



CHEAKAMUS RIVER WATERSHED ACTION PLAN

FINAL November 14, 2017

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The Fish & Wildlife Compensation Program is a partnership between BC Hydro, the Province of B.C., Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife impacted by BC Hydro dams.



The Fish & Wildlife Compensation Program is conserving and enhancing fish and wildlife impacted by BC Hydro dam construction in this watershed. Top row from left: Cheakamus Dam and powerhouse. Bottom row from left: Squamish River Powerhouse (Credit BC Hydro). Cover photos: Coho fry (Credit iStock) and Roosevelt Elk (Credit iStock).



The Fish & Wildlife Compensation Program (FWCP) is a partnership between BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife impacted by BC Hydro dams. The FWCP funds projects within its mandate to conserve and enhance fish and wildlife in 14 watersheds that make up its Coastal Region.

Learn more about the Fish & Wildlife Compensation Program, projects underway now, and how you can apply for a grant at fwcp.ca. Subscribe to our free email updates and annual newsletter at www.fwcp.ca/subscribe. Contact us anytime at fwcp@bchydro.com.



EXECUTIVE SUMMARY: CHEAKAMUS RIVER WATERSHED

The Fish & Wildlife Compensation Program is a partnership between BC Hydro, the Province of B.C., Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife impacted by BC Hydro dams.

This Action Plan builds on the Fish & Wildlife Compensation Program's (FWCP's) strategic objectives, and is an update to the previous *FWCP Watershed and Action Plans*. The Action Plan was developed with input from BC Hydro, Fisheries and Oceans Canada (DFO), Canadian Wildlife Service (CWS), Ministry of Environment (MOE), Ministry of Forests, Lands and Natural Resource Operations (FLNRO), participating First Nations, and local communities. It specifies actions that will conserve, restore and enhance fish and wildlife species and their habitats.

This Action Plan sets out Priority Actions for the FWCP that will guide funding decisions for FWCP projects in the Cheakamus River watershed. The focus of the next five-year period will be Priority Actions identified for fish, wildlife, and habitats in three broad ecosystems categories:

- [Rivers, Lakes & Reservoirs](#);
- [Wetland & Riparian Areas](#); and
- [Upland & Dryland](#).

These ecosystem categories are described in the Ecosystem Chapters, and proposed Priority Actions are in the [Action Table](#) at the end of this document. The Priority Actions are intended to support FWCP's strategic objectives of conservation, sustainable use and community engagement. Actions fall into one or more of the following types:

1. **Research and Information Acquisition** – These actions will collect information necessary to evaluate, review and implement subsequent conservation, restoration and enhancement actions. Examples include inventory, limiting factor assessments and other activities to address data gaps and information needs to complete other actions.
2. **Habitat-based Actions** – These actions will conserve, restore, and enhance habitats. Examples include habitat creation, restoration, and enhancement, enhancing habitat connectivity, and invasive species management.
3. **Land Securement** – These actions will contribute to the establishment of easements or covenants or the purchase of private land for conservation purposes.
4. **Species-based Actions** – These actions will alleviate limiting factors for a species. Examples include restoration planning, captive breeding/rearing and reintroduction.
5. **Monitoring and Evaluation** – These actions will monitor and evaluate projects supported by FWCP to understand the effectiveness of habitat- or species-based actions.

This Action Plan, and specifically the [Action Table](#), sets out FWCP priorities for investments in compensation activities within the watershed. However, actions may not translate into funded projects. FWCP funding limitations require priority setting across the Coastal Region's 14 watersheds. The process of selecting which actions will be implemented in any given year will occur during the annual grant intake and project selection cycle. See fwcp.ca for more.

About our Action Plan

This Action Plan provides important background information about the watershed, including hydro development projects by BC Hydro, and conservation and enhancement projects funded by the Fish & Wildlife Compensation Program (FWCP).

This Action Plan outlines our Priority Actions for fish and wildlife eligible for an FWCP grant. Anyone interested in applying for an FWCP grant should review our Priority Actions (see Action Table) and develop a grant application that aligns with a Priority Action(s).

[Contact us](#) to discuss our grants, Priority Actions and how we can help you develop your grant application. [Subscribe](#) and we will keep you posted about our grants and the projects we fund. Learn more at fwcp.ca

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CHEAKAMUS RIVER WATERSHED BACKGROUND

Introduction

The FWCP Action Plans provide strategic direction for each region based on the unique priorities, compensation opportunities, and commitments in the region and they reflect FWCP's vision and mission. The Action Plans describe the strategies and Priority Actions to support FWCP objectives. Please refer to the Action Plan Overview for more information on the process that was followed to develop Action Plans. The structure of this Plan is shown in Figure 1.

