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Ministry of Environment
Mining Operations Environmental Protection
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WEEKLY UPDATE REPORT – SEPTEMBER 30 TO OCTOBER 6, 2016

Water Management

Springer Pit

Water elevations are recorded daily at the Springer Pit. Surrounding groundwater elevations are recorded daily with a few exceptions. The summarized weekly data are presented here in Table 1.

Water quality monitoring is conducted at the Springer Pit (sample point E11a) weekly and the surrounding groundwater wells monthly. All results are reported to the Ministry of Environment (MoE) each quarter, and results are included here as they become available. Results for the Springer Pit from the last six sampling events are shown in Table 2. The results for the groundwater wells are reported in Tables 3 – 8 below.

Water Treatment and Discharge

Discharge of treated water continued this week; the total amount of treated water discharged between September 27th and October 4th was 198,332 m³ with an average discharging rate of 0.288 m³/s throughout this same period.

Rehabilitation Work

Hazeltine Creek Rehabilitation

Placement of till material and coarse woody debris on the east side of the Polley Flats has been completed. Construction of fish habitat features within upper Hazeltine Creek has been completed. Planting of shrubs at lower Hazeltine near Quesnel Lake has commenced.

Environmental Monitoring Program

Water Quality Monitoring

Samples were collected at end of pipe at the water treatment plant (station HAD-03) and throughout Hazeltine Creek on October 3rd. Results for HAD-03 from the September 27th and 29th sampling events are shown in Table 9.

QUL-58 was profiled and sampled on October 5th. The most recent profile data for QUL-58 is provided in Figure 1. Results from the September 5th sampling event compared to the BC Water Quality Guidelines (WQG) for aquatic life are shown in Table 10.

For previous results see the September 29, 2016 report available on the Imperial Metals website:

<https://www.imperialmetals.com/assets/docs/mt-polley/09.30.16.weekly-update-SEC.pdf>

A map of monitoring stations is available on the Imperial Metals website:

<http://www.imperialmetals.com/assets/docs/mt-polley/12.03.15.weekly-update.pdf>

The update for the Post-Event Environmental Impact Assessment Report is available on the Imperial Metals website:

https://www.imperialmetals.com/assets/docs/mt-polley/2016-06-03_1411734-124-R-Rev0-10000.pdf

Figure 1 shows field parameter profile results for turbidity and temperature at station QUL-58 in Quesnel Lake (station 100m from the Hazeltine Creek outflow diffusers, at the edge of the initial dilution zone).

Figure 2 shows field turbidity readings for upper, middle and lower Hazeltine Creek. Increases in turbidity along the creek are being monitored and are currently generally a result of the construction in the upper reaches of the creek and quickly drop out in the sedimentation pond at lower Hazeltine.

Figure 3 shows a time series graph of turbidity readings at site QUR-1/QUR-11 in the upper Quesnel River.

Table 1. Water elevations for Springer Pit and groundwater wells

	Last Week	This Week	Change
	28-Sep-16	5-Oct-16	(m)
Springer	1026.65	1025.82	-0.83
GW12-2a	1016.86	1016.71	-0.15
GW12-2b	1017.97	1017.76	-0.21
GW15-1a	1028.63	1027.93	-0.70
GW15-1b	1028.66	1027.94	-0.72
GW15-2a	1026.53	1026.17	-0.36
GW15-2b	1028.26	1027.77	-0.49

