Environmentally Sensitive Areas (ESAs) Mapping in the Cowichan Region – Phase II

(An update to the preceding data inventory and integration)

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Glossary of Key Terms and Acronyms

Biogeoclimatic system (BEC): Provincial ecosystem classification system used in forestry and natural sciences**.**

Ecological community: This term may refer to a specific terrestrial plant community, or to the full range of ecosystems that occur in a given landscape. Ecological communities may be as small as pocket Garry oak woodlands, or as large as an entire river and flood plain.

Endangered: Facing possible extinction.

Environmentally Sensitive Area (ESA): An area that contains sensitive or rare ecosystems, or other environmentally sensitive values. Often used as a synonym for Sensitive Ecosystems (see below).

Fragmentation: Barriers to animal and plant movement across the landscape; may be highways, populated areas, transmission lines, or natural areas such as large lakes.

Old Growth Management Area (OGMA): Areas of crown land set aside to meet old growth management targets. In the CVRD they occur in the forest lands south-west of Cowichan Lake.

Riparian areas: Rivers and streams, and associated river bank and streamside vegetation.

Sensitive Ecosystem (SE): an ecosystem in the landscape that is at-risk or ecologically fragile.

Sensitive Ecosystem Inventory (SEI): the standardized method by which sensitive ecosystems are mapped and described. The scale of mapping can be variable, ranging from 1:1 000 to 1:20 000. SEI mapping coverage in the CVRD is only available in some areas.

Terrestrial Ecosystems Information System (TEIS). Standardized data base template that is compatible with the provincial ecosystems data storage.

Terrestrial Ecosystem Mapping (TEM): TEM refers to the mapping of ecosystems in BC following a provincially approved methodology. A typical TEM project will map all ecosystems in a given area - of which sensitive ecosystems are a subset. TEM is usually done to a map scale of 1:15 000. TEM mapping coverage in the CVRD is incomplete.

Vegetation Resource Inventory (VRI): Forestry based inventory that has data on forest stands including tree age, species and height. VRI coverage in the CVRD is pending in some areas, and incomplete in others.

Disclaimer

The intention of this document is to ensure a transparent outline of the data used and the methods applied to create the CVRD ESA 2018 Inventory map product. Limitations include, but are not limited to:

- Reliability is limited by the accuracy and original purpose of the map product integrated into the ESA inventory layer (such as TEM, SEI, and VRI). The ESA map product and associated data relies on imperfect data.
- The majority of ESA features have not been field verified, and represent various levels of reliability. The level of confidence that we place on a given ESA polygon depends on a number of factors, including the original scale of mapping, original purpose of the map product, and imagery used for interpretation.
- The spatial product is largely based on a variety of scales that ranged from 1:1,000 (SEF mapping) to 1:20,000 scale TEM data. The detailed mapping completed for Phase II represents a 1:5,000 scale product.
- There is a limit to how precise you can be in ecosystem mapping. When interpreting imagery, it is limited by the pixel size, the image viewing scale, and the nature of what we are defining.

At this time, the ESA Inventory is best applied as a tool to inform management of this resource value (environmental sensitive areas) in the CVRD.

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1 Introduction

Environmentally Sensitive Areas (ESAs) are typically considered to be productive habitats important to biological diversity that are at risk of disappearing. Examples of ESAs found within the Cowichan Valley Regional District (CVRD) include streams, floodplains, wetlands, mature forest, and old forest. Many ESAs are considered to be sensitive ecosystems, defined as ecosystems at-risk or ecologically fragile such as Garry oak woodlands (RISC, 2006). With population growth and expanding land-use development, the pressure upon these ecosystems continues to increase. Progressive losses of ESAs could significantly impact the biological diversity of the area. To address this issue of concern, the CVRD is in the initial stages of developing a strategy for ESA management and conservation. As a first step in this process, the CVRD requires an inventory of existing ESA data and mapping for the region. By mapping and maintaining an inventory of ESAs, the CVRD can track changes in ESAs over time, and implement effective strategies for ESA conservation.

Phase I of this work was completed in April, 2018 (Madrone 2018), which involved the integration of existing map data. Ten map datasets that could be used to identify potential ESAs were integrated into a single dataset with standard RISC sensitive ecosystem classes. Some examples of input data were the 2004 East Vancouver Island Sensitive Ecosystems Inventory (SEI), 2008 CDFmm Terrestrial Ecosystem Mapping (TEM), and Vegetation Resources Inventory (VRI). Few of the input datasets provided full coverage of the CVRD. Since the initial data integration, the provincial VRI mapping has been updated and was recently released with nearly full coverage throughout the CVRD. Incorporating the updated VRI in Phase II serves to fill significant data gaps in the original ESA mapping.

As the various map data sources were produced with different objectives, at different times, scales, and using different imagery, the integration of this data does not represent a complete map of ESAs in the CVRD. This is why the resulting map product requires verification and editing by experienced ecosystem mappers to ensure the polygon boundaries are spatially accurate and the attributed sensitive ecosystem classifications are appropriate. Phase I of the project applied this detailed mapping process to a pilot area extending from the southeast corner of the CVRD up to and including the Koksilah River. Phase II applied the detailed mapping process to the eastern portion of the CVRD.

As requested by the CVRD, objectives of Phase II included:

i. Integrate the updated VRI mapping into the ESA layer;

ii. Complete the detailed mapping process within priority watershed areas (the eastern portion of the region); and,

iii. Provide documentation of the methods and a high level overview of the results.

1.1 Project Area

The CVRD project area is located between the Capitol Regional District (CRD), Alberni-Clayoquot Regional District (ACRD) and the Regional District of Nanaimo (RDN), on the south portion of Vancouver Island, British Columbia. It encompasses approximately 355,147 hectares of land extending from the east to west coast of Vancouver Island.

Within the Cowichan region there are 12 major watersheds and seven (7) coastal benchland units. The benchlands are coastal areas that do not contribute water flow to the major river systems. Examples of benchland units include the Malahat and Yellow Point Benchlands. The detailed mapping areas for Phase II include all of the east-draining watersheds in the CVRD, excluding the Nanaimo River and the upper portions of the Cowichan, Chemainus and Koksilah watersheds. Figure 1 provides an overview of the CVRD project area and the priority watershed areas.

