

Cowichan Koksilah Recovery Actions, reviewed July 2007

The CSRT group went through an update cycle and had the opportunity to review a number of projects and programs on the original Cowichan Recovery Plan developed in 2005 by LGL for Cowichan Tribes and provided to this group as a guiding document. The key projects identified for the upcoming period include the twelve summarized below. The original tabular data has been updated with information provided and is also attached for the groups review and additional comments.

1) **Implementation of the CBWMP** - this is consistent with the highest priority of the Cowichan Recovery Plan (LGL Ltd. 2005), and should focus on the steps necessary to raise storage behind the Catalyst weir by 30cm, and install low-head pumps for extreme drought protection. We have budgetted \$40K in our 2007 Georgia Basin/Vancouver Island Living Rivers Program for WMP implementation activities. These funds could be used to help map Cowichan Lake shoreline properties (LIDAR technology), relative to required mitigation/compensation under the Water Act. We await the planned vote by the CVRD's Committee of the Whole on moving forward with a WMP implementation strategy ASAP. **UPDATE CVRD's Committee of the Whole did not ratify a number of key initiatives identified in the report including, raising of wer, application for water license, adjustment of rule curve or implementation of governance model. The CSRT will have to discuss next course of action relative to this implementation item.**

(2) **Sediment management downstream of Cowichan Lake** - this is consistent with the second highest priority in the Cowichan Recovery Plan. The focus of this work in the next 1-2 years will remain Stoltz Bluff until we are satisfied we have remedial measures/designs well in-hand. Worked planned for September 2007 should take us a long way towards this goal. Annual maintenance of new sediment deposits on the constructed terrace will be an on-going issue, but may become less so as new "ring berms" at the base of existing gullies start to retain material and build shallower angles of repose back into the existing steep slope. Further geotechnical studies may lead to upslope treatment strategies, including surface/groundwater controls at the top of the bluff. Bio-engineering of exposed soils on the bluff, as well as on the terrace, will be considered pending success of this year's initial soil wrap and live-staking experiments.

(3) **A second phase of sediment management may be launched at sites upstream of Skutz Falls** (3 Firs; Block 51), pending results of this year's sediment source surveys and preliminary plans for future remediation. BCCF is working with LGL Ltd. (Marc Gaboury) and possibly TROW Engineering Ltd. (Jim O'Brien, P.Eng.) on this initiative. Proposed remediation works could be funded by Georgia Basin/VI Living Rivers, PSC (Southern Fund), HCTF and others, as required.

(4) **On-going TSS/turbidity monitoring** has been led by DFO (Margaret Wright, Water Quality Biologist) in an attempt to provide early results from the 2006 work at Stoltz Bluff. This should be continued in the winter of 2007/08. More detailed biophysical monitoring of the results of sediment management may be funded by the Pacific Salmon Commission in 2008/09.

(5) Sediment management in upstream reaches of the river should be directly linked to flood control and gravel removal activities in the lower floodplain, within Duncan city limits and Cowichan Tribes Reserve #1. Gravel removal at the Catalyst pumphouse should also be brought under this "umbrella."

(6) **Estuary protection, rehabilitation and land purchase.** Work collaboratively with the Cowichan Community Land Trust (Ann Archibald), Cowichan Tribes, DFO, TNT, TLC, DUC and other partners on an ambitious plan for estuary restoration and preservation. Georgia Basin/VI Living Rivers and PSC to assist with funding requirements. Support review of CEEMP planning process.

(7) The **Trestle Side-Channel re-design project** is proceeding through the BC Parks' approval process, led by BCCF, nhc Ltd. and DFO. The improvement of this channel is considered a high priority for chinook and coho production upstream of Skutz Falls, assuming sustained flows can be provided through a new intake structure. Funds to implement the recommended new intake design could be forthcoming from Georgia Basin/VI Living Rivers and PSC in 2008 (this will require a PSC concept letter be prepared by the August 26/07 deadline).

(8) **Other side-channel improvement projects** identified by Gaboury (2004) and others should be considered for funding on a priority basis, particularly in relation to how well they meet the CSRT and DFO's objectives for chinook and coho rebuilding. These could include, but not be limited to Lamb's side-channel, Channel 83A, Bonsall Slough and Major Jimmy's side-channel. Re-design and construction would take place over the next 3 years based on funding availability. See tabular data below

(9) **Pilot-scale spawning gravel placements in the outlet of Cowichan Lake.** Historic spawning areas within the first 1.5 km of the Catalyst Paper weir have become depleted of quality spawning gravel based on snorkel surveys conducted by MoE and BCCF in the late spring of 2006. Most of these sites overlap with a few riffle crests in a reach dominated by deep pool and glide habitats. The objective would be to target 1-2 riffles crests for experimental gravel placements using low-tech equipment (barge and bobcat or excavator with extended arm/reach off bank). All gravel would be screened and double-washed to minimize sediment release in a developed area with high recreational use. The sites would be selected this year and a proposal prepared for funding consideration. Georgia Basin/VI Living Rivers would likely be the primary funding source for implementation in the summer of 2008. Monitoring of fish use would start in the fall of 2008.

