Ecological Reconnaissance of

BCTS Blocks A93884 and A91376 near Roberts Creek and Gibsons, B.C.

for Elphinstone Logging Focus (ELF)

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Background

- Elphinstone Logging Focus (ELF) requested my expertise in assessing the occurrence of red- and blue-listed forested plant communities within proposed logging blocks on the slopes of Mt. Elphinstone near the communities of Roberts Creek and Gibsons, B.C. ELF has expressed concerns in the past about red-and blue-listed ecosystems not being properly represented/conserved on the Sunshine Coast. This led to a Forest Practices Board (FPB) investigation beginning in 2016 with a final report in 2018 (Forest Practices Board 2018). I was retained by the FPB as the investigating ecologist for that investigation of block A87125 which has now been harvested. Background information on the Mt. Elphinstone study area and methods used in this current assessment are drawn from my earlier FPB field assessment report (Banner 2016).

- The FPB report resulting from the 2016 investigation (Forest Practices Board 2018) had 3 recommendations with a response deadline of June 30th, 2018: 1) Government should provide legal objectives or guidance for managing the amount and distribution of these plant communities in the TSA; 2) Government should update the list of plant communities in the Identified Wildlife Strategy; and 3) BCTS should revise its protocol to include consideration of younger occurrences of plant communities.

- In the mean time, additional logging blocks are being prepared for harvest on BCTS's 5-year operating plan and ELF is specifically concerned about two blocks scheduled for harvest in 2018 on the slopes of Mt. Elphinstone (Figure 1 and 2). Block A93884 (previously A87126), approximately 53 ha in area (including eight subunits), occurs off the Roberts Flume FSR between East Wilson Creek and Clack Cr., north of the community of Roberts Creek. Block A91376, approximately 29 ha in area, occurs off Reed Road, north, and adjacent to, the community of Gibsons.

- ELF has similar concerns that these two blocks may contain significant areas of red- and blue-listed plant communities as designated by the B.C. Conservation data Centre. They feel that the conservation of these rare/threatened forest types on the slopes of Mt. Elphinstone within the Chapman Landscape Unit remains inadequate.

- Block A93884 (Clack Cr. Block) occurs within the 2137 ha expansion proposal for Elphinstone Provincial Park (McCrory 2015)[1]. This park proposal is included within the Roberts Creek Official Community Plan (Bylaw No. 641, 2011; Map 2 Parks and Trails) of the Sunshine Coast Regional District (SCRD) (http://www.scrd.ca/files/File/Community/Planning/RC%20OCP%20review/Map2_AreaD_ParksTrails.pdf).

- Block A91376 (Reed Road Block) occurs within District Lot DL1313 which is designated as "Park" on the Elphinstone Official Community Plan (Bylaw No. 600; Map3 Land Use Designations) of the SCRD (Sunshine Coast Regional District Staff Report 2016; http://www.scrd.ca/files/File/Community/Planning/Area%20E%20OCP/Elphinstone%20OCP%20Map3_AreaE_LU%20-%20March%2010%2C%202015.pdf), though acquisition and official designation as a Park by the SCRD has not yet occurred. DL1313 is also designated as Gibsons Watershed Reserve (B.C. Land Act designation) on published maps (MapArt Publishing 2002).

- The study blocks occur within the traditional territories of the Sechelt (Shíshálh) and Squamish (Skwxwú7mesh) First Nations.

- The CDC establishes and maintains the provincial list of elements at risk (B.C. Conservation Data Centre, BC Species and Ecosystems Explorer website), including ecological communities (the red and blue lists or "listed communities"), in order to assist land planners and managers with managing for biodiversity on crown and private land. However, there is no blanket provincial legislation for protection of these listed communities. Recent legislation governing the Great Bear Rainforest (B.C. Ministry of Forests, Lands, and Natural Resource Operations 2016) does specify specific protection measures for red listed (100% protection) and blue listed (70%) ecosystems and a guidance document for implementing this legislation is currently being developed (I am involved in that initiative). Legally binding Landscape Unit Plans (LUPs) also incorporate, to varying degrees, listed communities. For example, the Chapman LUP (B.C. Ministry of Sustainable Resource Management 2002), which includes the study blocks, explicitly mentions red listed (but not blue listed) ecosystems, utilizing the sensitive ecosystem inventory information described below. Some voluntary corporate initiatives are

[1] As described in McCrory 2015, the "Elphinstone 1500" original park proposal dating back over 20 years, was based on an estimated 1500 ha area that was later revised, through more detailed GIS analysis by Baden Cross, Applied Conservation GIS, to 2,137 ha of public land, including 139 ha (6.5%) that is currently protected in three small provincial parks.

currently underway in the province to manage for listed ecosystems (e.g., Western Forest Products; Banner et al. 2014). BCTS has a policy that deals mainly with red-listed ecosystems, currently focussing on conserving old-growth examples (>250 years old); however, as a result of the recent FPB report (Forest Practices Board 2018), some modifications to that policy may be underway.

- The CDC utilizes an international assessment system developed by NatureServe (B.C. Ministry of Environment 2006) to assess the quality of ecological community element occurrences (EOs). EOs are assessed based on three factors; condition, landscape context, and size, in order to calculate a final EO rank of excellent, good, fair, or poor. The assessment provided here will utilize this approach as further described below. A copy of the assessment procedure is provided for reference in Appendix 1.

- A sensitive ecosystems inventory (SEI) of the Sunshine Coast and adjacent islands was completed by the B.C Ministry of Environment between 2000 and 2005 (B.C. Ministry of Environment 2005). Thirty-eight 1:20,000 mapsheets were produced (available at: http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=3758. Mapsheets 92G.042 and 043 cover the slopes of Mt. Elphinstone and portions of these mapsheets, including the two study blocks, are shown in Figures 3 and 4. The maps incorporate the red and blue listed ecosystems, in addition to other unlisted but sensitive sites, into broad sensitive ecosystem map units, including old forest, woodland, herbaceous, riparian, wetland, and cliff units. A mature forest category is also mapped under the category "other important ecosystems". In addition to these broad ecosystem units, each polygon is also assigned a label denoting the composition of site units (site series and structural stages). It is important to note that the SEI mapping was based largely on air photo interpretation with 20% of polygons being ground truthed with ecosystem plots. Table 1 provides the SEI polygon composition for the polygons overlapping the two proposed logging blocks. These map labels will be further discussed below and compared with what was found in our field assessment.

- Terrestrial Ecosystem Mapping (TEM) has also been completed for the Chapman landscape Unit (Timberline Natural Resource Group 2008). Reports describing this mapping are available on the Ministry of Environment Ecological Reports Catalogue (EcoCat) site (http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=35894); however, digital map files for that project were not available for download from the EcoCat site so could not be examined for this study.

- The proposed logging blocks are located within the Coastal Western Hemlock biogeoclimatic zone, dry, maritime subzone (CWHdm). According to the CDC website and the SEI maps, all of the forested site series within the CWHdm support either red- or blue-listed ecological communities and the same situation holds for the CWHxm (very dry maritime) occurring at lower elevations in the study area. The SEI maps highlight the scarcity of old forest polygons within the CWHdm and xm (a few small polygons on mapsheets 92G.042 and 43). Mature forest polygons are considerably more common

and larger but still of limited extent on the slopes of Mt. Elphinstone. Note that while all site series in the CWHdm and xm support either red or blue listed ecosystems, the SEI maps only show polygons for the mature and old forest structural stages as these are the stages deemed to represent the rare/at risk seral stages within these subzones.

- Human development and forest harvesting, in combination with a more frequent historical fire history, in these and other southern CWH subzones have resulted in older forest age classes being significantly reduced in area, compared with CWH subzones to the north and at higher elevations (e.g., the CWHvm). While some site series and their older age classes are naturally rare/at risk because they are associated with restricted environmental factors (e.g., riparian sites), others are widespread (e.g., CWHdm/01, covering 50+ % of the landscape) but rarity of older age classes within these site series has been induced, largely by human activity over the past century. Within the entire CWHdm of the Chapman Landscape Unit, mature and old forest encompass 42% and 3% respectively of the total forest area (B.C. Ministry of Sustainable Resource Management 2002).

- The CWHdm occurs within Natural Disturbance Type 2 (NDT2) where stand replacing disturbances such as fire are infrequent and the natural disturbance 'average' return interval is approximately 200 years (Biodiversity Guidebook; Province of B.C. 1995). This is in comparison to wetter subzones of the CWH (e.g., CWHvm), classified as NDT1, with rare stand initiating events and longer average return intervals (250+ years; 500-1000+ years on the outer north coast). As a result, very old forests (>250 years old) are naturally less extensive in the CWHdm (in addition to being further reduced by human activity) compared with wetter CWH subzones to the north and at higher elevations.

- The References section lists additional documents utilized in my assessment of the ecosystems within the study area.

Field Reconnaissance

- ELF retained me to carry out an ecological reconnaissance of these blocks and provide them with an overview assessment of the occurrence and ecological characteristics of listed forest communities within the blocks. The field visits took place over three days; May 10th and 11th (12 hours total field time) in Block 93884 and May 12th (2+ hours total field time) in Block A91376. I was guided in the field by Ross Muirhead, Hans Penner and John Davies (May 10th only). ELF supplied some map resources – Google Earth overlays of block boundaries and established trail routes but I did not have access to detailed BCTS development/site maps/plans or other background (e.g., cruise) information for the blocks. The link to maps and digital information on the BCTS Chinook Business Area website is currently inactive.