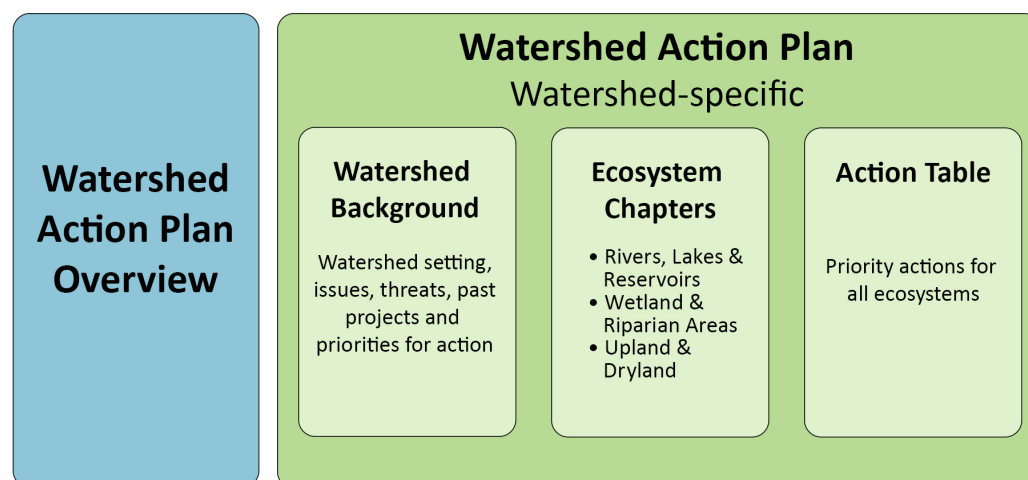


Figure 1: Structure of FWCP Action Plan Overview and Action Plan components.

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 km² 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 watershed has a diverse group of users. Industry uses other than hydro-electric generation include forestry and mineral exploration. Whistler Blackcomb Resort lies within the watershed and the region is a major destination for recreational activities, including skiing, mountain-biking, kayaking, climbing, hiking, and camping. Crown land outside parks is generally open to fishing, hunting, camping and off-road motorized recreation. Residential development is also increasing in the area. The Cheakamus and Squamish Rivers are in the territories of Squamish, Lil'wat, and Tsleil-Waututh First Nations.

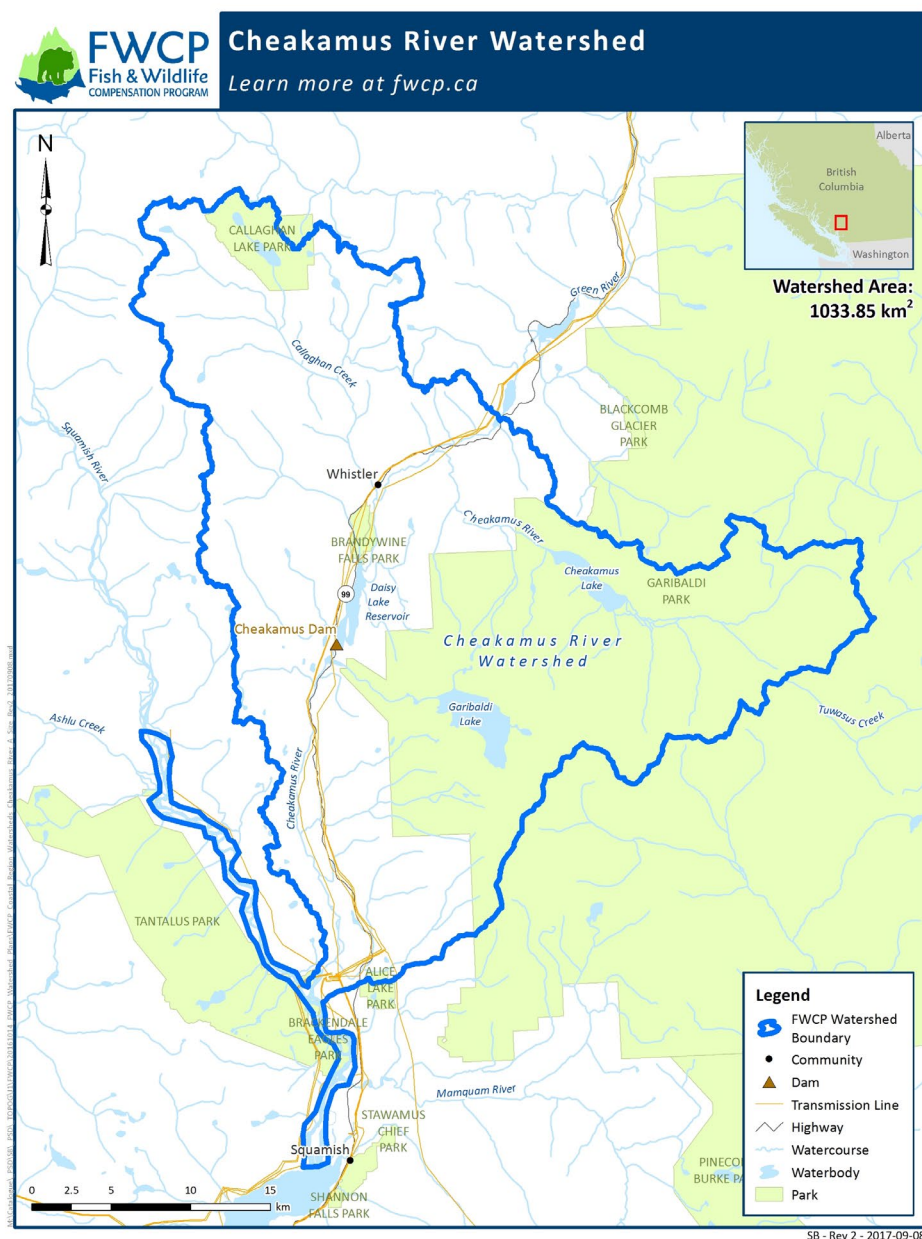


Figure 2: The FWCP Cheakamus River watershed boundary.

Land Ownership in the Cheakamus River Watershed

The eastern portion of much of the Cheakamus River 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. Proponents need to ensure proposed activities and access requirements do not conflict with local land ownership and, where necessary, provide the status of project/land owner discussions in the proposal.

