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Spray Lakes Sawmills
305 Griffin Road W.
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Attn: Jason Mogilefsky

Re: Review of High Conservation Values Forest Assessment report (category 4)

Dear Jason,

Please find attached our review of the Spray Lakes Sawmills High Conservation Values Forest Assessment (HCVF) report, category 4 (Forest Areas that Provide Basic Services of Nature in Critical Situations).

As requested, this review was completed in March 2014 by Tom Boag (fisheries biologist) and Kate Sinclair (hydrologist) at Applied Aquatics Research Ltd. Our report includes introductory material outlining the relevant categories and questions used to guide the identification of high conservation value forests. We focus the review on HCVF Groups 10, 12, and 15, as these were specifically included in the Category 4 designation.

Please do not hesitate to contact us with any queries.

Sincerely,
Applied Aquatic Research Ltd.

Thomas Boag, M.Sc., P. Biol.
Senior fish biologist

Kate Sinclair, Ph.D.
Senior Hydrologist/Environmental Planner

Review of High Conservation Values Forest Assessment report, Category 4, Spray Lakes Sawmills

1.0 Introduction

Applied Aquatic Research Ltd. (AAR) was commissioned by Spray Lakes Sawmills (SLS) to provide an independent review of Category 4 of their High Conservation Value Forest Assessment (HCVF) report (SLS 1980). This report presents results of an assessment for the presence of High Conservation Value (HCV) attributes on the Spray Lake Sawmills (SLS) Forest Management Agreement area (FMA). This FMA encompasses approximately 2,866 km^2 of the Rocky Mountain front ranges and foothills in southern Alberta, Canada, and is divided into two distinct areas separated by the Bow Valley corridor. The South FMA lies entirely within the Rocky Mountain Natural Region (comprised of Alpine, Subalpine, and Montane natural subregions), and the North FMA lies within the Rocky Mountain and Foothills natural regions, which account for 20% and 80% of the South FMA land area, respectively.

The AAR review was completed by Tom Boag (fisheries biologist) and Kate Sinclair (hydrologist). It provides an overall assessment of Category 4, followed by more detailed comments regarding the fisheries and watershed aspects of the report.

The concept of a HCVF focuses on the environmental, social, and/or cultural values that make a particular forest area outstandingly significant. HCVs are identified through a detailed assessment process (FSC 2004), and a HCVF must possess one or more of the attributes described by the categories listed in Table 1.

Table 1. HCVF categories.

Category 1	Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered species, refugia).
Category 2	Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.
Category 3	Forest areas that are in or contain rare, threatened or endangered ecosystems;
Category 4	Forest areas that provide basic services of nature in critical situations (e.g., watershed protection, erosion control).
Category 5	Forest areas fundamental to meeting basic needs of local communities (e.g., subsistence, health).
Category 6	Forest areas critical to local communities, traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

The identification of forest attributes and the assignment of a HCVF into a relevant category is guided by a series of key questions, which are associated with follow-up definitive and guidance questions (Table 2).

Table 2. Key, Definitive and guidance questions for the HCVF assessment for fishes, their habitat and hydrology.

Key Question	Definitive Question	Guidance Question
Question 1. Does the forest contain species at risk or potential habitat of species at risk as listed by international, national or territorial/provincial authorities?	*Are any of the rare, threatened or endangered species in the forest a species representative of habitat types naturally occurring in the management unit?*	*Are any of the rare, threatened or endangered species in the forest a focal species?* *Are there any ecological or taxonomic groups of rare species that would together constitute a HCV?* *Do any of the identified rare, threatened or endangered species (individually or concentration of species) have a demonstrated sensitivity to forest operations?* *Does the forest contain critical habitat for any individual species or concentration of species identified in the above questions?*
Question 4. Does the forest contain critical habitat for regionally significant species (e.g. species representative of habitat types naturally occurring in the management unit, focal species, species declining regionally)?	*Is the regionally significant species in significant decline as a result of forest management?*	*Is the population of regionally significant species locally at risk?* *Does the forest contain limiting habitat for regionally significant species?* *Are there any ecological or taxonomic groups of species or sub-species that would together constitute a regionally significant concentration?*
Question 12: Does the forest provide a significant source of drinking water?	Is there a sole available and accessible source of drinking water?	Are there watershed or catchment management studies that identify significant recharge areas that have a high likelihood of affecting drinking water supplies?
Question 13: Are there forests that provide a significant ecological service in mediating flooding and/or drought, controlling stream flow regulation, and water quality?	Are there high risk areas for flooding or drought?	Are there particular forest areas (i.e., a critical subwatershed) that potentially affect a significant or major portion of the water flow (e.g., 75% of water in a larger watershed is funneled through a specific catchment area or river channel)? Does the forest occur within a sub-watershed that is critically important to the overall catchment basin? Are there particular forest areas (i.e., a critical subwatershed) that potentially affect water supplies for other services such as reservoirs, irrigation, river recharge or hydroelectric schemes?

