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September 2, 2011

Mr. Eric Lloyd
Box 442
Bragg Creek, Alberta
T0L 0K0

Dear Eric,

Re: Recommendations for Forest Harvest in Southwest Alberta Foothills and Front Ranges

You have asked me to provide recommendations for forest harvest practices that will protect aquatic ecosystem integrity in the foothills and front ranges of southwest Alberta. The following recommendations are based on a brief review of effects literature and forestry guidelines as well as my personal knowledge of the Castle, Crowsnest, Oldman, and Bow watersheds and experience developing environmental mitigation measures and operating guidelines over the last 33 years.

Key Issues

Available literature indicates that the key effects of the forestry sector on aquatic integrity in Western North America are caused by: erosion from forestry roads; and direct and indirect loss or alteration of in-stream and riparian habitat. Changes in sediment and nutrient transport, water yield, channel structure, stream temperature, and in-stream habitat affect the amount and quality of flowing water, gravel substrates, food, and cover required by fish and other aquatic organisms (Hartman and Scrivener 1990; Chamberlin et al. 1991; Waters 1995).

Provincial ground rules (ASRD 2004) state that the objective of watershed protection and harvest planning is: "To design harvest layouts that minimize the impacts of harvest operations on water yield, regime and quality, watercourse structure, soils, cover and riparian habitat for fish and wildlife."

The following mitigation measures are recommended to reinforce or supplement those identified in Alberta's provincial ground rules.

1. Erosion Control Measures

Standard Operating Practices to control erosion are essential for protection of water resources and aquatic integrity (e.g., FSC 2004) and these should be developed for southwest Alberta. These standard practices should include:

- identification of unstable soils, slopes, and ground surfaces by a qualified geomorphologist and avoidance of these sensitive areas during road planning, layout, construction, and decommissioning;
- maintaining undisturbed riparian buffers on all water source areas, ephemeral and intermittent streams (30 m), small permanent streams (30 m), large permanent streams (60 m) and waterbodies (100 m);
- avoiding haul roads and landings on slopes $>30^{o}$ and in riparian buffers specified above;
- avoiding harvesting on slopes $>45^{o}$;
- minimizing the size of landings;
- identifying levels of permissible harvest in steep or otherwise sensitive watersheds;
- minimizing the number of stream crossings and using temporary crossings where feasible;
- directing drainage from disturbed sites (particularly roads and landings) onto stable, vegetated upland areas where downslope runoff is checked;
- prompt regeneration of roads, landings, and skid trails;
- use of arch culverts or bridges at intermittent, small permanent, and large permanent stream crossings;
- design crossing structures to accommodate peak flows, including increased water yield associated with harvesting activities;
- regular inspection and repair/replacement of drainage culverts and crossing structures; and
- implementing a monitoring/inspection program to confirm that Standard Operating Practices are being implemented and erosion is being controlled.

Rationale

Available science indicates that erosion control should particularly focus on roads, skid trails, areas with steep slopes, and water crossings.

> Logging-related effects are most commonly documented in steep ($>25^{o}$) tributary basins (e.g., Davies and Nelson 1993). In these areas, logging increases water yield because less incoming precipitation is lost to evapotranspiration. Road construction reduces the time from peak precipitation to peak flows by rerouting subsurface flow through ditches to streams (thus making streams 'flashier' and increasing their erosive power). Logging and road construction also exposes more mineral soil which can be eroded and transported into ephemeral or active channels, and thereby increase long-term sediment yield (Hartman and Scrivener 1990).
>
> There is widespread recognition of the adverse effects of increased sediment input on fish and other aquatic organisms (e.g., Newcombe and MacDonald 1991). Roads in the Alberta foothills are the largest source of sediments from human activities (Anderson and Anderson 1987). The relative

> contribution of sediment appears to be minimal from yarding (but higher if heavy machinery is used near streams), low from selective cutting or patch cutting, moderate from clear-cutting, moderately high from skid trails, and very high from logging roads (particularly those near streams or those that increase risk of mass soil failures and landslides) (Waters 1995).

