



**Forest
Practices
Board**

Pine Beetle Salvage Logging and Water Flows near Williams Lake, BC

FPB/IRC/166

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Introduction

The Complaint

In December 2008, the Forest Practices Board received a complaint from a rancher about proposed salvage harvesting of mountain pine beetle killed trees in the Big Creek area southwest of Williams Lake. The complainant was concerned that harvesting by Tolko Industries Ltd. (the licensee) would exacerbate the already altered hydrology of the area and impact water supplies.

Background

Twinflower Creek is an 8,500 hectare watershed and a tributary to Big Creek, west of Williams Lake on the Chilcotin Plateau. The complainant has a ranch on an alluvial fan midway up the watershed. There has been extensive harvesting on the Chilcotin Plateau, to address the current and historic mountain pine beetle infestations. Approximately 42 percent of the Twinflower Creek watershed above the fan has been harvested, mostly in the 1970s.

The complainant holds a water use licence for power generation for residential use on Twinflower Creek. He does not have a licence for drinking water. The only licence for drinking water on the creek is approximately 12 kilometres downstream from the ranch. The complainant gets drinking water from a well, but uses the creek for drinking water when the well is dry. He has a licence for irrigation purposes from a separate watershed.

There is a history of flooding and erosion events on the complainant's property. In 1989, in an attempt to mitigate the flooding and erosion problems, the Ministry of Forests and Range (MFR) excavated the creek through the property at the request of the landowner at the time. In 1991, a major storm (at an intensity only expected to occur every 200 years) caused considerable damage to the ranch. The creek was scoured, with eroded material deposited on the rancher's fields. After this event, a hydrologist determined that the 1989 excavation had made the creek channel more susceptible to damage.

The rancher says that in recent years old logging debris has plugged the creek and his water intake, and that sediment has filled his reservoir and water pipe. He also believes the excavation of the creek contributed to the drying up of the meadows on his property, which has required him to install additional irrigation equipment.

The rancher is concerned that the salvage harvesting will result in a significant increase to the peak flows in Twinflower Creek, with the potential for subsequent damage to his property. As well, he is concerned that there will be less water in the summer for irrigation and watering livestock.

The rancher is also concerned about the fire risk that further logging may create because of previous fires in the area, which were caused by machine operations. Given the isolated location of the ranch, he fears that the fire-fighting response from Williams Lake may be delayed, putting his ranch at risk.

This investigation considered the following questions:

Water:

1. What are the legal requirements for managing water during forest operations?
2. What does the research say about the effects of harvesting on hydrology?
3. What is the current situation and expected impact of harvesting on the watershed?
4. What might happen?

Fire Risk with Proposed Harvest:

5. What are the legal requirements?

Discussion

What are the legal requirements for managing water during forest operations?

The *Forest and Range Practices Act* (FRPA) requires licensees to address specific government objectives in their forest stewardship plans (FSP). The objective that relates to this issue is found in section 8 of the *Forest Planning and Practices Regulation* (FPPR) which states:

The objective set by government for water, fish and biodiversity within riparian areas is, without unduly reducing the supply of timber from British Columbia's forests, to conserve, at the landscape level, the water quality, fish habitat, wildlife habitat and biodiversity associated with those riparian areas.

Section 46 of the *Forest and Range Practices Act* prohibits a person from carrying out a forest practice that causes damage to the environment, unless acting in accordance with a plan, authorization or permit.

FRPA has specific requirements for community watersheds, but does not have a requirement to complete a watershed assessment of the impact of forestry activities on licensed waterworks. The practice requirements in the FPPR require that a person must not damage licensed waterworks, or harvest or construct a road within 100 metres of waterworks used for human consumption unless there will be no increase in sediment delivery to the water intake.

If a licensee complies with the riparian reserve and management zone regulations of FRPA, no further management of cumulative hydrological impact resulting from mountain pine beetle

attack or salvage harvesting is required. However, a licensee must ensure that the legal objectives for water quality are met and that no damage to the environment, as defined in FRPA, results. It is up to the licensee to decide how to assess whether its practices will meet these objectives.

In summary, the licensee must meet the practice requirements, but there is no onus on the licensee to conduct assessments on Twinflower Creek.

What does the research say about the effects of harvesting on hydrology?