- My approach to this investigation was to assess the study blocks for the occurrence and quality of listed community EOs using the CDC/NaturServe methods described above and described in Appendix 1. Identification of site series within the study blocks according to Green and Klinka (1994) is a necessary first step; since this was a reconnaissance level survey with limited field time, rather than a detailed mapping exercise, the goal was to gain an overview of site series composition within the blocks and an indication of relative proportions. Site series are defined as all land areas capable of producing a specific plant association at climax and are characterized by a combination of soil moisture and nutrient characteristics in combination with site and vegetation features. While site series are named according to their climax plant association, the plant community occupying the site at any given time reflects the current seral stage as determined by succession following past disturbance, either natural or man-caused. It is important to understand that the ecological communities (plant associations) listed by the CDC (B.C. Conservation Data Centre, BC Species and Ecosystems Explorer website) are typically associated with mature to old structural stages (late seral to old climax forest condition) of the specific site series that share their name. For example, the "Hemlock – flat moss site series" (CWHdm/01) represents average moisture and nutrient conditions for the CWHdm subzone and may be identified on sites varying from recently disturbed (herbaceous or shrub stages) to mature and old forest. Only mature and older examples of this site series, however, are likely to represent good to excellent element occurrences (EOs) of the blue-listed "hemlock – flat moss ecological community. Younger (e.g., "fair") examples, however, may have potential for recruitment and over time will develop the mature and old features required for good to excellent ecosystem integrity (see below).

- To help characterize stand structure, an important component of EO condition, tree heights (measured using Vertex Forester rangefinder) and diameters were sampled along the route and notes taken on snag and coarse woody debris abundance. Tree ages were also sampled using increment borers. Tree height, diameter, and age data are summarized in Tables 2 and 3. Limited soils information was also collected from "quick pits".

- Numerous photographs were taken along the traverses and a selection of these are provided in Figures 7 - 28 to illustrate ecosystem characteristics throughout the blocks.

Clack Creek Block (Block A93884)

Site series composition – Clack Creek Block

- Block A93884 has two major components (see Figures 1, 2, and 5), one to the west of Gough Cr. (G042C46N; +/- 27 ha) and one to the east (G042C3MY; +/- 25 ha) between Gough Cr. and Clack Cr. Field reconnaissance focused on the eastern portion as the western units occur in a previously harvested (strip cuts) research forest area. The

eastern portion of the block consists of one major subunit bordered on the west by Gough Creek and five smaller subunits to the east toward Clack Cr. separated by leave areas. Figure 5 shows our traverse track through the block subunits. There was insufficient time to explore the entire extent of all 6 subunits; however, our traverse sampled a good portion of the area of interest and from that we were able to collect information on forest ecosystem composition (overstory and understory species composition; site series) and structure.

- Based on our traverse of the block subunits A, B, C, and D (Figure 5), the dominant site series within the block is CWHdm/01 (Western hemlock – flat moss; 70%) with lesser amounts of CWHdm/05 (Western redcedar – sword fern; 20%) and CWHdm/07 (Western redcedar – foamflower; 10%). The latter site series is restricted to moister draws and stream edges. An interesting feature of this block is the occurrence of significant patches of the blue-listed species, *Rubus nivalis* (Snow bramble; Figure 7), mainly in and around subunit D (Figure 5). A field survey of the snow bramble populations in the study area was commissioned by ELF in 2014 (Symon 2014). Figures 8 to 15 illustrate the site series within this block. The block is included within SEI polygon 490 (Figure 3). At the broad sensitive ecosystem level, this polygon is mapped as a complex of dominantly Riparian fringe with minor Riparian gully and Wetland swamp (Table 1). The more detailed mapping of site units within this polygon has Western redcedar - sword fern and Western redcedar- foamflower as the units associated with the Riparian portion and Western redcedar – salmonberry associated with the Wetland portion. There is therefore some agreement with the SEI site unit designations, though the dominant unit we observed (Western hemlock – flat moss) was not mapped within the SEI polygon. Also, polygon 490 encompasses a larger area than the block subunits so proportions are likely to be different. The Western redcedar – salmonberry unit does not occur to any significant degree within the subunits we examined (but could occur in the leave areas between subunits that were not examined) and although the Riparian label is applied to the bulk of the polygon, I would disagree that this is the case within the blocks. Gough Creek and some other minor streams occur adjacent to, and within, the blocks and these have riparian fringe communities, but these would represent less than 20% of the area within the blocks. Note that subunits E and F (Figure 5) were not examined in the field.

Assessment of Listed Communities – Clack Creek Block

- With the site series identified in this block as a complex of CWHdm/01, /05, and /07, all potentially supporting element occurrences of listed plant associations (Western hemlock – flat moss and Western redcedar – foamflower are currently blue listed and Western redcedar – sword fern is currently red-listed), the next step is to assess the quality of these element occurrences using the CDC/NaturServe assessment procedure (B.C. Ministry of Environment 2006). This assessment assigns a quality rank to three separate element factors: condition, landscape context, and size and then an overall quality rank for ecological integrity is calculated for the element occurrence. For ready

reference, a copy of the assessment procedure is provided as Appendix 1. Frequent reference should be made to Appendix 1 in lieu of including too much extra detail here.

- For assessment, ecological communities are assigned a landscape type (or ecosystem group) by the CDC. The Western hemlock – flat moss association is considered a matrix ecosystem, while the western redcedar – sword fern and the Western redcedar – foamflower associations are considered large patch ecosystems. For matrix ecosystems, the weighting order (for calculating integrity ranking or EO quality) is size > landscape context > condition while for large patch ecosystems, the order is condition > size > landscape context.

- The assessment of plant community condition considers overstory and understory composition, maturity, and structural characteristics relative to their full potential that would be expressed in late mature old forest. In terms of understory development there is considerable variation from sparse (Figure 12) to patchy (the dominant condition; Figures 8-11, 14), with well-developed examples (Figure 15) being less typical. Understory composition for the three site series reflects, for the most part, the species composition illustrated in the vegetation summary tables of Green and Klinka (1994). Cover values are often lower, especially where overstories are denser, and one or two species may dominate (e.g., salal, sword fern, red huckleberry) with diversity and cover being generally lower than what would be expected in an old-growth forest.

- Overstory composition is variable throughout the block with Douglas-fir (long-lived seral tree species in the CWHdm) dominating in many areas with minor western hemlock and western redcedar (especially in the lower elevation portions of the block) and western hemlock dominating in other (mainly upper) areas. Forests are mature with main canopy ages ranging from a little over 100 years to 140 years (one age 160+ years; see Table 2). A large catastrophic 1860s fire is reported in Federation of B.C. Naturalists (1998?) and also in McCrory (2015) but it is unclear how this date was established or whether it has been confirmed by on the ground age determination. The fire is described as burning the entire Elphinstone slope and this would suggest an age of 140 - 160 years for the forests in the area. While older ages (140-150 years) are typical of other stands examined to the east and at slightly lower elevations (Banner 2016), this stand appears younger and provides some evidence that the fire history may be more complex than one large fire burning the entire Elphinstone slope all at one time. While this stand lacks any veteran overstory trees that survived the 1800s fires (that are typical of the older stands mentioned above), they do have a cohort of taller, larger diameter Douglas-fir that tend to fill that same structural role (Figures 20-22, 25, 26). These dominant trees are a similar age as the main canopy trees but 30-50 cm larger in diameter and up to 10+ m taller than main canopy trees. Many are over 100 cm in diameter and 55+ m tall. Another notable characteristic of these dominant trees is their branchy “wolf tree” nature, suggesting that they established and grew in more open conditions with branch stubs remaining quite far down their boles. This feature

combined with the high frequency of burnt out snags (Figure 9, 22-25) and lack of surviving veteran trees suggests a very hot and complete fire where some trees established and grew in very open conditions while a second cohort established around the same time and formed the eventual main canopy of the stand. This has given rise to some impressive stand structure for a stand of a little over 100 years old with a height differential between the dominant and suppressed canopies of 20+ m (Figure 26). This stand represents a solid structural stage 6 (Mature forest; B.C. Ministry of Forests and Range and BC Ministry of Environment 2010). This combined with other structural features such as abundant downed wood (Figure 27) and the significant snag component contributes "older" characteristics to this mature stand.

- With the characteristics described above, the forest associations in Block A93884 would rank as good (score of 3 out of 4) for element occurrence condition, according to the guidelines in Appendix 1 (pages 38-40) They do not represent the full expression of old-growth climax associations, yet they are good examples of mature forests that in addition, possess several of the structural and vegetation characteristics of older forests. As well, the stand has resulted largely from natural disturbance events, rather than past forest harvesting (except for minimal hand logging, cedar shake cutting, and cultural use) so this contributes to a good, rather than fair ranking.

- Assessing landscape context requires a larger look at where the ecosystems occur in relation to surrounding natural landscapes, urban and industrial development, and the levels of ecosystem patchiness, fragmentation, and connectivity (see Appendix 1, page 37-38). An excellent score (4 out of 4) is reserved for large unaltered landscapes, often with protected status. Good (3) applies to landscapes with up to 25% fragmentation where changes in natural disturbance regimes and harvesting may influence the element occurrence. Fair (2) reflects greater than 25% fragmentation with current management and development affecting the continued existence of the EO. Figures 1 and 2 help to assess landscape context, though a more detailed GIS exercise would likely be conducted in a more formal analysis. Although there are older adjacent cutblocks in close proximity to the study site (both inside and outside the BCTS chart area), they are regenerating forests (not permanently changed). Upslope of the study site there are some proposed cutblocks but to the west of Gough Creek there is an undeveloped corridor connecting the study site to natural forests upslope. Fragmentation and urban development occurs downslope from the site (>25%) but upslope current fragmentation is lower but still significant. In this situation, a score of 2 (fair) is appropriate. The Chapman LU was assigned a Biodiversity Emphasis Option (BEO) of Low during the 2002 landscape planning process and the BCTS five year plan shows numerous current and future cutblocks on the surrounding slope (B.C. Timber Sales 2018). This tends to preclude a good score (3) for landscape context, unless there is a future change in biodiversity emphasis versus timber management emphasis for this landscape unit.

