Mill and Narrows Creek Monitoring

Report for 2017 - 2018

Mill/Harrop Creek

Report Prepared For:

The Harrop Proctor Watershed Protection Society

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

July, 2019

Mill and Narrows Creeks Monitoring Summary Report for Nov, 2017 – 2018

Written by Jennifer Yeow, Passmore Laboratory Ltd and submitted August, 2019

Background

This report reviews monitoring data and findings on Mill (Harrop) Creek and Narrows Creek for the Harrop-Proctor Community Cooperative. The cooperative holds a community forest license which lies within Mill and Narrows Creek watersheds. The water monitoring program was initiated in 1999 to obtain baseline data, characterize water quality and assess changes associated with climate and development activities in the watersheds managed by the cooperative. The following information documents findings from November, 2017 to June, 2019. Starting with this report, flow measurements in cubic meters per second are no longer reported. Rather reporting is done as water level in meters using the automated sensor described below.

The program

The structure of 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 was established based on recommendations of local scientists and forest hydrologists in Canada and Idaho State, USA. The program relies on automated and manual readings of instream flow gauges. In November 2017, Onset brand, HOBO MX2001 Water level loggers were installed on both creeks. Measurements for water level and temperature are taken every 6 hours and averaged for a daily reading on the data sheets. The data from the loggers is downloaded using Bluetooth. For 2018 – June 2019, strategic collection of 53 water samples (Mill) and 48 samples (Narrows) were 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
- keep samples cool and dark prior to delivery to lab

In addition to automated water level readings and temperature, the collected samples were tested for turbidity and conductivity. In the past, we tested samples with high Turbidity for Suspended Sediment. This practice was discontinued in 2017. Five samples from Narrows and six from Mill creek were tested for confirmed coliforms, thermotolerant coliforms and E.coli bacteria. The frequency of sample collection for these parameters is recommended in the B.C. Ministry of Environment water quality guidelines and specifies five samples over thirty days. Regarding timing; To observe maximum counts for the year, we have found it best to collect during late summer to early fall.

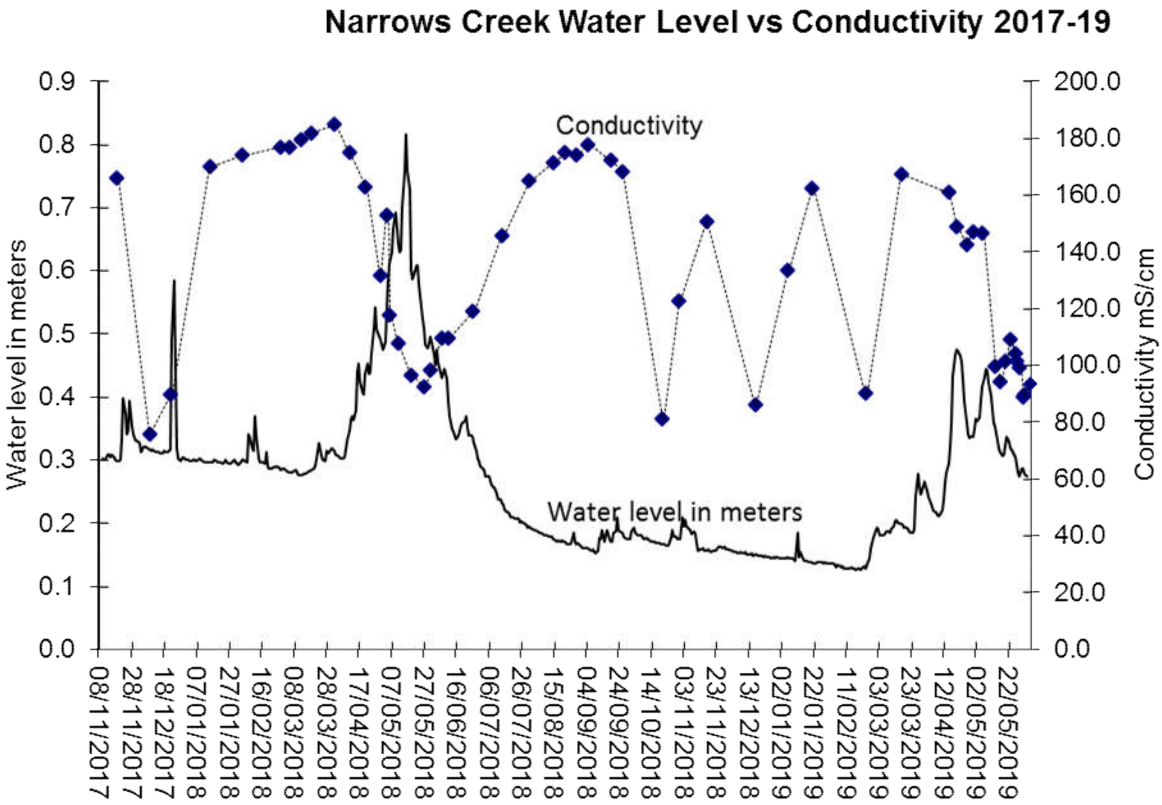
All physical and microbiological tests were performed at Passmore Laboratory Ltd. and follow methods outlined the "Standard Methods for Examination of Water and Wastewater" published by the American Public Health Association 23^{t} edition, 2017. Passmore Laboratory Ltd. is certified by the Provincial Enhanced Water Quality Assurance Program (EWQA) which regulates microbiological testing of drinking water.