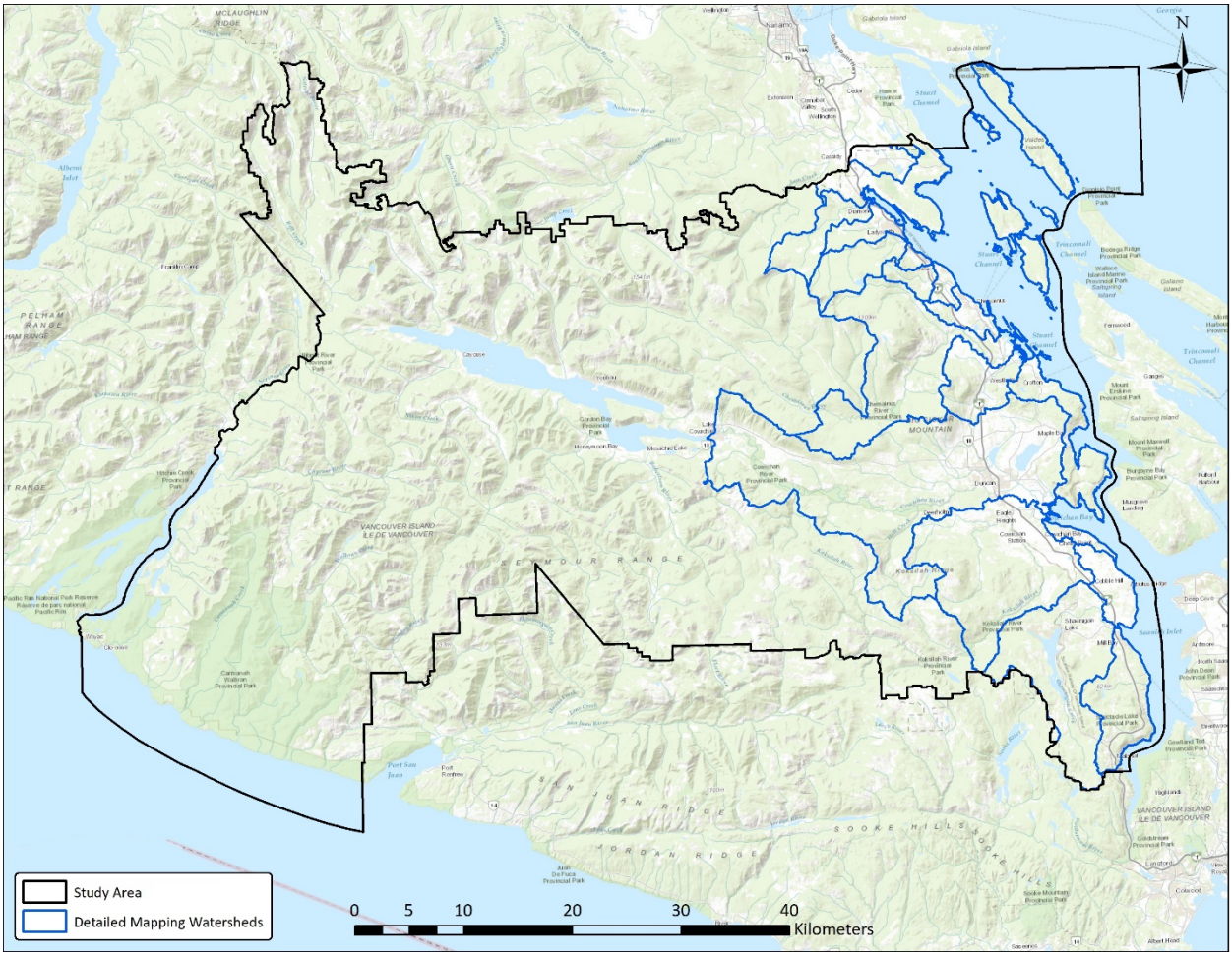

Figure 1. CVRD Study Area and Detailed Mapping Watersheds

2 Methodology

The mapping of sensitive ecosystems follows a standardized methodology established by the provincial government, set out in the *Standard for Mapping Ecosystems at Risk in British Columbia: An Approach to Mapping Ecosystems at Risk and Other Sensitive Ecosystems* (RISC, 2006). Madrone's methodology was consistent with this standard, with minor adaptations to fit the CVRD ESA context. Standard SEI mapcodes and class descriptions are provided in Appendix A, B and C.

2.1 Data Management

This mapping project was completed using ArcGIS 10.5. A file geodatabase (*.gdb) was created in ArcGIS to manage the ESA map data. ESAs were delineated in a polygon feature class and each polygon was attributed following the coding in RISC (2006).

The CVRD ESA database produced by Madrone is in Terrestrial Ecosystems Information System (TEIS) format for ease of quality control and to be consistent with provincial data storage standards (RISC, 2010). In addition to providing the resulting ESA data in TEIS Long Table format, we produced a more user-friendly short table version that only includes key attributes of interest for the typical use.

In order to meet the agreed to short timeline for product completion, a team of four terrestrial ecosystem mappers completed the detailed map verification and edits concurrently. Each mapper was assigned specific watersheds for assessment and mapping of ESA polygons. Four identical geodatabases were created and assigned to each mapper. The mappers entered their initials into a specified field upon completing edits or having verified attributes and linework. After the detailed mapping was completed, the assessed ESA polygons were combined into a single layer, along with the polygons that were outside the detailed mapping area.

2.2 Integration of Updated VRI

To integrate the updated VRI, we followed these general steps:

1. Clipped the updated VRI to the study area.
2. Queried the updated VRI data to select potential ESAs and created a new feature class from that selection.
3. Added SEI/ESA fields to the queried VRI attributes table.
4. Cross-walked the VRI attributes to SEI/ESA attributes (Table 1 shows the VRI attribute values that were potential equivalents to sensitive ecosystem classes, and how they were cross-walked or converted into that format).
5. Created a new feature class with an empty TEIS long table.
6. Loaded the cross-walked VRI data into the empty TEIS long table.

7. Deleted the polygons in the April 2018 ESA layer that originated solely from the outdated VRI data.
8. Completed a spatial overlay of the ESA layer and the updated VRI, such that all of the ESA linework and attributes were preserved, and adding new polygons only where the updated VRI covered new ground. This served to fill in data gaps with the updated VRI, but not overwriting existing ESA polygons where they overlapped with the VRI.
9. Deleted the resulting sliver polygons.

Table 1. VRI attributes queried as potential Sensitive Ecosystems and the cross-walked equivalent classes in SEI format

VRI Attributes		ESA Attributes			
Field Name	**Value**	**SECL_1**	**SECL_2**	**SDEC_1**	**SDEC_2**
PROJ_AGE_1	>=80 to <250	MF			
	>=250	OF			
PROJ_AGE_CLASS_CD_1	>=5 to <9	MF			
	9	OF			
PROJ_AGE_2	>=80 to <250		MF		
	>=250		OF		
PROJ_AGE_CLASS_CD_2	>=5 to <9		MF		
	9		OF		
BCLCS_LEVEL_3	W	WN			
BCLCS_LEVEL_5	BE	BE			
	BR	SV			
	RI	RI			
	RS	RI			
LINE_5_VEGETATION_COVER	ri	RI			
	RIV	RI			
NON_PRODUCTIVE_DESCRIPTOR_CD	S	WN			
NON_VEG_COVER_TYPE_1	RS	RI			
	BR	SV			
SPECIES_PCT_1	1 to 100			1 to 10*	
SPECIES_PCT_2	1 to 100				1 to 10*

** The SPECIES_PCT_# values were converted to decile format in the ESA attributes (SDEC_1 and SDEC_2). If the value of SPECIES_PCT_1 was null, 10 was applied to DEC_1.*

2.3 Detailed ESA Mapping (Verification and Editing at 1:5,000)

To verify the spatial accuracy and attributes resulting from the integration of existing ESA data[1], detailed mapping was completed in a priority pilot area of the CVRD. Orthophoto interpretation was applied to verify existing ESA data at a scale of 1:5,000. Attributes were revised where needed, and inaccuracies of ESA polygon delineation were addressed through linework edits. In effect, this process represented a "second pass" in the mapping process that built upon and improved the quality of the "first pass" of ESA data integration.

As an added benefit to this process, some ESAs that were not represented from the "first pass" were added during detailed mapping where they were observed by the mapper nearby the polygons being verified. However, the detailed mapping process did not exhaustively seek out new ESAs that weren't captured by the "first pass", as the primary focus was to verify and update the existing ESA data.

