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FISH AND WILDLIFE COMPENSATION PROGRAM

CHEAKAMUS WATERSHED

SALMONID ACTION PLAN

FINAL DRAFT

OCTOBER 2011

The FWCP is a partnership of:

BC hydro FOR GENERATIONS

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Cheakamus River Salmonid Action Plan

1 INTRODUCTION

The Fish and Wildlife Compensation Program (FWCP): Coastal Region evolved from its origin as the Bridge-Coastal Restoration Program (BCRP), a program initiated voluntarily by BC Hydro in 1999 to restore fish and wildlife resources that were adversely affected by the footprint of the development of hydroelectric facilities in the Bridge-Coastal generation area. Footprint impacts include historical effects on fish and wildlife that have occurred as a result of reservoir creation, watercourse diversions and construction of dam structures.

In 2009, the program developed a strategic framework that guides overall planning for compensation investments (MacDonald 2009). The framework has guided the development of strategic plans for each watershed within the FWCP program area, which are in turn informing action plans that focus on specific priorities within each watershed (Figure 1).

This Salmonid Action Plan sets out priorities for the Fish and Wildlife Compensation Program to guide projects in the Cheakamus River project area. It identifies actions to be undertaken throughout the Cheakamus River in support of salmonid fish species. The plan builds on the FWCP's strategic objectives and the Cheakamus River Watershed Plan (FWCP 2011). Action plans have also been developed for riparian and wetland areas and species of interest; and some actions may be complementary across the different plans.

The actions and priorities outlined in this plan have been identified through a multi-stage process involving BC Hydro, Fisheries and Oceans Canada (DFO), Canadian Wildlife Service (CWS), Ministry of Environment (MOE), local First Nations, and local communities. Initial priorities were developed through consultation with agency staff. These priorities were then reviewed and discussed at a workshop[1] to allow First Nations, public stakeholders, and interested parties to comment and elaborate on the priorities.

It is important to understand, however, that planning priorities within action plans may not translate immediately into funded projects. Limited program funding requires that priority-setting has to also be developed across the program as a whole, not just within action plans. The process of selecting which actions will be implemented in any given year will occur during the annual implementation planning cycle.

[1] Squamish (17 June, 2010)