Credit goes to Lloyd Johnson who read the gauges and collected samples during 2017, 2018 and 2019. Lloyds strategic sampling has been essential to help identify key max/min readings for these years.

The following table summarizes Narrows Creek data. No collections taken in 2002 and 2008

Table 1 Narrows Creek							
	Flow		Conductivity		Turbidity	Suspended Sediment	Number
	Maximum m3/sec	Minimum m3/sec	Maximum mmhos/cm	Minimum mmhos/cm	Maximum NTU	Maximum mg/l	Samples (n)
1999		1.86 (12/31)	157 (11/24)	86.2 (6/24)	0.9 (6/24)	9.0 (6/24)	25
2000	2.3 (6/17)	0.09(11/18)	210 (12/15)	74 (6/9)	1.7 (5/3)	3.3 (6/7)	26
2001	2.47 (5/25)	0.07 (2/23)	176 (4/13)	83.2 (5/25)	1.3 (5/25)	4.2 (5/25)	11
2003	3.6 (6/9)	0.158 (3/28)	164 (2/15)	75.4 (6/5)	3.2 (5/30)	30.6 (5/30)	41
2004	1.32 (6/20)	0.08 (12/1)	176 (3/19)	96.6 (6/14)	0.35 (5/5)	3.6 (5/5)	42
2005	1.95 (5/17)	0.099 (4/8)	167 (2/10)	90.5 (5/17)	0.45 (5/17)	1.5 (6/17)	40
2006	5.33 (5/20)	0.122 (2/25)	175 (2/11)	77.9 (5/20)	7.0 (5/20)	64.5 (5/17)	41
2007	3.87 (6/15)	0.087 (3/18)	168 (1/2)	76.7 (6/5)	4.0 (6/5)	58.5 (6/5)	13
2009	3.58 (5/31)	0.04 (3/20)	166 (3/10)	55.5 (5/31)	0.7 (5/31)	8.8 (5/31)	56
2010	2.4 (6/3)	0.134 (2/10)	170 (2/26)	87.9 (6/14)	0.55 (6/14)	5.3 (6/14)	36
2011	4.66 (6/21)	.094(12/10)	181 (4/20)	90.6 (6/21)	3.3 (6/6)	24.5 (5/12)	52
2012	4.0 (6/23)	0.09 (12/10)	180 (4/14)	82.1 (6/23)	8 (6/23)	126 (6/23)	39
2013	3.2 (6/23)	0.02 (10/05)	168 (4/23)	78.1 (5/12)	1.8 (5/08)	23.1 (5/06)	46
2014	2.13 (5/25)	0.08 (1/04)	148(12/06)	55.6 (5/23)	.95 (3/29)	5.1 (3/29)	57
2015	1.33 (6/2)	0.04 (1/1)	182 (1/1)	86.3 (5/11)	4.5 (10/6)	10.3 (5/21)	46
2016	1.4 (5/9)	0.14 (1/26)	179 (2/27)	99.9 (5/9)	0.45 (12/6)		21
2017	3.9 (5/29)*	0.119 (1/23)	174 (2/27)	76 (12/08)	6.5 (5/23)	58.6 (5/23)	16
2018	(5/15)		185 (4/1)	81.1 (10/20)	16.5 (5/18)		30

