

**BC Hydro  
QuickStart Funding**

**Summary Report of Work Conducted**

99 SI 22/23 - Shuswap Side-Channels and Riparian  
99 SI 24 - Gravel Recruitment on the Bridge, Seton, Cayoosh and Middle Shuswap Systems.

by

**Fisheries and Ocean Canada  
Resource Restoration Unit  
Habitat and Enhancement Branch  
BC Interior – South**

from

**September 1/01 to March 31/02**

prepared by

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and

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*It must be emphasized that the feasibility and assessment components of this report are preliminary. To complete a final channel feasibility assessment, the review of the report and undertaking of additional identified components are required. Work is on-going for the collection of assessment data.*

*Cost estimates are for preliminary planning purposes only. DFO is not responsible for any losses incurred.*

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## **Project and Financial Summary**

### 99 SI 22/23 - Shuswap Side-Channel and Riparian (\$110k total)

Due to the extensive overlap of the various off-channel and riparian projects these have been grouped together.

Under this project setback fencing, riparian planting and off-channel projects were assessed and developed. The main projects were two that were carried out in partnership with the Whitevalley Community Resource Centre Maltman Riparian using an experimental technique and the Maltman Channel Phase II as well as the Dale project in partnership with the Kingfisher Interpretative Society and Spallumacheen Band. In addition, assessment of existing channels and riparian sites was undertaken. This information leads to the adaptive management and refining of restoration techniques. Note - construction costs in the project report portion are approximate and have been rounded off for reference purposes only.

### 99 SI 24 - Gravel Recruitment on the Bridge, Seton, Cayoosh and Middle Shuswap Systems.

This study looked at gravel recruitment and retention in four key areas in the Bridge Coastal area

- 1) Middle Shuswap River from the Sugar Lake Dam to Mabel Lake;
- 2) Bridge River from Terzaghi Dam to the confluence with the Fraser River;
- 3) Seton River from the Seton Dam to the confluence with the Fraser River;
- 4) Cayoosh Creek from the Walden North Dam to the confluence with the Seton River.

There were four key purposes of the study

- 1) Identify sources providing gravel to the systems;
- 2) Identify where the material is retained;
- 3) Identify the limiting factors;
- 4) Suggest possible options for improving spawning gravel conditions.

Financial Summary of QuickStart 99 SI 22/23 and 99 SI 24 Projects (including other sources of funding and in-kind contributions)

BCRP PROJECT NUMBER	PROJECT NAME	ITEM OR PARTNER	QUICKSTART FUNDING CONTRIBUTION	OTHER FUNDING SOURCES	IN-KIND	
<b>99 SI 22/23</b>	Maltman Riparian	Equipment	4840.00			
		Materials	350.01			
		DFO			3000.00	
			Landowner			1000.00
	Maltman Phase II	Equipment	860.00			
		Labour	13383.57			
		Materials	6277.61			
		DFO				15000.00
			Whitevalley Community Resource Centre		25000.00	
			Landowner			8000.00
Dale Project	Equipment	29659.27				
	Materials	36589.19				
	DFO			50000.00	21000.00	
			Spallumacheen Band (Funding though TBFC)		49000.00	
	Assessment	Labour	11655.50			
		Materials	6954.00			
DFO				57900.00	22100.00	
<b>99 SI 24</b>	Gravel Recruitment	Labour/Services	25083.40			
		Materials	1365.00			
		DFO			3000.00	
	TOTAL SPENT/ CONTRIBUTED		137017.55	183900.00	73100.00	
	RETURNED TO BCRP		2982.45			
	ORIGINAL BCRP CONTRIBUTION		140000.00			

**SHUSWAP RIVER  
HABITAT IMPROVEMENTS  
MALTMAN RIPARIAN RESTORATION**

P. Cochrane, Eng. Tech.; Patricia Carlson, P.Eng.; M.Flynn, Bio.  
**Department of Fisheries & Oceans**  
Habitat & Enhancement Branch  
Kamloops, B.C. February 14, 2002

**Location:** Mabel Lake, B.C.

**Drawing:**

<b>Costs:</b>	BC Hydro QuickStart (construction)	\$ 5,000
	Landowner (in-kind)	\$ 1,000
	DFO (bio-engineering support)	<u>\$ 3,000</u>
	<b>TOTAL:</b>	<b><u>\$ 9,000</u></b>

**Project Description:**

An experimental technique was developed for use at this location on the Middle Shuswap to try riparian stabilization techniques that have reduced rock quantity and higher woody material volume to increase fish habitat in particular for Coho. It is a technique that is intended to be for short term (less than 5 years) survival under average conditions.

