



General Disclaimer

The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the Government of British Columbia of any product or service to the exclusion of any others that may also be suitable. Contents of this report are presented as information only. Funding assistance does not imply endorsement of any statements or information contained herein by the Government of British Columbia. Uniform Resource Locators (URLs), addresses, and contact information contained in this document are current at the time of printing unless otherwise noted.

Disclaimer of Liability

With respect to documents available from this server, neither the Government of British Columbia nor any of their employees, makes any warranty, express or implied, including the warranties of merchantability and fitness for a particular purpose, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

The British Columbia Provincial Government has not been granted permission to post this report publicly. The report is available to the public by contacting the Ministry of Forest and Range Library (address found below) or the owner of the report. The contact information for the report owner is found at the end of the report description.

MoFR Library

851 Yates Street
Victoria, British Columbia, Canada

Phone: (250) 387-3628

Fax: (250) 953-3079

E-mail: Forests.Library@gov.bc.ca

Open : Monday-Friday, 8:00-4:30

Mailing address:

BC Ministry of Forests & Range Library,
PO Box 9523, Stn Prov Gov,
Victoria, British Columbia, CANADA, V8W 9C2

**Shannon Creek – Crystal Creek
Watershed Assessment
(IWAP)**

Prepared for: Kalesnikoff Lumber Co. Ltd.
P.O. Box 3000
Thrms, B.C.

Prepared By: Kim Green, M.Sc., P.Geo.
Apex Geoscience Consultants Ltd.
1220 Government Street
Nelson B.C.

April, 2002



Executive Summary

RECEIVED
MINISTRY OF FORESTS
KOOTENAY EAST DISTRICT OFFICE

APR 29 2002

INTRODUCTION

The purpose of the Shannon and Crystal Creek watershed assessment is to identify the geomorphic processes controlling channel morphology, sediment delivery and sediment transport in the drainages and provide recommendations to guide forest development activities.

The watershed assessment for Shannon Creek and Crystal Creek was carried out according to the Interior Watershed Assessment Procedure Guidebook (second ed., 1999).

The watershed assessment consists of two levels of assessment; a preliminary office component to determine the equivalent clear-cut area (ECA) and other map-based inventory information related to the existing and proposed development and, a field component to assess the hydrologic and geomorphic condition of the watershed.

Approximately 3 kilometres of stream channel was observed in the field which included over 2 kilometres of the mainstem of Shannon Creek, approximately 300 metres of the north fork of Shannon Creek, and approximately 800 metres of the lower reaches of Crystal Creek.

The information reviewed as part of the Shannon Creek – Crystal Creek watershed assessment includes;

- Kalesnikoff Lumber Co. Ltd. Grohman Creek Forest Development Plan (2001)
- (1:20,000) Air photographs BC 137 and BC 144 (1939)
- (1:20,000) Air photographs 30BCB00038 (2000)
- Bedrock Geology Map (Andrew, et al., 1991)
- Terrain Mapping and Stream Channel Assessment (Utzig and Carver, 1999)
- Ministry of Energy and Mines Mineral Tenures Information
- Water Survey of Canada Hydrometric Data for Shannon and Crystal Creeks (Environment Canada)

Shannon Creek and Crystal Creek are located north of the town of Nelson, B. C., on the south-facing slopes along the north side of the West Arm of Kootenay Lake. Shannon Creek has a drainage area of 385 hectares. The drainage area of Crystal Creek is 237 hectares

There are currently 33 active domestic water licenses for consumptive use water on Shannon Creek. Crystal Creek has 43 active domestic water licenses.

A forest fire that occurred in 1934 deforested a large portion of the study area. No active mineral tenures are present in the Shannon Creek – Crystal Creek study area.

Shannon Creek and Crystal Creek are both sourced by springs originating from a series of fractures in the granitic bedrock at the upper elevations (see Section 3). Numerous spring-fed, perennial tributaries flow from fractures trending 050° to 080° and, as well, from the points of intersection of these fractures with fractures trending 150° to 180°. The fractures are most evident on the north side of Shannon Creek and across the upper elevations of Crystal Creek. The near-vertical nature of the fractures and the constant year-round flow

reported by the water users suggests that the spring water is groundwater-sourced. Surface drainage patterns in the study area are very complex and, for the most part, controlled by the bedrock fractures.

