GREATER GEORGIA BASIN
STEELHEAD Recovery Plan
www.SteelheadRecoveryPlan.ca

Construction of Artificial Fish Habitat in the Little Qualicum River, 2004

prepared for:

Pacific Salmon Foundation
Weyerhaeuser Company Ltd.
BC Ministry of Transportation
Habitat Conservation Trust Fund
BC Ministry of Water, Land & Air Protection

by:

J.D.C. Craig
Fisheries Technician
BC Conservation Foundation
Nanaimo, BC

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Wayne Brown[4] and John Eden[5] went out of their way to identify suitable trees near the restoration reaches and spent considerable time arranging contracts to allow us to acquire the project's wood. Mel Sheng[6] arranged for ballast rock at a reduced rate from a nearby highway construction project. Special thanks are extended to Ozero Bros. Contracting Ltd. and Wicklow West Holdings Ltd. who contributed ten large logs for habitat from their managed forest operation adjacent to the upper river. Shayne Vollmers[7] spent time reviewing plans and making recommendations for this and other LWD projects on Vancouver Island. Jeff Ainge[8] granted permission on behalf of the Regional District of Nanaimo to construct habitat on the banks of Little Qualicum River Regional Park. Jonathon Lobb[9] reviewed and approved construction plans for sites in the park. BCCF cable and construction crew members included Jeff Young, Ardith Turney and Adrie Bigsby. Craig Wightman[10] edited the report.

[1] Unit Manager, South Island Timberlands, Weyerhaeuser Company Ltd., Cassidy, BC.
[2] Terrain/Hydrology Specialist, Nanaimo Woodlands, Weyerhaeuser Company Ltd., Nanaimo, BC.
[3] Environmental Co-ordinator, Ministry of Transportation, Victoria, BC.
[4] Engineer Technician, Northwest Bay Division, Weyerhaeuser Company Ltd, Nanoose, BC.
[5] Area Manager, Northwest Bay Division, Weyerhaeuser Company Ltd., Nanoose, BC.
[6] Biologist, Restoration Resource Division, Fisheries and Oceans Canada, Nanaimo, BC.
[7] President, Vancouver Island Whitewater Paddlers Society, Nanaimo, BC.
[8] Parks Co-ordinator, Recreation and Parks Department, Regional District of Nanaimo, Parksville, BC.
[9] Parks Technician, Recreation and Parks Department, Regional District of Nanaimo, Parksville, BC.
[10] Senior Fisheries Biologist, Vancouver Island Region, Ministry of Water, Land and Air Protection, Nanaimo, BC.

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1.0 INTRODUCTION

The primary objective of the Greater Georgia Basin Steelhead Recovery Plan (GGBSRP) is "*to stabilize and restore wild steelhead stocks and habitat to healthy, self-sustaining levels"* (Lill 2002). Increasing freshwater productivity in selected east coast Vancouver Island and Lower Mainland watersheds is a primary focus of GGBSRP and includes mainstem fish habitat rehabilitation, off-channel habitat improvements, spawning gravel enhancements, and nutrient enrichment programs. These activities aim to increase the availability of high quality steelhead fry and parr rearing habitat and ultimately the number of smolts per spawner generated from target watersheds. The GGBSRP is an initiative of the Ministry of Water, Land and Air Protection (MWLAP) and the BC Conservation Foundation (BCCF), the ministry's primary delivery partner for implementing the Plan.

Located just north of the Town of Qualicum Beach, the Little Qualicum River is one of several steelhead streams on east Vancouver Island selected for significant habitat improvements (Figure 1). Habitat work has occurred in 2002 and 2003 (Craig 2003, 2004), and readers of this document are directed to those construction reports for further background information on local stock status, MWLAP's recovery plans, habitat restored to date, and past project funding and partners. More information on other watersheds and the Plan as a whole can be found at www.steelheadrecoveryplan.ca.

Figure 1. Little Qualicum River, southern Vancouver Island.