Footprint Impacts and Threats

Dam construction, hydropower development, and alterations in the hydrologic regime of the system have resulted in considerable changes to habitats and the fish and wildlife populations that rely on them.

Hydro-related Impacts

Inundation: Reservoir impoundment expanded the existing Daisy Lake from 21 to 395 ha. Impoundment also flooded 15 km of mainstem, 4.7 km of tributaries and the associated riparian areas, and 12 ha of wetlands.

Habitat Loss: The reservoir flooded 15 km of mainstream channel and 4.7 km of lower tributary channel, and associated riparian zones including coniferous and deciduous woodland, and wetland habitats, as well as 270 ha of upland forest. Cheakamus Dam has reduced gravel and large woody debris recruitment downstream particularly important for Pink and Chinook Salmon. Operating ranges of 12.35 m of the reservoir levels limit the establishment of riparian and/or aquatic vegetation in drawdown area. Loss of active side channel habitat due to river dykes, altered flow regime, and simplified mainstem channel complexity has reduced habitat for Pink, Chinook and Steelhead. 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 17 km 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 12.35 m and may limit fish access to tributaries; as well as limiting productivity from shallow littoral habitats in the 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, and others.

Diversions: 80% of the annual flow is diverted from the Cheakamus system into the Squamish. Chinook have been seen to migrate to the tailrace of the power house on the Squamish River. In the Squamish River there is a potential for short term total gas pressure events, and fluctuations in the Cheakamus Generating Station tailrace channel may affect salmon spawning.

Entrainment: Entrainment occurs, but the magnitude and impact is unquantified.

Terrestrial Footprint: Terrestrial impacts have resulted from the footprint of infrastructure associated with the project, including the dam, penstocks, channel, powerhouse, and associated roads and rights-of-way.

Non-hydro Impacts

Other impacts on the Cheakamus River 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.

Objectives for the Cheakamus River Watershed

Clear management objectives are needed to guide information gathering and effective prioritizing of management actions. Each Ecosystem Chapter has three objectives, which are high-level statements of desired future conditions (outcomes), consistent with FWCP strategic objectives, partner mandates and policies. Each Ecosystem Chapter also has more detailed sub-objectives, which provide more specific direction on desired future conditions. Priority Actions in the Action Table align with the objectives and sub-objectives, summarized in Table 1.

Table 1: Summary of objectives and sub-objectives in each Ecosystem Chapter.

Objectives	Sub-objectives		
	Rivers, Lakes & Reservoirs	Wetland & Riparian Areas	Upland & Dryland
Ensure a productive and diverse ecosystem	Conserve and restore habitat capacity and diversity for fish and other aquatic organisms.	Protect, enhance and create new wetland and riparian habitat.	Protect and enhance rare and ecologically significant upland/dryland habitat.
Maintain or improve the status of species of interest	Sustain and increase the population viability of: (a) Anadromous salmon (Coho, Chinook, Chum, and Pink) and Steelhead; and, (b) Resident salmonids (Rainbow, Cutthroat, and Bull Trout).	Maintain and, where feasible, increase the abundance of species of interest (e.g., federally listed species-at-risk and species identified through government, community, and First Nations engagement). See Action Table for specific species.	Maintain and, where feasible, increase the abundance of species of interest (e.g., federally listed species-at-risk and species identified through government, community, and First Nations engagement). See Action Table for specific species.
Maintain or improve opportunities for sustainable use	Maintain or improve opportunities for sustainable use, including for food, social, ceremonial, recreational, or commercial purposes.		

FWCP Projects Implemented: Cheakamus River Watershed

FWCP has been funding projects in the Cheakamus River Watershed since 1999 under the Bridge-Coastal Restoration Program (BCRP) and subsequently under the Fish & Wildlife Compensation Program¹ Coastal Region. A full list of the reports from projects undertaken to date is available online at www.fwcp.ca. Below is a brief summary of the work undertaken under each Ecosystem Chapter during the 2010/2011 to 2015/2016 FWCP project years.

Rivers, Lakes & Reservoirs

Six Rivers, Lakes & Reservoirs projects were undertaken in the Cheakamus River Watershed during the 2010/2011 to 2015/2016 FWCP project years with \$458,743 of FWCP funding. All six projects were habitat-based actions to create, improve and restore side channel and estuary habitats for salmonids in the Lower Cheakamus and Squamish rivers. The Squamish River Watershed Society has been working together with DFO, BC Parks and the Squamish Nation to restore important spawning and rearing habitat for Coho, Chinook, Pink and Chum salmon, as well as Cutthroat Trout and Steelhead. This includes a project in 2010/2011 to maintain and restore previously funded Bridge Coastal Restoration Project sites in the Squamish estuary, and two multi-year projects to re-water the Evans Creek side channel in the Lower Cheakamus and to restore the former West-Barr Log Sort into a functioning salt marsh in the Squamish Estuary. In 2012/2013, the Dave Marshall Salmon Reserve Habitat Enhancement project was also conducted, which involved the construction of new channel habitats and support structures for salmonid habitat located at Cheakamus Centre, formerly North Vancouver Outdoor School.

Wetland & Riparian Areas

Two Wetland & Riparian Areas projects were undertaken during the 2010/2011 to 2015/2016 FWCP project years with \$24,945 of FWCP funding. The first project conducted inventory surveys for two high priority amphibian species (Western Toad and Northern Red-legged Frog), as well as for Coastal Tailed Frog (no priority rating), around Daisy Lake, and investigated potential for wetland construction sites in this area. The second project (a seed project) was a management directive of land previously secured in the Squamish Estuary. There remains substantial work required to address priority Wetland & Riparian Areas species and habitats.

