chaparral, and edges of coniferous or hardwood forests. Most known occurrences are on Vancouver Island and the Gulf Islands; the only mainland population located in Pemberton.	**Potential** – along forest edges and rock outcrops. Closest sighting in Pemberton (~100km from site)	Red	1-E
Rana aurora	Northern Red-legged Frog	Wetlands, pools, and riparian areas of upland forests.	**Potential** – in wetland, low-gradient reaches of streams, isolated pools. Closest sighting at Horseshoe Bay.	Blue	1-SC
Birds					

Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	Low elevation old-growth and mature second-growth forests.	**Potential** – in mature forest on steep slope. Report of nest in Furry Creek area (2005).	Red	1-T
Ardea herodias fannini	Great Blue Heron, *fannini* subspecies	Aquatic areas <0.5 m deep, fish bearing streams and rivers, undisturbed nesting in tall trees.	**Potential** – foraging near wetland and creeks. Closest sighting in Squamish (2019).	Blue	1-SC
Brachyramphus marmoratus	Marbled Murrelet	Nest in old growth forests in coastal areas; in salt water usually within 2 km of shore.	**Potential** – Mapped critical habitat found on site (Map 5).	Blue	1-T
Butorides virescens	Green Heron	Aquatic areas, especially slow moving, shallow waters with good riparian cover; nest in vegetation over water or sometimes in dry woodlands.	Potential – suitable wetland/marsh habitat on site.	Blue	-
Coccothraustes vespertinus	Evening Grosbeak	Frequently uses dry to moist forest types, occasionally found in riparian forests. Nests in dense deciduous and conifer forests.	**Potential** – both conifer and broad leaf stands on site.	Yellow	
Chordeiles minor	Common Nighthawk	Open coniferous forests, savanna, grasslands, fields, vicinity of cities and towns. Nesting on bare ground in open areas.	Unlikely – site is mainly on steep slopes.	Yellow	1-T
Contopus cooperi	Olive-sided Flycatcher	Various forest habitats: openings within forests and forest edges, subalpine coniferous forest, mixed forest, burned over forest, bogs and forested wetlands, along forested riparian areas. Mostly nests in conifers with tall dead standing trees nearby.	**Potential** – in riparian areas, wetlands, forest edges.	Blue	1-T
Cypseloides nniger	Black Swift	Forages at high altitudes over forests and in open areas. Nests behind or next to mountain waterfalls and wet cliffs, or in caves.[1]	**Potential** – cliffs for nesting and many waterfalls and wet cliffs on site.	Blue	-
Falco peregrinus anatum	Peregrine Falcon, *anatum* subspecies	Cliff edges near water, interior rivers and wetlands.	**Potential**– no cliffs for nesting. Confirmed at foreshore beach by Cascade on Feb 2019.	Red	1-SC
Hirundo rustica	Barn Swallow	Open areas, fields, ponds with vertical nesting habitat, especially buildings.	Unlikely – lack of open areas.	Blue	1-T

Megascops kennicottii	Western Screech Owl, *kennicottii* subspecies	Lower elevations in woodland, especially broadleaf and riparian woodland, also moist coniferous forests; often in riparian zones; nests in tree cavities.	**Potential** – in mature trees in riparian areas.	Blue	1-SC
Patagioenas fasciata	Band-tailed Pigeon	Breeds from near sea level to 760 m elevation in edges and openings in mature coniferous, mixed and deciduous forests, city yards and parks, wooded groves, open bushland, golf courses and orchards.	**Potential** – along edges of mature forests.	Blue	1-SC
Strix occidentalis	Spotted Owl	Old growth, dense, multi-layer canopy coniferous forest with a range of snags and nesting hollows available.	Unlikely – no suitable old growth habitat. Snags and veteran trees present on site for foraging.	Red	1-E
Mammals					
Gulo gulo luscus	Wolverine, *luscus* subspecies	Large home ranges in alpine and arctic tundra, boreal and mountain forests, negatively associated with human disturbance[2].	Unlikely – site near human disturbance.	Blue	1-SC
Myotis keenii	Keen's Myotis	Associated with coastal forest habitat. Mostly, but not restricted to old growth.	**Potential** – large old growth cedars on site for roosting.	Blue	3
Myotis lucifugus	Little Brown Myotis	Nests in caves, hollow trees, human made structures. Foraging usually in woodlands near water.	**Potential** – intermittent old growth areas on site.	Yellow	1-E
Oreamnos americanus	Mountain Goat	Steep alpine and subalpine habitat.	Unlikely – low elevation.	Blue	-
Pekania pennanti	Fisher	Large tracts (>100 ha) of dense forests at low to mid elevation <2500 m.	**Potential** – large area of dense forest on site.	Blue	-
Sorex bendirii	Pacific Water Shrew	Semi aquatic; moist riparian habitats of streams and marshes below 850 m in coniferous/mixed forests usually within 200 m of water[3]	**Potential** - in slow moving waters, can be located up to 200 m from waterbodies but 95% found within 25 m. Nearest known occurrence is in Squamish.	Red	1-E
Ursus arctos	Grizzly Bear	Non-forested or partially forested sites with a wide range of foraging habitats, usually in subalpine to alpine areas.	**Potential**- foraging habitat on site.	Blue	-

Fish					
Acipenser medirostris	Green Sturgeon	Coastal marine waters, estuaries and the lower reaches of large rivers.	Unlikely – lacking suitable habitat.	Red	1-SC
Oncorhynchus clarkii	Cutthroat Trout, *clarkii* subspecies	Low gradient coastal streams and estuarine habitats.	**Confirmed** – sightings have been reported in Furry Creek, Lower middle Creek and in North Creek.	Blue	-
Salvelinus confluentus	Bull Trout	Specific habitat requirements including deep pools in cold rivers <15°C and lakes to small, steep gradient streams. Most commonly in cold, clean, complex and connected watercourses below 12°C.[4]	**Potential** – Furry Creek is a cold, clean and complex, connected watercourse, however, surveys in area have not detected bull trout within subject boundary.	Blue	-
Invertebrates					
Argia vivida	Vivid Dancer	Spring fed streams or pools; associated with cool or hot springs.	Unlikely – no springs observed on site.	Blue	-
Cicindela hirticollis	Hairy-necked Tiger Beetle	Usually associated with a body of water (lakes, oceans, streams and rivers) and sand beaches[5].	**Possible**- sandy beaches on site.	Blue	-
Erynnis propertius	Propertius Duskywing	Open oak or mixed woodlands with the foodplant oaks.	Unlikely – no open oak habitat on site.	Red	-
Euphyes vestris	Dun Skipper	Grassland/shrub, vernal pools and seasonal seeps.	Unlikely – lack of grassland/ shrub habitat but vernal pools and season seeps present.	Red	1-T
Ophiogomphus occidentis	Sinuous Snaketail	Sunny stream banks and sandy lakeshore beaches at low elevations.	**Possible** –sandy sunny stream banks on site.	Blue	-

Source: BC Species and Ecosystem Explorer search for the Squamish Forest District and CWH Biogeoclimatic Zone (BC Conservation Data Centre, 2018).

Habitat information from (BC Ministry of Environment and Conservation Data Centre, 2019) unless otherwise cited.

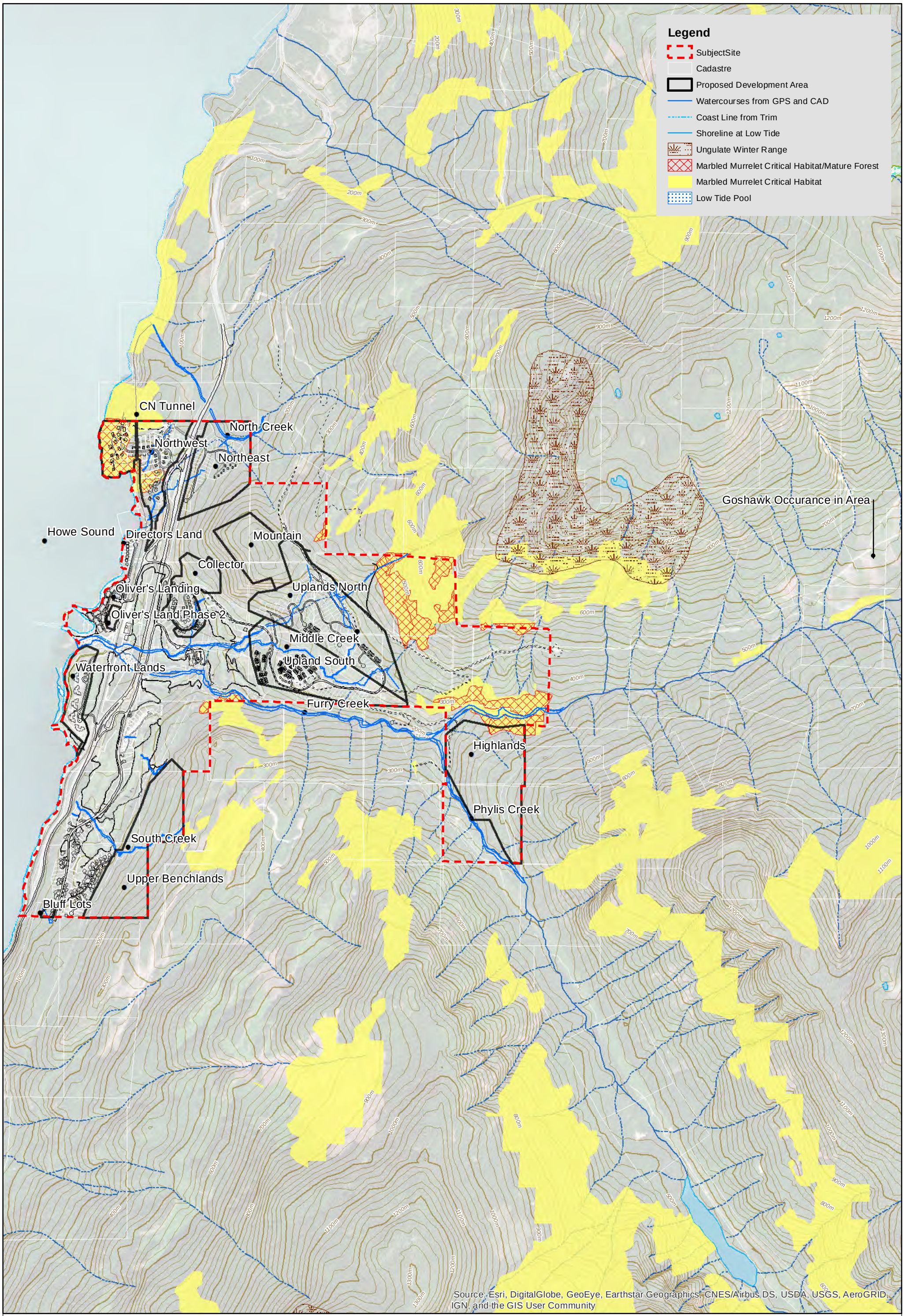
[1] (Environment and Climate Change Canada and Environment and Climate Change Canada, 2015)