- Finally, the factor of size is assessed. From Appendix 1, page 38: "Size refers to the area of occupancy of the element occurrence. If an ecosystem occurs in mosaic with other ecosystems, the area is calculated based on the estimated proportion of occupancy. The importance of size varies based on the type of ecosystem. Size is relatively unimportant in small patch or linear ecosystems. For large patch and matrix type ecosystems, the larger occurrences are more viable because of reduced edge effects and reduced susceptibility to degradation or extirpation by large scale disturbance events." Table A1.1 (page 44) provides size criteria for ecosystem groups (matrix, large patch, small patch, linear) as an aid to assessing size. While it is difficult to properly assess size of EOs without detailed GIS analysis of the adjoining landscape, from the Google Earth image (Figures 2) as well as the SEI inventory maps (Figures 3 and 4), it is safe to assume that the EOs likely extend somewhat beyond the boundaries of the study blocks we specifically examined. Therefore, a conservative assessment of size would yield a score of 2 (fair) which for matrix ecosystems (CWHdm/01) is 20 -200 ha and for large patch ecosystems (CWHdm/05 and /07) is 2-30 ha.

- With each of the assessment factors individually scored, overall EO quality or ecological integrity scores can be calculated by summing the weighted scores. For the western hemlock – flat moss (CWHdm/01), a matrix ecosystem, using the stairstep approach (Appendix 1, page 41) size is weighted 0.45, landscape context 0.33, and condition 0.22 so the calculation is: (2*0.45) + (2*0.33) + (3*0.22) = 2.22. With even weighting the score is 2.31. This represents a fair (C) tending to good (B) (requiring a minimum score of 2.5 ; see Appendix 1, Table 15, page 41 for EO rank score categories) overall integrity ranking for the Western hemlock – flat moss blue listed element occurrence within the study blocks.

- For the Western redcedar – sword fern (CWHdm/05; red-listed) and the Western redcedar – foamflower (CWHdm/07; blue-listed) associations (large patch ecosystems), the factor weightings are slightly different (condition > size > landscape context). The calculation is: (3*0.45) + (2*0.33) + (2*0.22) = 2.45. With even weighting the score is 2.31. Thus, the overall EO integrity ranking for these two listed associations is also fair (C) tending to good (B).

Reed Road Block (Block A91376)

Site series composition - Reed Road Block

- Block A91376 is approximately 29 ha in area. Figure 6 shows our traverse through this block; limited time was available and thus a smaller portion of the entire block could be examined compared to A93884. The portions of the block examined contained significant proportions of CWHdm/05 (Western redcedar – sword fern; Figure 16 -18) and lesser amounts of (in moister draws) /07 (Western Redcedar – foamflower; Figure 19), both with very well-developed understories. CWHdm/01 also occurred but due to our limited survey time, it was difficult to estimate site series proportions. This block

overlaps with eight SEI polygons (Figure 4, Table 1). In terms of broad sensitive ecosystem units, Mature coniferous forest dominates, but Riparian fringe and Wetland swamp also occur. The latter is in polygon 82 which is largely excluded from the block as are portions of polygon 78 (Riparian fringe). Western hemlock – flat moss is the dominant site unit mapped within the block with significant areas of Western redcedar – sword fern mapped as well. Combining the SEI mapping with our field reconnaissance information, a reasonable estimate of site series proportions is CWHdm/01:60%, /05:30%, and /07:10%, but this would need to be field-confirmed. Note that the Reed Road block is close to the boundary with the CWHxm at lower elevations and thus illustrates some transitional aspects such as the occurrence of scattered arbutus and ocean-spray (Green and Klinka 1994) near the lower block boundary.

Assessment of Listed Communities – Reed Road Block

- Since we had just a little over two hours at the Reed Road block, I am limited to making some conclusions about the portion we did examine (see our traverse track in Figure 6) and some more preliminary conclusions about the block as a whole, based on the SEI mapping and examining the Google Earth image of the block. Conclusions on the Reed Road block will be largely based on a comparison of conditions observed in this block with what we saw in A93884.

- The same three site series occurring in A93884 (CWHdm/01, 05, and 07) occurred in this block but proportions were estimated by combining our field observations with the SEI mapping. Western Hemlock – flat moss (01 – blue listed) likely dominates (+/- 60%) but Western redcedar – Sword fern (05 – red-listed) is common (+/- 30%), and Western Redcedar – foamflower (07 – blue-listed) occurs in moister portions (+/-10%). A significant difference between the two blocks was the very well-developed understories in the Reed Road block compared with A93884 where patchy understories dominated. Understories here were more diverse, more consistently well-developed and taller – up to 2 m tall in places. Lush communities of sword fern and other forbs/ferns with tall salmonberry, huckleberries, red elderberry, and other shrubs were typical (Figures 16, 17, 19).

- Stand age was not established accurately but coring a 100+ cm dbh Douglas-fir and estimating age based on rings/cm (72-year count; pith not reached; no suppression indicated on the core) resulted in an estimated age between 100-150 years. This stand also resulted from wildfire as evidenced by frequent burnt snags throughout the stand. Similar to A93884, no veteran overstory trees remained and a similar cohort of taller, larger dbh Douglas-fir, established after the fire, formed a dominant layer; one measured at 70 m tall and 179 cm dbh (Table 2, Figure 28). In general, the stands examined had greater stature than those in A93884 (Tables 2 and 3). Stands examined were dominantly Douglas-fir with western hemlock, western redcedar, and in some

areas red alder seral remnants. Leave areas within the block had a much higher deciduous component and lush understory development.

- For the same reasons noted above for Block A93884, the forests examined in A91376, would rank as Good (3 out of 4) for element occurrence condition according to the guidelines in Appendix 1 (pages 38-39). Not old-growth, but good examples of mature forests that have good structural diversity and well-developed plant communities. Based on the very well-developed understory communities, there may be justification for a slightly higher condition ranking (e.g., 3+) but considering a relatively small portion of the block was examined in detail, a score of 3 is appropriate at this point, pending further investigation.

- Landscape context and size assessment scores will also be similar to Block A93884. Both would be scored as fair (2). For landscape context, while upslope development is considerably less, the block occurs near the Gibsons rural/urban fringe which represents permanent ecosystem change from natural condition (compared with forest harvesting, a temporary change in successional stage). Size considerations are the same with ecosystems within the block expected to meet the fair (2) criteria in Table A1.1 (page 45) – for matrix ecosystems (CWHdm/01), 20 -200 ha and for large patch ecosystems (CWHdm/05 and /07), 2-30 ha.

- Overall EO integrity ranking for the red- and blue-listed forest communities within Block A91376 is thus expected to be the same as for Block A93884 (see above calculations) – fair (C) tending to good (B). A more complete assessment of this block is required to confirm this assessment, though examination of the Google Earth image, combined with the SEI ecosystem mapping, tends to support our assessment. If the well-developed understory plant community conditions we observed in the portion sampled are typical of the entire block, then a good (B) ranking for EO integrity may be justified.

Conclusions/Recommendations

- The combination of overstory and understory composition and structural characteristics exhibited by the mature forest stands in both blocks examined resulted in a ranking of good for element occurrence condition. But when the factors of size and landscape context are incorporated into an overall score for ecological integrity, the ranking is reduced to fair (tending to good). The Chapman Landscape Unit was assigned a low biodiversity emphasis option in the last planning process that occurred 16 years ago (B.C. Ministry of Sustainable Resource management 2002) and thus forest harvesting has been occurring at a considerable rate. This will continue to decrease the integrity of remaining good element occurrences, either through their direct harvest and reduction in size or as a result of the landscapes around them becoming more fragmented and converted to earlier seral stages. Immediate improvement in planning for red- and blue-listed ecosystem conservation is essential to ensure that a selection good quality EOs will be available to contribute to high quality reserves. Otherwise, over time it will

become more and more of a recruitment program where younger, lower quality EOs must be set aside for eventual development of good quality attributes.

- Assessment results must be put into perspective with the overall ecological integrity of the larger landscape being examined – in this case the CWHdm in the Chapman LU. Considering the natural and man-induced disturbance history of this subzone/landscape unit, the absolute scarcity of old forests, and even limited amounts of mature forest, especially in the CWHdm, scores of fair (to good) for ecological integrity of EOs likely represent the higher scores possible in this Landscape unit/subzone and over time will give rise to EOs of good to excellent quality.

- A sensitive ecosystem inventory B.C. Ministry of Environment 2005) as well as terrestrial ecosystem mapping (TEM; Timberline Natural Resource Group 2008) exist for the Chapman/Elphinstone study area. With additional field work to ground truth polygons, these inventories could be used as the basis for a comprehensive conservation strategy for red- and blue-listed ecosystems in the study area. Both proposed harvest blocks studied in this investigation encompassed mapped sensitive ecosystem polygons and this brings into question how much these inventories are currently being used to minimize impacts on listed plant communities. Although our field work indicated that further ground truthing is required to increase the accuracy of this mapping, these inventories combined with the work of McCrory (2015) and the Coastal Douglas-fir and Associated Ecosystems Conservation Partnership (Cullington 2015), provide a solid foundation for an Elphinstone conservation plan.

- The Reed Road Block was incorporated into the BCTS operating area relatively recently – sometime between 2011 and 2016 (according to historical map documentation; comparing B.C. Timber Sales 2011 and 2016). Historically, this District Lot (DL1313) was given Watershed Reserve status (MapArt Publishing 2002; The Local Weekly 2014) and is designated in the Elphinstone Official Community Plan as “Park, which should be acquired for current and future park use and environmental protection” (Sunshine Coast Regional District Staff Report 2016). Such historical precedents should be considered as candidates for conservation within a focussed strategy for rare and threatened ecosystems.