GEOMORPHIC OVERVIEW

The channel of Shannon Creek in the upper elevations is described as a small woody debris step-pool channel. For the length of Shannon Creek cobbles and boulders in the channel are mossy and angular. Shannon Creek has a mainstem channel and one large tributary channel. Reach 5 extends northward, upslope from the height of land between Shannon Creek and Grohman Creek. Reach 5 of Shannon Creek is considered an extension of the mainstem channel for this assessment but is only connected through surface flows to the mainstem channel for a short period during spring runoff. The channel of Shannon Creek through reaches 2 and 3 and 5 is classified as non-alluvial (flowing water is not controlling channel morphology).

The channel of Crystal Creek is non-alluvial for most of its length. The morphology of Crystal Creek varies in morphology from a blocky cascade pool in the lower elevations to bedrock cascade channel at the upper elevations. Three reaches are defined for Crystal Creek. Large woody debris does not function in the channel to maintain channel stability. Sediment transported by Crystal Creek is limited mainly to sand and gravel.

RIPARIAN ASSESSMENT

For both Shannon and Crystal Creeks, riparian vegetation consists primarily of under-mature cedar, hemlock and fir. Alder, hazelnut and mountain ash are common in patches where the coniferous forest has not regenerated following the 1934 fire. Mature fir and hemlock comprise the riparian vegetation on the east side and along the valley bottom of Shannon Creek at the mid and upper elevations on slopes that were not burned during the fire. Both Shannon and Crystal Creeks have had a significant amount of disturbance to the riparian vegetation on their fans.

INTERPRETATION OF CHANNEL STABILITY

The channels of Shannon and Crystal Creeks are interpreted as stable. Both Shannon and Crystal Creeks are predominantly colluvial channels with blocky colluvium and bedrock armoring the channel bed and banks. There is no evidence that the channels of Shannon Creek or Crystal Creeks have carried debris flow or debris flood events with any frequency in the past.

HYDROLOGICAL SENSITIVITY, HAZARD RATINGS AND RISK ASSESSMENT

Hydrological Sensitivity Rating

The sensitivity rating for a given hydrological factor reflects the channels ability to adjust to small changes in a hydrological factor without resulting in negative impacts to channel stability and water quality or quantity. For example, a channel with a low sensitivity to small increases in peak flows will not experience channel destabilization or increased sediment transport rates or decreased water quality as a result of slightly elevated peak flow events.

Hydrological Hazard Rating

Hazard ratings for the hydrologic factors are a qualitative assessment of the likelihood of an event occurring given the existing or proposed level of development or existing level of disturbance that exists in the watershed. Specifically, the hazard ratings reflect,

- the probability (or likelihood) of an increase in peak flows,
- the probability of increases in sediment delivery and/or
- the probability of an impact occurring to riparian function,

given the existing or proposed level of development or the existing level of disturbance from natural events such as forest fire or bug kill.

Hydrological Risk Assessment

A qualitative assessment of risk of impacts to channel stability, water quality and quantity for the different hydrological factors is determined by comparing the level of sensitivity for a given hydrologic factor against the existing and proposed hazard rating for each factor. The risk ratings for Shannon and Crystal Creeks are applied to the length of the mainstem channel.

It is important for all resource users (including water licensees) to note that a watershed can have an inherent level of risk of impact from the hydrological factors even though the likelihood of an event occurring given the existing or proposed development is assessed as low. An inherent level of risk (i.e. moderate risk) for a hydrologic factor is assessed when the channel is considered to be highly sensitive to either peak flow increases, or increases in sediment delivery or impacts to the riparian area.

Resource development is not excluded where a moderate or high risk exists. However, resource managers must be willing to adapt management practices to account for the natural sensitivity of the watershed and the potential hazards associated with development.