Table 2. Springer Pit supernatant water chemistry results

		Springer Pit Supernatant					
Date Sampled		17-Aug-16	23-Aug-16	30-Aug-16	06-Sep-16	13-Sep-16	19-Sep-16
Physical Tests							
Conductivity	µS/cm	1190	1210	1200	1190	1190	1170
Hardness (as CaCO ₃)	mg/L	505	501	480	496	492	500
pH	pH	7.92	7.91	7.86	7.85	7.84	7.77
Total Suspended Solids	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	0.26	0.24	0.28	0.29	0.28	0.50
Anions and Nutrients							
Nitrate (as N)	mg/L	8.79	8.67	9.13	9.10	9.01	9.28
Sulfate (SO ₄)	mg/L	543	538	565	563	556	572
Total Metals							
Aluminum (Al)-Total	mg/L	0.04	0.03	0.03	0.03	0.03	0.05
Arsenic (As)-Total	mg/L	0.00095	0.00093	0.00085	0.00092	0.00086	0.00098
Cadmium (Cd)-Total	mg/L	<0.000020	<0.000015	0.0000092	<0.000015	0.0000114	<0.000015
Copper (Cu)-Total	mg/L	0.00266	0.00272	0.00275	0.00303	0.00315	0.00389
Iron (Fe)-Total	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Total	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Total	mg/L	0.167	0.181	0.178	0.176	0.176	0.188
Selenium (Se)-Total	mg/L	0.0367	0.039	0.0349	0.0366	0.0374	0.037
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	0.0272	0.0221	0.0238	0.0280	0.0238	0.0241
Arsenic (As)-Dissolved	mg/L	0.00093	0.00084	0.00083	0.00089	0.00089	0.00091
Cadmium (Cd)-Dissolved	mg/L	<0.000020	<0.000015	0.0000099	<0.000015	0.0000152	<0.000015
Copper (Cu)-Dissolved	mg/L	0.00214	0.00219	0.00216	0.00239	0.00236	0.00245
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.03
Lead (Pb)-Dissolved	mg/L	0.000092	<0.000050	<0.000050	<0.000050	0.000053	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.162	0.167	0.166	0.164	0.168	0.182
Selenium (Se)-Dissolved	mg/L	0.0376	0.0386	0.0348	0.0369	0.0389	0.0374

Table 3. GW 12-2a water chemistry results

		GW 12-2A					
Date Sampled		14-Apr-16	11-May-16	08-Jun-16	12-Jul-16	18-Aug-16	15-Sep-16
Physical Tests							
Conductivity	µS/cm	233	230	229	232	231	230
Hardness (as CaCO ₃)	mg/L	49.5	49.4	50.7	50.8	46.2	48.5
pH	pH	8.15	7.97	8.20	7.95	7.92	7.99
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO ₄)	mg/L	65.8	65.6	64.5	64.1	62.8	63.8
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	0.0059	0.0047	0.0070	0.0046	0.0040	0.0045
Arsenic (As)-Dissolved	mg/L	0.00223	0.00209	0.00242	0.00234	0.00218	0.00237
Cadmium (Cd)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0368	0.0394	0.0398	0.0407	0.0388	0.0393
Selenium (Se)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Table 4. GW 12-2b water chemistry results

		GW 12-2B					
Date Sampled		13-Apr-16	11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16
Physical Tests							
Conductivity	µS/cm	590	598	631	660	668	638
Hardness (as CaCO ₃)	mg/L	302	324	331	343	324	312
pH	pH	7.86	7.97	8.00	7.81	8.25	8.16
Anions and Nutrients							
Nitrate (as N)	mg/L	3.68	3.33	3.05	2.98	2.96	2.98
Sulfate (SO ₄)	mg/L	123	132	150	166	174	169
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00053	0.00050	0.00058	0.00057	0.00052	0.00057
Cadmium (Cd)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	0.0000073	0.0000052	<0.000050
Copper (Cu)-Dissolved	mg/L	0.0008	0.00077	0.00081	0.00081	0.00081	0.00081
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0215	0.0208	0.0194	0.0219	0.0210	0.0210
Selenium (Se)-Dissolved	mg/L	0.0104	0.0108	0.0117	0.0111	0.011200	0.010200

Table 5. GW 15-1a water chemistry results

		GW 15-1A					
Date Sampled		14-Apr-16	11-May-16	08-Jun-16	12-Jul-16	18-Aug-16	15-Sep-16
Physical Tests							
Conductivity	µS/cm	281	272	271	275	279	277
Hardness (as CaCO ₃)	mg/L	82.1	81.3	81.0	70.9	70.5	72.7
pH	pH	8.04	8.04	8.12	8.08	8.03	8.05
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO ₄)	mg/L	62.9	62.5	61.6	62.6	63.2	64.9
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	0.0030	0.0082	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00473	0.00460	0.00474	0.00450	0.00404	0.00460
Cadmium (Cd)-Dissolved	mg/L	0.0000071	<0.0000050	0.0000066	<0.0000050	<0.0000050	<0.0000050
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0233	0.0246	0.0258	0.0263	0.0256	0.0256
Selenium (Se)-Dissolved	mg/L	0.000057	<0.000050	<0.000050	<0.000050	<0.000050	0.000067