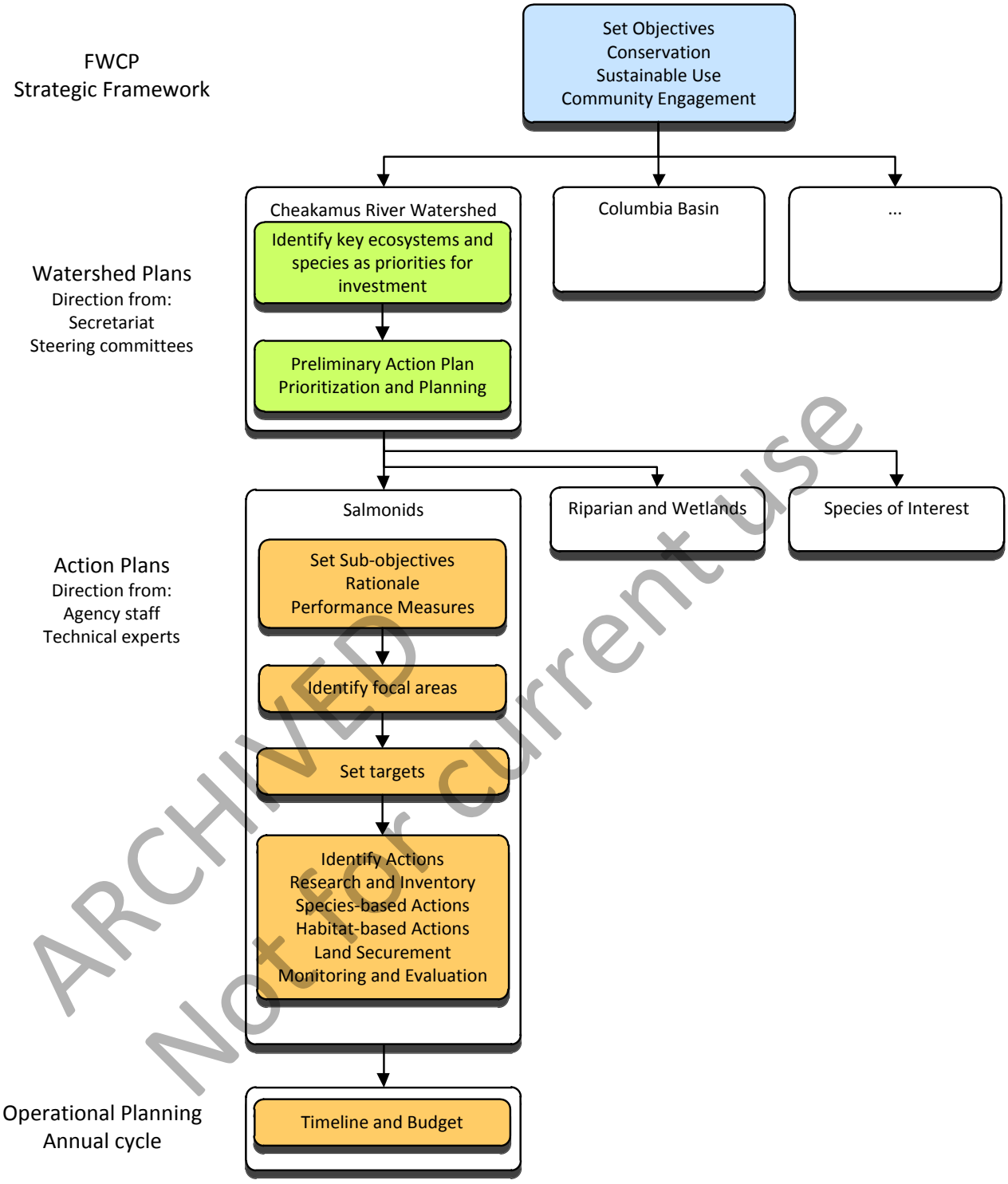

Figure 1. Relationship between the Salmonid Action Plan and higher level planning and objectives.

2 OVERVIEW CONTEXT

The Cheakamus River is a tributary of the Squamish River, which flows into the head of Howe Sound. The Cheakamus River originates in the Fitzsimmons Range of the Coastal Mountains approximately 100 km north of Vancouver, between the communities of Whistler and Squamish (Figure 2). The watershed has an area of 1,070 km^2 and ranges in elevation between 30 m at its confluence with the Squamish River to 2300 m at its headwaters. 75% of the watershed is upstream of Daisy Lake Reservoir. The valley is steep and consists of coastal hemlock and Douglas fir in the lower reaches and mountain hemlock in the upper elevations. It experiences a Pacific Coastal climate resulting in prolonged and heavy precipitation between October and January, predominantly on the western facing slope, with as much as 700 mm in November. Summers are often sunny and warm. Runoff is dominated by spring snow melt with high flows in May and June and low flows in the late summer. Late autumn and winter storms may also result in large inflow.

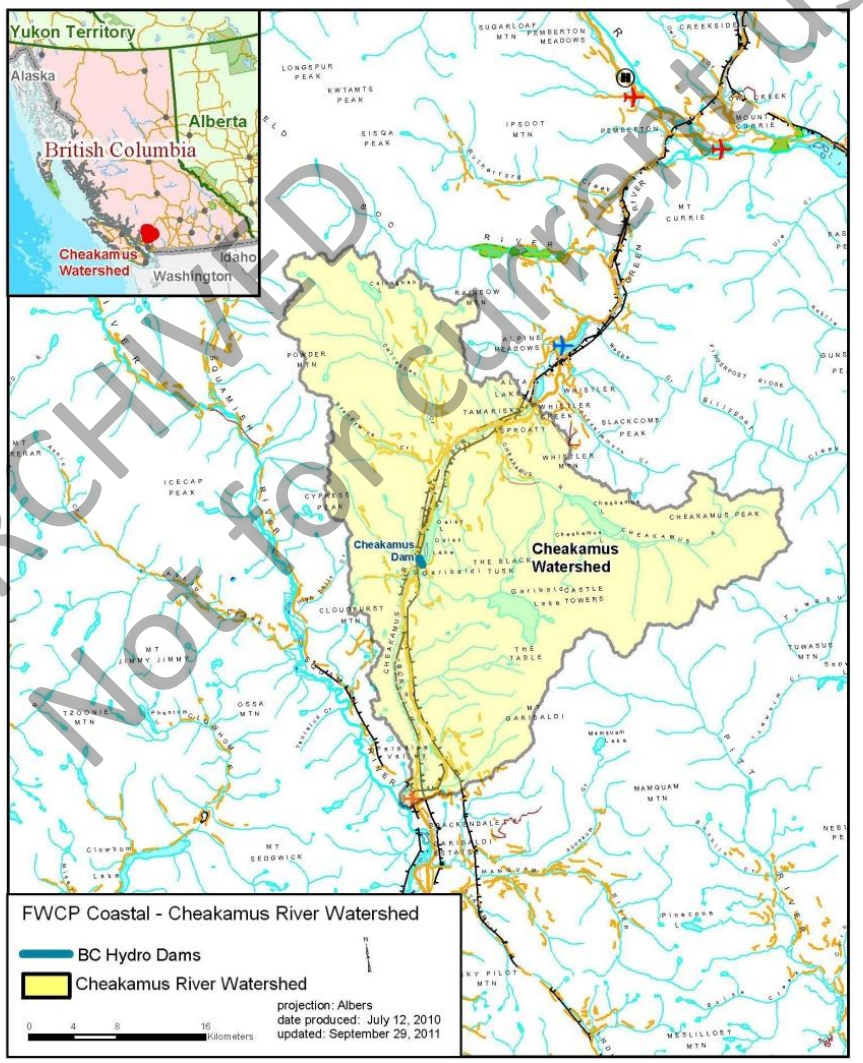

Figure 2. The Cheakamus River watershed.

