Wolverton Creek Monitoring

Report 2013

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 11, 2014

Wolverton Creek Summary Report for 2013

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 2013 readers collected 22 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.

In late summer, 9 samples were collected by an employee of Passmore Laboratory Ltd and tested for total coliforms, thermotolerant coliforms and E.coli as recommended in Provincial Guidelines for evaluating drinking water.

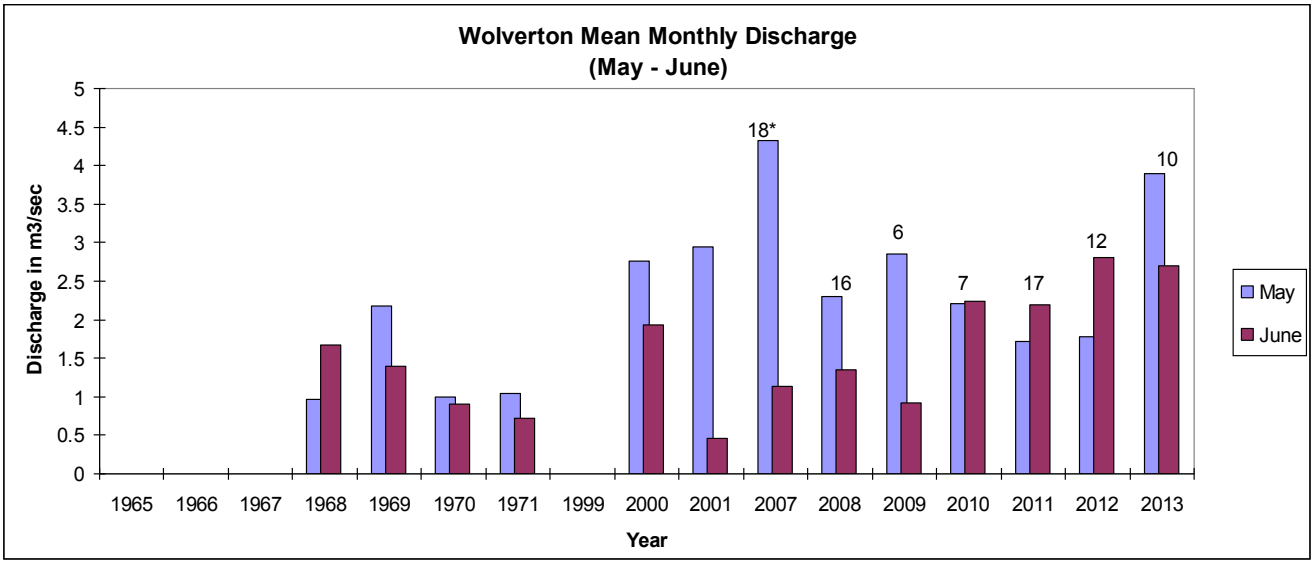
The objectives of the program are to:

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 km_2 in size, and Wolverton Creek is 5.47 km in length. It is a second order stream with a northeast aspect.

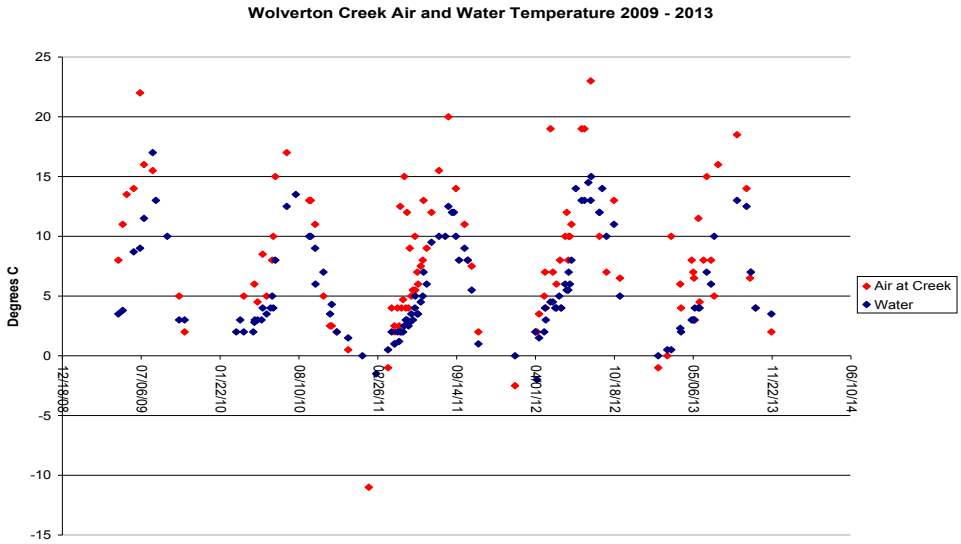
Flow



* 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 9 years. While years 2002 - 2006 were not included, it appears that May, 2007 and 2013 were relatively high flow years. One gauge reading (May 22nd) was the highest seen in 9 years of study. June flow was in a normal range when compared with past years. There may be a trend towards higher flows at Spring freshet when compared to historic values.

