Wolverton Creek Monitoring

Report 2014

Photo Credit: Jennifer Yeow

Report Prepared For:

The Wolverton Creek Water Users and Kalesnikof Lumber Ltd.

Report Prepared By:
Passmore Laboratory Ltd.
Winlaw
V0G 2J0

June, 2015

Wolverton Creek Summary Report for 2014

Background
The charts and information below summarize findings obtained by monitoring Wolverton Creek. The summary is not intended to be a comprehensive assessment of the creek

Members of the Wolverton Creek Water users collected data that contributed to this report. Thankyou to Judy Laret, Doug Adair and Ruth Hackett for collecting samples.

The program
The present monitoring program is based on recommendations given in "Monitoring Guidelines to Evaluate the Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska" by L.H. MacDonald. Sample frequency is based on recommendations from J. Allan Issacson, Forest Hydrologist, Idaho Sate. The program relies on manual reading of in stream flow gauges, calibration of gauges by flow readings taken with a Price Current meter (RIC standard procedures). Velocity readings are taken at intervals of 6 to 12 inches across the stream. A stage discharge curve is developed and in 2014 readers collected 25 samples based on the following criteria:

- Collect during and after storm events and/or heavy rain
- Collect more samples during Spring freshet and Fall rain events
- Collect when creek water appears turbid and
- Samples are held cool and dark prior to delivery to lab

The samples were tested for turbidity and conductivity. If turbidity is greater than 1NTU, total suspended solids were performed.

Between May 23 and Sept 23, 5 samples were collected by an employee of Passmore Laboratory Ltd and tested for total coliforms, thermotolerant coliforms and E.coli.

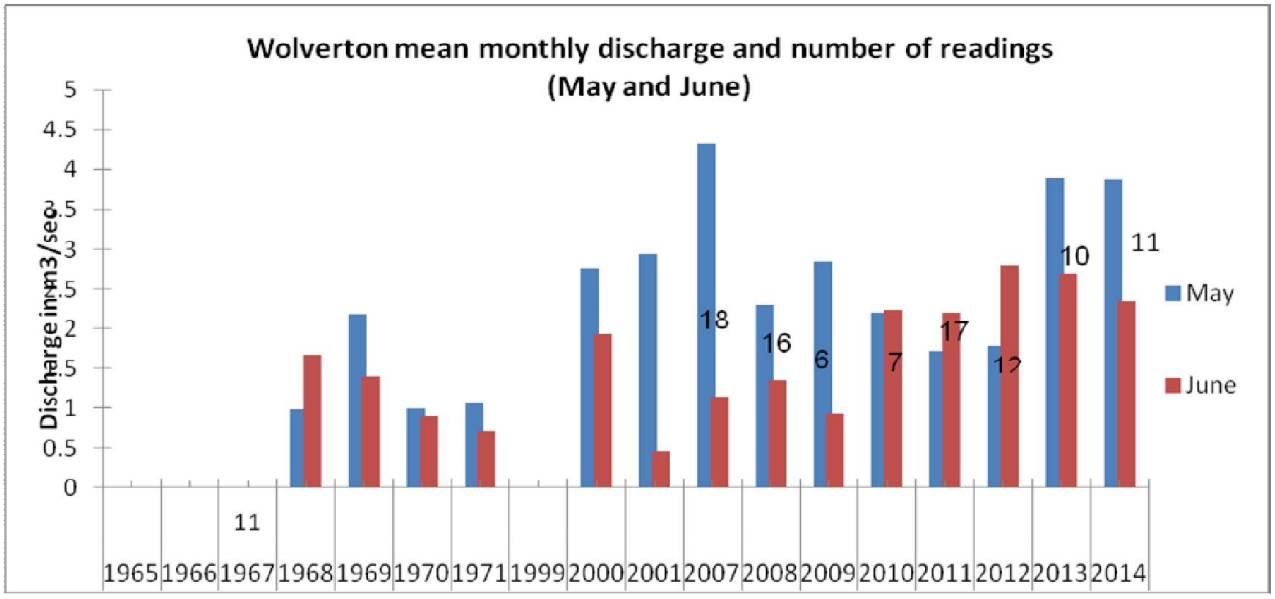
The objectives of the program are to:

1. **Collect water quality and flow data using a systematic sampling regime**
2. **Determine the number of days per year that parameters exceeded provincial drinking water quality guidelines as a function of discharge.**
3. **Examine trends in drinking water quality in Wolverton Creek as forest development increases within the watershed.**

Characteristics of the Wolverton Watershed

Wolverton Creek watershed is located just north of Slocan Park, and 30 km north of Castlegar . The creek drains the Norns Range west to the Slocan River. The Wolverton Creek watershed is 15.27 km2 in size, and Wolverton Creek is 5.47 km in length. It is a second order stream with a northeast aspect.