Disturbance of forest stands, either through harvesting or the killing of trees by the mountain pine beetle, results in a variety of hydrological effects within a watershed. The 'peak flow' in streams is linked to the amount of clearcut area in the watershed. Snowpack in clearcuts accumulates to greater depths than in forested areas because of the loss of tree canopy interception. In the spring, the snowpack melts more rapidly in clearcuts because of the lack of shade. Depending on the amount of clearing, the net effect can be higher peak flows occurring earlier in the season, compared to those that occur in a mature, non-harvested forest. These higher peak flows can affect water quality and stream channel stability.

Studies in BC indicate that a stand of dead conifer trees will continue to provide approximately 50 percent of the hydrological function of a live stand, after the conifer trees have lost their needles. Allowing a stand to die, decay and regenerate naturally will result in a slower rate of hydrological change, compared with clear cut harvesting which results in an immediate change to a maximum equivalent clearcut area (ECA) level. However, the natural process also prolongs the hydrological recovery of the area. Research on the Fraser Plateau indicates that stands regenerating after clearcutting will be hydrologically similar to a clearcut for about 12 years, but by 35 years, the regenerated stands will be providing a similar hydrological function as a mature stand.

In its 2007 study of the impact of the mountain pine beetle infestation on the hydrology of the Baker Creek Watershed, the Board commented on the management dilemma that while salvage harvesting will lead to higher peak flow changes, not harvesting may leave stands vulnerable to fire and slower hydrological recovery.¹ More recently, the significance of the fire risk has been questioned, and it is not regarded as an issue after the needles drop, though it remains a potential hazard once the trees fall to the ground.

With regard to impacts on low flows, there is no indication in recent BC research reports that existing summer water shortages would be reduced further by harvesting. Theoretically,

¹ Forest Practices Board, 2007. *The Effect of Mountain Pine Beetle Attack and Salvage Harvesting on Streamflows*. SIR 16.

increased runoff from harvesting could reduce the availability of water in the summer, but this is apparently rarely observed.² More commonly, field studies have found either no effect or only slight increases in low flow.³⁴

What is the current situation and expected impact of harvesting on the watershed?

The licensee proposes to harvest approximately 292 hectares in several cutblocks, all at higher elevations and more than 200 metres from the creek (photo 1). The licensee describes the stands within the blocks as having a “greater than 90 percent” pine component.



Photo 1: View of Twinflower Creek watershed with 1970s logging in foreground and mature stands in the higher elevations in the background.

² Carver, M, 2001. *Using indicators to assess hydrologic risk*. IN: Watershed Assessment in the Southern Interior of British Columbia: Workshop Proceedings. Penticton March 9-10, 2000. Ministry of Forest. Working Paper 57.

³ Uunila, L, B.Guy and R. Pike. 2006, *Hydrologic Effects of Mountain Pine Beetle in the Interior Pine Forests of British Columbia: Key Questions and Current Knowledge*. Streamline. Watershed Management Bulletin vol.9 (2).

⁴ Redding, T., R. Winkler, P.Teti, D.Spittlehouse, S. Boon, J. Rex, S. Dube, R.D.Moore, A.Wei, M.Carver, M.Schnorbus, L.Reese-Handsen, and S. Chatwin. 2008. *Mountain pine beetle and watershed hydrology*. J. of Ecosystem Management. 9(3).

In 2009, the licensee reassessed the watershed, determined both the current and projected equivalent clearcut area (ECA) and had a consultant review the data. The consultant, who had previously assessed the creek in the field in both 1999 and 2002, estimated the current ECA to be about 28 percent, approximately 7 percent of which was old cutblocks, with most of the remainder being due to mature pine killed by the mountain pine beetle (photo 2).

Because the standing dead trees continue to intercept some snow and provide shade, modifying snow melt, the area of dead pine is considered to be at 50 percent ECA, whereas a clearcut is 100 percent ECA. The proposed harvest will increase the ECA in the watershed to 33 percent. The consultant advised that, although the increase in ECA is not large, the location of the cutblocks at higher elevations increases the peak flow risk and, because of the known sensitivity of the creek channel through the alluvial fan, caution is appropriate.

The peak flow hazard index (PFHI), in which both the ECA and road densities are considered, can be a more meaningful measure of potential impacts. The index measures on a scale between 0 and 1.0 with above 0.5 considered a moderate hazard and above 0.7 considered a high hazard for peak flow changes. When this cutting permit was previously being considered in the late 1990s, the MFR regional hydrologist recommended that the PFHI for the watershed should not exceed 0.5. Since then, the mountain pine beetle has impacted the watershed. Tolko estimates that the current PFHI is about 0.66 and this will increase to 0.78 with harvesting. The risk of increased peak flows and associated channel changes, possibly bank erosion, would be in the “high” category for an estimated five to eight years.



