Forest Practices Board

Forestry Activities in the Peachland and Trepanier Creek Community Watersheds

Complaint Investigation #17046

FPB/IRC/224

September 2019

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Board Commentary

This complaint was about the impacts of forestry activity on water quantity, quality and flows in the Peachland and Trepanier community watersheds. These are legally designated community watersheds in the Okanagan that provide drinking water to the community of Peachland. Under the *Forest and Range Practices Act* (FRPA), forest practices in community watersheds are subject to a higher standard than other watersheds, in order to protect drinking water.

Our investigation found that all forest practices were consistent with the legal requirements in FRPA.

The Board also found that these watersheds are actively used for many different activities and by different industries, which creates the potential for unmanaged or undetected cumulative effects.[1] The absence of watershed-specific monitoring data makes it difficult to determine if cumulative effects are happening, given the inherent natural variability in the watersheds.

While forest licensees' responsibilities to manage for cumulative effects of forestry and range activities are clearly laid out in FRPA, no one is responsible for managing the cumulative impacts of *all activities* in the watersheds. A recent report by the BC Auditor General[2] pointed out systemic gaps in accountability and coordination for drinking water protection, including source water protection planning.

In 2015, the District of Peachland completed a sediment source assessment, which provides a qualitative risk assessment that could be used to manage cumulative effects; this effort is commended. A monitoring strategy could also be developed to identify feasible strategies to better inform watershed management. The Board has previously commented on the value of increased sampling in community watershed using the Forest and Range Evaluation Program's (FREP) water quality effectiveness evaluation protocol and the FREP stream and riparian area evaluation protocol.

The Board is encouraged by the creation of a watershed technical advisory group that will bring together all parties with a role in watershed management. This group needs to be supported with a clear mandate and roles. This group will likely improve transparency of activities in the watershed and may be a suitable venue to address major opportunities for improvement. It could:

- examine ways to improve monitoring information so there is a better chance to detect, and if necessary, correct, cumulative watershed effects.
- ensure that recommendations from ongoing watershed assessments and studies are implemented as required.
- investigate opportunities to reduce risk of sediment from non-forestry roads, legacy roads for which no one has responsibility for as well as industrial forest roads.
- examine roads in the watershed for long term risks and consider a long term access plan that would identify high-risk areas where roads should be deactivated or avoided to reduce risks to water quality.

[1] Cumulative effects are changes to environmental, social and economic values caused by the combined effect of past, present and potential future human activities and natural processes.

[2] The Protection of Drinking Water. BC Auditor General. June 2019.

Executive Summary

In November 2017, the Forest Practices Board received a complaint about impacts to water quality in the Peachland and Trepanier community watersheds. The complainants asserted that forestry activities in the watersheds have negatively affected the quality of drinking water and increased the number of boil water advisory notices, resulted in stream bank erosion and caused a landslide off the Munroe forest service road into Peachland Creek.

In order to address the complainants' concerns, the investigation looked into those matters related to forest practices and considered the following questions:

1. Did licensees adequately assess risks to water quality?
2. Did licensees meet their legal obligations under the *Forest Planning and Practices Regulation* (FPPR)?

The Board determined that forest licensees' management of risks to water quality was reasonable. Forest licensees have conducted numerous assessments over the years to evaluate the risk of forestry activities, using suitably qualified professionals, at both the watershed and stand levels. Licensees followed the recommendations in the assessments and have maintained communication and shared the assessments with the District of Peachland.

Forestry activities complied with the legal requirements. There are many developments and activities in these watersheds, in addition to forestry, that can impact the water resource and it was not possible to differentiate between forestry and non-forestry impacts. The investigation determined that forestry activities did not cause impacts on human health that could not be addressed through water treatment. The landslide on the Munroe forest service road was not caused by forestry activities and licensees maintained natural drainage patterns and maintained forestry roads consistent with the FPPR.

Introduction

Complaint

On November 13, 2017, the Forest Practices Board received a complaint from a resident of Peachland and member of the Peachland Watershed Protection Alliance, about impacts to water quality in the Peachland and Trepanier community watersheds. These watersheds provide drinking water to the community of Peachland.

The complainants assert that forestry activities by Tolko Industries Ltd. (Tolko), British Columbia Timber Sales (BCTS), Ntityix Resources LP (Ntityx) – owned by Westbank First Nations, Kamloops Woodlot Education Society (KWES) and Gorman Bros. Lumber Ltd. (Gorman Bros.) in the two community watersheds have:

1. resulted in stream bank erosion,
2. caused a landslide off the Munroe forest service road (FSR) in the Peachland community watershed,
3. negatively affected the quality of drinking water in the watersheds, and
4. increased the number of boil water advisory notices.

The investigation considered how forest licensees addressed the risks to water quality from forestry activity in the watershed and whether forest licensees met their legal obligations.

Background

The District of Peachland (DOP) currently draws its water from Okanagan Lake and from two designated community watersheds: Peachland Creek and Trepanier Creek (see map on page 2).[3] The Peachland Creek watershed is about 12 500 hectares and is the primary source of water for Peachland. Water from spring snowmelt is collected and stored in the Peachland Lake and Glen Lake reservoirs, located at the upper end of Peachland and Greata creeks. The water is chlorinated at the Peachland Creek intake facility, located 5.6 kilometres upstream from Okanagan Lake.