The site is approximately 100 m downstream of the Maltman Channel Phase 2 intake.

Most riparian stabilization techniques are engineered to be long term, consequently a large volume of rock that has been historically used. This makes sense when a permanent infrastructure is being installed at high risk locations along a river. Where there is not the risk of infrastructure being attacked, most erosion sites can be treated with a 'softer' approach that will fail over time and be replaced by the recovering vegetation. The toe of the slope is typically the area where erosion is the most significant and protecting this with harder armouring materials, such as rock, when needed.

Fish were observed to be utilizing the wetted portion of the structure in large densities.

Live cottonwood or willow posts sharpened on end and driven to below low water table (min. 6" dia)  
Space posts 6' to 8'

5/16" Grade B chain tightly wrapped around trees, stapled to posts and anchored into rock at toe and top of bank.  
Use 1-1/2" dia hole in rock and Epcon C6 epoxy to secure chain.

Bank


Whole conifer trees (min. 6" dia, 10' long with limbs and stump intact)

Angular rock armoured toe

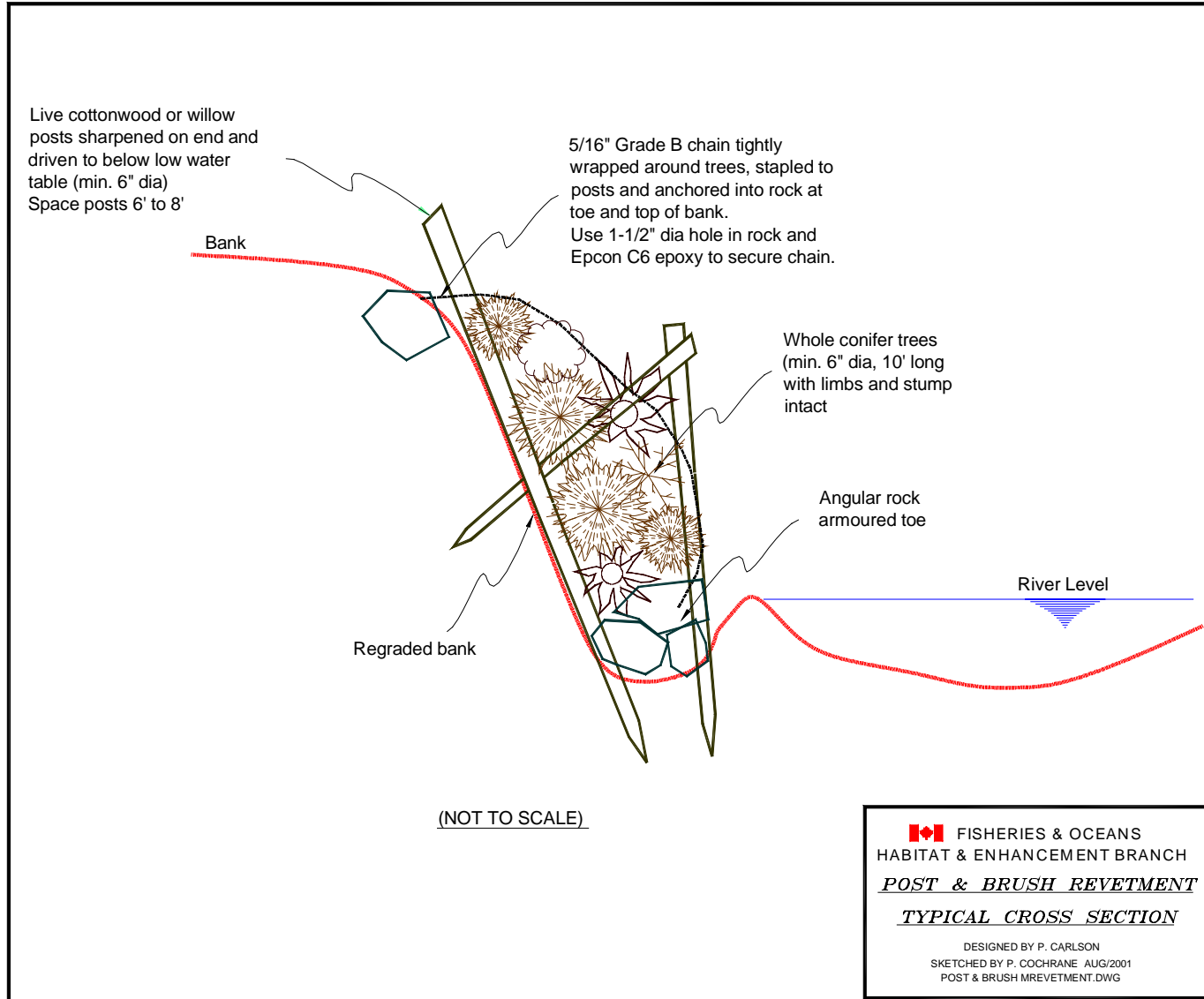
River Level

Regraded bank

(NOT TO SCALE)