(10) **Riparian management/silvicultural treatments** should be considered on all public lands downstream of Cowichan Lake, where necessary. This would be done under direction of a contract RPF, or with assistance from the Ministry of Forests. Priority attention should be given to sites within the BC Parks' linear protected area along the river where bank erosion is now evident. This could ultimately be combined with action item #3 above, and the river upstream of Skutz Falls should be the highest priority.

(11) **Maintenance of Skutz Falls fishway.** This needs to be assessed annually to ensure the fishway is unobstructed by debris and bedload to ensure the most efficient passage of spawning salmon and steelhead.

(12) **Survey of restoration opportunities in tributaries to Cowichan Lake**, including but limited to Robertson River, Shaw Creek, Nixon Creek, Sutton Creek, Meade Creek and Cottonwood Creek.

(12) **Survey of restoration opportunities in the Koksilah River**, building on work to be done by LGL Ltd. (Marc Gaboury) and Cowichan Tribes in 2007.

Stock Status and Recovery Actions

Appendix D1 Table of recovery actions to address critical uncertainties in stock status and hatchery effectiveness with preliminary project designs and cost estimates (donated labour and materials are costed for the purposes of this recovery plan). Note that some of these SS projects will also contribute to monitoring the recovery plan.

Project Code	Uncertainty Issue	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded?
SS-1 Currently funded	Escapement	Cowichan River	Cowichan mainstem	Fall Chinook, coho, chum	Adult	2005	20	Annual	\$100,000	\$2,000,000	1. Installation, maintenance and operation of counting weir on Cowichan (\$85,000 per year) 2. Achieve precision of ±15% (mark recapture if necessary) 3. Annual reporting of results (\$15,000) 4. Construction and maintenance of weir is amortized over 20 years	Annually (DFO-AFS) Currently funded
SS-2 Currently funded	Escapement	All	Somenos, Kelvin, Robertson, Shaw, Patricia	Coho	Adult	2005	20	Annual	\$35,000	\$700,000	1. Conduct visual surveys of 5 tributaries throughout CRPA using walks and/or swims (approximately 5 surveys per system per year) (\$6,000 per system per year) 2. Achieve precision of ±30% using AUC analysis 3. Expand estimates from tributaries to entire CRPA using habitat expansion as per Bocking and Peacock (2005). 4. Annual reporting of results (\$5,000)	Some Years (DFO) Currently funded
SS-3 Currently funded	Escapement	Cowichan River	Cowichan mainstem	Chum	Adult	2005	20	Annual	\$30,000	\$600,000	1. Conduct visual surveys of lower Cowichan using helicopter as well as walks of key areas (approximately 5 surveys per year) (\$6,000 per system per year) 2. Achieve precision of ±30% using AUC analysis 3. Annual reporting of results (\$5,000).	Annually (DFOAFS) Currently funded
SS-4	Escapement	Cowichan River, Cowichan Lake Tributaries	Robertson? Upper Cowichan mainstem?	Spring Chinook	Adult	2006	20	Annual	\$7,500	\$150,000	1. Identify spawning areas for spring Chinook and conduct visual surveys using swims/walks (approximately 3 surveys per year (\$5,000 per year) 2. Achieve precision of ±30% using AUC analysis 3. Annual reporting of results (\$2,500).	No

SS-5 No longer funded	Escapement	Cowichan River, Koksilah River	Cowichan mainstem, Koksilah mainstem	Steelhead	Adult	2006	20	Annual	\$15,000	\$300,000	1. Establish index sites and conduct visual surveys on Cowichan and Koksilah using swims (approximately 5 surveys per year) (\$10,000 per year) 2. Achieve precision of $\pm 30\%$ using AUC analysis (for index sites) or expanded peak count 3. Annual reporting of results (\$5,000).	Some years (MWLAP) No longer funded
SS-6	Escapement	Koksilah River	Koksilah mainstem	Fall Chinook, coho, chum	Adult	2005	20	Annual	\$15,000	\$300,000	1. Conduct visual surveys on Koksilah using swims (approximately 5 surveys per year) (\$10,000 per year) 2. Achieve precision of $\pm 30\%$ using AUC analysis or expanded peak count 3. Annual reporting of results (\$5,000).	No
SS-7	Juvenile production	Cowichan River	Cowichan mainstream	Chinook, coho, steelhead	Fry, Parr, Smolts	2006	20	Annual	\$100,000	\$2,000,000	1. Conduct downstream trapping study using mark-recapture design and RSTs (March – end of June) (4 months at \$21,250 per mo) 2. Generate mark-recapture estimates ($\pm 20\%$) and evaluate hatchery contributions to freshwater production	Annually during 1990s Started

