5260/5280/5300 Tanya Drive
City of Nanaimo
Detailed Biophysical Assessment

Prepared for:

Broadview Developments

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1.0 ENVIRONMENTAL SETTING

1.1 GEOGRAPHIC SETTING

The proposed study area, which encompasses three large properties, is located along the northern region of the City of Nanaimo. Measuring approximately 29 hectares, the study area is located on 1:20,000 TRIM mapsheet #092G.021 and is bounded roughly by Lost Lake to the east, Linley Valley Park to the south, Lost Lake Road to the north and Rutherford Road to the west. Refer to figure 1 below outlining the subject property(s).

1.2 PHYSIOGRAPHY, HYDROLOGY AND CLIMATE

Low relief topography and frequent rocky outcrops characterize the City of Nanaimo in which the study area is located. Glacial till soils, often with a distinct lower layer that is a mixture of sand and crushed rock (from glaciation), are the predominant upland soils. Marine deposits are rare as the elevation is close to 100m. The moisture deficit is approximately 330mm, but varies considerably with aspect, exposure, soils and ground cover.

There are two waterbodies within the study area meeting the definition of a stream as defined by the Riparian Areas Regulations (RAR) legislation. Two isolated ephemeral ponds are also present on site however do not meet the definition under the RAR legislation as they do not connect directly to fish habitat.

Climate data for the study area are available from Environment Canada's Atmospheric Environment Service (AES) and Ministry of Environment (MoE). AES maintains a climate station at the Nanaimo airport. The data recorded include temperature and precipitation.

- The mean daily temperatures are above freezing throughout the year.

- Mean daily minimum temperatures below freezing can occur from October through March, although the long-term averages of daily minimum temperatures are at or above freezing.
- The mean daily temperature difference between the coldest winter month and the warmest summer month is approximately 16°C.

Precipitation data show the following patterns:

- Most of the precipitation (86%) falls from October through March.
- Snow can occur any time from October through April.
- The driest months are in the summer (July and August).

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Figure 1. Site Overview (Proposed Lot in Red)

1.3 METHODOLOGY

1.3.1 Identification and Review of Environmental Data

Prior to actual on-site investigations of vegetation, wildlife and aquatic communities within the delineated site, a detailed office based investigation on all three environmental components (aquatic resources, wildlife and vegetation) to be studied were initiated. For the most part, this involved researching government databases, including the Department of Fisheries and Oceans (DFO) and the Ministry of Environment (MoE), as well as related reports. Please find below a detailed lists of material used and interpreted for our assessments on vegetation, wildlife, and aquatic habitat.

- Aerial photos, reports and site boundaries (City of Nanaimo, Ministry of Environment – MoE, GoogleEarth).
- BC Conservation Data Centre – Rare Wildlife (Appendix C) and Vascular Plants of the South Vancouver Island Forest District – Appendix D
- BC Conservation Data Centre – Rare Plant Communities Tracking List of the South Vancouver Island Forest District - BC Conservation Data Centre - Appendix E
- City of Nanaimo – NanaimoMap – http://maps.nanaimo.ca/nanaimomap/

1.4 FIELDWORK

Fieldwork related to the detailed biophysical assessment of the study area was conducted on various dates between March 2015 and June of 2017. For all aspects of our assessment including vegetation, aquatic habitat and wildlife, transects and delineated site boundaries where laid down over the study area to ensure maximum coverage (Appendix A). Upon completion, a total of 6 biophysical assessment transects measuring 100m in diameter were assessed thoroughly as well as a complete site walk through resulting in over 85% coverage of the delineated site. In addition, various biophysical assessments of

the site were conducted including but not limited to a vegetation survey, an amphibian survey, small mammal survey, large mammal survey, raptor and blue heron survey, fish and fish habitat survey, and bird inventory. Specific methods relevant to each survey including a breakdown of field equipment are discussed in greater detail in section 2 of this report.

1.5 HISTORICAL LAND USE

Historical land use within the study area has included logging operations in the early 1900's as well as in the 1950's. This is evident throughout the property as old logging roads and skidder trails are prevalent throughout. Other documented uses included hunting and trapping activities as well as a livestock operation (chickens, cows etc.). Present day land uses are primarily limited to a single family residential use and small scale hobby farm activities.

2.0 BIOPHYSICAL ASSESSMENT - METHODS & RESULTS

2.1 VEGETATION

2.1.1 Biogeoclimatic Zones

The study area lies within the Moist Maritime subzone of the Coastal Douglas Fir zone (CDFmm), which occurs along a small portion of southeastern Vancouver Island, several islands in the Georgia Strait and a narrow strip of the adjacent mainland. Elevation limits of the CDFmm range from sea level to approximately 150m. The CDFmm experiences warm, dry summers and mild, wet winters. Forests on zonal sites are dominated by Douglas fir, accompanied frequently by western red cedar, grand fir, arbutus, Garry oak and red alder. Major understory species include salal, dull Oregon-grape, ocean-spray, bracken fern, sword fern, trailing blackberry, western trumpet honeysuckle and Oregon beaked moss. Typical vegetation of CDFmm is presented in Table 1. A list of species found on the study area is found in Tables 2 to 4.

Table 1. Vegetation Typically Occurring Within the Moist Maritime Coastal Douglas-fir Subzone (CDFmm)

Douglas-fir	Pseudotsuga menziesii
Garry oak	*Quercus garryana*
Arbutus	*Arbutus menziesii*
Bigleaf maple	*Acer macrophyllum*
Western red cedar	*Thuja plicata*
Grand fir	*Abies grandis*
Western flowering dogwood	*Cornus nuttallii*
Shore pine	*Pinus contorta* var. *contorta*
Western yew	*Taxus brevifolia*
Salal	*Gaultheria shallon*
Dull Oregon-grape	*Berberis nervosa*

Baldhip rose	*Rosa gymnocarpa*
Ocean-spray	*Holodiscus discolor*
Western trumpet honeysuckle	*Lonicera ciliosa*
Snowberry	*Symphoricarpos spp.*
Hairy honeysuckle	*Lonicera hispidula*
Falsebox	*Paxistima myrsinites*
Labrador tea	*Ledum groenlandicum*
Indian-plum	*Oemleria cerasiformis*
Salmonberry	*Rubus spectabilis*
Red elderberry	*Sambucus racemosa*
Sword fern	*Polystichum munitum*
Bracken fern	*Pteridium aquilinum*
Alaska oniongrass	*Melica subulata*
Big-leaved sandwort	*Moehringia macrophylla*
Pacific sanicle	*Sanicula crassicaulis*
Purple peavine	*Lathyrus nevadensis*
Broad-leaved shootingstar	*Dodecatheon hendersonii*
Nodding trisetum	*Trisetum cernuum*
Vanilla leaf	*Achlys triphylla*
Three-leaved foamflower	*Tiarella trifoliata*
Lady fern	*Athyrium filix-femina*
Skunk cabbage	*Lysichitum americanum*
False lily-of-the-valley	*Maianthemum dilatatum*
Electrified cat's tail moss	*Rhytidiadelphus triquetrus*
Oregon beaked moss	*Kindbergia oregana*
Step moss	*Hylocomium splendens*
Lichen	*Cladonia spp.*
Palm tree moss	*Leucolepis menziesii*
Sphagnum moss	*Sphagnum spp.*

2.1.2 Vegetation Communities

Information utilized in describing and identifying vegetation communities was obtained through a review of past reports, government databases as well as a five day field program. Please refer to methodology sections below for study details.