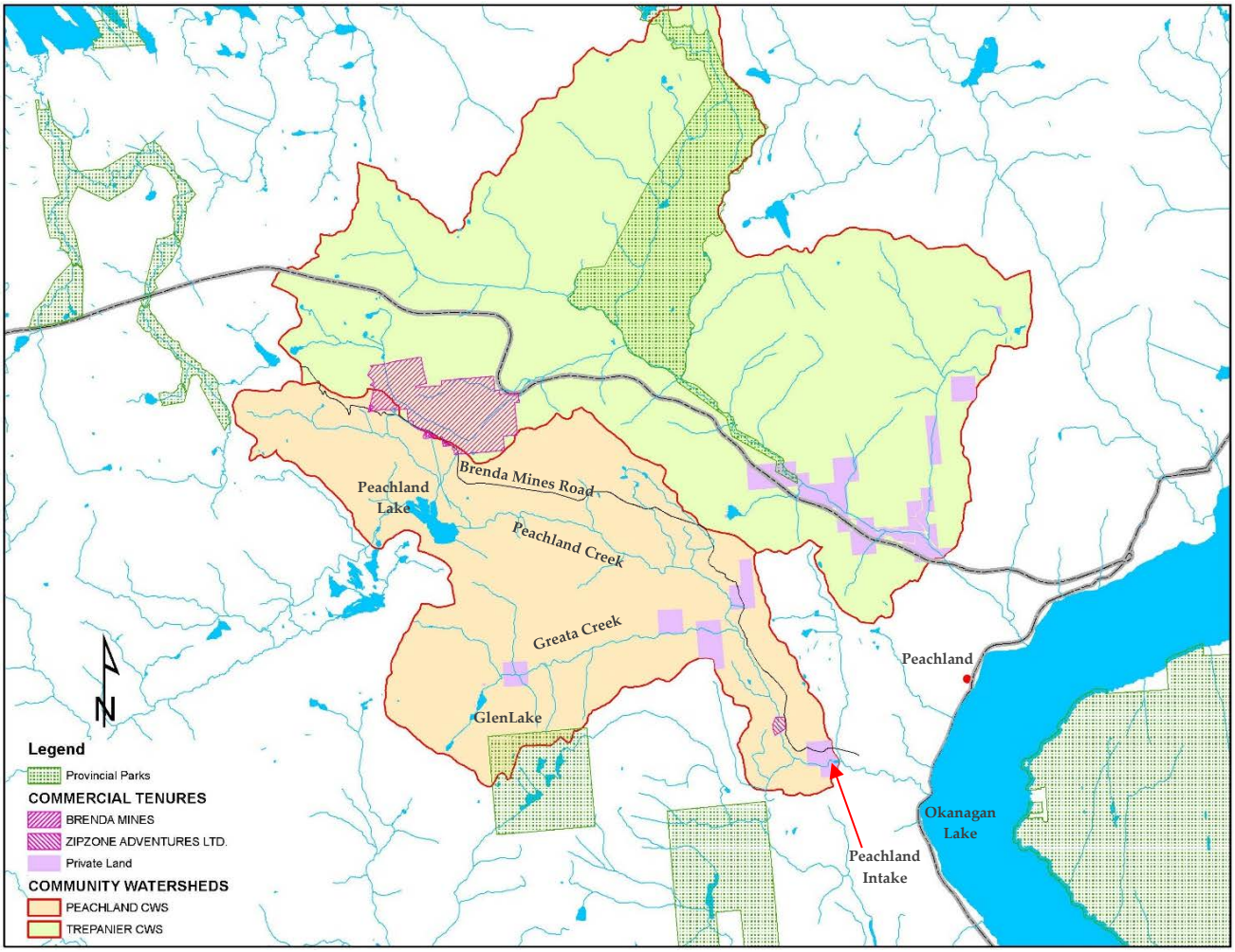
Trepanier Creek community watershed is about 18 500 hectares and supplies water to the DOP residents north of Trepanier Creek. However, due to the topography of the Trepanier Creek watershed, there is only limited storage available within the watershed, and it often experiences low water flow in the early fall. The Trepanier Creek system is supplemented with water from an intake on Okanagan Lake when needed.

Community Watersheds

A community watershed is a watershed grandparented into FRPA from the former *Forest Practices Code of British Columbia Act,* or established under FRPA because government decided that special forest management is required in the watershed to protect water used for drinking.

Community watersheds have specific practice requirements: provide enhanced riparian retention adjacent to streams, lakes and wetlands; ensure sediment from excavated or bladed trails does not affect drinking water; avoid building a road within 100 metres of springs; avoid fertilizer use near streams and waterworks; size culverts and bridges to pass peak flows; and notify water purveyors of activities.

[3] DOP is in the process of constructing a new treatment facility on Peachland Creek, expected completion in 2020. DOP will drop Trepanier Creek as a source of water once the treatment facility is completed. Water from Okanagan Lake will supplement any water deficits after the new treatment facility is operational.



Overview Map of Peachland and Trepanier Creek Watersheds

Both watersheds have a long history of land use that has influenced the quantity and quality of water (Table 1). Currently, the watersheds are subject to industrial and non-commercial uses, which can affect the hydrologic process.[4i] Although there are numerous factors affecting the hydrology of the watersheds, this investigation was limited to assessing the effects of forestry activities (timber harvesting and roads) on water quality and quantity.

[4] Hydrologic process is the complex interactions between the weather and the biophysical environment as water flows through the hydrologic cycle. These processes include precipitation, interception, evaporation, infiltration, soil moisture storage and hillslope flow, overland flow, and groundwater. The processes and their spatial and temporal variability are occur at both the stand and watershed scales.

Table 1. Activities in the Peachland and Trepanier Creek Watersheds

ACTIVITY	PEACHLAND	TREPANIER
Forestry	Tolko, Ntityix, KWES and Gorman Bros. (very minor activity)	Ntityix, KWES and Gorman Bros.
Range	Yes	Yes
Wildlife	Ungulate winter range in lower portion	Ungulate winter range in lower portion
Commercial	Brenda Mines, zip line, ATV tours, gravel pits, active mineral exploration	Majority of Brenda Mines, gravel pits
Non-commercial Recreation	Hunting, fishing, biking, ATVs, snowmobiles, x-country skiing, camping and boats on Peachland Lake	Hunting, fishing, biking, ATVs, snowmobiles, x-country skiing
Other	Brenda Mines Road	Highway 97C connector
Private Land & Residences	Yes	Yes

Forestry activities have occurred in the Peachland and Trepanier watersheds since the 1960s. In the 1980s, mountain pine beetle began attacking stands in the watersheds. In the early 1990s, harvesting was primarily by clearcutting to salvage the attacked stands. Around 2009, mountain pine beetle once again emerged in the drainages and harvesting rates increased to salvage damaged stands.

Picture 1. Looking south past Peachland Lake. The Brenda Mines pond is in the upper left background.

Picture 2. Recent harvesting in Trepanier watershed. Highway 97C is to the left and Brenda Mines is in the upper portion of the picture.

