Mill and Narrows Creek Monitoring

Report 2016

Mill/Harrop Creek

Report Prepared For:

The Harrop Proctor Watershed Protection Society

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Mill and Narrows Creeks Monitoring Summary Report for 2016

Written by Jennifer Yeow, Passmore Laboratory Ltd and submitted August, 2017

Background

This report reviews monitoring data and presents findings on Mill (Harrop)Creek and Narrows Creek for the Harrop-Proctor Community Co-Operative. The Co-Operative 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 Co-Operative. The following information documents findings from April, 2016 to July 2017. Narrows and Mill creeks have been monitored since 1999 and 2002 respectively.

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 manual reading of instream flow gauges. The gauges are calibrated by creek channel metering using a Price Current meter (RIC standard procedures) at intervals of 6 to 12 inches across the stream and 4-5 metering sessions cross channel per year. Regression formulas that are consistent with the manual method are used to calculate stage-discharge tables to three decimal places. In 2016, deviations for each calculated discharge ranged from 0.5 – 13.1 % (average 5.9%) for Mill Creek and 2.5 – 3.7% (average 3.1%) for Narrows Creek (see hydrometric summary). A stage discharge curve was developed for each creek. Strategic collection of 21 water samples (Mill) and 22 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 within one week

In addition to flow readings, samples were tested for suspended solids when turbidity readings were greater that 0.5 NTU. One sample from each creek was tested for confirmed coliforms, thermotolerant coliforms and E.coli bacteria. The frequency of sample collection for these parameters as recommended in the B.C. Ministry of Environment Water Quality Guidelines specifies five samples over thirty days during late summer. One sample was collected from each creek in 2016. Water temperature readings were taken hourly via temperature Hobo Temp Pro data loggers.

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) and participates in reviews through the University of British Columbia Clinical Microbiology Proficiency Testing (CMPT) Program.

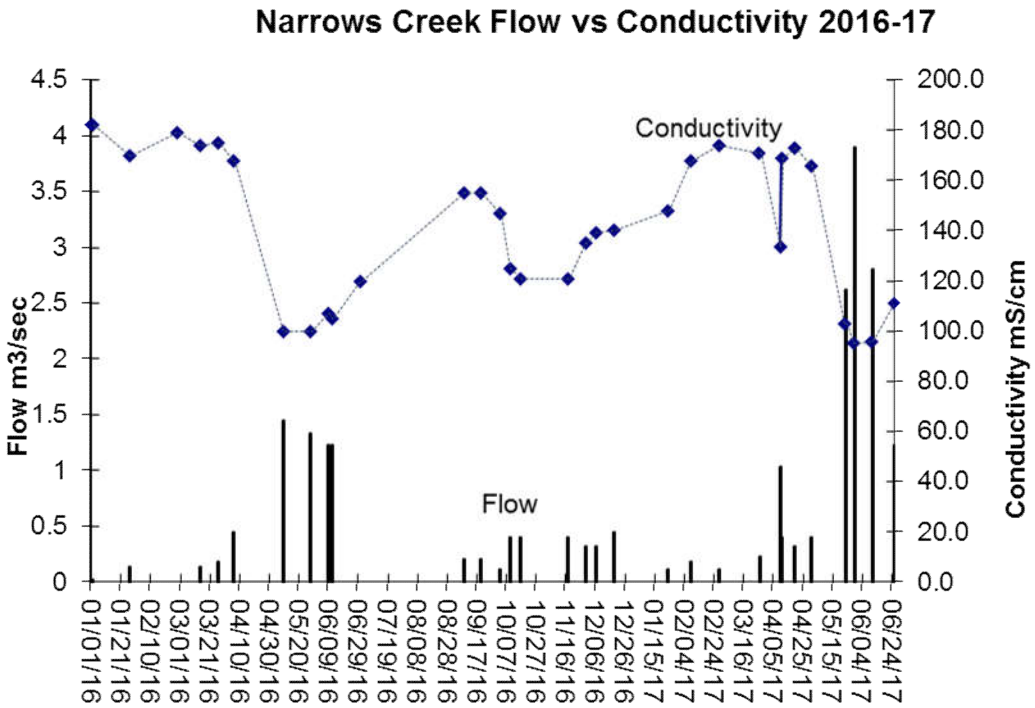
Credit goes to Pam Dykstra and Lloyd Johnson who read the gauges and collected samples during 2016 and 2017. Lloyds strategic sampling helped to identify important readings in 2017.