Project Code	Uncertainty Issue	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded?
											3. Annual reporting of results (\$15,000).	again in 2005 (DFO)
SS-8	Juvenile production	Koksilah River	Koksilah mainstem	Chinook, coho, steelhead	Fry, Parr, Smolts	2006	20	Every 4 years	\$50,000	\$200,000	1. Conduct downstream trapping study using mark-recapture design and RSTs (March – end of June) (4 months at \$10,000 per mo) (Note – add on costs to Project SS-7) 2. Generate mark-recapture estimates ($\pm 20\%$) and evaluate hatchery contributions to freshwater production 3. Annual reporting of results (\$10,000).	No
SS-9	Juvenile production, marine survival	Cowichan Lake, Cowichan River, Koksilah	Kelvin Creek, Somenos, Robertson (or Shaw, or lake aggregate)	Coho	Fry, Parr	2006	3	Annual	\$50,000	\$150,000	1. Coded-wire tag approximately 30,000 juvenile coho emigrating from 1 of 3 zones in CRPA in each of 3 years 2. Compare marine survival rates from Cowichan with Black Creek and Vancouver Island hatchery coho 3. Annual reporting of results (\$10,000). 4. If results indicate that Cowichan marine survivals are very different, then continue with monitoring	No

SS-9a	Fry Salvage	Tributary – mainstream to lake		Coho							Tom Rutherford has plan with details..	
SS-10	Catch	Cowichan River, Koksilah River Cowichan Bay	Cowichan River, Koksilah River Cowichan Bay	Chinook, Chum, Coho	Adult	2005	20	Annual	\$30,000	\$600,000	1. Conduct creel survey of all terminal fisheries (sport and Cowichan tribes in CRPA (including Bay and River) 2. Annual reporting of results (\$10,000).	Partial (DFO-AFS)
SS-11	Hatchery effectiveness	Cowichan River	Cowichan mainstem	Fall Chinook	Fry	2006	5	Annual	\$50,000	\$250,000	1. Coded-wire tag 250,000 fall Chinook fry from hatchery for next 5 years to evaluate hatchery effectiveness 2. Monitor returns in Project SS-1 and through catch monitoring in fisheries 3. Annual reporting of results (\$10,000).	Partial (DFO) Currently funded ~200,000 annually, last year \$275,000
SS-12	Hatchery effectiveness	Cowichan River	Cowichan mainstem	Spring Chinook	Fry	2006	10	Annual	\$10,000	\$100,000	1. Coded-wire tag all spring Chinook fry from hatchery for next 10 years to evaluate hatchery effectiveness 2. Monitor returns in Project SS-1 and through catch monitoring in fisheries 3. Annual reporting of results	No
SS-13	Hatchery effectiveness	Cowichan River	Cowichan mainstem	Steelhead	Parr	2006	20	Annual	\$5,000	\$100,000	1. Coded-wire tag all steelhead parr from hatchery to evaluate hatchery effectiveness and enable marked fishery 2. Annual reporting of results 50,000 adipose clip	Annual (MWLAP) \$? NO assessment funding
								Totals	\$497,500	\$7,450,000		

Population Gains

Appendix D2 Table of recovery actions to directly affect population gains with preliminary project designs and cost estimates (donated labour and materials are costed for the purposes of this recovery plan).

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded?
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PG-1	Harvest Rates	Marine / Cowichan Recovery Planning Area	Marine / Cowichan Recovery Planning Area	Fall Chinook	Adult	2005	20	Annual	\$10,000	\$200,000	1. Develop annual harvest management plans for fall Chinook based on marine survivals, freshwater survivals, escapement objectives 2. Target maximum harvest rate of 25% during recovery Current estimates are 65-70% 3. Prepare annual fishing plan	Annual (DFO-AFS, CT, other sectors)
											<i>Some concern was expressed at the last meeting that a discussion regarding sustainable harvest rates should take place at the Harvest Roundtable not in our documents and workplans...</i>	
PG-2	Hatchery	Cowichan River	Cowichan River	Fall Chinook	Adult	2005	20	Annual	\$500,000	\$10,000,000	1. Continue with hatchery supplementation of fall Chinook 2. Annual reporting of results (\$10,000)	Annual (DFO)
PG-3	Harvest Rates	Cowichan River	Cowichan mainstem	Spring Chinook	Adult	2005	20	Annual	\$5,000	\$100,000	1. Develop annual harvest management plans for spring Chinook based on marine survivals, freshwater survivals, escapement objectives 2. Prepare annual fishing plan	No
PG-4	Hatchery	Cowichan River	Cowichan River	Spring Chinook	Adult	2005	20	Annual	\$50,000	\$1,000,000	1. Hatchery supplementation of spring Chinook 2. Annual reporting of results (\$10,000)	No
PG-5	Hatchery	Cowichan River	Cowichan River	Coho	Fry	2005	20	Annual	\$25,000	\$500,000	1. Continue fry salvage program	Some
PG-5	Harvest Rates	Marine / Cowichan Recovery Planning Area	Marine / Cowichan Recovery Planning Area	Chum	Adult	2005	20	Annual	\$15,000	\$300,000	1. Develop annual harvest management plans for chum based on marine survivals, freshwater survivals, escapement objectives 2. Target maximum harvest rate of 20% during recovery 3. Cost includes DNA sampling to enable separation of Cowichan stock from other stocks in mixed-stock fisheries (\$10,000 per year amortized over 20 years) 4. Review stock composition estimates on annual basis 5. Prepare annual fishing plan	Annual (DFO-AFS, CT, other sectors)
PG-6	Harvest Rates	Cowichan River, Koksilah River	Cowichan River, Koksilah River	Steelhead	Adult	2005	20	Annual	\$5,000	\$100,000	4. Develop annual harvest management plans for steelhead based on marine survivals, freshwater survivals, escapement objectives 5. Prepare annual fishing plan	Annual (MWLAP)
PG-7	Hatchery	Cowichan Bay	Cowichan Bay	Clams		2006	3	Annual	\$15,000	\$45,000	1. Experimental seeding of beaches 2. Reporting and evaluation	No
								Totals	\$625,000	\$12,245,000		