Upland & Dryland

No Projects were undertaken during the 2010/2011 to 2015/2016 FWCP project years that addressed Upland & Dryland species or habitats.

Interactions with Other Ongoing Processes

Water Use Plan (WUP) – BC Hydro undertook Water Use Planning in the Cheakamus River Watershed to find a better balance of power and non-power interests (such as fish, wildlife and recreation) when operating the system. The resulting WUP Order directed incremental operational changes and monitoring studies to determine the effectiveness of the operational changes. FWCP partners support and coordinate with the WUP ordered monitoring studies, however FWCP does not fund the monitoring associated with operations.

Fish Passage Decision Framework – Any studies to assess the feasibility of restoring fish passage at existing BC Hydro facilities must adhere to the [Fish Passage Decision Framework](#) (BC Hydro 2016) to be funded by the FWCP.

Fish Entrainment Strategy – Fish entrainment issues are addressed through BC Hydro's Fish Entrainment Strategy (BC Hydro 2006). Grant applications to study or mitigate entrainment issues are not eligible for FWCP funding.

¹ The Program changed its name in 2011 from the BCRP to the FWCP.

ECOSYSTEM CHAPTERS

CHEAKAMUS RIVER WATERSHED

ECOSYSTEM CHAPTER: RIVERS, LAKES & RESERVOIRS

Actions for Rivers, Lakes & Reservoirs

The [Action Table](#) in this document (see page 21) identifies our Priority Actions to conserve and enhance fish & wildlife in this watershed. Priority Actions are organized by Action type: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Actions are assigned a priority ranking from 1 (highest priority) to 3 (lowest priority).

Aquatic Habitat in the Cheakamus River Watershed

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 River 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. For convenience, we refer to Char in this report as Bull Trout, but acknowledge the considerable uncertainty regarding proper identification.

DFO operates the Tenderfoot Hatchery on the Cheakamus River 5 km above its confluence with the Squamish River. The hatchery augments Chinook, Coho, Steelhead, Pink and Chum populations.

Limiting Factors

Limiting factors vary among species and need to be further assessed. They are expected to include:

- **Habitat area:** There is a limited amount 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. Reductions in groundwater flows may also influence spawning and rearing habitat.
- **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.
- **Access:** Lower flows have resulted in reduced access to tributaries and side-channels. Access to the Squamish River estuary from the lower Squamish River is affected by the presence of a dyke, which may reduce estuary rearing by juveniles.
- **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.
- **Competition:** Pink and Chinook salmon face competition for spawning habitat from the large Chum Salmon population.

Knowledge Status

Habitat

A detailed account of habitat impacts from hydropower development is provided in BCRP (2000) and is summarized on page 8. In addition to present and historic hydropower impacts, there are diverse 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 Salmon spawning habitat, and slight increases to rearing habitat for resident fish and benthic invertebrate production.

Over the past 15 years FWCP (under BCRP) has spent over \$2 million in the Cheakamus River Watershed, and has undertaken projects with DFO, MOE and community partners (North Vancouver Outdoor School, Squamish River Watershed Society, and Squamish First Nation). Much of this work has been to support habitat-based actions to create, improve and restore side channel and estuary habitats for salmonids in the Lower Cheakamus and Squamish rivers. 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 Chinook, Coho, Pink and Steelhead, such as the Moody channel and the Evans Creek side channel. In the Squamish River estuary, 14,488 m² 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. In 2012/2013, the Dave Marshall Salmon Reserve Habitat Enhancement project was also conducted, which involved the construction of new channel habitats and support structures for salmonid habitat located at Cheakamus Centre, formerly North Vancouver Outdoor School.

Knowledge Gaps

The following knowledge gaps have been highlighted by agencies, First Nations and stakeholders:

- To help set priorities for restoration, the program needs a better understanding of limiting factors that can be addressed by restoration initiatives.
- Understanding the effects of previous restoration efforts and a need to develop detailed restoration plans to achieve long-term salmon conservation objectives.
- Bull Trout/Dolly Varden stock status and distribution in the Cheakamus River Watershed is a continued uncertainty.
- Trends in groundwater flow in tributary habitats of the Cheakamus River and the groundwater flow requirements to sustain salmon spawning and rearing habitats that rely heavily on groundwater upsurge.
- Additional locations for land securement that could support salmonid conservation objectives.

Objectives and Measures

The following objectives have been developed to define the scope of the Rivers, Lakes & Reservoirs Ecosystem Chapter. While the objectives are expected to remain stable over time, the projects funded may evolve as management priorities shift, or new information becomes available.

Objective 1: Ensure a productive and diverse aquatic ecosystem.

This objective addresses overall ecosystem integrity and productivity and directs compensation activities to develop productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple aquatic species to conserve and restore habitat capacity and diversity for fish and other aquatic organisms.

Measures — Measures will be ecosystem- and project-specific.

Objective 2: Maintain or improve the status of species of interest

This objective is supported by two sub-objectives:

1. Sustain and increase the population viability of anadromous salmon and steelhead

Measures – Measures will be species- and project-specific.

2. Sustain and increase the population viability of resident salmonids.

Measures – Measures will be species- and project-specific.

Objective 3: Maintain or improve opportunities for sustainable use.

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 the above objective also support this sustainable use objective

Measures — There are no specific measures required at this time, aside from those associated with Objective 1 and 2.

