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FISH AND WILDLIFE  
COMPENSATION PROGRAM

# CHEAKAMUS WATERSHED *WATERSHED PLAN* FINAL DRAFT

OCTOBER 2011

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# Table of Contents

1	Introduction.....	2
1.1	Fish and Wildlife Compensation Program .....	2
	Vision.....	3
	Principles.....	3
	Partners.....	3
	Policy Context.....	3
	Program Delivery.....	4
	Project Investment Criteria.....	5
2	Cheakamus Watershed.....	6
2.1	Setting.....	6
2.2	Footprint issues .....	7
2.3	FWCP Accomplishments to date.....	9
3	Strategic Objectives for FWCP.....	10
4	Priorities.....	11
4.1	Introduction .....	11
4.2	Priority setting in the Coastal Region .....	11
4.3	Priority action plan summaries .....	13
	Salmonid Action Plan .....	13
	Riparian and Wetlands Action Plan.....	14
	Species of Interest.....	14
5	References.....	16
APPENDIX A .....		17
	Habitats .....	17
	Fish.....	17
	Mammals.....	19
	Birds .....	19

# Table of Figures and Tables

Figure 1:	Relationship between the FWCP Strategic Framework, basin strategic plans and action plans. .2
Figure 2:	The Cheakamus River watershed. [Draft Map].....7

# Cheakamus River Watershed Plan

## 1 INTRODUCTION

This Cheakamus Watershed Plan sets forth the strategic direction for the Fish and Wildlife Compensation Program: Coastal Region.

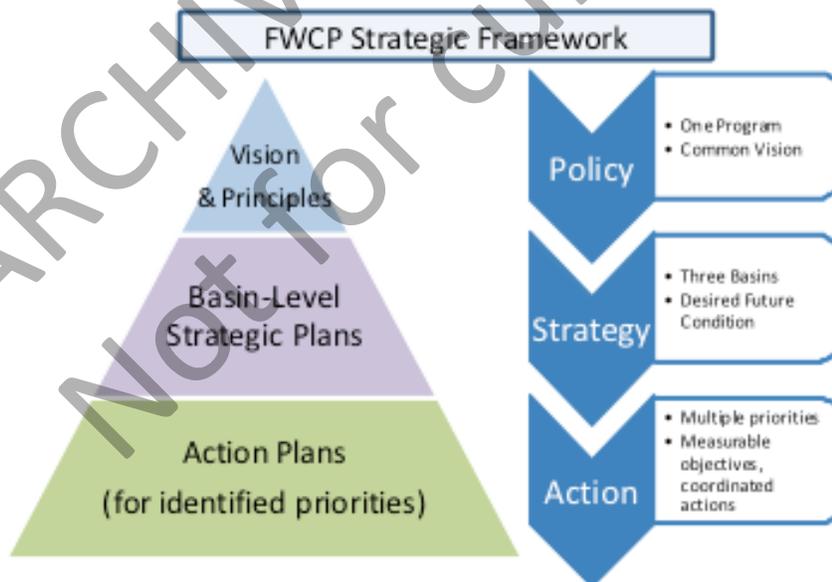
It begins by briefly outlining the vision, principles, policy context and strategic objectives that form the foundation of the FWCP. A description of the Cheakamus setting includes an overview of the hydro-electric facilities and footprint impacts created by those facilities.

The priority setting process is described, followed by a short direction-setting synopsis of a set of priority Action Plans. Taken together, this Watershed Plan and the accompanying Action Plans present the FWCP: Coastal priorities for investments in compensation activities within the Cheakamus Watershed.

### 1.1 FISH AND WILDLIFE COMPENSATION PROGRAM

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 original 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 the 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).



**Figure 1: Relationship between the FWCP Strategic Framework, basin strategic plans and action plans.**

Delivery of the program as a whole is guided by a vision, set of principles and policy priorities as developed by the program's partners.

## VISION

### ***Thriving fish and wildlife populations in watersheds that are functioning and sustainable.***

An effective program will support the maintenance of healthy fish and wildlife populations in basins significantly altered by hydroelectric development. Actions taken should satisfy both the conservation and sustainable use objectives and, where possible, restore ecosystem function, making species more resistant to emerging pressures such as climate change.

## PRINCIPLES

**Approach** - The program has a forward-looking, ecosystem-based approach that defines the desired outcomes and takes actions to restore, enhance and conserve priority species and their habitats.

**Decision Making** - The program efficiently uses its resources and works with its partners to make informed and consensus-built decisions that enable the delivery of effective, meaningful and measurable projects that are supported by the impacted communities.

**Geographic Scope** - Within the watersheds, basins and ranges of the populations of species affected by generation facilities owned and operated by BC Hydro.

**Objectives** - The program defines and delivers on compensation objectives that reflect the partnership's collective goals, and that align with local provincial and federal fish and wildlife conservation and management objectives in the areas where we work.

**Delivery** - The program strives to be a high performing organization with skilled and motivated staff and partners delivering efficient, effective and accountable projects.