In 2004, mainstem work started and/or continued on several river systems in each region, including the Little Qualicum River. Work on the Little Qualicum focused on construction of large woody debris (LWD) "jams" prescribed in *Fish habitat restoration designs for five east Vancouver Island watersheds* (Gaboury and McCulloch 2002). In addition to LWD work, plans were made to address an October 2003 channel avulsion that occurred upstream of Section D (Gaboury and McCulloch 2002, Craig 2004, nhc Ltd. 2004).

Sites considered for construction were located in sections D and E on the mainstem (Gaboury and McCulloch 2002), surrounded by private forest and farm land as well as regional park. Sites were examined from a river navigation point of view by the Vancouver Island Whitewater Paddlers Society, and application was made to Transport Canada for construction approval under the Navigable Waters Protection Act. Permission to access and construct sites was sought early from landowners.

Financial support for the project was received from the Habitat Conservation Trust Fund, the Ministry of Transportation's Environmental Fund, Weyerhaeuser's San Juan Opportunistic Fund[11], and the Pacific Salmon Foundation. The latter two were portions of 2003 grants that were unspent because fire threat during the instream work window significantly curtailed last year's restoration activities. Weyerhaeuser also allowed timber on nearby private forest lands to be used as the project's major LWD source[12]. Additional wood was donated by Ozero Bros. Contracting Ltd. and Wicklow West Holdings Ltd., a partnership that conducts small-scale, selective logging in the upper watershed. The Ministry of Transportation also contributed rock to the avulsion project.

Following design principles refined in the 1990s during initiatives such as the Watershed Restoration Program, wood used in artificial habitat structures should be:

- native;
- large in bole diameter (>0.5m) for structural durability;
- green wood to maximize structure life; and,
- conifer species (cedar and Douglas fir is preferred) as they generally rot slower than hardwoods.

Additionally, full trees with rootwads and branches attached are preferred to provide optimal micro habitat features. Frequently used cover types include stable rootwads, debris clusters, log jams and full tree accumulations (Cederholm et al. 1997). These LWD structures are best suited to rear juvenile steelhead if positioned in habitats having moderate to high water velocities during summer base flows.

This report describes the habitat structures installed in 2004, and the materials, techniques and costs associated with their construction in the Little Qualicum River.

2.0 METHODS

2.1 Site Selection

Gaboury and McCulloch (2002) originally prescribed a total of six sites in section E, approximately 1.5km downstream of the anadromous falls in Little Qualicum Falls Provincial Park. Following field planning in June 2004, two sites were cancelled because of high public use (swimming hole) and/or installation logistics (excessive pool depth). Prescriptions at remaining sites were updated as necessary and quantities of wood and ballast rock for the final list were confirmed.

Some sites in section D were considered but were dependent on the status of restoration works in the avulsion channel immediately upstream. These sites were placed on a secondary list, to be constructed in conjunction with stabilizing the avulsion channel.

[11] San Juan Opportunistic Fund. A legacy of $2M to be spent over 20 years on fish habitat restoration within private Vancouver Island forest lands of TimberWest Forest Ltd. and Weyerhaeuser Canada Ltd., as part of the San Juan Watershed Agreement (1996).
[12] The value of trees harvested for fish habitat was applied against the company's SJOF commitments.

2.2 Materials

From January 2004 field surveys with Weyerhaeuser staff, 24 standing Douglas fir trees were identified in one of the company's private land settings in lower Whisky Creek (Little Qualicum sub-basin). On April 3, 2004 and under contract with Weyerhaeuser, BCCF hired an excavator (John Deere, model 892E) and hydraulic "bin" truck to harvest and transport the wood to restoration sites on the Little Qualicum. Trees along the setting's new road were first pushed over by excavator. They were then bucked twice to lengths of 10 to 14.3 m and loaded into the bin truck, which accommodated up to 4 trees (logs with roots attached, plus the corresponding middle and branched top sections). Wood was hauled and dumped at two gravel road staging areas near Section E, and later skidded on remnant roads to streamside locations. Wood was also staged on two farm fields, adjacent to section D.