 FISHERIES & OCEANS  
HABITAT & ENHANCEMENT BRANCH  
*POST & BRUSH REVETMENT*  
*TYPICAL CROSS SECTION*

DESIGNED BY P. CARLSON  
SKETCHED BY P. COCHRANE AUG/2001  
POST & BRUSH MREVTMENT.DWG



**SHUSWAP RIVER  
HABITAT IMPROVEMENTS  
DALE PROJECT**

P. Cochrane, Eng. Tech.; Patricia Carlson, P.Eng.; M.Flynn, Bio.

**Department of Fisheries & Oceans**

Habitat & Enhancement Branch  
Kamloops, B.C. February 14, 2002

**Location:** Mabel Lake, B.C

<b>Costs:</b>	BC Hydro QuickStart (feasibility & construction)	
		\$ 65,000.00
	Spallumacheen Band – funding from	
	TBFC/FishRBC(construction)	\$ 49,000.00
	DFO (construction)	\$ 50,000.00
	DFO (bio-engineering support)	\$ 21,000.00
	<b>TOTAL:</b>	<b><u>\$175,000.00</u></b>

**Project Description:**

This project was constructed on private property, with the consent of the landowners Rob and Marian Dale and Ann Hatfield and Keith Richards.

The construction site was isolated to allow for salvage of any fish in the lower wetted reaches.

The habitat improvements (figure 1) included excavating 1100 meters of channel to a maximum cut of 1.5 meters, encouraging groundwater infiltration. Spoil from the excavation was side cast and used to construct a set back dyke along the river to provide some flood protection for the newly constructed habitat complex.

Because the construction was carried out outside of the stream construction window, special measures were taken to prevent the discharge of sediment laden water from entering the Shuswap River. This involved the isolation of the channel at the downstream confluence with the river, and pumping all sediment-laden water to a settling area in a large isolated natural depression. The intake also was installed in isolation of the river's flow (photo 1)

At the upstream end of this channel, a double walled corrugated plastic pipe and valve (photo 2, 3) provide controlled river flow into the complex. An infiltrator system was also installed in the same trench as the intake pipe to provide additional groundwater flow from an area where it was not feasible to create an open channel. This system provides approximately 2 cfs. One culvert crossing was installed on the Dale property and a foot bridge support were installed for the Richard/Hatfields. Complexing of the channel included the reconstruction of several marshes, the excavation of numerous pools (photos 4, 5, 6).





**Photo 1** During the installation of the intake, a sediment curtain was used in conjunction with a fish screened pump to control sediment.



**Photo 2** A slide gate was fabricated for the end of the corrugated plastic pipe for controlling the in flow from the Shuswap River. It can be adjusted without entering the man hole casing.



**Photo 3** The pipeline for the intake was through a deep cut (up to 5 m). Two machines were used to speed up the installation and clean up process.



**Photo 4** Marshes were reconstructed in areas adjacent to the new channel alignment to provide fish and wild life habitat.



**Photo 5** The outlet of the project was very low lying and required minimal excavation to ensure positive outflow. The high point was left till the end of the project to assist with sediment control.



**Photo 6** A blind groundwater fed pond was constructed to provide additional groundwater flow and habitat.

**SHUSWAP RIVER  
HABITAT IMPROVEMENTS  
MALTMAN PROJECT  
PHASE 2**

**P. Cochrane, Eng. Tech.; Patricia Carlson, P.Eng.; M.Flynn, Bio.  
Department of Fisheries & Oceans  
Habitat & Enhancement Branch  
Kamloops, B.C. February 14, 2002**

**Location:** Mabel Lake, B.C.

<b>Costs:</b>	BC Hydro QuickStart (feasibility & construction)	\$ 20,000
	Whitevalley Community Resource Centre (construction)	\$ 25,000
	Landowner (in-kind)	\$ 8,000
	DFO (bio-engineering support)	\$ 15,000
	<b>TOTAL:</b>	<b><u>\$ 68,000</u></b>

**Project Description:**

Additional stable off channel spawning and rearing habitat, was created along intermittent flood channels of the Middle Shuswap River (photo 1). This habitat is utilized by Coho, Chinook, rainbow trout, and kokanee.