ECOSYSTEM CHAPTER: WETLAND & RIPARIAN AREAS

Actions for Wetland & Riparian Areas

The [Action Table](#) in this document (see page 21) identifies our Priority Actions to conserve and enhance fish & wildlife in this watershed. Priority Actions are organized by Action type: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Actions are assigned a priority ranking from 1 (highest priority) to 3 (lowest priority).

Wetland and Riparian Areas in the Cheakamus River Watershed

Wetland and riparian areas are the most diverse and biologically rich terrestrial ecosystems in BC and are considered highly valuable from an ecological standpoint. Riparian areas are the areas bordering on streams, lakes, and wetlands that link water to land. The blend of streambed, water, trees, shrubs and grasses directly influences and provides habitat for fish and wildlife. The abundance, distribution and condition of wetland and riparian habitats may be limiting factors for many species, especially amphibians, which depend upon them either for the majority of their lifecycles or for key periods such as breeding. Riparian and wetland habitats are often critical in terms of maintaining function and structure for natural systems, including helping to support trophic level functioning and genetic diversity, as well as providing key ecological services such as erosion control, flood control, assimilation of nutrients and water purification. Furthermore, many wetland and riparian species are the focus of sustainable use activities by First Nations and non-First Nations people. Riparian and wetland areas are commonly inundated by impoundments or adversely affected by changes in hydrological regimes that result from water management for power generation. Loss and alteration can significantly affect the services provided by these ecosystems.

The FWCP uses three general categories of riparian and wetland areas for setting objectives (Table 2). These categories define a general level of ecosystem functioning and require different management actions to maintain and improve their condition.

Table 2: Categories of riparian and wetland habitats used by the FWCP.

Category	Description
Category 1 – Natural riparian or wetland habitat	Largely intact ecosystems with natural disturbances sufficient to maintain subclimax communities and processes characteristics of wetlands and riparian ecosystems.
Category 2 – Disclimax or degraded wetland or riparian habitat, or creation of habitat	Formerly natural wetland or riparian ecosystems that have lost most or all of their natural disturbance regime and are no longer functioning effectively as wetland or riparian habitat. These areas are candidates for restoration.
Category 3 – Restored or created riparian or wetland habitat	Ecosystems resulting from water impoundments, diversions or other artificial disturbances that require active management to maintain productivity and function.

Limiting Factors

The limiting factors for wetland and riparian areas are predominantly related to extent of the available habitat, connectivity and distribution of the habitat, and its productivity. Limiting factors need to be further assessed and are expected to include:

- **Extent:** The contribution of riparian and wetland habitats to broader ecological function is predominantly limited by the extent of the habitats on the land base. Habitats are lost through inundation and conversion to other land uses.
- **Distribution:** Connectivity among riparian and wetland habitats, and between these habitats and other habitats and features, are important for dispersal of plants and animals and for seasonal movements of some species. Wetland and riparian habitats that are isolated will likely have decreased diversity compared to those which experience a healthy connectivity between areas. Distribution is therefore related not only to the extent of healthy riparian and wetland habitats, but also to adjacent land uses.
- **Productivity:** Even where riparian and wetland habitats are adequately represented and connected, there are several factors that can affect their productivity:
 - Hydrologic conditions such as water level variability and flow rates are among the most important variables driving riparian and wetland habitat development, structure, functioning and persistence (National Research Council 2001). Wetlands and riparian ecosystems require dynamic water regimes to maintain their productivity, but managed systems can result in unnatural cycles of stability and de-watering that can impair function or result in succession to different habitat types (e.g., forest, mudflats).
 - Stressors such as invasive species or disruptive human access can affect community structure and function.
 - Loss of specific habitat features can affect life requisites of specific species, e.g., dense nesting cover for waterfowl, suitable tree cavities for nesting owls or waterfowl, basking sites to turtles.
 - Poorly understood factors limit the productivity of created wetlands. These are generally thought to be related to unnatural hydrologic regimes and soil conditions (e.g., Atkinson et al. 2010).

Knowledge Status

Habitat

Basin-wide trends in the abundance, distribution and productivity of riparian and wetland habitats have not been compiled (other than direct BC Hydro footprint impacts). The area of inundation has not increased since dam construction, but the productivity of adjacent habitats has continued to be affected, either directly or indirectly as a result of BC Hydro operations.

FWCP partners have undertaken restoration of tidal channels and marsh areas in the Squamish estuary. In addition, FWCP investments have been used to assist in the purchase of the Mamquam Blind Channel and areas in Squamish estuary. It has been recognised that the estuary houses significant riparian and wetland habitat in the area. There is also a relatively new Skwelwil'em Squamish Estuary Wildlife Management Area in the estuary. Nevertheless, development and urbanization in adjacent lands continue to pose a threat to riparian and wetland areas in the estuary.

Upstream of the estuary there are areas of riparian and off-channel habitat both along the Squamish and Cheakamus Rivers. Much of the area lies in conservation zones with the lower reaches of the Squamish River is in Tantalus and Brackendale Eagles Provincial Parks and Baynes Island Ecological Reserve.

Significant changes to riparian and wetlands in the area include:

- Unknown loss of habitat from conversion to other land uses or succession to different habitat types; and,
- Deterioration in productivity from hydrology changes and stressors such as invasive species.

Knowledge Gaps

Species inventories have been restricted to the area around Daisy Lake and have been limited to amphibians. The distribution and abundance of other species-of-interest has not been investigated and is a necessary step before proposing specific restoration actions.