2.1.2.1 Methodology

2.1.2.1.1 Office Study

The office study involved a review of site maps supplied by the client, as well as a review of all relevant maps for the site posted on the regional Sensitive Habitat Inventory (City of Nanaimo – Nanaimo Map). The study area consisted of the study area plus 10m on either side. Other information, maps and aerial photographs reviewed included:

- Air Photo Mosaic (NanaimoMap, 2016)
- 1:20,000 TRIM Mapsheet
- Community Mapping Network of BC
- Element Occurrence Report (EOR) from the British Columbia Conservation Data Centre (BC CDC)
- GoogleEarth - 2016

2.1.2.1.2 Field program

Cascadia Biological Services conducted field reconnaissance of the site between May 2015 and June 2017 during which time the following tasks were completed.

The vegetation of the site was examined by establishing 10m x 10m vegetation quadrats within each of the different plant communities. The placement of these quadrats was decided based on a general reconnaissance of the site while a global positioning unit (GPS)

was used to accurately plot each quadrat on a map *(Appendix A).* The following information was recorded:

- Complete list of plant species within the quadrat
- Presence of rare and endangered species

Overall, a total of 4 distinct vegetation communities where assessed resulting in the following quadrats listed below:

- Quadrat #1 – Rocky Outcrop/Woodland,
- Quadrat #2 - Riparian,
- Quadrat #3 – Conifer Dominated Older Second Generation Forest
- Quadrat #4 – Disturbed (not sampled)

These 3 ecosystems above were delineated for further study based on overall size and importance within the study area.

2.1.3 Assessment Results

Vegetation communities within the delineated site consisted primarily of shrubs, coniferous and deciduous species in the young forest stage, several old growth vegetative polygons and flowers along rocky outcrops. Of the species encountered, none were listed on the *Conservation Data Centre: Rare Vascular Plant/Vegetative Communities Tracking List – South Island Forest District (Appendix D & E)).* Please refer to Appendix A for quadrat locations. For a complete list of plants identified in the delineated study area, refer to Tables 2-4 below as well as plates 1-6 for typical photographs. Please note that this list is a summary of plant species identified in our quadrat assessments and is indicative of the site during late spring, and by no means, represents the site as a whole due to seasonal variability in plant species. As areas of special concern (rocky outcrops, woodland etc.) where often identified immediately outside of the established quadrats, plants species identified during these assessments have been included into the nearest quadrat location.

Table 2. Quadrat #1 – Woodland/Rocky Outcrop Ecosystem

Arbutus menziesii (Arbutus)
Pseudotsuga menziesii ssp menziesii (Douglas fir)
Holodiscus discolor (Ocean Spray)
Cytisus scoparius (Scotch Broom)
Mahonia aquifolium (Tall Oregon-Grape)
Elymus glaucus (Blue Wildrye)
Kindbergia oregana (Oregon Beaked Moss)
Timmia austriaca (False-Polytrichum Moss)
Alectoria sarmentosa (Common Witch's Hair Lichen)
Platismatia glauca (Ragbag Lichen)
Plectritis congesta (Sea Blush)
Claytonia perfoliata (Miner's-Lettuce)
Bromus vulgaris (Columbia Brome)
Vaccinium ovalifolium (Oval-Leaved Blueberry)
Cladonia chlorophaea (False Pixie Cup)
Polytrichum juniperinum (Juniper Haircap Moss)
Racomitrium lanuiginosum (Hoary Rock Moss)
Parmelia salcata (Waxpaper Lichen)
Capsella bursa-pastoris (Shepherd's Purse)
Collinsia parviflora (Small-flowered Blue-eyed Mary)
Polystichum munitum (Sword fern)
*Gaultheria shallon (*Salal)
Pachistima myrsinites (Falsebox)
Rubus ursinus (Trailing Blackberry)

Plate #1 – Typical view of rocky outcrop quadrat

Plate #2 – Typical view of a rocky outcrop ecosystem

Table 3. Quadrat #2 – Riparian Ecosystem

Pseudotsuga menziesii ssp menziesii (Douglas fir)
Alnus rubra (Red Alder)
Thuja plicata (Western Redcedar)
Polystichum munitum (Sword Fern)
Gaultheria shallon (Salal)
Mahonia nervosa (Dull Oregon-Grape)
Acer macrophyllum (Bigleaf Maple)
Kindbergia oregana (Oregon Beaked Moss)
Pteridium aquilinum (Bracken Fern)
Holodiscus discolor (Ocean Spray)
Hypnum subimponens (Curly Hypnum)
Polytrichum juniperinum (Juniper Haircap Moss)
Hypnum subimponens (Curly Hypnum)
Nephroma resupinatum (Pimpled kidney)
Phragmites australis (Common Reed)
Equisetum fluviatile (Swamp Horsetail)
Vicia Americana (American Vetch
Veronica serpyllifolia (Thyme-leaved Speedwell)
Fauria crista-galli (Deer Cabbage)
Trifolium repens (White Clover)
Bellis perrenis (English Daisy)
Taraxacum officicinale (Common Dandelion)
Rubus ursinus (Trailing Blackberry)
Physocarpus capitatus (Pacific Ninebark)
Rubus discolor (Himalayan Blackberry)
Amelanchier alnifolia (Saskatoon)
Symphoricarpos mollis (Trailing Snowberry)
Spirea douglasii (Hardhack)
Acer Macrophyllum (Big Leaf Maple)
Lysichiton Americana (Skunk Cabbage)
Ranunculus repens (Creeping Buttercup)
*Rosa gymnocarpa (*Baldhip Rose)
Rubus laciniatus (Evergreen blackberry)

Plate #3 – Typical view of riparian quadrat

Plate #4 – Typical view of riparian quadrat

Table 4. Quadrat #3 – Coniferous Dominant

Pseudotsuga menziesii ssp menziesii (Douglas fir)
Arbutus menziesii (Arbutus)
Gaultheria shallon (Salal)
Holodiscus discolor (Ocean Spray)
Kindbergia oregana (Oregon Beaked Moss)
Rosa gymnocarpa (Baldhip Rose)
Mahonia nervosa (Dull Oregon-Grape)
Hypnum subimponens (Curly Hypnum)
Platismatia glauca (Ragbag Lichen)
Polytrichum juniperinum (Juniper Haircap Moss)
Alectoria sarmentosa (Common Witch's Hair)
Parmelia salcata (Waxpaper Lichen)
Lonicera ciliosa (Western Trumpet Honeysuckle)
Bromus vulgaris (Columbia brome)
Thuja plicata (Western Red Cedar)

Plate #5 – Typical view of conifer dominated quadrat

Plate #6 – Typical view of conifer dominated quadrat

2.1.4 Rare and Endangered Vascular Plants and Plant Communities

2.1.4.1 Rare and Endangered Vascular Plants

The Conservation Data Centre (CDC) reports the occurrence of 164 taxa of rare and endangered vascular plants within the South Island Forest District; 86 blue-listed and 78 red-listed *(Appendix D).* Rare and endangered species are categorized into 'red' 'blue' and 'yellow' lists. Red listed species include species that are extirpated in British Columbia, in danger of becoming extirpated, or threatened. Blue listed species are

species that are sensitive or vulnerable to human activity or habitat encroachment. Yellow-listed taxa are those species or subspecies that are not red or blue listed. Based on site observations, no red/blue listed plant species were observed.