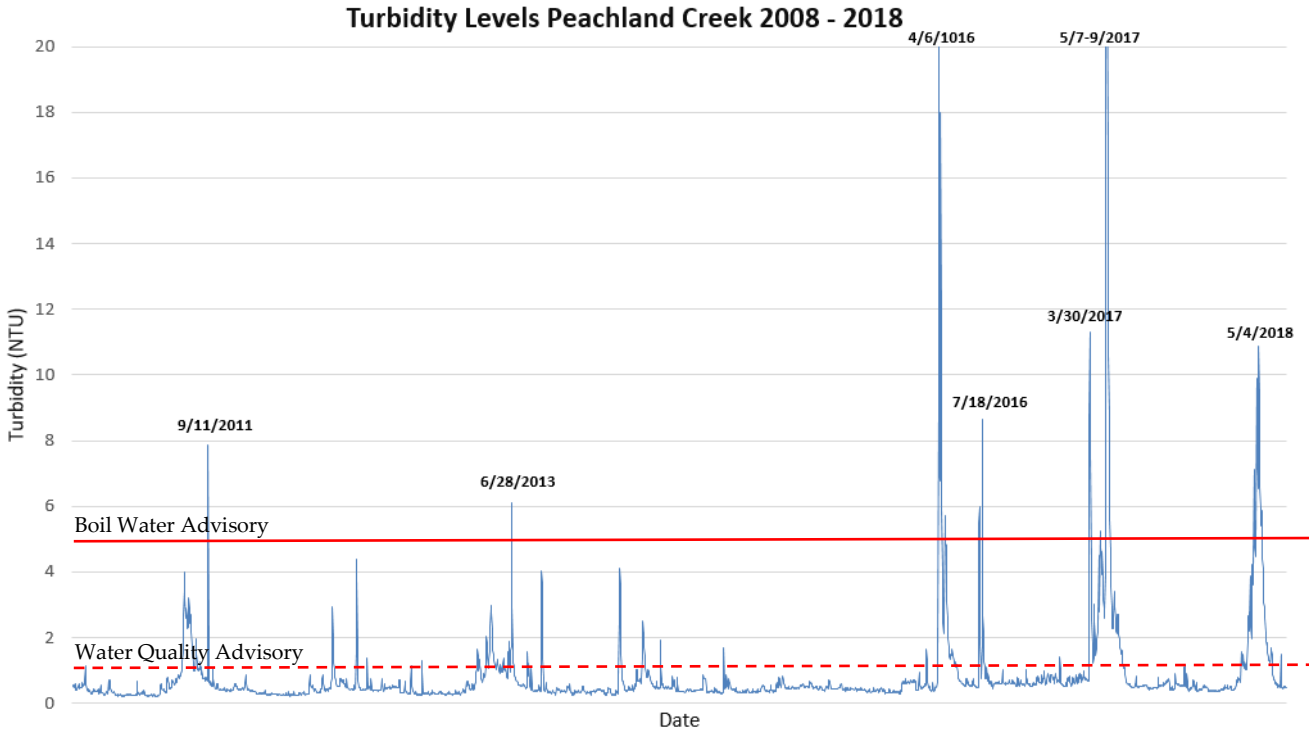
Clearcut harvesting removes all or most of the forest canopy—there are few trees to intercept rain and snow—which can lead to increased run-off of water and changes to stream flows.[ii] In the southern interior of BC, in snowmelt-dominated watersheds, changes in water flow timing, magnitude and frequency are often noted where more than 25 percent of the area has been clearcut harvested and not yet hydrologically recovered[5] (referred to as the equivalent clearcut area or ECA). Increased peak flows may scour stream channels and ditch lines, and increase suspended sediment in the streams (turbidity). Currently, both watersheds are approaching 25 percent ECA, if harvesting continues as proposed.

[5] The process by which the hydrologic characteristics of a watershed that has been subject to harvesting are restored to near pre-harvest condition by forest regeneration.

However, ECA is an indicator of the potential hydrologic response to forest disturbance and re-growth. It is not a stand-alone metric for watershed analysis, nor is it a substitute for professional analysis and field assessment.[6] ECA is one of several variables to consider when assessing the impact of forest development on the hydrologic process. Other important variables include distribution of harvesting by aspect, elevation and basin throughout the watershed, along with road density and water management related to roads.

An additional factor in these watersheds is that water from spring snowmelt is collected and stored in the Peachland Lake and Glen Lake reservoirs, located at the upper end of Peachland and Greata creeks. The reservoirs allow the DOP to release water in a regulated manner through the summer and fall months when natural water levels are low, and to avoid high stream flows, which would erode the stream channel.

The current waterworks system provides water to the DOP, and has been relatively consistent in the quantity and timing of flow at the waterworks. This is primarily attributed to the reservoir lakes in the Peachland Creek watershed allowing water to be released in a regulated manner through the summer and fall months when natural water levels are low, and the ability to supplement the water system with water from Okanagan Lake during low flow events.



Graph 1. Turbidity levels at the Peachland Creek Treatment Facility, 2008 to 2018. The turbidity is from water after it has passed through the settling ponds and the coarse screen filter. Note that 2016 was a very high snow pack year with high spring runoff and 2017 was a 1 in 50 year peak flow event throughout the Thompson-Okanagan area.

[6] Winkler R. and S. Boon. 2017. *Equivalent clearcut area as an indicator of hydrologic change in snow-dominated watersheds of southern British Columbia.* Prov. B.C., Victoria, B.C. Exten. Note 118. www.for.gov.bc.ca/hfd/pubs/Docs/En/En118.htm

The DOP told Board investigators that turbidity[7] usually increases during spring runoff, after heavy rains or after a significant event such as a landslide. The DOP currently treats any increase in turbidity by issuing a water quality advisory or a boil water advisory. DOP staff noted that water quality or boil water advisory notices are a frequent occurrence, generally in the spring[8] and that the trend is relatively constant from year to year (Graph 1). The graph shows significant spikes in turbidity in 2017 and 2018. A very high snow pack combined with high spring runoff occurred in 2016, and in 2017 a 1 in 50 year peak flow event occurred throughout the Thompson-Okanagan area and 2017 was also when the Munroe FSR landslide event occurred. It is important to note that turbidity is only measured at the DOP intake facility. There are no monitoring stations for sub-basins to establish additional baseline data that could be used to determine the impacts of forestry and other activities on stream flows and turbidity.