## PARTNERS

The program is a partnership between BC Hydro, the BC Ministry of Environment, Fisheries and Oceans Canada, First Nations and public stakeholders. Our goal is to have engagement and participation of all the partners in priority setting, approval, review and delivery of the program.

## POLICY CONTEXT

The FWCP addresses the policy requirements and social commitments to compensate for impacts to fish and wildlife associated with the development of BCH's generating facilities. The core responsibilities of the agencies are:

### **Ministry of Environment**

The Ministry of Environment manages and delivers a wide range of programs and services that support the Province's environmental and economic goals<sup>1</sup>. The Ministry encourages environmental stewardship, develops innovative partnerships, engages First Nations, stakeholders and the public and actively promotes the sustainable use of British Columbia's environmental resources. Within this broader context, the Ministry has a number of responsibilities that are particularly relevant to the development and implementation of actions under the FWCP including:

- Management and conservation of the province's biodiversity;
- Protection of fish, wildlife, species-at-risk and their habitats;

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<sup>1</sup> <http://www.bcbudget.gov.bc.ca/2010/sp/pdf/ministry/env.pdf> (MOE Service Plan)

- Protection and restoration of BC's watersheds; and,
- Provision and management of fish and wildlife-based recreation.

A number of policies and plans guide the Ministry in delivering on these goals and objectives. The **Conservation Framework**<sup>2</sup> is British Columbia's approach for maintaining the rich biodiversity of the province, providing a set of science-based tools and prioritized actions for conserving species and ecosystems in B.C. **Program Plans for Freshwater Fisheries, Wildlife and Ecosystems**<sup>3</sup> articulate a clear set of strategies supported by actions to achieve both conservation-based outcomes and the provision of recreational opportunity. **Recovery Strategies and Management Plans** have been developed to guide the maintenance, recovery and/or use of specific species and ecosystems. These plans may include specific performance measures and targets.

### Fisheries and Oceans Canada

Under the **Fisheries Act**, DFO is the primary agency responsible for conserving and managing Canada's fisheries, including pacific salmon. It does so through management and monitoring of fisheries, protection of fish habitat, and pollution prevention. The **Policy for the Management of Fish Habitat** (1986) has an overall objective of 'net gain' of fish habitat and helps guide the implementation of fish habitat protection through collaboration with relevant provincial agencies. The **Species at Risk Act** mandates protection of geographically and genetically distinct populations. The principle goal of the **Wild Salmon Policy**<sup>4</sup> is "to restore and maintain healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity". This achieved through safeguarding genetic diversity, maintaining ecosystem integrity and managing for sustainable fisheries.

### BC Hydro

As a Crown Corporation, BC Hydro is committed to producing, acquiring and delivering electricity in an environmentally, socially and financially responsible manner,<sup>5</sup> through managing impacts from its operations, and weighing environmental values with social and economic interests. Where negative impacts cannot be avoided, it will work to mitigate or offset them, enhance affected habitat and sustain resources over the long term. As part of its water licenses to operate its facilities, BC Hydro is required to undertake compensation programs in different regions of the province. Through the compensation program, it is committed to developing positive projects, such as investments to improve fish stocks, and building relationships to encourage stakeholder and aboriginal community engagement, particularly where their input can contribute to better decisions.

## PROGRAM DELIVERY

The overall vision and common principles drive the FWCP program and projects, and provide a foundation for determining strategic priorities at the watershed level (Watershed Plans) which are developed into Action Plans. The bulk of projects undertaken by the FWCP will be delivered under Action Plans that lay out a suite of key actions to achieve specific goals associated with species and ecosystems. Actions could include research, implementation activities, monitoring and evaluation activities, and communication mechanisms. Applicants are encouraged to use the Watershed Plans and Action Plans to develop projects that meet the overall objectives of the FWCP program. Technical Committees, staff and the management board will reference the plans to ensure that the highest priority projects are invested in.

A portion of the FWCP program activities will include small-scale, short-duration strategic projects that target specific issues identified by program partners or others (e.g., community members). These could include projects not yet identified in any action plans, as well as lower priority Action

<sup>2</sup> <http://www.env.gov.bc.ca/conservationframework/>

<sup>3</sup> <http://www.env.gov.bc.ca/esd/>

<sup>4</sup> Canada's Policy for Conservation of Wild Pacific Salmon, 2005.

<sup>5</sup> BC Hydro Social Responsibility Policy.

Plan items that require timely response in order to take advantage of a investment or partnership opportunity.