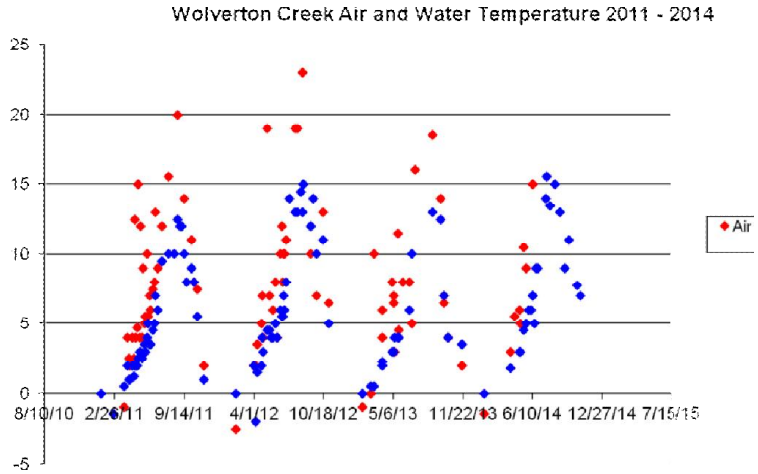
Flow



* Indicates number of readings taken during May and June combined.

Historically, May is the month when Wolverton Creek experiences high flow. The creek was monitored by Water Survey Canada between 1965 and 1971. The current program has been monitoring flow for 10 non consecutive years. While years 2002 - 2006 were not monitored, it appears that May, 2007 and 2013 and 2014 were relatively high flow years when compared to 2008 - 2012.