[2] COSEWIC, 2003

[3] Craig *et al.*, 2010

[4] McPhail and Baxter, 1996

[5] Klinkenberg, n.d.



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CASCADE ENVIRONMENTAL RESOURCE GROUP LTD

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Map 5 - Species at Risk Occurrence

Bio-Inventory
Fine Peace Holdings Canada
Furry Creek, British Columbia

5 Discussion

The sections below discuss the potential impacts on the environmentally valuable resources (EVRs) that were identified on or near the subject property, as discussed in section 4 above, and as referenced in the preliminary site survey table in Appendix 1.

5.1 Physical Environment

As previously stated, the elements of the physical environmental are not considered to be EVRs and the discussion in this section instead focuses on how these elements may interact with the proposed development to potentially impact the EVRs identified on and near the site.

5.1.1 Climate

The current climate at the site's location will not influence the impacts of the proposed development on the identified EVRs. As the climate changes, however, the International Panel on Climate Change (IPCC) predicts an increase in the frequency, intensity and/or amounts of precipitation in mid-latitude locations (IPCC, 2013).

5.1.2 Geology

The geology of the study area has the potential to impact the EVRs due to the presence of steep slopes and rock outcrops. If blasting of rock outcrops or cutting and filling will be required these will have direct impacts on the affected areas. These potential impacts are further discussed in the relevant sections below.

5.1.3 Soils

The soils of the study area are not expected to have any influence on the potential impacts to EVRs from the proposed development.

5.1.4 Geomorphology

The lowest portion of the study area, within the Oceanside Lands, is at sea level, and has the potential to be affected by flood hazards particularly the Waterfront Lands at the confluence of Furry Creek to Howe Sound. Existing flood protection measures were noted to be mostly completed as per the Delcan *Waterfront Phase of Olivers Landing Flood Control and Shoreline Protection Measures Furry Creek, B.C.* around the Waterfront Lands including riprap on the foreshore of Furry Creek Beach and banks of Furry Creek and the construction of the overflow channel along fairway 15. It has been noted that additional fill will be required within Fairway 15 to bring the land and to appropriate flood heights. If any change is required to lands and vegetation within the spill out of the emergency channel into the foreshore of Howe Sound a DFO request for review and authorization must be obtained before alterations to foreshore environment can begin.

5.1.5 Hydrology

Development can alter soil hydrology through vegetation removal, compaction and surface hardening. Ground saturation is expected to increase with development. Dewatering during development will likely be required for excavations and any other work that may take place below the water table. A sediment and erosion control plan (SECP) should be developed prior to the construction phase of the development

to ensure that sediment-laden water from the site is not discharged into, or otherwise enter, the watercourses. The SECP should include provision for environmental monitoring by a Qualified Environmental Professional (QEP). A Storm Water Management Plan should be developed during the detailed design stage of the development to ensure that the quantity and quality of stormwater resulting from the development is dealt with appropriately.

5.2 Terrestrial Environment

5.2.1 Terrestrial Ecosystem Mapping

The results of the Terrestrial Ecosystem Mapping were used to determine the potential for species and ecosystems at risk to occur on the subject property, which are discussed separately in the sections below.

5.2.2 Vegetation

The subject area was mainly composed young and mature forest types due to extensive forest harvesting of the area. A small section of old growth forest was delineated by VRI mapping however was unreachable on foot due to the steep terrain and is not planned to be affected by development (Map 3). Other areas composed of shrub were identified within the hydro right of ways due to frequent disturbance and pole sapling forest type was observed in more recently harvested areas. Due to large area and varying topography of the land 7 site series within the CWHdm subzone and 2 sites series within the CWHvm1 subzone variant were observed within the subject area.

Mature forests consist of a more complex structure than young forests, with mature forests containing more coarse wooded debris, formation of snags and a larger abundance of wildlife trees than its young forest counterpart and is therefore generally considered greater in ecological value. Due to the greater ecological value of mature forests stages vegetation removal should be limited whenever and wherever possible to preserve this habitat after development. Section 5.2.4 considers the retention of mature forest occurrences within each development pod as they relate to specific site series and ecological community at risk.

5.2.3 Plant Species at Risk

There are no known occurrences of any plant species at risk within the study area, nor were any observed during the site investigations. Six species (2 vascular plants and 4 mosses), however, were identified as having the potential to occur, each of which is discussed below.

5.2.3.1 Vascular Plants

Vancouver Island beggarticks (Blue, Special Concern) is an aster that grows in wetland habitats including ditches, willow wetlands, old riverbeds, pond margins and streamsides. It requires fluctuating water levels on an annual basis for germination and seed set (BC Conservation Data Centre, 2019). This species has the potential to occur within the riparian areas of the creeks and golf course pond, and in the wetlands.

Washington springbeauty (Red) is an annual herb that occurs on moist to mesic rock outcrops and forests (BC Conservation Data Centre, 2019). Within the study area, this species has the potential to occur on the rock outcrops and in the moist forested areas.

As Vancouver Island beggarticks potentially occur within aquatic and riparian habitats, their habitats will be encompassed and protected from development within the riparian setbacks that will be maintained on all the watercourses on site (see section 5.4). Washington springbeauty on rock outcrops may be

impacted by future development at the site if blasting of the rock outcrops will occur. If any blasting of rock outcrops is to occur, it is recommended that a survey for Geyer's onion and Washington springbeauty first be conducted in late spring to early summer by a Qualified Environmental Professional. If any individuals are located, blasting of the area of occurrence will have to be avoided until additional mitigation measures and/or conservation requirements are determined.

5.2.3.2 Mosses

Holzinger's brachythecium moss (Blue) occurs on coarse woody debris and at the bases of trees, usually within less disturbed mature forests (Golder Associates, 2014), while its habitat requirements are not well known.

Roell's brotherella (Red) is known to grow on rotten logs, stumps, and at the base of live trees, including bigleaf maple and red alder (BC Conservation Data Centre, 2019; COSEWIC, 2010); however, its habitat requirements are not well known.

Callicladium haldanianum (Blue) is also found on logs and stumps in coniferous and deciduous forests, occasionally at the base of trees ((BC Conservation Data Centre, 2019). It occurs at low to moderate elevations. It grows in flat or loose extensive mats that are usually devoid of other species (Coast Forest Conservation Initiative, 2011).

Tripterocladium leucocladulum (Blue) forms dense silky mats on shaded to exposed rocks, cliffs and bark of hardwoods such as Garry oak, tan oak, canyon live oak and bigleaf maple (BC MOE, 2017). It occurs mostly at low elevations (BC Conservation Data Centre, 2019).

These species have the potential to occur in the forested areas on site, particularly in mature forests where rotten logs, stump and deciduous trees are abundant. *Tripterocladium leucocladulum* also has the potential to occur on shaded rocks and cliffs, which are found in forested areas throughout the study area. If clearing or other works are proposed within other areas of mature forests, it is recommended that a survey for these species be conducted by a Qualified Environmental Professional familiar with these species. Note that surveys for mosses can occur at any time of year, if they are not covered by snow.

5.2.4 Ecological Communities at Risk

In regards to ecological communities, large tracts of undisturbed plant communities are considered ecologically more important than disturbed/ fragmented second growth communities. The subject area ecological community has been reduced by selective harvesting resulting in a young and mature second growth forest which has also been fragmented by the golf course development.

The ecological communities do not pose a constraint to rezoning or development, however, they still provide habitat qualities and have the potential to reach an older forest structure and complexity; vegetation removal should be limited whenever possible during any development particularly in the mature growth sections. This section discusses the mature ecological communities in each development pod in which vegetation removal should be minimized to prevent loss of this habitat. Occurrences of mature ecological communities at risk are shown on Map 4. Note that, Porteau Bluff lands and Oliver's Landing did not contain any mature occurrences of ecological communities.

Waterfront Lands

The Waterfront Lands contain one red listed ecological community on the western foreshore. This community will be inherently protected by the marine foreshore buffer in which disturbance cannot occur.