2.1.4.2 Rare and Endangered Plant Communities

The CDC reports the occurrence of 34 rare and endangered plant communities in the South Island Forest District within the CDFmm; 28 red-listed and 6 blue-listed (Appendix E). Based on site observations, no red/blue listed communities were documented on the property.

2.2 WILDLIFE

2.2.1 Survey Methodology

All wildlife surveys conducted on the subject property were performed as much as possible according to Resource Inventory Committee and/or Canadian Wildlife Service standards where possible. Other information collected included using various government databases and internet searches.

2.2.1.1 Raptors and Breeding Bird Inventory

To ensure adequate detection of all species present, our study area was firstly, broken down into six separate transects which were equally spaced at a distance of approximately 100m (Appendix A). Transects were labelled from 1-6 starting from east to west. All calls/visual observations were then recorded and assigned to either the closest transect or point count station.

Nocturnal Roadside Call Playback Survey Methodology

These surveys followed procedures outlined in "Standard Inventory Methodologies for Components of British Columbia's Biodiversity: Raptors (Version 1.1) Section 3.3.3". Calls and songs of five target species potentially occurring in the study site were played at Spotting Scope Location (SSL) #1 (Appendix A). Calls of each species were played for a period of five minutes each beginning with calls of the smallest species and ending with those of the largest as per the standards:

1) Northern Saw-whet Owl (NSWO);
2) Northern Pygmy Owl (NOPO) Blue-listed;
3) Western Screech Owl (WESO) Blue-listed;
4) Barred Owl (BDOW); and
5) Great-horned Owl (GHOW).

2.2.1.2 Amphibian Survey

The goal of this inventory was to identify species and distribution within the study area. As a result, a concerted effort was made along the four identified watercourses, wetted depressions as well as other areas thought suitable.

Field Study

Sample Design for Amphibians

The amphibian surveys focused on identifying species present and distribution, however, special attention was given to the red-legged frog (blue listed species) and areas along the 4 watercourses.

Although this blue listed species and its habitat identifications were of focus, all sightings during the survey period were recorded including the results of minnow traps placed at key locations.

2.2.1.3 Small Mammal Survey

This survey focused on all areas within the study area and followed the MoE Inventory Branch for the Terrestrial Ecosystems Task Force Resource Inventory Committee (RIC) protocols.

Office Procedures

The following office preparation was performed prior to the field surveys:

- Review of the *"Inventory Methods for Small Mammals : Shrews, Voles, Mice & Rats", Standards for Components of British Columbia's Biodiversity, No. 31 (1998);*
- Review the introductory manual No. 1 *Species Inventory Fundamentals;*

The survey addressed the building footprint in the development area, as well as areas with a high likelihood of species occurrence.

Field Sampling Procedures

Sample Design

This study involved determining species identification and distribution by establishing randomly located traps sites within the study area (Small Mammal Trap locations – SMT1-6). The number of traps was dependent on the potential species, and overall size of the study area. Live traps were used to minimize impacts to caught individuals. The following methodology was used during the survey:

- All traps were placed in areas where rodents and small to medium sized mammals were expected to occur in the project study site;
- Two small traps (mice, shrews etc.) and two larger traps (weasels, raccoons, cats etc,) were used per station;

- Each type of vegetation unit on the study site was sampled using this methodology and traps were placed in homogeneous habitat (Appendix A);
- GPS coordinates were taken for each trap location;
- All traps were flagged with flagging tape;
- Each trap was baited with peanut butter (mice, shrews) and sardines (larger traps);
- Traps were set for a period of 72 hrs.
- Once completed, all traps were removed;

2.2.1.4 Large Mammal Survey

The purpose of the large mammal ground survey was to:

- Assess species composition and distribution;
- Identify areas for potential habitat use.

The following ground-based survey methodology was conducted for this phase of the large mammal survey:

Office Procedure

- Review of BC Ministry documents Section 2 “Conducting Wildlife Inventory” in the introductory manual, *Species Inventory Fundamentals (No.1);*
- Review of mapping for the area (i.e. air photo, 1:20,000 scale TRIM mapping);
- Identify potential habitat.

Sample Design

Identify species composition and distribution throughout the lot along delineated transects as well as thorough walk through covering 80% of the area. From this assessment, identify signs including scat, tracks, browsing areas, scrapings etc..

Species Ratings and Accounts

Background

Attached in Appendix C, is a list of BC Conservation Data Centre's Rare Vertebrate Animal Tracking List for the South Island Forest District (2015). Red and Blue rated vertebrates potentially occurring within this Forest District are listed.

The COSEWIC and British Columbia's Red, Blue and Yellow rating status definition for each species identified are presented below.

COSEWIC ratings for species have been defined the following ways:

Extinct - A species that no longer exists.

Extirpated - A species that no longer exists in the wild in Canada, but occurring elsewhere (for example, in captivity or in the wild in the United States).

Endangered - A species facing imminent extirpation or extinction.

Threatened - A species likely to become endangered if limiting factors are not reversed.

Vulnerable - A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Not At Risk - A species that has been evaluated and found to be not at risk.

Indeterminate - A species for which there is insufficient scientific information to support status designation.

Red, Blue and Yellow status as defined by the B.C. Conservation Data Centre's Red, Blue and Yellow definitions are as follows:

Red list:

Includes any indigenous species or subspecies (taxa) considered to be Extirpated, Endangered, or Threatened in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent

extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Red-listed taxa include those that have been, or are being, evaluated for these designations.

Blue List:

Includes any indigenous species or subspecies (taxa) considered to be Vulnerable in British Columbia. Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

Yellow list:

Any indigenous species or subspecies (taxa), which is not at risk in British Columbia. The CDC tracks some Yellow listed taxa, which are vulnerable during times of seasonal concentration (eg. breeding colonies).

2.2.2 Assessment Results

2.2.2.1 Bird Inventory

The bird survey was conducted on various dates between April 2015 and June of 2017. The night/nocturnal surveys were completed on the evenings of February 5th and 7th of 2017. A total of 38 bird species (passerines and raptors) were encountered on the study site during the transect survey and as incidental sightings. As point count stations/owl calling stations were aligned along designated transects, the summary table below incorporates all birds identified to the nearest transect location and number. The following is a result of the transect/point count/auditory surveys performed on the delineated study area. Refer to Table 5 below.

