
TURBIDITY MONITORING AND FISH CAPTURE AND RELEASE OPERATIONS
FOR SEDIMENT TRAP MAINTENANCE ASSOCIATED WITH OBED MOUNTAIN MINE
SOLIDS RECOVERY PROJECT ON APETOWUN CREEK, NORTHEAST OF HINTON,
ALBERTA

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1.0 INTRODUCTION

Pisces Environmental Consulting Services Ltd. (Pisces) was retained by Millennium EMS Solutions Ltd. (MEMS) to conduct aquatic environmental monitoring during sediment trap maintenance activities for sediment traps constructed in the Apetowun Creek drainage as part of the Obed Mountain Mine (OMM) Solids Recovery Plan (MEMS 2013). Sediment trap maintenance activities included the removal of treated jute fiber curtains and the removal of any fish potentially trapped in Sediment Trap 3 (Figure 1).

Jute curtains were installed in the sediment traps in an effort to improve waterborne sediment capture. However, the curtains have been determined to have run the course of their service life; becoming saturated with sediment and needing to be removed prior to the onset of winter.

Fish capture and release (FC&R) operations were required at Sediment Trap 3 because of the potential for fish to become trapped during low flows. During high flows a surface connection between Apetowun Creek and Sediment Trap 3 can occur and fish are able to pass in and out of the sediment trap. Once a reduction in stream flows severs the connectivity with Apetowun Creek fish remaining in the sediment trap will become trapped. As such, FC&R operations were required to remove the fish from the sediment trap prior to winter. Additionally FC&R operations were conducted at Sediment Trap 2B and at Sediment Trap 3 within areas cordoned off by fish blocking nets to provide a fish-free pump intake sites.

Pisces Qualified Aquatic Environment Specialists (QAES) conducted aquatic environmental monitoring including turbidity monitoring, routine water quality monitoring, and FC&R operations as described in the Fish and Fish Habitat Protection Plan (FFHPP) prepared for the Solids Recovery Project (Pisces 2014). The following is a summary report of aquatic environmental monitoring conducted for sediment trap maintenance.