- Conservation planning should include a better inventory of existing reserves (Parks, OGMAs, etc.) to confirm their listed community composition and integrity rankings. Such initiatives are important even for landscape units that have been assigned low biodiversity emphasis options in the past; conservation initiatives should be spread over all landscape units. Proactive planning is much preferable to dealing with public and professional concern over rare and threatened forest types on a block by block basis, as is the current situation. The SCRD currently does not endorse forest harvesting in the proposed Elphinstone Park expansion area or in Watershed Reserves (Sunshine Coast Regional District Staff Report 2016; Sunshine Coast Regional District 2016). This

SCRD position, combined with significant public concern related to ecological, hydrological, recreational, and forestry values on the Elphinstone slopes, begs for a more currently relevant conservation plan/strategy that would better identify areas of highest conservation value as well as areas best suited to sustainable rotation forestry. Such a strategy is best coordinated by the provincial government in cooperation with the Regional District, First Nations, public interest groups, and forest licensees.

- Public education is an important component of ecosystem conservation. The Reed Road Forest Block, as well as other forests with good quality element occurrences on the lower slopes of Mt. Elphinstone are heavily used by the public for a variety of recreational pursuits; these locations are ideal for the installation of public forest ecology interpretation trails. Such efforts could be coordinated with the ongoing Coastal Douglas-fir and Associated Ecosystems Conservation Partnership (Cullington 2015).

Tables and Figures

Table 1. Polygon labels for Sensitive Ecosystem Inventory polygons that overlap with proposed forest harvesting blocks A93884 and A91376 located on mapsheets 92G.042 and 043.

Block	SEI Polygon	Decile	Sensitive Eco Label	Site Unit Label	Structural stage
A93884	490	6	Riparian fringe	Western redcedar-sword fern	Mature forest
		2	Riparian gully	Western redcedar - foamflower	Young forest
		2	Wetland swamp	Western redcedar - salmonberry	Shrub/herb
A91376	109	7	Mature forest - conifer	Western hemlock – flat moss	Mature forest
		3	Mature forest - conifer	Western redcedar – sword fern	Mature forest
A91376	82	5	Wetand - swamp	Western redcedar – Sitka spruce – Skunk cabbage	Pole/sapling
		5	Wetland - swamp	Western redcedar – Sitka spruce – Skunk cabbage	Young forest
A91376	126	6	Mature forest - conifer	Western redcedar – sword fern	Mature forest
		4	Mature forest - conifer	Western hemlock – flat moss	Mature forest
A91376	147	10	Mature forest - conifer	Western hemlock – flat moss	Mature forest
A91376	122	6	Riparian fringe	Western redcedar – sword fern	Young forest
		4	Young forest		
A91376	119	8	Mature forest - conifer	Western hemlock – flat moss	Mature forest
		2	Mature forest - conifer	Western redcedar – sword fern	Mature forest
A91376	146	10	Mature forest - conifer	Western hemlock – flat moss	Mature Forest
A91376	78	6	Riparian fringe	Western redcedar – sword fern	Pole/sapling
		4	Riparian fringe	Western redcedar – sword fern	Young forest

Table 2. Summary of tree measurements collected in blocks A93884 and A91376 during field visit May 10-12, 2018. Dbh (cm) = Diameter at breast height in centimeters; Ht (m) = height in meters; Count age (years) = ring count at breast height (add a minimum of 5 years to breast height for total age); Cw = western red cedar; Hw = western hemlock; Fd = Douglas fir. Heights were measured with Vertex Forester rangefinder.

Species	Block	Canopy layer	Dbh (cm)	Ht (m)	Count age (years)	Comments
Fd	A93884	Dominant	134.0	58	60+	pith not reached; no release
Fd	A93884	Dominant	86.0	56	90+	Pith not reached; no release
Hw	A93884	Main canopy	47		111	hit pith; no release
Fd	A93884	Dominant	138	50	138	hit pith; no release
Fd	A93884	Dominant	67	51	96	hit pith; no release
Cw	A93884	Main canopy	50.5	40	95+	near pith
Hw	A93884	Main canopy	57.5	41	96	Hit pith
Hw	A93884	Main canopy	86.5	44	160+	Close to pith
Hw	A93884	Main canopy	59	40		No age
Hw	A93884	Suppressed	36	28	108	115 total age
Fd	A93884	Dominant	97.5	55		No age
Fd	A93884	Dominant	86.5	56	96	105 total age
Hw	A93884	Main canopy	57	44	95	105 total age
Fd	A93884	Dominant	131	51		No age
Fd	A93884	Dominant	73	51		No age
Hw	A93884	Main canopy	62	40.5		No age
Hw	A93884	Suppressed	29	37		No age
Hw	A93884	Suppressed	38	28.5		No age
Fd	A93884	Dominant	97.5	52.5		No age
Fd	A93884	Dominant	135	55		
Hw	A93884	Main canopy	59		118	Hit pith
Fd	A93884	Dominant	118.5	63		No age
?Cw	A93884	Burnt snag	180			
?	A93884	Burnt snag	163			
?	A93884	Burnt snag	203			
?	A93884	Burnt snag	163			
?	A93884	Burnt snag	160+	+/- 40		
?Fd	A93884	Burnt snag	222			Was originally much larger
Fd	A91376	Dominant	121	64		
Fd	A91376	Upper main canopy	154	54		
Fd	A91376	Dominant	179	70.3		
Fd	A91376	Dominant	103		72	Pith not reached but age est. age between 100 and 150 based on rings/cm; no suppression
Fd	A91376	Upper main canopy	97	56.4		

Table 3. Summary of tree canopy characteristics for Blocks A93884 and A91376 based on reconnaissance sampling. Numbers in brackets indicate number of trees sampled)

Block	Dbh Main canopy	Ht Main canopy	Dbh of Dominant trees	Ht of Dominant trees	Comments
A93884	83 (5)	45-50 (est)	108.2 (7)	56-58 (2)	
A93884	65.5 (8)	40-43 (2)	103.4 (3)	51 (1)	
A93884	66 (3)	42.6 (3)	92 (2)	55.5 (2)	Suppressed layer = 36 cm dbh; 28 m tall (1)
A93884	56.8 (10)	40.5 (1)	109.6 (9)	51.0 (2)	Suppresssed layer = 33.3 cm dbh; 33 m tall (2)
A91376	80+ (est)	50-56 (3)	134 (3)	55-70 (2)	Limited sampling in this block

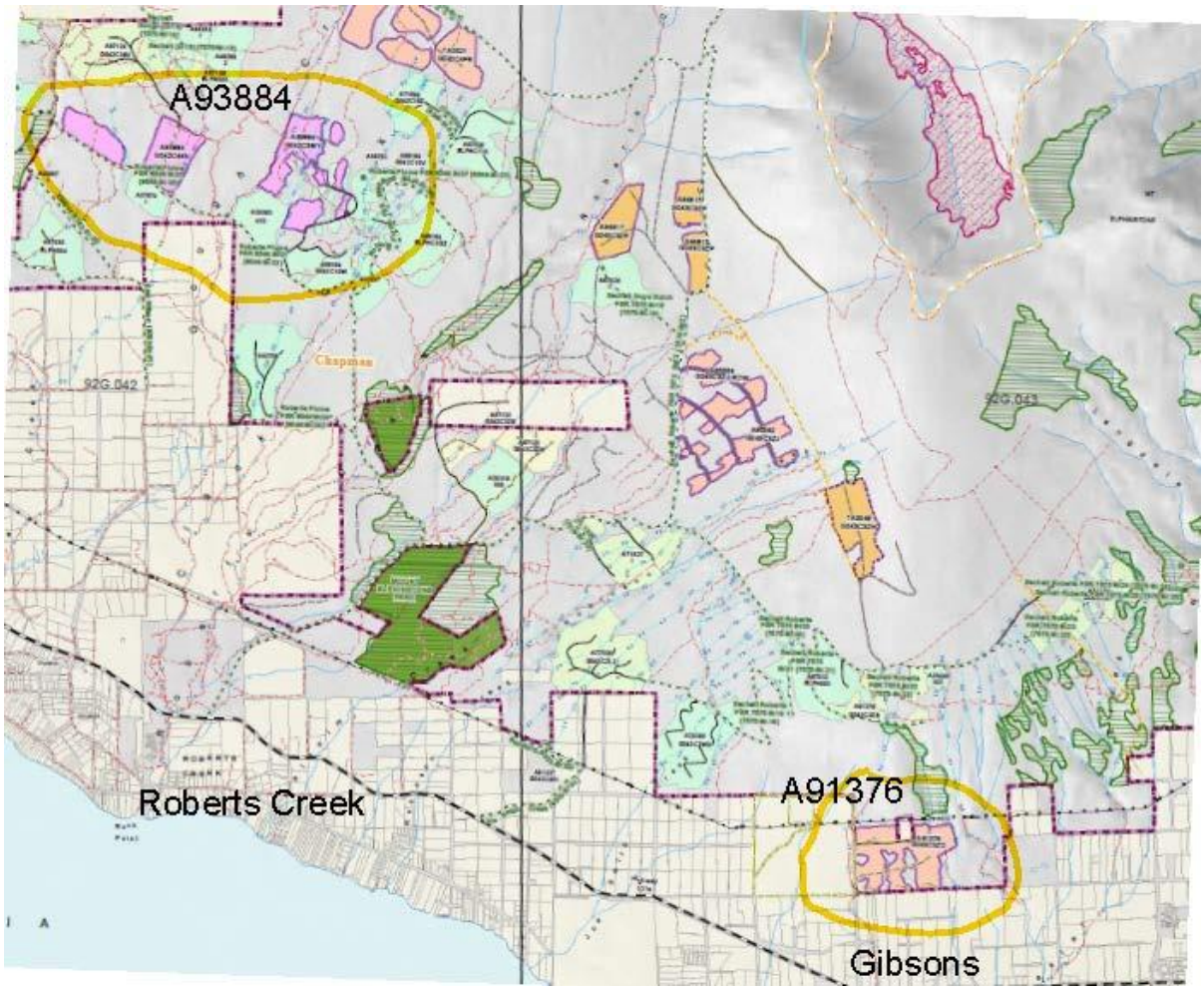

Figure 1. Location of Blocks A93884 (purple units within yellow outline on upper left) and A91376 (orange unit within yellow outline on lower right) on BCTS Five Year Operating Plan Map (dated 2018/02/06)