Additionally, a small selective logging operation on the south side of section E made available ten large logs (spruce and Douglas fir; ~18 m^3) a week prior to instream construction.

Rock for ballasting (0.7-1.0 m mean diameter, box-shaped) was purchased from a highway construction contractor that had agreed to supply the rip rap requirements of several fisheries projects in the area. The suitability of this rock for drilling/epoxy techniques was confirmed on May 4 by cabling two large boulders and successfully dragging them with a dump truck. Rock was subsequently delivered to two gravel road staging areas near section E in mid-June.

2.3 Construction

Ballast rock and LWD were staged beside restoration sites using a rubber-tired front-end loader (Caterpillar model 950) and a clamshell bucket-equipped excavator (Komatsu 200LC-6) operating with fish-safe hydraulic fluid[13].

Structures were constructed in sequence going upstream from the lowest site, with the excavator operating in the stream channel only when necessary. To reduce streambank impacts, a minimum number of channel entry points were used. Prior to the excavator entering the channel, wood and rock were hoe-chucked from the staging site on the bank into the pool or run to be complexed. Where possible, structures were positioned to take advantage of higher water velocities within the habitat unit and to maximize use by steelhead juveniles. Excavator and front end loader operators carried spill kits for containment of deleterious materials, and time in or near the river was minimized. A spill boom installed across the stream's wetted width was maintained downstream of each construction site.

Half inch steel cable (ungreased, wire core) was used to attach ballast rock to LWD. New cable allowed for the best possible epoxy bond between the cable ends and the rock drill holes. Less expensive used half inch cable was employed to tether LWD to stable trees in the riparian zone. Once positioned, ballast rock was drilled using an electric hammer drill (Bosch, model 11241 EVS) and a 9/16 inch drill bit. Rock drill bits were either 13 or 21 inches in length, the latter used for boulders that were somewhat submerged. Holes eight to ten inches deep were scrubbed and flushed

[13] Chevron Clarity® Hydraulic Oils.

to remove loose material, and Epcon two part epoxy (model no. C6) secured the cables. In each case, a sufficient quantity of epoxy was injected to ensure all space in the hole was filled once the cable end was inserted. Cable was cut on-site with an electric grinder (Dewalt, 7 inch) and attached to LWD or anchor trees using galvanized cable clamps secured with an electric impact wrench (Dewalt, ½ inch chuck). Care was taken to ensure cables between ballast and LWD were as short and tight as possible to reduce wear and movement within the structure. To secure and further tighten cables, steel staples (4 x 3/8 inch minimum) were also hammered into the logs. To hide cables, LWD boles were occasionally bored with an electric wood drill (Dewalt, ½ inch chuck) and a 3/4 inch ship auger bit with a welded extension (total length 35 inches). To prevent girdling of live trees, cables were loosely attached around the base and sheathed with 3/4 inch (ID) black pvc tubing. A portable generator (Honda, model EW 2500) supplied power to the two drills.

Construction and cable crews followed forest fire prevention and suppression regulations as outlined in the Forest Practices Code of BC Act. Sufficient shovels, pulaskis, and hand-tank pumps were kept on hand at all times during site construction and cabling. A portable pump unit with an intake screened to protect fish was set up daily at each site with a nozzle and 200 feet of discharge hose[14]. Fire watches occurred following each day's construction.

All construction personnel used safety equipment including hard hats, high visibility vests, eye and ear protection, two-way radios, gloves and dust masks when applicable. Emergency procedures were clarified and first aid equipment kept on hand included Level 1 first aid kits, blankets, neck collars, eye wash bottles and a cellular phone. The site supervisor and at least one other crew person held Level 1 First Aid certification and Transportation Endorsement.

From the same locations, photographs were taken of all sites before and after construction.