Objectives and Measures

The following objectives have been developed to define the scope of the Wetland & Riparian Areas Ecosystem Chapter. While the objectives are expected to remain stable over time, the projects funded may evolve as management priorities shift, or as new information becomes available.

Objective 1: Ensure productive and diverse wetland and riparian ecosystems.

This objective addresses overall ecosystem integrity and directs compensation activities to maintain ecosystem productivity by protecting, enhancing or creating new wetland and riparian habitat.

This objective is supported by three sub-objectives:

1. Secure remaining Category 1 riparian and wetland habitat.

Wetland and riparian areas can be heavily impacted by conversion to other lands uses, such as agriculture development or forestry, amongst others. Securing remaining habitat to prevent loss is very important. Habitat is considered secure if it is protected from conversion to other land use, for example by purchasing the land or negotiating a covenant agreement.

Measures — Measures will be ecosystem- and project-specific.

2. Reduce threats to Category 1 riparian and wetland habitat.

Wetlands and riparian areas are subject to a variety of threats both internally and externally. Many naturally functioning riparian and wetland habitats (Category 1) can benefit from management actions that reduce specific threats (e.g., treatment for invasive species, access control, forestry in adjacent areas etc.).

Measures — Measures will be ecosystem- and project-specific.

3. Restore degraded or create new riparian and wetland habitat (Category 2).

While conservation of existing high quality habitat is always preferable, category 1 habitat may be limited or the opportunities for conservation are difficult. Restoration opportunities may be more available in areas where changes in water regime have altered successional pathways in pre-existing riparian and wetland ecosystems. Typically the regime in managed watersheds becomes more stable. Riparian and wetland ecosystems require the disturbances caused by fluctuating water levels to maintain their productivity. When these disturbances are reduced or eliminated, riparian and wetland ecosystems transition to other ecosystem types. Projects can be designed to restore the original ecological function of these areas, or to create new riparian or wetland habitats that differ from what was present historically, but still represent an improvement in function.

Measures — Measures will be ecosystem- and project-specific.

Objective 2: Maintain or improve the status of species of interest.

Actions under this objective focus on addressing limiting factors that are not otherwise addressed by general improvements to ecosystem function under Objective 1. The intent is to maintain, or where feasible, increase the

abundance of species of interest (e.g., federally listed species-at-risk or species identified through government, industry, public and First Nations engagement).

Measures — Measures will be species- and project-specific.

Objective 3: Maintain or improve opportunities for sustainable use.

Many wetland and riparian species are the focus of sustainable use activities by First Nations and non-First Nations people (e.g., duck hunting, medicinal plants, wildlife viewing). Actions addressing Objectives 1 and 2 will often support this sustainable use objective.

Measures — Measures will be species- and project-specific.

ECOSYSTEM CHAPTER: UPLAND & DRYLAND

Actions for Upland & Dryland

The [Action Table](#) in this document (see page 21) identifies our Priority Actions to conserve and enhance fish & wildlife in this watershed. Priority Actions are organized by Action type: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Actions are assigned a priority ranking from 1 (highest priority) to 3 (lowest priority).

Upland and Dryland in the Cheakamus River Watershed

Upland and dryland habitats are those that occur above areas of permanent inundation or periodic flooding. They are usually the habitats least affected by hydroelectric generating infrastructure or operation; however, footprint impacts have occurred and they contribute to the cumulative effects of human-related activities in these habitats. Upland/dryland habitats are diverse and can range from unvegetated areas to grasslands, forests and alpine ecosystems. Different habitats are associated with distinct species assemblages that react to direct or indirect stressors in their distinct habitat niches.

Within the Cheakamus River Watershed, elevations range from close to sea level to 2300 m. At lower elevations, the climatic conditions are typified by wet, mild winters and warm but relatively dry summers. Upper elevations experience cooler temperatures, heavy snowfalls, and a shorter growing season. The watershed lies within the Georgian Depression Ecoprovince (Demarchi 1996) with variants of the Coastal Western Hemlock dry subarctic (CWHds2) and moist subarctic (CWHms1) subzones occurring at low elevations. Higher elevations are dominated by Mountain Hemlock (MHmm2), Englemann Spruce Subalpine Fir (ESSFmw) and alpine parkland and meadow ecosystems (Green and Klinka 1994). Talus, rock and glaciers are common at the highest elevations. Most of the watershed is forested, with lower elevations dominated by Western Hemlock (*Tsuga heterophylla*), Amabilis Fir (*Abies amabilis*), Western Redcedar (*Thuja plicata*), and Douglas-fir (*Pseudotsuga menziesii*). Shrub layers include Red Huckleberry (*Vaccinium parvifolium*), Alaskan Blueberry (*V. alaskaense*), and Salal (*Gaultheria shallon*). Higher-elevation forests are dominated by Yellow-cedar (*Chamaecyparis nootkatensis*) and Mountain Hemlock (*Tsuga mertensiana*; Green and Klinka 1994).

Limiting Factors

Limiting factors vary among species and need to be further assessed. They are generally associated with:

- **Habitat loss and alteration:** The cumulative effects of forestry and hydro-electric development have resulted in substantial losses and alterations to habitat and habitat connectivity.
- **Habitat connectivity:** Habitat loss and road development have resulted in lost connectivity between habitats, which alter wildlife movement.

Knowledge Status

Habitat

Forestry, hydro-electric development, highway rail development, as well as an increasing resident population has altered ecosystems and the species that rely on them. Changes in the seral distribution of forests has reduced the abundance of old forest and has likely resulted in localized biodiversity impacts.

