current ENVIRONMENTAL
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Post Construction Environmental Monitoring Report

Project:
Brooklyn Creek (2010) Channel Enhancement Project

Objectives:
- Isolate worksite
- Salvage and relocate fish, amphibians, native plants
- Implement measures outlined in prescriptions
- Restore disturbed areas following construction

Proponent:
Town of Comox

Contractor:
Ridgeline Excavating Ltd.

Dates:
In-stream Restoration: Aug 5 – Sept. 2, 2010
Riparian restoration: Nov 3 - 19, 2010

Project Biologist/Technicians:
Rupert Wong, RPBio/ Dusty Silvester & Jim Palmer

Location:
km 1+100 to 1+460
Brooklyn Creek, Comox, BC

Introduction

Brooklyn Creek (WC 920-558600) flows in a southeasterly direction for 7.2 km before draining into Comox Harbour. Based on available information from the FISS Report[1], Brooklyn Creek supports anadromous cutthroat (*Oncorhynchus clarki*) and coho salmon (*O. kisutch*) populations. According to Cousens & Lee (1999)[2] chum (*O. keta*) and pink salmon (*O. gorbuscha*) are known to utilize the lower reach. On August 5, 2010 environmental protection measures outlined in Wong (2010)[3] were implemented in preparation for in-stream restoration (ISR) work. Between Aug. 9 – Sept. 1, ten pool complexes including rock riffles, large woody debris (LWD) structures and spawning platforms were installed as well as completion of 2 bank revetment features. In addition, a channel spanning log jam was removed to improve fish passage. Northwest Hydraulic Consultants provided general construction specifications and heavy equipment used for ISR work was provided by Ridgeline Excavating Ltd.

The Brooklyn Creek (2010) Channel Enhancement Project was made possible by funding and in-kind contributions provided by Town of Comox, Habitat Conservation Trust Fund, Pacific Salmon Foundation, Ridgeline Excavating Ltd., Current Environmental (CE), Brooklyn Creek Watershed Society (BCWS), Fisheries and Oceans Canada, Fanny Bay Enhancement Society and Streamside Native Plants. CE technicians, Dusty Silvester and Jim Palmer carried out the environmental monitoring and implementation as per Wong (2010)[3] under the direct supervision of project biologist, Rupert Wong. Riparian planting following construction was started Nov 3 and completed on Nov 19 by CE with assistance from the BCWS and the local community.

Methodology

Prior to construction the ISR reach was suitably isolated and from Jul 21 to Aug 9 BCWS and CE salvaged fish within the area using an array of capture methods. Fish salvage efforts continued during construction as needed to remove remaining fish concentrated as channel segments were dewatered by pumps. An inventory of captured fish species is summarized in Table 1.

Wherever possible riparian plants were salvaged from temporary tote roads and reserved for the reclamation phase. Prior to

[1] Department of Fisheries and Oceans (DFO). 2006. Fisheries Information Summary System. http://a100.gov.bc.ca/pub/fidq/fissReport.do
[2] Cousens, B. & C. Lee. 1999. Preliminary Fisheries Resource, Habitat and Development Impact Assessment of Brooklyn Creek in Comox, BC. Prepared for Associated Engineering Ltd. 13 pp.
[3] Wong, R. 2010. Brooklyn Creek (2010) Channel Enhancement Project, Comox, BC. Prepared for Town of Comox & the McLean and Lawson Families, 39 pp.

any bed disturbance stream flow was temporarily diverted by means of a coffer dam and pumps to ensure continuous clean water supply to downstream fish habitat. Activities involving channel disturbance included construction of pool complexes, installation of LWD features and bank revetments and building temporary stream crossings (Photos 1 - 4). Heavy machinery used for ISR work included a Kubota KX121 excavator for the construction of pool complexes, including installation of rock riffles, LWD features, spawning platforms as well as bank revetment structures. While most installations were completed with the excavator positioned over vegetated banks some locations with site constraints required work within the channel. A T-190 Bobcat was used to deliver materials over temporary tote roads from the staging area to within reach of the excavator in order to reduce impact of machine tracking within the channel.