Habitat Knowledge Actions

Appendix D3. Table of recovery actions to directly affect habitat knowledge with preliminary project designs and cost estimates. (donated labour and materials are costed for the purposes of this recovery plan).

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded
HK-1	Identify Lake Rearing Habitat	Cowichan Lake	Cowichan, Bear, Mesachie lakes	Coho	Fry	2006	2	Annual	\$20,000	\$40,000	1. Assess littoral areas of Cowichan, Bear, and Mesachie lakes to identify and characterize primary coho rearing habitat 2. Identify protection and rehabilitation opportunities	No
HK-2	Watershed Assessment	Cowichan Lake Tributaries	Robertson, Sutton, Nixon, Shaw, Meade, Cottonwood	Coho, Steelhead	Fry, Adult, Parr	2008	2	Annual	\$50,000	\$100,000	1. In cooperation with private land owners, conduct watershed and habitat assessments on three tributaries each year to determine condition of watershed, probable causes of channel disturbance and instability, critical limiting factors for coho and steelhead, and rehabilitation opportunities. 2. Prioritize potential rehabilitation works and develop rehabilitation designs for specific sites within high priority reaches where there is a high likelihood of rehabilitation success. 3. Determine preliminary costs for high priority rehabilitation designs.	No

HK-3	Reduce Sediment Loads and Improve Sediment Management	Cowichan River Mainstem	Stoltz Slide, Block 51 and other significant sediment sources	Chinook	Fry, Adult, Parr	2005	1	n/a	\$60,000	\$60,000	<ol style="list-style-type: none"> 1. Conduct preliminary investigations to identify / measure / map major sediment sources in the watershed below Lake Cowichan, quantify sediment loading rates, and link loading rates and sediment composition to biological effects on fish habitat and production. The latter need should be facilitated by a current DFO study of Chinook salmon egg incubation conditions and success, relative to known sediment sources, loading rates and gravel quality. 2. Assess and cost a range of geotechnical and engineering options designed to significantly reduce sediment loading of the river, for priority point sources identified above. This phase will produce detailed engineering surveys/designs for the major sediment source at Stoltz Slide as well as other problem sites that are identified in the synoptic survey above. 3. Develop a preliminary Cowichan River Sediment Management Plan that identifies sources, quantities, composition, remedial measures and a monitoring program to determine the effectiveness of remediation. This will be presented as a draft to stakeholders for review and consensus on future actions, timeframes and joint funding requirements. 2. Stolz Slide work and 	PSC funding sediment assessments and DFO study in 2005 Ongoing
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												remediation ongoing through 2008 with replanting and analysis of upslope failure initiation zones. Maintenance of structures and benches in lower sections ongoing.	
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Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded
HK-3a	Sediment budget for lower Cowichan	Cowichan Mainstem	Lower Cowichan Mainstem	Coho, Chinook, Chum	Fry, Adult Parr	2008	1				<ol style="list-style-type: none"> Development of sediment budget and Floodplain analysis relative to dyke control features and maintenance. 	No, funding proposals developed and forwarded to UBCM
HK-4	Improve Summer Flows and Water Temperatures	Cowichan River Mainstem	Cowichan River Mainstem	Coho, Chinook, Chum, Steelhead	Fry, Adult, Parr	2005	1	n/a	\$150,000	\$150,000	<ol style="list-style-type: none"> Develop a Water Management Plan for Cowichan River and consider increasing potential water storage by raising the Cowichan Lake Weir height thereby increasing summer flows 	Water Management Study completed

											<p>in the mainstem, and re-establishing connectivity to off-channel and tributary areas. 2. Assess feasibility and benefits of a deep water lake discharge to the river to reduce high summer temperatures.</p> <p>2. Water Basin Plan recommendations and report received and amended by CVRD Board September 2008. Demand Management options accepted. Supply side options not currently supported by CVRD Board of Directors. No support provided to the amendment of rule curve variations.</p>	
HK-5	Watershed Assessment	Cowichan River Tributaries	Holt	Coho, Steelhead	Fry, Adult, Parr	2010	1	n/a	\$30,000	\$30,000	<p>1. In cooperation with private land owners, conduct watershed and habitat assessments to determine condition of watershed, probable causes of channel disturbance and instability, critical limiting factors for coho and steelhead, and rehabilitation opportunities. 2. Prioritize potential rehabilitation works and develop rehabilitation designs for specific sites within high priority reaches where there is a high likelihood of rehabilitation success. 3. Determine preliminary costs for high priority rehabilitation designs.</p>	No