Knowledge Gaps

Knowledge of species and ecosystems in the Cheakamus River Watershed is limited. There have not been extensive inventories specifically targeting ecosystems or species of interest.

Objectives and Measures

The following objectives have been developed to define the scope of the Upland & Dryland Ecosystem Chapter. While the objectives are expected to remain stable over time, the projects funded may evolve as management priorities shift, or as new information becomes available.

Objective 1: Ensure productive and diverse upland and dryland ecosystems.

Actions under this objective are aimed at protecting/enhancing rare or ecologically significant features.

Measures — Measures will be ecosystem- and project-specific.

Objective 2: Maintain or improve the status of species of interest.

Actions under this objective focus on addressing limiting factors that are not otherwise addressed by general improvements to ecosystem function under Objective 1. The intent is to maintain, or where feasible, increase the abundance of species of interest (e.g., federally listed species-at-risk or species identified through government and First Nations engagement).

Measures — Measures will be species- and project-specific.

Objective 3: Maintain or improve opportunities for sustainable use.

Upland and dryland habitats and associated species are also a focus of sustainable use activities by First Nations and non-First Nations people (e.g., hunting, medicinal plant collection, wildlife viewing). Actions addressing Objectives 1 and 2 will often support this sustainable use objective.

Measures — Measures will be species- and project-specific.

ACTION TABLE

This Action Table identifies the FWCP's Priority Actions to conserve and enhance fish and wildlife impacted by BC Hydro dams in this watershed. Actions identified as OPEN (see Delivery Approach column) are eligible for a grant. When completing your online grant application, you will be required to identify a Priority Action(s) that best aligns with your project idea. A high-quality grant application will clearly demonstrate alignment with Priority Action(s) in an Action Table.

CHEAKAMUS RIVER WATERSHED ACTION TABLE								Version: 21July2020	
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
1	All	Research & Information Acquisition	CMS.ALL.RI.01.01 Develop a current habitat assessment map-P1	1	Fish & Wildlife	<p>Develop a current habitat assessment map for priority fish & wildlife species in the Cheakamus watershed. Habitats to be assessed & mapped include:</p> <ul style="list-style-type: none"> • Wetlands • Riparian Areas • Stream Habitats • Estuary Habitats • Connectivity Corridors • Forested Ecosystems (e.g., seral stage distribution) • Over-wintering habitat for species that utilize talus or rock features (e.g., bats, snakes) • Culturally Important Areas <p>Mapping is to include as much on-the-ground information as possible relevant to the subject fish & wildlife species. The assessment should focus on practical conservation and restoration opportunities. For fish, this work should inform development of habitat restoration and protection plans for priority species and habitats. Consideration should be given to potential impacts from available climate change predictions relevant to the specific habitats (i.e., potential changes to vegetation communities, precipitation, wetland hydro-periods, snowpack, wildfire risk, wildlife movements, etc.). Recommendations should be made through this work for future management actions and assessments.</p>	Improved strategic planning for conservation and restoration opportunities.	Directed	Throughout

CHEAKAMUS RIVER WATERSHED ACTION TABLE								Version: 21July2020	
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
2	All	Research & Information Acquisition	CMS.ALL.RI.02.01 Conduct a limiting factors analysis- Anadromous section of the Lower Cheakamus Riv-P1	1	Fish & Wildlife	<p>Conduct a limiting factors analysis for priority fish and/or wildlife in the Cheakamus watershed or sub-basins to support prioritization of future projects. This will include an assessment of population status, habitat status or habitat capacity and/or a cost-benefit analysis of any habitat-based actions proposed by the program, and should be considerate of the root causes of degraded habitats and limitations to productive potential. For fish, sub-basins for assessment include the anadromous section of the Lower Cheakamus River (Priority 1), the Upper Cheakamus below Daisy Lake Dam (Priority 3), the Upper Cheakamus above Daisy Lake Dam, including Daisy Lake, Upper Cheakamus River and tributaries (Priority 2), the Squamish River below the Powerhouse (Priority 2), and the Squamish River estuary (Priority 1). Chinook Salmon and Steelhead are the highest priority fish species for limiting factors analyses. Analyses should build upon previous and ongoing assessments, including the Water Use Plan studies and any existing restoration plans, in association with local agency, First Nation and BC Hydro staff, private landowners and other land managers.</p> <p>*Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.</p>	To determine cost-benefit of potential FWCP actions and support prioritization of future projects. Leads to the creation of robust habitat or species-based restoration plans for the watershed or sub-basins.	Directed	Throughout
			CMS.ALL.RI.02.02 Conduct a limiting factors analysis- Upper Cheakamus below Daisy Lake Dam-P3	3					
			CMS.ALL.RI.02.03 Conduct a limiting factors analysis- Upper Cheakamus above Daisy Lk Dam, incl. Daisy Lk, Upper Cheakamus Riv&tributaries-P2	2					
			CMS.ALL.RI.02.04 Conduct a limiting factors analysis- Squamish River below the Powerhouse-P2	2					
			CMS.ALL.RI.02.05 Conduct a limiting factors analysis- Squamish River estuary-P1	1					