In March 2017, a landslide adjacent to the Munroe FSR[9] introduced sediment into Peachland Creek about 800 metres upstream of the DOP water treatment facility. The landslide caused a spike in turbidity and the DOP issued a boil water notice. Also in 2017, several trees on the Brenda Mines property blew over and diverted a creek running through the property from its channel, which then ran down a road on the mine property and eventually into the Trepanier Creek system. The increased flow washed out a portion of a forestry road and introduced enough sediment into Trepanier Creek that it could not be used for domestic consumption.

These factors led to the complainant's concerns and the subsequent filing of this complaint with the Board in November 2017.

Legal Requirements

The sections of the FPPR under FRPA that are relevant to this complaint are paraphrased below:

- **Section 8.2 (2)** provides that the objective set by government is that the cumulative hydrological effects of primary forest activities in a community watershed:
    a. do not have a material adverse impact on the quantity of water or the timing of the flow of the water to the waterworks, **or**
    b. do not have a material adverse impact on human health that cannot be addressed by water treatment.
- **Section 8.2 (3)** provides that the above objective set by government applies only to the extent that it does not unduly reduce the supply of timber from BC's forests.

[7] Turbidity is measured in nephelometric *turbidity* units (NTU). The Turbidity Index is a messaging tool designed to notify water customers of current turbidity levels and, therefore, the relative risk of drinking the water. The index shows whether water is Good (<1 NTU), Fair (1-5 NTU), or Poor (>5 NTU), and provides specific recommendations for each rating. https://www.interiorhealth.ca/YourEnvironment/DrinkingWater/Documents/turbidity.pdf

[8] Interior Health Authority requires that the DOP issue a water quality advisory notice when turbidity exceeds a specified level and a boil water advisory notice when turbidity exceeds a higher level. Interior Health Authority must give permission to the DOP to remove the notices once turbidity falls back to a specified level. DOP continues to chlorinate the water supply even when the water quality and boil water advisories are in effect.

[9] A road constructed, modified, or maintained by the minister under the provisions of the *Forest Act*, or declared a FSR. FSRs are used to provide access to managed forest land. Licensees wishing to use an FSR for industrial purposes must enter into a road use permit with the minister.

- **Section 37** requires licensees to ensure that primary forest activities[10] do not cause a landslide that has a material adverse effect on a number of resource values including water.
- **Section 39** requires licensees to maintain natural surface drainage patterns when constructing a road, a temporary access structure or a permanent access structure.
- **Section 79** requires licensees to maintain a road by ensuring the structural integrity of the road prism and clearing width are protected, the drainage systems of the road are functional and, when the road is being used by industrial users, it can be used safely by industrial users.
- **Section 59** requires licensees to ensure that primary forest activities do not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks.

Investigation Results

Discussion

The investigation is not a detailed review of all activities in the watershed; watershed assessments provide such detail. Board staff and a consulting hydrologist reviewed the watershed assessments, forest stewardship plans (FSPs),[11] and other reports and analysis in order to assess the planning and practices implemented by the licensees.

Board staff and the consulting hydrologist also conducted a field review of the Peachland and Trepanier watersheds. The field review looked at the watersheds on the ground and included an aerial overview to identify sediment sources, stream channel condition and general condition of the watersheds.[12]

The Board also identified several forestry and non-forestry-related factors affecting the hydrological process and risk to water quality in the watersheds:

- Road legacy issues. There is a network of roads that were built prior to the road construction standards of today.
- Multiple resource activities. Resource activities include logging, ranching, mining, agriculture and recreation (commercial and public).
- Residential properties as well as blocks of nonresidential private land.
- BC Hydro power line right-of-way.
- Highway 97C

[10] FPPR defines **primary forest activity** to be one or more of timber harvesting, silviculture treatments, road construction, road maintenance or road deactivation.

[11] A forest stewardship plan is a key planning element in the FRPA framework and the only plan subject to public review and comment and government approval.

[12] The Board investigation is significantly less detailed than would be expected in a hydrological assessment.

However, the Board's jurisdiction is limited to assessing compliance with FRPA. The Board investigated the effects of forestry activities on water by reviewing the planning and practices conducted by the forest tenure licensees and the general condition of the watershed. The investigation addressed the following questions:

1. Did the licensees adequately assess risks to water quality?
2. Did the licensees meet their legal obligations under the FPPR?

Did The Licensees Adequately Assess Risks To Water Quality?

Forest licensees are operating in the Peachland and Trepanier community watersheds and have the potential to impact the quantity, quality and timing of stream flows. Forest licensees manage the risk that proposed harvesting and road construction activities may have on forest resource values by relying upon the decisions and advice of foresters and other professionals to assess risks and prescribe strategies to mitigate them. Risk assessment involves the process of determining the hazard (the likelihood of an event occurring; for example, increased sediment) and consequence (the impact of the event on a specific resource value; for example, water quality). A well-conducted assessment provides a consistent, scientifically defensible approach to assess risk and develop recommendations to help manage risks of proposed forestry activities.

The licensees use a qualified professional to assess the risk of forest activities on sediment delivery, and change in water quantity and timing of flow when working in a community watershed. If the risk of increased turbidity is moderate or high, the licensees' further commit to conducting a hydrological assessment and ensuring the cutblock design and road locations are consistent with the recommendation of the assessment.

Assessing the hydrological risk of forestry activities requires specialized knowledge and experience[13]. It is up to the licensee and their coordinating forest professional to ensure that individuals completing these assessments are competent. The purpose of a watershed assessment is to provide watershed-level recommendations for forest development, based on an assessment of the potential for cumulative hydrological effects from past natural and man-made disturbances and proposed forest harvesting and road building.[iii]

A hydrological assessment investigates watershed characteristics, geomorphic and hydrologic processes, sensitivity to disturbance, and disturbance history. It may include an analysis of hydrometric and climate data, determination of hydrologic recovery of regenerating forest stands (ECA), landslide frequency, rates of sediment production, and the risk and consequences of proposed forest development on changes to peak flows, potential for landslides, potential for accelerated surface erosion and the anticipated changes to the channel riparian buffer.