Temperature

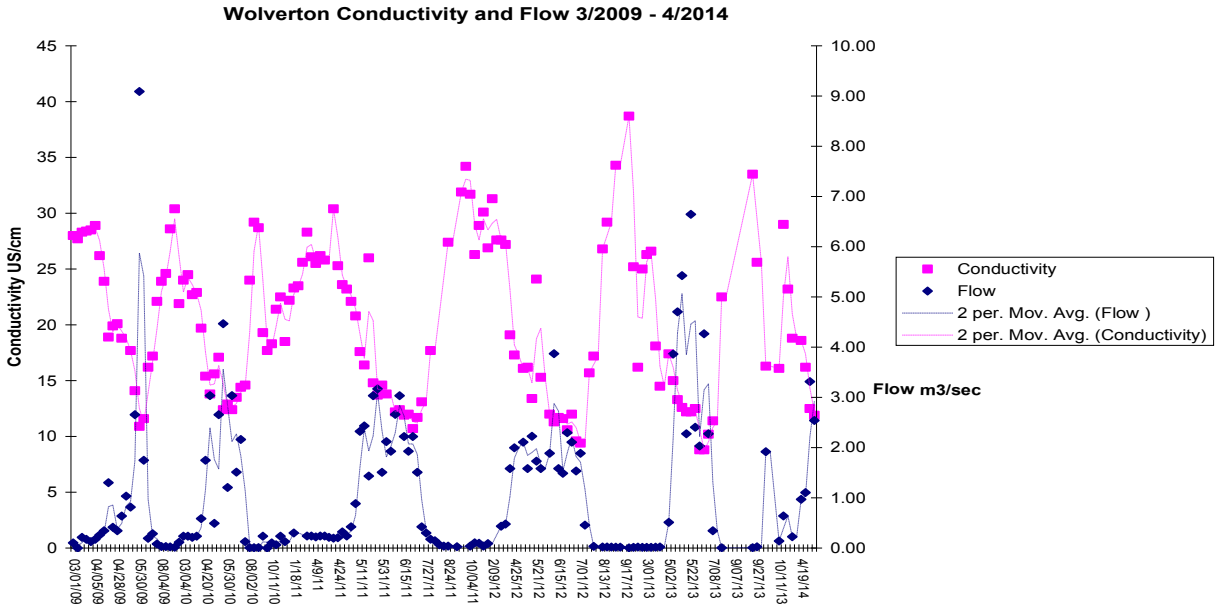


The chart above shows Wolverton Creek Water remains relatively cool (less than 15 degrees centigrade. This means it provides a cool water input to the Slocan River where summer temperatures often rise above 20 degrees C. Past studies on local creeks have shown that drinking water quality stays high when water temperatures are below 10 degrees C (1). Two readings (11%) were greater than 10C. They occurred in August and mid September which coincided with high E. coli counts described below.

Conductivity

Conductivity expressed as "specific conductance at 25 degrees C" is a measure of the ability of water to carry an electric charge. It is directly related to the concentration of dissolved minerals.

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. E.g. as flow in increases, dissolved minerals decrease & conductivity decreases. In Fall, when flow decreases, conductivity (and mineral content) rises. Below is the chart for conductivity vs. flow for Wolverton Creek between 2007 - 2013.



This cyclic pattern can be seen for years 2007 through 2013. The high flow for year 2013 was seen on May 22nd, when water levels rose to 18.69 m3/sec and corresponding conductivity dropped to 12.2 uS/cm. After this time, conductivity levels continued to drop and the low for the year was reported on June 9th. They then rose extremely fast to a high of 33.5uS/cm on September 9th. The low flow at 0.006m3/sec for the year was noted early (August 25th) when compared to previous years. The high flow observed on May 22, 2013 at 6.64m3/sec was relatively high when compared with previous years. See chart above and table below. These readings illustrate the extreme nature of Wolverton Creek's flow regime e.g. rapid increase and drops in flow and conductivity.

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)

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.