The detailed mapping process involved visually assessing and updating the ESA inventory data, to ensure its accuracy. Specifically, the mapper completed the following tasks:

Visual Assessment

- Visually assessed each ESA polygon in reference to 2014 orthophotos (most recent aerial imagery) and digital elevation models (where available), at a scale of 1:5,000.

Polygon Linework Updates

- Merged small adjacent polygons that originated from separate datasets, but represented the same ESA feature.
- Deleted small polygons where the adjacent polygon linework was more accurate in representing the same ESA feature.
    - Polygons were only deleted after their attributes were considered, as part of the attribute verification and update.
- Edited polygon lines manually to provide a spatially accurate representation of each ESA feature at the assessed scale (1:5,000).
- Sub-divided polygons where it was practical to separate out two or three ESA types, to produce pure ESA polygons.
- Sub-divided polygons where it was practical to separate out disturbances (i.e. subdivision development, deforestation, etc.) that were visible within the polygons.

Attribute Verification and Update

- Verified whether each polygon's sensitive ecosystem attributes appeared correct.
- Updated the attributes where a more accurate ESA classification could be applied.

[1] Madrone 2018

- Only the sensitive ecosystem attributes were edited – existing SEF, TEM and fields from input datasets were not altered, and remain in their original format within the spatial layer database provided for future reference.
    - The sensitive ecosystem attributes include Sensitive Ecosystem Class 1 through 3 (SECL_1, SECL_2 and SECL_3) and Sensitive Ecosystem Subclass 1 through 3 (SESUBCL_1, SESUBCL_2, SESUBCL_3).
    - Standard codes were used from the Standards for Mapping Ecosystems at Risk (RISC, 2006), which are provided in Appendix A.
- As noted above, polygons were subdivided to ideally represent only one ESA type (a "pure" polygon), such that only SECL_1 and SESUBCL_1 were populated. However, not all of the polygons could be separated into pure ESA types, particularly where two or three types were intermixed and splitting them out would result in very small polygons, or was not possible due to polygon complexity.
- Where disturbances were subdivided out of existing ESA polygons, the sensitive ecosystem class for disturbances was changed to 'NS' (Non-Sensitive).
- The sensitive ecosystem class was also changed to 'NS' (Non-Sensitive) where the forest stand age (structural stage) in the original mapping was incorrect (i.e. originally mapped as mature forest, but interpreted by the mapper as young forest).
- Pure non-sensitive polygons were deleted from the final ESA dataset.
- If there was any doubt about whether to change the attributes or not, we defaulted to the original attributes (as the original mapper may have had field data to inform their work).

Creation of New ESA Polygons

- Created new polygons where additional ESAs were identified nearby the existing polygons being assessed (i.e., typically within field of view of detailed review at 1:5,000 scale).
- Note that this was only done where unmapped ESAs were seen by the mapper while they were assessing and panning between the existing polygons – the imagery was not assessed exhaustively outside of the existing ESA polygons.

2.4 Quality Assurance

Quality assurance was undertaken at all steps of the process and included the following:

- An initial meeting was held to discuss the QA process during the mapping project.
- Discussion of the ideal mapping scale that would combine accurate landscape interpretation with productivity (1:5000 most of the time with occasional zooming in to 1:2000)

- Discussions regarding accurate imagery interpretation of certain ESA types, for example distinguishing between wetland marshes, fens, swamps, and bogs.
- Informal peer review of ESA attributes during the mapping process (ie discussion with other mappers for their opinion on issues regarding imagery interpretation).
- Discussion regarding linework such as accurate delineation of high, medium, and low bench floodplains along creeks and rivers.
- Distinguishing between sometimes visually similar ecosystem types (such as mature and old forest), or wetland fens and herb-dominated small forest openings in flat areas.
- What SEI attributes to apply in certain situations. For example, what labels to use in the mudflats and intertidal meadows in the Chemainus and Cowichan estuaries where conventional SEI labels may appear to be imprecise.

Database QA which involves a number of steps including:

- Verifying that all polygons have been assigned attributes and that all the appropriate fields in the data base have attributes.
- Insuring that a logical combination of classes and subclasses has been used: for example wetland_rock outcrop is likely an error.
- Insuring that accurate edge mapping between adjacent mapping areas has been carried out.
- Topological checks that insure a one-to-one relationship between map polygons and polygon numbers or object ID numbers in the data base. Small sliver polygons are identified at this point and can be deleted or merged with adjacent polygons.

3 Results: Inventory and Integration of Existing ESA Data

The April 2018 CVRD ESA Inventory (Phase I) integrated multiple map products within the CVRD landbase of approximately 348,723 hectares. Phase II integrated potential ESAs from the updated VRI and applied imagery interpretation to refine the mapping in priority watersheds. The total coverage of polygons assessed during Phase II is 35,058 hectares (7,200 polygons). Of the assessed area, 8,130 hectares (2,080 polygons) were determined to represent non-sensitive ecosystems or land use and were deleted from the final ESA layer. The final ESA map layer has a polygon coverage of 114,908 hectares (14,550 polygons) within the CVRD study area. Clipped to the detailed mapping area (priority watersheds), there are 6,268 polygons covering 30,109 hectares. General polygon counts and areas for each of the feature classes provided in the final geodatabase deliverable are summarized in Table 2.

Table 2. Overall Count and Coverage of Assessed and Final ESA Polygons

	Feature Class Name	Description	Area (ha)	# of Polygons
All Assessed Polygons	ESAs_and_NS	Total Polygon Coverage	123,058	16,630
		Total Assessed Area	38,763	8,402
		Total Assessed in December 2018	35,058	7,200
		Non-Sensitive Polygons (Removed from Final)	8,130	2,080
ESA Polygons in CVRD Study Area	ESAs_Final_Jan_11_2018	Total ESA Polygon Coverage	114,908	14,550
ESA Polygons in Priority Watersheds	ESAs_Final_Watersheds_Jan_11_2018	Total ESA Polygon Coverage (Clipped to Watersheds)	30,109	6,268

After completing Phase II, the area of mapped potential ESAs increased from 93,953 hectares to 113,628 hectares (32% of the landbase – excluding non-sensitive components of ESA polygons). Of the mapped ESAs, the types with the most representation are old forest (62,289 ha), mature forest (27,273 ha) and freshwater lakes and ponds (9,449 ha). Following those are riparian areas (5,158 ha), wetlands (3,307 ha), woodland (3,192 ha), sparsely vegetated (936 ha), and seasonally-flooded field (1,111 ha). Herbaceous and intertidal were the least represented classes at 610 and 304 hectares respectively.

In the east-draining watershed areas that were subject to orthophoto interpretation, a total of 29,333 hectares of potential ESAs were mapped (over 27% of the landbase). Of these, mature forest (16,493 ha) was by far the most represented ESA class. Following that were woodland (3,168 ha), riparian (3,021 ha), wetland (2,245 ha), freshwater (1,273 ha) and old forest (1,024 ha). The least represented classes were herbaceous (576 ha), intertidal (225 ha), and sparsely vegetated (196 ha). A breakdown of ESA coverage and representation is provided in Table 2.

ESA composition is shown in Figures 2 and 3. Composition is the proportion or percentage a particular ESA type accounts for the total area of mapped potential ESAs. For example, within the east-draining watersheds, the area covered by mature forest accounts for 56% of all mapped ESAs (16,493 ha out of 29,333 ha). Looking at the entire CVRD study area, old forest accounts for 55% of the mapped ESAs, and 24% of the potential ESAs are mapped as mature forest.