Directors Lots

The Directors Lots contain a blue listed mature occurrence of an ecological community along the riparian foreshore which will inherently protected by the marine buffer.

Northwest Lands

The Northwest Lands consist of a complex of red and blue mature ecological communities within the steeper terrain towards the foreshore. Part of this ecological community will be protected by the marine buffer, however, the remainder of the polygon should retain as much vegetation as possible.

Collector Lands

The Collector Lands contain red and blue listed ecological communities. Within each polygon the riparian area will be protected, however, vegetation removal should be minimized whenever possible within the rest of the polygon.

Uplands South

Uplands South contain mature occurrences within one polygon and vegetation loss should be minimized within it. Preliminary development is anticipated within the existing cleared mined site to reduce disturbance.

Uplands North

Uplands North Lands contain remnant patches of mature forest containing a complex of predominantly HM (blue) and RS (red) ecological communities. As these polygons are located on the fringes of the development pod vegetation removal should be minimized during site design.

Uplands East

Uplands east contains site series DC (red) and site series DS (blue) mature occurrence of ecological communities. No development is currently planned in this area however any future plans should consider minimizing vegetation removal in these areas.

Mountain Lands

Sites series HM (blue) DC (red) and DS (blue) are present in a mature structural stage within the Mountain Lands and vegetation retention should be considered within these areas.

Northeast Lands

A complex of HM (blue) and RS (red) mature ecological communities are present, preliminary development utilizes the alignment of the remnant access road which will minimize vegetation loss, vegetation retention should be considered within these areas.

Upper Benchlands

A complex of HM (blue) DC (red and DS (blue) mature ecological communities are present on the steep slopes of the Upper Benchlands, development should utilize the remnant access road alignment to minimize disruption of mature occurrences within the polygons.

Highlands

The Highlands contain a complex of mature AB (yellow) and AF (yellow) ecological communities with areas of pole sapling from recent harvesting. Yellow ecological communities are not risk and therefore are not as ecologically important as red and blue listed ecological communities. However, vegetation retention should still be considered in mature occurrences during site design.

5.2.5 Invasive Species

Management of the invasive species present on site presents an opportunity for restoration, as the appropriate treatment/removal of these will improve the ecological condition of the site. Himalayan

Blackberry, English holly, English ivy, butterfly bush, Scotch broom, oxeye daisy and orange hawkweed, were the only species observed, however, a comprehensive survey for invasive species was not conducted. A thorough inventory of invasive species occurring on the site should be conducted prior to development focusing on the RM site series polygons and areas around remnant and existing access roads within the subject area. The mobilization of machinery during development presents a vehicle for invasive species to become introduced to the site. It is important that all equipment brought onto the site is clean of soils and vegetative material that may contain invasive species. An invasive species management plan (ISMP) for the site should be prepared prior to development that includes the above.

5.2.6 Other Environmentally Valuable Resources

5.2.6.1 Wildlife Trees

Wildlife trees within the study area are of high wildlife habitat value. These occur in mature forests, which are mostly located within riparian areas and on steep slopes. Those trees within the riparian areas will be protected within the riparian setbacks (see section 5.2.6.4 on riparian areas below). Some of these trees, however, may present safety concerns to personnel carrying out the work due to the potential for wind fall. Precautions should be taken to identify and manage potentially hazardous trees, while maintaining as many of these as possible for wildlife habitat. An assessment of any potential hazard trees should be conducted by a certified Wildlife/Danger Tree Assessor prior to removal. If any trees are to be removed, this must occur outside of the bird breeding window, or be preceded by a bird nesting survey conducted by a Qualified Environmental Professional (see Section 5.3.5.3 below). Any trees removed within the riparian areas must also be replaced as per the BC Ministry of Environment, Lands and Parks tree replacement criteria (Tree Replacement Criteria, 1996).

5.2.6.2 Coarse Wooded Debris

The presence of coarse woody debris (CWD) within the study area provides habitat to small mammals such as, weasels, rodents (food source for other predator species), reptiles and amphibians (use CWD for cover to move from breeding areas to foraging locations), as well as the species at risk that have potential presence within the subject boundary to use CWD. Poorly decomposed CWD is in moderate abundance within younger forested areas, while pieces of varying structure stage classes of decay, occur in areas of more mature vegetation. CWD within mature forests of riparian areas will not be disturbed by proposed development, while CWD occurring elsewhere on site may need to be disturbed and/or removed. It is recommended that as much CWD, of varying sizes and stages of decay, be maintained as possible to the original state or cover percentage for CWD or to the satisfaction of a QEP. If CWD is to be removed, this should occur between late spring and early fall when mammals are less likely to be seeking shelter. There is also the opportunity to improve existing riparian habitat by relocating CWD into riparian areas or areas requiring restoration by a QEP.

5.2.6.3 Wildlife Movement Corridors

The proposed development of the subject properties would require large mammals, which currently travel through these vacant lands, to alter their movement patterns, likely displacing them, and limiting their movement, to the forested riparian areas that offer more challenging travel conditions but greater cover. Small mammals will also be displaced to forested riparian areas. Amphibians and reptiles, which frequent riparian areas, may be subject to increased predation from displaced mammals. It is recommended that vegetated corridors between watercourses be maintained for wildlife movement corridors to prevent further fragmentation of available habitat.

While some of the rocky outcrops occur in steeper areas that may not be developed, there are areas that maybe disturbed from future development if this occurs (i.e. by blasting). This should be timed between

late spring and early fall when mammals are less likely to be seeking shelter and temperatures are warm enough for reptiles to maintain body heat away from the rocks.

5.2.6.4 Riparian Areas

Riparian areas provide valuable habitat to many species of birds, small mammals, reptiles and amphibians, which use the areas for drinking, cover, movement, forage and breeding. Riparian areas may also provide food and nutrient sources for downstream fisheries resources. Riparian areas are some of the most biologically diverse land areas. Ecosystem services provided by riparian areas include sediment, nutrient and pollution control (capture and retention of sediments, nutrients and pollution from upland run-off, erosion control, floor storage and infiltration to recharge groundwater.

Within the study area, riparian areas are associated with all the creeks, drainages and wetlands discussed in Section 4.3. Preliminary RAR assessments were completed on creeks within the proposed development during this assessment and results are discussed in Section 5.4

5.2.6.5 Rocky Outcrops

The rocky outcrops identified within the study area provide potential habitat to small mammals, reptiles, and birds, and should remain undisturbed where possible (BC Ministry of Environment, 2012a; BC Ministry of Forests, Lands and Natural Resource Operations, 2014). If they are to be disturbed outside of this window, it is recommended that a Qualified Environmental Professional survey these to ascertain whether they are being used by mammals or reptiles and to determine appropriate timing for works in their proximity.

5.2.6.6 Cliffs

The cliffs within the Mountain Lands are not currently planned for development and therefore will not be affected. The cliff areas should be protected from any future development as they provide nesting and roosting habitat for cormorants, the listed species at risk peregrine falcon and other birds.

5.3 Wildlife

In general, preserving or rehabilitating the environmentally valuable resources, as discussed in the sections above, will serve to protect wildlife values and mitigate development impacts. However, additional factors to consider are discussed in the sections below.

5.3.1 Amphibians and Reptiles

The aquatic habitats, associated riparian areas, and rock outcrops are of greatest value to species of amphibians and reptiles and these should be retained in their existing condition wherever possible. While the aquatic habitats and riparian areas will be protected through riparian buffers, there is the potential for disturbance for the construction of road crossings. Where roads are to bisect riparian areas and creeks, they should be designed to avoid aquatic disturbances and to minimize the area of intrusion into the riparian areas. Prior to any such works, it is recommended that a salvage effort for any amphibians be conducted by a Qualified Environmental Professional (QEP) following best practices in order to avoid causing harm to any amphibians during the works.

If any of the rock outcrops are expected to be disturbed, this should be timed to occur between late spring and early fall when temperatures are warm, and reptiles are able to maintain body heat away from the rocks and are not expected to have to stay near rocky outcrops. If disturbance is expected to occur

outside of this window, a survey for reptiles (and mammals, see below) should be conducted by a QEP and a determination made at that point as to best practices and timing of the works.

Reptiles and amphibians migrate to and from egg-laying sites or breeding areas and are vulnerable to road kill, predation, and barriers to movement during spring breeding timing windows, especially within fragmented landscapes (Provincial Western Toad Working Group, 2014). Plans to develop roadways near or over watercourses and wetlands should consider amphibian and reptile best management practices, specifically for installing amphibian and reptile underpasses/corridors.

Artificial light at night has the potential to disrupt migrations, feeding and other ecological functions both in terrestrial and aquatic ecosystems (Elizabeth Perkin et al., 2011). Outdoor lighting should conform to the principles of the International Dark Sky Association by discouraging upward lighting and spill lighting and directing illumination to target areas (Cadillac Fairview Corporation Limited et al., 2007).

Best management practices stated in the Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (Ministry of Environment, 2014) and within Develop with Care (BC Ministry of Environment, 2012a) should be adhered to, along with the specific recommendations for species at risk, as detailed in Section 4.2.2 above.