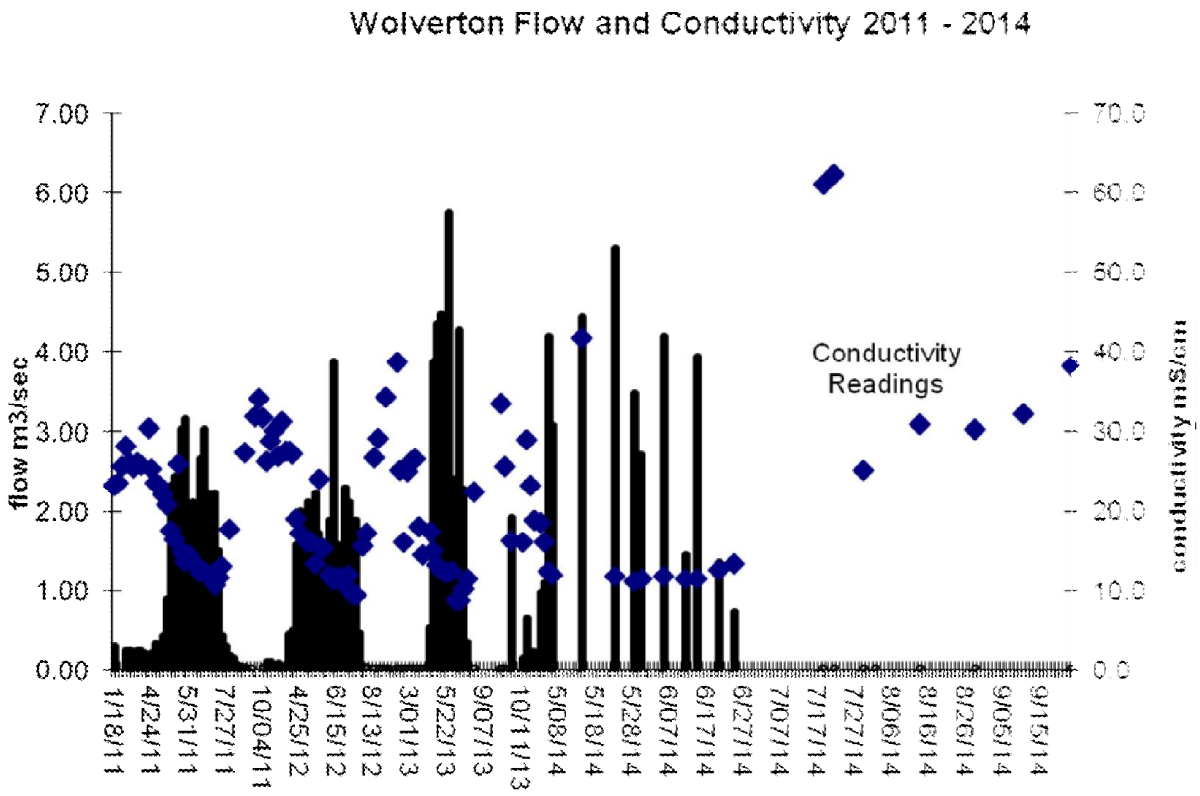
Temperature



The chart above shows Wolverton Creek Water remains relatively cool (less than 15 degrees centigrade). This means it provides a cool water input to the Slocan River where summer temperatures often rise above 20 degrees C. Past studies on local creeks have shown that drinking water quality stays high when water temperatures are below 10 degrees C (1). In 2014, sixty eight percent of the readings were less than 10C.

Conductivity and Flow

Conductivity is expressed as "specific conductance at 25 degrees C" . It is a measure of the ability of water to carry an electric charge and is directly related to the concentration of dissolved ions in the water. E.g. as the total dissolved substances in the water increases, the conductivity of the water also increases. There is usually an inverse relation between conductivity and flow. For example, as flow increases, dissolved minerals decrease & conductivity decreases. Conductivity can also vary when disturbance occurs in the watershed (6). In Fall, when flow decreases, conductivity (and mineral content) rises. Below is the chart for conductivity vs. flow for Wolverton Creek between 2011 - 2014.



Historically, Wolverton experiences a sharp decline in flow every year around the middle of June. As can be seen in the chart above, in 2011, this occurred June 22nd (2.2m3/sec), in 2012, July 1 (1.88m3/sec), in 2013 on June 20 (4.26m3/sec). In 2014 on June 20th the flow dropped to 1.35m3/sec. This is a relatively extreme drop when compared with previous years.

Regarding low flow, historically 2-3 of the readings are below 0.01m3/sec in August - September. In 2014, 5 readings were below 0.01m3/sec. Year 2014 was also notable for exceptionally high conductivity readings. Readings of 61.0mS/cm on July 18th and 62.3mS/cm on July 21were the highest seen in 10 years of monitoring. Historically, the high readings did not go above 40mS/cm.

These values illustrate the nature of Wolverton Creek's flow regime (e.g. rapid increase and drops in flow and conductivity) We also may be seeing a trend towards more extremes. See table below.

Conductivity and Flow cont.

Year	Minimum Flow and date occurred (m3/sec)	Maximum Flow and date occurred (m3/sec)	Minimum Conductivity and date occurred (uS/cm)	Maximum Conductivity and date occurred (uS/cm)
2011	0.027 (9/07)	3.168 (5/26)	10.7 (6/22)	34.2 (9/20)
2012	0.003 (9/28)	3.871 (6/05)	9.4 (7/01)	38.7 (9/28)
2013	0.006 (8/25)	6.64 (5/22)	8.8 (6/09)	33.5 (9/18)
2014	0.002 (9/23)	5.29 (5/23)	11.2 (5/28)	62.3 (7/18)