Table 3. ESA area breakdown by SEI Class for east-draining watersheds and all of the CVRD

	East-Draining Watersheds		All of CVRD	
ESA Type	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**
Seasonally-Flooded Field	1,109.4	1.05%	1,110.5	0.31%
Freshwater	1,272.8	1.20%	9,449.1	2.66%
Herbaceous	575.5	0.54%	609.8	0.17%
Intertidal	225.4	0.21%	304.1	0.09%
Mature Forest	16,493.1	15.55%	27,272.7	7.68%
Old Forest	1,023.6	0.96%	62,289.0	17.54%
Riparian	3,020.5	2.85%	5,158.1	1.45%
Sparsely Vegetated	195.8	0.18%	935.7	0.26%
Woodland	3,168.1	2.99%	3,192.2	0.90%
Wetland	2,248.6	2.12%	3,307.1	0.93%
TOTAL	**29,332.7**	**27.65%**	**113,628.2**	**31.99%**
Study Area (ha)	106,082.8		355,147.0	

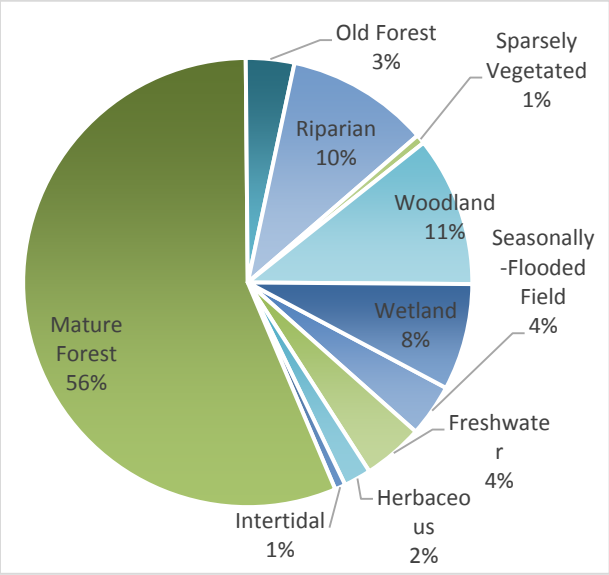

Figure 2. ESA Composition in the Detailed Mapping Study Area (East-Draining Watersheds)

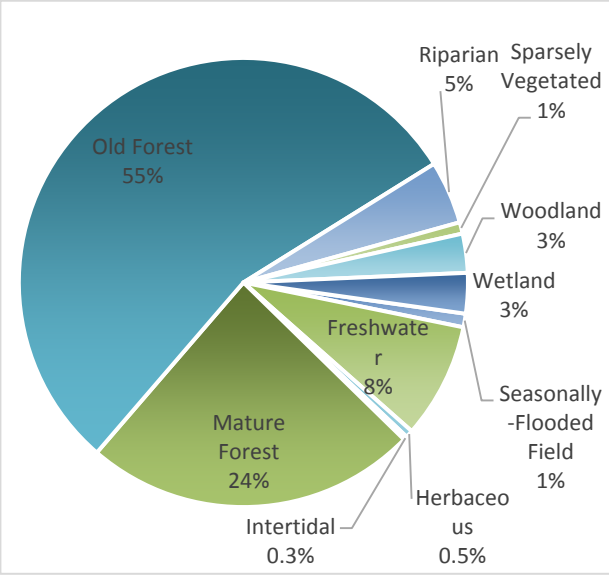

Figure 3. ESA Composition in the CVRD Study Area

A full breakdown of ESA areas, representation and composition by sensitive ecosystem class and subclass is provided in Appendix D.

Polygons covering a total of 38,763 hectares have been assessed and updated within the detailed mapping area. After removing non-sensitive areas and clipping the full ESA layer to the detailed mapping watersheds, 6,268 ESA polygons remain covering 30,109 hectares. Overall, the detailed mapping effort resulted in:

- simplified the polygon linework,
- improved linework accuracy (due to adjustments applied at a scale of 1:5,000),
- adjusted linework for recent disturbances (updated features and labels),
- reduced number of complex polygons (only the first decile component was populated wherever pure polygons could be made), and
- identified some previously unmapped ESAs.

4 Discussion

4.1 Reliability of the Mapping

The CVRD ESA 2018 Inventory is based on existing mapping available at this time. The resulting dataset does not represent an exhaustive region-wide inventory. Field verification is an important aspect of ecosystem mapping projects, and although much of the input data was supported with field verification at the time it was produced, up-to-date field work is warranted. We recommend that field verification is completed for priority areas to ensure the accuracy of the ESA map product where accuracy is deemed most important. Typically a subset of the mapped ESAs would be selected for field visitation based on the type of ESA, land tenure, access, status (disturbed or undisturbed) and distance from other ESAs.

Once on site, ecosystems would be described following (MOF, MOE, 1998), as well as Green and Klinka (1994). Wetlands would be described according to MacKenzie and Moran (2004), and plant names would follow Pojar and McKinnon (2005). In a typical ecosystem mapping project, field verification would aim to sample 15% of the map polygons. To put this into perspective, assuming an average size of 15 ha for a mapped ecosystem polygon, about 335 ESA polygons would be created in a mapped area of 5,000 ha. Therefore 50 ESA polygons would be field verified to achieve 15% polygon visitation. Verification of 15% of the polygons is associated with the lowest end of sampling required for survey intensity level (SIL) 4, which ranges between 15-25% (RISC, 1998). The following paragraph regarding survey intensity and scale is adapted from the TEM standards (RISC, 1998).

The survey intensity used in the preparation of an ecosystem map should be determined by project objectives and the proposed us of the map. If the map is to be used for making specific management decisions about portions of land (e.g., building footprints, sub-divisions, site preparation, conservation, etc.), then the map needs to be very reliable. Increased reliability is usually achieved through a higher survey intensity and selection of a finer map scale (e.g., 1:5,000 instead of the broader 1:20,000 scale). However, both of these factors increase the

cost of the mapping project. If the map is to be used only for general land planning, then a lower survey intensity is appropriate and mapping can be done at a broader scale.

A low survey intensity (e.g., 0-4% is the lowest level and is referred to in the standards as "R" for reconnaissance or preliminary mapping) does not necessarily mean that a map will be less reliable, although this is generally the case. Other factors influencing reliability are ecosystem complexity, relationship of ecological variation to readily identifiable aerial photo attributes, and surveyor knowledge and experience (RISC, 1998).

The detailed mapping of the pilot area used 0.5 m resolution 2014 imagery that was viewed at 1:5,000. For the majority of ESAs in the detailed map area, we can imply an accuracy of +/- 5 m to either side of the line that delineates the ESA features. However, the level of confidence will also depend on the type of ESA. For example, it is easier to see and therefore delineate a line along a pond or lake edge compared to the gradual change between a shrubby wetland and swamp. Part of the logic behind application of buffers to ESAs is to account for uncertainty in delineation of the features.

5 Closure

The CVRD ESA mapping was built upon by incorporating new data from the updated VRI, and in the priority eastern watershed areas the ESA polygons attributes and linework were assessed against 2014 imagery and edited through the detailed mapping process. The result is a representation of ESAs based on the existing input data and subsequent mapper verification. We recommend field verifying a subset of the mapped ESAs to refine and provide a high degree of confidence in the accuracy of the product.