Figure 2. Overview of BCTS block locations on slopes of Mt. Elphinstone for landscape context. Blocks A93884 and A91376 are the subject of this report; Block A87125 was the subject of a previous Forest Practices Board investigation regarding red- and blue-listed forest communities (Forest Practices Board 2018)

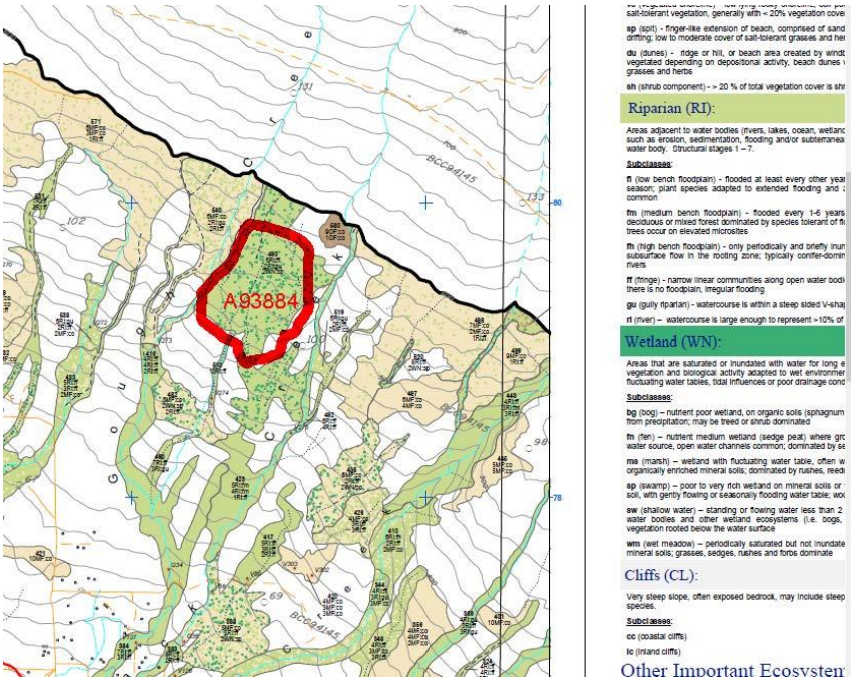

Figure 3. Rough overlay (red polygon) of the location of eastern portion of Block A93884 on Sensitive Ecosystem Inventory (SEI) completed by the B.C. Ministry of Environment (2005). Refer to Figure 5 for accurate block configuration. Most of Block A93884 encompasses one SEI Polygon (490). See table 1 for a summary of SEI polygon attributes and the text for a comparison with our field observations for the polygon.

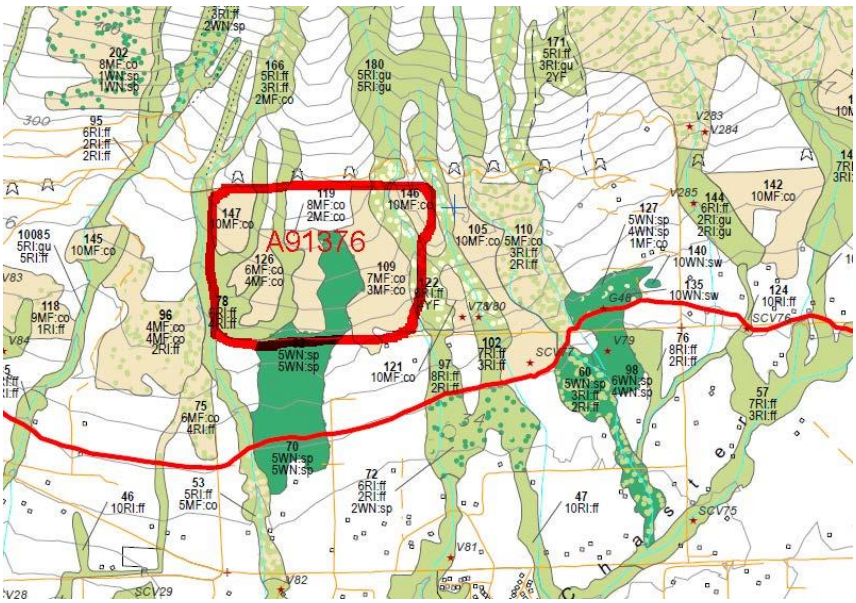

Figure 4. Rough overlay (red polygon) of the location of Block A91376 on Sensitive Ecosystem Mapping completed by the B.C. Ministry of Environment (2005). Refer to Figure 6 for accurate block configuration. Lower red line represents the boundary between the CWHxm (lower elevations) and the CWHdm (upper elevations where the block is located). See table 1 for a summary of SEI polygon attributes and the text for a comparison with our field observations for the polygon.

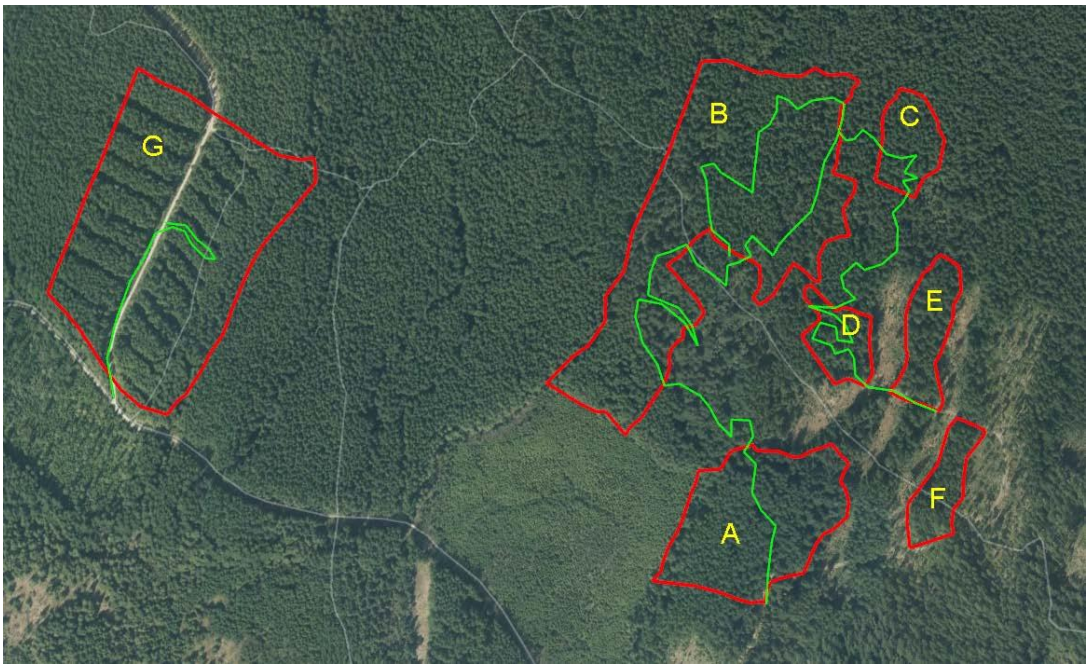

Figure 5. Traverse route (green track line) for Block A93884. Yellow letters indicate block subunits referred to in text.

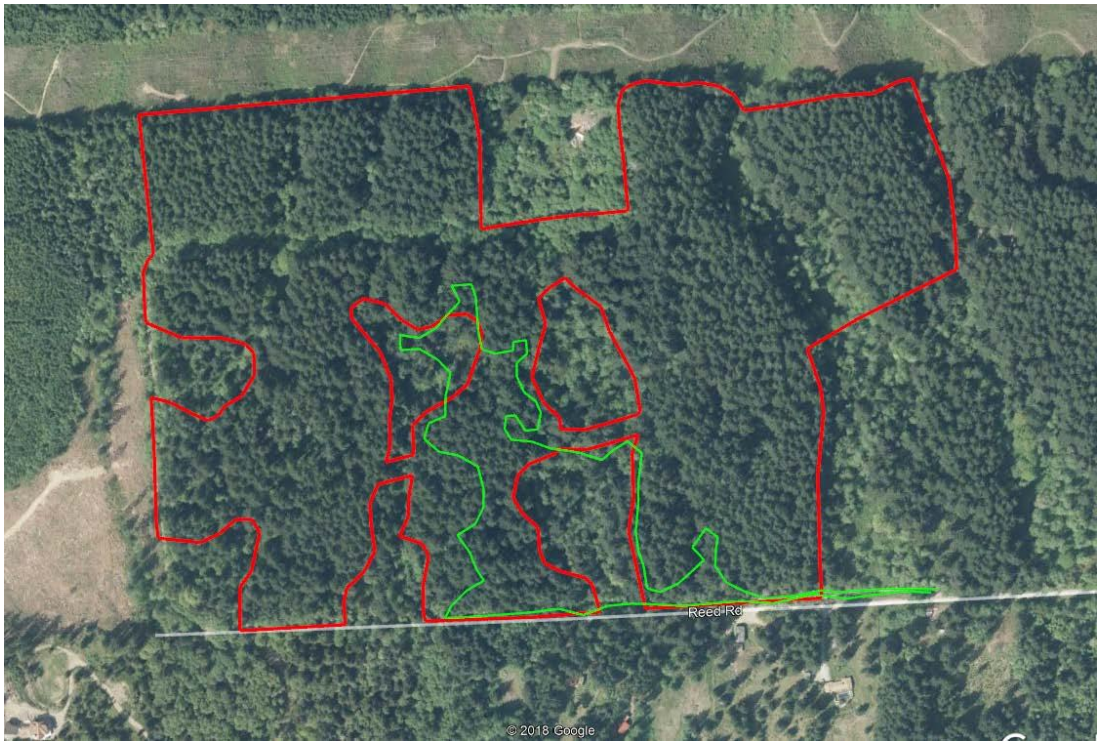

Figure 6. Traverse route (green track line) for Block A91376.