Table 6. GW 15-1b water chemistry results

		GW 15-1B					
Date Sampled		14-Apr-16	11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16
Physical Tests							
Conductivity	µS/cm	684	712	844	902	866	820
Hardness (as CaCO ₃)	mg/L	327	350	428	447	404	379
pH	pH	7.86	7.98	7.93	7.80	8.16	8.08
Anions and Nutrients							
Nitrate (as N)	mg/L	0.26	0.66	1.74	2.36	2.12	1.85
Sulfate (SO ₄)	mg/L	201	217	298	341	295	278
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00163	0.00148	0.00156	0.00148	0.00149	0.00152
Cadmium (Cd)-Dissolved	mg/L	0.0000072	0.0000065	0.0000110	0.0000095	0.0000091	0.0000119
Copper (Cu)-Dissolved	mg/L	0.00058	0.00062	<0.00050	<0.00050	0.00052	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0049	0.0048	0.0045	0.0046	0.0044	0.0046
Selenium (Se)-Dissolved	mg/L	0.0114	0.0092	0.0108	0.0107	0.008450	0.007090

Table 7. GW 15-2a water chemistry results

		GW 15-2A					
Date Sampled		13-Apr-16	11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16
Physical Tests (Water)							
Conductivity	µS/cm	201	200	201	200	200	200
Hardness (as CaCO ₃)	mg/L	57.5	58.3	59.7	58.7	55.4	56.5
pH	pH	8.16	8.10	8.35	8.10	8.08	8.08
Anions and Nutrients							
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfate (SO ₄)	mg/L	38.1	37.5	36.8	36.4	35.7	36.4
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	0.0035	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00367	0.00353	0.00382	0.00403	0.00394	0.00401
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0423	0.0427	0.0429	0.0433	0.0430	0.0430
Selenium (Se)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	0.000054	<0.000050	0.000052

Table 8. GW 15-2b water chemistry results

		GW 15-2B					
Date Sampled		13-Apr-16	11-May-16	08-Jun-16	12-Jul-16	17-Aug-16	15-Sep-16
Physical Tests (Water)							
Conductivity	µS/cm	379	384	386	386	384	375
Hardness (as CaCO ₃)	mg/L	153	160	160	155	143	142
pH	pH	8.03	8.09	8.14	8.00	8.12	8.12
Anions and Nutrients							
Nitrate (as N)	mg/L	0.952	1	0.962	0.805	0.696	0.649
Sulfate (SO ₄)	mg/L	82.0	84.2	84.9	83.0	81.5	82.5
Dissolved Metals							
Aluminum (Al)-Dissolved	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Arsenic (As)-Dissolved	mg/L	0.00206	0.00188	0.00205	0.00212	0.00197	0.00210
Cadmium (Cd)-Dissolved	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Copper (Cu)-Dissolved	mg/L	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	<0.00050
Iron (Fe)-Dissolved	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	0.0413	0.0431	0.0436	0.0444	0.0437	0.0436
Selenium (Se)-Dissolved	mg/L	0.000260	0.000289	0.000344	0.000303	0.000353	0.000339

Table 9. Sample analysis results for HAD-03 (end of pipe from the water treatment plant)