## PROJECT INVESTMENT CRITERIA

At the level of individual project investment and implementation decisions, the FWCP applies the following criteria to further define its role and actions within defined program areas:

- FWCP does:
  - Fund actions to create, restore, or otherwise improve the function of ecosystems that have been impacted by BC Hydro activities;
  - Fund actions to create, restore, or otherwise improve the function of alternate ecosystems that provide a better opportunity for investment;
  - Participate as a team member in species of interest planning;
  - Fund specific management actions for species of interest as identified by recovery teams and action/implementation groups;
  - Fund baseline inventory that contributes to the development of habitat or species based actions within Action Plans;
  - Fund monitoring programs designed to measure the effectiveness of FWCP funded habitat and species actions; and,
  - Contribute to all aspects of managing co-operatively managed conservation lands.
- FWCP does not:
  - Fund core activities of government or non-government agencies or programs;
  - Lead the development of species recovery goals;
  - Fund, co-ordinate or lead National Recovery Teams for species at risk;
  - Develop policy related to land or wildlife management;
  - Administer government regulations;
  - Engage in enforcement and compliance activities, except in relation to co-operatively managed conservation lands; and,
  - Fund programs designed exclusively to address government harvest objectives.

## 2 CHEAKAMUS WATERSHED<sup>6</sup>

### 2.1 SETTING

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 1070 km<sup>2</sup> 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.

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.

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.

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.

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<sup>6</sup> More details of the watershed can be found at the FWCP website:  
<http://www.bchydro.com/bcrp/projects/watersheds.html>

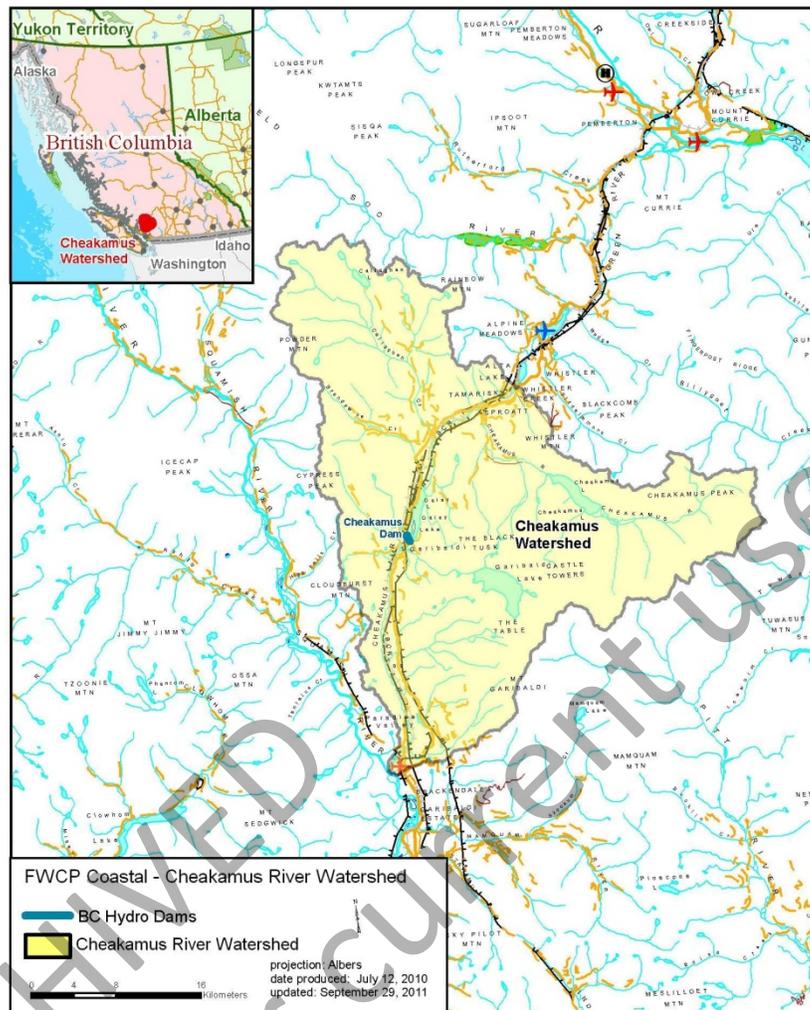


Figure 2. The Cheakamus River watershed. [Draft Map]

## 2.2 FOOTPRINT ISSUES

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 section deals with impacts throughout the Cheakamus River Area and is based on:

- the BCRP Strategic Plan, Volume 2, Chapter 13, Cheakamus River, (December 2000);
- the WUP Consultative Committee Report - (BC Hydro May 2003); and
- findings in the Community Workshop (Squamish, June 17, 2010).

**Inundation:** Reservoir impoundment expanded the existing Daisy Lake (21ha) to 395ha. The reservoir shoreline length is now 3 km.

**Habitat loss:** The reservoir flooded 15 km of mainstream channel and 4.7 km of lower tributary channel, and (120ha) associated riparian zones including coniferous and deciduous woodland, and

wetland habitats, as well as 270ha of upland forest. Cheakamus Dam has reduced large woody debris (LWD) recruitment downstream particularly important for pink and Chinook salmon as well as gravel recruitment downstream. 13m fluctuations in reservoir levels limit the establishment of riparian and/or aquatic vegetation in drawdown area.

Loss of active side channel habitat due to river dykes and altered flow regime, and simplified mainstem channel complexity has reduced habitat for pink, Chinook and steelhead.