3.0 RESULTS

The scope of 2004 restoration activities on the Little Qualicum originally included work on the October 2003 channel avulsion. In May 2004, nhc Ltd. (North Vancouver) were contracted to develop feasible, cost-effective options to address the avulsion. However, following extensive consultations, the engineered prescription (*Little Qualicum River Meander Restoration Concepts, Recommendations and Design Report*; under separate cover) recommended by federal and provincial fisheries agencies was rejected by the landowner, and the avulsion was not stabilized. Construction of the remaining prescribed LWD sites in section D below the avulsion was postponed until the channel upstream is stabilized and bedload originating from it will not adversely impact new LWD structures downstream. A renewed access agreement with the land-owner will also be required.

3.1 Site Construction

LWD construction focused on section E, the most upstream segment of river prescribed by Gaboury and McCulloch (2002). Permission to access the river through private land and regional park was received by June 17, 2004. A permit under Section 9 of the Water Act was received June 23, 2004

[14] Because work was in a stream channel, written exemption from the Code's 450m hose length requirement was obtained from K. Seegmiller, Forest Officer/Official, South Island Forest District, MOF, Port Alberni.

from MWLAP. Authorization under the Navigable Waters Protection Act was obtained July 26, 2004 from Transport Canada. Development permits valid until August 2005 from the Regional District of Nanaimo were already on file from a 2003 application.

Instream construction was completed over three days from August 9 through 11, 2004. A total of four LWD structures at four sites were constructed (Figure 2; Appendix A, photos 1-14; Appendix B) at a cost of $20,700 (Appendix C).

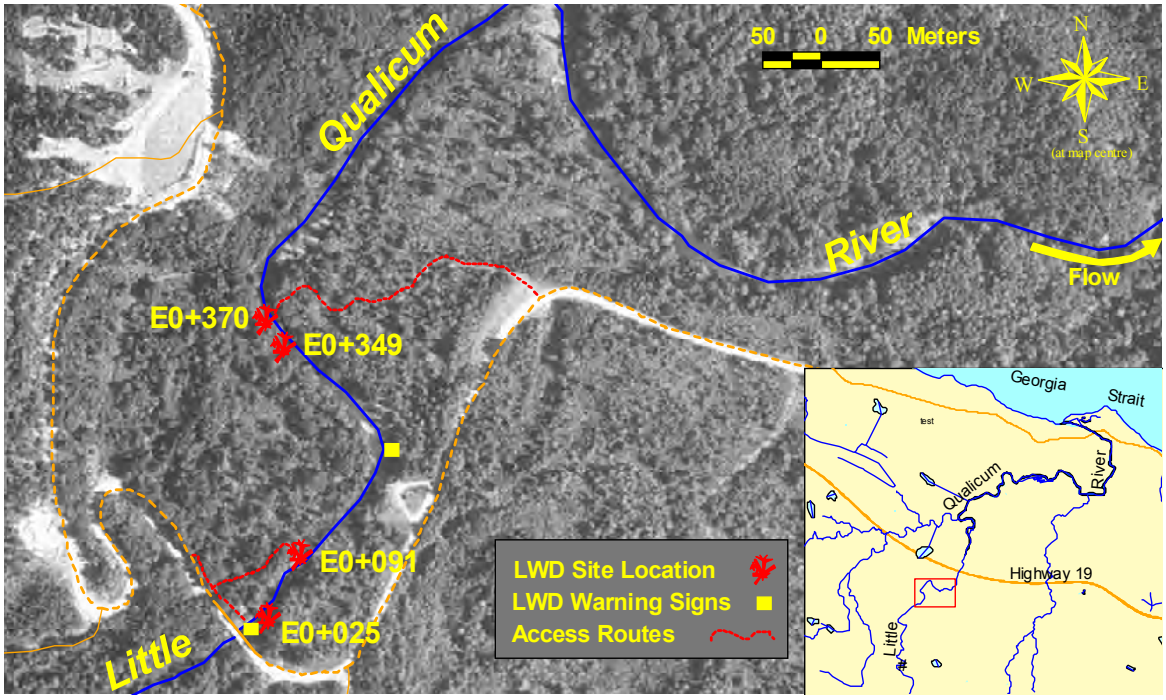

Figure 2. Constructed LWD sites on the Little Qualicum River, August 2004.