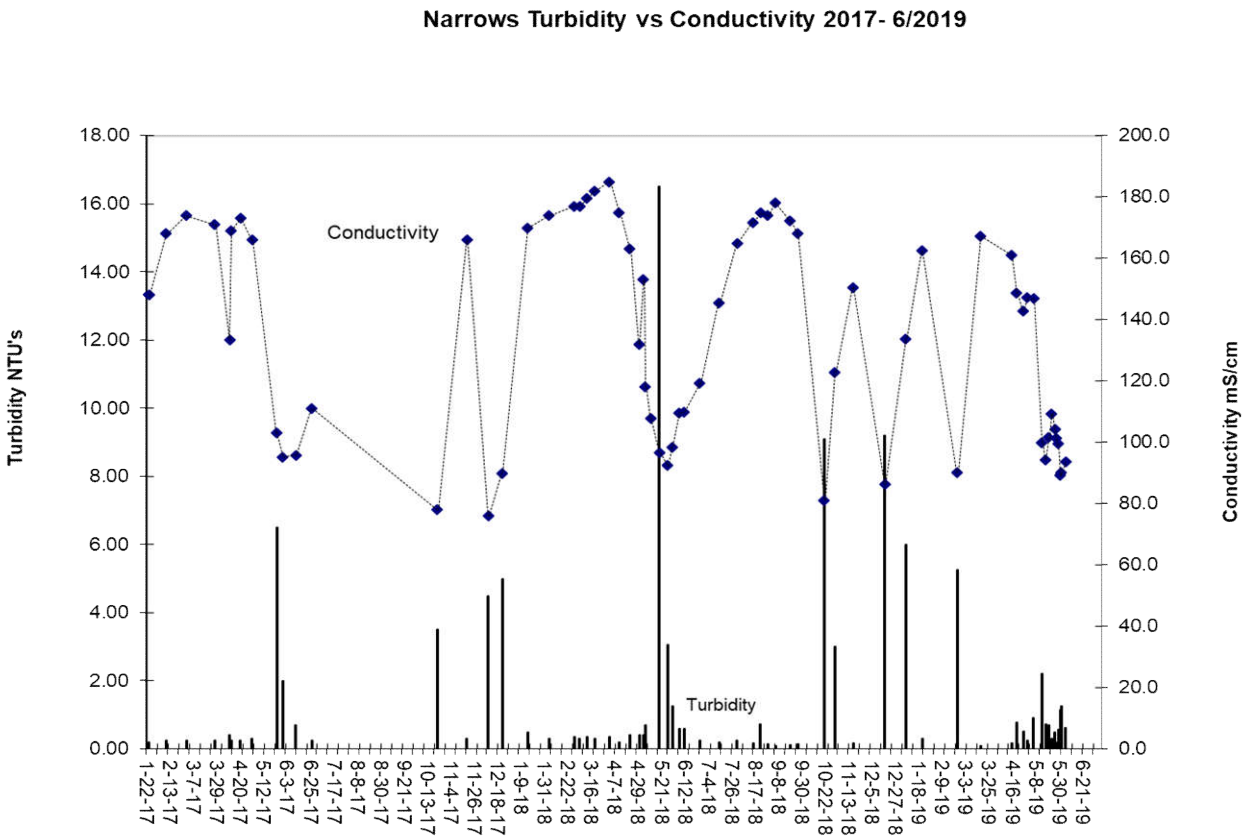
Chart 1



Narrows Creek Flow, Conductivity:

Narrows Creek peak flow normally occurs between mid May and mid June and low flow occurs in Winter to early Spring or occasionally in Fall. In the chart above we have graphed water level as read by the automated sensor against conductivity in mS/cm. Daily readings were averaged for a 24-hour period. As with flow, conductivity shows an inverse relation to the water level readings. High water was recorded on 5/15 while the low conductivity for Spring (as collected by a sample on 5/18) was 96.7mS/cm. The lowest conductivity reading for the year at 81.1mS/cm was in Fall. Two addition low winter readings were taken in winter, 2019. Likely, the high flow for 2019 occurred before May 22nd and was significantly lower than 2018. See above chart 1.