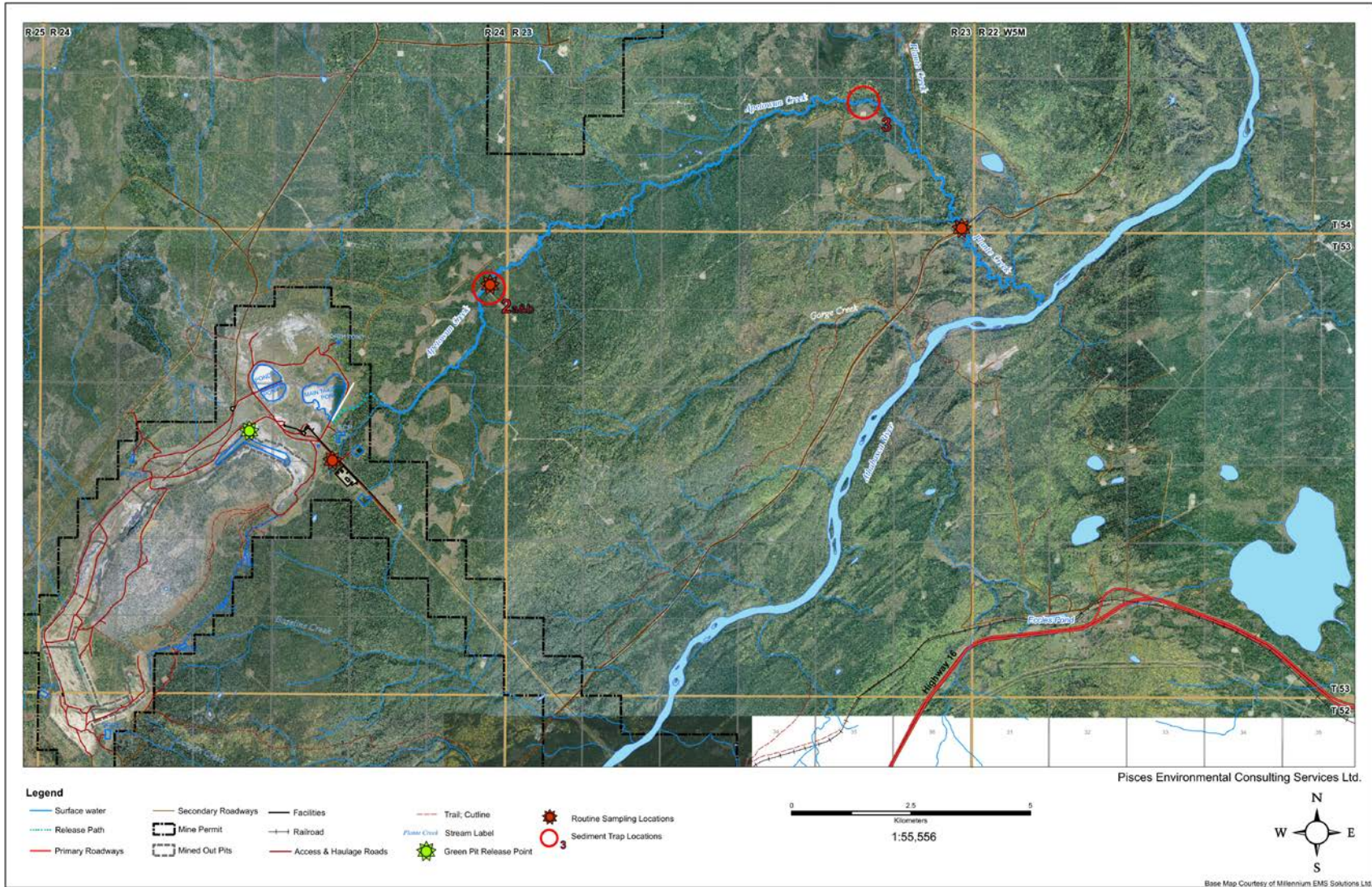


Figure 1: Location overview of sediment trap maintenance areas on Apetowun Creek, October 21 to 23, 2014.

2.0 METHODS

2.1 AQUATIC ENVIRONMENTAL MONITORING

Pisces' QAES monitored instream construction activities and collaborated with project managers and construction personnel during the course of the sediment trap maintenance activities.

Primary duties for on-site QAES included:

- FC&R operations;
- Turbidity monitoring at instream work sites;
- Routine water quality sampling at established sites within the Apetowun Creek drainage.

2.1.1 Fish Capture and Release

FC&R operations were conducted at Sediment Trap 2B on October 21, 2014 in preparation for pumping operations. The area was located within Apetowun Creek immediately upstream of the sediment trap. The pumping site was isolated from fish movement from both upstream and downstream using fish blocking nets.

FC&R operations were conducted at Sediment Trap 3 on October 22 and 23, 2014. Sediment Trap 3 is a two cell sediment trap, separated from the creek at the inlet, in between the two cells, and at the outlet by steep rock drain spillways. The spillways were observed at the time of the works not to allow for fish passage in between the cells or out of sediment trap. Prior to the start of the works, sandbags were placed across the inlet to limit flow and any possible fish movement into the sediment trap.

In order to complete the FC&R operations, each cell needed to be dewatered to allow for an effective fish capture. Fish blocking nets were installed in both the upstream and downstream cells to provide a fish exclusion for pumping sites. FC&R operations were carried out within each fish exclusion area prior to dewatering activities.

Once pumping sites were prepared and pumps and hoses were set up a silt curtain was installed at the outlet of the downstream cell to provide additional mitigation for any turbidity produced by the dewatering process. Water from the upstream cell was pumped onto the spillway of the downstream cell until the water level of the upstream cell was of an adequate depth to allow for FC&R operations to be completed. Once the FC&R operations were complete, the water from the downstream cell was pumped back into the upstream cell until the water in the downstream

cell was at an appropriate depth for the FC&R operations in the downstream cell to be completed.

Fish presence within the isolated areas was determined using one or more of the following sampling gear; a LR-24 Smith-Root backpack electrofisher, a seine net, and/or a GPP 2.5 Smith-Root Boat electrofisher. All fish captured were identified, enumerated, weighed and measured, unless numbers of individual species exceeded 100 fish, in which case a subsample of 30 individuals would be processed in full and the remaining fish would only be identified and enumerated. After processing, all fish were released into an appropriate location adjacent to the work sites on Apetowun Creek. Pisces will report the data collected during the fish salvage operation to Alberta Fish and Wildlife as required by the conditions of the Fish Research License (14-2008).