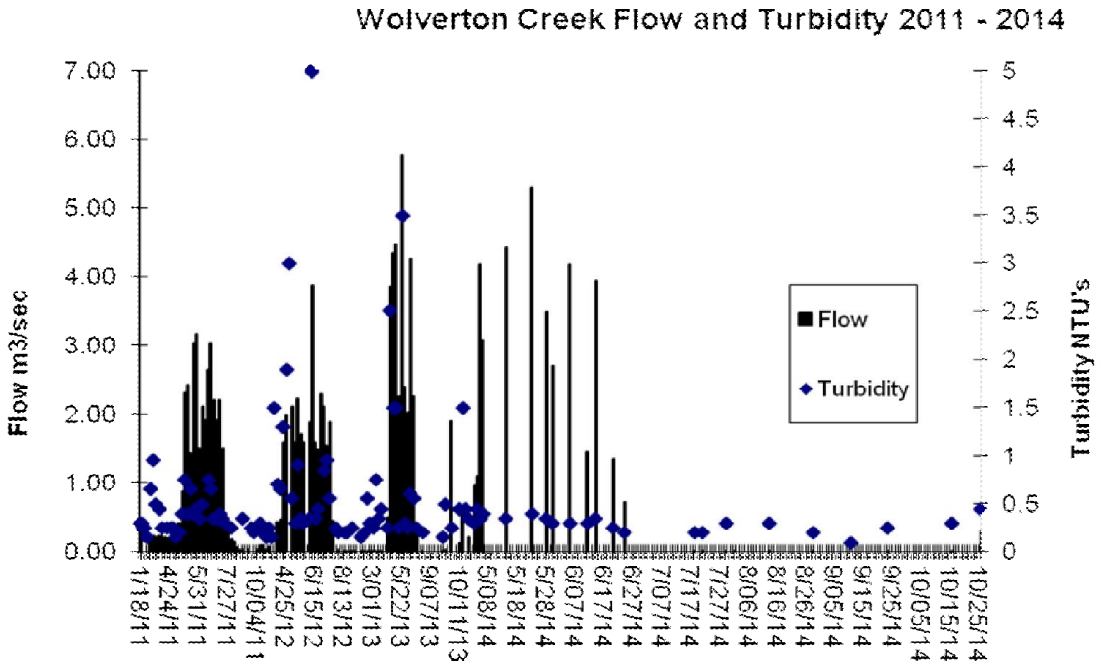
Turbidity

Turbidity is a "measure of the relative clarity of water. It is caused by colloidal matter, such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms suspended in the water. It is not a direct measure of suspended particles suspended in the water. Rather, turbidity measures of the scattering effect that such particles have on light.

The most important health-related effect of turbidity is its ability to shield microorganisms from disinfection. Turbidity has been shown to be correlated with the contamination of water by *Giardia* and *Cryptosporidium*. Hence, turbidity serves as a measure for indicating the risk of contamination by these pathogens. Ministry Guidelines for Turbidity in drinking water are 1NTU. NTU's stands for "nephelometric turbidity units" and is a scale developed for this test.

The protocol for this program is to measure suspended sediment on samples over 0.5NTU.

In 2013, one or 4% of the samples collected were greater than 0.5NTU.



Turbidity Chart

Wolverton Creek Year	Highest Turbidity Reading	%Samples greater than 0.5NTU	% Samples less than 0.25NTU	Number of Samples
2011	0.95	22	40	35
2012	27	50	25	28
2013	3.5	23	36	22
2014	1.2	4	72	25

Coliform Bacteria

Coliforms refer to a group of bacteria that have been tested for over 90 years as indicators of human infection. Their presence is used to indicate that other pathogenic organisms of fecal origin may be present. These include other bacteria, viruses, protozoa (giardia, cryptosporidium) and multicellular parasites. There are no Provincial guideline limits for total coliforms in untreated drinking water but thermotolerant coliforms and E.coli are not permitted.

Wolverton experienced exceptionally high fecal and E.coli counts in 2013. The counts for 2014 were lower. Three samples were taken from water users homes on August 15th. All samples from taps without filters contained fecal coliforms and E.coli.
In summary, Wolverton is not a safe drinking water source in summer when water temperatures rise And, in 2014, the water from Wolverton Creek did not meet drinking water standards for three of the 5 days tested.

Coliform Bacteria Test Results for 2014

Date	Fecal Coliforms CFU/100ml	E.coli CFU/100ml
5/23/2015	0	0
7/21/2015	8	6
7/29/2015	0	3
8/15/2015	202	88
9/23/2015	0	0

References

2. Wolverton Creek Monitoring Summary Report 2013, Jennifer Yeow, Passmore Laboratory Ltd.

3. Wolverton Creek Hydrogeomorphic Assessment December 5, 2006, Apex Geoscience Consultants Ltd.

4. Water Survey Canada's website: http://scitech.pyr.ec.gc.ca/waterweb

5. Water quality guidelines from the Provincial Govt's website: http://www.env.gov.bc.ca/wat/wq/BCguidelines/approv_wq_guide/approved.html#1

6. Monitoring Guidelines to Evaluate the Effects of Forestry Activities on Streams in the Pacific Northwest & Alaska L.H McDonald EPA 910/9-91-001