Narrows Creek Cont.
Chart 2

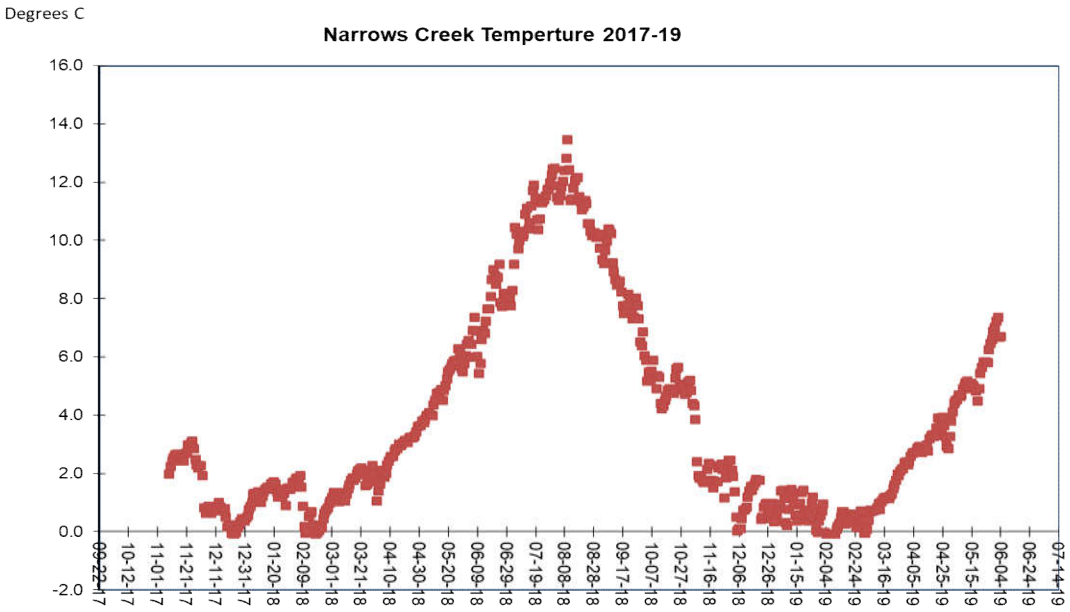


Narrows Creek Turbidity:

Narrows Creek normally has low turbidity. In 2017, three samples of the 16 taken between June and December were greater than 3NTUs. *In 2018, on May 18th, the highest reading (16.5NTU) observed for over 16 years of monitoring was recorded. This was noted 3 days after the peak flow for 2018 was recorded.* Two more high values in Fall and Winter coincided with low conductivity readings – 9.1 NTU on 10/20 and 9.2 NTU on 12/16. They did not, however, coincide with spikes in water level (chart 1). Other high turbidity readings (6 NTU on 1/5 and 5.25 NTU on 2/22/2019) were seen.

Provincial Guidelines recommend for raw waters of exceptional clarity which normally do not require treatment to reduce natural turbidity, readings should not exceed 5 NTU at any time (2). Provincial Standards state that natural background turbidity should be less than 5 NTU (7).

Chart 3



Narrows Creek Temperature

Temperature for Narrows in 2018 was measured hourly and converted to "daily mean" in the chart above. The sensor was partially out of the water towards the end of July, 2017. No unusually high or low temperatures were noted in 2018. Readings were within trends from the past.

Narrows Creek Coliforms

Samples are normally collected in late summer when water temperatures are high.
While there are no official Provincial Standards for untreated drinking water our experience monitoring creeks in the Kootenays has shown there is a relation between development activities and fecal coli/E.coli counts. Total coliforms are not associated with human infection but thermotolerant coliforms and E.coli should not be present. Other than one sample (8/30/2017) with a E.coli count of 3/100ml, all sample were negative or very low. Since samples were collected during the time of year when counts are highest, Narrows creek would be considered a very good water source relative to other surface water sources for drinking water.