As recommended in the Board's 2014 special investigation, Community Watersheds: From Objectives to Results on the Ground,[iv] the assessments should accurately describe the risk of proposed development on the water resource and identify measures or recommendations for the licensee to implement that will reduce the impact of forestry activities on water quality and quantity, and timing of stream flows. The hydrologist rarely provides a limit or ECA cap on harvest levels because the

[13] There is no formal definition for a hydrologist. In general, the qualifications include (1) a master's degree or a PhD. specializing in hydrology or water resource science and 1 year of related experience; and (2) registration or eligible for registration as a Professional Geoscientist or Professional Engineer, a Registered Professional Forester or a Professional Agrologist.

ECA is only an indicator that a risk may exist. Instead, the licensee(s) reviews the assessment and adjusts its activities to mitigate the risk of forestry activities impacting water quality, quantity and timing of stream flows.

Forest licensees, the DOP and the provincial government have completed eight watershed-level assessments for the Trepanier and Peachland community watersheds since 1999 (Appendix 1). Qualified professionals, including professional engineers, fluvial geomorphologists/hydrologists and geoscientists prepared the assessments. These assessments contained various recommendations that become more stringent as risk increased. The recommendations include; stream crossing remediation, road management (maintenance and deactivation, controlling surface runoff and remediation work), improved communication with the DOP, ECA triggers, flow monitoring, riparian management strategies (including cattle and recreation), stand prioritization for harvesting and rehabilitation of stands damaged by mountain pine beetle, and adaptive management. Licensees shared the findings of their assessments with the DOP and invited the DOP on field reviews.

This most recent assessment was led by a professional engineer with expertise in watershed management, hydrology and sediment control. The field work was conducted in 2017 and the report was completed in July 2018. This report considered the cumulative hydrological impact by incorporating existing and proposed harvesting activities of the forest licensees working in the watershed. The licensees reviewed the results of this assessment with the DOP. The licensees also provided a summary report on the assessment and conducted a field review with the hydrologist who prepared the assessment, several members of the Peachland Watershed Protection Alliance, and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD). In addition, all licensees and the hydrologist met with the DOP Healthy Watershed Committee on November 21, 2018, to present a summary of the assessment. This committee included the Director of Operations, Mayor and some councillors from the DOP, some members of the public and a few Peachland Watershed Protection Alliance members.

Licensees also completed cutblock level assessments, which were incorporated into operational practices at the cutblock level. Board staff noted during the field review that operational practices appeared reasonable. These included identifying and managing watercourses, including retention of vegetation and machine-free zones, leaving riparian buffers, grass seeding to revegetate exposed mineral soil and maintaining natural drainage patterns.

Finding

Forest licensees assessed risks to water quality by conducting watershed and stand level assessments over the years, using suitably qualified professionals, to evaluate the risk of forestry activities. Licensees followed the recommendations in the assessments, including prioritizing stands for salvage harvesting, maintaining natural drainage, carrying out ongoing road maintenance and deactivation, and limiting the proximity of roads and cutblocks to riparian features. Licensees have shared this information with the DOP.

Did The Licensees Meet Their Legal Obligations Under FPPR?

This section evaluates the extent to which licensee activities met legal obligations under the FPPR. Each relevant section of the FPPR is evaluated separately.

Section 8.2

Section 8.2(2) of FPPR states government's objective for water that cumulative hydrological effects of primary forest activities within a community watershed:

a. do not have a material adverse impact[14] on the quantity of water or the timing of the flow of the water to the waterworks, or
b. do not have a material adverse impact on human health that cannot be addressed by water treatment required under an enactment, or the licence pertaining to the waterworks.

Section 8.2 (3) of FPPR provides that the above objective set by government applies only to the extent that it does not unduly reduce the supply of timber from BC's forests.

Quantity of Water or Timing of Flow

Primary forest activities are defined as road construction, timber harvesting, road maintenance, silviculture treatments and road deactivation. There are a number of forestry and non-forestry factors potentially changing the cumulative hydrology of the watersheds and thereby the water quantity or timing of flow. It is difficult to separate the effects of forestry activities from naturally occurring factors, such as climate, weather and biophysical characteristics, and overall cumulative effects of non-forestry activities, particularly in watersheds with many other land uses such as highways, power transmission lines, mines, agriculture, and other developments.

The 2018 watershed assessment concluded that there was a low to moderate risk of changes to quantity of water or the timing of flow to the waterworks. The report also recommends a series of measures designed to mitigate possible impacts to water quantity or timing of flow from planned development as well as legacy road issues. Our investigation determined the licensees are implementing the recommendations in the watershed assessment.

Quality of Water

The risk of introducing sediment into a stream was considered moderate to high in the 2018 watershed assessment. The Board has previously commented that "it is not the sediment itself that is particularly harmful to human health; rather, it is the human pathogens that can adhere to sediment particles and be transported to the intake that are harmful."[15]

The existing DOP water treatment facility is not capable of treating increases in turbidity. Therefore, to address the risk of pathogens masked by sediment particles, the DOP issues a water quality or boil water advisory when specific turbidity thresholds are surpassed. The DOP is installing a new water treatment facility that will be better able to deal with future turbidity issues.

[14] https://www.for.gov.bc.ca/ftp/HTH/external/!publish/web/frpa-admin/frpa-implementation/bulletins/CE-40-Material-Impact.pdf
[15] SIR40 Community Watersheds: From Objectives to Results on the Ground, page 16.

Finding

The investigation found that primary forest activities have a low to medium risk (as per the 2018 watershed assessment) of cumulative hydrological effects on the quantity of water or timing of flow. The licensees are implementing operational practices designed to mitigate future risk of cumulative hydrological effects with riparian buffers, grass seeding of exposed soils and maintaining natural drainage patterns. In addition, any impacts to water quantity and timing of flows are buffered by lakes in the watershed used as reservoirs.

The investigation also determined that the licensees' activities did not have a cumulative hydrological effect that caused material adverse impacts to human health that could not be addressed by water treatment at the waterworks, including water quality and boil water advisories.

Sections 37 and 79

Section 37 of FPPR requires licensees to ensure that primary forest activities do not cause a landslide that has a material adverse effect on water quality.