80% diversion of water to Squamish valley has reduced usable habitat downstream.

**Migration barriers:** Anadromous fish were not present in the original Daisy Lake as passage up the Cheakamus river is blocked by waterfalls about 17km upstream of the confluence with the Squamish River. The larger reservoir presents a barrier to the movement of ungulates and bears.

**New Habitat:** Daisy Lake reservoir has created new habitat for rainbow trout and Dolly Varden, and kokanee. DFO created new channel habitats downstream for chum and coho. BCRP investments have added new habitat through restoration work related to side channel development, off-channel development, marsh and tidal channel restoration, amongst others.

**Fluctuating Reservoir:** The water fluctuations are 13m and may limit fish access to tributaries; as well as limiting productivity from shallow littoral habitats in original lake. Lack of vegetation in the drawdown zone has effects on ungulates, furbearers, small animals and water fowl.

**Altered Flow Regime.** Reduced mainstem flow allows colder Rubble Creek flow to dominate lower Cheakamus and may have resulted in some species decline. Reduced flows and a changed flow regime in 28 km of Cheakamus River has had unknown effects on aquatic wildlife and unknown effects on estuarine habitats and wildlife such as American Dipper, heron etc.

**Diversions.** 80% of the annual flow is diverted from the Cheakamus system into the Squamish. Some Cheakamus fish, Chinook, have been seen to migrate to tailrace of the power house on the Squamish River. In the Squamish River there is a potential for short term TGP events, and fluctuations in the Squamish side channel may affect salmon spawning.

**Entrainment.** There is little mortality associated with fish passing through the turbines at the powerhouse.

## 2.3 FWCP ACCOMPLISHMENTS TO DATE

Over the past decade the Bridge Coastal Restoration Program has invested approximately \$1.4 million in the Cheakamus watershed. Approximately 23,330 m<sup>2</sup> of new side channel work has been completed. Additionally, 6,700 m<sup>2</sup> of side channel habitats were restored or improved. In the Squamish River estuary, 14,488 m<sup>2</sup> of new intertidal channel was constructed.

### **Restoration work includes:**

- Pond development, such as Moody's channel and extension of Dave's Pond.
- Off channel and side channel habitat throughout the lower system focusing on coho, pink and rainbow trout.
- Gravel placement.
- Squamish river estuary and tidal channel and marsh restoration.

### **Conservation and enhancement work includes:**

- Land acquisition, such as Mamquam Blind Channel Purchase and acquisition in Squamish estuary.

### **Research work includes:**

- Feasibility of engineered log jam pilot project.

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### 3 STRATEGIC OBJECTIVES FOR FWCP

Strategic objectives for the Fish and Wildlife Compensation Program reflect a synthesis of the core objectives and mandates of the partner agencies as they relate to mitigating impacts associated with hydro-power generation in British Columbia.

Conservation and sustainable use are core objectives for both the Ministry of Environment and Fisheries and Oceans. Conservation is addressed in terms of maintaining specific species or habitats both in terms of their importance for diversity (including genetic diversity), as well as their importance for ecosystem functions, integrity and productivity. For example, a species such as White Sturgeon may be important in terms of species diversity, while Pileated Woodpeckers may be important for maintaining ecosystem functioning and integrity by creating habitat for other species. Sustainable use incorporates the human interest in utilizing species for sustenance, commercial, recreational, or cultural purposes. Consequently, species such as coho, moose or bald eagles (wildlife viewing) could be considered important from a sustainable use perspective.

Community engagement is a core objective for BC Hydro under the compensation program and is driven by its social responsibility policy. It also reflects the 'shared stewardship' goal of the Ministry of Environment and those of Fisheries and Oceans' Stewardship and Community Involvement program. It reflects the importance of incorporating local values and interests in determining and implementing projects.

The FWCP strategic objectives are therefore:

#### Conservation

- **Maintain or improve the status of species or ecosystems of concern.**  
This focuses on the conservation goals for ecosystems, habitats or ecological communities, and specific species. Priorities may be identified through the provincial Conservation Framework, or at the Conservation Unit level under the federal Wild Salmon Policy. Conservation priorities may also be identified at the watershed level based on local conditions.
- **Maintain or improve the integrity and productivity of ecosystems and habitats.**  
This addresses the concept of ecosystem integrity, resiliency and the functional elements of ecosystems, including efforts to optimize productive capacity.

#### Sustainable Use

- **Maintain or improve opportunities for sustainable use, including harvesting and other uses.**  
This objective focuses on the program's role in restoring or enhancing the abundance of priority species and in providing information to resource management decision makers related to providing opportunities for harvesting and other uses. Harvesting includes First Nations, recreational, sport and commercial harvests. Other uses may include cultural, medicinal, or non-consumptive uses.

#### Community Engagement

- **Build and maintain relationships with stakeholders and aboriginal communities.**  
This objective stems from BCH's social responsibility policy, MOE's shared stewardship goal and the approach of DFO's Stewardship and Community Involvement Program. This recognizes the importance of engaging aboriginal communities, local stakeholders, and other interest groups to contribute toward making good decisions and delivering effective projects.