Question 14: Are there forests critical to erosion control?	Are there forest areas where the degree of slope carries high risk of erosion, landslides and avalanches?	Are there soil and geology site types that are particularly prone to erosion and terrain instability? Is the spatial extent of erosion-prone or unstable terrain such that the forest is at high risk (also of cumulative effects)?
Question 15: Are there forests that provide a critical barrier to destructive fire?	***Not relevant to forest ecosystems in Canada.***	
Question 16: Are there forest landscapes (or regional landscapes) that have a critical impact on agriculture or fisheries?		Are there agricultural or fisheries production areas in the forest that are potentially severely negatively affected by changes in wind and microclimate and microhabitat?

2.0 Scope of the Review

Of the 16 HCVF groups identified in the SLS HCVF report, 3 are identified as having Category 4 attributes (Table 3). HCVF groups 10 and 12 have attributes that relate to fisheries and are guided by Key Question 16. As HCVF Group 12 also falls into Category 1 (Key Question 3: *Does the forest contain species at risk or potential habitat of species at risk as listed by international, national or territorial/provincial authorities?*), we primarily focus on the Category 4 designation, but take into account the critical habitat values described by Category 1. HCVF Group 15 has attributes that relate to the hydrological characteristics of the region (Key Question 13).

Table 3. HCVF Groups and assessment details

HCVF Group #:	10	**Ecological Scale:**	Community/Habitat Level
Category:	4	**Key Question:**	16
HCVF attribute:	Critical Impact on Fisheries		
HCV(s):	Important stream reaches identified by AESRD as pure westslope cutthroat trout population sites and known bull trout spawning sites.		
HCVF Group #:	12	**Ecological Scale:**	Landscape Level
Category:	1 and 4	**Key Question:**	3 & 16
HCVF attribute:	Significant Concentrations of Biodiversity Values/Critical Impact on Fisheries		
HCV(s):	The Highwood River watershed portion of the FMA designated as a Nationally Significant ESA/ The Red Deer River watershed portion of the FMA designated as a Nationally Significant ESA		

HCVF Group #:	15	**Ecological Scale:**	Landscape Level
Category:	4	**Key Question:**	13
HCVF attribute:	Significant Ecological Service		
HCV(s):	The Elbow River main stem and its adjacent alluvial aquifer		

3.0 Review

3.1 Overall Comments

SLS provide a detailed assessment of HCVF areas within their FMA. Category 4 conservation values (Key Questions 12–16) are described in sufficient detail to enable a good understanding of the relevant environmental attributes of each HCVF group. We do, however, propose some revisions, particularly to the way that the management of recharge areas, and the impact of harvesting on peak flows in spring are addressed. These points are discussed in more detail below.

We concur with the selection of Westslope Cutthroat Trout and Bull Trout as appropriate HCVF species given their status provincially and nationally. Their greatest threat comes from access into their habitats. Specifically, erosion associated with road ditches, crossings on approach slopes to watercourse crossings, uncontrolled ATV operation within the channel, and human predation associated with access. This is well documented in the SLS report.

In relation to the maps used in the report; these are very useful and well-constructed, but they have very poor resolution, making it difficult to even identify river channels and catchment areas. We recommend that these are output at higher quality throughout the document.

3.2 Specific Comments

We suggest that the sentence on p. 35: “This ecoregion did support 1 endemic mammal species…”, be changed to: “This ecoregion does support 1 endemic mammal species, 1 endemic amphibian, 2 fish species (Westslope Cuttroat Trout and Bull Trout)…”

Further there is an apparent discrepancy in the report between the results of Ripley et al. (2005), who found a significant negative relationship between road density and the probability of finding a Bull Trout (p.55), and Townsend (see p. 85), who found no significant difference between streams associated with logging and the control sites. We feel that it is important to note here that, particularly for Quirk Creek, the disruption to fish habitat may not be directly related to logging, but is associated with higher ATV use within the catchment. The access for ATVs is primarily via logging roads.