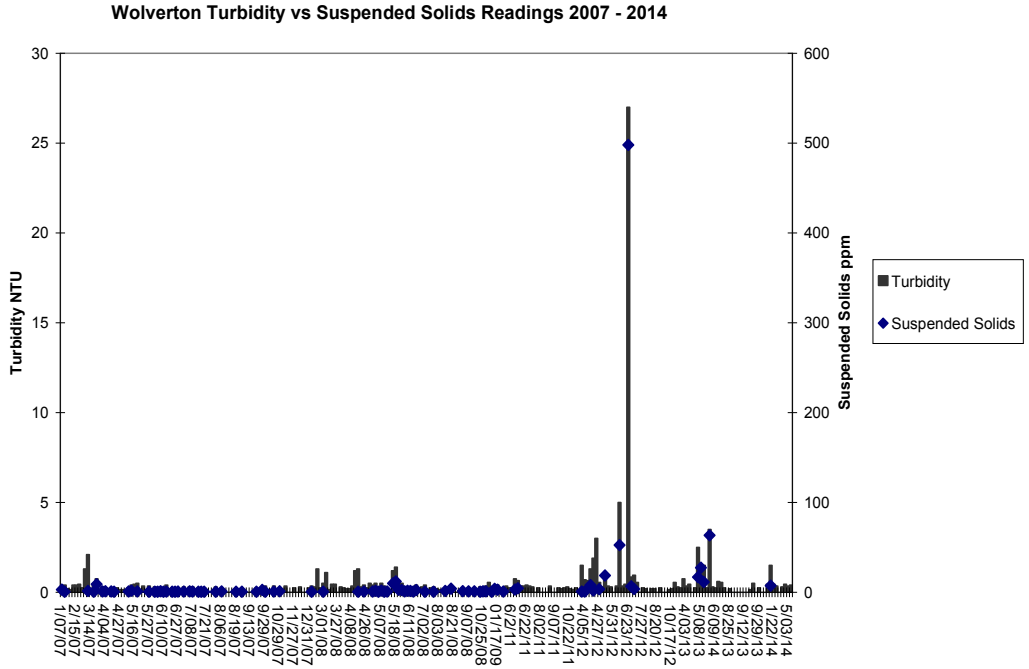
The most important health-related effect of turbidity is its ability to shield microorganisms from disinfection. Turbidity has been shown to be correlated with the contamination of water by *Giardia* and *Cryptosporidium*. Hence, turbidity serves as a measure for indicating the risk of contamination 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, five or 23% of the samples collected were greater than 0.5NTU.

When this program started, we ran suspended solids on every sample. The chart below illustrates the correlation between suspended solids and turbidity. Note the fact that most of the high turbidity (and suspended solids) readings are seen in 2012 and 2013.

These observations *may* also relate to the higher volume of sediment noted at the user intake site.



Turbidity Chart

Wolverton Creek Year	Highest Turbidity Reading	%Samples greater than 0.5NTU	% Samples less than 0.25NTU	Number of Samples
2007	2.1	10	50	40
2008	1.4	24	32	53
2009	1.6	22	55	27
2010	1.2	13	50	24
2011	0.95	22	40	35
2012	27	50	25	28
2012	3.5	23	36	22

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.

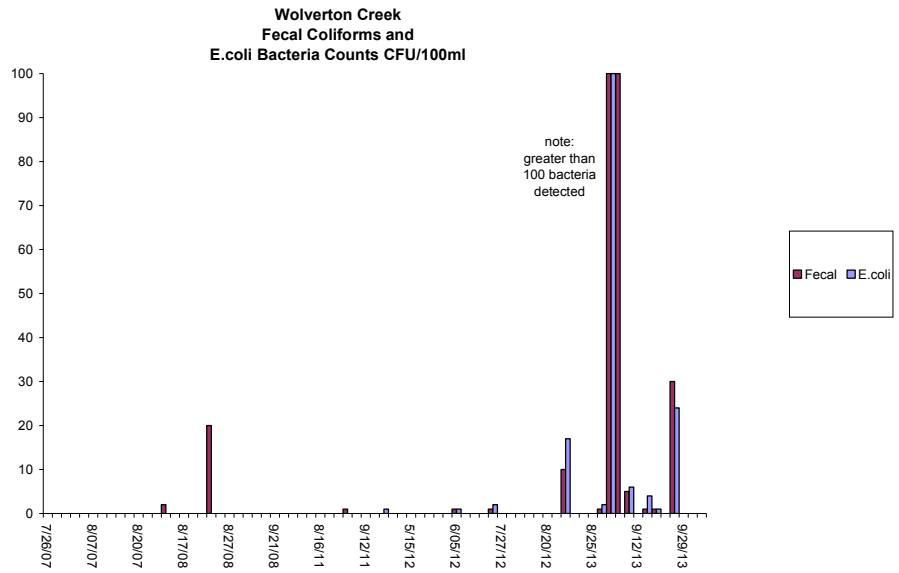
As seen in the chart below and historically, Wolverton has low fecal coliforms and E.coli. This was not the case in 2013.

Normally, 5 samples are tested over 30 days. However, because of the high counts seen on September 6th, a total of 7 samples were collected at the gauge. In addition, high E.coli counts were seen in samples collected from water users house taps.

In summary, the water from Wolverton Creek did not meet drinking water standards for all the days tested.

Coliform Bacteria Test Results for 2013

Date	Fecal Coliforms CFU/100ml	E.coli CFU/100ml
9/03/2013	1	2
9/06/2013	gt200	gt200
9/07/2013	gt270	gt100
9/09/2013	5	6
9/13/2013	1	4
9/18/2013	1	1
9/30/2013	30	24



References

1. Wolverton Creek Monitoring Summary Report 2012, Jennifer Yeow, Passmore Laboratory Ltd.

2. Wolverton Creek Monitoring Summary Report 2010 - 2011, 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