## 4 PRIORITIES

### 4.1 INTRODUCTION

Across the FWCP as a whole, the general process of identifying priority action plans involves three steps:

#### **Step 1 – Identification (Candidate Priority Species and Ecosystems)**

The first step involves identifying and prioritizing the species and ecosystems against the core strategic objectives, and how they have been impacted by footprint issues associated with hydro-power generation.

#### **Step 2 – Preliminary Planning**

This step consists of reviewing the identified priorities with consideration to identifying candidate action plans. It may involve grouping species or ecosystems together for coordinated action. Key considerations include: addressing limiting factors, exploring the opportunity for multiple benefits, addressing any specific local threats, the practicality of implementing actions, and the plan's consistency with existing agency programs.

#### **Step 3 - Prioritization**

This step consists of a final prioritization of candidate action plans (and their priority areas) according to cost effectiveness and technical feasibility criteria:

- **Technical Feasibility.** – The program should generally seek out investments that are the most technically feasibility. Considerations generally include the use of proven methods and availability of technical resources. Innovative approaches should be considered but they must have a credible technical foundation and reasonable expectation of success. The potential interrelationship with system operations and programs being implemented by the Water License Requirements program must also be considered.
- **Cost Effectiveness.** – The program should generally seek out investments that are the most cost effective. This includes issues or actions which may benefit multiple species, areas where there is an opportunity to leverage additional funds for activities, issues where previous work has been conducted and incremental expenditure may have substantive benefits, actions that are closely related to on the ground actions with measurable impacts, amongst others.

### 4.2 PRIORITY SETTING IN THE COASTAL REGION

In the Coastal region of the FWCP, Step 1 involved a review of existing Watershed Restoration Plans, interviews with agency staff, a series of community workshops and a final evaluation.

In 2000, specific restoration objectives were originally articulated in the Watershed Restoration Plans.<sup>7</sup> These plans contain details of the major footprint impacts, objectives and limiting factors for productivity and have guided the work of the FWCP Coastal for the past decade.

Priorities for FWCP Coastal were reviewed in 2009 and 2010 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 priority setting was developed through consultation with agency staff. These were then reviewed and discussed at

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<sup>7</sup> Watershed Restoration Plans may be obtained at the FWCP website:

<http://www.bchydro.com/bcrp/projects/watersheds.html>

a series of open houses to allow First Nations, public stakeholders, and interested parties to comment and elaborate on the priorities.

The results from the Cheakamus Watershed workshop are summarized in Appendix A, highlighting the species, habitats, and specific activities as priorities for further work. On the aquatic side, Chinook and pink are considered as the highest priority salmon for FWCP investment. Coho, while an important species for the watershed, is considered as a medium priority as significant work has already been done for this species. Sockeye and chum are considered as low priorities, however, it was noted that chum is a very high priority from a sustainable use point of view and thus it is important to maintain the side channel habitat that has been created. Also, steelhead are a high priority species, and in particular there is strong support for developing channels near the Powerhouse. Bull trout are also considered a high priority species and as they are dependent upon their food source, all projects benefiting chum, coho & pink would serve to benefit bull trout as well.

Grizzly bears are considered as a high priority due their conservation importance as well as their social importance. Other high priority species include wolverine, Western Screech owl, Red-legged frog and Western toad. Black tailed deer are seen as a very high priority species, primarily for sustainable use purposes. Bald eagles should also be noted for their significance as a major viewing species in the area and important for tourism. Riparian and wetlands are considered as the highest priority ecosystems to conserve and restore. While a relatively large amount of wetland and riparian habitat is currently under conservation in the estuary other areas warrant conservation. The issue of corridor and wildlife movement is also important as it addresses a number of key species such as carnivores and ungulates. However, its limiting factor is primarily related to highway and rail development as opposed to BC Hydro facilities and operations.

The priorities emerging from the workshops were subsequently reviewed by BCH and Agency staff in relation to how well they addressed the strategic objectives, the extent to which species were impacted by footprint impacts, and what activities could provide multiple benefits to multiple species (see Appendix B). The resulting direction for the Cheakamus River Watershed is to focus the next five year period on the development and implementation of three priority *Action Plans* for priority topic areas: Salmonids, Riparian / Wetlands and Species of Interest. Other areas for future action plan development were identified as the estuary (focus on investigation and inventory to determine management options).

## 4.3 PRIORITY ACTION PLAN SUMMARIES

The Salmonid and Riparian / Wetlands Action Plans focus on overall ecosystems in support of multiple fish and wildlife species. The objectives and sub-objectives within these two plans reflect the overall ecosystem focus, and the plans include primarily habitat-based actions, supported as required by research/information acquisition, assessments and monitoring/evaluation actions.

The Species of Interest Action Plan focuses on species of conservation concern (including species-at-risk) or other regionally important species for management planning process. The objectives, sub-objectives and actions within this plan reflect this focus on individual species.