5.3.2 Birds

Under the *Wildlife Act,* birds and active nests are legally protected in British Columbia, while the nests of some raptors and herons are further protected year-round. Section 34 of the BC *Wildlife Act* (Queen's Printer, 1982) states:

> *A person commits an offence if the person, except as provided by regulation, possesses, takes, injures, molests or destroys*
>
> *(a) a bird or its egg,*
>
> *(b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl or*,
>
> *(c) the nest of a bird not referred to in paragraph (b) when the nest is occupied by a bird or its egg.*

Vegetation clearing should occur outside of the typical bird breeding period of April 1 to July 31 to ensure that no active nests are disturbed. If clearing is to take place during this window, a nesting bird survey should be completed by a Qualified Environmental Professional prior to any clearing and any active nests protected with suitable buffers, as determined by the QEP. While the nests of raptors and herons listed in Section 34(b) are further protected year-round, no nests of these species were observed on site. A survey targeting raptor nests should be conducted of the study area prior to any design in order to identify any nests and ensure that appropriate protective buffers are in place (Caskey et al., 2013).

Migratory birds, as defined in Article I of the *Migratory Birds Convention Act,* are also protected under this *Act*, which prohibits the possession of a migratory bird, its nest, or its egg.

5.3.3 Mammals

It is important that all wildlife attractants, including food and other odorous materials, are not left unattended during development of the site and are secured anytime the site is unattended. Further, bear safe guidelines should be incorporated into the proposed development, including garbage facilities and landscaping (www.bearsmart.com). Under the BC *Wildlife Act* (Queen's Printer, 1982), a person commits an offence if they feed dangerous wildlife or leave attractants where they are accessible to wildlife. Offences also include harassing wildlife with the use of vehicles or other mechanical devices or the possession of wildlife or a part of any wildlife in the absence of a permit and all such activities must be avoided.

5.3.4 Fish

The provisions of the *Riparian Areas Protection Act* (British Columbia Ministry of Water Land and Air Protection Environmental Stewardship Division Biodiversity Branch, 2006) and best management practices stated within *Develop with Care* (BC Ministry of Environment, 2012a) should be adhered to, along with the specific recommendations for species at risk, as detailed in Section 4.4.6. The watercourses on the property should be protected, as all watercourses on the property drain into fish-bearing waters downstream.

5.3.5 Wildlife Species at Risk

Twenty-one provincial and federally listed wildlife species at risk have the potential to occur in the study area; three of which have been confirmed. The following paragraphs detail the habitat preferences, likelihood of occurrence, potential impacts of the development and proposed mitigation measures to protect for each of these species at risk.

5.3.5.1 Amphibians

Western Toad

Western toads (Special Concern) breed in a variety of habitats, typically along the margins of lakes, ponds and slow-moving streams (COSEWIC, 2012a). During breeding season, large numbers tend to congregate at waterbodies and actively search for mates. They then migrate between breeding habitat and non-breeding upland habitat, including a large variety of habitats including grasslands, meadows and many different forest types from sea level to the alpine (COSEWIC, 2002a). Riparian habitats which are used frequently by Western toad are protected under the Riparian Areas regulation, and through the provisions of the SLRD 11 guidelines. However, toads migrate to and from egg-laying sites and are vulnerable to road kill, predation, and barriers to movement during spring breeding periods, especially in fragmented landscapes (Provincial Western Toad Working Group, 2014). Plans to develop roadways between wetland/stream areas or over watercourses should consider amphibian and reptile movements and life history traits by installing amphibian and reptile corridors/underpasses.

It can be noted that western toads are known to breed in Alice Lake Provincial Park, located approximately 30 km away from the study area.

Coastal Tailed Frog

Coastal tailed frogs (Special Concern) are the only frog species in North America that breed in cold steep mountain streams (COSEWIC, 2011). This species is particularly sensitive because it requires clean, cold, streams with high dissolved oxygen levels for rearing and breeding, as well as suitable riparian and upland habitats during the terrestrial (adult) portion of their life cycle. Coastal tailed frog is known to occur in the area, but because of the timing of the survey visit no sightings were reported. No works will occur within the riparian areas, with the potential exception of the construction of road crossings. A search for any frogs should be conducted by a Qualified Environmental Professional prior to road construction works in and adjacent to these watercourses and if any frogs are found, these should be relocated outside of the work area following appropriate handling protocols (as per Provincial Western Toad Working Group, 2014).

Northern Red-legged Frog

Habitat for northern red-legged frogs (Blue, Special Concern) includes a variety of permanent and temporary freshwater bodies adjacent to areas having significant forest cover and emergent vegetation (COSEWIC, 2002b). Suitable terrestrial habitat includes dense riparian vegetation that maintains cool and moist conditions, loose soils, coarse woody debris, and leaf litter (COSEWIC, 2002b). All associated habitat features for Northern red-legged frog are found within the study area.

Best management practices for these frog species recommend protecting habitat up to 30-150 m from the high-water mark of any waterbodies (Ministry of Environment, 2014). The maintenance of the riparian areas and aquatic habitat within the study area, as well as water quality, will ensure that the habitat most valuable for these species is maintained. No works will occur within the riparian areas, with the potential exception of the construction of road crossings. A search for any frogs should be conducted by a Qualified Environmental Professional prior to road construction works in and adjacent to these watercourses and if any frogs are found, these should be relocated outside of the work area following appropriate handling protocols (as per (Ministry of Environment, 2014).

5.3.5.2 Reptiles

Northern Rubber Boa

Northern rubber boas (Special Concern) are frequently found near rocks in forested areas and clearings in humid mountainous regions or dry lowland areas and are sometimes found in disturbed areas. Specific habitats are required for thermoregulation and overwintering, which include loose soils suitable for burrowing, leaf litter, woody debris, rocks, outcrops and talus slopes. This species, therefore, has the potential to occur within the study area, in association with the rock outcrops found within the study area. Before blasting of rock, a survey by a QEP for northern rubber boa is recommended, especially for development pods consisting of steep rocky outcrops, talus slopes, or clearings in mature forests near steep/rocky outcrops. During site investigation within the Mountain, Uplands North, East, South and potentially (but unlikely) in Upper Benchlands, and North East these habitats have potential for northern rubber boa presence.

Sharp-tailed Snake

Sharp-tailed snake (Red, Endangered) is a very small species of snake with a maximum length of 30 cm. They are currently only known to occur on Vancouver Island and the Gulf Islands, however there is one known population on the mainland (Sharp-tailed Snake Recovery Team, 2008). The known population occurs in Pemberton, approximately 100 km north of the study area, however the abundance of rock outcrops may be used by this species within the study area. Sharp-tailed snakes frequently occur in open-canopy forests often dominated by Douglas-fir and arbutus (*Arbutus menziesii*) and on rocky hillsides (Sharp-tailed Snake Recovery Team, n.d.). This species has potential to occur in the open forests and rock outcrops seen especially within the Mountain, Uplands North, East and South and potentially (but unlikely) in Upper Benchlands, and Northeast development pods.

While it is unlikely that the rock outcrops will be disturbed during the future development of the site, if they are to be disturbed, this could impact suitable habitat for these species. In such case, it is recommended that surveys for these species of snakes be conducted prior to any potential disturbance to these areas. Should any snakes be found, they can be relocated to adjacent areas of suitable habitat not expected to be disturbed. Snakes are not easily located during summer, when they tend to take shelter under cover objects during the day; therefore, searching under cover objects may be required if the search occurs in the summer (Environment Canada, 2016).

5.3.5.3 Birds

Northern Goshawk, laingi subspecies

The Northern Goshawk *laingi* subspecies (Red, Threatened) prefers forest stands with large amounts of mature or old-growth trees or stand characteristics, but it may breed in younger stands within the Coastal Western Hemlock (CWH) biogeoclimatic zone maritime variants. Northern Goshawks specifically need forests with high canopy closure for ease of hunting and access to prey (Northern Goshawk Accipiter gentilis laingi Recovery Team, 2008). The forested slopes above the Furry Creek provides potentially suitable habitat for this species. While this habitat is not expected to be impacted by future development of the site (due to its steepness and location below the top of bank of a riparian ravine), it is recommended that a survey targeting the nests this species be conducted by a Qualified Environmental Professional before clearing of trees takes place if development occurs within breeding bird windows. Survey's should target areas where habitat is preferable for Northern Goshawk (mature forests and young hemlock stands adjacent to mature forests) to ensure that if a nest is present, adequate protective buffers are in place.

Great Blue and Green Herons

Great Blue Herons (Blue, 1 SC) tend to forage along the coast, in fresh and saltwater marshes, along rivers and in grasslands. Smaller numbers of herons forage in kelp forests, from wharves and in anthropogenic waterbodies. They are mostly arboreal nesters and colonies are typically situated in forests near large eelgrass (*Zostera marina*) meadows, along rivers, and in estuarine and freshwater marshes. (B. Gebauer and E. Moul, 2001)

Green and blue herons forage in slow moving or shallow water, and nest in dense trees or tall shrubs within 1 km of foraging habitat. They breed as either solitary pairs or widely spread in small colonies, and nests can be used for multiple years. The species is migratory and is at the northern extent of its range in southern British Columbia. (*Moelp- Recommended 5 Year Post-Monitoring Schedule for Instream Complexing Projects Conducted by Community Stewardship Groups*, n.d.)

Habitat for both species of heron exist within the Furry Creek development boundary. It is important that the waterbodies on site and their associated riparian vegetation is not disturbed in order to protect this species. As these will be protected by riparian buffers the future development of this site is not expected to affect the available foraging habitat of these species.