2.1.2 Turbidity Monitoring Program

Physical disturbance of the jute curtains was noted to release a limited portion of the sediment held by the curtains into the sediment traps. As such, stream flows were routed around the sediment traps to prevent sediment being transported into the stream during the removal of the jute curtains. At Sediment Trap 2A and Sediment Trap 3 flow was routed through the natural channels around the sediment traps. At Sediment Trap 2B flow was pumped around the sediment trap.

In keeping with the FFHPP, sediment monitoring was conducted during all instream activities identified to have the potential to mobilize sediment into the stream (Pisces 2014). The primary objective of the monitoring program was to minimize sediment escapement into the watercourse during instream activities, using turbidity as a surrogate measure for total suspended solids (CPWCC 1999). If total suspended solids (TSS) levels increased during instream works, activities were halted and mitigation procedures were implemented to decrease silt escapement. Turbidity monitoring methods followed the specifications outlined in Pisces' FFHPP prepared for the Solids Recovery Project.

The relationship between turbidity (NTU) and TSS (mg/L) was determined to be:

$$\text{TSS} = 5.0788 * (\text{NTU})$$

$$R^2 = 0.9273, n = 12$$

The monitoring program definition of an exceedance was based on the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2002) summarized in Table 2.1.

Table 2.1. Turbidity/TSS Monitoring Compliance Criteria.

Compliance Criteria For Short Term (<24 hr) Effect
When background levels are less than or below 250 mg/L: <ul style="list-style-type: none"> • A maximum increase of 25 mg/L is allowed.
When background levels are above 250 mg/L: <ul style="list-style-type: none"> • TSS may be increased by 10% above background levels.

In accordance with the FFHPP, compliance points were established at one stream width downstream of works, two stream widths downstream of works, and three stream widths downstream of the work area. Background samples were taken approximately 5 m upstream of the works.

Throughout the monitoring program, individual water samples were tested in the field for turbidity in NTU with a LaMotte 2020 turbidity meter. In general, sampling was conducted on an hourly basis; however monitoring frequency fluctuated with construction activities. In total, Pisces conducted monitoring on three consecutive days from October 21, 2014 to October 23, 2014.

2.1.3 Routine Water Quality Sampling

During the course of the sediment trap maintenance activities, the on-site QAES implemented a water quality sampling program at established sites within the Apetowun Creek drainage. Sampling locations and procedures followed the specifications outlined in the FFHPP prepared for the Solids Recovery Project (Pisces 2014).

3.0 RESULTS

3.1 FISH CAPTURE AND RELEASE OPERATIONS

FC&R operations at Sediment Trap 2B were completed on October 21, 2014. Three passes of the 10 m x 1.5 m x 0.05 m area were completed for a total effort of 964 backpack electrofisher on-time seconds. A total of two Spoonhead Sculpin (*Cottus ricei*) were captured during the FC&R operations.

The FC&R operations at Sediment Trap 3 were divided into the upstream and downstream cells. Following the dewatering process, the upstream cell area was approximately 15 m x 5 m x 0.5 m, while the downstream cell area was approximately 20 m x 5 m x 0.5 m.

A total of eight electrofishing passes, totaling 3,974 seconds, and two seine net pulls were completed on the upstream cell. The fish capture total included one Brook Trout (*Salvelinus fontinalis*), seven Burbot (*Lota lota*), 14 Mountain Whitefish (*Prosopium williamsoni*), 14 Rainbow Trout (*Oncorhynchus mykiss*), and 292 Spoonhead Sculpin.

FC&R efforts on the downstream cell were conducted in 13 electrofishing passes, totaling 3,232 seconds and one seine net pull. One Brook Trout, four Mountain Whitefish, and 25 Rainbow Trout comprised the total fish capture from the downstream cell. A complete record of sampling efforts and results is provided in Appendix A.

3.2 TURBIDITY MONITORING PROGRAM

Turbidity monitoring was conducted during all instream activities including flow redirection, jute curtain removal, and sediment trap dewatering. Turbidity monitoring results indicated that most sediment trap maintenance activities did not produce an appreciable effect on stream turbidity. However, one turbidity sampling run was recorded indicating turbidity levels that exceeded allowable limits. On October 21, 2014 at Sediment Trap 2A, during the transfer of flow from the sediment trap into the natural channel, the initial flush of water in the natural channel mobilized streambed sediment creating a spike in turbidity. Work was halted until turbidity levels returned to compliance to prevent any further sediment mobilization. Turbidity readings from the following turbidity sampling run, taken 30 minutes after the exceedance was recorded were found to have returned to acceptable levels. All other turbidity readings taken during sediment trap maintenance operations were found to be within compliance.