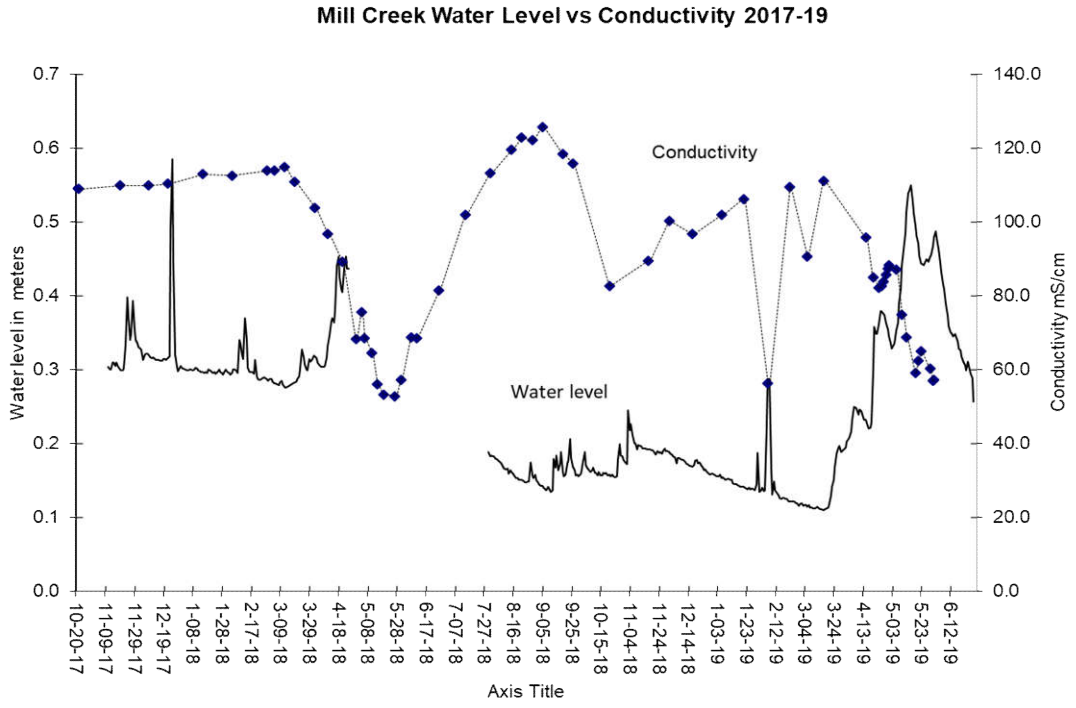
Table 2. Narrows Creek Coliforms 2017-2018	Total Coliforms per 100ml	Thermotolerant Colifoms per 100ml	E.coli per 100ml
8/23/2017	gt 250	1	1
8/30/2017	gt 280	3	3
9/20/2017	35	0	0
8/21/2018	0	0	0
8/29/2018	20	0	0
9/4/2018	14	1	1
9/25/2018	20	0	0
gt = greater than			

Mill Creek Summary Table

The following table summarizes Mill Creek data

Table 3 Mill Creek Summary Sheet							
	Flow		Conductivity		Turbidity	Max Sediment	Number
	Max m3/sec	Min m3/sec	Max mmhos/cm	Min mmhos/cm	NTU	mg/l	Sample (n)
2002			95.8 (8/8)	51.4 (6/17)	1.9 (6/17)	12.6 (5/29)	15
2003	2.8 (6/10)	0.15 (3/8)	119 (9/20)	52.2 (6/10)	2.5 (5/5)	32.1 (10/31)	32
2004	2.6 (5/28)	0.28 (3/13)	111 (1/31)	59.0 (4/16)	0.55 (3/26)	2.7 (6/27)	17
2005	4.2 (5/17)	0.30 (12/10)	106 (4/05)	59.6 (5/17)	0.85 (6/17)	12.6 (6/17)	35
2006	11.8 (5/18)	0.30 (3/29)	115 (10/12)	45.7 (5/18)	13.0 (5/18)	149.0 (5/18)	39
2007	6.9 (6/6)	0.10 (1/10)	119 (9/28)	50.8 (6/6)	1.3 (6/6)	11.4 (6/16)	22
2008	5.6 (6/1)	0.20 (2/24)	115 (3/17)	55.3 (6/1)	0.65 (5/19)	7.4 (5/19)	21
2009	3.2 (5/31)	0.30 (3/4)	154 (11/18)	58.2 (6/16)	0.55 (5/31)	5.5 (5/17)	11
2010	3.3 (6/14)	0.20 (2/9)	137 (8/8)	59.5 (6/14)	0.55 (4/22)	6.7 (6/24)	40
2011	4.03 (5/26)	0.27 (3/15)	122 (12/9)	55.9 (6/6)	3.0 (6/6)	8.0 (5/25)	47
2012	7.8 (6/2)	0.217 (9/27)	122 (12/19)	48.4 (6/22)	2.3 (6/07)	42.9 (6/16)	55
2013	10.6 (5/13)	0.366 (9/02)	158 (6/22)	50.0 (5/13)	2.3 (5/12)	37.7 (5/12)	54
2014	3.71 (5/25)	0.149 (1/18)	171 (2/15/)	55.5 (5/25)	2.8 (4/5 & 4/12)	65.9 (4/05)	55
2015	3.7 (6/2)	0.08 (1/1)	131 (5/5)	59.0 (6/6)	0.7 (5/21)	4.8 (5/25)	43
2016	3.27 (5/16)	0.134 (1/1)	111(9/19)	58.7 (5/27)	0.45 (3/14)		22
2017	9.98(5/29)*		114 (2/27)	55.4 (5/29) 53.4 (6/5)	4.5 (5/23)*	75.3 (5/23)	17 55.5 (5/
2018	(5/14)		125.8 (9/4)	52.9 (5/26)	12.6 (5/18)		32