Local media (*The News*; Parksville/Qualicum area) covered the construction phase of the project and acknowledged supporters of habitat rehabilitation work in the Little Qualicum and other Vancouver Island rivers in 2004 (Appendix D).

In all cases, LWD structures were triangulated[15], ballasted and tethered to trees on the streambank. A three-person crew completed cable and epoxy work over four days from August 11 to 16. Approximately 300 m of cable (240 new, 60 used), 100 steel staples, 3 rock drill bits, 14 epoxy cartridges, 75 cable clamps, and 25 m of cable sheathing tube were used in site construction. Approximately 48 metric tons of large rock appropriate for drilling were used to anchor structures.

[15] Prescriptions (Gaboury and McCulloch 2002) for sites E0+025 and E0+091 were changed to include triangulated logs from the stream bank for improved structure integrity.

After sites were built, gravel bars were re-contoured, access routes were put to bed (naturalized), and reclamation seed[16] was applied at a density of approximately 80kg/ha. Further planting, including conifer seedlings, may occur in the spring of 2005 as part of a separately funded riparian silviculture project. Access entrances off the main gravel road were trenched to prohibit vehicle use.

Signage was installed to warn swimmers and other outdoor enthusiasts of the river's new habitat structures (Appendix A, photo 15). Two ¾ inch wooden signs, 1.2 m square, were lag-bolted to trees in the river corridor. One was located on the river's right bank, immediately upstream of site E0+025 (Appendix A, photo 16). The second sign was positioned adjacent to a pool frequented by swimmers, halfway between sites E0+091 and E0+349.

LWD pieces stockpiled along section D were not used in this project. Preliminary plans have been developed for restoration work on the lower river in partnership with the Town of Qualicum Beach. The remaining pieces will likely be staged at this new rehabilitation site in early 2005.

Routine effectiveness monitoring of 2004 sites following standards recently developed for the province (Anonymous 2003) is planned for May 2005. Funded by a separate HCTF project, monitoring will include structural evaluations as well as assessments of structure use by juvenile steelhead and coho, and by resident trout.

[16] CWH biogeoclimatic zone mix, Common No.1 Forage; Pickseed Canada Inc., Abbotsford, BC.

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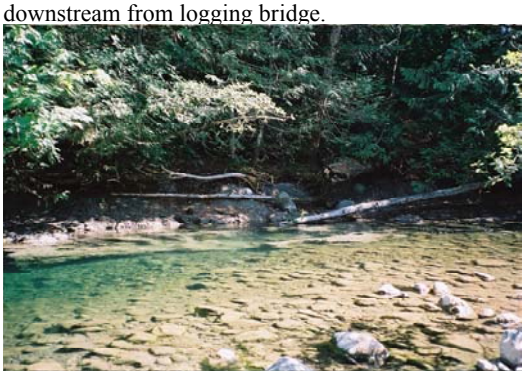
Appendix A.

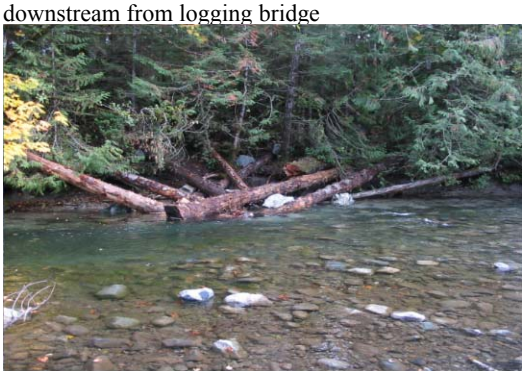
Photo documentation.