A complete record of turbidity measurements and construction activities obtained during the monitoring is provided in Appendix B.

3.3 ROUTINE WATER QUALITY SAMPLING

Routine water quality sampling was carried out on each day that QAES staff were on site and construction activities were ongoing, for a total of three sampling days. Table 3.1 summarizes the water quality results that were obtained from October 21 to 23, 2014.

Table 3.1. Routine water quality results for October 21 to 23, 2014.

Date	Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Specific Conductivity (uS)	Turbidity* (NTU)	TSS* (mg/L)
October 21, 2014	Control	7.2@17:00	8.01	9.01	1082	2.6	5
	Routine 1	7.0@16:00	10.51	8.21	844	2.5	2
	Routine 2	6.8@17:20	11.57	8.02	501	1.8	5
October 22, 2014	Control	4.4@6:45	8.09	9.57	1073	4.9	7
	Routine 1	4.4@17:45	11.07	8.20	767	3.7	2
	Routine 2	4.0@20:00	11.15	8.06	474	1.1	3
October 23, 2014	Control	3.8@6:30	7.91	9.27	1033	1.8	3
	Routine 1	Not sampled. All works downstream of sample location.					
	Routine 2	4.0@19:00	11.21	8.09	463	2.2	4

*Results obtained from Exova Labs

4.0 SUMMARY

Sediment trap maintenance activities were carried out from October 21 to 23, 2014 at Sediment Trap 2A, Sediment Trap 2B, and Sediment Trap 3. Maintenance activities included removal of jute curtains and the removal of any trapped fish in Sediment Trap 3. Pisces staff provided aquatic environmental monitoring for the maintenance activities which included turbidity monitoring, routine water quality sampling and FC&R operations. Photographs of the work areas are provided in Appendix C.

FC&R operations were completed at Sediment Trap 2B and Sediment Trap 3 for a total capture of 360 fish from a combined total effort of 8,152 electrofisher on-time seconds and three seine net pulls. The total fish capture was comprised of five fish species. Spoonhead Sculpin were the most prevalent fish species captured (294), followed by Rainbow Trout (39), Mountain Whitefish (18), Burbot (7) and Brook Trout (2).

Turbidity monitoring was conducted for instream activities at each of the sediment traps. Only one turbidity sampling run at Sediment Trap 2A on October 21, 2014 produced results above acceptable levels. The exceedance was short-lived and turbidity levels returned to compliance within 30 minutes. All other turbidity monitoring results were in compliance.

5.0 CLOSURE

If you have any questions regarding the foregoing, please contact our office at your convenience.

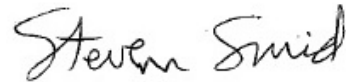
Sincerely,

Pisces Environmental Consulting Services Ltd.

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6.0 REFERENCES

- Canadian Council of Ministers of the Environment. 2002. Canadian Environmental Quality Guidelines for the Protection of Aquatic Life: Total Particulate Matter. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment. Winnipeg, Manitoba.
- Canadian Pipeline Water Crossing Committee. 1999. Watercourse Crossings 2nd Edition.
- Millennium EMS Solutions Ltd. 2013. CVRI Obed Mountain Mine Revised Solids Recovery Plan. Prepared for Coal Valley Resources Inc. and Sherritt International Corporation. 23 pp + Appendices.
- Pisces Environmental Consulting Services Ltd. 2014. Fish and Fish Habitat Protection Plan for Proposed Remedial Works on Apetowun Creek near Hinton, Alberta. Prepared for Millennium EMS Solutions Ltd., Edmonton, Alberta.

Appendix A

Fish Capture Record

Table A-1. . Fish capture record for Sediment Trap 2B, October 21, 2014.

Date:		October 21, 2014	
Stream Name:		Apetowun Creek	
Project:		Sediment Trap Maintenance	
Section:		Sediment Trap 2B	
UTM reference:		473674E 5941040N	
Section length (m):		10 X 1.5 X 0.05	
Effort(seconds):		964 sec	
Sample #	Species	Fork/Total Length (mm)	Weight (g)
1	SPSC	48	1
2	SPSC	44	<1

Table A-2. Fish capture record for the upstream cell of Sediment Trap 3, October 22 and 23, 2014.