Table 5. Summary Table of Bird Survey

Transect #	Date	Total Species Encountered Along Each Transect	Red/Blue Species Encountered
1	Various May 2017	5	0
2	Various May 2017	6	0
3	Various May 2017	9	1
4	Various June 2017	8	0
5	Various June 2017	8	0
6	Various June 2017	2	0
TOTAL		**38**	**0**

*Blue listed Great Blue Heron was observed

Detailed information for each transect and associated point count stations including species noted is presented in Appendix G, as well as a generalized summary in Table 6 below.

Table 6. Species Abundance and Diversity Along Each Transect

Transect	No. of Individuals Observed Along Each Transect
1	7
2	7
3	13
4	13
5	8
6	2
Grand Total	**50**

Diurnal Stand Watch/Point Counts

The greatest number of individuals and species diversity was observed along transect(s) 3 and 4 with the lowest being observed along transect 6. No active bald eagle nest was observed during our assessment of the property. No heron rookery or other large tree top stick nests were found on the subject property during the survey despite meticulous searching with a high powered/anchored spotting scope (refer to Appendix A for location) as well as aerial drone footage of the site. The site does however have the potential to provide good foraging for diurnal raptors as well as nocturnal (owls) as was evident in our assessment results.

Nocturnal Stand Watch/Point Counts

The nocturnal raptors (owls) survey was conducted the evening of February 5th 2017 and February 7th 2017 at one owl calling stations (SSL #1) which had been established at what was assumed to be excellent calling locations (Appendix A). Eventual results revealed the site to be an excellent calling location as 3 owls were called in within ten minutes (two barred owls and one great horned owl). The arrival of the owls from the east within 10 minute of call initiations suggest the owls quite possibly have a nest within or immediately outside of the study area.

2.2.2.2 Amphibian Survey

The amphibian survey was conducted between May and June of 2017.

A total of 3 roughskin newts, several American bullfrogs and numerous pacific tree frogs were encountered during the survey period. Transects were the same as the bird inventory transects. All wetted areas and adjacent riparian areas as well as woodland trails were surveyed for species.

In total, approximately 10 hrs. of survey time including auditory, time constraint and systematic searches were spent searching the following locations and habitats throughout the study area:

- All ephemeral drainages and wetted depressions

Species assessed are presented in *Table 7 below:*

Table 7. Amphibians Encountered During Time Constraint and Systematic Searches

Species	No.	Method	Total Time	Location
Roughskin newt	1	Minnow trap	72hrs.	MT1
Roughskin newt	1	Minnow trap	72hrs.	MT3
Roughskin newt	4	Minnow trap	72hrs.	MT4
American bullfrogs	<5	Audio Observation (AO)	2 days	Around Lost Lake
American bullfrogs	<5	Audio Observation (AO)	2 days	Around Lost Lake
Pacific tree frog	5	Minnow trap	72 hrs.	MT2
Pacific tree frog	4	Minnow trap	72 hrs.	MT5
Pacific tree frog	>100	Auditory	4 hrs	MT1-MT5

Each G-trap trap was checked after the 24 hour period ensuring minimal mortalities.

2.2.2.3 Small Mammal Survey

Six (Havahart) traps (Small Mammal Traps – SMT 1-6) were set at various locations along the proposed site (Appendix A – numbered clockwise from northwest corner) and each habitat type was sampled where possible. As well, 6 larger traps were set at various locations near the SMT traps. The traps were recovered after a period of 72 hrs. (checked every 24 hr. period) with 3 eastern cottontails, 2 deer mice, 1 vagrant shrew, 2 mink, 3 raccoons and 1 rat recovered. Please refer to Table 8 below:

Table 8. Results of Live Small Mammal Trapping

Trap Site Number	Species Captured
SMT #1	1 eastern cottontail, 1 rat
SMT #2	1 deer mouse, 1 eastern cottontail
SMT #3	2 deer mouse
SMT #4	1 deer mouse
SMT #5	1 vagrant shrew, 1 mink
SMT #6	2 deer mouse, 1 raccoon

2.2.2.4 Large Mammal Survey

The study site was walked numerous times during the course of evaluation and each time it was searched for large mammal signs. As well, a more detailed assessment involving 6 transects was performed in conjunction with the bird survey. *Table 9* presents an overview of incidental wildlife sightings. Please refer to Appendix F for a detailed summary table.

Table 9. Incidental Wildlife Sightings

Species	Evidence	Location
Blacktail Deer	visual	various
Cougar tracks	visual	northeastern boundary
Red Squirrel	visual	various
Raccoon	caught	various locations
Northern Alligator Lizard	visual	various
Barred Owl	visual	SSL #1
Great horned owl	visual	SSL #1
Cooper Hawk	visual	Northern edge of larger wetland
Bald Eagle	visual	various
Red-tailed Hawk	visual	various
Grey Squirrel	visual	southern boundary

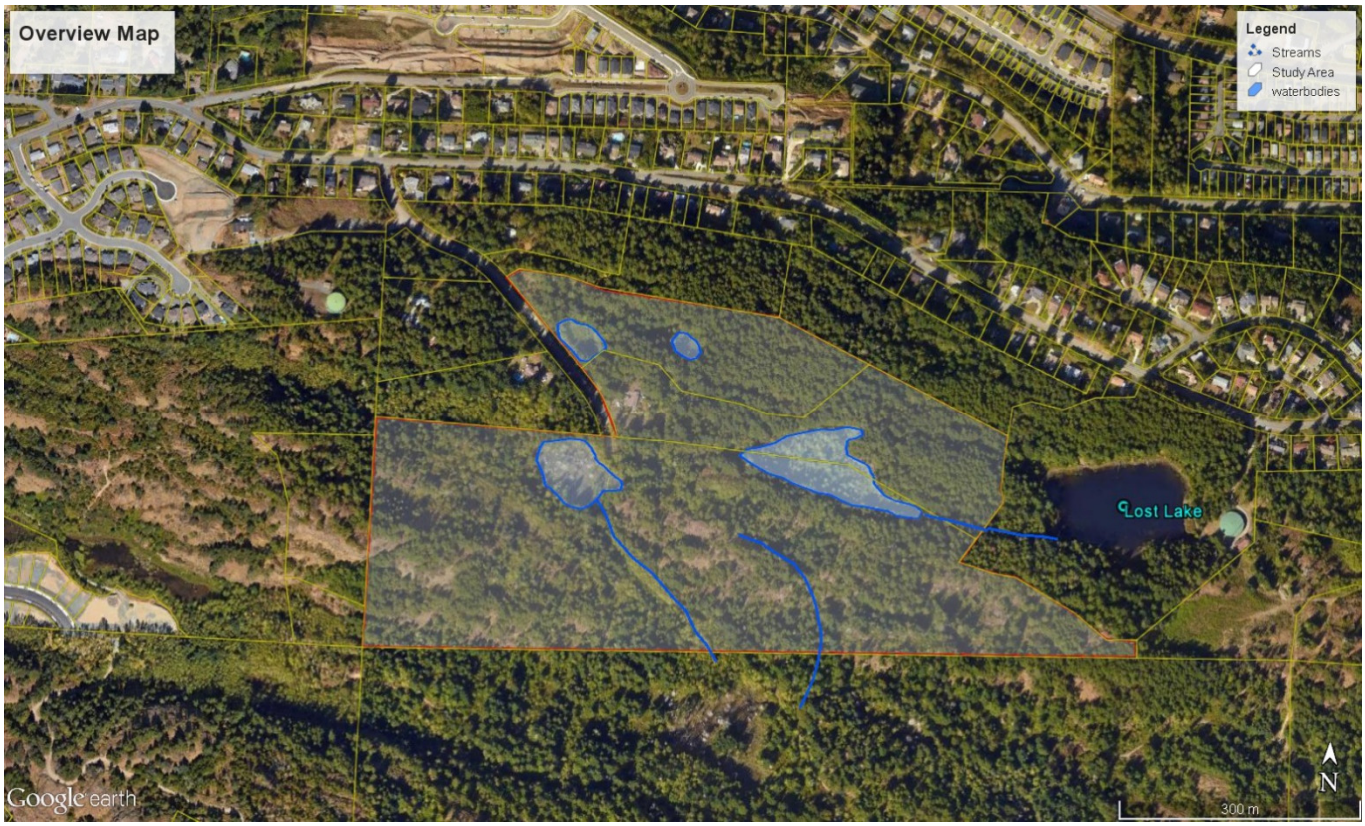
American Mink	visual	two larger wetlands
Eastern Cottontail	visual	various