Photo 2: View of extensive areas of dead pine in the Twinflower Creek watershed.

What might happen?

This is somewhat unknown. The PFHI indicates that there will likely be an increase in the peak flow of Twinflower Creek, primarily due to the mountain pine beetle attack and further elevated by the new harvesting. In describing the risk ratings in the 1999 Interior Watershed Assessment Procedure (IWAP), Carver (2001) explains that a high risk rating means that the assessed level of forest development is likely to cause changes to the hydrologic regime, and that the probability of a significant hydrological impact is 50 to 75 percent. Given the previous instability of the lower portion of the creek, this raises some concern about impacts on the rancher's property.

However, the potential for damage on the property has apparently changed since the 1991 storm event. The excavation work done by MFR in 1989 increased the channelization of the creek and reduced the likelihood that it would overflow its banks and damage surrounding land. In its recent review for the licensee, the consultant described the stream channel through the rancher's property as sensitive to peak flow changes, however, an MFR hydrologist explained that although the banks would continue to slough, the channel location was more stable because the channel had been scoured down to a small canyon and should be less affected by peak flows. According to the rancher, the creek continues to get wider and deeper in areas through his property.

Based on a 1999 channel assessment, the hydrologist consultant described the channel reaches upstream from the rancher's property as being stable and generally buffered by vegetation, with slight to moderate sensitivity. This is supported by a report from the MFR hydrologist, who noted the stable condition of the channel above the fan based on an aerial inspection.

The licensee's view is that, even though the PFHI is already close to high and will increase with harvesting, the increased risk is balanced against a faster recovery of the watershed to full hydrological function with harvesting and reforestation than if the dead stands were left to recover naturally. The licensee's analysis shows that the increased risk from harvesting (upper line in Figure 1) will last for about 20 years, beyond which the watershed will be functioning at a higher level hydrologically than if the dead stands are not harvested. However, this assumes that there will be no further impacts from natural hazards such as fire, insects or disease in that time.

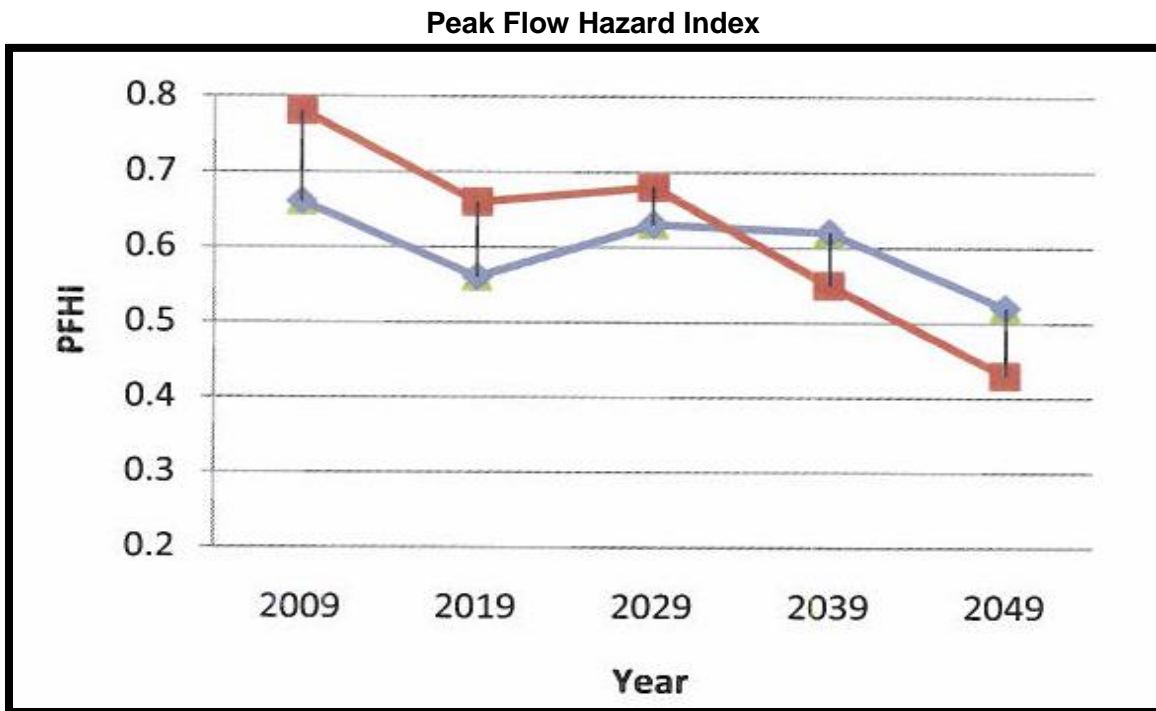


Figure 1 (source: Tolko), Change in Peak Flow Hazard from Harvesting (upper line) over time, vs. no Harvesting (lower line).