Marbled Murrelet

The marbled murrelet (Blue, 1 T) is a small seabird that forages in marine nearshore habitat (< 1 km off land) or in sheltered waters, and usually nest within 50 km of the sea, in lower elevation old-growth forest. Suitable habitat for this species requires trees with sufficient height to allow stall landing and jump-off departures (typically greater than 30 m tall) with large branches (15 to 74 cm in diameter) covered in a soft substrate (i.e. moss) for nest cup. They also require openings in the canopy for unobstructed flight access, and overhead cover to provide shelter and reduce predation. (Ministry of Environment, Lands and Parks, 2001)

Critical habitat for this species has been identified throughout the study area and records of nests found in the area as far back as 1985 have also been reported. Further assessment of the potential quality of habitat for marbled murrelet nesting should be conducted by a Qualified Environmental Professional (*MOELP- Recommended 5 Year Post-Monitoring Schedule for Instream Complexing Projects Conducted by Community Stewardship Groups*, n.d.). Development pods in the Northwest, east of Upper Benchlands, Uplands North and South and Highlands show suitable marbled murrelet habitat and, therefore, if clearing of trees is necessary then a pre-clearing nest survey should include and draw focus to marbled murrelet critical habitat within these sites, if any are found then the appropriate protective buffers should be determined and maintained by the QEP.

Evening Grosbeak

The evening grosbeak (yellow) is a large finch with a large thick bill used to extract seeds from cones and fruits. Grosbeaks can use their large bills to crack open larger fruits and extract almost or all the flesh compared to other species in their family allowing grosbeaks to forage less and eat less often to meet their daily metabolic requirements (Gillihan and Byers, 2001). Evening grosbeaks also consume invertebrates such as beetles, western spruce budworm larvae, caterpillars and aphids (Gillihan and Byers, 2001). Grosbeaks prefer a broad range of habitat types (typically spruce and fir coniferous or mixed forests) and have been known to migrate out of these sites and beyond their typical range when seed crops are low. Nests of evening grosbeaks occur high (~20m) in the canopy in thick deciduous or conifer foliage making it difficult for researchers to study evening grosbeak's, therefore very little is known about their life history.

Suitable habitat is available within the project boundary for evening grosbeaks. Mixed deciduous/conifer forests and mixed conifer (fir/spruce) also occur on site. It is recommended that a pre-construction nesting survey be conducted and if nests of evening grosbeaks are found, the appropriate protective buffers should be implemented and maintained until a QEP has determines the nest inactive.

Olive-Sided Flycatcher

Olive-sided flycatchers (Blue, Threatened) breed in coastal forests with the high densities in the mountains of western Canada. They tend to occur in open coniferous or mixed forests, or along forest edges, often near water including wetlands. They prefer patchy landscapes influenced by natural disturbances such as fires. While they can occur in young forests and along the edges of clear-cuts, they require the presence of snags and tall trees for perching and foraging. Nests tend to be in shorter trees under thick canopy cover. (C. on the S. of E. W. in C. COSEWIC, 2007)

Suitable breeding habitat occurs within the study area, particularly along the edges of the wetlands and along the mature forest edges. It is recommended, however, that as per the general recommendations for nesting birds, that clearing occur outside of the bird breeding window of April 1 to July 31 or be preceded by a bird nest survey by a Qualified Environmental Professional and if any nests are found that a suitable buffer be protected until nesting is complete.

Black Swift

Black swifts are the largest breeding swift in North America, they are fast flying birds with long pointed wings and a slightly notched tail. They are considered blue status in BC because of their inconspicuous life history, specific habitat requirements and low reproductive rate (black swifts will have up to one egg within a clutch in a breeding season). Swifts will nest behind waterfalls and within crevices and cracks on cliff edges, flying over open or forested areas for terrestrial invertebrates (preferably flying ants).

Black swift habitat exists within the property boundary where steep cliffs meet riparian habitats specifically in the uplands north and south development areas. A pre-construction nesting survey should be conducted and if black swift nests are found, the appropriate protective buffers should be implemented and maintained until a QEP has determines the nest inactive.

Peregrine Falcon, anatum subspecies

Three subspecies of peregrine falcon can be found in North America, *anatum sub*species differentiates from others by having a different range and molt pattern. Habitat requirements for peregrine include steep cliffs and talus slopes near open flyways such as meadows, grasslands, and low-lying shrubs and usually located near open water or riparian areas/wetlands. Peregrine's have also been seen using human made structures such as towers for nesting or perching. Alteration of peregrine habitat has posed a threat to peregrine success; manipulation of cliff habitat increases predator access and human encroachment have been known to decrease reproductive success. Cliff and wetland habitat modification or other bird small habitats such as migratory songbirds can have a negative effect on peregrine success from the removal of insect and other small bird prey items. (COSEWIC, 2007)

Peregrine's have been confirmed in the area from Cascade surveyors during one of the site visits at Furry Creek foreshore. Peregrine habitat exists within the development boundary at the Mountain, Uplands North, East, South and potentially (but unlikely) in Upper Benchlands, and Northeast of development pods as well as beachfront near Furry Creek where open flyways (in the form of low-lying shrubs adjacent to rock outcrops and steep cliffs) are present. Peregrine's have also been reported breeding and potentially foraging on Squamish Chief (~20km from proposed development boundary).

Western Screech-owl, kennicottii subspecies

Western screech-owl *kennicottii* subspecies (Blue, Threatened) is a small owl that nests in natural cavities, such as those from rotted out branches, as well as those excavated by large woodpeckers. Preferred nest trees have diameters at breast height of 25 cm or greater and include deciduous trees such as black cottonwood and bigleaf maple. Dense conifer and mixed deciduous/coniferous forests have been identified as necessary for survival. (COSEWIC, 2012b)

Potentially suitable habitat and nest trees occur within the riparian areas as well as in the mature forests and/or trees along creeks and streams located on site. While the riparian areas will not be disturbed during future development of this site, it is recommended that vegetation removal occurs outside of the bird breeding season of April 1 to July 31, to preclude the necessity to conduct further studies to confirm the presence or absence of Screech-Owl nests (BC Ministry of Sustainable Resource Management, 2002).

Band-Tailed Pigeon

Band-tailed pigeons (Blue, Special Concern) breed in the western regions of the Americas, including south coastal BC, some of which over-winter in California while a few remain in BC for the winter. These pigeons breed along edges and openings in mature coniferous, mixed and deciduous forests and in wooded groves and open bushlands, as well as in city parks up to 760 m in elevation. Preferred feeding areas offer flowering and berry-producing trees and shrubs, from spring through fall. Forestry practices may negatively affect their habitat by creating dense second-growth forest with few berry-producing shrubs. (COSEWIC, 2008)

Potentially suitable habitat for this species occurs along the forest edges of mature stands and in open woodlands. Berry producing plants are most abundant in riparian areas, which may be used as foraging habitat. While vegetation within the riparian areas will not be disturbed with the future development of the site, it is recommended that, as per the general recommendation for vegetation clearing, that forest clearing occur outside of the bird breeding season of April 1 to July 31 or be precluded by a songbird nest survey by a Qualified Environmental Professional. Particular attention should be focused along forest edges and openings within the study area. Any active nests will be protected with a species-specific buffer until vacated.

5.3.5.4 Mammals

Keen's Myotis

Keen's myotis is considered blue listed in BC, as a result of mismanaged forestry practices and human encroachments (especially in the lower mainland and south eastern Vancouver Island). Across most of keen's myotis habitat range southwest facing rock crevices, live or dead mature trees with snags, loose bark and/or cracks and crevices near riparian habitats are considered important habitat features.

The above-mentioned habitat features exist within the project boundary and therefore maintaining and assessing for wildlife trees during construction would benefit Keen's myotis's that are potentially located within the project boundary. Additionally, riparian habitats which are used frequently by keen's myotis are protected under the Riparian Areas regulation, and through the provisions of the SLRD 11 guidelines.

Little Brown Myotis

The little brown myotis (LBM) can be found across Canada with a status in BC of yellow. In the summer, little brown bats roost in tree cavities, rock crevices, and under the bark of trees (University of BC, 2017). LBM occupy a wide range of habitats from arid grasslands to humid coastal forests and from sea level to 2288 m above sea level in the Rockies (the greatest altitude range of any other bat) (University of BC, 2017). Can be found in most forest types both moist and dry and usually around open water or riparian areas.

Because of the broad habitat preferences of LBM, they are likely to occur within the subject boundary. Riparian habitats which are used by the LBM are protected under the Riparian Areas regulation, and through the provisions of the SLRD Electoral Area D Official Community Plan Bylaw No. 1135.

Fisher

The fisher is a medium sized mammal in the weasel family with brown fur, accented by a beige mottled chest (Badry, 2004). Fisher's can occupy many forest types, including mixed coniferous and deciduous forests however, they are unlikely to occupy open forests and anthropogenic disturbed areas, or areas influenced by human activity. Fisher habitat is often associated with riparian habitat types where vegetation is low and thick, it is reported that fishers may use these sites for resting (using features such as broken tops, coarse woody debris and snags).

Riparian habitats which are frequently used by the fisher are protected under the Riparian Areas regulation, and through the provisions of the SLRD Electoral Area D Official Community Plan Bylaw No. 1135.

Pacific Water Shrew

The Pacific water shrew (Red, 1 E) is a semi-aquatic shrew associated with skunk cabbage marshes, red alder riparian and stream habitats, and dense wet forests of western redcedar (COSEWIC, 2006). The Pacific water shrew (PWS) is known to occur in Squamish. As detailed in Best Management Practices Guidelines for PWS, portions of the forested riparian areas within 100 m of a watercourse would be considered as providing the attributes desirable for the species (based on the terrestrial ecosystem site series known to occur in this area) (Craig et al., 2010; and Craig, 2007). The BMP guidelines also have criteria where potential habitat is rated as nil under certain biophysical conditions. This is typical where stream banks are high (> 1m) and steep (> 65%), where there is no habitat connectivity and the length of the watercourse, among others. This would appear to be the case for the majority of the watercourses on site. In addition, the watercourses where there may be potential for habitat are known to dry up in summer.