Chart 4



Mill Creek Water Level and Conductivity:

Mill Creek normally experiences high flow between mid May to early June and low flow occurs in Fall to early Spring. In November, 2017, a water level logger was installed. In May, 2018 the device was swept downstream. It was recovered and reinstalled in July. While flow data was not calculated, the conductivity on May 26, 2018 was the lowest seen since 2013 reflecting an exceptionally high flow. See table 3 and chart 4.

Mill Creek cont

Chart 5

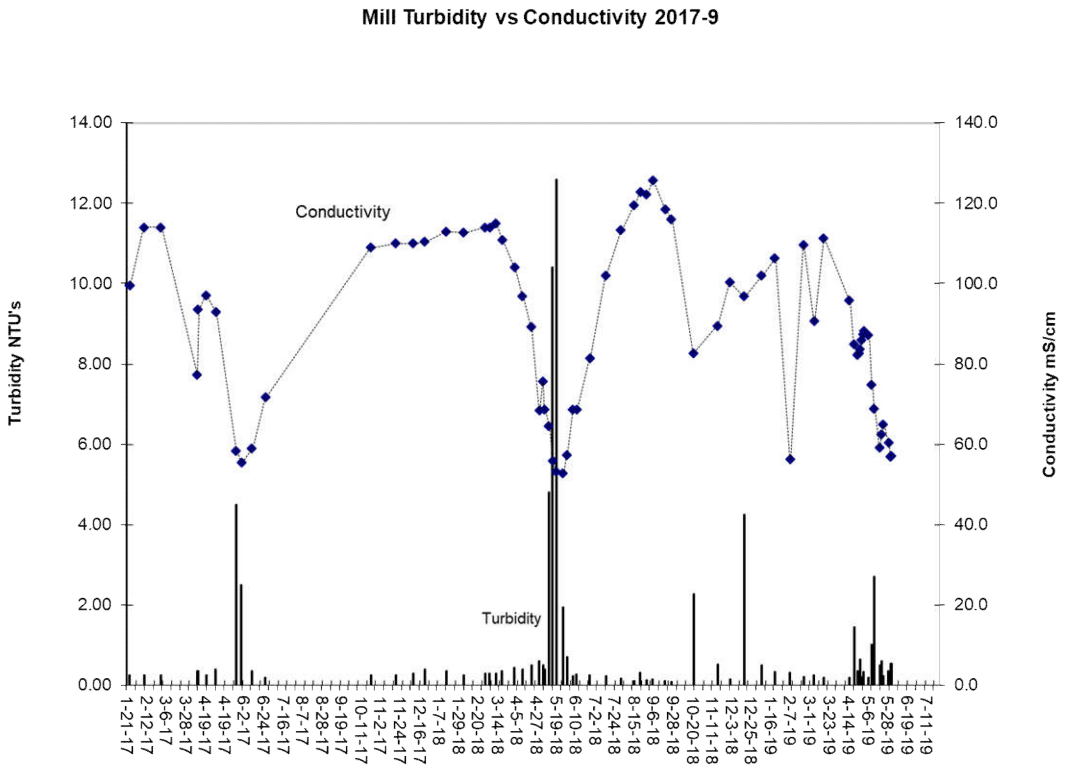
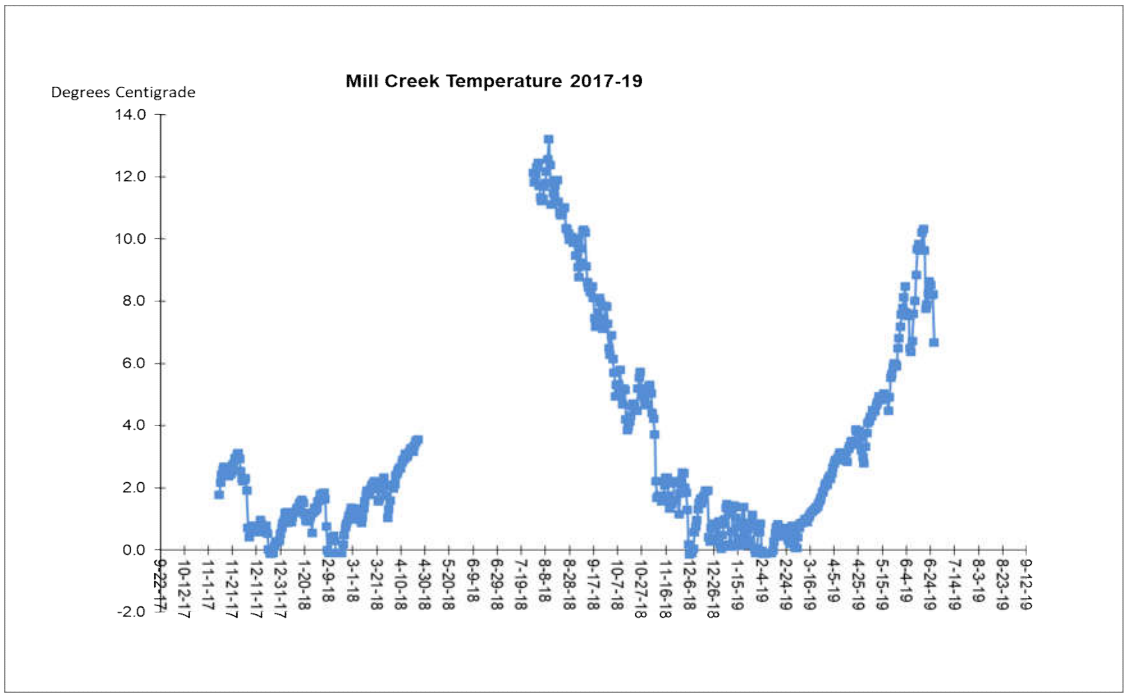