	Lab Analysis Results for HAD-03		Permit 11678
	27-Sep-16	29-Sep-16	mg/L
Total Suspended Solids (mg/L)	<1.0	<1.0	15
Nitrate (as N)- Total (mg/L)	8.72	8.74	9.7
Ammonia (as N) - Total (mg/L)	0.0639	0.0489	0.41
Phosphorus (P) - Total (mg/L)	0.0046	0.0051	0.09
Sulphate (mg/L)	533	540	720
Arsenic (As) - Total (mg/L)	0.00094	0.00103	0.0034
Copper (Cu)-Total (mg/L)	0.00400	0.00351	0.012
Cadmium (Cd)-Total (mg/L)	<0.000015	0.0000177	N/A
Chromium (Cr) - Total (mg/L)	<0.00050	<0.00050	0.0011
Iron (Fe) - Total (mg/L)	<0.030	<0.030	0.11
Molybdenum (Mo)-Total (mg/L)	0.190	0.187	0.2
Selenium (Se)-Total (mg/L)	0.0365	0.0378	0.06
Vanadium (V) - Total (mg/L)	0.00111	0.00132	0.0081
Zinc (Zn) - Total (mg/L)	0.0056	<0.0030	0.0083

Table 10. Sample analysis from the Quesnel Lake initial dilution zone (QUL-58)

	05-Sep-16				BC WQG for Aquatic Life	
	QUL-58-S	QUL-58-AT	QUL-58-BT	QUL-58-B	Maximum	30-Day Average Max
Hardness (as CaCO ₃) (mg/L)	50	49.6	52.9	54.8	-	-
Total Suspended Solids (mg/L)	1.2	<1.0	<1.0	<1.0	+25 from background	+5 from background
Nitrate (as N) (mg/L)	0.053	0.052	0.168	0.197	32.8	3
Copper (Cu)-Total (mg/L)	0.00076	0.00064	0.00081	0.00143	see note ¹	see note ¹
Molybdenum (Mo)-Total (mg/L)	0.000313	0.000310	0.000901	0.001490	2	1
Selenium (Se)-Total (mg/L)	0.000086	0.000110	0.000201	0.000342	no max guideline	0.002
Sulphate (mg/L)	6.41	6.41	8.22	10.10	no max guideline	see note ²
Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	see note ^{3,4}	see note ³

¹ Hardness dependent Cu guideline: BC max WQG (mg/L) = (0.094(hardness)+2)/1000;

BC 30-d WQG(mg/L) = 0.002 at hardness ≤50mg/L, at hardness >50mg/L = 0.04*hardness/1000.

² Hardness dependent sulphate guideline: BC-30d WQG (mg/L)=128 at hardness <30mg/L, at hardness 31-75mg/L =218, at hardness 76-180mg/L=309, at hardness 181-250mg/L=429, at hardness >250mg/L determine base on site water

³ Hardness dependent dissolved Cd guideline: max BC WQG(mg/L)=(exp(1.03*hardness)-5.274))/1000;