The Cheakamus and Squamish Rivers are in Squamish First Nations territory. The eastern portion of much of the Cheakamus watershed lies within Garibaldi Provincial Park. The lower reaches of the Squamish River is in Tantalus and Brackendale Eagles Provincial Parks and Baynes Island Ecological Reserve, and the mouth of Squamish lies in the Skwelwil'em Squamish Estuary Wildlife Management Area.

The Cheakamus project includes Daisy Lake Dam, Daisy Lake Reservoir, a diversion tunnel and two penstocks, the Cheakamus Generating Station, and a channel that takes flow from the powerhouse to the Squamish River. Water withdrawn from Daisy Lake Reservoir flows via canal under the Sea-to-Sky Highway into Shadow Lake, a small (< 4 ha) headpond at the diversion tunnel entrance. All flows diverted from the Cheakamus are released to the Squamish River about 21 km upstream of its natural confluence with the Cheakamus. 80% of the annual inflow to Daisy Lake Reservoir is diverted to the Squamish River, with the remainder released to the 26 km stretch of Cheakamus River below the Daisy Lake Dam. The hydropower facilities were constructed by BC Electric Co. and became operational in 1957.

DFO operates the Tenderfoot Hatchery on the Cheakamus 5 km above its confluence with the Squamish River. The hatchery augments Chinook, coho, steelhead, pink and chum populations.

2.1 FISH AND FISH HABITAT IN THE CHEAKAMUS RIVER

A number of natural barriers on the lower Cheakamus River restrict anadromous salmon and steelhead to the lower 17.5 km of river. Chinook, coho, chum, pink, sockeye and steelhead occur in the lower Cheakamus, along with the resident salmonid species rainbow trout, cutthroat trout and bull trout. These resident salmonids occur also above the barrier and upstream of Daisy Lake Dam. Other fish species listed in the watershed include kokanee, mountain whitefish, prickly sculpin, threespine stickleback and lamprey. There is an important recreational sport fishery on the lower Cheakamus River for pink, chum, steelhead and other species.

There is taxonomic uncertainty about the char that occur in the Cheakamus system. The two species are difficult to distinguish in the field and both occur in this region. Various documents refer to both bull trout and Dolly Varden in the Cheakamus watershed, but there have been no definitive surveys or studies. Typically, the char that occur in large lakes and mainstem rivers in this region are bull trout, but Dolly Varden also occur, particularly in smaller tributaries and in headwaters (Rick Taylor, UBC, personal communication). For convenience we refer to char in this report as bull trout, but acknowledge the considerable uncertainty regarding proper identification.

2.2 IMPACTS AND THREATS

Fish and Wildlife habitat and species have been significantly altered due to the construction of the dams, the development of hydro-power, and alterations in the hydraulic regimes of the systems. The following summary of the primary footprint impacts is derived from:

- Bridge-Coastal Restoration Program: Strategic Plan, Volume 2: Watershed Plans, Chapter 13: Cheakamus River (December 2000);
- Cheakamus River Water Use Plan Consultative Committee Report (October, 2003); and
- Findings in the Community Workshop (Squamish, 17 June, 2009).

Hydro-related Impacts — The impacts that occurred are based on location in the watershed as follows:

Cheakamus River upstream of Daisy Lake Dam.

1. Daisy Lake Reservoir inundated a pre-existing lake (21ha), flooded 15 km of mainstem channel, 5 km of tributary channels, 12 ha of wetlands, and riparian habitat around each.
2. Large drawdown (13 m) reduces littoral productivity, and may affect access to tributaries for fish.

Daisy Lake Dam and lower Cheakamus River

3. The dam footprint led to loss of instream and riparian habitat.
4. The dam has reduced recruitment of gravel and large woody debris (LWD) to downstream areas.
5. Reduced flow in the lower Cheakamus has diminished habitat capacity.
6. Loss of active side channel habitat is likely due to dyking and altered flow regime.
7. Reduced flow from upper Cheakamus allows colder Rubble Creek flow to dominate the lower Cheakamus River, which may have caused declines in some species.
8. Entrainment occurs, but the magnitude and impact is unquantified.

Diversions

9. The large diversion of water from Cheakamus to Squamish River impacts productivity in the Cheakamus River downstream of Daisy Lake Dam.
10. There is potential for short-term elevated TGP events.