Key Question 4: Does the forest contain critical habitat for regionally significant species?

Table 6 lists regionally significant species and habitat associations. Included in the table are Bull Trout and Westslope Cutthroat Trout. The authors also list Bull Trout and Westslope Cutthroat Trout separately in the list which follows as "mortality limited" (Bull Trout) and "process limited" (Westslope Cutthroat Trout). This is true; however, like Westslope Cutthroat Trout, Bull Trout are also vulnerable to "process limitation". Bull Trout hybridize readily with Brook Trout when their age overlaps within a watershed. Like Bull Trout, Cutthroat Trout are also vulnerable to human predation. We would argue that both should be "process and mortality limited"

Key Question 12: Does the forest provide a significant source of drinking water?

This section provides a good overview of the key hydrological characteristics of the Red Deer and Bow River basins, and the seasonal hydrological regime (snow, glacial melt, and ground water contributions).

We agree with the conclusion that forests in the SLS FMA do not provide a significant source of drinking water compared to snowmelt on the eastern slopes of the Rocky Mountains. However, we recommend that:

1. **SLS provide some estimates of the water use required for their forestry operations, both currently and in future years.**

This section of the report also addresses the guidance question: *Are there watershed or catchment management studies that identify significant recharge areas that have a high likelihood of affecting drinking water supplies?* Given that anywhere from 25% to 45% of annual surface water volumes in Alberta are provided by discharge of groundwater into rivers and streams (AWRI, 2009), the modification of recharge areas by forestry activities is a key potential impact on water resources and aquatic habitats in the Bow and Red Deer river basins.

The SLS HCVF report outlines the recharge/discharge areas in the Red Deer River watershed (p.82), but we recommend that:

2. **Additional comments are added to describe the proportion of SLS FMA land located within recharge areas, and the potential disturbance to recharge areas by forestry activities.**

In this context, we suggest that the discussion is updated with respect to the 2011 Alberta Water Research Institute (2009) groundwater report, available at the Alberta Water Portal at: http://water-alberta.net/docman-view-document, and other relevant literature (e.g., Hayashi and van der Kamp, 2009).

The discussion of climate change effects on snowmelt and stream flow east of the Rocky Mountains (p.85–86) is highly relevant to future water availability in the SLS FMA. However, the last paragraph of p.85 needs some clarification and reference to relevant literature.

This paragraph states that:

"Climate change and warming trends may impact the timing of stream flows. A smaller percentage of precipitation is expected to fall as snow in winter, resulting in less snow available for spring melt and lower stream flows in spring. A decreased peak flow in spring would be expected to occur earlier. Winter flows would be expected to increase, as more winter precipitation falls as rain."

3. **The statements regarding climate change effects on the seasonal hydrograph in Alberta need further explanation and clarification.**

For example, long-term shifts in the timing of streamflow have been observed for snowmelt-dominated basins throughout western North America since the late 1940s (Mote, 2003; Regonda et al., 2005; Rood et al. 2005, 2008). These shifts represent an advance to earlier streamflow timing by one to four weeks in recent decades relative to conditions that prevailed in the 1950s through to the mid-1970s (Stewart et al., 2008). Studies have also found that winter flows have increased slightly due to increases in temperature (Karl et al., 1993) and the fraction of precipitation falling as rain (Mote, 2003). However, decreased flows have occurred in April/May in Canada (Stewart et al., 2008), and there is evidence of significant 20th century declines in the annual flow of Alberta rivers flowing to Hudson Bay and the Arctic Ocean (Rood et al., 2005).

In summary, our key recommendations for this section are to:

- Add a description of current and potential future water use within the FMA (for forestry operations) on p.78 and/or p.85 (Future Considerations).
- Add a description of the proportion of SLS FMA land located in groundwater recharge areas.
- Expand the section that addresses climate change effects on the hydrology of Alberta, and include additional references.

Key Question 13: Are there forests that provide a significant ecological service in mediating flooding and/or drought, controlling stream flow regulation, and water quality?