All three priority action plans in the Cheakamus River Watershed provide broad support to the FWCP strategic sustainable use objective.

The three priority action plans for the Cheakamus River system are summarized below. The full plans can be accessed on the FWCP website ([provide](#)).

### SALMONID ACTION PLAN

#### Rationale

Salmonid species have been heavily impacted by the creation of dams and hydroelectric facilities in the Cheakamus system. Limiting factors for salmonids in the Cheakamus watershed vary among species, but as approximately 80% of the water is diverted, limiting factors focus on useable habitat. Adopting a 'Multi-species Status Review and Feasibility' project is important. The logic of this would be to ensure that the highest priority actions will be being taken in areas that have the greatest opportunity first and build this into a Salmonid Action Plan.

Conservation and sustainable use priorities include Chinook, pink, steelhead and bull trout. In the case of Chinook limiting factors to productivity need to be identified. Re-development of the Powerhouse channel would benefit Chinook and steelhead. Pink are also important based on the overall value to the ecosystem functioning provided by their large numbers. There are numerous opportunities for pink such as restoration work in Sift and Evans creeks as well a reworking existing side channels. Engineered logjams and large woody debris are also important to ensure habitat; however, issues of safety must be addressed in the Action Plan. Also, diverted water tends to bring fish up the Squamish instead of the Cheakamus, therefore opportunities along the lower Squamish should also be explored.

Almost all the BCRP investment in the Cheakamus system has been related to improving fish productivity. Additional financing should focus on building on the existing work to date and evaluating the highest priority actions for restoration. Education and community awareness would be part of the program.

#### Focus

1. Increase available salmonid habitat in the Cheakamus River watershed for priority species (Chinook, pink, steelhead and bull trout) through restoration work including: rewatering Swift and Evans creeks; reworking existing side and off channels, as well as developing new opportunities.
2. Research to improve understanding of limiting factors of Chinook.
3. Maintain more abundant species such as coho and chum.
4. Support sustainable recreational fisheries in the Cheakamus River compensation areas.

## Expected outcome

- Improved habitat capacity and productivity in multiple stream systems.
- Sustained abundance of anadromous and resident salmonid populations at target levels over time.
- Improved targets for both habitat capacity (pre-development) and abundance for all salmonid species.

## RIPARIAN AND WETLANDS ACTION PLAN

### Rationale

Riparian and wetland areas have been impacted by the reduced flow in the lower Cheakamus as well as inundation of Daisy Lake reservoir. These areas are the limiting factor for critical life stages of many species, both aquatic and terrestrial. Riparian and wetland areas are extremely diverse and biologically rich and are considered as highly valuable from an ecological stand point.

While much of the lower estuary is already under some form of protection there are other areas of the Squamish and Cheakamus rivers that warrant protection. In particular the areas with cottonwood and older trees that provide nesting sites for cavity nesters, as well as eagles, herons etc. Also the slopes around Daisy Lake are very steep and provide little wetland or consistent riparian habitat.

To date, FWCP has not significantly funded restoration of riparian areas or wetlands in the Cheakamus. Activities should focus on mapping exercise to determine the best wetlands and riparian areas on the lower Cheakamus and Squamish, and possible areas for benching on Daisy Lake. Subsequently, analyse the best opportunities for preservation, such as out-reach with private land owners, covenants, land conservation, and land acquisition in key areas.

### Focus

1. Mapping and identification of critical habitat. In particular low gradient riparian habitats, in particular cottonwood with old trees, as well as possible areas for benching around Daisy Lake.
2. Assessment of opportunities for conservation and restoration, including legal status, ownership, land use, etc.
3. Identify and undertake key actions for currently known locations of importance, e.g., land purchase, creating old growth characteristics, wetland enhancement.
4. Identify and support existing initiatives which may assist conservation.

### Expected outcome

- Identification and prioritization of locations and potential future actions for conservation, protection, restoration and creation of wetland and riparian habitats.

## SPECIES OF INTEREST

### Rationale

'Species of interest' are defined as species of conservation concern (including species-at-risk) or other regionally important species.

There are several species of interest, either for conservation or sustainable use, which would benefit from specific actions or projects. Possibilities may focus on species, such as grizzly bears, black tailed deer, wolverines, Red-legged frogs, Western toads or Western Screech owls, amongst

others. Activities could include identifying limiting factors for their productivity, identifying critical areas for their habitat, and determining appropriate activities, such as developing nesting sites for owls etc.

For example improving the connectivity of Grizzly Bear habitat is of noted priority. This would likely benefit other species such as black tailed deer and wolverine. While Inundation of Daisy Lake likely impacted movement of some species, the largest impact has been related to the highway and its expansion. Work on corridor and connectivity could take advantage other wildlife activities that might be undertaken, such as riparian conservation or improved fish population that bears could forage. In the case of grizzly bear corridors, work funded through BCRP could include initiating studies for research with a goal of bringing in other funders when there was more certainty around what the solutions might be.