HK-6	Watershed Assessment	Cowichan River Tributaries	Somenos	Coho	Fry, Adult, Parr	2006	1	n/a	\$40,000	\$40,000	1. In cooperation with private land owners, conduct watershed and habitat assessments to determine condition of watershed, probable causes of channel disturbance and instability, critical limiting factors for coho and steelhead, and rehabilitation opportunities. 2. Prioritize potential rehabilitation works and develop rehabilitation designs for specific sites within high priority reaches where there is a high likelihood of rehabilitation success. 3. Determine preliminary costs for high priority rehabilitation designs.	No
HK-7	Watershed Assessment	Cowichan River Tributaries	Somenos, Quamichan	Coho	Fry, Adult, Parr	2006	3	Annual	\$100,000	\$300,000	1. Limnological Assessments 2. Hydrological Assessments 3. Fish Assessments 2. Quamichan Lake Stewardship group formed and actively seeking project funding.	No
HK-8	Assess Culvert / Fish Passage	Cowichan River Tributaries	Skutz Creek, Holt and tributaries	Coho	Adult, Fry	2008	1	n/a	\$40,000	\$40,000	1. Conduct culvert / fish passage assessment. 2. Develop plans of remedial measures to ensure fish passage.	No
HK-9	Watershed Assessment	Koksilah River & Tributaries	Mainstem, Glenora, Kelvin, Norrie	Coho, Chinook, Chum, Steelhead	Fry, Adult, Parr	2010	2	Annual	\$40,000	\$80,000	1. In cooperation with private land owners, conduct watershed and habitat assessments to determine condition of watershed, probable causes of channel disturbance and instability, critical limiting factors for coho and steelhead, and rehabilitation opportunities.	No

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded
											2. Prioritize potential rehabilitation works and develop rehabilitation designs for specific sites within high priority reaches where there is a high likelihood of rehabilitation success. 3. Determine preliminary costs for high priority rehabilitation designs.	
HK-10	Assess Culvert / Fish Passage	Koksilah River & Tributaries	Koksilah River & Tributaries	Coho	Adult, Fry	2008	1	n/a	\$20,000	\$20,000	1. Conduct culvert / fish passage assessment. 2. Develop plans of remedial measures to ensure fish passage.	No
HK-11	Hydrological Modeling and Feasibility of Setback Dyking	Cowichan Estuary	Quamichan, Hatchery, and South Side Spur dykes	Chinook, Chum, Coho, Steelhead	Fry, Adult, Parr	2006	1	n/a	\$80,000	\$80,000	1. Conduct preliminary investigations to assess the effects of current dyking in the lower river on floodwater routing and sediment deposition / transport. Topographic survey data of the channel and floodplain, and historical flow records would be required to model effects. 2. Assess feasibility of removing specific dykes and re-constructing setback dykes. Model effects of setback dykes on floodwater routing and sediment deposition / transport. Determine the positive and negative effects of setback dyke construction on fish and fish habitat, flood risk, sediment deposition and transport, etc. Examine effects of gravel removal and determine need and potential locations for regular gravel extraction from the river. 3. If feasible and net effects are positive, determine preliminary costs for setback dyke option. This phase will produce conceptual engineering designs for the setback dykes.	No 2007 Funding proposal developed and requested from UBCM for a portion of the Hydrological modeling process.

HK-12	Intertidal Mapping of Substrate, Vegetation and Fauna	Cowichan Estuary	Cowichan Estuary	Chinook, Chum, Coho, Steelhead, Shellfish	All	2005	1	n/a	\$50,000	\$50,000	1. Complete inter-tidal mapping of substrate, vegetation and fauna. 2. Develop rehabilitation plan for estuary including protecting / re-establishing vegetation, shellfish, etc.	Cowichan Tribes funded Archipelago for Phase 1 in 2005
HK-13	Identify Densities of Bivalves on Beaches	Cowichan Bay	Cowichan Bay	Clams	n/a	2010	1	n/a	\$25,000	\$25,000	1. Conduct assessment to identify densities of bivalves on beaches.	No
HK-14	Population and distribution of Crabs	Cowichan Bay	Cowichan Bay, Samsun Narrows, Satellite	Crabs	n/a	2010	1	n/a	\$50,000	\$50,000	1. Conduct population assessment of crabs within the Bay.	No

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Currently Funded
			Channel									
HK-15	Water Quality Monitoring	Cowichan Bay	Cowichan Bay	All	n/a	2006	10	Seasonal	\$20,000	\$200,000	1. Conduct water quality monitoring. 2. Tissue analysis of crabs 3. Annual reporting of results (\$5,000).	No
								Totals	\$775,000	\$1,265,000		

Habitat Gain Recovery Actions

Appendix D4. Table of recovery actions to directly affect habitat gain with preliminary project designs and cost estimates. (donated labour and materials are costed for the purposes of this recovery plan).