Figure 7. Rubus nivalis (Snow bramble) in Block A93884, subunit D (See Figure 5)

Figure 8. Block A93884; CWHdm/01 Western hemlock – flat moss mature forest with burnt snag remains and a dominant post-fire Douglas-fir.

Figure 9. Block A93884; CWHdm/01 Western hemlock – flat moss mature forest with burnt snag from mid to late 1800s fire.

Figure 10. Block A93884; CWHdm/01 Western hemlock – flat moss mature forest with western redcedar component.

Figure 11. Block A93884; CWHdm/01 Western hemlock – flat moss mature forest.

Figure 12. Block A93884; CWHdm/01 Western hemlock – flat moss mature forest with western redcedar component.

Figure 13. Block A93884; well- to moderately well-drained podzolic soil typical of CWHdm /01 Western hemlock – flat moss association

Figure 14. Block A93884; CWHdm/05 Western redcedar – sword fern mature forest association dominated by Douglas-fir and western hemlock.

Figure 15. Block A93884; CWHdm/05 Western redcedar – sword fern mature forest association dominated by Douglas-fir and western hemlock.

Figure 16. Block A91376; CWHdm/05 Western redcedar – sword fern mature forest association dominated by Douglas-fir and western hemlock.

Figure 17. Block A91376; CWHdm/05 Western redcedar – sword fern mature forest association dominated by Douglas-fir and western hemlock with well-developed understory vegetation.

Figure 18. Block A91376; Moderately well-drained podzolic soil typical of CWHdm/05 Western redcedar – sword fern site series.

Figure 19. Block A91376; CWHdm/07 Western redcedar – foamflower mature forest association dominated by Douglas-fir and western hemlock. Very well-developed understory vegetation.

Figure 20. Block A93884; Overstory Douglas-fir, 138 cm diameter at breast height (dbh), 50 m tall, 140 years old. Beside burn remnant snag from late 1800s fire.

Figure 21. Block A93884; Overstory Douglas-fir; note abundant branch stubs suggesting open growing conditions for these larger dominant post-1860s fire "wolf trees".

Figure 22. Block A93884; Dominant overstory Douglas-fir and fire snag; two important structural elements in these fire-regenerated mature forest stands.

Figure 23. Block A93884; Fire snag remains from mid to late 1800s fire

Figure 24. Block A93884; Fire snag from mid to late 1800s fire in hemlock -dominated CWHdm/01 Western hemlock – flat moss mature forest association in the upper portion of sub-unit B (see Figure 5).

Figure 25. Block A93884; Dominant, branchy overstory Douglas-firs and fire snag; two important structural elements in these fire-regenerated mature forest stands.

Figure 26. Block A93884; Stand edge profile of mature forest showing variation in canopy height between main canopy and larger dominant Douglas-firs.

Figure 27. Block A93884; Moderate amounts of downed wood occur throughout these stands, though the 1800s fire was apparently very intense and likely consumed considerable material. No veteran (pre-fire) trees remain but burnt snags are common (see previous figures)

Figure 28. Dominant Douglas-fir in Block A91376, measuring 70.3 m tall and 179 cm dbh. Age estimated at less than 150 years old (i.e., established after the mid to late 1800s wildfire).

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Appendix 1: Conservation Data Centre Methods for Assessing and Ranking Ecological Community Elements and Element Occurrences (Section 4 Excerpted from B.C. Ministry of Environment 2006)

4 CDC Methods

The B.C. Conservation Data Centre (CDC http://www.env.gov.bc.ca/cdc/) collects and disseminates information on biological ***elements*** at risk, including ecological communities. The CDC is part of NatureServe, an international organization of cooperating Conservation Data Centres and Natural Heritage Programs; all use the same method known as the 'natural heritage methodology' to collect and exchange information.

The central idea of the method incorporates the concept of the ***element occurrence*** (EO): the spatial representation of an ecological community or species at a specific location. An ecological community EO is an area of land in which the ecological community is present[18]. An EO's conservation value for a given ecological community is dependant on its potential continued occurrence at a given location. The EO may represent a stand or patch of an ecological community, or more commonly, a cluster of stands or patches of an ecological community (NatureServe 2002).

The Ecological Community Element ***Conservation Status Rank*** and the Ecological Community Element Occurrence (EO) Rank are different and are discussed in Sections 4.1 and 4.2. Element Conservation Status Rank assesses the present status of each ecological community type whereas ***Element Occurrence Rank*** is used to assess a particular occurrence (EO) of an ecological community. The number of element occurrences, the number of element occurrences with good or excellent viability, and the number of appropriately managed and protected element occurrences are three of the criteria used in assessing the Element Conservation Rank (Table 11).

Element occurrence specifications, described in Section 4.4, define the evidence needed to indicate the presence of a biological element (EO) and what factors or distance separate one EO from another. Specifications also outline the criteria by which the element occurrence is ranked as having Excellent, Good, Fair, or Poor viability.

4.1 Element Conservation Status Assessments

Ecological communities and species can be assessed globally ("G"), nationally ("N") and sub-nationally ("S", provincially, in Canada) on a scale of 1 to 5 (see below). An example of a complete status would be "G2N2S1."

The CDC assesses an Element based on a variety of rarity factors including the number of Element Occurrences and the number of EOs with Good to Excellent viability (Table 12) and on a number of risk-factors including threats and short- and long-term trend (Table 13). In the absence of EOs with EO rank assessments, trends and threats to the ecological community are used with range to determine the Conservation Status.

[18] For example, a specific site with climax vegetation identified as an at-risk ecological community.

Table 11 - CDC Status Assessment Definitions.

Critically Imperilled	because of extreme rarity (5 or fewer extant occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extirpation or extinction
Imperilled	because of rarity (typically 6-20 extant occurrences or few remaining individuals) or because of some factor(s) making it vulnerable to extirpation or extinction
Rare or uncommon	(typically 21-100 occurrences); may be susceptible to large-scale disturbances; e.g., may have lost extensive peripheral populations
Frequent to common	(greater than 100 occurrences); apparently secure but may have a restricted distribution; or there may be perceived future threats
Common to very common	demonstrably secure and essentially ineradicable under present conditions

Table 12 – Rarity status assessment factors for ecological communities (adapted from Masters et al. 2003)

Status Factor	Description
Number of Occurrences	Estimated, inferred, or suspected number of occurrences believed extant for the ecological community.
Number of Occurrences with Good Viability	The number of occurrences believed extant that have excellent or good viability.
Range Extent	Estimated current range of the ecological community.
Area of Occupancy	Estimated current area of occupancy. Excludes areas unoccupied or unsuitable for community development.

Table 13 – Risk status assessment factors for ecological communities (adapted from Masters et al. 2003)

Number of Protected and Managed Occurrences	The number of occurrences that are appropriately protected and managed for the long-term persistence of the element.
Long-term Trend	The observed, estimated, inferred, or suspected degree of change over the long term (ca. 200 years).
Short-term Trend	The observed, estimated, inferred, or suspected degree of change over the short term (10-100 years).
Threats (Severity, Scope, and Immediacy)	The degree to which the ecological community is observed, inferred, or suspected to be directly or indirectly threatened, including: scope (how much), severity (how critical and irreversible), and immediacy (how likely, how soon).
Intrinsic Vulnerability	The likelihood of regeneration or recolonization; consider characteristics that make it vulnerable or resilient to natural or anthropogenic stresses or catastrophes.
Environmental Specificity	The resilience of the ecological community due to degree of specificity of site requirements or site restrictions e.g., sand dune ecosystems.
Other Considerations	Any other information that should be considered in the assignment of a conservation status.

4.2 Element Occurrence Ranking

The EO Rank provides an assessment of the viability of the EO in question. Viability is the likelihood that if current conditions remain unchanged, an occurrence will persist for a defined period of time, generally 20-100 years. Viability is defined in terms of species populations; for ecological communities, viability is more appropriately termed ecological

integrity. The ecosystem occurrence itself must have sufficient ecological integrity to be sustained in the foreseeable future if it is to have practical conservation value. Each EO must be assessed for practical conservation value and this assessment is distinct from the overall element conservation status.

To facilitate consistent prioritizing of areas for conservation, a method was developed by the NatureServe network (NatureServe 2002) to assess and rank occurrences of ecological communities at risk for conservation value. Three criteria are assessed for each EO: 1) Size; 2) Landscape Context; 3) Condition (NatureServe 2002). The relationship of the criteria and the Viability assessment are expressed as:

Assessment of Ecological Integrity (Viability) = ∑Landscape Context, Size, Condition

Each of these criteria is described in detail in Sections 4.4.2.a, 4.4.2.b and 4.4.2.c.

4.3 Ecological Community Landscape Types

Ecological integrity is assessed using the criteria of Condition, Landscape Context, and Size (see previous section). These three factors are applied differently depending on the landscape type of the ecological community: matrix, large patch, small patch, or linear.

Matrix: occupies a very large area with high connectivity to other community types. Size generally has priority over Landscape Context which has priority over Condition[19].

Large Patch: occupies 'middle ground' between matrix and small patch types (some may be more similar to matrix or to small patch types). Condition has priority over Size which has priority over Landscape Context.

Small Patch: occupies small areas, tends to vary less in size than large patch and matrix communities, contains more specialized species and is sensitive to factors affected by landscape context. Condition has priority over Landscape context which has priority over Size.

Linear: has a large amount of edge and is typically dependent on water currents or flow regimes and is generally highly sensitive to factors affected by landscape context; often supports very specialized species. Landscape Context has priority over Condition which has priority over Size.