2.3 AQUATIC RESOURCES

2.3.1 Watercourses

Waterbodies within the subject property consist of five watercourses three of which flow from the northwest to the southeast. The two other waterbodies are stand alone/isolated pocket wetlands measuring both less than 300 m^2. Located along the northern boundary of the study area, both are isolated from fish habitat and therefore do meet Riparian Areas Regulations (RAR) criteria. Of the two streams that flow within the study area, the first stream drains a large wetland complex located along the northwestern boundary of the property. The stream travels from this headwater wetland in a southeastern direction flowing periodically subterranean before finally flowing into a larger wetland in a City Park immediately outside of the southern boundary of the property. The headwater wetland appears to have been affected by beavers over the last couple of years as browsing and dam building was evident. The second stream flows from a large wetland located along the northeastern boundary of the property. The stream from this location flows in an eastern direction before entering a large lake system (Lost Lake) immediately to the east of this property. Of the three watercourses, all are considered Riparian Areas Regulations (RAR) watercourses given their direct connectivity to fish bearing watercourses. Please refer to Figure 2 below identifying the watercourses assessed within the study area. Setbacks for the streams would be 10m along the stream component and 30m along the southern boundary of the wetland. The north, eastern and western aspects of the wetland would receive a 15m setback. All waterbodies including the isolated wetlands would be subject to a 15m riparian setback as per the City of Nanaimo's riparian setbacks. For the purpose of this assessment, the streams will default to a 15m riparian setback based on the City of Nanaimo's setback bylaws which supersede those achieved under the RAR legislation.

Figure 2. Waterbody Map



2.3.2 Surface Water Use

No information of surface water use was documented during our assessment of the property.

2.3.3 Survey Methodology

2.3.3.1 Office Study

A review of Ministry of Environment (MoE) and the Department of Fisheries and Oceans environmental databases was undertaken. Internet addresses for these databases are as follows:

B.C. Conservation Data Centre: Rare Vertebrate Tracking List; South Island Forest District (Appendix C)

Tracking lists of rare and endangered vertebrates occurring in the South Island Forest District were reviewed and a rare element occurrence report (EOR) was requested. This report, available in ArcInfo export format, was then plotted as an overlay to existing 1:20,000 TRIM maps to identify rare elements. Forest District tracking lists name those species that are known to occur, strongly expected to occur, or which have occurred in the past within a given forest district. An EOR provides a list of all recorded rare and endangered specimens that have previously been identified in the area. A map of the rare elements in and around the study area are presented in Appendix F. From this map, we have determined that the study area lies outside of any documented/mapped environmentally sensitive attributes.

2.3.3.2 Field Survey

Stream Biophysical Survey

A biophysical habitat survey was conducted using parameters outlined in the Ministry of Environment/Department of Fisheries and Oceans Stream Survey forms, which allowed information to be collected on the following:

- Channel characteristics - including floodplain description;
- Description of watercourse length, average channel width, average wetted width, average maximum depth and banks;
- Barriers to fish passage - including debris jams, culverts, weirs, beaver dams etc.;
- Substrate characteristics - including estimated percentages of materials;
- Description and percentage of pools, runs, and riffles;
- Location and description of bridges, culverts, water control, water intake and storm water discharge structures;

- Vegetation - detailed riparian overstorey, understorey, and herb layer characteristics including a species list;
- Threatened, rare and endangered species - estimated use and a detailed species list; and
- Potential salmonid spawning and rearing habitat rating (low, medium or high) with rational for rating described.

2.3.4 Minnow Trap Assessment Summary

Five minnow traps baited with cat food and set at three locations (Appendix A) was monitored over the course of three days (checked once a day). The results of our assessment are presented previously in Table 7.

2.4 CULTURALLY MODIFIED TREES

During our overall assessment of the study area, a concentrated effort was made to identify culturally modified trees within the delineated boundaries. Our effort focused primarily on large cedar trees, which were customarily used by indigenous peoples for various items including baskets etc. Our assessment resulted in no culturally modified trees being observed.

3.0 ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

3.1 AQUATIC RESOURCES

The following represents a list of potential impacts to aquatic life and aquatic habitat within the proposed site boundaries. Of the waterbodies identified, all five were identified as having potential vulnerabilities to future development on the lot(s). As the watercourses are considered fish bearing by default, a RAR report will have to be generated for those lots and roads that fall within the 30m Riparian Assessment Area (RAA). Although not fish bearing, all four waterbodies have been rated moderate in terms of amphibian habitat value amphibian habitat. Proposed works within said area will most likely involve stormwater outfalls and other utilities. Works within these areas should proceed when the watercourses are dry. Where development permits need to be issued within 30m of a waterbody for the construction of roads etc., environmental monitoring on-site by a qualified professional biologist is recommended. Overall, disturbances to watercourses within the site are expected to be minimal if proper planning and construction practices are adhered to. Please refer to the Impact Summary Table below (Table 9) for a complete list of impacts and mitigation solutions.