11. Flow fluctuations in the Cheakamus Generating Station tailrace channel may affect salmon spawning.

Non-hydro Impacts - Other impacts on fish populations in the Cheakamus watershed include effects of harvest, dyking, logging activities and the construction of roads, railways and power lines. A large spill occurred in 2005 from a CN Rail derailment, which spilled 40,000 litres of sodium hydroxide into the Cheakamus River just downstream of Daisy Lake Reservoir, with estimates of over 500,000 fish killed, including coho, Chinook, pink, chum and rainbow trout. The ultimate effects of the spill are not known, and monitoring of effects continues to be conducted.

2.3 LIMITING FACTORS

The principle known limiting factors affecting salmonid production in the Cheakamus River are summarized here.

1. **Habitat area**: There is limited amounts of spawning and rearing habitat, and additional development may further reduce habitat. Former spawning, rearing and overwintering areas are permanently lost or seasonally reduced due to flow diversions and low operating flows.
2. **Habitat quality**: Physical habitats below dams are altered by reduced sediment and wood recruitment. Lakes and streams in this region have naturally low nutrient levels, which limits freshwater productivity.
3. **Competition**: Pink and Chinook salmon face competition for spawning habitat from the large chum population.
4. **Access**: Lower flows have resulted in reduced access to tributaries and side-channels.
5. **Diversions**: The Cheakamus diversion has reduced annual flow volumes in the lower Cheakamus River. Altered flows have affected wetted area, seasonal temperatures and stream productivity.

2.4 TRENDS AND KNOWLEDGE STATUS

HABITAT TRENDS

A detailed account of habitat alterations from hydropower development is provided in BCRP (2000) and a summary is in Section 2.2. In addition to present and historic hydropower impacts there are impacts in the watershed from logging, dyking, linear developments, and industrial spills.

Changes in operations as part the Cheakamus Water Use Plan have been implemented to improve aquatic habitat conditions (BC Hydro 2005). The expected

benefits of the WUP are the maintenance or improvement of fish habitat conditions in Cheakamus River below Daisy Lake Dam, including substantial increases to chum spawning habitat, and slight increases to rearing habitat for resident fish and benthic invertebrate production.

Over the past decade FWCP (under BCRP) has spent over $1.5 million in the Cheakamus watershed, and has undertaken projects with DFO, MOE and community partners (North Vancouver Outdoor School, Squamish River Watershed Society, and Squamish First Nation). Approximately 23,330 m^2 of new side channel work has been completed, and 6,700 m^2 of existing side channel habitats have been restored or improved. This includes an extension of Dave's Pond development, and creation of off-channel and side channel habitat throughout the lower Cheakamus River focusing on coho, pink and rainbow trout, such as the Moody channel. In the Squamish River estuary, 14,488 m^2 of new intertidal channel was constructed, which improved overall fish access to the central estuary and is expected to improve fish productivity. Areas in the estuary were purchased with the Squamish Nation, including the Mamquam Blind Channel Purchase.

STOCK TRENDS

Chinook — The highest restoration priority for DFO in the Cheakamus River is Chinook salmon, and an interim target has been set of 250,000 0+ juveniles. Potential habitat for restoration is limited, but there appear to be some opportunities for restoration. Competition with chum for spawning habitat may ultimately limit success of Chinook salmon in the Cheakamus. Chinook stocks declined markedly from 25,000 to 30,000 adult spawners in the 1960s to several thousand in the 1980s. Chinook are augmented by hatchery operations, but there is also natural spawning and recruitment.

Pink — Pink salmon are identified by DFO as a high priority for restoration. Pinks have been reduced from runs of several hundred thousand spawners (e.g., 351,700 in 1961 and 555,000 in 1965) to only a few thousand in recent years. DFO has set an interim target of 150,000 spawners, or 10 million fry. Like Chinook, there appear to be opportunities for restoration, but competition with chum for spawning habitat may limit success of pink salmon in the Cheakamus.

Coho — There is a relatively healthy population of coho in the Cheakamus and DFO has assigned this species a medium priority for restoration. Coho tend to focus on the upper portion of the Cheakamus River just below the canyon and falls. There are currently an estimated 35,000 to 100,000 smolts from the system.

Sockeye — Sockeye occur in the Cheakamus in small numbers. This is a riverine population, since there is no lake for rearing. DFO considers sockeye to be a low priority for restoration.

Chum — There is a stable population of chum in the Squamish and Cheakamus. They have responded well to various habitat and restoration works already conducted, and current escapements are around 186,000. Maintaining the chum

population and habitat is a very high priority, but additional restoration is low priority at this time.