4.4 Element Occurrence Specifications

EO specifications provide consistency in defining, mapping, and ranking EOs. They can be developed for individual ecological communities or for ecological groups. Ecosystems with similar abiotic requirements, similar physiognomy, and similar geographic distribution are

[19] For matrix and large patch forest and grassland ecosystems in heavily impacted landscapes, Condition will have increased priority at least equivalent to Landscape Context and may also have priority over Size.

commonly grouped together. An example of specifications for a matrix forest type and matrix grasslands are included in Appendix H: Example Element Occurrence Specifications.

4.4.1 Separating Element Occurrences

EOs are separated from other EOs by barriers or by specified distances across intervening areas of different natural, semi-natural, or cultural vegetation. The separation and delineation of EOs must be consistent as the resulting number of EOs support the conservation status assessment.

4.4.1.a Barriers

Barriers are obstacles that prevent the expansion or alter the function of communities and gene flow. Barriers are common for aquatic and wetland communities, but are uncommon for many upland communities. Examples of barriers include large bodies of water, large rivers, urban areas, and some agricultural and forest plantation areas.

4.4.1.b Separation Distances

Separation distances are defined to provide consistent delineation of EOs. A separation distance is defined as one that significantly reduces gene flow and species dispersal. Data from gene flow studies are rarely available and decisions on separation distances are made on the best available information. Ecological communities that are separated by natural and semi-natural areas with very similar ecological function and species composition are less likely to inhibit species dispersal and gene flow than those separated by areas with very different characteristics. Some examples of commonly used separation guidelines are given below.

- ***Matrix***: (1) substantial barriers to natural processes or species movement, including cultural vegetation greater than 0.5 km wide, major highways, urban development, large bodies of water, (2) different natural community wider than 2 km (3) major break in topography, soils, geology, etc., especially one resulting in a hydrologic break.

- ***Small patch***: (1) substantial barriers to natural processes or species movement, including cultural vegetation greater than 0.25 km wide, major highways, urban development, large bodies of water, (2) different natural community wider than 1 km along a river corridor or within a wetland, or 0.5 km in other situations, (3) major break in topography, soils, geology, etc., especially one resulting in a hydrologic break.

- ***Large patch***: (1) substantial barriers to natural processes or species movement, including cultural vegetation (includes clearcuts/tree plantations) greater than 0.5 km wide, major highways, urban development, large bodies of water; (2) a different natural community wider than 1 km; (3) a major break or change in the ecological land unit (e.g., topography, soils, geology).

- ***Linear*** : (1) substantial barriers to natural processes or species movement, including cultural vegetation or very degraded example of same community greater than 0.25 km wide, major highways, urban development, large bodies of water, (2) different natural community wider than 1 km along a river corridor, or 0.5 km in other

situations, (3) major break in topography, soils, geology, etc, especially one resulting in a hydrologic break.

See Appendix I: Example Separation Distance Specifications for specific examples of separation distances.

4.4.2 Element Occurrence Rank Criteria

Element Occurrences are ranked based on three factors: size, condition, and landscape context (see Table 14 below). Each of the three factors are rated in a four class ranking system and these classes are assigned a numerical value which allows for calculation of overall viability ranks as well as facilitating thematic mapping for conservation priorities.

Table 14 – Element Occurrence rank factors and components.

Factor	Components
Size	Area of Occupancy
Condition	Development / Maturity (stability, old growth)
	Species composition and biological structure (species richness, evenness of distribution, presences of exotics)
	Ecological processes (degree of disturbance by land use, e.g. grazing, harvesting, changes in hydrology or natural disturbance regime)
	Abiotic physical / chemical factors (stability of substrate, physical structure, water quality, excluding processes)
Landscape Context	Landscape structure and extent (pattern, connectivity e.g., measure of fragmentation / patchiness, measure of genetic connectivity)
	Condition of surrounding landscape (i.e. development / maturity, species composition and biological structure, ecological processes, abiotic physical / chemical factors)

4.4.2.a Landscape Context

Landscape context considers both the abiotic and biotic features of the geographic area adjacent to and surrounding the EO. The condition of the landscape is assessed by the integrity of ecological processes, species composition, and structure of the vegetation, including its maturity and stability, and the stability of the abiotic features of the landscape (NatureServe 2002). Patchiness, fragmentation, and connectivity are specific attributes of the landscape. Fragmentation is a measure of the proportion of the landscape that is fragmented. Fragmentation by anthropogenic influences can generally be determined from air photo or satellite imagery or from analysis of a digital base map such as TRIM.

Excellent (4): The surrounding landscape has little to no fragmentation (<5%) due to anthropogenic influences (no roads, other transportation corridors, rural settlement or urban developments, no industrial activity or recent forest harvesting). The EO occurs within a larger landscape that has some formal protected status (e.g., Federal or Provincial park/reserve). There may be some de facto protection where no future development is foreseen, e.g., access restricts use, or there is no known plan to develop or disturb present conditions, or the site is protected by conservation covenants.

Good (3): Up to 25% of the surrounding landscape is fragmented. The larger landscape context provides some protection from anthropogenic disturbance (e.g., park land or crown

land rather than private land) but changes in natural disturbance regimes and harvesting may influence the element occurrence (e.g., fire suppression within a landscape previously dominated by frequent fire).

Fair (2): More than 25% of the surrounding landscape is fragmented and affected by anthropogenic influences. Current management and development of the surrounding landscape may affect the continued existence of the element occurrence, i.e. removal of vegetation, hydrological changes, invasive alien species, etc.

Poor (1): Less than 25% of the surrounding landscape consists of natural or semi-natural vegetation. Fragmentation is due to urban and agricultural land use, or other cultural vegetation. Current plans will result in significant alteration or destruction of the element occurrence, e.g., development plans, harvesting plans, mining operations, anthropogenic structures.

4.4.2.b Size

For ecological communities, size refers to the area of occupancy of the element occurrence. If an ecosystem occurs in mosaic with other ecosystems, the area is calculated based on the estimated proportion of occupancy. The importance of size varies based on the type of ecosystem. Size is relatively unimportant in small patch or linear ecosystems. For large patch and matrix type ecosystems, the larger occurrences are more viable because of reduced edge effects and reduced susceptibility to degradation or extirpation by large scale disturbance events. Exceptions to this are areas where existing disturbance precludes any remaining matrix occurrences (e.g., some grassland and forest matrix ecosystems). In this case, condition is equally or more important than landscape context.

Criteria for size are specific to each ecological community at risk.

4.4.2.c Condition

Condition is an assessment of the composition, structure, and ecological function of the ecological community. Condition can be thought of as the degree of departure from the structure, function, and distribution of late seral ecological communities prior to European settlement. Successional stage, stability, ecological processes, disturbance regimes, alteration of physical or chemical processes, and changes in species composition are all factored in to the assessment of condition. Condition is a primary factor in conservation assessments for small and large patch systems, and secondary or equivalent to landscape context for linear systems, and matrix forest and grasslands in heavily altered landscapes.

The stage of vegetation development, such as mature forest or old forest, reflects the level of ecological stability in long lived forest ecosystems. However, younger successional stages originating from natural disturbance are ranked higher than those originating from human disturbance.

Changes in natural disturbance regimes and anthropogenic disturbances reduce condition. Intact natural disturbance regimes, particularly for fire-maintained systems and flood systems, are critical to ecological integrity. For wetland ecological communities, alterations in the

hydrological regime can be a primary degrader of condition. The type and degree of anthropogenic disturbance will also influence the rank. For example, recovery of any

ecosystem after soil removal is not likely; recovery of a grassland ecosystem after moderate grazing is likely.

Invasion of alien plant species is a special form of disturbance. The introduction of alien species can have devastating effects on native species populations and ecosystems. The presence of alien species, especially invasive alien species, degrades the condition of a site, whereas the presence of native, early successional species does not. The proportion of invasive alien plant species is critical for determining grassland condition.

The types and extent of disturbance and current land use can, to a certain level, be interpreted from imagery. Artificial structures, agricultural development, wetland modifications can all be observed, recorded, and assessed in the mapping process. Field data documenting the presence, extent, and proportion of alien plant species provides additional data to assess the condition of each ecosystem.

A: Excellent (4):

a. Typical climax vegetation.
b. No anthropogenic disturbances or changes to natural disturbance regimes have altered the EO (including fire exclusion or flood control), no vegetation or soil removal has occurred. Forested ecological communities are generally late seral vegetation. Wetland and riparian communities have intact hydrologic regimes. There is minimal influence of domestic grazing.
c. No alien species occur at the site.
d. No artificial structures occur at the site.
e. There is little or no internal fragmentation (< 5%) of the occurrence.

B: Good (3):

a. Typical mature seral vegetation.
b. For forested communities, there has been no soil removal or disturbance to soil surface; little or no influence of old road beds or skid tracks, no construction evidence, old selection harvesting only, minimal changes to natural disturbance regimes (including fire exclusion or flood control). Forested ecological communities are late seral or mature, or younger if originating from natural disturbance. Wetland and riparian communities have largely intact hydrologic regimes. There is low-moderate influence of domestic grazing.
c. Minor cover of alien species (<5% except <20% in grasslands) may occur at the site. Some earlier successional species occur.
d. Some artificial structures may occur at the site (< 2% of total area of occurrence).
e. There is little or no internal fragmentation (<5%) of the occurrence.

C: Fair (2):

a. Anthropogenic disturbances and changes to natural disturbance regimes have occurred. Forested ecological communities are young seral stages after harvesting. There is moderate to high influence of domestic grazing in grassland ecological communities. There may be significant alterations to the hydrologic regime in wetlands and riparian ecosystems.

b. Significant cover of alien species occurs (5-20% in forests and riparian systems, up to 60 % in grasslands). Most of the plants in grassland communities are early successional species.
c. Some artificial structures may be present (less than 10% of total area).

d. There is minor internal fragmentation (<5%) of the EO.