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)*				6.5 (5/23)*	58.6 (5/23)	

* as of Aug, 2017

Chart 1

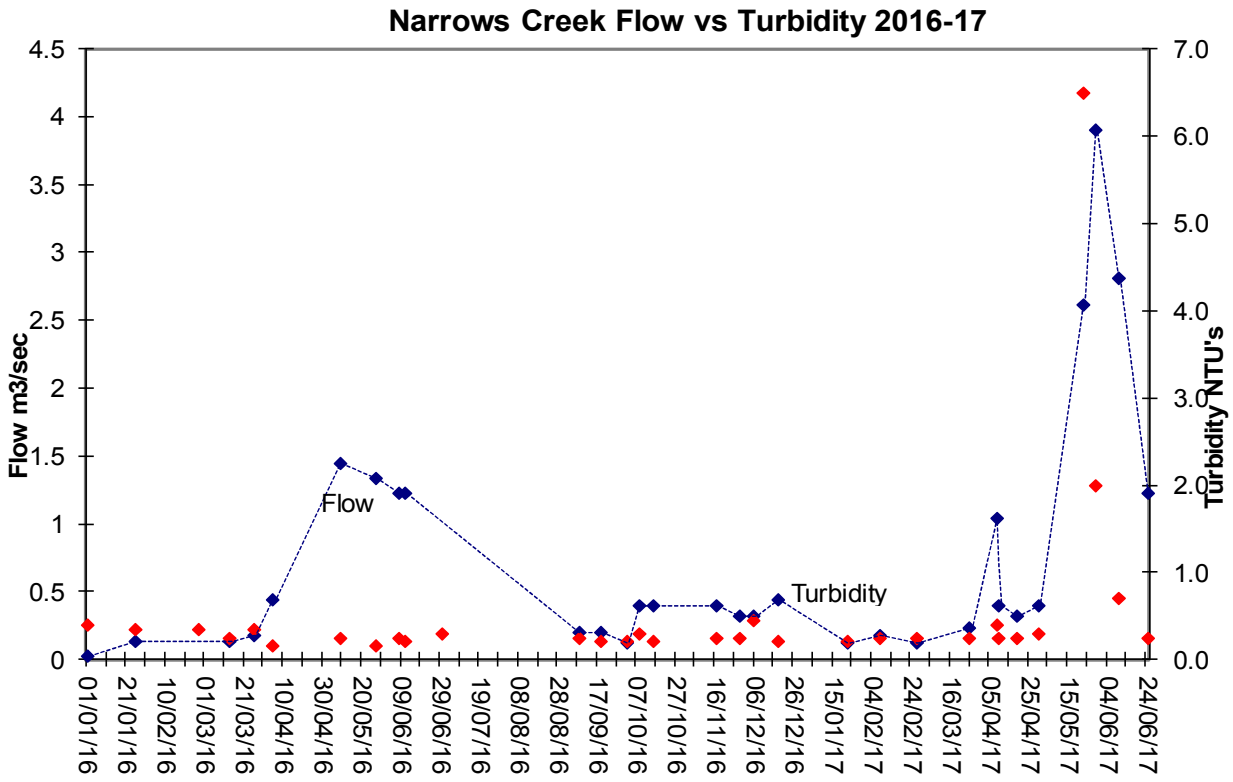


Narrows Creek Flow, Conductivity:

Narrows Creek peak flow normally occurs between mid May to mid June and low flow occurs in winter to early spring. The high flow reading for 2016 observed on May 9th was 1.4m3/sec. and the low flow reading on January 26th was 0.14m3/sec. The highest conductivity reading (179 m3/sec) was reported on February 27th, 2016. The lowest conductivity reading (99.9mS/cm) was reported on May 9th.
The high flow reading for 2017 at 3.9m3/sec (5/29) was over 2 times as high as seen in 2016.

Narrows Creek Cont.