Available science indicates that ephemeral and intermittent stream channels and riparian habitat warrant protection.

> Although Alberta Ground Rules note that disturbance of ephemeral and intermittent streams can lead to downstream sedimentation, they require buffer retention in ephemeral and intermittent streams only where fisheries values are demonstrated to be present. Research has shown that such small waterbodies are very important to the quality of downstream habitats and are most easily altered by forestry activities. They are also a source of organic material (energy) to downstream areas and this input is disrupted for some time following forest harvest (Chamberlin et al. 1991; Davies and Nelson 1993). Buffer retention along all ephemeral and intermittent tributaries is therefore recommended to protect aquatic integrity, regardless of whether or not these tributaries have demonstrated fisheries potential.

2. In-Stream and Riparian Habitat Management Measures

Standard Operating Practices to maintain in-stream and riparian habitat should be developed for southwest Alberta. These standard practices should include:

- classifying waterbodies and associated riparian areas according to ecological sensitivity and likelihood of adverse effects by a qualified biologist;
- avoiding the most sensitive waterbodies during road planning, layout, construction, and decommissioning;
- identifying site-specific special operating conditions (i.e., habitat protection measures) and least-risk activity period(s) for each class of waterbodies identified above;
- avoiding in-stream activities outside the specified least-risk period(s);
- maintaining undisturbed riparian buffers on all water source areas, ephemeral and intermittent streams (30 m), small permanent streams (30 m), large permanent streams (60 m) and waterbodies (100 m);
- prompt restoration of damaged stream channels, banks and riparian areas;
- minimizing the number of stream crossings and using temporary crossings where feasible;
- use of arch culverts or bridges at intermittent, small permanent, and large permanent stream crossings;
- design crossing structures to accommodate peak flows, including increased water yield associated with harvesting activities;
- regular inspection and repair/replacement of crossing structures; and
- implementing a monitoring/inspection program to confirm that Standard Operating Practices are being implemented and in-stream and riparian habitat is being adequately managed.

Rationale

Available science indicates that intact in-stream and riparian habitats maintain long-term aquatic integrity.

In-stream habitat provides the food, cover, and reproductive/overwintering areas required by fish and other aquatic organisms. Direct or indirect loss or alteration of this habitat affects the growth, survival, distribution and numbers of these organisms (Hartman and Scrivener 1990). Riparian habitat provides energy to waterbodies and also regulates temperature and sediment/nutrient input. Clearing of riparian areas alters these processes and can lead to increased bank erosion, altered stream channel dimensions, lowered groundwater table and summer flows, increased summer water temperatures, and winter icing (Chamberlin et al. 1991; BCF and BCE 1995a,b). As the total amount of in-stream and riparian disturbance increases, risk of adverse effects increases (BCF and BCE 1995a), so reducing incremental loss of in-stream and riparian habitat will benefit aquatic integrity.

Available science indicates that culvert crossings have a high failure rate and fragment stream channels for migratory fish species such as those found in southwest Alberta.

Active stream crossings are often a chronic source of sediments and in-stream and riparian habitat changes. A frequently overlooked source of riparian habitat loss is water crossings, with a recent study concluding that 0.06 ha of riparian habitat was lost at each road crossing (Harper and Quigley 2000). An inventory of road crossings in the Prince George Forest District found that 36% of surveyed road culverts were barriers to movement (Harper and Quigley 2000). A similar study in the Alberta foothills near Edson found that 29% of surveyed road culverts were probable barriers to movement, and 40% were possible barriers (Marshall 1996). Road crossing density was positively associated with fine substrate and embeddedness and negatively correlated with trout standing stocks in a foothills study area (Eaglin and Hubert 1993). Minimizing the number of stream crossings and using least risk crossing methods will reduce cumulative effects on fish and other aquatic organisms.

Closure

I trust that these recommendations are sufficient for your purposes. Please feel free to contact me at (403) 266-6363 with any comments or questions.

Yours truly,

T.M. (Terry) Antoniuk, P.Biol., RPBio.

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