Date:		October 22 and 23, 2014	
Stream Name:		Apetowun Creek	
Project:		Sediment Trap Maintenance	
Section:		Sediment Trap 3 (Upstream Cell)	
UTM reference:		481484E 5944843N	
Section length (m):		15 X 5 X 0.5	
Effort(seconds/pulls):		3974sec/ 2 net pulls	
Sample #	Species	Fork Length (mm)	Weight (g)
1	SPSC	35	<1
2	SPSC	39	<1
3	SPSC	37	<1
4	SPSC	35	<1
5	SPSC	41	<1
6	SPSC	39	<1
7	SPSC	42	<1
8	SPSC	35	<1
9	SPSC	32	<1
10	SPSC	38	<1
11	SPSC	38	<1
12	BURB	298	134
13	BURB	202	43
14	BURB	81	6
15	RNTR	61	3
16	RNTR	68	4
17	RNTR	58	2
18	SPSC	39	<1
19	SPSC	37	<1
20	SPSC	37	<1
21	SPSC	37	<1
22	SPSC	36	<1
23	SPSC	37	<1
24	SPSC	37	<1
25	SPSC	39	<1
26	SPSC	37	<1
27	SPSC	26	<1
28	SPSC	38	<1
29	SPSC	37	<1
30	SPSC	36	<1
31	SPSC	34	<1
32	BURB	123	10
33	SPSC	36	<1
34	SPSC	38	<1
35	SPSC	39	<1
36	BKTR	170	55
37	RNTR	175	60
38	BURB	263	87
39	RNTR	57	3
40	RNTR	58	2
41	MNWH	87	6

Table A-2 Continued. Fish capture record for the upstream cell of Sediment Trap 3 on October 22 and 23, 2014.

Date:		October 22 and 23, 2014	
Stream Name:		Apetowun Creek	
Project:		Sediment Trap Maintenance	
Section:		Sediment Trap 3 (Upstream Cell)	
UTM reference:		481484E 5944843N	
Section length (m):		15 X 5 X 0.5	
Effort(seconds/pulls):		3974sec/ 2 net pulls	
Sample #	Species	Fork Length (mm)	Weight (g)
42	MNWH	81	5
43	MNWH	95	8
44	MNWH	78	5
45	RNTR	70	4
46	RNTR	67	4
47	MNWH	86	7
48	MNWH	82	5
49	MNWH	87	6
50	RNTR	63	2
51	SPSC	35	<1
52	SPSC	29	<1
53	SPSC	37	<1
54	SPSC	36	<1
55	SPSC	41	<1
56	SPSC	36	<1
57	SPSC	34	<1
58	SPSC	38	<1
59	SPSC	37	<1
60	SPSC	43	<1
61	SPSC	37	<1
62	SPSC	36	<1
63	SPSC	37	<1
64	SPSC	38	<1
65	SPSC	34	<1
66	SPSC	33	<1
67	SPSC	37	<1
68	SPSC	37	<1
69	SPSC	35	<1
70	SPSC	38	<1
71	SPSC	35	<1
72	BURB	93	4
73	RNTR	59	3
74	RNTR	63	4
75	MNWH	88	7
76	MNWH	81	5
77	BURB	103	7
78	SPSC	37	<1
79	MNWH	91	7
80	MNWH	76	4
81	MNWH	86	5
82	MNWH	91	9
83	RNTR	73	5
84	MNWH	84	7
85	RNTR	60	2
86	RNTR	71	3
SPSC Count		242	

Table A-3. Fish capture record for the downstream cell of Sediment Trap 3 on October 23, 2014.