Table 4 Date	Mill High Turbidity Readings NTU's
5/23/2017	4.5
5/29/2017	2.5
5/10/2018	4.8
5/14/2018	10.4
5/18/2018	12.6
10/20/2018	2.28
12/16/2018	4.26

Characterization of Mill Creek (Turbidity)

In 2017, 15 samples were tested and all were less than 0.5NTU. In 2018, 32 samples were tested and 5 were greater than 2 NTU's. One historic turbidity reading in 2006 (13 NTU on May 18) was reported. The May 18th 2018 reading of 12.6 NTU's was the highest seen since that reading 12 years ago.

Chart 6



Mill Temperature

Hourly readings were taken between November and April. After the logger was retrieved at the end of July, readings resume. No unusually high readings were noted

Coliform Bacteria

In year 2017, two of the three samples contained E.coli and Fecal Coliforms. In 2018, one sample contained a relatively high number of both E.coli and fecal Coliforms. All samples were within Provincial Source Drinking Water Guidelines which state less than 10 fecal and E.coli/100ml for collection of 5 samples over 30 days (7).

Table 4 Mill Creek Coliforms for 2017 - 2018	Total Coliforms per 100ml	Thermotolerant Colifoms per 100ml	E.coli per 100ml
8/23/2017	gt 250	1	1
8/30/2017	gt 280	3	3
9/6/2017	gt 240	1	0
8/21/2018	5	0	0
8/28/2018	34	0	0
9/4/2018	6	0	0
9/25/2018	33	6	6
10/2/2018	0	0	0
gt = greater than			

References

1. Water Survey Canada's website: http://scitech.pyr.ec.gc.ca/waterweb
2. Water quality guidelines from the Provincial Govt's website: http://www.env.gov.bc.ca/wat/wq/BCguidelines/approv_wq_guide/approved.html#1
3. Monitoring Guidelines to Evaluate the Effects of Forestry Activities on Streams in the Pacific Northwest & Alaska, L.H McDonald EPA 910/9-91-001
4. Wildland Water Quality Sampling and Analysis, John D. Stednick
5. Health Canada Website: www.hc-sc.gc.ca
6. Harrop and Narrows Creeks Monitoring Summary Report for 2016, J. Yeow
7. British Columbia Source Drinking Water Guideline https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/source_drinking_water_quality_guidelines_bcenv.pdf

Respectfully Submitted

Jennifer Yeow
Passmore Laboratory Ltd.