Based on advice from its consultant, the licensee made commitments to mitigate the impacts of the harvesting on the watershed, including ensuring that:

- Appropriate buffers are placed along Twinflower Creek and other tributaries.
- Prompt road deactivation occurs post harvest to restore natural drainage. The main road across over Twinflower Creek will be blocked at the bridge to restrict access into the watershed. This should reduce the potential for human started fires and protect the integrity of the road deactivation works.
- Ditches as well as road segments may be removed to reduce lateral connectivity of water and sediment.
- Exposed soils, namely roads, will be grass seeded at time of road deactivation to minimize erosion.
- Non-pine leading types, including non-pine regeneration areas within the block (provided they are greater than 0.25 hectares in size) will be retained to provide further structure and shading in an effort to regulate snow melt. Several internal WTPs have been established and will be maintained post harvest.
- Existing culverts/bridges within the watershed are inspected to ensure that they are conservatively sized and any damaged or undersized culverts are replaced as necessary. The licensee did a culvert replacement of the existing structure at km 2,412 (Twinflower

Creek) two years ago, as it was identified as a priority for safe fish passage and to bring the crossing up to Q100 standard.

- Culverts or bridges are placed at all stream crossings and groundwater seepage areas for the new and upgraded roads that are associated with the permit.
- Harvesting will occur during the winter to minimize soil compaction and rutting. Based on the soil types and site series, the bulk of the blocks are more appropriate to winter harvest.
- Post-harvest regeneration in areas that have been deemed for planting as soon as possible.

The licensee has committed to meeting government's water quality objective and implementing the above mitigation plan to minimize risks. However, under FRPA, results, not planning are the focus and since the FRPA objective for water is vague, it is not clear how it would be applied or enforced in this situation. Regardless, the licensee believes that its mitigation measures will protect water quality from its actions, but points out that it cannot control all factors.

There has not been a formal, full watershed assessment completed for the area, but under FRPA one is not required. The IWAP guidebook indicates that a field review, and possibly a channel assessment by a qualified professional, is the next step in the procedure. As noted, some field review, including assessing the channel, was done in the past.

When FRPA replaced the Forest Practices Code (the Code) in 2004, the process for planning and approving forest practices changed. Under FRPA, licensees have the responsibility for deciding what forest practices are appropriate to be consistent with government's legislated objectives, whereas under the Code licensees were required to receive approval for specific cutblock plans.

Now, MFR's only involvement in planning is to review the licensee's forest stewardship plan (FSP) to determine whether it is consistent with the government objectives stated in FRPA. Government expects licensees to conduct assessments as they deem necessary and to conduct their practices in a manner that avoids problems. Once the FSP is approved, MFR no longer has a significant role in managing issues that may arise with landowners, except through enforcement action after the fact. When a cutting permit application is made, district managers have little ability to refuse to issue it, even if they anticipate problems.

So in terms of watersheds, while the licensee's site plans must be consistent with its FSP and the FRPA objective for maintaining water quality at the landscape level, the water objective is qualified by, 'without unduly impacting the timber supply'. There is no objective under FRPA for domestic water supplies that are not within a community watershed, or for watersheds like Twinflower Creek, where the water use is for industrial or agricultural purposes.

This case highlights a dilemma regarding how to balance the rancher's needs to minimize adverse impacts to the hydrology of the watershed, with the need to recover value from

mountain pine beetle attacked stands and return attacked stands to productive forest. It is difficult to predict the outcomes of forest operations; the complainant understandably wants no or minimal risk to his water supply. The licensee's rationale for harvesting and accepting a higher risk is based upon economic benefits and possibly improving the rate of hydrologic recovery in the watershed over the longer term. For the rancher, the short term risk is what is relevant.

Fire risk with proposed harvest – what are the legal requirements?

This concern is based upon fire escapes that occurred during previous logging.

Two fires occurred in the area in 2007, both human-caused, and the complainant asserts that the available equipment and the response time from Williams Lake were not adequate to deal with these fires.