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Current Funding
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HG-1	Assess / Improve Cowichan Lake Fishway	Cowichan Lake	Lake outlet	Coho , Trout	Fry	2008	1	n/a	\$70,000	\$70,000	1. Assess upstream fish passage for juvenile salmon and trout 2. Design/construct an improved fish passage facility to effectively pass juvenile salmon and trout	No
HG-2	Stabilize Sediment Sources	Cowichan Lake Tributaries	Robertson, Nixon	Steelhead, Coho	Adult, Fry, Parr	2009	5	Annual	\$50,000	\$250,000	1. Conduct investigations to identify / measure / map major sediment sources in each watershed. 2. Assess and cost a range of geotechnical and engineering options designed to significantly reduce sediment loading from priority point sources, and to develop a sediment management and fish passage strategy for the alluvial fans. This phase will produce detailed engineering surveys / designs for the major sediment sources, and potentially bypass channels for fish passage in the alluvial fan zone. 3. Implement remedial measures at priority sediment-sources. It is expected the implementation phase of this project will take 2-3 years depending on available budgets and the scope of work to be done. Coincident with physical remediation works, a monitoring program will be initiated to determine the effectiveness of prescribed treatments.	No
HG-3	Improve Summer Baseflows (rearing)	Cowichan Lake Tributaries	Halfway Ck	Coho	Fry	2012	2	Annual	\$75,000	\$150,000	1. Storage from Fairservice (Cook's) Lake could yield a flow release of 2.3 L/s for approximately 150 days. Fairservice Lake is a 2.1 ha marsh and would require 2 m of storage. 2. Further hydrological analysis needed to determine if 2.3 L/s will be adequate flow to maintain habitat.	No
HG-4	Improve Off-channel Rearing	Cowichan Lake Tributaries	Shaw (Wren), Nixon, Sutton	Steelhead, Coho	Adult, Fry, Parr	2010	3	Annual	\$100,000	\$300,000	1. Conduct topographical survey and evaluate feasibility for potential off-channel construction. 2. If feasible, complete off-channel design and construct. 3. Three streams identified for off-channel development – for each stream cost estimate assumes: \$15,000 for survey and design; \$85,000 for construction.	No 2007 Cree sedin remc lowe as pa prog

HG-5	Channel / Slope Stabilization	Cowichan River Mainstem	Stoltz Slide, Block 51 and other significant sediment sources	Chinook	Fry, Adult, Parr	2008	4	Annual	\$300,000	\$1,200,000	1. Once a course of action has been endorsed from Project HK3, remedial work will begin at priority sediment sources. Potential work at Stoltz Slide includes: a) in the mainstem: channel excavation, terraced toe berm and partial weir; and b) on the slide: gully stabilization using bioengineering treatments. It is expected the implementation phase of this project will take 2-3 years	YES work with upsl stab proj 2008
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Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Current
											depending on available budgets and the scope of work to be done. Coincident with physical remediation works, the monitoring program will be initiated to determine the effectiveness of prescribed treatments.	
HG-6	Improve Instream Habitat (rearing, access)	Cowichan River Tributaries	Somenos, Holt are priorities	Steelhead, Coho	Adult, Fry, Parr	2006	3	Annual	\$50,000	\$90,000	1. Conduct fish passage assessment, identify opportunities to improve rearing habitat and prepare rehabilitation designs. 2. Implement remedial measures at culverts and construct instream / off-channel rehabilitation works.	No
HG-7	Secure Riparian Corridor	Cowichan River Mainstem	Upper River between Block 51 and Lake outlet	Chinook, Steelhead, Coho, Chum	Fry, Adult, Parr	2007	19	Annual	\$50,000	\$900,000	1. Most of existing riparian corridor from Cowichan River mouth to Block 51 is owned by the Crown, which offers long-term protection of the riparian vegetation. The section of river upstream of Block 51 is the primary spawning area for Chinook and steelhead but has only a few land parcels under Crown ownership. 2. In cooperation with private land owners, opportunistically purchase or secure through conservation agreements land parcels along both sides of the river to provide protection for the riparian corridor and channel over the long term. 3. Additional funds will need to be leveraged (The Land Conservancy?)	No Some pr affordec setbacks