The effect of forest harvesting on catchment water yields is well-described in the HCVF report. Particular attention is paid to the potential of forest harvesting to accelerate spring melt by removing the shading capacity of the forest canopy, and accelerating spring snow melt at high elevations. As presented in Table 8 of the HCVF report, forest harvesting in the SLS FMA has the potential to increase peak flows in spring given: a larger harvested area, additional harvesting at higher elevations, less wetland storage (and faster runoff), and a greater area of impervious surfaces associated with road construction.

These effects are modelled with the University of Alberta Equivalent Clearcut Area (ECA) model. This model estimates the 'hydrologically effective disturbance' area in forested regions subject to harvesting and clearcuts. Using this model, SLS has implemented a management plan that maintains maximum ECA below 20% disturbance for the first 25 years. The HCVF

report notes that using this threshold, "SLS's harvest levels are expected to have minor effects on water yield that are within the normal range of variation."

The model is used to produce water yield projections over a 200-year period using long-term average climatic conditions. We have two key concerns about this approach:

1. Given the high variability (temporal and spatial) in precipitation (Mwale *et al.*, 2005; Jiang *et al*., in press), snow accumulation and melt, and river flows in Alberta, **the long-term average climatic conditions may not sufficiently represent future climate variability.** Thus, the projection of future water yield based on historical climate data may contain a high margin of error. This needs to be addressed in the description of the modelling approach.

2. **There is no quantification of the effect of harvesting on the seasonal hydrograph, which is particularly important during extreme peak flows.** Given the floods of June 2013 in the Bow River catchment, we feel that this is a crucial aspect of the report that needs to be updated. The last paragraph of page 90 notes that the effect of harvesting on peak flows is not likely to be significant in large watersheds (<200 km^2), but we question the effect of clearcut regions during an extreme runoff event (such as June, 2013) when the water table is high, snowmelt is at its seasonal maximum, and there is the additional delivery of a high volume of rainfall.

Given extreme variability in flood volumes experienced recently across the province, some reference to climate change effects on the seasonality of peak flows (discussed above) should also be made. Earlier peak spring discharge may result in less streamflow being captured safely in key reservoirs, which has important implications for water management in Alberta.

In this context, the discussion of the effects of flooding on the Bragg Creek community (p. 95) needs to be updated with additional information regarding the 2013 flood. Further, we recommend that specific management objectives are identified, such as communication strategies for liaising with provincial and City of Calgary water resource planners to mitigate the effects of forest harvesting on spring peak flows in the Bow River catchment.

Key Question 14 (Are there forests critical to erosion control?) and 15 (Are there forests that provide a critical barrier to destructive fire?)

Neither Key Question 13 nor 14 were considered relevant for the identification of HCVF Groups in the SLS FMA (Table 3). While, the HCVF report acknowledges that there are slopes within the SLS FMA that are critical for erosion control, we agree that this risk has been described adequately and mitigated within the FMA by excluding these from harvest.

Key Question 16: Are there forest landscapes (or regional landscapes) that have a critical impact on agriculture or fisheries?

This section highlights the importance of the Highwood and Sheep rivers in terms of supporting the Bow River rainbow trout population, and in providing spawning grounds for Bull and Cutthroat Trout. Both Bull Trout and Cutthroat Trout are species of management concern in Alberta. The Cutthroat Trout is listed as a threatened species in Canada, with the survival of local populations dependent on a five-year recovery plan. As outlined in the SLS report, there are several streams on the FMA with the potential to contain Cutthroat Trout populations with genetic purity values of 0.99 or more.

The HCFV report provides a good overview of the current knowledge of Cutthroat Trout populations and their genetic diversity, and SLS makes a commitment to work with the Westslope Tout Recovery Team to implement recommendations included in the recovery plan.

4.0 Summary

SLS has provided a thorough assessment of Category 4 HCVF areas within their FMA. We outline some minor additions and clarifications that will strengthen the report. These include the inclusion of Bull Trout and Cutthroat Trout as process and mortality limited; a description of the water use required for forestry operations, both currently and in future years; a better overview of the proportion of the SLS FMA located in groundwater recharge areas; and a more comprehensive description of climate change effects on precipitation, the timing of snow melt, and the seasonal hydrograph in Alberta.

The major revisions that we suggest concern the modelling approach used for the 200-year water yield projections. Our concerns are based on the error associated with using historical climate data make projections of climatic conditions over the next 200 years. There is also no estimate of the effect of forest harvesting on peak spring flows, which has very important implications for flooding, particularly in the South FMA near Bragg Creek.

5.0 References

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