To date FWCP has not invested to any great extent in wildlife and has only recently initiated a project to examine amphibians in the Cheakamus watershed. More knowledge is needed regarding which species exist, in which habitats, and the opportunities available for their protection. Also, needed is a strategy for evaluation and monitoring that will support the ongoing process of renewing species plans and priorities in the Cheakamus River system.

### **Focus**

1. Identification of existing and potential species of interest, their potential or known limiting factors, and opportunities for conservation or improved productivity.
2. Support for existing recovery plans: e.g., the Grizzly Bear recovery plan.

### **Expected outcome**

- Improved knowledge and status of FWCP priority species of concern.
- Identification and prioritization of species, locations and potential future actions for conservation and protection.

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## APPENDIX A

The following list of species, ecosystems and actions were identified by agencies, First Nations and communities as being the top priorities for activities under the FWCP program. Following initial input from agencies, a multi-stakeholder workshop was held in Squamish (17 June, 2010) to identify priorities. Two breakout groups, for fish and wildlife, identified priorities which were reviewed in plenary to allow all participants to comment on the findings.

### List of potential opportunities for fish and wildlife

#### HABITATS

Species	FWCP Rank	Sust. Use	Comments
Riparian habitat	Very high (5)	Very low (1)	These are one of the highest priority ecosystems. Projects: 1) Conservation covenants on private lands 2) Restoration of damaged sites 3) Snag densities may limit some wildlife species so snag creation may be worthwhile
Wetlands	v. high (5)	Very low (1)	These are one of the highest priority ecosystems in the area. Critical habitats for many wildlife species. • Projects: 1) Conservation and restoration to more natural conditions. 2) Covenants on private lands.
Rare ecological community	Low (2)	v. low (1)	Not critical for wildlife habitat in the Cheakamus so low priority. • Projects: 1) Identification of communities
Rare plants	Med (3)	Low (2)	Projects: 1) Inventory needed for rare vascular plants, lichens, and mosses

#### FISH

Species	FWCP Rank	Sust. Use	Comments
Pink Salmon	High (4)	High (4)	<b>Target of 100K-300K spawners (alternatively 10 million fry).</b> Currently 2-3 million fry including hatchery production.
	High (4)		Rewatering of Swift Creek (intake from river). Also benefit to Chinook and coho. Would also reduce stranding of all instream rearing species of salmonids. ( Concern that this may impact WUP studies)
	High (4)		Rewatering of Evans Creek and physical works. Also of benefit to other instream rearing species.

Species	FWCP Rank	Sust. Use	Comments
	Very High (5)		Rework existing side channels to benefit pink spawning. Also benefit to chinook
Chinook	Very High (5)	High (4)	Target of 250K juveniles @ index site at Outdoor School. Difficult to assess adult numbers due to turbidity.
	Very High (5)		Purchase Didson sonar device (\$120K) to improve ability to assess adult chinook and steelhead. Benefit to both BCRP and WUP. Partner possibilities
	High (4)		Continued restoration of and access to estuarine lands. Also benefit to coho and chum.
	High (4)		Powerhouse channel d/s of/High Falls Creek. Redevelop channel to benefit chinook along with gravel placement. Requires a minimum flow from the powerhouse.
Coho	Med (3)	High (4)	<b>Target an annual average of 120K outmigrating smolts @ index site.</b> Currently between 35K and 100K.
	High (4)		Swift Creek project identified above for pinks and chinook.
	High (4)		Creation of groundwater pools specifically targeting coho overwintering (e.g. Paradise channels).
Sockeye	Low (2)	Med (3)	<b>Present in small numbers. No targets</b>
	Low (2)		Restoration opportunities are a low priority.
Chum	Low (2)	Med (3)	Target ???, population stable and sustainable
	Low (2)		Restoration opportunities are a low priority.
	Very High (5)		Maintain existing channels along with water quality and quantity.
All Species	High (4)	High (4)	Contribution to hands-on community education programs aimed at awareness. Partner with DFO Community Advisor.
Steelhead	Very High (5)		Interim escapement target of 400 adults for Cheakamus. Habitat capacity estimated to be 700 adults and 7000 smolts. Marine survival alimiting factor.
	Very High (5)		Feasibility of restoration of Powerhouse channel. **Squamish stocks distinct from Cheakamus and are an extreme conservation concern.
	Very High (5)		Feasibility studies of Engineered log jams in mainstem.
	Very High (5)		If feasible, install pilot log jams and monitor
	Very High (5)		Feasibility of LWD placement in reserve lands in lower river
	High (4)		Habitat complexing and slope stabilization in Brohm Creek.
	Med (3)		Assess potential improvements to sidechannel ~ 5km d/s of Bailey Bridge.
Bull Trout	High (4)	Med (3)	No targets but blue-listed.
	Med (3)		Evaluation of current status of population and habitat.
	Med (3)		Feasibility for restoration opportunities.