Steelhead — This is MOE's highest priority species in the Cheakamus and Squamish rivers. An interim escapement target for Cheakamus steelhead is 400 adults. The estimated habitat capacity for steelhead is approximately 700 adults and 7000 smolts. Instream parr habitats, such as pools, boulders, large woody debris, and other cover are the major limiting factors, along with low marine survival rates. There are a number of restoration opportunities that are a very high priority for MOE.

Bull Trout — Bull trout are the next highest priority for MOE. The species is provincially blue-listed, and there is limited information about population status, distribution and trends.

Cutthroat — Coastal cutthroat trout are provincially blue-listed and are a medium priority for MOE. Information about their population status, distribution and trends is limited.

Other fish — Rainbow trout, kokanee, mountain whitefish, prickly sculpin, threespine stickleback and lamprey have been recorded in the Cheakamus watershed, but at this time are considered lower priority.

KNOWLEDGE GAPS

The knowledge gaps vary among species. Some species, such as chum, have been monitored fairly well, whereas there is little known about bull trout and coastal cutthroat trout in the system. Limiting factors are known for steelhead, such as the need for rearing habitat for parr, however, less is understood regarding where that habitat could be created, or how it can be engineered in such an active river. Less is understood about Chinook, in part because turbidity at the time of their spawning makes monitoring difficult.

3 ACTION PLAN OBJECTIVES, MEASURES AND TARGETS

Clear and realistic management objectives are necessary to guide information acquisition and prioritize management actions. Priority actions and information needs will change as both improvements to the system are realized and information is gained. The current plan reflects the information available and values expressed by stakeholders (FWCP partners, First Nations and local communities) through reports, interviews and regional workshops held between 2009 and 2011.

3.1 OBJECTIVE AND TARGET SETTING

The following terminology is used in this report.

Objectives:	Objectives are high-level statements of desired future conditions (outcomes), consistent with FWCP partner mandates and policies.
Sub-objectives and Status Indicators:	Sub-objectives are detailed statements of desired future conditions within objectives, from which status indicators can be derived and alternative management actions evaluated. Sub-objectives and indicators provide the details necessary to translate policy into actions and to evaluate their consequences. They may be arranged hierarchically within objectives, and usually indicate conditions necessary to attain the objective to which they refer.
Measures:	Measures are specific metrics whose values indicate the degree to which desired future conditions have been achieved. They can be either qualitative or quantitative. There is a preference to develop the latter where possible for ease of monitoring.
Targets:	Targets are the values of measurable items that indicate the attainment of a desired condition. In the current context these may be expressed as a single value or as a range to acknowledge the inherent variability of ecosystems.
Actions:	Management actions, plans or policies for achieving the objectives.

Objectives are the “ends” or the outcomes we ultimately care about. Actions are the “means,” or the things we do to achieve them. This report focuses on describing the actions required to achieve the objectives in relation to Salmonid species and fish in general. Actions relating to specific species or habitats may also be related to actions in other Action Planning documents such as the Riparian and Wetlands or Species of Interest plans.

3.2 OBJECTIVES, MEASURES AND TARGETS

Management objectives are common to all locations in the Cheakamus watershed, although the species of interest vary between the upper and lower watershed and thus the list of indicators and targets may differ.

This section briefly summarizes the objectives, sub-objectives and status indicators. While the objectives are expected to remain stable over time, the indicators and targets may evolve as management priorities for agencies shift, or new information becomes available.

There are two management objectives for salmonids in the Cheakamus River:

1. Conservation – Ensure a productive and diverse aquatic ecosystem,

2. Sustainable Use – Maintain or improve opportunities for sustainable use.

Supporting these objectives are sub-objectives that break each into its key components and provide further clarity.

Objective 1. **Ensure a productive and diverse aquatic ecosystem.**

Rationale — This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple fish species.

There are two sub-objectives, which divide salmonids into anadromous and resident species, since priorities tend to fall along these lines in different locations in the Cheakamus watershed.

1. Maximize the viability of anadromous salmon and steelhead,
2. Maximize the viability of resident salmonids.

The sub-objectives are supported by the following status indicators:

1. Anadromous salmon and steelhead
    a. Chinook salmon
    b. pink salmon
    c. coho salmon
    d. chum salmon
    e. steelhead trout

2. Resident salmonids
    a. bull trout
    b. cutthroat trout

The indicators focus on species of greatest management concern. There is a tacit assumption that these are to some extent true indicator species and that meeting targets for these species will support conservation of other fish species.

There are different priority species in different parts of the Cheakamus watershed. Projects need not focus solely on these species, but they are the species of greatest interest to most stakeholders. From a conservation perspective, the priorities are as follows.

Chinook are high priority and coho are a medium priority for DFO. There are limited opportunities to enhance Chinook and coho habitat in the lower Cheakamus River. Pink salmon are a high priority for DFO, as they try to rebuild a stock that was historically considerably more productive. The chum salmon population is currently healthy and is a lower priority for DFO relative to other anadromous salmon. Sockeye occur in low numbers in the Cheakamus and are a low priority for restoration.