This project constructed on private property, with the consent of the landowners Bill & Chris Maltman.

Due to the timing of the construction outside of the instream construction window, special measures were taken to prevent the discharge of sediment laden water from entering the Shuswap River (photo 2). This involved the isolation of the channel at the downstream confluence with the river, and pumping all sediment-laden water to a settling area in a large isolated natural depression.

The habitat improvements (figure 1) included excavating approximately 400 meters of channel to a maximum cut of 1 meter. Complexing of the channel included the excavation of numerous pools and placement of woody materials and rock (photo 2, 3, 4, 5).

At the upstream end of this channel, a 100 metre long 750 mm corrugated HDPE pipe with a concrete intake and gate valve provide controlled river flow. Due to the low gradient in the channel, very little groundwater was developed though the channel will be continually wetted due to the water table level. The intake provides auxiliary flow for both Phase 1 and 2 channel (photo 6).

Rock for channel complexing and intake protection was acquired from a talus slope developed near the habitat improvements, on Maltman's property.

Seeding, tree planting, fencing, and some minor clean up work was carried out in the spring of 2001.



**Photo 1** Typical channel pre-construction which was backwatered during high water events and often was cut off from the main river stranding fish. After construction some mud flat areas were retained for diversity in habitat type.



**Photo 2** Excavators were used for placing rock and woody material for complexing in excavated pool areas.



**Photo 3** Near completed riffle section, woody material still to be placed. The rock at the toe assists in maintain an open channel by prevent erosion to the toe of the side slope due to spawning fish.



**Photo 4** Additional pool habitat was created and complexed with wood.



**Photo 5** Hillside view of top end of channel with the intake pipe already installed..



**Photo 6** Installation of concrete intake with gate valve was conducted in isolation of the main river flow to control sediment.

## **Other Identified Off-Channel Projects**

### **The Bigg Channel:**

This channel was identified through air photos and anecdotal information from local residents and survey work to determine suitability for intake possibilities. The channel crosses the property of seven landowners.

Preliminary surveying was done to verify feasibility and assist in the conceptual design for the project. The obtained information indicated that an 100 m long intake is feasible with approximately 600 m of channel excavation, with a cut of 2.5 m or less, to connect it to the existing marsh and channel complex. Several landowner crossings will require upgrading to allow for the required increase in volume of water that would be supplied by the intake. A large portion of the channel is currently through marsh and treed areas.

Presence/absence fish trapping was also done with six traps placed through out the channel though focussing in the top end of the channel were there are isolated pockets of water. Of these traps one, at the approximate midpoint of the channel's length, was found to have two (2) juvenile Coho.

Final surveying is still required to ensure the increased extent of the wetted areas after additional flow is introduced to provide all potential partners with an improved understanding of the project.

It is also recommended that test holes be done in the excavated channel section to ensure that the substrate is suitable though it is expected to be gravel that is suitable for salmonid spawning based on other projects in the area.

With any fisheries project it is recommended that setback fencing be constructed to protect the riparian area by limiting livestock access and delineating cultivated areas. The preferred setback distance is 15 m from top of bank on both sides of the channel, in order to achieve a minimum measurable biological impact.

Based on other similar projects' construction costs, exclusive of on-site supervision and design, preliminary estimates for the channel are:

Intake	\$ 20,000
600 m channel excavation (includes complexing)	\$ 90,000
Setback fencing (both sides of channel)	\$ 48,000
Modifications to existing channel to contain flows, complex	\$ 40,000
Channel Crossings (estimated 12)	\$ 36,000
<u>Contingency (15%)</u>	<u>\$ 35,000</u>
Preliminary Estimate	\$263,000

Funding has been conditionally approved for the Whitevalley Community Resource Centre to undertake this project by the Bridge Coastal Restoration Program in the 2002/03 fiscal year.

### ***Norris Creek:***

Norris creek is located in what was likely a remnant channel of Harris Creek and/or Duteau Creek. The potential exists for this to be developed into a 1 to 2 kilometre long groundwater complex.