Chart 2

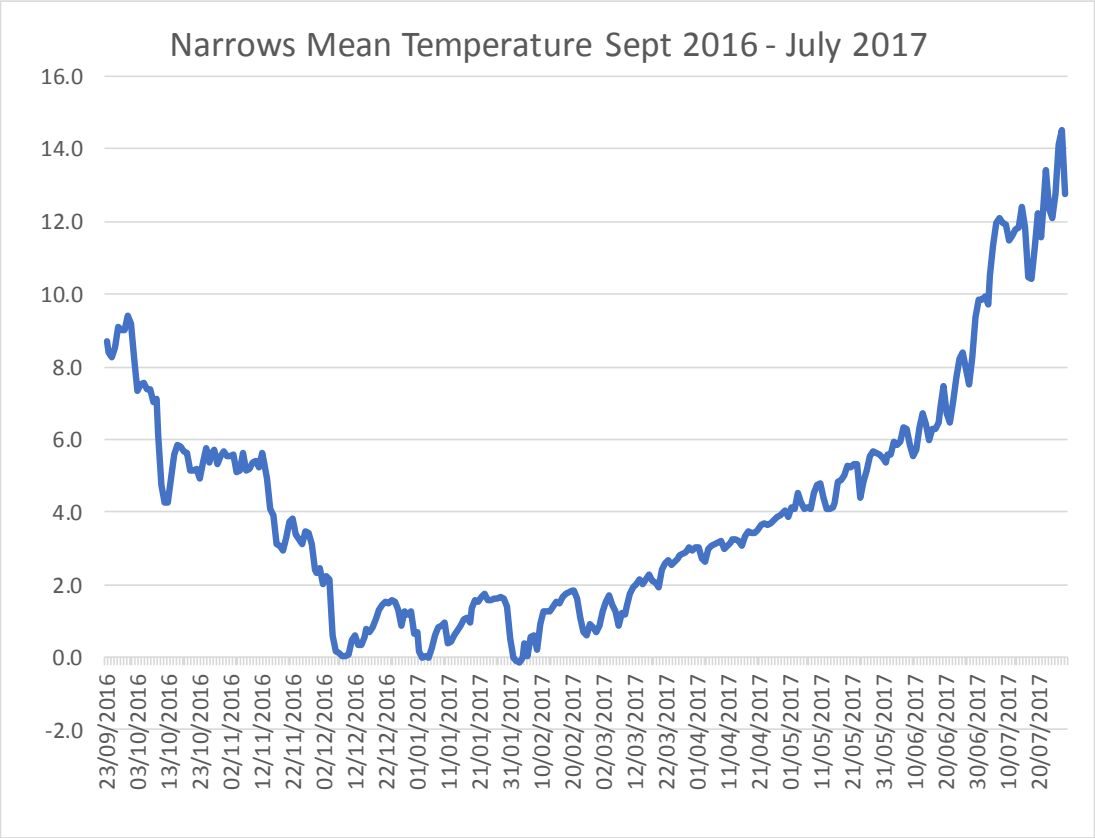


Narrows Creek Turbidity:

Narrows Creek normally has low turbidity. Samples with turbidity over 0.5 NTU are tested for suspended solids and in 2016 no samples were seen. In 2017 three samples were tested: May 23 was 58.6mg/l, May 29th was 44.3mg/l and June 10 was 4.6mg/l. Regarding turbidity: Provincial Guidelines recommend for raw waters of exceptional clarity (less than or equal to 5 NTU) which normally do not require treatment to reduce natural turbidity, readings should not exceed 5 NTU at any time (2). All samples were below 5 NTU in 2016. In 2017 on 5/23 one sample was recorded at 6.5NTUs. This was the third highest reading recorded for Narrows.

Provincial Standards state that natural background turbidity should be less than 5 NTU (7).

Chart 3



Narrows Creek Temperature

Temperature for Narrows in 2016 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

Table 2. Narrows Creek Coliforms 2016	Total Coliforms per 100ml	Thermotolerant Colifoms per 100ml	E.coli per 100ml
9/22/2016	2	0	0

Narrows Creek Coliforms

Samples are normally collected in late summer when water temperatures are high.
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 counts.
Total coliforms are not associated with human infection but thermotolerant or fecal coliforms and E.coli should not be present. See Health Canada "Bacterial Waterborne Pathogens" : www.hc-sc.gc.ca
In 2016, one sample was collected. Provincial Guidelines recommend collection of five samples over 30 days.