However, the licensee says the appropriate required equipment was on hand with one of the fires (caused by a feller buncher). A ministry water bomber arrived within about half an hour to put out that fire. The second fire was an escaped slash burn, which occurred outside of the fire season. The Board did not investigate these past escapes and discusses these incidents only in terms of the legislated requirements for addressing fire risk.

If the licensee is processing at the stump (removing tops and branches from the tree), which is becoming a more common practice, the fire hazard in the cutblock is increased. Sections 11 and 12 of the *Wildfire Regulation* require licensees to assess and abate fire hazard during operations. If a fire occurs, licensees must be able to show that they have taken reasonable steps to identify and abate any fire hazard.

The licensee noted in correspondence with the complainant that there is an increased risk of fire being caused, and fed by, logging debris left on the ground in the cutblock. Given the remote location, precautionary measures should be in place and adequate equipment available on site to reduce reliance on a response from Williams Lake.

The *Wildfire Regulation* requires that suitable fire-fighting hand tools and a fire-suppression system be available on site during high risk activities including felling and skidding logs. However, while there is increased fire risk when any activity is occurring, the licensee has committed to harvest in the winter, which will reduce that risk.

Conclusions

Under FRPA, the licensee is not required to assess the hydrologic condition of the Twinflower Creek watershed. However, field visits and informal assessments of the hydrologic condition done by both the licensee's consultant and MFR staff over a 10-year period have shown that

peak flow changes are likely without harvesting, but the probability increases further with harvesting.

Neither the consequences of potential increased peak flows, nor the degree that further harvesting could worsen the situation, are clear.

The licensee is required to assess and abate the fire hazard during its operations.

Commentary

Like much of the interior of BC, the Chilcotin area has been impacted heavily by the current mountain pine beetle infestation and government's general direction is to capture some economic benefit before the dead trees decay and lose value. However, the combined effect of historic harvesting and pine beetle mortality results in risks to the complainant's property, which are predicted to increase with the new harvesting. These risks have to be considered and weighed against the economic benefits, and a potentially shorter hydrologic recovery in the long term if greenup occurs at a faster rate post-harvest.

The peak flow risk level in the watershed is beyond the moderate threshold that the regional hydrologist recommended not be exceeded before the watershed was impacted by the mountain pine beetle. The hazard indices are based on map data only and do not necessarily predict what has happened or will happen on the ground. Although developed by experts, the thresholds between low, moderate and high risk are arbitrary. As such, the assessments may not provide clear answers on the consequences. Ultimately, the procedure relies on field observations by qualified professionals if warranted by the risks.

Professional reliance does not appear to address the complainant's concern. Forest and other qualified professionals do not have the authority to decide whether or not to proceed under current forestry legislation, it is the licensee's stewardship decision to make based on the projections of risks. The potential impacts are to the complainant's buildings, irrigation and power-generation infrastructure. The licensee expects to manage any impacts to water quality that are within its control, with its mitigation plan. In the end, it appears that the rancher bears the risk and has no reasonable recourse if problems occur.

There are no water-related objectives in FPRA or the government orders that clearly apply in this case, and therefore there are no water-related results or strategies outlined in the licensee's FSP that it is required to achieve for Twinflower Creek. In particular, there is no requirement for an automatic review when high thresholds are reached. In the absence of meaningful objectives or standards, there is no clear guidance for the licensee to judge its decision by and little for government staff to assess compliance against if any adverse impacts occur. While it is not known whether there will be adverse consequences resulting from the harvesting in Twinflower

Creek, it is likely that such conflicts between tenure holders will become more frequent in the interior with continued beetle harvesting.

In the Board's view, there is a fundamental weakness in the FRPA system that allows one tenure holder to hold the power of decision over another tenure holder. This is of particular concern when conditions on the landscape are already highly degraded due to past disturbances such as logging, insect damage or fire.

Recommendation

The Board recommends that government consider this case as support for the Board recommendation made in the recent report, *Logging and Lakeshore Management near Vanderhoof*, FPB/IRC 163, March 2010. In that investigation, the Board found an inequity in the decision making authority of one tenure holder over another. The Board said "Ultimately, a system of objectives and regulation coupled with respectful, mediated solution-seeking would be more equitable for the people involved, and more effective for stewardship of the many tenured interests that the province has vested on the landscape." The Board recommended that a mediation process be developed to deal with direct overlapping interests of tenured land and forest resource users.

The Board is also of the opinion that it would be appropriate for government take action to assist the complainant should changes in flow conditions in the creek impact buildings and irrigation infrastructure on the property.



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