Summary of Sensitivity, Hazard and Risk ratings for Shannon Creek

Hydrologic Factor	Sensitivity rating of Hydrologic Factor	Hazard rating of Hydrologic Factor			Level of Risk	
		Existing	Proposed	Comments	Existing	Proposed
Peak Flows	High - Shannon Creek is assessed as having a high sensitivity to increases in peak flows due to the steep gradients, lack of storage sites and fine bedload.	Low	Low	There is a low level of existing development (9% ECA). Proposed development results in an ECA of 18% and is located on open, south-facing slopes.	Moderate	Moderate
Sediment Delivery	High - Shannon Creek has highly erodible soils along the mainstem channel. Steep gradients and limited sediment storage capacity will result in rapid transport to intakes.	Low	Moderate	Existing development is limited to 1 road crossing and 1 block that is removed from the channel. Proposed development includes a road that crosses above unstable and erodible soils.	Moderate	High*
Riparian Function	High - Shannon Creek is dependent on small woody debris through Reach 4 for channel and bank stability.	Low	Low	The existing road crossing at the top of Reach 4 is the only existing disturbance to the riparian area. There is no proposed development in the riparian area.	Moderate	Moderate

- Moderate with prescriptions to reduce water diversion, concentration and surface erosion.

Summary of Sensitivity, Hazard and Risk ratings for Crystal Creek

Hydrologic Factor	Sensitivity rating of Hydrologic Factor	Hazard rating of Hydrologic Factor			Level of Risk	
		Existing	Proposed	Comments	Existing	Proposed
Peak Flows	High - Crystal Creek is assessed as having a high sensitivity to increases in peak flows due to the steep gradients, lack of storage sites and fine bedload.	Low	Low	There is no existing development. Proposed development results in an ECA of 10% and is located on open, south-facing slopes.	Moderate	Moderate
Sediment Delivery	Moderate - Crystal Creek has steep gradients and limited sediment storage capacity that will result in rapid transport of fine sed. to intakes.	Low	High	Proposed development is situated above steep headwater gullies and is situated in an area with erodible soils and complex drainage patterns.	Low	High*
Riparian Function	Moderate - Crystal Creek is dependent on vegetation in steep headwater gullies to reduce occurrence of snow avalanches.	Low	Low	There is no proposed development in the riparian area.	Low	Low

- * Moderate with prescriptions to reduce water diversion, concentration and surface erosion.

DISCUSSION AND RECOMMENDATIONS FOR FOREST MANAGEMENT

Shannon Creek

The proposed development activities identified on Kalesnikoff's development plan represent an increased risk of impacting channel stability and water quality through increased sediment delivery to the mainstem channel.

Recommendations

Proposed roads and excavated trails in Shannon Creek will require detailed drainage design by a qualified professional that will ensure minimal disruption to surface and sub-surface drainage patterns. Road widths and cut slope heights should be minimized to reduce the likelihood of intercepting sub-surface flows. Alternatives to bladed trails (such as snow roads) should be considered where possible. Appropriate erosion control measures will be required for erodible soil and rock surfaces exposed during road and trail construction.

Due to the erodible nature of the soil and bedrock it is recommended that roads and bladed trails in Shannon Creek be deactivated as soon as possible following completion of harvesting activities. Deactivation measures for roads and bladed trails should include recontouring, decompacting, placing woody debris, mulching and revegetating areas with exposed mineral soil.

Crystal Creek

The proposed development includes 1 kilometre of road located on the moderate slopes above the steep headwater gullies. As with Shannon Creek the proposed development results in an increased risk of sediment delivery to the headwater gullies. Road and trail construction on these slopes could cause changes to surface drainage patterns, create additional springs to develop through excavation across bedrock fractures and expose bedrock and soil that is susceptible to erosion.

The proposed development in Crystal Creek does not represent an increased risk of channel instability or impacts to water quality or quantity through increases in peak flows or disturbances to the riparian area. The risk of increased sediment delivery to Crystal Creek related to the proposed development will be reduced if recommended measures to minimize water diversion, water concentration and surface erosion are implemented.

Recommendations

Proposed roads and bladed trails in Crystal Creek will require detailed drainage design by a qualified professional that will ensure minimal disruption to surface and sub-surface drainage patterns. Road widths and cut slope heights should be minimized to reduce the likelihood of intercepting sub-surface flows. Alternatives to bladed trails (such as snow roads) should be considered where possible. Erosion control measures will be required for areas of erodible soil and rock exposed during road and trail construction.

Due to the erodible nature of the soil and bedrock it is recommended that roads and bladed trails in Crystal Creek be deactivated as soon as possible following completion of harvesting activities. Deactivation measures should include recontouring, decompacting, placing CWD and revegetating areas with exposed mineral soil.