And:

Section 79 of FPPR requires licensees to maintain a road by ensuring the structural integrity of the road prism and clearing width are protected, the drainage systems of the road are functional and that the road can be used safely by industrial users.

The complainant was concerned that Gorman Bros. was responsible for a landslide off a switchback on the Munroe FSR, approximately 800 metres upstream of the settling pond and intake for the Peachland Creek water treatment facility.

The primary forest activities considered under sections 37 and 79 are road construction, road maintenance or road deactivation.

The Munroe FSR was built in the 1940s and was realigned close to its present location in the 1950s. The road section where the landslide occurred is located on potentially unstable terrain with a high soil erosion hazard. This section of road was deactivated in 2002, but prior to deactivation works, and in recognition of stability issues, a terrain stability field assessment and soil erosion field assessment were completed by a government geotechnical engineer.

Gorman Bros. needed to reactivate the Munroe FSR to access new forestry development. It started field work in 2014 and contracted an engineering firm to conduct a terrain stability assessment for a proposed road upgrade, which included the section of road adjacent to where the landslide would eventually occur. The terrain stability assessment was published in 2015 and identified that water quality and fisheries resources in Peachland Creek watershed would be at potential risk from a landslide initiating off the Munroe FSR. The terrain stability assessment included recommendations for the reactivation, which Gorman Bros. implemented. These included relocation and installation of cross drain culverts, minor brushing and road surfacing, stabilization of road fill and transportation of excavated material off site; these recommendations were implemented the year prior to the slide occurring.

Gorman Bros. holds a road use permit for the Munroe FSR, including the road section in the area where the landslide occurred. The road use permit requires the permit holder to carry out all maintenance activities. Maintenance requires (as per section 79 of FPPR) the licensee to ensure the

structural integrity of the road prism[16] and clearing width are protected, the drainage systems of the road are functional, and that the road can be used safely for industrial purposes.

Gorman Bros. observed some instability below a switchback on the Munroe FSR in March 2016 and contracted the engineering firm to evaluate the issue. Gorman Bros. scheduled a field review for March 11, 2016, with the DOP and the engineering company to review the instability. The engineering firm identified that Peachland Creek was undercutting the bottom of the slope (below the fill slope of the road) as part of the natural meandering[17] of the stream. The engineering firm discussed with Gorman Bros., that Peachland Creek be re-channeled to move it away from the bottom of the slope because, regardless of the works completed to stabilize the road, a landslide was likely imminent if the stream continued undercutting the stream bank. It also prescribed removing material from the road edge and shifting the road in from the crest of the slope, which Gorman Bros. implemented. These measures were intended to reduce the impact of the road on the stability of the slope below and to help maintain the integrity of the road prism should a failure occur.

Responsibility for addressing the soil erosion risk and potential for a landslide from the natural action of the stream is unclear. It was not Gorman Bros. responsibility to re-channel Peachland Creek because the erosion was a natural process and it was not eroding the road fill slope (which is part of the road prism). The DOP said it was not aware of the suggestion to re-channel Peachland Creek and would not have taken on the responsibility to complete the work even if they had known about it.

In late March 2017, a landslide occurred downslope of the switchback on the Munroe FSR (not within the road prism), releasing sediment into Peachland Creek and triggering a boil water advisory. Gorman Bros. contracted the same engineering firm to investigate the landslide. The assessment concluded that the landslide event was caused by erosion and undercutting by Peachland Creek at the toe of the slope (below the road fill slope), combined with a significant precipitation and snowmelt that increased saturation of the slope and resulted in the onset of slope movement.

The engineering firm's assessment also concluded that, immediately following the landslide event, the road prism above the headscarp of the landslide was still intact and safe for passage of pickup vehicles. The assessment also made three recommendations that could be implemented immediately, which Gorman Bros. said they followed. In addition, the assessment identified a residual risk of more landslides and erosion events, regardless of these works. The assessment recommended that the Munro FSR be considered for permanent deactivation upon completion of harvesting activities accessed by this road to mitigate the residual risk. Gorman Bros. said it will recommend to the FLNRORD that the road section be permanently deactivated upon completion of harvesting activities. However, FLNRORD will make the final decision on the deactivation because this is a Forest Service Road.

Another engineering firm applied on behalf of Gorman Bros. to re-channel Peachland Creek away from the toe of the slope after the 2017 landslide, so that further slide activity would not affect the creek (pictures 5 and 6). The application was approved and Peachland Creek was re-channeled. Gorman Bros. supplied the equipment to carry out the re-channel. The DOP was not involved in the design or construction of this re-channel project.

[16] The road prism extends from the top of the cut bank to the toe of the fill slope.

[17] A meander is produced by a stream or river as it erodes the sediments comprising an outer, concave bank (cut bank) and deposits this and other sediment downstream on an inner, convex bank.

A second landslide occurred in April 2018, on the same section of road as the 2017 landslide, but it did not reach Peachland Creek. Gorman Bros. again contracted the same engineering firm to assess the landslide. The assessment determined that the second landslide was likely due to the excavated material from the original (1950s) construction being side-cast[18] down the slope (rather than being hauled away) combined with additional side-cast from the recent road upgrade. This resulted in settlement, tension cracks, and then slope failure. The assessment also made several recommendations, which Gorman Bros. said they implemented.

Picture 5. Slope failure below Munroe FSR.

Picture 6. Peachland Creek re-channeled away from toe of the landslide.

Findings

Section 37

The Board considers the first landslide did adversely impact water quality because enough sediment entered the stream that a boil water advisory notice was issued. However, the Board accepts the Professional Engineer's assessment that Gorman Bros. primary forest activity did not cause the landslide and it did not occur within the road prism. The second landslide was attributable to primary forest activity within the road prism. However, the slide did not reach Peachland Creek and therefore did not impact water quality.

Section 79

Gorman Bros. held a road use permit for the section of road where the landslide occurred. This required Gorman Bros. to maintain the structural integrity of the road. In 2016, they contracted the engineering firm to assess the identified instability along this section of road, and implemented the prescribed activities from that field review. The engineering firm also identified that a landslide below the Munroe FSR was likely imminent if the stream erosion and undercutting of the slope base below the road continued.