The federal *Species at Risk Act* (SARA) speaks to not destroying critical habitat as defined in federal recovery strategies and action plans; although, in the absence of an issued Emergency Order, the Species at Risk Act is not applicable to private lands. No critical habitat so defined, is found on site. Despite the lack of critical PWS habitat adjacent to Furry Creek and other drainages on the subject property, the riparian habitat adjacent to these watercourses will receive protection under the Riparian Areas regulation, and through the provisions of the SLRD Electoral Area D Official Community Plan Bylaw No. 1135.

Grizzly Bear

The grizzly bear is a blue listed species and the largest predator found in BC. Usually associated with open forests and mountain valley habitats (opposed to the black bear which is commonly associated with forested landscapes). In most of the grizzly's range they are solitary however, grizzlies on the coast congregate near rivers and streams at salmon spawning locations (BC Ministry of Environment, 2012b). In the winter grizzly's will generally hibernate at high elevations (not always and can be seen at lower elevations) in the winter and usually excavate their dens at the base of trees and shrubs, rock crevices, or in caves (BC Ministry of Environment, 2012b).

Grizzly's are an occasional visitor in the area during most of the year, however suitable denning sites are unlikely to occur within the property boundary due to the proximity to human residences and development, Highway 99, and the elevation within the project boundary.

5.3.5.5 Fish

Cutthroat Trout

Cutthroat trout (Blue) prefers gravelly, lowland streams and lakes. Small, cool, clean streams with gravel are needed for spawning. Cutthroats are confirmed to occur in Furry Creek, North Creek and Middle Creek downstream of highway 99, therefore should creek crossings be included in the proposed development plan then low impact creek crossings, such as clear-span bridges, should be used. In-stream works should be minimized whenever possible and a fish salvage will be required prior to any works that would impact a watercourse.

Bull Trout

Bull trout (Blue) is a cold-water species and their habitat requirements include cold, clean streams with a variety of connected habitats for various life stages (McPhail and Baxter, 1996). Bull trout spawn in low-gradient streams that consist of gravel and cobble substrate and abundant instream cover, rearing occurs in shallow side channels with low flows and riffles and overwintering occurs in deeper side channel habitats. Bull trout have the potential to occur in Furry Creek; however previous investigations of the fisheries status of Furry Creek have not detected any bull trout. However, determining specific species for bull trout can be difficult and often requires rigorous survey techniques (such as DNA analysis); therefore, any in-stream work should be minimized to limit the potential impact to this species and the water quality within the riparian areas.

5.3.5.6 Invertebrates

Hairy-neck Tiger Beetle

Little is known about the hairy-necked tiger beetle (sometimes referred to as the moustached tiger beetle), it is medium sized (2-14 mm) beetle and is most active during summer months. Tiger beetles have sickle-shaped mouth parts, long thin antennae with 11 segments, a long body with their head and eyes wider than the thorax, long thin legs, and the primary distinguishing feature being a 'G shape' at the front of their wing covers (the elytra) as opposed to a C shape on their beetle counterpart (*C. repanda*). They are often associated with beach or sandy habitats near streams, rivers, lakes and oceans (Roth, 2014)and therefore their presence is likely to occur at the foreshore portion of the project development. Foreshore environments where the hairy necked tiger beetles are likely to occur are protected under the Riparian Areas Regulation and the Department of Fisheries and Ocean where a necessary setback will be provided. If construction is to occur within foreshore, a preliminary survey for tiger beetles is recommended.

Sinuous Snaketail

Sinuous snaketail are a blue listed species in BC and included within the dragonfly family. Sinuous snaketail are distinguished from other dragonfly's (such as the similar coloured, boreal snaketail) from their widely separated eyes, green and yellow bodies and striped patterns of brown and black (University of BC, 2017). Snaketail are often associated with dense riparian vegetation that maintains cool and moist conditions, loose soils, coarse woody debris, and leaf litter (Government of Montana, 2019). Habitat for snaketail are located within the subject boundary where riparian habitats are noted within dense mature forested stands. These areas are protected under the riparian area regulation and the SLRD Electoral Area D Official Community Plan Bylaw No. 1135.

5.4 Aquatic Environment

5.4.1 Freshwater

Multiple watercourses run through the subject property; any proposed development within 30 m of a waterbody requires a Development Permit application in accordance with the Riparian Projection Development Permit Area in Section 7 of the SLRD Electoral Area D Official Community Plan Bylaw No. 1135.

Furry Creek, Middle Creek, Middle Creek Tributaries 1-3, North Creek, North Creek Tributaries 1 and 2, South Creek and Watercourses 1, 1A, 2 and 3 were flagged for RAR assessment to determine the Streamside Protection and Enchantment Areas (SPEAs). The Detailed Assessment methodology (Ministry of Water, Land and Air Protection & Department of Fisheries and Oceans, 2006) was employed to determine the resulting preliminary SPEAs from the High Water Mark of each watercourse. The detailed assessment method "determines the "Zone of Sensitivity" for the features, functions and conditions of the riparian assessment area". The SPEA width is then the largest "Zone of Sensitivity" resulting from an individual assessment. The SPEA will also be subject to "measures" to protect the integrity of the SPEA. Results are discussed below, with the drainages shown on Map 4a to d.

5.4.1.1 Furry Creek

Based on the detailed assessment methodology using LIDAR data to determine the highwater mark, the following "Zones of Sensitivity" (ZOS) were determined for Furry Creek:

Furry Creek:

- *Large Woody Debris*: **15 m ;**
- *Litter Fall and Insect Drop*:**15 m;**
- *Shade*: **30 m.**

Since the proposed development is on the north side of Furry Creek the Shade ZOS does not apply and the preliminary resultant Streamside Protection and Enhancement Area (SPEA) for Furry Creek relative to the subject property is **15 m** from the High Water Mark. In addition to the SPEA width, additional measures will need to be implemented, at the direction of a QEP, to protect the SPEA; this will likely preclude development with the Furry Creek ravine.

5.4.1.2 Middle Creek

Utilizing the detailed assessment methodology, the following "Zones of Sensitivity" (ZOS) were determined for Middle Creek:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10.98 m ;**
- *Shade*: **10.98 m**

The resultant preliminary SPEA for Middle Creek relative to the subject property is **10.98 m** from the High Water Mark.

5.4.1.3 Middle Creek Tributary 1

Using the detailed assessment methodology, the following "Zones of Sensitivity" (ZOS) were determined for Middle Creek Tributary 1:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **11.60 m ;**
- *Shade*: **11.60 m**

The resultant preliminary SPEA for Middle Creek Tributary 1, relative to the subject property is **11.60 m** from the High Water Mark.

5.4.1.4 Middle Creek Tributary 2

The detailed assessment methodology was used to determine the following "Zones of Sensitivity" (ZOS) for Middle Creek Tributary 2:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*:**7.12 m**

The resultant preliminary SPEA for Middle Creek Tributary 2 relative to the subject property is **10 m** from the High Water Mark.

5.4.1.5 Middle Creek Tributary 3

The detailed assessment methodology was used to determine the following "Zones of Sensitivity" (ZOS) for Middle Creek Tributary 3:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*:**7.12 m**

The resultant preliminary SPEA for Middle Creek Tributary 3 relative to the subject property is **10 m** from the High Water Mark.

5.4.1.6 North Creek

Based on detailed assessment methodology, the following "Zones of Sensitivity" (ZOS) were determined for North Creek:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **15 m ;**
- *Shade*: **26.44 m**

The resultant preliminary SPEA for North Creek relative to the subject property is **26.44 m** from the High Water Mark, on the south bank, and **15.0 m** on the north bank.

5.4.1.6.1 North Creek Tributary 1

Using the detailed assessment methodology, the following “Zones of Sensitivity” (ZOS) were determined for North Creek Tributary 1:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*: **4.69 m**

The resultant preliminary SPEA for North Creek Tributary 1 relative to the subject property is **10 m** from the High Water Mark.

5.4.1.6.2 North Creek Tributary 2

The following “Zones of Sensitivity” (ZOS) were determined for North Creek Tributary 2 using the RAR detailed assessment methodology:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*: **8.72 m**

The resultant preliminary SPEA for North Creek Tributary 2 relative to the subject property is **10 m** from the High Water Mark.

5.4.1.7 South Creek

Based on detailed assessment methodology, the following “Zones of Sensitivity” (ZOS) were determined for South Creek:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **15 m ;**
- *Shade*: **17.45 m**

The resultant preliminary SPEA for South Creek relative to the subject property is **17.45 m** from the High Water Mark on the south side of the creek, and 15 m on the north side.

5.4.1.8 Watercourse 1

Using the detailed assessment methodology, the following “Zones of Sensitivity” (ZOS) were determined for Watercourse 1:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*: **10.26 m**

The resultant preliminary SPEA for Watercourse 1 relative to the subject property is **10.26 m** from the High Water Mark on the south side of the watercourse, and **10 m** on the north side..

5.4.1.9 Watercourse 2

Utilizing the detailed assessment methodology, the following "Zones of Sensitivity" (ZOS) were determined for Watercourse 2:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*: **8.03 m**

The resultant preliminary SPEA for Watercourse 2 relative to the subject property is **10 m** from the High Water Mark.