Of the length of this remnant channel there are three properties where the fish habitat improvement works could be pursued

Some of the landowners are reluctant for project to be investigated though this site shall remain identified with potential for work should they be interested at some time in the future. An alternative irrigation system may be required for one landowner to ensure that flows will be adequate year round. Improvements to the Dure Meadow Road crossing should also be examined in partnership with Ministry of Transportation and Highways staff/representatives.

Should this project be pursued in the future it is recommended that water quality (chemistry, oxygen and temperature) due to the adjacent agricultural practices be monitored. A survey should be undertaken with test holes to verify substrate and elevations.

### ***Brett Creek:***

With FRBC/WRP funds between 1997 and 1999, Brett Creek, a groundwater fed tributary to Harris Creek, was studied to determine the potential for expanding it as an off channel complex.

The area through which Brett flows, is under heavy cultivation and grazing, as a result water quality was of a concern. Water temperature and dissolved oxygen were monitored at various locations to identify any problems. Temperature was observed to typically be high on hot days and oxygen levels were often low. These readings were attributed to minimal riparian and high nutrient loading.

Test holes were also done and were not ideal though the substrate was workable in some areas for potential increasing groundwater flows.

A small artesian was also identified, historically it was used for a small trout farm in conjunction with the Province several years ago. It free flows at an estimated 40 USgpm. Based on anecdotal information it may be possible to develop additional artesian wells in the area for providing flows to augment Brett's base flow of 250 USgpm.

Based on the early monitoring results, it was decided to limit restoration works to riparian fencing, approximately 8 km total, to restrict livestock access and allow the riparian to recover. The setback for the fences ranges from 5 m to 50 m from top of bank on each side of the creek.

In partnership with a landowner, water quality, particularly temperature and dissolved oxygen, are still being monitored. Temperature is critical for this system and appears to be the limiting factor at this time. Riparian planting has been undertaken in partnership with the local community and landowners to address this issue

Fish are often observed at the confluence of Brett and Harris Creeks and for approximately 1km upstream around the first road crossing.

It is recommended that further work be limited to riparian planting and monitoring until the water quality concerns are fully addressed.

Potential sites exist upstream of Wilsey Dam though passage issues must be addressed first. A report undertaken on behalf of DFO is pending.

Passage concerns at road culverts upstream of the dam. Partnerships are being pursued with the Ministry of Transportation and Highways to examine improvements that could be done to address sites such as the Ferry Creek multiplate.

Fish passage was examined in a report conducted by Northwest Hydraulic Consultants Ltd. for DFO.

### **Ongoing Assessment of Middle Shuswap and Tributary Off-Channel Projects Preliminary Summary**

\$19000 for assessment

\$80000 DFO in-kind contribution (\$57.9k cash, Technical support \$22.1)

Off-channel restoration projects are effective in high-energy stream, such as the Shuswap River, where it is unworkable to rehabilitate the mainstem. There is evidence that side-channels can be more productive for juveniles salmon than mainstem habitats (Nickelson et al, 1992). Off-channel areas have also been recognised as valuable for juvenile overwintering habitat (Bustard and Narver 1975, Nickelson et al, 1992).

Maltman Channel was constructed in two phases. Construction of Phase I started November 16, 1998 and was complete on December 24, 1998. The time period for the construction of Phase II was from March 16, 2001 to April 20, 2001. Maltman Channel was constructed with the primary goal of providing stable rearing and spawning habitat for coho, chinook, and rainbow trout. Maltman Channel has historically been used for spawning and rearing habitat but due to bedload movements in the Middle Shuswap River, the channel was cut off from the mainstem of the river.

Water temperatures play an integral role in salmonid survival. Walther and Nener (2000) suggest that the optimum temperature for rearing juvenile salmon (*Oncorhynchus spp.*) is between 8°C and 15°C. Exposure to temperatures exceeding 20°C to 23°C and temperatures less than -0.4°C to -0.7°C can be lethal to pacific salmon due to the effects on metabolic processes (Brett 1970). Studies have shown that when streams reach lethal temperatures juvenile salmon will tend to distribute themselves around areas where cooler groundwater is present (Walther and Nener 1997). These groundwater sources also provide warmer water temperatures during winter months. The buffering effect of groundwater on stream temperatures may also increase salmonid survival by protecting juveniles from major temperature fluctuations that sometimes occur over a short period of time within surface water-fed systems (Nener and Wernick 1998).