HG-8	Improve Off-channel Rearing	Cowichan River Mainstem	Major Jimmy's, Bible Camp, Trestle, Channel 83A (total area affected = 20,000 m2)	Chinook, Chum, Coho, Steelhead	Fry, Parr	2006	5	Annual	\$100,000	\$500,000	1. Implement remedial measures to constructed side channels at Lamb's and Trestle that include upgrading the intake structures and adding LWD cover. 2. Improve instream cover in Major Jimmy's channel by adding LWD to 14 specified sites. 3. Enhance an existing overflow channel at Bible Camp by re-constructing the channel, placing LWD in pool habitats, and providing a river intake that could be regulated. 4. Install intake structure and improve natural overflow inlet in Channel 83A	No Hatcher, upgrade, complex undertak 2007 in partners between Cowichan
HG-9	Raise Cowichan Lake Weir to Increase Summer River Flows	Cowichan River Mainstem	Cowichan Lake Weir	Chinook, Steelhead, Chum, Coho	Fry, Adult, Parr	2006	1	n/a	\$250,000	\$250,000	1. Raise the Weir to increase summer flows in mainstem, to improve fish migration, and to improve connectivity of river to off-channel habitats. 2. Decision on feasibility and new height of Weir dependent on recommendations from Cowichan Water Management Plan.	Water Manage funded i CVRD o in 2007, decision remove recomm on raisin from rep
HG-10	Improve Fish Passage	Cowichan River Mainstem	Skutz Falls Fishway	Chinook	Adult	2006	2	Annual	\$50,000	\$100,000	1. Assess current Chinook passage capability through Skutz Falls fishway under low flow conditions 2. Implement remedial measures to improve Chinook passage at fishway	No

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Curr Fund
HG-11	Improve Summer Flows (rearing)	Cowichan River Tributaries	Richards, Holt, Averill	Coho, Steelhead	Fry	2008	3	Annual	\$50,000	\$150,000	1. Conduct assessment of water storage potential to improve summer baseflows and rearing. 2. Prepare water storage designs and flow management plans for suitable sites.	No
HG-12	Improve Riparian Corridor	Cowichan River Tributaries	Somenos, Quamichan, Richards, Averill, Bings	Coho, Steelhead	Fry, Adult, Parr	2010	10	n/a	\$50,000	\$500,000	1. In cooperation with private land owners, opportunistically rehabilitate riparian zones and establish riparian management plans for crossings, pastures, etc. 2. Initiate demonstration riparian projects with landowners, particularly on agricultural lands.	No

HG-13	Improve Fish Migration	Koksilah River Mainstem	Marble Falls Fishway	Chinook, Steelhead, Chum, Coho	Adult	2008	2	Annual	\$50,000	\$100,000	1. Assess current Chinook passage capability through Marble Falls fishway. 2. Implement remedial measures to improve fish passage.	No
HG-14	Improve Riparian Corridor	Koksilah River & Tributaries	Mainstem, Norrie, Kelvin	Chinook, Steelhead, Chum, Coho	Fry, Adult, Parr	2010	10	n/a	\$50,000	\$500,000	1. In cooperation with private land owners, opportunistically rehabilitate riparian zones and establish riparian management plans for crossings, pastures, etc. 2. Initiate demonstration riparian projects with landowners, particularly on agricultural lands.	No
HG-15	Stabilize Sediment Sources	Koksilah River & Tributaries	Mainstem, Glenora, Norrie, Kelvin	Chinook, Steelhead, Chum, Coho	Fry, Adult, Parr	2012	5	Annual	\$50,000	\$250,000	1. Conduct investigations to identify / measure / map major sediment sources in each watershed. 2. Assess and cost a range of geotechnical and engineering options designed to significantly reduce sediment loading from priority point sources. This phase will produce detailed engineering surveys / designs for the major sediment sources. 3. Implement remedial measures at priority sediment-sources. It is expected the implementation phase of this project will take 2-3 years depending on available budgets and the scope of work to be done. Coincident with physical remediation works, a monitoring program will be initiated to determine the effectiveness of prescribed treatments.	No
HG-16	Improve Off-channel Rearing	Koksilah River & Tributaries	Mainstem, Glenora	Chinook, Steelhead, Chum, Coho	Fry, Parr	2012	3	Annual	\$100,000	\$300,000	1. Based on rehabilitation opportunities from Project HK-8 prepare off-channel designs for suitable sites. 2. Construct off-channel habitats, intake structures, LWD structures, etc. at suitable sites.	No
HG-16a	Assess culvert/fish passage	Koksilah River and Tributaries	Glenora and Industrial Area	Chinook, Steelhead, Chum and Coho	Fry, Adult, Parr	2008	1				1. Assess current drainage patterns and storm water greenways linked to side channel habitat. 2. Develop hybrid RAR setbacks and potential drainage features 3. Develop multi stakeholder partnerships with residents, agricultural interests, industrial areas as well as agencies including DFO, MOE, MOT and CVRD	No
HG-17	Recapture Off-channel Rearing	Cowichan Estuary	Cowichan Estuary	Chinook, Steelhead, Chum, Coho	Fry	2008	5	Annual	\$100,000	\$500,000	1. Based on recommendations from Project HK-10, implement rehabilitation measures to recapture off-channel sloughs and backwaters, and perennial flood channels.	No