Peachland Creek continued to undercut the toe of the slope and that, combined with a significant weather event, led to the landslide.

The pullback of the slope and shifting of the road prism into the cut-slope in this road section reduced the impact the landslide had on the road. The licensee maintained the structural integrity of the road prism as required by section 79 of FPPR.

[18] Moving excavated material onto the downslope side of a temporary access structure, excavated or bladed trail, or landing during its construction.

Section 39

Section 39 of FPPR requires licensees to maintain natural surface drainage patterns when constructing a road, a temporary access structure or a permanent access structure.

When the Board field-reviewed the watersheds in May 2018, it did not see any instances where natural surface drainage was not maintained on forestry roads.

Finding

Licensees maintained natural surface drainage patterns.

Section 59

Section 59 of FPPR requires licensees to ensure that primary forest activities do not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks.

In its 2014 report on Community Watersheds,[19] the Board interpreted "material harmful to human health" to include items such as petroleum products, fertilizers and other harmful chemicals. The special investigation also references other investigations by the Board that describe the risk sediment in water may create and the most recent publication by the Office of the Provincial Health Officer; Clean, Safe, and Reliable Drinking Water[20] confirms the Board's interpretation. When sediment enters a stream, the water becomes turbid, increasing the risk that pathogens from wild and domestic animals (e.g., livestock) and human sources will attach to the sediment particles. Water from the watershed must be treated so it is safe for human consumption. A domestic water licence specifies the quantity of water but not the quality. Provincial expectations are that the water licensee will treat the water so that it is safe for human consumption. If the water is highly turbid, the treatment of water through ultraviolet light, chlorination and/or filtration is less effective and there is a risk that pathogens will remain attached to, or masked by, the sediment. Therefore, boiling water will address the risk that pathogens may still be present in the water when the water is turbid.

Although sediment is likely the most common risk to drinking water quality that can be caused by forestry operations, the section 59 requirement is not contravened unless the sediment contains pathogens harmful to human health and reaches the intake. Investigators identified instances where sediment was being deposited into streams, but did not determine the sediment contained pathogens harmful to human health. Proving "harm to human health" requires: determining that the material is inherently harmful (e.g., petroleum products); lab analysis of a water sample confirming the presence of pathogens harmful to human health; or actual sickness in which medical evidence confirms the ingestion of the water as the cause.

Finding

Licensees' forestry activities complied with section 59 of the FPPR; there was no evidence that licensees introduced material harmful to human health in water diverted for human consumption by a licensed waterworks.

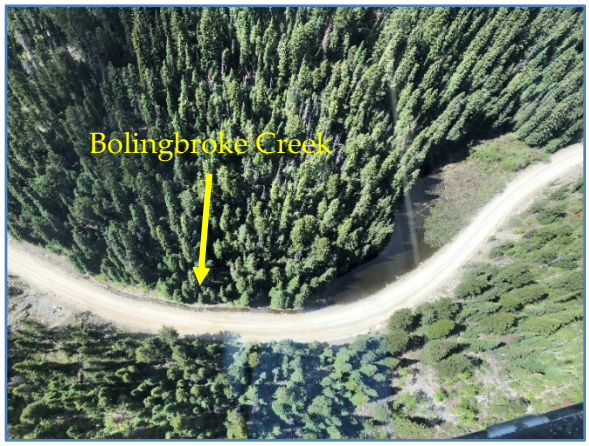
[19] Community Watersheds: From Objectives to Results on the Ground, https://www.bcfpb.ca/wp-content/uploads/2016/04/SIR40-Community-Watersheds-From-Objectives-to-Results-on-the-Ground.pdf Page 9

[20] Clean, Safe, and Reliable Drinking Water, Office of the Provincial Health Officer, June 2019

Other Sediment Management Opportunities

Forestry practices should not increase the natural variability of sedimentation in a watershed. It is a good practice to mitigate forestry-related sediment due to the inherent risk sediment poses to water quality. Board investigators and the contracted hydrologist noted some opportunities for forest licensees and government to further reduce the risk of sediment entering Peachland and Trepanier Creeks. These include:

1. Review cross drain culvert spacing on sections of continuous grade to any major stream crossing. Although natural drainage was maintained (i.e., culverts at stream crossings and non-classified drainages) and there was no evidence of slope failures, investigators determined that additional cross drains in these sections would help to better manage spring runoff and major rainfall events by dissipating ditch water away from the crossing instead of concentrating it at the crossing.
2. Review culvert size on older roads, especially the Brenda Mines road and power line right–of-way access roads, and replace them if they are undersized.
3. Review the Peachland FSR adjacent to Bolingbroke Creek (pictures 7 and 8) to evaluate opportunities to mitigate the sediment from the road and ditch into Bolingbroke Creek.



Picture 7. Peachland FSR adjacent to Bolingbroke Creek. Bolingbroke Creek is immediately adjacent to the Peachland FSR.

Picture 8. Peachland FSR adjacent to Bolingbroke Creek. Note the road prism erosion.

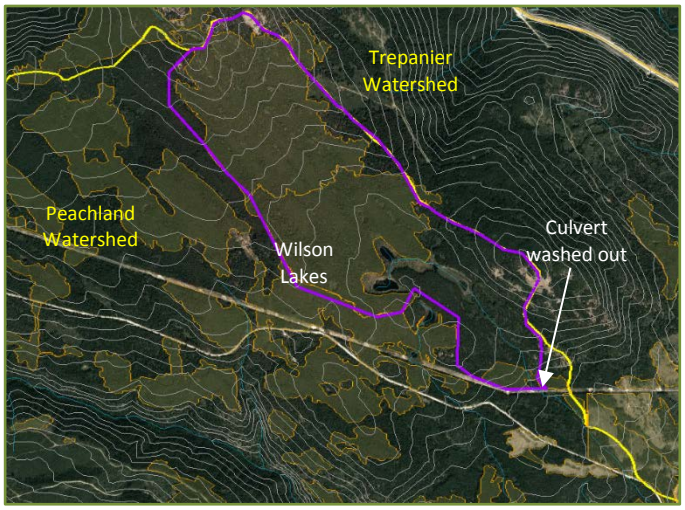
There were also a few instances of excessive ditch line erosion, but these were not pervasive and were attributed to significant spring runoff rather than poor maintenance by the licensees.