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Appendix A: SEI Map Codes from the Standards for Mapping Ecosystems at Risk (2006)

Appendix D: SEI Map Codes, Map Units and Descriptions

Below is a table of approved Sensitive and Other Important Ecosystems map codes and descriptions. Units that are no longer mapped (historical use) are shown in *italics*. Projects named 'Central & North Okanagan' refers to the Central Okanagan, Bella Vista – Goose Lake Range, Lake Country, and Vernon Commonage SEIs. New classes, subclasses and their accompanying codes must be approved by the CDC ecologist.

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensiitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
AP	hb	SE	Alpine:herbaceous	Alpine ecosystems dominated by forbs or graminoid vegetation.	South Okanagan	Either
AP	kr	SE	Alpine:krummholz	Alpine ecosystems dominated by krummholz trees.	n/a	Either
AP	pf	SE	Alpine:parkland forest	Ecosystems at the transition between alpine and subalpine where trees occur in distinct clumps.	South Okanagan	Either
AP	sh	SE	Alpine:shrub	Alpine ecosystems dominated by dwarf shrubs.	South Okanagan	Either
AS		SE	Antelope-brush Steppe	Shrub ecosystems dominated by antelope-brush	South Okanagan	Interior
AS	as	SE	Antelope-brush Steppe	Shrub ecosystems dominated by antelope-brush in fair to good condition.	South Okanagan	Interior
AS	ds	SE	Antelope-brush Steppe: disturbed	Shrub ecosystems dominated by antelope-brush in poor condition	South Okanagan	Interior
BW		SE	Broadleaf Woodland	Ecosystems dominated by deciduous species at climax	Central Okanagan	Interior
BW	ac	SE	Broadleaf Woodland:aspen copse	Permanent aspen ecosystems in moist depressions in grasslands	Central Okanagan	Interior
BW	as	SE	Broadleaf Woodland:aspen seepage	Permanent aspen ecosystems on seepage slopes, usually in forested areas	Central Okanagan	Interior
CB		*SE*	*Coastal Bluff*	*Vegetated rocky islets and shorelines. Historical use only, now mapped as HB:cs or HB:vs.*	*Vancouver Island*	*Coastal*
CB	*cl*	*SE*	*Coastal Bluff:cliff*	*Vegetated coastal cliffs and bluffs. Historical use only, now mapped as CL:cc*	*Vancouver Island*	*Coastal*
CL		SE	Cliff	Steep slopes, often with exposed bedrock.	Sunshine Coast	Coastal
CL	cc	SE	Cliff:coastal	coastal cliffs	Sunshine Coast	Coastal
CL	ic	SE	Cliff:inland	inland cliffs	Sunshine Coast	Coastal

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
DG		*OIE*	*Disturbed Grasslands*	*Grasslands with 20-60% noxious weeds or invasive alien plants. This unit was used only in the Central and North Okanagan. Historical use only, now mapped as Gr:dg.*	*Central Okanagan*	*Interior*
FS		OIE	Seasonally Flooded Agricultural Fields	Annually flooded cultivated fields or hay fields	Sunshine Coast/ Vancouver Island/ South Okanagan	Either
FW		SE	Freshwater	Freshwater ecosystems include bodies of water such as lakes and ponds that usually lack floating vegetation	Islands Trust	Either
FW	la	SE	Freshwater: lake	Naturally occurring, static body of open water greater than 2 m deep and generally greater than 50 ha, with little to no floating vegetation.	Islands Trust	Either
FW	Pd	SE	Freshwater: pond	Small body of open water, greater than 2 m deep and generally less than 50 ha, with little to no floating vegetation.	Islands Trust	Either
GR		SE	Grasslands	Ecosystems dominated by bunchgrasses and shrubland ecosystems that occur in a grassland matrix	Central & North Okanagan / South Okanagan	Interior
GR	dg	SE	Grasslands:disturbed	Greater than 60% of plant cover is comprised of invasive alien species; **overrides all other grassland subclasses where it occurs**.	South Okanagan	Interior
GR	ge	SE	Grasslands:gentle slope	Mixed grass/forb grassland ecosystems on slopes <25%. Optional subclass for use where it helps meet project objectives.	South Okanagan	Interior
GR	gr	SE	Grasslands:grasslands	Ecosystems dominated by bunchgrasses; less than 10% tree cover	Central & North Okanagan/ South Okanagan	Interior
GR	sh	SE	Grasslands:shrublands	Moist ecosystems dominated by shrubs (usually rose and snowberry); occur in a grassland matrix	Central & North Okanagan	Interior
GR	ss	SE	Grasslands:steep slope, shallow soils	Mixed grass/forb grassland ecosystems on slopes >25%; shallow soils. Optional subclass for use where it helps meet project objectives.	South Okanagan	Interior
GR	st	SE	Grasslands:steep slope, deep soils	Mixed grass/forb grassland ecosystems on slopes >25%; deep soils. Optional subclass for use where it helps meet project objectives.	South Okanagan	Interior
HB		SE	Herbaceous	Non-forested ecosystems with less than 10% tree cover. Most have shallow soils and bedrock outcrops.	Sunshine Coast	Coastal
HB	cs	SE	Herbaceous:coastal	Influenced by proximity to the ocean: > 20% vegetation cover of grasses, herbs, mosses and lichens.	Sunshine Coast	Coastal

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
HB	du	SE	Herbaceous:dune	Ridge, hill or beach area created by windblown sand; variable vegetation cover	Sunshine Coast	Coastal
HB	hb	SE	Herbaceous:herbaceous	Inland sites dominated by herbaceous vegetation; shrubs account for less than 20% of the vegetation: >10% tree cover, generally shallow soils.	Sunshine Coast	Coastal
HB	sh	SE	Herbaceous:shrub	Shrubs account for more than 20% of the vegetation, with grasses and herbs.	Sunshine Coast	Coastal
HB	sp	SE	Herbaceous:spit	Sand and gravel deposits with low to moderate cover of salt-tolerant grasses and herbs	Sunshine Coast	Coastal
HB	vs	SE	Herbaceous:vegetated shoreline	Low-lying rocky shorelines with less than 20% vegetation	Sunshine Coast	Coastal
HT		*SE*	*Terrestrial Herbaceous*	*Sites with continuous herbaceous dominated vegetation cover. Historical unit, now mapped as HB:hb.*	*Vancouver Island*	*Coastal*
HT	*ro*	*SE*	*Terrestrial Herbaceous:rock outcrop*	*Sites with rock outcrops. Historical unit, now mapped as Sv:ro*	*Vancouver Island*	*Coastal*
HT	*sh*	*SE*	*Terrestrial Herbaceous:shrub*	*Sites with more than 20% shrub cover. Historical unit, now mapped as HB:sh*	*Vancouver Island*	*Coastal*
IT		SE	Intertidal	Mudflats, beaches and rocky shorelines that link the marine and terrestrial environments	Islands Trust	Coastal
MF		OIE	Mature Forest	Large patches of conifer-dominated forest where stand structure includes vertical heterogeneity and the average tree age is generally 80 years or more (Sunshine Coast). Forests dominated by mature trees (Okanagan).	Sunshine Coast/ Central & North Okanagan/ South Okanagan	Either
MF	bd	OIE	Mature Forest:broadleaf	Dominated by broadleaf trees (>75%)	Central & North Okanagan / South Okanagan	Interior
MF	co	OIE	Mature Forest:coniferous	Dominated by coniferous trees (>75%)	Central & North Okanagan	Interior
MF	mx	OIE	Mature Forest:mixed	Dominated by a mixture of coniferous and broadleaf trees (<75% coniferous and > 25% broadleaf)	Central & North Okanagan	Interior
NS		NS	Non-Sensitive	Used when displaying non-sensitive ecosystems themed from TEM/PEM		