Mill Creek Summary Table

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)*			55.4 (5/29)*	4.5 (5/23)*	75.5 (5/23)	

* as of August, 2017

Mill Creek Flow and Conductivity:

Mill Creek high flow normally occurs between mid May to early June and low flow occurs in Fall to early Spring. In 2016, the recorded high flow at 3.27 m3/sec occurred on May 16th . The lowest value was reported on January 1st at 0.134m3/sec. *The high flow recorded for 2017 (May 29th) was the third highest seen in 15 years.*

Chart 4

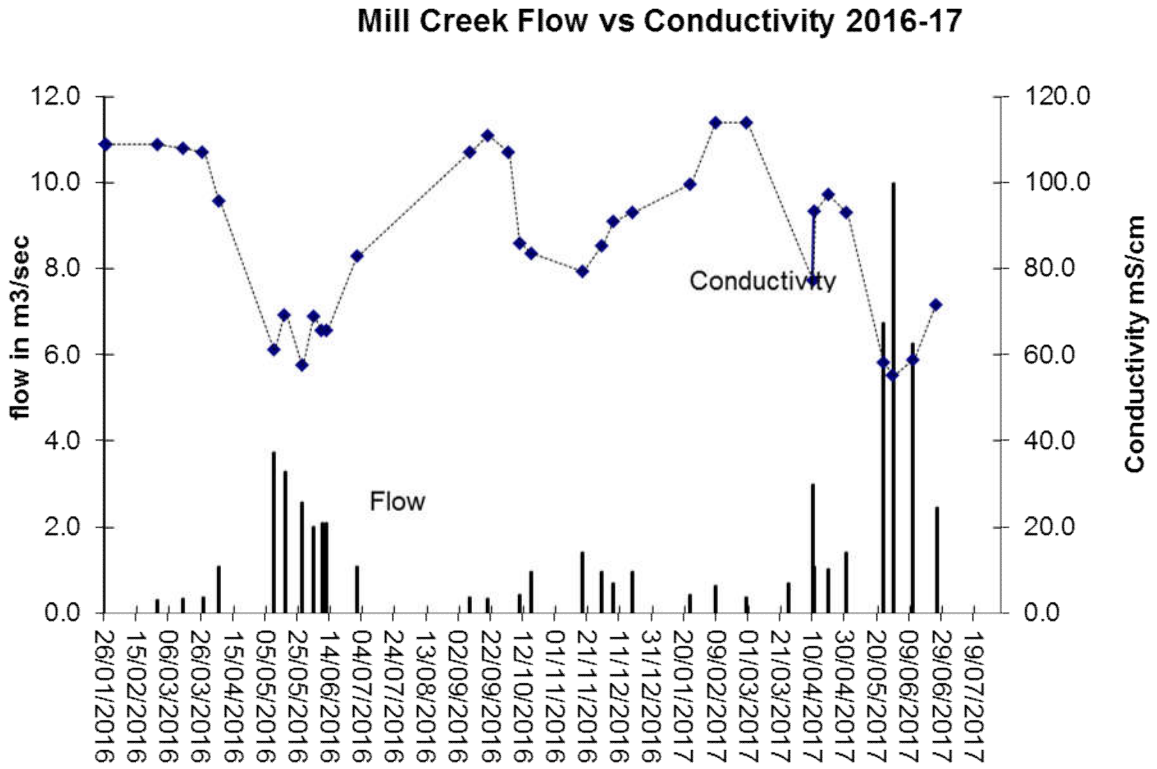


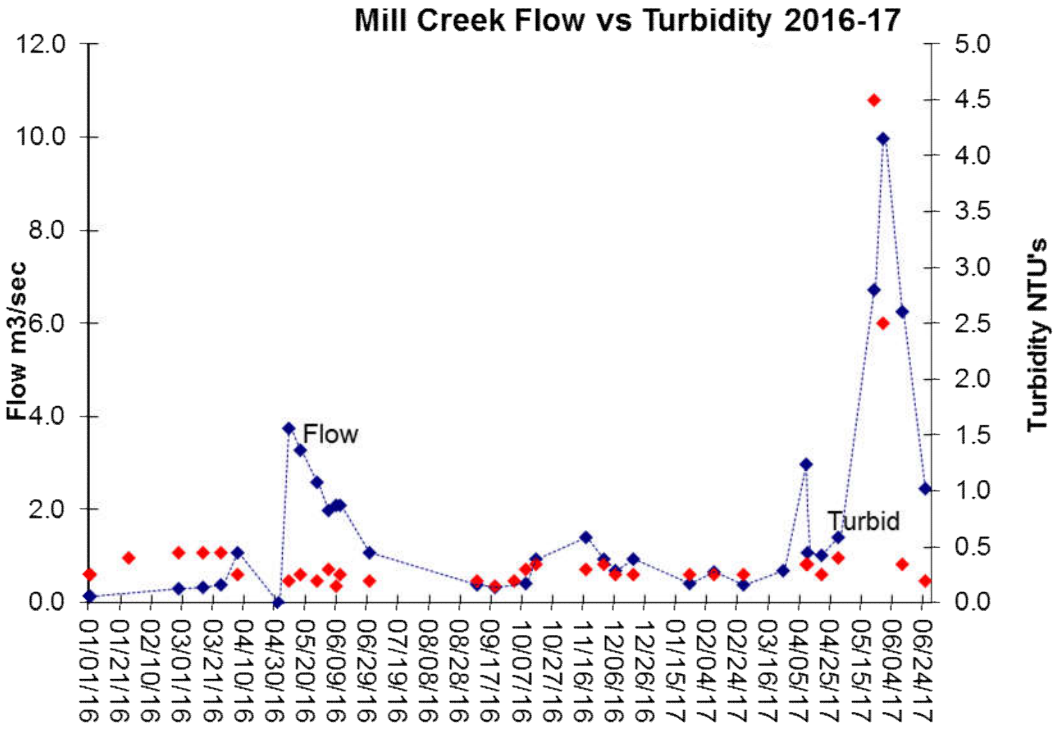
Table 3 Date	Turbidity NTU's	Suspended Solids mg/l
5/23/2017	4.5	75.7
5/29/2017	2.5	33.7

Characterization of Mill Creek (Turbidity)

In 2016, 22 samples were tested and all were less than 0.5NTU. To date, in 2017, 10 samples have been collected. Five of these were taken during high water and two were over 0.5NTU. See Chart 5.