Sediment Risk and Turbidity

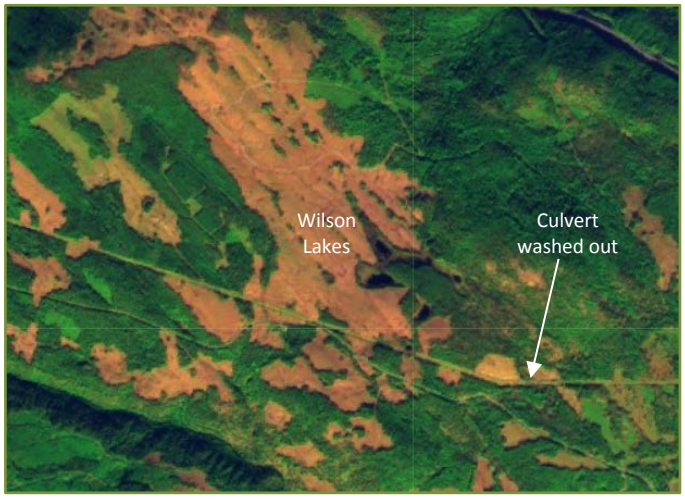
Forestry activities may have an impact at an individual stream drainage level. For example, investigators observed a washed-out culvert on a power line right-of-way within the Wilson Lakes catchment area (picture 9). Forestry activities may have contributed to this event. However, the Board could not determine the extent to

Picture 9. Stream eroding around a culvert across a BC Hydro access road in spring of 2017 & 2018.

which logging contributed to the wash-out (pictures 10 and 11), given the cumulative effect of the high snow pack, high spring runoff and lack of information on the culvert sizing (picture 12) or road maintenance history.



Picture 10. Wilson Lakes before harvesting. The proposed harvesting targets mountain pine beetle-infested stands and is shaded. The approximate location of the Wilson Lakes drainage is outlined in purple.



Picture 11. Wilson Lakes after harvesting. About 275 hectares were harvested from the Wilson Lake catchment area, increasing peak flows for that specific catchment.

Picture 11. Picture 12. An example of a non-forestry related factor. Ditch line erosion resulting from a plugged culvert on the Brenda Mines Road.

Conclusions

This investigation examined a complaint about forestry activities in the Peachland and Trepanier community watersheds and the impacts to the quality of drinking water for the community of Peachland. The investigation found there are numerous activities in these watersheds that are likely impacting the water resource, however, the investigation could only assess the effects of forestry activities. The investigation looked at how forestry licensees assessed and managed the risks of their activities and their compliance with the *Forest and Range Practices Act*.

Did the licensees adequately assess and manage risks to water quality?

The Board determined that the forest licensees adequately assessed the risk of forestry activities on water quality and quantity, consistent with expectations under FRPA and professional reliance. Licensees used suitably qualified professionals, including professional foresters, engineers, fluvial geomorphologists/hydrologists and geoscientists to conduct assessments at the watershed and stand levels. Licensees managed the risk of their activities by implementing the recommendation of the assessments. Licensees also maintained reasonable communication with the DOP.

Did licensees meet their legal obligations?

The Board concludes that licensees met their legal obligations and complied with sections 8.2, 39, 59 and 79 of the FPPR. There are many developments and activities in these watersheds, in addition to forestry, that can impact the water resource and it was not possible to differentiate between the forestry and non-forestry impacts. Moreover, the investigation did determine that forestry activities did not cause impacts on human health that could not be addressed through water treatment. The Munroe FSR landslide was not attributed to forestry activities and licensees maintained natural drainage patterns and maintained forestry roads consistent with the FPPR. Finally, there was no evidence that licensees introduced material harmful to human health (e.g., petroleum products, fertilizers) into streams in the watersheds.

ENDNOTES

[i] Winkler, R. 2010. Compendium of Forest Hydrology and Geomorphology in British Columbia Volume 1 of 2. Chapter 6. https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66.htm

[ii] Winkler, R. and S. Boon, 2017. Equivalent clearcut area as an indicator of hydrologic change in snow dominated watersheds is southern British Columbia. Prov. B.C., Victoria, B.C. Exten. Note 118. www.for.gov.bc.ca/hfd/pubs/Docs/En/En118.htm

[iii] B.C. Ministry of Forests. 2001. Watershed assessment procedure guidebook. 2nd ed., Version 2.1. For. Prac. Br., Min. For., Victoria, B.C. Forest Practices Code of British Columbia Guidebook. https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/wap/WAPGdbk-Web.pdf

[iv] https://www.bcfpb.ca/wp-content/uploads/2016/04/SIR40-Community-Watersheds-From-Objectives-to-Results-on-the-Ground.pdf

Appendix: List of Assessments Completed

July 2018	Watershed Assessment of Proposed Forest Development within the Peachland Creek Community Watershed *- Forest Hydrology Consulting*
June, 2017	Investigation of the Landslide below the Munro FSR at 1.6km *- Onsite Engineering Ltd.*
July 2015	Terrain Stability Assessment Munro FSR Upgrade Peachland, BC *- Onsite Engineering Ltd.*
Mar 2016	Trepanier Creek 2015 Watershed Assessment *- Dobson Engineering Ltd.*
Jan 2015	Sediment Source Assessment on Peachland Creek *- Urban Systems*
May 2010	Peachland Creek and Trepanier Creek – Watershed Assessment Report for Drinking Water Source Protection *- Golder Associates Ltd.*
Feb 2010	Peachland Creek Hydrological Risk Assessment *- Grainger and Associates Consulting Ltd. and Streamworks Unlimited*
Feb 2010	Trepanier Creek Hydrological Risk Assessment *- Grainger and Associates Consulting Ltd. and Streamworks Unlimited*
Feb 2002	Terrain Stability Field Assessment and Soil Erosion Field Assessment for Deactivation of Munroe Lake FSR *- Geotechnical Engineer, Kamloops Forest Region*
July 2001	Watershed Assessment Report for the Trepanier Creek Watershed *- Dobson Engineering Ltd.*
Sept 1999	Interior Watershed Assessment for the Peachland Creek Watershed *- Dobson Engineering, Ltd.*

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