3.2 WILDLIFE

Wildlife issues within the delineated site boundaries include a minimal loss of habitat for various animals presently utilizing this parcel of land. They include deer, cougar, rabbits, raccoons, squirrels, numerous birds and various raptors identified in our assessment, which utilize this parcel of land primarily for foraging. Of particular importance however, is a older growth Douglas fir polygon as well as the riparian areas and rocky outcrops including one wildlife den area. The areas of moderate significance are identified in Appendix B. Special attention to noise including blasting activities and overall disturbances will also have to be strictly monitored in and around this site, specifically, during the time period of January 30th and June 30th when nesting activities (various raptors) in and around the area are expected to occur. In summary, although construction activities associated with this development will undoubtedly affect and

remove present habitat within select areas, the overall percentage of disturbed land within the study area is expected to be low and therefore, minimal risk is expected to the species identified in our assessments or of those species listed as having the potential to occur by the BC CDC (British Columbia Conservation Data Centre). Please refer to the Impact Summary Table below (Table 9) for a complete list of impacts and mitigation solutions.

3.3 VEGETATION

Our assessment in May and June of 2017 resulted in the identification of >50 plant species in 3 different vegetative communities. Of the three identified, the greatest diversity of plants was along the rocky outcrop/woodland community quadrat. Our assessment within this quadrat resulted in the identification of numerous flowering plants (none identified by the BC CDC as red/blue listed) forming part of a larger distinct ecosystem within a Douglas fir dominated stand of conifers. As is evident by the topography of the proposed lot(s), this area will undoubtedly be affected by construction activities as it is by far the best building site within the study area as well as being the most practical. As a result, it is recommended that areas outside of those required for the development, be disturbed as little as possible. This includes adding high visibility snow fencing to reduce construction related impacts as well as educating future tenants on areas of concern including invasive species introduction and Scottish Broom management. The removal and management of introduced species will have an overall positive effect on the area that remains of the rocky outcrop/woodland polygon(s). Direct impacts related to the construction of the site will result in the removal of most species along building footprints and road locations. Due to the impacts associated with the removal of present vegetative communities, it is proposed that as a mitigative measure, areas outside of those needed for the building footprints and associated areas dedicated to construction be disturbed as little as possible and that native trees (primarily arbutus and Garry oak) and shrubs be used for landscape planting. Please refer to the Impact Summary Table below for a complete list of impacts and mitigation solutions.

Table 9. Impact Summary Table.

Environmental Parameter	Potential Impacts	Mitigative Measures	Residual Impacts
Vegetation	Loss of natural vegetation currently existing on site along the proposed development footprint and infrastructure location(s).	Riparian removal will be limited to the fullest extent possible. Removal of invasive species Reclamation of unpaved disturbed areas with native trees and shrubs.	Loss of vegetation in the area immediately required to accommodate the development Positive impacts resulting from revegetation with native species.
Aquatic Life and Habitat	Loss of riparian buffers along moderate value habitat associated with proposed infrastructure	Minimize disturbances to riparian reserves.	Impacts to the headwater wetland and amphibian habitat
Wildlife	Loss of habitat resulting from vegetation clearing. Changes in wildlife movements. Sensory disturbance to sensitive species. Stress to wildlife caused by increases in human encounters including foot and road traffic	Construction of nesting boxes with old growth attributes to accommodate the loss of older second generation forest. No potentially sensitive species found to breed within 100m of the proposed road development None Use wildlife movement controlling structures and devices	Loss of habitat for some species where vegetation is permanently removed to accommodate the development Minimal changes to wildlife movements Potential disturbance to wildlife Some stress to select species associated with increases in traffic

3.4 MONITORING

All construction activities within areas identified as sensitive are monitored by a Professional Biologist. These include wildlife trees as well as works in woodland/rocky outcrop areas. As well, it is recommended that a detailed sediment control plan be implemented prior to fall/winter rains.

3.5 SITE CONSTRAINTS

As part of a Development Impact Assessment, a site constraints map was developed to help identify areas of particular concern related to topography, hydrology, sensitive ecosystems and associated buffers. The overall goal of this exercise was to develop a working map on which developers, interested parties, construction managers etc. could allow for changes to the development plan during the initial phases of the project when sensitive components were identified during the biophysical assessment stage of the project. As a result, options have been explored in regards to the development footprint placement, road placement that provide for alternative layout/design structures that adapt to the need for habitat protection. From this map, it is mandatory that all future works within identified sensitive habitats be assessed by a professional biologist prior to permits being granted if works are not initiated after 6 months of the date of this report. Please refer to Appendix B for a detailed site constraints map identifying waterbodies, wildlife trees and rocky outcrop/woodlands.

3.6 SITE CONSTRAINTS

Due to the environmentally sensitive nature of this project, the following recommendations are to be followed if subdivision is to proceed in order to ensure minimal impacts to the environment.

3.6.1 Environmental Monitoring

Tree Cuts Within the Proposed Disturbed Area

- Minimize disturbances to vegetation outside of those areas needed to access soil deposit area, safely cut, haul, and transport timber.
- Where possible, fall trees away from sensitive habitats as determined by on-site biologist.

Soil Deposit/Removal Within the Proposed Disturbed Area

- Minimize soil deposit within areas classified as sensitive;
- Areas classified as sensitive (to be protected) outside of those areas required for the development footprint are to be protected during the construction phase of the project when construction activities are within 30m. The preferred method of protection is snow-fencing set back from the area requiring protection by at least 5m.
- Install "Tree Protection" signs.
- Take all measures necessary to prevent activities such as storage of materials or equipment, stockpiling of soil or excavated materials, burning, excavation or trenching or cutting of roots or branches within the tree protection areas.
- Restrict vehicle traffic to designated access routes and travel lanes to avoid soil compaction and vegetation disturbances.
- Avoid alterations to existing hydrological patterns to minimize impact on vegetation.

3.6.2 Sensitive Ecosystems

The sensitive ecosystems on site should be protected from mechanical damage during site clearing and construction. This protection can be achieved through:

- Limiting clearing to the minimum area required for construction.
- Installing "Sensitive Ecosystem Protection" signs and any additional working space. The minimum amount of vegetation possible will be removed from environmentally sensitive areas or areas where rare or endangered plants or plant communities are identified by the environmental monitor. These are for those areas outside of the proposed development footprint;
- Take all measures necessary to prevent activities such as storage of materials or equipment, stockpiling of soil or excavated materials, burning, excavation or trenching or cutting of roots or branches within the sensitive ecosystem protection areas.

The following guidelines, as outlined in the Sensitive Ecosystems Inventory Conservation Manual (MELP, 2000), should be followed after site development where possible:

- Control the introduction or spread of invasive species;
- Prevent wildlife disturbance (especially nesting or breeding areas);
- Locate developments where possible away from sensitive core areas;
- Establish a buffer zone between the core sensitive areas and the development area; and,
- Maintain hydrologic regime.

3.6.3 Roads

In order to reduce the overall impact associated with roads, alignment should follow the natural topography and be as narrow as possible in order to reduce the total impervious surface area. Where sensitive polygons must be crossed, bridges and/or box culverts (open bottom) should be placed to allow for safe passage of wildlife as determine by on-site QEP.