Date:		August 1, 2014	
Stream Name:		Apetowun Creek	
Project:		Sediment Trap Maintenance	
Section:		Sediment Trap 3 (Downstream Cell)	
UTM reference:		481484E 5944843N	
Section length (m):		20 X 5 X 0.5	
Effort(seconds/pulls):		3232 sec/ 1 net pull	
Sample #	Species	Fork Length (mm)	Weight (g)
1	RNTR	78	4
2	RNTR	65	4
3	RNTR	66	4
4	RNTR	140	35
5	RNTR	52	2
6	MNWH	92	10
7	RNTR	76	7
8	MNWH	90	9
9	RNTR	71	5
10	RNTR	67	3
11	BKTR	164	45
12	RNTR	153	48
13	RNTR	144	40
14	MNWH	78	6
15	RNTR	68	4
16	RNTR	69	4
17	RNTR	65	3
18	RNTR	182	85
19	MNWH	86	7
20	RNTR	79	6
21	RNTR	71	4
22	RNTR	73	5
23	RNTR	62	3
24	RNTR	67	3
25	RNTR	56	3
26	RNTR	62	3
27	RNTR	63	4
28	RNTR	49	2
29	RNTR	60	4
30	RNTR	59	3

Appendix B

Turbidity Monitoring Results and Construction Log

Table B-1. TSS results and construction log for Sediment Trap 2A maintenance, October 21, 2014.

Time	Calculated TSS (mg/L)				Exceed (Y/N)	Construction Log, QC/QA and other comments
	Control (+5 m)	Compliance Point 1 (-7 m)	Compliance Point 2 (-14 m)	Compliance Point 3 (-21 m)		
12:15	31.6	21.72	24.27	27.72	N	Started opening the natural channel dam wall.
13:15	23.86	84.95	79.87	64.20	Y	Flow routed through natural channel. Initial scouring creating turbidity.
13:45	26.25	30.83	45.83	44.10	N	Turbidity returned to compliance. Jute curtains removed.
14:15	25.69	29.05	26.20	39.22	N	Flow rerouted through the sediment trap. Activities complete.

Table B-2. TSS results and construction log for Sediment Trap 2B maintenance, October 22, 2014.

Time	Calculated TSS (mg/L)				Exceed (Y/N)	Construction Log, QC/QA and other comments
	Control (+5 m)	Compliance Point 1 (-7 m)	Compliance Point 2 (-14 m)	Compliance Point 3 (-21 m)		
9:00	26.66	31.23	26.40	29.20	N	Flow pump around started and sandbagging of the sediment trap outlet completed.
10:00	27.72	14.1	40.09	30.62	N	Removed jute curtains. Activities complete by 9:30.

Table B-3. TSS results and construction log for Sediment Trap 3 maintenance, October 22, 2014.

Time	Calculated TSS (mg/L)				Exceed (Y/N)	Construction Log, QC/QA and other comments
	Control (+5 m)	Compliance Point 1 (-7 m)	Compliance Point 2 (-14 m)	Compliance Point 3 (-21 m)		
14:10	11.75	12.46	9.87	10.12	N	Started pumping from the upstream cell into the downstream cell.
15:10	7.53	5.14	6.66	5.39	N	Increase in turbidity within the downstream cell from the pumps discharge. Improving discharge pad and installing a silt curtain at the downstream end of the downstream cell No significant changes in turbidity within the creek.
1700	8.04	12.2	10.63	10.23	N	Installed second pump to pump water into a vegetated upland area. Started upstream cell FC&R.

Table B-4. TSS results and construction log for Sediment Trap 3 maintenance, October 23, 2014.

Time	Calculated TSS (mg/L)				Exceed (Y/N)	Construction Log, QC/QA and other comments
	Control (+5 m)	Compliance Point 1 (-7 m)	Compliance Point 2 (-14 m)	Compliance Point 3 (-21 m)		
9:15	28.89	25.33	30.27	20.96	N	Ice present on water surface. Resumed pumping from the upstream cell into downstream cell and continued upstream cell FC&R.
10:15	7.89	8.75	10.07	8.80	N	Continued pumping and upstream cell FC&R.
11:15	10.63	8.39	8.70	10.38	N	Upstream cell FC&R complete. Pumping from the downstream cell to the upstream cell. No water entering the creek from the sediment trap.
15:30	8.75	9.92	9.56	9.31	N	Starting the downstream cell FC&R. No water entering the creek.

Appendix C
Colour Plates



Plate 1. Looking downstream at Sediment Trap 2A after the jute curtain removal.



Plate 2. Looking upstream at the Sediment Trap 2B pump site fish exclusion.



Plate 3. Looking upstream at the Sediment Trap 2B flow pump around discharge.



Plate 4. Looking downstream at the upstream cell of Sediment Trap 3.



Plate 5. Looking downstream at the outlet of the downstream cell of Sediment Trap 3.



Plate 6. Looking upstream across the downstream cell of Sediment Trap 3.