1. Site E0+025 (pre-construction) looking downstream from logging bridge.

2. Site E0+025 (post construction) looking downstream from logging bridge



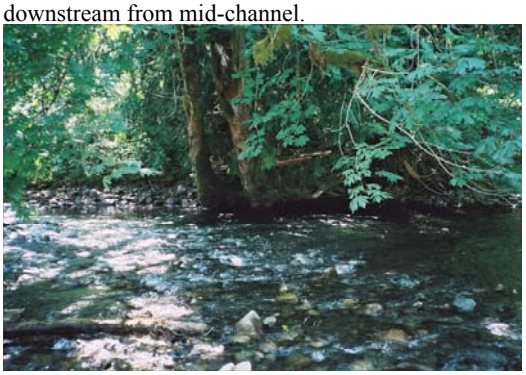
3. Site E0+025 (pre-construction) looking upstream from river left.



4. Site E0+025 (post construction) looking upstream from river left.

5. Site E0+091 (pre-construction) looking downstream from mid-channel.

6. Site E0+091 (post construction) looking downstream from mid-channel.



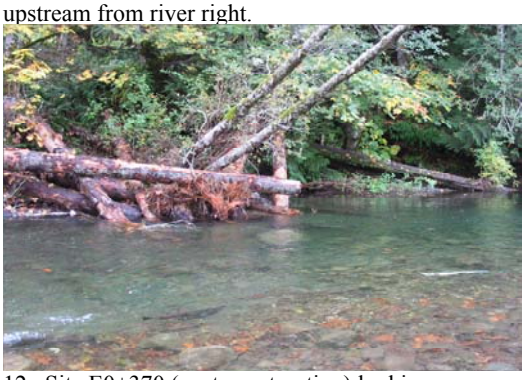
7. Site E0+349 (pre-construction) looking downstream from river right.

8. Site E0+349 (post construction) looking downstream from river right.

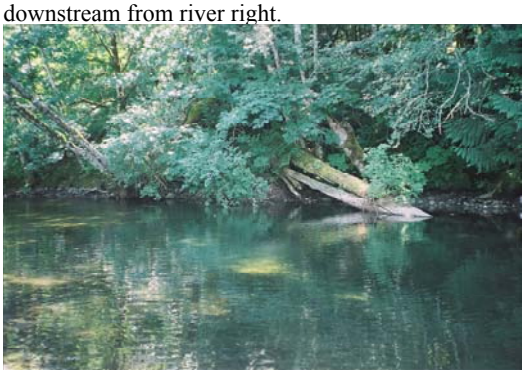
9. Site E0+349 (pre-construction) looking upstream from river right.

10. Site E0+349 (post construction) looking upstream from river right.

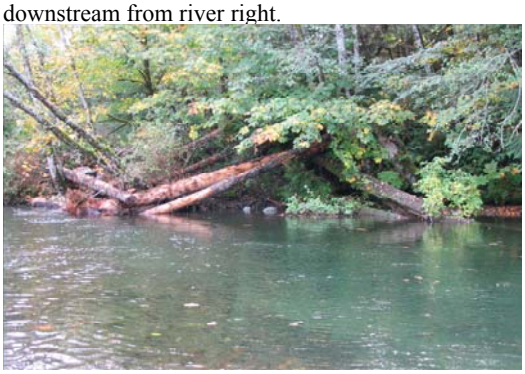
11. Site E0+370 (pre-construction) looking downstream from river right.



12. Site E0+370 (post construction) looking downstream from river right.

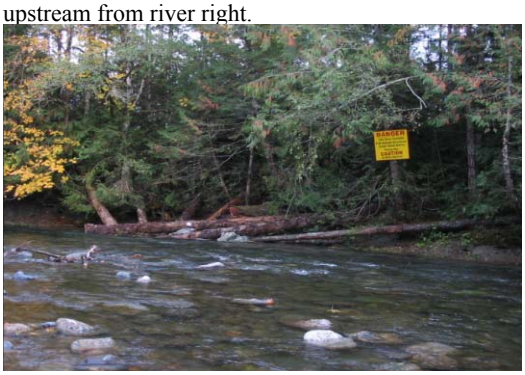


13. Site E0+370 (pre-construction) looking upstream from river right.



14. Site E0+370 (post construction) looking upstream from river right.

15. LWD warning signage.



16. LWD warning signage installed upstream of uppermost site (E0+025).

Appendix B.