Steelhead, cutthroat and bull trout are high priorities for MOE in the lower Cheakamus River. The steelhead population is affected by low marine survival and the interim target is about half of the estimated capacity of the Cheakamus River. Relatively little is known about cutthroat trout, rainbow trout and bull trout population status, distribution and opportunities for restoration.

Steelhead, Chinook, coho, chum and pink are augmented by hatchery production. Increasing natural production is considered a high priority by all FWCP parties. Historically, there was no anadromous fish access beyond the falls in Cheakamus River, so fish passage is not a significant issue at this time.

Measures — Measures for the sub-objectives relate to the long-term viability of indicator fish populations, and may include distribution, population structure, abundance, and size or age distribution. At this time, the focus will be on abundance. Compensation activities may focus on improving habitat, but success will ultimately be assessed with measures of abundance. Abundance is currently measured through escapement estimates, snorkel swims, and Water Use Plan monitoring activities. Where necessary, additional monitoring may be required for the compensation program to assess progress under this objective.

Targets — Species targets were determined by DFO and MOE and are indicated in Table 1.

Table 1. Species management targets by location in the Cheakamus system.

Location	Species	Target (5 year average)
Lower Cheakamus	Coho	120,000 out-migrating smolts (as measured at the Outdoor School index site)
	Chinook	250,000 fry (as measured at the Outdoor School index site)
	Steelhead	400 adults (interim escapement target)
	Chum	maintain current abundance (186,000 to 200,000 spawners)
	Bull trout	no target
	Cutthroat	no target
	Sockeye	no target
	Pink	150,000 spawners or 10 million out-migrating fry (as measured at the Outdoor School index site)
Daisy Lake Reservoir and Upper Cheakamus	Cutthroat	no target
	Bull trout	no target

Objective 2. Maintain or improve opportunities for sustainable use.

Rationale — This objective reflects the important sustainable use benefits that can be derived from healthy fish populations. Many salmonid species are the focus of First Nations, commercial and recreational fisheries. Consequently, any actions aimed at achieving objective 1 also support this sustainable use objective. Although there are no direct actions for improving sustainable use at this time, it is conceivable that projects aimed at generally improving opportunities or increasing the participation in the fisheries could be identified by the program partners in the future.

As additional context, it should be noted that fisheries management agencies have an overall responsibility to manage the fisheries resource at a level of abundance and distribution to support First Nations' traditional uses and rights. These responsibilities are dealt with through the ongoing process of decision-making, which is not a formal part of this FWCP plan. In addition to this, First Nations' interests in overall conservation and sustainable use benefits have been incorporated into the development of this plan.

Measures and Targets — There are no specific measures or targets required at this time, aside from those associated with objective 1.

As part of their overall management responsibilities, DFO uses information such as abundance trends and escapement estimates to regulate angling and commercial harvest. MOE collects information on angler days, catch per unit effort, and number of fishing licences sold in the region, which informs decisions related to angling regulations.

4 ACTION PLAN

4.1 OVERVIEW

The Action Plan has many individual actions, which are presented in Section 4.2. Some actions support multiple sub-objectives, which in turn support multiple objectives. Figure 3 provides an overview of the link between actions and objectives.