Proper signage and speed reduction should also be considered in areas where potential conflicts may exist at the wildland interface.

3.6.4 Stormwater

A detailed stormwater management plan for the development should be developed prior to the initiation of works and include the most recent Best Management Practices (BMP) in stormwater planning. Of particular importance will be the stormwater generated adjacent to the headwater wetlands. As a result, stormwater control including bioswales, detention ponds, etc. should be used to the fullest extent in order to reduce peak flows and runoff through the developable areas

3.6.5 Recreational Trail System

Trail systems through protected areas as well as areas deemed sensitive should incorporate best management practices for viable trail design. Design considerations should include proper trail surfacing, proximity to protected/sensitive areas, recommendations for dogs and other pets as well as proper signage identifying the sensitive attributes of select areas.

3.6.6 Habitat Compensation and Enhancement

In order to reduce the overall impacts associated with land use activities proposed for select areas within the study area, the following list of recommendations should be adhered to in order to reduce the overall impacts associated with the development. These include the following;

- Nest box program to be developed for the proposed development. Nest box programs calculate the potential loss of nesting cavities based on calculations derived from existing conditions within the total proposed disturbed areas. The cavities are then replaced with nesting boxes at select sites in consultation with the designated QEP;
- Reptile/wildlife monitoring program to be developed for the neighbourhood plan. The monitoring program assesses overall reptile/wildlife response to

disturbances associated with the proposed works as they progress. If required, recommendations identified by the QEP are forwarded to construction managers and municipal staff for review and implementation;

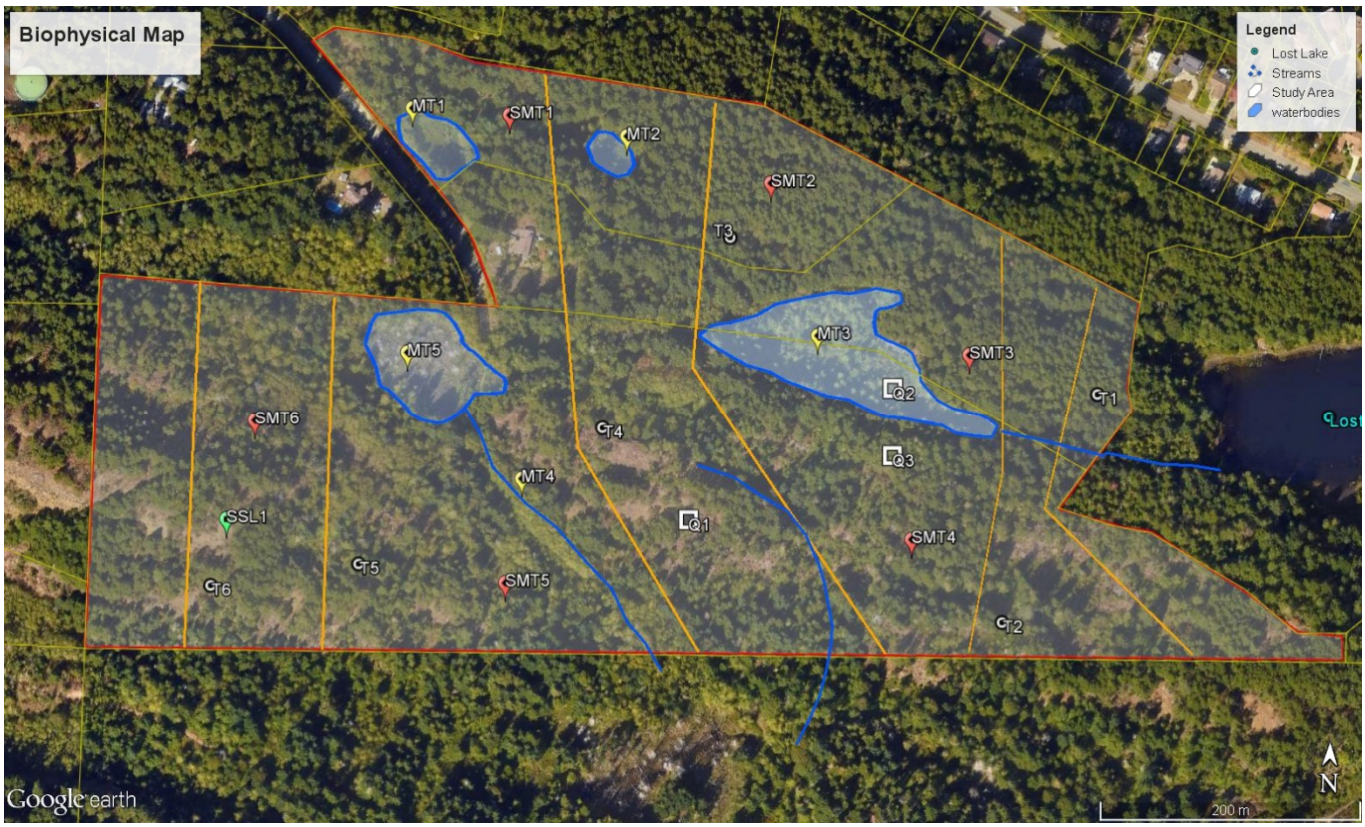
- Reptile basking/rearing platforms to be constructed at ratios equivalent to 1 platform for every 1 acre disturbed. Basking platforms consist of a 100 square metre area (1m in height as a minimum) made of various rock including boulders, cobble and other material that allow for various sized voids. All platforms must face south and have less than 20% canopy closure to allow for maximum solar heating;
- It is recommended that 50% of the sensitive areas identified in Appendix B be saved through conservation covenants. The area should be contiguous in nature and if possible, tie in both environmentally sensitive attribute including riparian and woodland ecosystems. The total areas to be preserved can include ecosystem restoration areas including those areas that are created from the ground up.

4.0 BIBLIOGRAPHY

No literary sources cited except for those web documents identified within the body of the report.