Species	FWCP Rank	Sust. Use	Comments
All species	Med (3)		Recreational angler surveys currently undertaken by CN will need to be repeated within 3-5 years
Daisy Lake			
All species	Med (3)		Stock assessment of Daisy Lake. Last undertaken in 1981. Focus on trout char and kokanee.
Upper River			
All species	Med (3)		Assess recreational fisheries in the upper river and assess opportunities for improvement. Focus on rainbow and bull trout.

## MAMMALS

Species	FWCP Rank	Sust. Use	Comments
Grizzly bear	Very high (5)	Med-high (3-4)	Special Concern and Blue List species. Integrate all projects with the Grizzly Bear Conservation Strategy. High impact from highway, railway, and human activities. Because of their social importance, their relevance to First Nations issues and their potential to be hunted it was felt that the sustainable use value should be 3-4 Projects: 1) Crossing structures to facilitate dispersal and gene flow across highway and railways.
Elk	Med-high (3-4)	Med (3)	Winter range and riparian habitats are critical. • Projects: 1) Some potential for restoration and securement of habitat. 2) Monitoring of herds 3) Crossing structures and fencing to facilitate movements across highway and railway barriers. As elk have been extirpated and it was felt that for the moment they should not be seen as such a high sustainability priority as they are not hunted, nor is there a potential to hunt them in the near future.
Wolverine	High (4)	Med (3)	Special Concern and Blue List species. • Projects: 1) Inventory. 2) Breeding/foraging habitat restoration potential best managed at landscape levels
Black tailed deer	Very high (5)	Very high (5)	Winter range is critical. Impacted by highways and human settlements. Important for First Nations. • Projects: 1) Crossing structures over highway. 2) Vegetation management along highway to reduce roadkills. 3) winter range enhancement.

## BIRDS

Species	FWCP Rank	Sust. Use	Comments
Western Screech owl	High (4)	Very low (1)	Special Concern and Blue-listed subspecies. Mature to old riparian forest and cavity dependent. • Projects: 1) Inventory. 2) Habitat restoration (riparian and snag management, nest boxes)

Species	FWCP Rank	Sust. Use	Comments
Bald Eagle	Med (3)	Very high (5)	It is the principal viewing species in the valley. There is a festival associated with Eagle viewing in Brackendale each year. Projects: 1) Protection of riparian forest for roost habitat
Great Blue Heron	Med (3)	Very Low (1)	Special concern and blue listed. No active nesting colonies known in watershed. But Squamish estuary is very important regionally. • Projects: Not much potential in the Cheakamus watershed, but some in estuary.
Band-tailed Pigeon	Med (3)	High (4)	Special Concern and Blue-listed species. • Projects: 1) Breeding/foraging habitat restoration potential best managed at landscape levels. 2) Mineral site identification and protection.
Sooty and ruffed Grouse	Very low (1)	Med – high (3-4)	High management interest but restoration potential low. • No priority projects identified.
Riverine birds (American Dipper, Belted Kingfisher, Common Merganser, Harlequin Duck)	Med (3)	Very Low (1)	Common and/or widespread species. • Main concern is cumulative impacts from all hydro projects combined. Mostly concerned with Harlequin Ducks (priority rating is high-4). • Projects: 1) Assess effects of dams and operations on populations and productivity

Species	FWCP Rank	Sust. Use	Comments
Red-legged Frogs	High (4)	v. low (1)	Special Concern and Blue list species. • Projects: 1) landscape level planning for ephemeral breeding ponds. 2) Wetland construction. 3) Assessment of effects of Bullfrogs and other invasive species on populations.
Western Toad	High (4)	v. low (1)	Special Concern species. Wetland dependent for breeding. Declining numbers. Projects: 1) Wetland conservation and restoration.
Species at Risk on general	Very High (5)	Very low (1)	General scarcity of information on distribution and densities for most SAR, as well as the above mentioned species, the list should include: Coastal Tailed Frogs Band-tailed Pigeon Rubber Boa 2 species of bat Invertebrates (Dragon flies) Projects: 1) Inventory needed for all SAR 2) Habitat restoration and securement.

**Potential Wildlife Species at Risk in the Cheakamus River watershed (note: not an exhaustive list)**

	<b>COSEWIC</b>	<b>CF-Rank</b>
<b>Amphibians and reptiles</b>		
Red-legged Frog	Special Concern	3,1,2
Western Toad	Special Concern	3,2,4
Coastal Tailed frog		
Rubber boa	Special Concern	5,3,4
<b>Mammals</b>		
Grizzly bear	Special Concern	3,2,3
Wolverine	Special Concern / Blue listed	3,2,3
Townsend's Big-eared Bat		5,2,3
<b>Birds</b>		
Band-tailed Pigeon		5,2,3
Great Blue Heron, fannini subspecies	Special Concern	3,6,1
Sooty Grouse		5,2,3
Ruffed Grouse		4,2,4
Western Screech-Owl, kennicottii subspecies	Special Concern	3,1,2