D: Poor (1):

a. Significant anthropogenic disturbances have occurred, particularly removal or disturbance of soil materials and vegetation. There are significant alterations to the hydrologic regime of wetlands and riparian ecosystems.
b. Alien species may dominate a vegetation layer or may total more than 20% (>60% for grasslands) cover overall.
c. Significant artificial structures occur (>10% of total area of occurrence).
d. The element occurrence is fragmented by artificial structures or barriers.

4.5 Element Occurrence Ranking Procedure

Conservation Data Centres and Heritage Programs have developed Element Occurrence Specifications for some community types; others have 'umbrella' specifications for groupings of communities. Determining an Element Occurrence (EO) and EO Rank is outlined in the following sequence.

1. Determine if the vegetation is representative of the Community Element in question.
   If No, then no further assessment is needed.

   If Yes, (or somewhat ambiguous),

2. What System should be considered?

   Matrix[20]: Size has priority over landscape context which has priority over condition.

   Large Patch: Condition has priority over size which has priority over landscape context

   Small Patch: Condition has priority over landscape context which has priority over size

   Linear: Landscape context has priority over condition which has priority over size

3. Assess the three criteria for viability: landscape context, condition, and size.
   Landscape context: scale of very high landscape fragmentation to no fragmentation at all, distribution of natural vegetation

   Condition: consideration of the species composition, structure, vegetation development and ecological processes, and abiotic features of the element occurrence

   Size: consider if the size is typical of the community type? larger? smaller?

4. Assign the Element Occurrence Rank[21]

   Rate each of the three factors (size, condition, and landscape context) using the values according to spatial pattern priority matrix, large patch, small patch, linear) (see Section 4.3) and the following formula from NatureServe's Element Occurrence Standards (2002):

[20] For matrix and large patch forest and grassland ecosystems in heavily impacted landscapes, Condition is equivalent to or has priority over Landscape Context.

[21] For more information please see Conservation Assessment Procedure for Element Occurrences at: http://www.env.gov.bc.ca/cdc/ecology/index.html

(P * x) + (S * y) + (T * z) = EO Rank Value

where

P = weighting (%) assigned to primary rank factor
S = weighting (%) assigned to secondary rank factor
T = weighting (%) assigned to tertiary rank factor

and

x = numeric equivalent for primary rank factor rating
y = numeric equivalent for secondary rank factor rating
z = numeric equivalent for tertiary rank factor rating

and

each factor is rated in a 4 class scale (see section 4.4.2.c)

(Excellent) = 4

(Good) = 3

(Fair) = 2

(Poor) = 1

There are several methods of weighting the ranking factors (NatureServe 2002). The default values, known as the 'stairstep' method are: primary = 45%, secondary = 33% and tertiary = 22%. The weighting of numeric values for each factor vary depending on the relative importance of each factor (i.e., in some cases the tertiary factor may be of very little importance and in some cases all three factors are of equal importance). EO ranks have numerical value as indicated in Table 15.

Table 15 – Element Occurrence Rank numerical values.

Element Occurrence Rank	Numerical value
A	$> 3.25 \leq 4.00$
B	$> 2.50 \leq 3.25$
C	$> 1.75 \leq 2.50$
D	$> 1.00 \leq 1.75$

Examples of different methods of weighting the ranking factors are shown in Table 16, where x = good (3), y = excellent (4), z = fair (2) for all examples. Preferred weighting methods are described in EO specifications for individual or grouped Ecological communities.

Table 16. Example weighting methods

Methods	Weighted Values	Priority	Formula	Rank
Stairstep	P=45%, S=33%, T=22%	P>S>T	(45% * 3) + (33% * 4) + (22% * 2) =3.11	B=Good
Steep Stairstep	P=57%, S=33%, T=10%	P>>S>>T	(57% * 3) + (33% * 4) + (10% * 2) = 3.23	B=Good
Extreme Stairstep	P=70%, S=20%, T=10%	P>>>S>T	(70% * 3) + (20% * 4) + (10% * 2) = 3.10	B=Good
Even	P=33%, S=33%, T=33%	P=S=T	(33% * 3) + (33% * 4) + (33% * 2) = 2.97	B=Good
Tertiary of Low Weight	P=45%, S=45%, T=10%	P=S>>T	(45% * 3) + (45% * 4) + (10% * 2) = 3.35	A=Excellent
Primary of Greatest Weight	P=60%, S=20%, T=20%	P>>S=T	(60% * 3) + (20% * 4) + (20% * 2)	B=Good

4.6 Examples of Element Occurrences and Ranking

This section provides two cases evaluating a particular example of an ecological community to determine whether it represents an EO and, if so, what the EO Rank is. The second example incorporates a re-assessment of the Conservation Status of the riparian ecological community.

4.6.1 Riparian EO Ranking Example 1

1. Vegetation somewhat fits floristic composition of the ecological community in herb/shrub layer, the tree layer is deciduous only, and there is conifer regeneration in the shrub layer. Ten percent of vegetation cover is seeded agronomic mix. There is a sufficiently similar floristic composition to consider the community as an example of the element of interest.
2. Ecological community is a linear landscape type therefore landscape context is the primary factor, condition is the secondary factor, and size is the tertiary rank factor.
3. Viability criteria:
    a. Landscape context is highly fragmented (>35%), and the landscape is comprised mainly of roads, farms, urban settlements, and some active forest harvesting. Assessment: Poor (1)
    b. Condition: 10% cover of alien plants, some may be invasive, disturbance is harvesting of all mature conifers approximately 20 years ago, some mature deciduous remains, soil surface seriously disrupted in some areas, and recreational trails bisect the area. There is a dam 2 km upstream which influences the water levels. Assessment: Poor (1)

c. Size: the stand at River A runs from the confluence of Creek B and Creek C, down to a change in topography created by steep face of exposed bedrock (a total of 0.75 km). Small for typical community. Assessment: Fair (2)

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4. Assessment of Element Occurrence: this ecological community is somewhat representative of the element and may become more representative with time. However, the landscape context is highly fragmented and the effects on the long-term viability of the riparian system is in question, particularly in view of the fact that there is a dam upstream and the management of the dam may affect water levels. Also, there are alien plants present at the site and the amount of development in the area suggests this situation will not improve.
5. Final Element Occurrence Rank:

   $(P * x) + (S * y) + (T * z)$

   $(0.45 * 1) + (0.33 * 1) + (0.22 * 2) = 1.22$

   The value 1.22 indicates the final EO rank of D, Poor. This occurrence will not be used in the conservation ranking assessment, however, it will be mapped in the CDC database in the event that there are not sufficient examples of better condition to protect or restore.

4.6.2 Riparian EO Ranking Example 2

1. Vegetation fits floristic composition of the ecological community in herb/shrub layer, and tree layer (both conifer and deciduous). There is sufficient similarity to floristic composition to consider the community as an example of the ecological community at risk.
2. Ecological community is a linear landscape type therefore landscape context is the primary factor, condition is the secondary factor, and size is the tertiary rank factor.
3. Viability assessment:
   a. Landscape context is somewhat fragmented (<25%) by roads and some harvesting. There is active logging within 1 km of the riparian area but it is buffered by greater than 200 m of undisturbed forest. No settlements, farms, or other industrial activity within 10 km radius. Assessment: Good (3).
   b. Condition: Time since last major flood event seems to be greater than 50 years, minor flooding evidenced by presence of last years deciduous litter snagged in shrubbery and base of tree stems. No invasive alien plants, only two old springboard stumps present, animal trails evident, undisturbed soil surface. Stand age appears to be greater than 60 but less than 120 (cored conifer a: 116 yrs, cored conifer b: 87 yrs, cored conifer c: 65 yrs), multilayered canopy of mixed conifer/deciduous, good vertical and horizontal structure. Assessment Good to Excellent (3.5).
   c. Size: the stand at River A runs from the confluence of Creek B and Creek C, down to a change in topography created by steep face of exposed bedrock (a total of 0.75 km). Small for typical community. Assessment Fair (2).
4. Assessment of Element Occurrence: The floristic composition of this community represents an ecological community at risk. Landscape context indicates little fragmentation. Condition does not appear to be negatively affected by upslope harvesting or invasive alien plants. The natural flooding regime appears to be

unimpeded by activity upstream or downstream. There is no sign of anthropogenic disturbance apart from the springboard stumps; disturbance from this activity seems to

have recovered completely. The community is smaller than typical for this community type.

5. Final Element Occurrence Rank:

$$(P * x) + (S * y) + (T * z)$$

$$(0.45 * 3) + (0.33 * 3.5) + (0.22 * 2) = 2.94$$

The value 2.94 indicates the final EO rank of B, Good. This EO will be mapped in the CDC database and will be valuable in re-assessing the existing Element Conservation Status. The area may be highlighted as a site for potential preservation and special management by the appropriate resource managers.

6. Element Conservation Status Assessment:

This is now the 5th mapped EO of this community that is ranked as Good. There is one occurrence ranked Excellent, 10 ranked Fair, and 34 ranked Poor. Some 100 km of riparian systems are protected within a Park that lies within the range of this ecological community. While the area has not been inventoried or mapped, it is likely to include at least one good to excellent condition EO. Within the total range of this community type, there has been extensive harvesting of floodplain systems and there are likely few undisturbed examples of this ecological community in unfragmented landscapes.
Recommendation on Element Conservation Status: Leave as S2. An additional 10 to 20 Good to Excellent Viability EOs are required to upgrade the Status to S3.

Table A1.1. Size Classes for Ecosystem Groups (from Banner et al. 2014)

Ecosystem Group	A rating*	B rating*	C rating*	D rating*	Minimum size*
Matrix	> 2000	200-2000	20-200	< 20	2
Large patch	> 80	30-80	2-30	< 2	0.25
Small patch	> 40	10-40	2-10	< 2	0.05
Linear	> 20	8-20	1-8	< 1	0.25

* All measurements in hectares