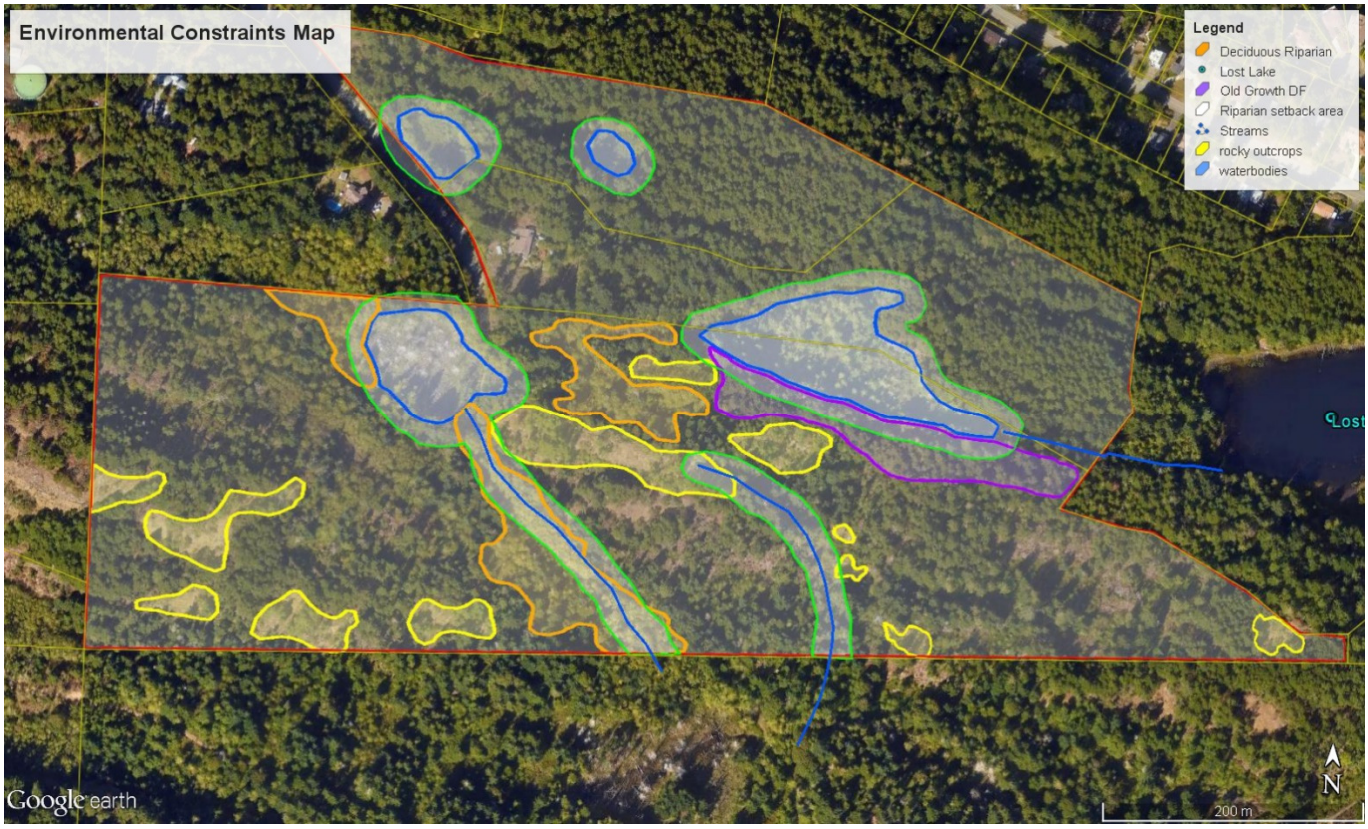
Cascadia Biological Services

Appendix A – Biophysical Map (also available as separate attachment)



Cascadia Biological Services

Appendix B – Environmental Opportunities Map (also available as separate attachment)



Note: Orange polygons represent riparian areas of significance including wildlife trees. Yellow polygons represent rocky outcrops. Green polygons represent 15m riparian setbacks. Blue polylines and polygons represent waterbodies

Appendix C, D and E – (Separate Attachments)

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Appendix F – Wildlife Transect Data (Separate Attachment)

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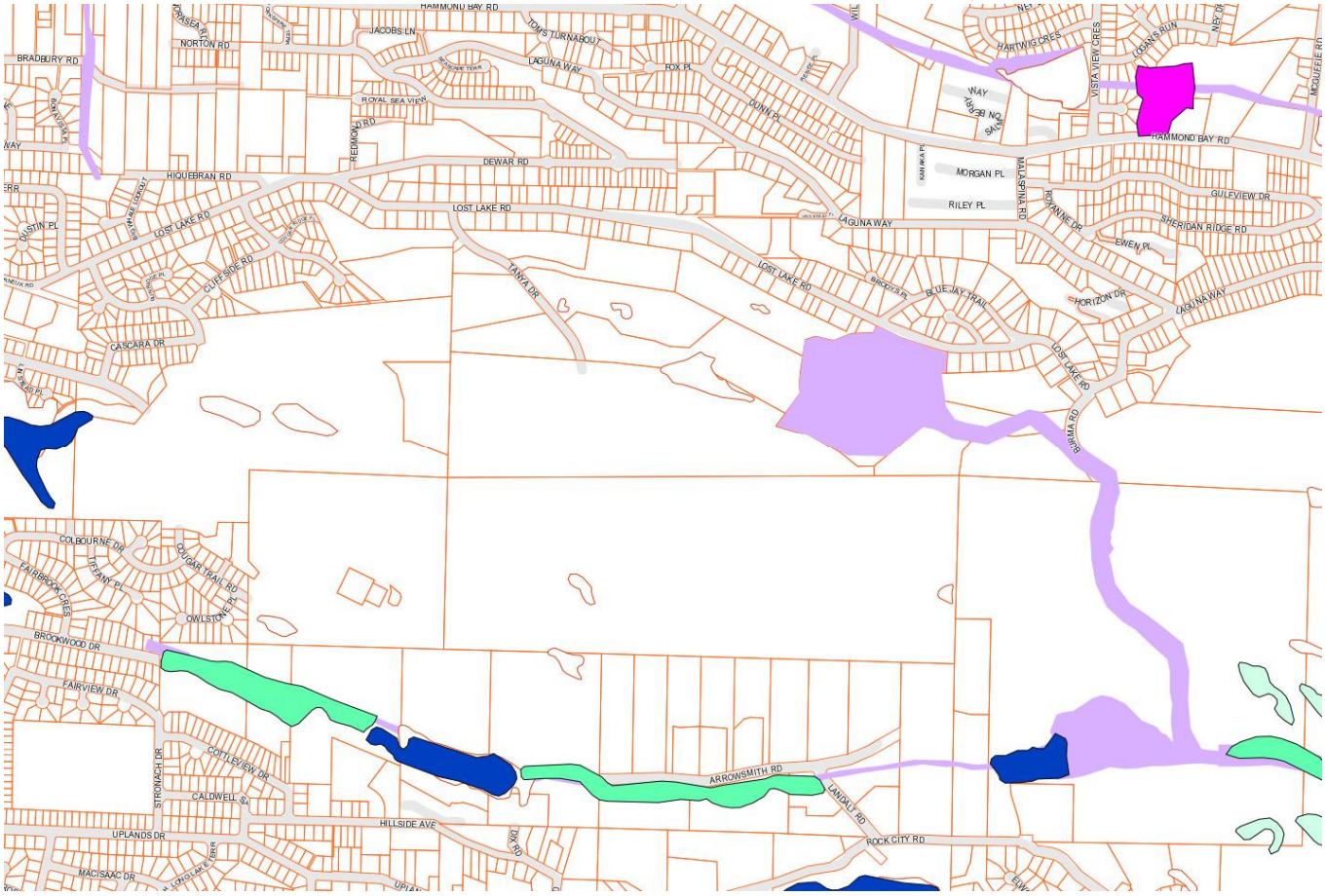
Appendix G – Rare Element Occurrence Map



Note: Closest polygon to the east in darker pink represents a lake and stream