BC 30-d WQG(mg/L) =(exp(0.736*ln(hardness)-4.943))/1000

⁴ Water quality guidelines are for dissolved cadmium

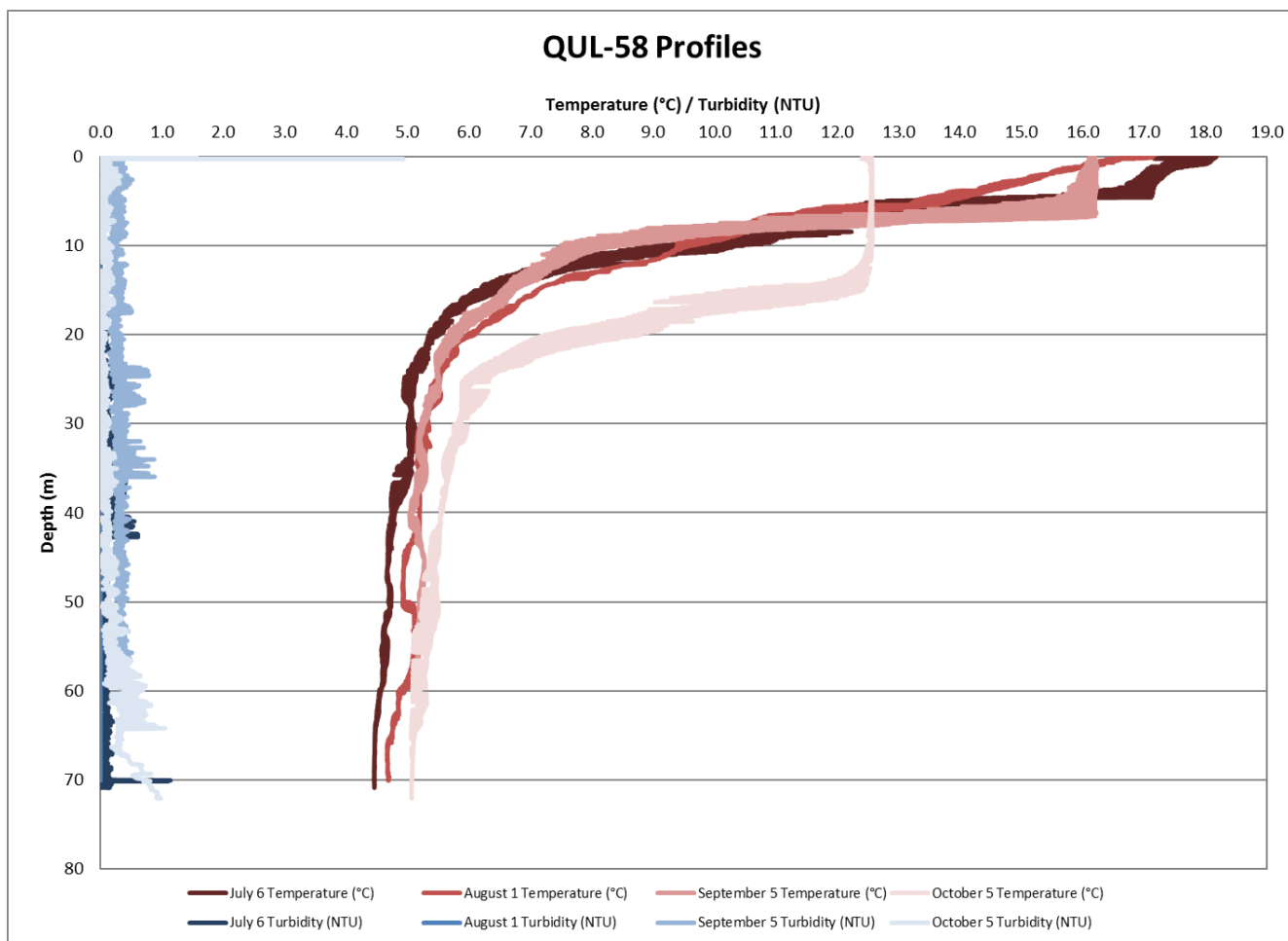


Figure 1. Turbidity and temperature profiles at QUL-58 on July 6, August 1, September 5, and October 5, 2016.