Vemco™ thermographs (herein referred to as thermographs) were placed in several of the Middle Shuswap mainstem streams and tributaries. The thermographs were programmed to record temperature readings every two hours. The goals of the temperature program are:

1. To compare the difference between groundwater channels and river surface water temperatures
2. To document the buffering effect of groundwater on water temperatures
3. To compare the temperature difference between tributary and mainstem river water temperatures
4. To identify areas where temperatures might be limiting juvenile salmonids summer and winter habitat
5. To provide information to regulatory bodies looking at issues involving sensitive stream designations

Thermographs were placed in many of the off-channel habitats around the Lumby area. Several thermographs were installed in tributaries and in the adjacent mainstem to compare temperature readings.

The recorded temperature data is very important for establishing baseline temperature data in the Middle Shuswap drainage area. Monitoring temperatures in these systems has given Fisheries managers a better understanding of the temperature problems facing juvenile salmon. The temperature data has also helped in identifying areas for future restoration efforts.

In the spring of 2000, two temporary fish fences were placed in Maltman Channel, one fence was installed 50 meters downstream from the intake valve. The second fence was placed 100 meters upstream from the confluence with the Middle Shuswap River. The objective of placing a fence by the intake was to monitor the number and the species of fish entering Maltman Channel. The objective of the second fence at the downstream end of Maltman was to monitor the number of fish leaving the channel. The second fence was flooded out for several days so presumably many fish left Maltman Channel without being enumerated. To counter this problem, in the fall of 2001 a permanent fish fence was constructed at the bottom end of Maltman Channel, 200 meters upstream from the confluence with the Middle Shuswap River.

In August of 2000, Maltman Phase I was assessed to determine if the coho fry present were showing a preference for certain habitats within Maltman Channel. The habitat complexes were categorised into 5 different groups: undercut structures, deep pools with woody debris, rootwads, straight uncomplexed runs and groundwater habitats. The assessment involved selecting structures, isolating the structures using beach seines and Gee trapping the isolated area for a standard 24 hour set time. The groundwater section was treated as a category so 3 structures in the groundwater section were assessed. In the surface fed section of Maltman Channel, 3 structures from each category were assessed (3 runs, 3 undercuts, 3 rootwads, 3 deep pools). The number of coho trapped in each category was added together and is presented in Table 2.

At the time of this study, the coho present in Maltman Channel appeared to be showing a preference for deep pools and woody material. The coho fry were also seem to be gravitating towards the colder water in the groundwater section. If you consider the number of traps and the number of fish, the groundwater pond has many more fish per trap than the surface fed portion of the channel. It would be interesting to repeat this study varying the time of day and the time of year to learn more about coho habitat preference.

Several tributaries were Gee trapped to determine fish presence. In the summer of 2000, Gee traps were set in Brett Creek, Teal Creek and in Creighton Creek.

In addition to the Gee trapping data, a crew from DFO assessed several mainstem restoration sites in August 2001 and again in January 2002. The assessment program involved a physical or structural evaluation and a biological assessment of the selected restoration sites. The physical evaluation involved inventorying the structures present and assigning effectiveness ratings. The biological assessment involved isolating a section of a restoration site with a beach seine and Gee trapping the isolated area. The goals of the assessment were to provide baseline data for future comparisons and to compare juvenile utilization at the various restoration sites. This data is in the process of being written up.

In addition to the trapping data, in 2000 and 2001 a juvenile trapping fence has been operated on Ruechel Channel to monitor the fish utilizing Ruechel Channel for rearing and overwintering habitat. The 2000 downstream juvenile fence was installed on Ruechel Channel on April 5, 2000 and removed June 22, 2000. One problem arose with the fence data. Lawson Creek connects the upper portion of Ruechel Channel with Duteau Creek. Juvenile fish could have left Ruechel Channel via Lawson Creek without being enumerated. This problem was addressed in 2001 with the installation of a second fence on Lawson Creek. The 2001 fences were installed April 5 and

removed June 23. One interruption in the operation of the Ruechel fence occurred April 15, 2001 with the removal of a beaver dam upstream of the fence. The removal of the beaver dam increased the flow in the channel and resulted in extensive breaching and undermining of the fence. The fence was reinstalled April 18, 2001. The number of rearing fish that were pushed out of Ruechel Channel during this time is unknown. Table 3 shows the results for the 2000 and 2001 fence data.

The downstream trap data is important data for understanding how many fish are migrating out of the Ruechel Channel in the spring. The data shows that Ruechel Channel is providing important overwintering habitat for juvenile fish. This data also provides baseline data for future comparisons.

### **Gravel Recruitment**

Gravel Recruitment on the Bridge and Seton and Middle Shuswap Systems.  
Separate Report