Site summary including location and wood used.

Appendix B. Site summary including location and wood used.

Site Name (chainage in metres)	Prescribed (2002)	Built (2004)	Location	Bole with Rootwad	Bole Only	Top
Access: old LB spur immediately downstream of Ozero bridge.						
E0+025	LO-3	DJ-5	RB	2	4	2
E0+091	LO-4	LT-3 (x2)	LB	2	3	1
Access: old RB spur from gravel mainline.						
E0+349	DJ-5	DJ-5	LB	2	5	2
E0+370	LT-6	DJ-5	LB	1	6	5

Notes: Section E begins at Ozero bridge crossing and continues downstream.
RB = right bank looking downstream, LB = left bank.

Appendix C.

Estimated project expenditures.

Appendix C. Estimated project expenditures (as of December 31, 2004).

Category	Description	Amount
Major Equipment:		
	Excavator (falling, construction, cleanup, incl mob)	5,300
	Bin Truck (hauling)	400
	Skidder (staging)	400
	Front End Loader (staging, incl mob)	1,100
	Sub-total	**7,200**
Light Equipment:		
	Construction equipment rental, vehicle lease	500
	Sub-total	**500**
Materials/Project Costs:		
	LWD	0
	Ballast rock (including delivery)	900
	Cable, epoxy, staples, seed, fuel, etc.	2,900
	Sub-total	**3,800**
Manpower:		
	Project coordinator, including report preparation	3,600
	Technician	700
	Cable crew labour	2,400
	Manpower expences	200
	Sub-total	**6,900**
Administration:	BCCF	2,300
	Sub-total	**2,300**
Total Cost:		**$20,700**

Note: The above costing is for sites constructed in 2004 only and does not include expenditures on engineered prescriptions (to address October 2003 channel avulsion) or LWD acquired and staged but not yet used.

Appendix D.

Media coverage.

news

THE NEWS, Tuesday, August 17, 2004 • A21

Woody debris give fish cover, habitat in rivers

By JESSICA KERR
News Reporter

Work being done on some local rivers is wrapping up for the season.

Both the Englishman and Little Qualicum rivers have undergone some construction in the last few weeks. Work has been done in and around both rivers as a part of a fish habitat rehabilitation project.

The project — part of the Greater Georgia Basin Steelhead Recovery Plan, which is administered by the B.C. Conservation Foundation — involves constructing Large Woody Debris (LWD) structures at various locations along the river banks.

The LWD structures simulate wood accumulations that would naturally occur, and provide cover for the fish in the rivers, mainly Steelhead trout and Coho salmon.

"It's really quite cutting edge," said Mike McCullough, project manager with the GGBSRP. "We really go out of our way to do as much for as little as possible."

James Craig, a fisheries technician with BCCF who oversaw the work at Little Qualicum River, said another year of work is expected to be done there.

"We're slowly getting to the end of the list with this river."

Work is also being done on three other rivers on the east coast of Vancouver Island, Goldstream, Chemainus and Quatse rivers have also been targeted for repairs.

The work is funded by several partner groups, including the Pacific Salmon Foundation, the Ministry of Transportation, Ministry of Water, Land and Air Protection, the Habitat Conservation Trust Fund. Wood for the LWD structures for both projects was donated by Weyerhaeuser, TimberWest and Ozero.

For more information on the plan visit www.steelheadrecoveryplan.ca.

JESSICA KERR PHOTO

CREWS WERE WORKING at using cables to secure the large logs and rocks that make up one of the four new Large Woody Debris structures along the Little Qualicum River Friday morning.

The News and Weekender