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
OF		SE	Old forest	Patches of conifer-dominated forest with complex vertical structure, where the average tree age is generally 250 years or more (Sunshine Coast). *Historically defined as forests older than 100 years for Vancouver Island.*	Sunshine Coast/ Vancouver Island	Coastal
OF	bd	SE	Old forest: broadleaf	Forests dominated by large old broadleaf trees.	n/a	Either
OF	co	SE	Old forest:coniferous	Forests dominated by large old coniferous trees (Central Okanagan); coniferous forests that appear to be older than 140 years (South Okanagan). Conifer-dominated (>75%) forests generally >250 years (Sunshine Coast)	Central & North Okanagan/ South Okanagan/ Sunshine COast/ Vancouver Island	Either
OF	mx	SE	Old forest:mixed	Forests dominated with a mixture of coniferous and broadleaf trees (<75% coniferous and > 25% broadleaf).	Central & North Okanagan/ Vancouver Island	Either
RI		SE	Riparian	Ecosystems associated with and influenced by water. Includes areas along creeks, streams, gullies, canyons and larger floodplains. Includes fringes along ponds, lakeshores, and some sites with significant seepage.	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either
RI	ff	SE	Riparian:fringe	Fringe ecosystems associated with streams, pond or lake shorelines or sites with significant seepage but no floodplain.	Sunshine Coast/ Central & North Okanagan/ South Okanagan	Either
RI	fh	SE	Riparian:high bench	High bench floodplain terraces (only periodically and briefly inundated by high waters but lengthy subsurface flow in the rooting zone.	Sunshine Coast	Coastal
RI	fl	SE	Riparian:low bench	Low bench floodplain terraces (flooded at least every other year)	Sunshine Coast	Coastal
RI	fm	SE	Riparian:medium bench	Medium bench floodplain terraces (flooded every 1-5 years for short periods).	Sunshine Coast	Coastal
RI	fp	SE	Riparian:bench or Riparian:forested floodplain	Benches along creeks and rivers (high, medium, or low benches in the Central Okanagan); forested floodplain (South Okanagan)	Central & North Okanagan/ South Okanagan	Interior
RI	*g*	*SE*	*Riparain:gully*	*Gullies. Historical unit, now mapped as RI:gu*	*Vancovuer Island*	*Coastal*

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
RI	gu	SE	Riparian:gully	Watercourse is in a steep V-shaped gully (Sunshine Coast); gullies with intermittent or permanent creeks (Central Okanagan/ South Okanagan)	Sunshine Coast/ Central & North Okanagan/ South Okanagan	Either
RI	ri	SE	Riparian:river	Large river watercourses including gravel bars	Central & North Okanagan/ South Okanagan	Either
RI	sh	SE	Riparian:shrub floodplain	Shrub dominated floodplain or lakeshore.	South Okanagan	Interior
SG	*co*	*OIE*	*Older Second Growth Forest: coniferous*	*Conifer forests 60-100 years old with <15% deciduous. Historical unit, now mapped as MF:co.*	*Vancovuer Island*	*Coastal*
SG	*mx*	*OIE*	*Older Second Growth Forest: mixed*	*Older forests 60-100 years old with >15% deciduous. Historical unit, now mapped as MF:mx.*	*Vancovuer Island*	*Coastal*
SS			Sagebrush steppe	Optional class where sagebrush dominated ecosystems are separated from grasslands	South Okanagan	Interior
SS	ds	SE	Sagebrush steppe: disturbed	Shrub steppe ecosystems where greater than 60% of plant cover is comprised of invasive alien species; **overrides all other shrub steppe subclasses where it occurs**.	South Okanagan	Interior
SS	ss	SE	Sagbrush steppe:sagebrush steppe	Typical sagebrush steppe ecosystems. Optional subclass for use where it helps meet project objectives.	South Okanagan	Interior
SS	ss	SE	Sagebrush steppe	Shrub steppe ecosystems on slopes <25% in fair to good condition. Variable soil depth.	South Okanagan	Interior
SS	st	SE	Grasslands:steep slope, deep soils	Shrub steppe ecosystems on slopes >25%; deep soils. Optional subclass for use where it helps meet project objectives.	South Okanagan	Interior
SV		SE	Sparsely Vegetated	Areas with 5-10% cover of vascular vegetation	Central & North Okanagan/ South Okanagan/ Vancouver Island	Interior
SV	cl	SE	Sparsely Vegetated:cliff	Steep rock slopes, often near vertical, with exposed bedrock; may have <5% vegetation cover	Central & North Okanagan/ South Okanagan/ Vancouver Island	Interior
SV	gr	SE	Sparsely Vegetated:shallow soil	Sparse grassland vegetation on very shallow soils (<20cm deep)	Naramata	Interior

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
SV	ro	SE	Sparsely Vegetated:rock outcrop	Rock outcrops not dominated by shrubs (was HB:ro)	Central & North Okanagan	Interior
SV	*sd*	*SE*	*Sparsely Vegetated:coastal sand dunes*	*Sand dunes. Historical unit, now mapped as HB:du.*	*Vancouver Island*	*Coastal*
SV	sh	SE	Sparsely Vegetated:shrub	Shrub dominated rock outcrop areas	Central & North Okanagan/ South Okanagan	Interior
SV	*sp*	*SE*	*Sparsely Vegetated: sand spits*	*Coastal gravels and sand spits. Historical unit, now mapped as HB:sp.*	*Vancouver Island*	*Coastal*
SV	ta	SE	Sparsely Vegetated:talus	Areas dominated by rubbly blocks of rock (talus)	Central & North Okanagan/ South Okanagan	Interior
WD		SE	Woodland	Dry, open stands generally with between 10 and 25% tree cover (Sunshine Coast). Open stands of Douglas-fir or ponderosa pine, often on shallow soils, 10-20% canopy cover in unaltered state (Central & North Okanagan). *Historically defined as less than 50% canopy cover for Vancouver Island*.	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either
WD	*bd*	*SE*	*Woodland:broadleaf*	*Broadleaft (Garry oak and trembling aspen) dominated woodland stands. Historical unit, now mapped as BW*	*Vancouver Island*	*Coastal*
WD	co	SE	Woodland:coniferous	Conifer dominated woodland stands including open stands on shallow soils, steep warm aspects or high elevations where climate restricts tree productivity.	Sunshine Coast/ Central & North Okanagan/ South Okanagan	Either
WD	mx	SE	Woodland:mixed	Mixed conifer and broadleaf stands. Greater than 25% coniferous and >25% broadleaf trees.	Sunshine Coast	Coastal
WN		SE	Wetland	Areas characterized by daily, seasonal or year-round water at or above the surface.	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either
WN	bg	SE	Wetland:bog	Bog. Nutrient-poor peat wetlands on organic (sphagnum) soils; water source from precipitation.	Sunshine Coast / Vancouver Island	Either
WN	fn	SE	Wetland:fen	Fen. Groundwater-fed peat (sedge) wetlands; primary water source is groundwater or runoff.	Sunshine Coast/ South Okanagan/ Vancouver Island	Either