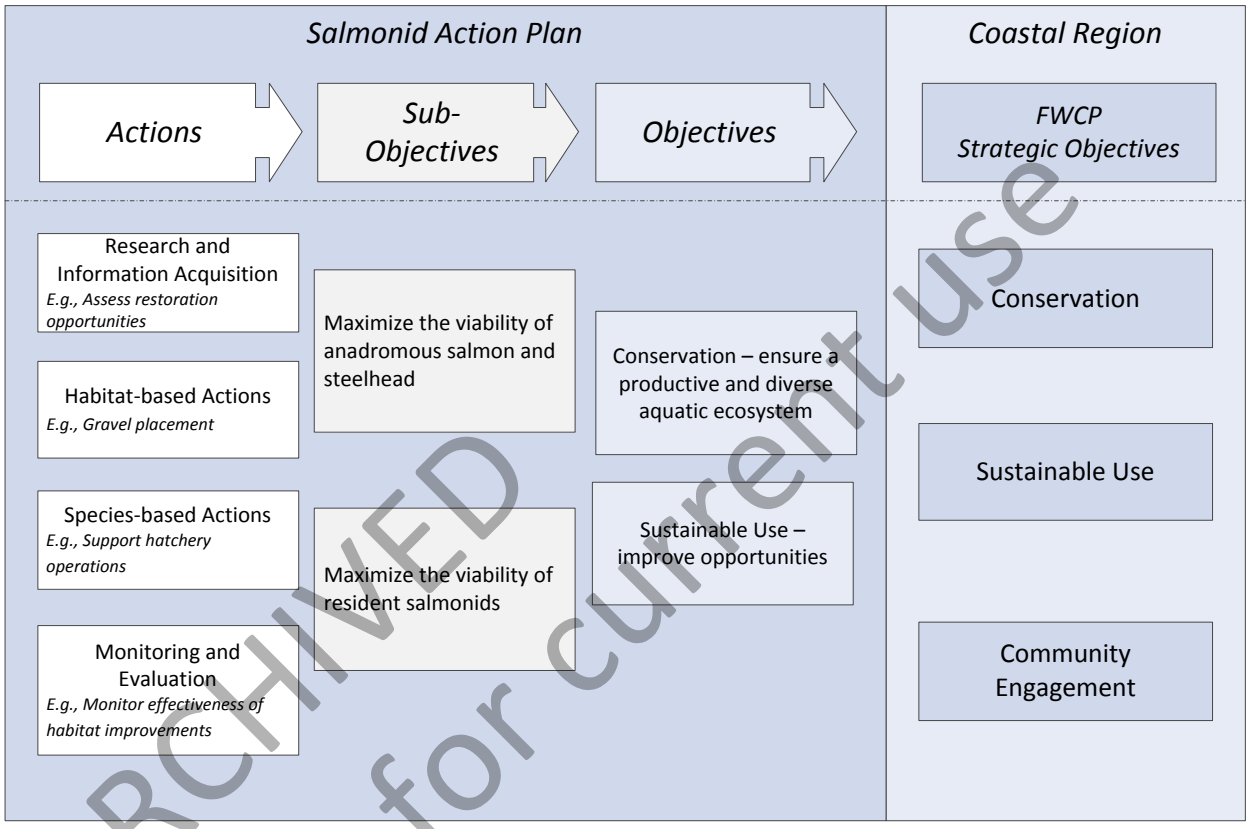

Figure 3. Relationship between actions, sub-objectives and objectives in this Salmonid Action Plan and the FWCP strategic objectives in the Cheakamus River Watershed Plan.

4.2 COMPONENTS

This section presents the main actions identified under each sub-objective along with the supporting rationale for why the actions are required and what they will achieve. Actions are organized under five broad categories: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Also provided are priority ratings to guide investment planning efforts. Actions are assigned priorities from 1-3. Note that low priority actions are not included in the table.

Sub-objective: Maximize the viability of anadromous salmonids.

Table 2:Actions with associated priorities and target species in the Cheakamus River.

Actions	Lower Cheakamus	Daisy Lake Reservoir	Upper Cheakamus	Squamish River	multiple species	Anadromous					Resident		
						Chinook	Coho	Chum	Steelhead	Pink	Bull trout	Cutthroat	Rainbow
Research & Information Acquisition													
Conduct analysis of limiting factors for Chinook, and assess and implement improved methods for assessing Chinook and steelhead status.	1*					x			x				
Assess the engineered log jam that was installed in the mainstem.	1*				x								
Assess feasibility of placement of large woody debris in the Cheakamus River.	1*				x								
Develop a strategic investment plan for all species. Conduct a multi-species "Status Review and Feasibility Study" and highlight priority projects and monitoring needs.	1				x								
Assess feasibility of restoring Powerhouse channel for enhancing salmonids. (Note that work is ongoing as part of WUP monitoring.)				1	x								
Assess side channel and off-channel habitat for multiple species, for example the side-channel 5 km downstream of the Bailey Bridge.	2				x								
Assess opportunities for restoration of Brohm Creek.	2				x								
Identify new opportunities for chum habitat restoration.	3							x					
Habitat Based Actions													
Maintain existing constructed habitat enhancements for all salmonids.	1*				x								
Improve existing side channels and off channel areas for all salmonids.	1*			1	x								
Following feasibility study, re-develop Powerhouse channel downstream of High Falls Creek and place gravel for spawning salmonids.				1*	x								
Continue restoration of estuary areas. This would particularly benefit Chinook, but would also benefit all other salmonids.				1	x	x							
Species Based Actions													
Support hatchery augmentation for Chinook, coho, steelhead, pink and chum in relation to specified targets.	2				x								
Land Securement													
There are possible opportunities in the lower Cheakamus and Squamish systems where land securement may address fisheries management objectives.	2				x								
Monitoring & Evaluation													
Assess efficacy of habitat enhancements undertaken by the program.	2				x								
Assess adult returns and out-migrating smolts as a measure of overall fish production in relation to specified targets.	2				x								

* particularly important projects

Rationale.— To support targets for anadromous salmon and steelhead a number of actions are proposed. Most actions focus on improving habitat for different species and life stages, but there is much we don't know biologically and physically about the species and habitats of interest, so actions also include collecting information to help evaluate and implement compensation options and assessing performance of implemented restoration activities. There is a considerable amount of data on salmonid species the Cheakamus system, from WUP studies and monitoring to works associated with the CN Spill. There has also been much work conducted by groups such as the Squamish River Watershed Society and Squamish Estuary Conservation Society. A review and collation of existing data should be a priority, particularly where feasibility studies were linked to physical works and where effectiveness monitoring has been conducted to assess results. This would support making informed choices on implementing the most cost-effective projects, with an understanding of what is possible and the

costs and benefits of different approaches. This would aid priority setting both within and among waterbodies within the Cheakamus system.