Mill Creek cont

Chart 5



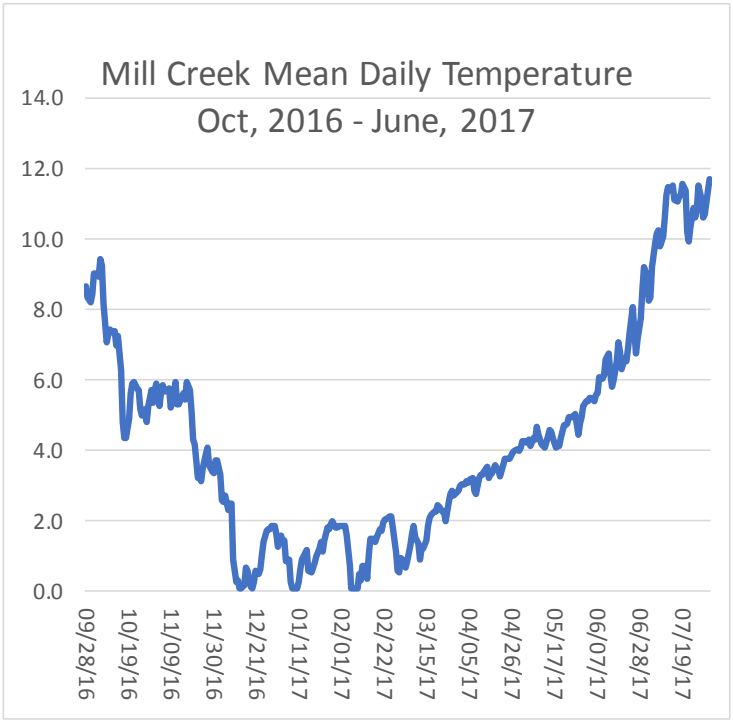


Chart 6

Mill Temperature

Between Sept, 2016 and July 23, 2017 hourly readings were taken. On July 3rd , 2017 the creek temperature rose above 10C and likely will remain at or above this value through August.

Coliform Bacteria

In year 2016 one sample were collected and found positive for E.coli and Fecal Coliforms
See Table 4.

Table 4 Mill Creek Coliforms for 2016	Total Coliforms per 100ml	Thermotolerant Colifoms per 100ml	E.coli per 100ml
9/22	4	1	1

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 2014, 2015, J. Yeow
7. British Columbia Water Quality Guidelines: Drinking Water Sources Guideline Summary

Respectfully Submitted

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