Class Code	Subclass Code	Sensitive Ecosystem (SE) / Other Important Ecosystem (OIE) / Non-Sensitive (NS)	Class:subclass name	Description	Project	Coastal / Interior / Either
WN	ms	SE	Wetland:marsh	Marsh. Graminoid or forb-dominated freshwater, estuarine or saline nutrient-rich wetlands that are permanently or seasonally inundated.	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either
WN	sc	SE	Wetland:shrub carr	Shrub carr. Shrub-dominated ecosystems with moist soils on frost-prone depressions.	n/a	Interior
WN	sp	SE	Wetland:swamp	Swamp. Shrub or tree-dominated wetlands with temporary shallow flooding and significant above or below ground water flow	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either
WN	sw	SE	Wetland:shallow water	Shallow water. Permanently flooded, less than 2m deep mid-summer and less than 10% cover of emergent vegetation.	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either
WN	wm	SE	Wetland:wet meadow	Wet meadow. Briefly inundated, graminoid-dominated meadows.	Sunshine Coast/ Central & North Okanagan/ South Okanagan/ Vancouver Island	Either

Appendix B: Commonly Used Environmentally Sensitive Areas (ESAs) / Sensitive Ecosystem Mapcodes for the CVRD ESA Inventory

SEI Class	SEI Subclass	Brief Description	Allowed Structural Stages
WN: Wetland		**Terrestrial – freshwater transitional areas.**	
WN	bg: bog	Nutrient-poor wetlands on peat-moss organic soils	2b, 3a, 3b, 4, and 5
WN	fn: fen	Groundwater-fed sedge-peat wetlands	2b, and 3a
WN	ms: marsh	Graminoid or forb-dominated nutrient-rich wetlands	2b
WN	sp: swamp	Shrub or tree-dominated wetlands	2b, 3a, 3b, 4 and 5
WN	sw: shallow water	Permanently flooded, water less than 2m deep at mid-summer.	2c
FW: Lakes and Ponds			
FW	pd: pond	Open water > 2 m deep and generally < 8 ha	Not applicable
FW	la: lake	Open water generally > 8 ha	Not applicable
IT: Intertidal & shallow sub-tidal		**Ecosystems at marine and terrestrial interface**	Not applicable
OF: Old Forest		**Forests > 250 yrs**	
OF	co: coniferous	Conifer > 75% of stand	7
MF: Mature Forest		**Forests > 80 yrs, < 250 yrs, ≥ 5 ha**	
MF	co: coniferous	Conifer-dominated (> 75% of stand composition)	6
MF	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf	6
MF	bd: broadleaf	Stand composition >75% broadleaf	6
WD: Woodland		**Dry site, open stands with <50% tree cover**	
WD	co: coniferous	Conifer > 75% of stand	5, 6, and 7
WD	bd: broadleaf	Broadleaf > 75% of stand	5 and 6
HB: Herbaceous		**Non-forested ecosystems; usually shallow soils, often with bedrock outcrops.**	
HB	cs: coastal herbaceous	Influenced by proximity to the ocean: > 20% vegetation cover of grasses, herbs, mosses and lichens	1b, and 2b
HB	sh: shrub	Shrubs > 20% cover, with grasses and herbs.	3a and 3b
SV: Sparsely Vegetated		**Areas with 5 – 10% vascular vegetation (may be greater in patches); often with mosses, liverwort and lichen cover**	
SV	cl: cliff	Steep slopes, often with exposed bedrock.	1a, and 1b
SV	ro: rock outcrop	Rock outcrops – areas of bedrock exposure, variable vegetation cover.	1a, 1b, 2b, and 3a

SEI Class	SEI Subclass	Brief Description	Allowed Structural Stages
RI: Riparian		**Ecosystems associated with and influenced by freshwater**	
RI	fh: high bench	High bench floodplain terraces	5, 6 and 7
RI	fm: medium bench	Medium bench floodplain terraces	4, 5, and 6
RI	fl: low bench	Low bench floodplain terraces	2b, 3a, and 3b
RI	ri: river	Large river watercourses including gravel bars	Not applicable

* Structural stages were not assigned to the CVRD ESA Inventory features, but were maintained in the dataset when provided in the original map product.

Appendix C: ESA/SEI Class and Subclass Descriptions for the CVRD ESA Inventory

Riparian (RI)

Ecosystems associated with and influenced by freshwater, generally along rivers, streams, and creeks, but for SEI, also includes fringes around lakes. Ecosystems are influenced by factors such as erosion, sedimentation, flooding and/or subterranean irrigation due to proximity to the water body. This Class includes all vegetation developmental stages, i.e., structural stages 1 through 7, but only in a natural or semi-natural state.

Subclasses:

fl – low bench floodplain: flooded at least every other year for moderate periods of growing season; plant species adapted to extended flooding and abrasion, low or tall shrubs most common (up to structural stage 3b, as anything more developed than that indicates less frequent flooding).

fm – medium bench floodplain: flooded most years for short periods (10-25 days); deciduous or mixed forest dominated by species tolerant of flooding and periodic sedimentation (structural stage varies depending on level of disturbance).

fh – high bench floodplain: only periodically and briefly inundated by high waters, but lengthy subsurface flow in the rooting zone; typically conifer-dominated floodplains of larger coastal rivers (typically older structural stages reflective of reduced flooding frequency; structural stage 3-7 depending on level of disturbance).

ri – river: river and associated gravel bars, if wide enough to be mapped.

Wetland (WN)

Wetland ecosystems are found where soils are saturated by water for enough time that the excess water and resulting low oxygen levels influence the vegetation and soil. The water influence is generally seasonal or year-round and occurs either at or above the soil surface or within the root zone of plants. Wetlands are usually found in areas of flat or undulating terrain. They encompass a range of plant communities that includes western redcedar/skunk cabbage swamps, cattail marshes, and peat-moss dominated bogs. Estuarine vegetation is in a separate Class for this SEI to emphasize the different flooding frequency (mostly diurnal) and water chemistry (brackish). Therefore, the wetland class is for freshwater wetlands.

Subclasses:

bg – bog: acidic, nutrient-poor wetlands that characteristically support peat-mosses and ericaceous shrubs such as Labrador tea and bog-rosemary. Being generally isolated from mineral rich groundwater or surface water, their primary source of water and nutrients is from rainfall.

fn – fen: underlain by sedge or brown moss peat, fens are closely related to bogs. In addition to rainfall, fens receive mineral and nutrient-enriched water from upslope drainage or groundwater. Thus a broader range of plants, including shrubs and small trees, is able to grow.

ms – marsh: characterized by permanent or seasonal flooding by nutrient-rich waters. May include some areas of diurnal flooding of fresh water above the normal high high-tide, due to high river water levels. Examples include freshwater marshes that are dominated by rushes, sedges or grasses.
sp – swamp: wooded wetlands dominated by 25% or more cover of flood-tolerant trees or shrubs. Characterized by periodic flooding and nearly permanent sub-surface waterflow through mixtures of mineral and organic materials, swamps are high in nutrient, mineral and oxygen content.
sw – shallow water: wetlands characterized by water less than 2 m in depth in mid-summer; transition between deep water bodies and other wetland ecosystems (i.e. bogs, swamps, fens, etc.); often with vegetation rooted below the water surface.

Freshwater (FW)

Freshwater ecosystems include bodies of water such as lakes and ponds that usually lack floating vegetation.

Subclasses:
la - lake
pd - pond: naturally occurring, small body of open water, greater than 2 m deep and generally less than 8 ha, with little to no floating vegetation; shallower water than a lake.

Old Forest (OF)

Generally conifer-dominated forest with complex vertical structure, where the canopy tree ages are mostly 250 years old or older, but may include older mixed coniferous stands. Old broadleaf stands are unlikely to occur in the CVRD.