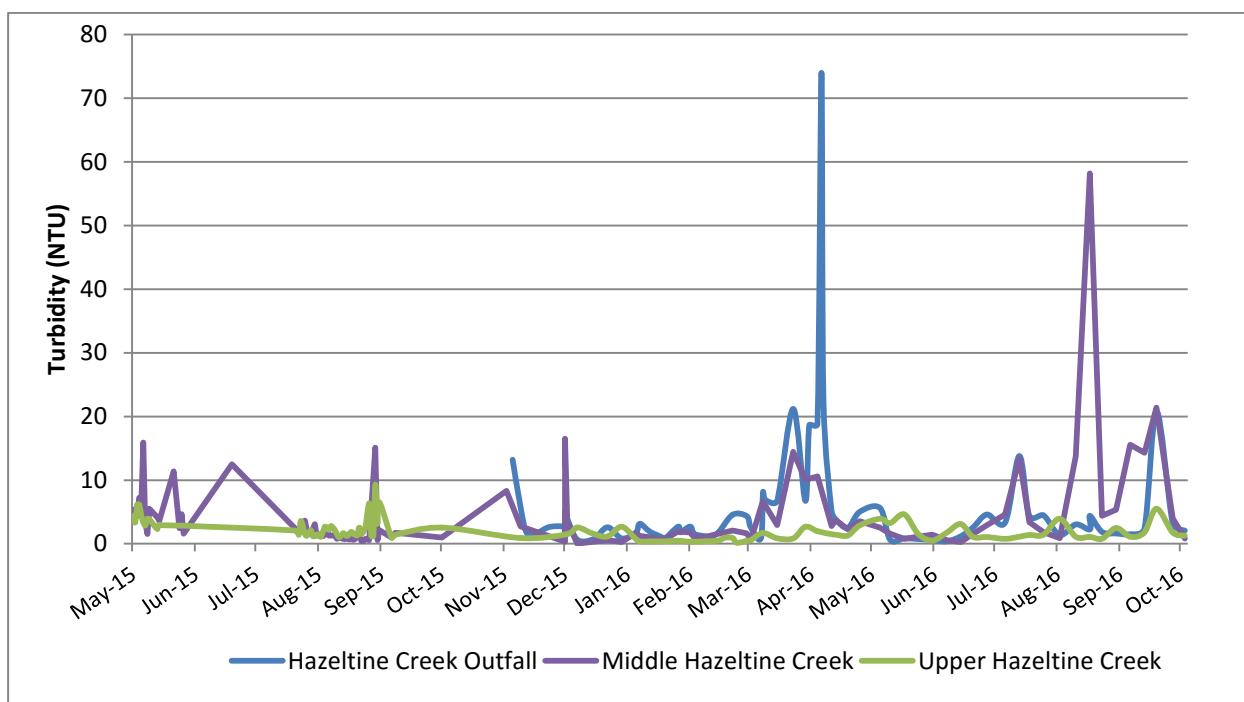


Figure 2. Time series graph for May 15, 2015 – October 3, 2016 showing turbidity levels at monitoring locations in upper and lower Hazeltine Creek

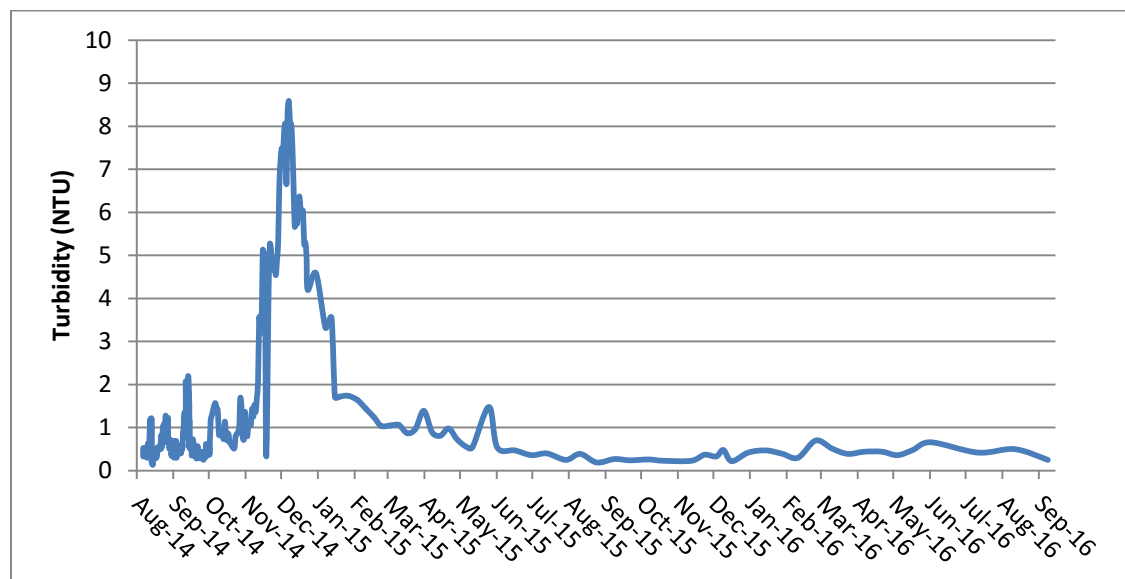


Figure 3. Time series of turbidity readings at site QUR-1/QUR-11 in the upper Quesnel River. Samples are collected monthly from this site.