FWCP (BCRP) and other programs have completed a number of habitat enhancements in the Cheakamus and Squamish watersheds. Despite these works certain key species such as pink, Chinook and steelhead would benefit from additional restoration efforts. DFO has indicated that the main priorities for restoration in the Cheakamus system are Chinook and pink salmon, both of which are thought to be limited in part by competition with chum salmon for spawning habitat. The Chum population is currently stable and abundant. Additional work on chum is a low priority at this time, but maintaining existing channels with adequate good quality water is a high priority. Opportunities remain for increased re-working of side channels, such as Evans and Swift creeks, which would likely benefit several species. There are other opportunities to enhance steelhead habitats in the lower Cheakamus.

There are many restoration opportunities in the lower Cheakamus, but there are also cost-effective projects for restoring habitat in the Squamish River. For example, Chinook are attracted to the Cheakamus Generating Station tailrace channel. There may be potential to enhance this area for Chinook and steelhead. Any works in this channel would require consideration of flow releases as prescribed in the Cheakamus WUP. An evaluation of restoration opportunities in the Powerhouse Channel is a priority.

Many of the activities that enhance the status of salmonid species and improve ecological integrity of their habitats may also benefit a sustainable fishery. Pink, chum, steelhead and other species provide an important recreational sport fishery on the Cheakamus. Enhancement of fish and fish habitat will also support First Nations fisheries. BC Hydro funding has not typically been directed at funding of hatchery operations, but program partners have a responsibility for sustainable use of fish resources and will therefore consider sustainable use issues under the compensation program.

Monitoring is a cornerstone of good resource management because it provides information on present status and trends and allows post-implementation assessment of management decisions and programs. Monitoring provides direction on adjustments that may be necessary. There are multiple elements related to anadromous salmon and steelhead that require monitoring. Realistically, monitoring will likely focus on abundance of different life stages of sportfish and species of concern, and the level of effort will likely vary among locations and species. Results of monitoring should feed directly into compensation program evaluation and help revise objectives and targets, where necessary. Special care will be required to ensure that implementation and monitoring of FWCP: Coastal projects complements that of the Water Use Plan. Since the Cheakamus River can be fairly turbid, monitoring can be problematic and efforts to monitor effectively may require testing and using new methods and equipment.

Sub-objective: Maximize the viability of resident salmonids.

Table 3: Actions with associated priorities and target species in the Cheakamus River.

Actions	Lower Cheakamus	Daisy Lake Reservoir	Upper Cheakamus	Squamish River	multiple species	Anadromous					Resident		
						Chinook	Coho	Chum	Steelhead	Pink	Bull trout	Cutthroat	Rainbow
Research & Information Acquisition													
Conduct an inventory and assessment of bull trout and coastal cutthroat trout population status and identify restoration opportunities and priorities for future FWCP investment.	2										x	x	

Rationale.— The rationale for the proposed actions related to resident salmonids is similar to that discussed above for anadromous salmon and steelhead, and some of those proposed projects will benefit resident fish also. At this time there are no habitat restoration actions proposed solely for resident fish species in reaches with anadromous fish also, or for locations upstream of anadromous reaches where only resident fish occur. The primary actions required for resident salmonids is to develop a better understanding of present stock status and possible restoration options for different species. For example, population status and opportunities for habitat improvements require assessments of rainbow trout, cutthroat trout and bull trout.

4.3 UNSUPPORTABLE PROJECTS

DFO and MOE have indicated they would not support the following projects.

- BC Hydro has implemented a number of operational changes under the Cheakamus River Water Use Plan, which is expected to improve conditions for fish and other resources. There are concerns that some restoration works could confound results from studies underway to evaluate aspects of the WUP. FWCP partners support the WUP and its associated monitoring studies and recognize the need to avoid confounding WUP monitoring results.
- Projects related to fish passage at BC Hydro facilities must adhere to the Fish Passage Decision Framework for BC Hydro Facilities (BC Hydro 2008), including requirements for evaluation of specific prerequisite biological studies.
- Habitat enhancement projects (e.g., improving fish passage at natural barriers, modifications to specific habitats) may require agency review, and in some cases prerequisite biological studies, to evaluate risks and benefits.

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Rick Taylor, Zoology Department, University of British Columbia. Email correspondence with Todd Hatfield, February 24, 2011.