Subclasses:
co – conifer-dominated forest stands (>75% conifer composition) where canopy tree ages mostly 250 – 400 years old.

Mature Forest (MF)

Forests generally >80 yrs old and < 250 yrs old. Mature forests are not as structurally complex as old forests, but can function as essential habitat areas for many wildlife species and as primary connections between ecosystems in a highly fragmented landscape.

Subclasses:
co – conifer dominated (> 75% coniferous species).
mx – mixed conifer and deciduous (<75% coniferous and < 75% broadleaf composition).

Woodland (WD)

Woodlands are open forests, generally less than 50% tree cover, as a result of site conditions, i.e., they are ecological woodlands. They are found on dry sites, mostly on south facing slopes of rocky knolls and bedrock-dominated areas. The stands can be conifer dominated or mixed conifer and arbutus (or deciduous hardwoods, e.g., Garry oak) stands and because of the open canopy, will often include non-forested openings, generally on shallow soils and bedrock outcroppings.

Subclasses:

co – conifer dominated ecological woodlands (greater than 75% coniferous composition).
bd – broadleaf dominated ecological woodlands (greater than 75% broadleaf composition).

Herbaceous (HB)

This class comprises non-forested ecosystems (i.e., less than 10% tree cover), generally associated with shallow soils, often with bedrock outcroppings, coarse-textured soils, or natural disturbances (wind or wave action); includes a variety of natural ecosystems such as large, bedrock-controlled openings within forested areas, coastal headlands, shorelines vegetated with grasses and herbs, sometimes low shrubs, and moss and lichen communities on rock outcrops.

Subclasses:
cs – coastal herbaceous: criteria as for 'hb' but influenced by proximity to ocean; windswept shoreline and slopes; > 20% vegetation of grasses, herbs, mosses and lichens.
sh – shrub component: > 20 % of total vegetation cover is shrub cover, with grasses and herbs.

Sparsely Vegetated (SV)

Areas of low vascular vegetation cover, generally 5 – 10 percent, but may be greater in some patches; may have high cover of mosses, liverworts and lichens.

Subclasses:
cl – cliff: steep to very steep slopes, often with exposed bedrock; may include steep-sided sand bluffs**.**
ro – rock outcrop: exposed bedrock, usually at the top of knolls or on portions of steeper slopes.

Intertidal & Shallow sub-tidal (IT)

Mudflats, beaches and rocky shorelines influenced by diurnal tidal cycles with little to no freshwater input (primarily through rainfall runoff). The intertidal ecosystems link the marine and terrestrial environments.

Other Important Ecosystems

Other Important Ecosystems are mapped to identify important elements of biodiversity or recruitment sites for ecosystems at risk or important wildlife habitat requiring recovery or restoration.

Mature Forest (MF)

Forests generally >80 yrs old and < 250 yrs old. These mature forests are not as valuable as old forests as far as representing the at-risk ecosystems, but can be important habitat areas for many wildlife species, and serve as primary connections between ecosystems in a highly fragmented landscape. They also represent recruitment for old forest where that feature is limited or lost (this is especially common within the CDF biogeoclimatic zone).

Subclasses:
co – conifer dominated (> 75% coniferous species).
mx – mixed conifer and deciduous (<75% coniferous and < 75% broadleaf composition).
bd – broadleaf dominated (greater than 75% broadleaf composition)

Appendix D: Full Breakdown of ESA Area, Representation and Composition by Sensitive Ecosystem Class and Subclass

		Mapped ESAs in Priority Watersheds (Detailed Mapping Area)			Area of Mapped ESAs Region-Wide (All of CVRD)		
ESA Mapcode (Sensitive Ecosystem Class and Subclass)	Description	Area (ha)	Representation (% of Study Area)	Composition (% of Mapped ESAs)	Area (ha)	Representation (% of Study Area)	Composition (% of Mapped ESAs)
CL:cc	Coastal Cliff	0.8	0%	0%	0.8	0%	0%
FS	Seasonally-Flooded Field	1,109.4	1%	4%	1,110.5	0%	1%
FW:la	Freshwater Lake	1,129.1	1%	4%	9,229.1	3%	8%
FW:pd	Freshwater Pond	143.7	0%	0%	220.0	0%	0%
HB:cs	Herbaceous - coastal	106.7	0%	0%	113.6	0%	0%
HB:du	Herbaceous - dune	7.3	0%	0%	12.0	0%	0%
HB:hb	Herbaceous - herbaceous	325.1	0%	1%	325.4	0%	0%
HB:sh	Herbaceous - shrub	136.4	0%	0%	158.8	0%	0%
IT	Intertidal	136.2	0%	0%	203.2	0%	0%
IT:ms	Intertidal Marsh	89.2	0%	0%	100.9	0%	0%
MF	Mature Forest	0.1	0%	0%	10,064.5	3%	9%
MF:bd	Mature Forest - broadleaf	347.8	0%	1%	347.9	0%	0%
MF:co	Mature Forest - coniferous	9,475.2	9%	32%	10,140.1	3%	9%
MF:mx	Mature Forest - mixed	6,669.9	6%	23%	6,720.3	2%	6%
OF	Old Forest - undifferentiated	N/A	N/A	N/A	28,436.7	8%	25%
OF:co	Old Forest - coniferous	988.1	1%	3%	33,816.8	10%	30%
OF:mx	Old Forest - mixed	35.5	0%	0%	35.5	0%	0%
RI	Riparian - undifferentiated	N/A	N/A	N/A	1,150.0	0%	1%
RI:ff	Riparian - fringe	1,019.0	1%	3%	1,022.8	0%	1%
RI:fh	Riparian - high bench	377.8	0%	1%	965.5	0%	1%
RI:fl	Riparian - low bench	96.8	0%	0%	124.8	0%	0%
RI:fm	Riparian - medium bench	644.6	1%	2%	840.5	0%	1%
RI:gu	Riparian - gully	458.7	0%	2%	459.7	0%	0%
RI:ri	Riparian - river	423.6	0%	1%	594.9	0%	1%
SV:cl	Sparsely Vegetated - cliff	10.9	0%	0%	10.9	0%	0%
SV:ro	Sparsely Vegetated - rock outcrop	164.1	0%	1%	896.0	0%	1%
SV:ta	Sparsely Vegetated - talus	20.1	0%	0%	28.0	0%	0%
WD:bd	Woodland - broadleaf	172.2	0%	1%	172.4	0%	0%
WD:co	Woodland - coniferous	353.9	0%	1%	371.1	0%	0%
WD:mx	Woodland - mixed	2,641.9	2%	9%	2,648.7	1%	2%
WN	Wetland - undifferentiated	N/A	N/A	N/A	359.0	0%	0%
WN:bg	Wetland - bog	87.8	0%	0%	106.8	0%	0%
WN:fn	Wetland - fen	173.7	0%	1%	177.0	0%	0%
WN:ms	Wetland - marsh	250.0	0%	1%	255.6	0%	0%
WN:sp	Wetland - swamp	1,637.0	2%	6%	2,284.6	1%	2%
WN:sw	Wetland - shallow water	93.9	0%	0%	110.7	0%	0%
WN:wm	Wetland - wet meadow	6.3	0%	0%	13.4	0%	0%
	TOTAL Mapped ESAs (ha)	**29,332.7**			**113,628.2**		
	Study Area (ha)	**106,082.8**			**355,147.0**		
NS	Non-Sensitive	775.9			1,025.0		