5.4.1.10 Watercourse 3

The following "Zones of Sensitivity" (ZOS) were determined for Watercourse 3 using the detailing assessment methodology:

- *Large Woody Debris*: **10 m ;**
- *Litter Fall and Insect Drop*: **10 m ;**
- *Shade*:**4.18 m**

The resultant preliminary SPEA for Watercourse 3 relative to the subject property is **10 m** from the High Water Mark.

5.4.1.11 Wetlands and Ponds

The wetland swamp identified within polygon 6RC5mC 4RF5mC within the Uplands North Lands which encompasses Middle Creek Tributary 2, are protected by the RAR as it connects to connects to fish bearing waters of lower Middle Creek and Furry Creek. Due to snow cover during the field assessment of the wetland only preliminary high water mark data and flags have been collected to delineate the wetland. A detailed riparian assessment by a QEP is required on the wetland swamp once snow cover has melted to determine the appropriate SPEA from the high-water mark to guide planning within the area.

5.4.1.12 Furry Creek Bridge Crossing

A bridge across Furry Creek is planned between the existing Oliver's Landing and Waterfront Lands. Bridge abutments and large-scale riprap were noted to be present and in place for the construction of the bridge. If the construction of a free spanning bridge deck within this location is planned a Section 11 notification/approval under the *Water Sustainability Act* is required prior to development. Permitting under the federal *Fisheries Act* is required if any works are planned below the high water mark.

The works should adhere to federal and provincial standards for instream works. Bridge works should be monitored by a QEP to ensure appropriate mitigation measures are performed.

5.4.2 Marine

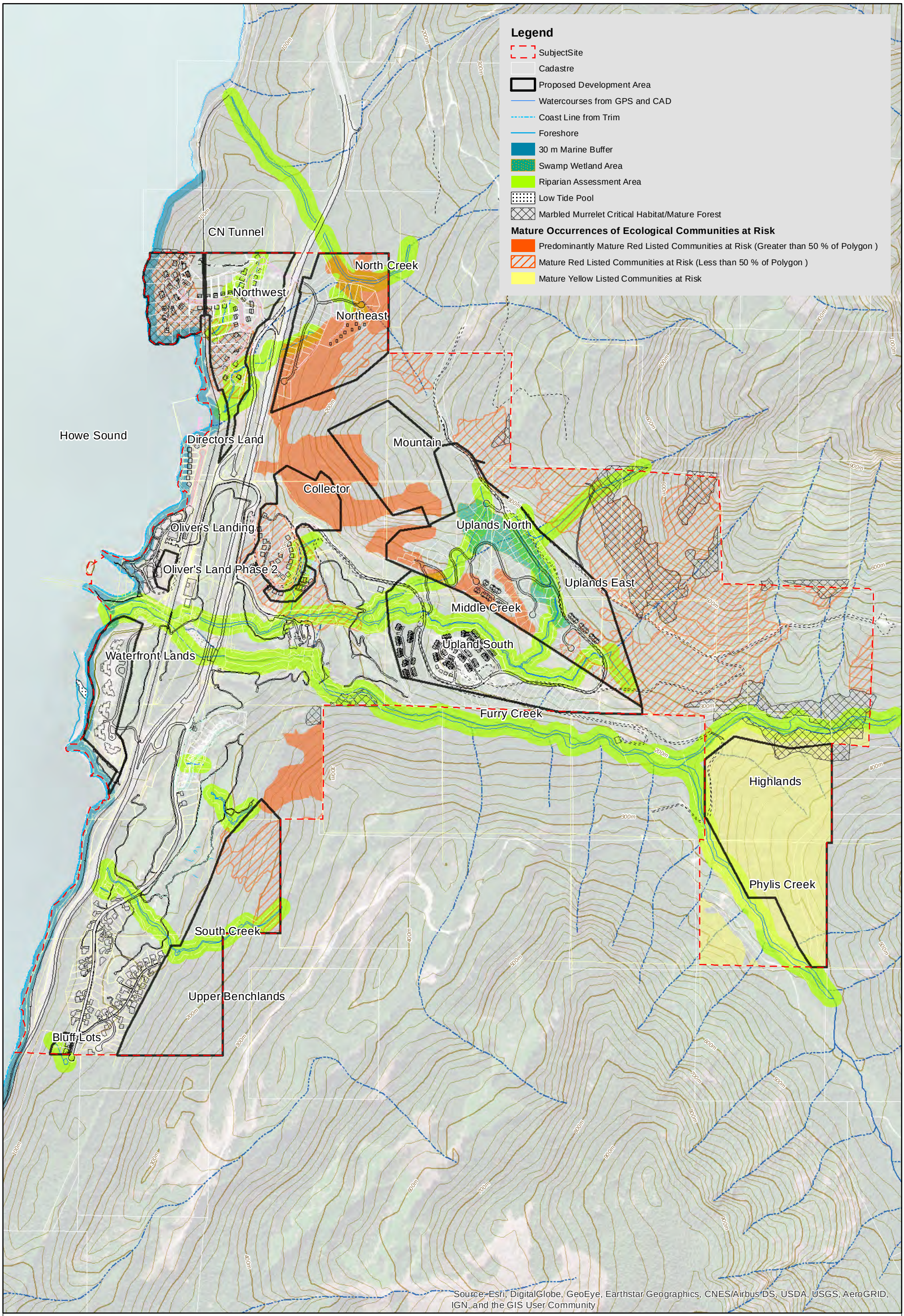
As discussed in section 0, the Furry Creek Beach foreshore is a tidally influenced marine environment and is protected by the Federal *Fisheries Act.* A preliminary riparian marine buffer of 30 m is recommended from the high watermark and will provide protection from development to the marine environment conserving shade, litterfall, slope stability and water filtration properties within the Oceanfront Lands of the Waterfront Lands, Directors Lots and Northwest Lands development pods. The marine 30 m buffer is displayed on Map 4.

The construction of a public pier was part of the covenant conditions for development within the Waterfront Lands. The foreshore area was assessed for feasibility of the public pier in this location. The intertidal area was seen to be productive containing variable habitat panel conditions with kelp present in the lower intertidal area providing vegetation and habitat for marine species.

If the proposed pier (located within the foreshore of Furry Creek Beach) is planned to be constructed, then a DFO request for review must be submitted once development plans have been finalized and an Authorization obtained as it would lead to the permeant alteration and destruction of marine intertidal fish habitat as per paragraph 35 (2)(b) of the *Fisheries Act Regulations*.

Compensation is also anticipated as a requirement for DFO authorization. Compensation (or offsetting) should be within the same vicinity or watershed with clear fisheries management objectives or regional restoration priorities in mind. Consultation with First Nations may also be required to determine local compensation requirements.

Other considerations for the proposed development of the public pier on or within Furry Creek Beach is the approval under the *Navigable Waters Protection Act* as well as consider the regulations provided by the Navigable Waters Works Regulations (Transport Canada, 2009).



GIS Cartographer: Nicola Church
Date: March 15, 2019
CERG File#: 926-01-02
Projection: UTM Zone 10N NAD83
Orthophoto/Data: ESRI/BC Gov
High Water Maks are not from survey. For reference only and not to be used for development
Riparian setback locations to be determined following completion of legal survey of high water mark locations.

CASCADE ENVIRONMENTAL RESOURCE GROUP LTD

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Map 6 - Opportunities and Constraints

Bio-Inventory
Furry Creek Golf Course
Furry Creek, British Columbia

6 Conclusions and Recommendations

6.1 Conclusions

This report details the findings of the preliminary bio-inventory assessment of environmentally valuable resources (EVRs) in the subject area, in addition to a discussion of potential impacts on these as a result of the proposed future development of the site. Opportunities for restoration are also discussed.

EVRs identified on or near the site include the potential occurrences of 8 plant species at risk and 22 wildlife species at risk as well as several habitat features, as listed below:

Vascular Plants:

- Vancouver Island beggarticks (Blue, Special Concern)
- Washington springbeauty (Red)

Mosses:

- Holzinger's brachythecium moss (Blue)
- Roell's brotherella (Red)
- *Callicladium haldanianum* (Blue)
- *Tripterocladium leucocladulum* (Blue)

Wildlife:

Amphibians

- Western Toad
- Coastal Tailed Frog
- Northern Rubber Boa
- Sharp-tailed Snake
- Northern Red-legged Frog

Birds

- Northern Goshawk, laingi subspecies
- Great Blue Heron, fannini subspecies
- Marbled Murrelet
- Green Heron
- Evening Grosbeak
- Olive-sided Flycatcher
- Black Swift
- Peregrine Falcon, anatum subspecies
- Western Screech Owl, kennicottii subspecies
- Band-tailed Pigeon

Mammals

- Keen's Myotis
- Little Brown Myotis
- Fisher

- Pacific Water Shrew
- Grizzly Bear

Fish

- Cutthroat Trout, clarkii subspecies
- Bull Trout

Invertebrates

- Hairy-necked Tiger Beetle
- Sinuous Snaketail

Habitat Features

- Wildlife trees and snags
- Coarse woody debris
- Riparian areas
- Wildlife movement corridors
- Rocky outcrops
- Cliffs
- Creeks and drainages
- Wetlands
- Foreshore Beaches
- Ponds

Opportunities for restoration present on the subject properties include the removal of invasive species and the relocation of any pieces of the coarse woody debris needing to be removed to the riparian areas in order to improve habitat in these areas.