Table 1. Summary of fish salvage results for electrofishing (EF) and minnow trapping (MT) within 360 m of isolated mainstem habitat.

EF* (T= 9981 s)			
Species	**Number**	**CPUL**	**CPUE**
CT	523	1.453	0.052
CO	75	0.208	0.008
SB	37	0.103	0.004
Mort.	8	0.022	0.001
Total	643	1.786	0.064
MT (T = hrs.)			
Species	**Number**	**CPUL**	**CPUE**
CT	118	0.328	0.289
CO	165	0.458	0.404
SB	-	-	-
Mort.	-	-	-
Total	283	0.786	0.697

* With some variation, settings on the Smith Root Type 12B electrofisher were adjusted to: Freq. I; Pulse Width 3; Volts 300.

Environmental work during construction involved directing and monitoring equipment operations, labour crews, safety programs, riparian planting, and maintaining compliance with mitigative measures outlined in Wong (2010)[3]. During the installation of spawning platforms and rock riffles the wash down water was intercepted with pumps and discharged to biophysical BMPs including natural depressions in the adjacent forest. Turbidity levels were measured during construction to ensure minimum water quality standards were complied to (Photo 5). Site reclamation following construction involved installation of native rooted stock and live willow stakes as well as placement of recumbent course woody debris and a vertical snag for the benefit of wildlife (Photos 6 & 7).

Environmental Outcomes

No unexpected disturbances were incurred on riparian or fish habitat as a result of ISR work. Disturbances to the channel banks and streambed were minimized during machine crossings and material distribution by constructing temporary crossings or protecting the banks with logs (Photo 8). While water quality measurements collected throughout construction showed that turbidity temporarily increased as a result of ISR work the levels remained within acceptable limits.

Field Modifications to Design

Modifications to design or prescriptions were made in the field to better adapt methods and materials to site conditions. Field modifications to prescriptions are summarized in Table 2.

Table 2. Summary of field modifications to Prescriptions

Prescription	**Modification**	**Technical rational**
12 pool complexes	10 pool complexes	• Funding constraints
9 LWD features	7 LWD features	• Funding constraints
Live fascines used to help control erosion	Live stakes used to help control erosion	• Suitable alternative

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Photos

Photo 1. Construction of rock riffle using small excavator positioned in stream channel. (Aug 24, 2010).

Photo 2 & 3. Installation of riffle and LWD features at km 1+200 during (top) and after construction (bottom) on Aug 19 & Oct 14 respectively.

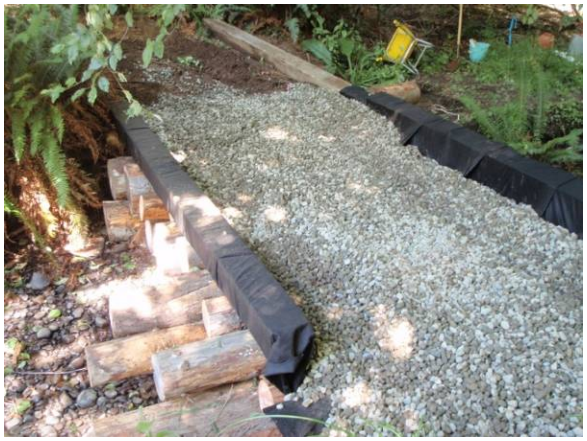

Photo 4. Temporary log bridge used at km 1+200 showing gravel reserved during bridge decommissioning for riffle construction.
(Aug. 9 2010).

Photos

Photo 5. Turbidity measurement taken at temporary crossing during bridge construction. (Aug 9, 2010).

Photo 8. Temporary bank protection using logs to reduce impact of boulders delivered by bobcat to riffle construction site (Aug 17, 2010).

Photo 6. Wildlife tree installed during decommissioning of temporary tote road (Aug 9, 2010).

Photo 7. Planting of rooted native stock completed by CE & BCWS volunteers (Nov 4, 2010).