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Current Funding
HG-18	Eelgrass Expansion	Cowichan Estuary	Cowichan Estuary	Salmon, Shellfish	Fry	2006	10	Annual	\$50,000	\$500,000	<ol style="list-style-type: none"> Based on recommendations from Project HK-11, implement protection / rehabilitation measures to increase and improve the condition of tidal vegetation, particularly eelgrass. follow up with Paul R comments regarding the potential use of mesh enclosures (eg goey duck farming) as artificial supports to eel grass colonization. 	No 2006 with Seac Cons fund unde Eel g resto pilot selec in C Bay.
HG-19	Clam Beach Seeding	Cowichan Bay	Cowichan Bay	Clams	n/a	2011	2	Annual	\$20,000	\$40,000	1. Assess effectiveness of seeding through population growth and production monitoring (considered as an experiment).	No
HG-20	Maintenance and Monitoring	All	All	All	All	2006	20	Semi annual	\$100,000	\$1,000,000	<ol style="list-style-type: none"> Monitor and maintain restoration works Report on effectiveness 	No
								Totals	\$1,715,000	\$7,650,000		

Stewardship and Education Recovery Actions

Appendix D5. Table of recovery actions to directly affect stewardship and education activities with preliminary project designs and cost estimates. (donated labour and materials are costed for the purposes of this recovery plan).

Project Code	Objective	Zone	Location	Species (10 & 20)	Life Stage (10 & 20)	Start Year	No. of Years	Frequency	Annual Cost	Total Cost	Project Description	Current Funding
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SW-1	Riparian Management	Cowichan Lake & Tributaries	Lake shore, Robertson, Shaw, Nixon, Sutton, Meade, Cottonwood	Chinook, Steelhead, Chum, Coho	Adult, Fry, Parr	2006	15	Annual	\$15,000	\$225,000	1. Develop public information materials on best management practices and practical land and riparian management strategies that protect / rehabilitate streamside corridors. 2. Develop materials on methods and practices that reduce non-point source pollution impacts. 3. Target landowners managing agricultural lands and forest harvesting companies.	No Pot fun CV out pro
SW-2	Riparian Management	Cowichan River & Tributaries	Mainstem, Somenos	Chinook, Steelhead, Chum, Coho	Adult, Fry, Parr	2006	15	Annual	\$15,000	\$225,000	1. Develop public information materials on best management practices and practical land and riparian management strategies that protect / rehabilitate streamside corridors. 2. Develop materials on methods and practices that reduce non-point source pollution impacts. 3. Target landowners managing agricultural lands and forest harvesting companies. 4. work with the Somenos Management Committee and North Cowichan to more effectively distribute information.	No Pot fun CV out pro
SW-3	Water Conservation	Cowichan River & Tributaries	Mainstem, Somenos	Chinook, Steelhead, Chum, Coho	Adult, Fry, Parr	2006	15	Annual	\$15,000	\$225,000	1. Develop public information materials on best management practices for water conservation through more efficient use of water. 2. Target landowners with water withdrawal licenses.	No Pot fun out the Wa Stu
SW-4	Riparian Management	Koksilah River & Tributaries	Mainstem, Norrie, Glenora, Kelvin	Chinook, Steelhead, Chum, Coho	Fry, Adult, Parr	2006	15	Annual	\$15,000	\$225,000	1. Develop public information materials on best management practices and practical land and riparian management strategies that protect / rehabilitate streamside corridors. 2. Develop materials on methods and practices that reduce non-point source pollution impacts. 3. Target landowners managing agricultural lands and forest harvesting companies.	No Pot fun CV out pro
SW-5	Water Conservation	Koksilah River & Tributaries	Mainstem, Norrie, Glenora, Kelvin	Chinook, Steelhead, Chum, Coho	Fry, Adult, Parr	2010	15	Annual	\$15,000	\$225,000	1. Develop public information materials on best management practices for water conservation through more efficient use of water. 2. Target landowners with water withdrawal licenses.	No Pot fun out the Wa Stu
SW-6	Protect Intertidal Habitat	Cowichan Estuary	Cowichan Estuary	Shellfish and Vegetation	n/a	2005	20	As needed	\$5,000	\$100,000	1. Manage foreshore developments to protect and recover intertidal habitats by adhering to community development plans and establishing protocols for the review of development proposals.	No

SW-7	Protect Intertidal Habitat	Cowichan Bay	Cowichan Bay	Shellfish and Vegetation	n/a	2005	20	As needed	\$5,000	\$100,000	1. Manage foreshore developments to protect and recover intertidal habitats by adhering to community development plans and establishing protocols for the review of development proposals.	No
SW-7a	Protect intertidal Habiata	Cowichan Bay and Estuary	Cowichan Bay	All	all	2007/8	ongoing				Support the review and revitalization of the Cowichan Estuary Environmental Management Plan (CEEMP)	MC con Rog
SW-8	Reach out to communities and Schools	All	All	All fish and Shellfish	all	2006	15	Annual	\$15,000	\$225,000	1. Develop educational material on the freshwater and marine ecosystems of the Cowichan-Koksilah basins, including existing flora and fauna, current habitat conditions and threats, and activities that can be undertaken to prevent impacts to environment. 2. Target general community and K-12 school children	