Recommendations to mitigate the potential impacts from the proposed development on EVRs on and near the site are provided in the following section.

6.2 Recommendations

Based on the results of the BIA, the following recommendations are made to minimize potential negative impacts on the identified EVRs arising from the proposed development:

1. Design the development to protect sensitive ecosystems including wetlands, creeks, riparian areas, rock outcrops, cliffs, foreshore areas and mature forests.
2. Ensure all watercourses delineated on Map 4a to d identified to be protected under the *Riparian Areas Regulation* remain free from impact and development and Streamside Protection and Enhancement Areas are protected both during and after development. Watercourses need to be surveyed by a BC Land Surveyor in order to establish setbacks prior to development.
3. The wetland located within Uplands South, encompassing Middle Creek Tributary 3 will require a detailed assessment by a QEP at a later date once snow melt has occurred to determine the appropriate SPEA.
4. Maintain vegetated corridors between watercourses where possible to provide wildlife movement corridors and prevent further fragmentation of available habitat. Install amphibian and small mammal eco-passages under roadways via culverts to preserve and enhance habitat connectivity, subject to the project design and review by the project QEP.

5. Low impact creek crossings such as clear span bridges and/or arch culverts/box culverts should be used where stream crossings are necessary. Permitting for stream crossings will be required from the MFLNROD under Section 11 the *Water Sustainability Act*. Stream crossings will also have to be constructed under compliance with the federal Fisheries Act.
6. The bridge abutments and riprap banks for the proposed bridge from the existing development at Oliver's Landing to the Waterfront Lands were observed to be present. A Section 11 notification of the *Water Sustainability Act* will be needed before construction begins, if a free spanning bridge is planned. If any inwater works are required below the high-water mark of Furry Creek a DFO request for review and a Section 11 approval under the *Water Sustainability Act* will be required.
7. A request for review from DFO concerning the *Fisheries Act* must be obtained when detailed development plans have been completed for the lands adjacent to marine foreshore including the Waterfront Lands, Director's Lots and Northwest Lands to receive applicable marine buffer setbacks (preliminarily set at 30 m, subject to detailed design). The setbacks should be protected from development unless an approval is received from DFO.
8. The proposed public pier is located within the intertidal foreshore of Furry Creek Beach. A DFO Authorization must be obtained for the development of the public pier as it would lead to the permeant alteration and destruction of marine intertidal fish habitat as per paragraph 35 (2)(b) of the *Fisheries Act Regulations*. The development of the public pier would likely require habitat compensation as part of the DFO Authorization and must comply with the *Navigable Waters Act*.
9. Conduct a survey for raptor nests, particularly those of northern goshawk, as well as marbled murrelet of mature forests within the development pods prior to detailed design in order to identify any nests and nesting habitat, and to ensure that appropriate protective buffers are in place.
10. All vegetation clearing should occur outside of the typical bird breeding period of April 1 to July 31 to ensure that no active nests are disturbed. If clearing is to take place during this window, it must be preceded by a nesting bird survey, conducted by a QEP, and any active nests protected with suitable buffers until nesting is complete. Particular attention should be paid to:
    - forest edges and openings for band-tailed pigeon, goshawk;
    - rock outcrops and sparsely vegetated areas for common nighthawk, peregrine falcon; and
    - wildlife trees and snags for western screech-owl, goshawk, olive-sided flycatcher.
11. Avoid disturbances and vegetation clearing within the areas of mature forests where possible and minimize disturbances where not. If clearing or other disturbance is proposed within areas of mature forest, have a survey conducted by a QEP for the following species at risk. If any are found, appropriate mitigation measures will be determined.
    - Moss species, including Holzinger's brachythecium, Roell's brotherella, *Callicladium haldanianum,* and *Tripterocladium leucocladulum*; and
    - Northern rubber boa.
12. Identify and manage potentially hazardous trees, while maintaining as many of these as possible for wildlife habitat. An assessment of any potential hazard trees should be conducted by a certified Wildlife/Danger Tree Assessor. Any trees removed within the riparian areas must also be replaced as per the BC Ministry of Environment, Lands and Parks tree replacement criteria. See #5 for the timing of removal.
13. Avoid disturbances of rock outcrops and cliffs where possible and minimize disturbances where not. If any blasting or other disturbance of rock outcrops is to occur, it is recommended that this occur between late spring and early fall when mammals are less likely to be seeking shelter and temperatures are warm enough for reptiles to maintain body heat away from the rocks. Prior to

any disturbance of these habitats, have targeted surveys conducted by a QEP for the following species at risk. If any are located, appropriate mitigation measures will be determined.

- rubber boa and sharp-tailed snake;
- Peregrine falcon nests, particularly between April 1 and July 31; and
- Washington springbeauty, in late spring to early summer.

14. It is recommended that as much coarse woody debris (CWD), of varying sizes and stages of decay, be maintained as possible. If CWD is to be removed, this should occur between late spring and early fall when mammals are less likely to be seeking shelter. There is the opportunity to improve existing riparian habitat by relocating any pieces of CWD needing to be removed into the riparian areas.
15. An invasive species survey and management plan that incorporates the recommendations included in this report should be developed by a QEP and implemented for the subject property. The plan should be prepared prior to any land clearing or earthworks
16. Wildlife attractants, including food and other odorous materials, must not left at construction sites and must be secured anytime the construction site is unattended. Further, bear safe guidelines should be should be incorporated into the proposed development, including garbage facilities and landscaping
17. Prior to any construction activities within the riparian areas for any creek crossings, have targeted surveys conducted by a QEP for the following species at risk. If any are found, these can be relocated to suitable riparian areas nearby. This may require the installation of isolation fencing along the work site boundary.
    - northern red-legged frog, western toad, and coastal tailed frog, and
    - northern rubber boa.
18. Development of a Stormwater Management Plan and a Sediment Erosion and Control Plan for site preparation, construction and post-construction.
19. Any construction activities anticipated to have any potential effect on water quality in water bodies on or adjacent to the site should be monitored by a QEP.
20. Development and construction of the property should follow guidelines and recommendations outlined in: *Environmental Best Management Practices for Urban and Rural Land Development* (BC MOE, 2014a). This includes best management recommendations for storm water, pollution prevention and wildlife and ecosystem management.

7 Signature and Seal

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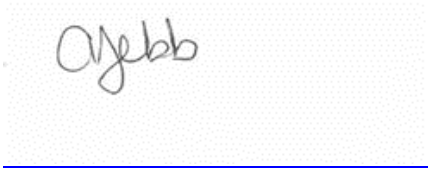

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9 Statement of Limitations

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This document should not be construed to be:

- A Phase 1 - Environmental Site Assessment
- A Stage 1 – Preliminary Site Investigation (as per the Contaminated Sites Regulation of the Environmental Management Act)

10 Appendices

10.1 Appendix A – EVR Preliminary Site Survey

Environmentally Valuable Resources on or near development site	Yes	No	Un-known	Comments
Terrestrial ecosystems in relatively unmodified state:				
• conifer-dominated older forests or mature forests (>100 years old)	X			Section 4.2.1 & 5.2.2
• conifer-dominated second growth forests (60-100 years old)	X			Section 4.2.1 & 5.2.2
• grasslands/shrub /herb communities		X		
• deciduous woodlands		X		
• coastal bluffs	X			Section 4.3.2 & 5.4.2
• sparsely vegetated (e.g., sand dunes)	X			Section 4.3.2 & 5.4.2
• cliffs/rock faces/talus slopes	X			Section 4.2.5 & 5.2.6
Ecosystems at risk:				
• ecological communities on Conservation Data Centre Red or Blue Lists	X			Section 4.2.3 & 5.2.4
• sensitive ecosystems (ecosystem types identified by Sensitive Ecosystems Inventories)		X		
• areas identified as environmentally sensitive areas by local governments	X			Section 4.3.1 & 5.4.1
Aquatic or riparian ecosystems:				
• seasonal or permanent watercourses (streams, creeks, rivers, ditches)	X			Section 4.2.3 & 5.2.4
• seasonal or permanent wetlands	X			
• groundwater springs and seepages, or vernal pools		X		
• lakes or ponds	X			
• riparian ecosystems beside these aquatic ecosystems	X			
• vegetated gullies		X		

Species at risk and their habitats:				
species at risk identified by COSEWIC	X			Wildfire: Sections 4.4.6 & 5.3.5 Plants: Sections 4.2.2 & 5.2.3
species on provincial Red and Blue Lists	X			
regionally significant species	X			
habitats for any of these species	X			
Significant habitat features, e.g.,:				
• wildlife trees	X			Sections 4.2.5 & 5.2.6
• rotting logs and other course woody debris	X			Sections 4.2.5 & 5.2.6
• caves		X		
• cliffs and rocky outcrops	X			Sections 4.2.5 & 5.2.6
• seasonally flooded fields		X		
• hedges and shelterbelts		X		
• old buildings potentially used by bats or birds		X		
• other				
Areas of significant use by wildlife—e.g.,:				
• wildlife travel corridors	X			Sections 4.2.5 & 5.2.6
• ungulate winter ranges; spring forage sites		X		
• den sites (badger, snake, etc.)	X			Sections 4.4.2 & 5.3.1
• perch trees, raptor or heron nest sites	X			Sections 4.4.3 & 5.3.2
• other				

Potential for restoration on development site	**Yes**	**No**	**Un-known**	**Comments**
• Streams in culverts		X		
• Degraded ecosystems, including riparian zones		X		
• Invasive species control	X			Sections 4.2.4 & 5.2.5