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
2 cont.			CMS.ALL.RI.02.06 Conduct a limiting factors analysis- Cheakamus watershed – P3	3					
3	All	Research & Information Acquisition	CMS.ALL.RI.03.01 Develop a comprehensive restoration & protection plan- Anadromous section of the Lower Cheakamus Riv-P1	1	Fish & Wildlife	Develop a comprehensive restoration and protection plan for fish and/or wildlife in the Cheakamus watershed or sub-basins in relation to limiting factors analyses and assessment of population status/habitat capacity. Restoration refers to habitat or species-based actions that restore habitat capacity or population viability, while protection includes habitat-based actions or land securement that protect important habitat from further degradation. Plans must include: <ul style="list-style-type: none"> • Baseline description of the watershed (hydrology (including groundwater), climate, topography); • Priorities of local First Nations for conservation and restoration; • Previous assessment and restoration works; • Distribution, timing, biological and critical habitat requirements and status of species in the watershed; • Clear goals and objectives based on a desired future condition; • Summary of habitat indicators and limiting factors (based on analyses of habitat pressure indicators, habitat state indicators, limiting factors analysis); • Knowledge gaps and recommended research and/or assessment priorities; 	To determine high priority, cost-effective habitat and/or species-based actions that can be supported by the FWCP.	Directed	Throughout
			CMS.ALL.RI.03.02 Develop a comprehensive restoration & protection plan- Upper Cheakamus below Daisy Lake Dam-P3	3					

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
3 cont.			CMS.ALL.RI.03.03 Develop a comprehensive restoration & protection plan-Upper Cheakamus above Daisy Lk Dam, incl. Daisy Lk, Upper Cheakamus Riv&tributaries-P2	2		<ul style="list-style-type: none">• Restoration priorities with rationale/discussion;• Selected indicators and performance standards for effectiveness monitoring program; and,• Monitoring protocol and schedule. Plans may be multi-species and habitat-based or they may be focused on individual high priority species in the watershed. High priority fish species include Chinook, Pink, Chum and Coho Salmon, Steelhead/Rainbow Trout, Cutthroat Trout and Bull Trout. High priority wildlife include bats, amphibians, and riparian-associated mammals and birds, as well as Category 1 wetland and riparian areas. Plans should be developed in association with local agency, First Nation and BC Hydro staff, landowners and other land managers.			
			CMS.ALL.RI.03.04 Develop a comprehensive restoration & protection plan-Squamish River below the Powerhouse-P2	2		Sub-basins for fish plans include the anadromous section of the Lower Cheakamus River (Priority 1), the Upper Cheakamus below Daisy Lake Dam (Priority 3), the Upper Cheakamus above Daisy Lake Dam, including Daisy Lake, Upper Cheakamus River and tributaries (Priority 2), the Squamish River below the Powerhouse (Priority 2), and the Squamish River estuary (Priority 1). Restoration plans are best developed as 'living documents' so that they can be updated over time. A number of priority actions have been developed already and are described in this Action Table, but further development of restoration actions would be beneficial.			
			CMS.ALL.RI.03.05 Develop a comprehensive restoration & protection plan-Squamish River estuary-P1	1		For fish, any plans should consider and build upon the Squamish River Watershed Salmon Recovery Plan (Golder 2005) and the Cheakamus Ecosystem Recovery Plan (CERTC 2015). *Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.			

CHEAKAMUS RIVER WATERSHED ACTION TABLE								Version: 21July2020	
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
3 cont.			CMS.ALL.RI.03.06 Develop a comprehensive restoration & protection plan- Cheakamus watershed – P3	3					
4	All	Habitat-based Actions	CMS.ALL.HB.04.01- Implement high priority habitat-based actions-P1	1	Fish & Wildlife	Implement high priority habitat and/or species-based actions for fish and/or wildlife as recommended by mapping activities (Action 1), inventory (Action 20), or by the restoration and protection plan (Action 3), or other similar plans already developed in the watershed. Note that a number of priority habitat and/or species-based actions have been developed already and are described in this Action Table, but further development of restoration actions would be beneficial.	Implement high priority, cost-effective habitat and/or species-based actions that can be supported by the FWCP.	Open	Throughout
		Species-based Actions	CMS.ALL.SB.04.02- Implement high priority species-based actions-P1	1	Fish & Wildlife				
5	All	Land Securement	CMS.ALL.LS.05.01 Conduct an options assessment for land securement-P1	1	Fish & Wildlife	Considering ecosystem, conservation, and/or local management objectives, conduct an options assessment for land securement that establishes priority areas to be protected through land securement and identifies feasible mechanisms (e.g., fee-simple purchase, covenants, WHAs, etc.).	Prioritize locations and secure partnerships for land securement.	Open	Throughout
6	All	Land Securement	CMS.ALL.LS.06.01 Land securement-P1	1	Fish & Wildlife	Land securement in association with partner organizations to address fish and wildlife management objectives or to support habitat-based actions proposed by the FWCP. Land securement could address ecosystem function objectives across the watershed plan chapters of Rivers, Lakes & Reservoirs, Riparian/Wetland, and Upland/Dryland. Refer to options assessment findings, in Action 5 above, before conducting land securement activities.	Conserve, protect and restore ecosystem function and resilience through land securement.	Open	Throughout

CHEAKAMUS RIVER WATERSHED ACTION TABLE								Version: 21July2020	
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
7	All	Monitoring & Evaluation	CMS.ALL.ME.07.01 Develop and implement an integrated monitoring plan for fish and/or wildlife-P1	1	Fish & Wildlife	Develop and implement an integrated monitoring plan for fish and/or wildlife in the Cheakamus River watershed or sub-basins in relation to existing agency monitoring programs, limiting factors analyses (Action 2), restoration plans (Action 3) and/or habitat or species-based actions supported by the FWCP. Monitoring should inform limiting factors analyses and/or habitat restoration and should be compatible with existing programs.	Support prioritization of monitoring associated with actions to sustain and restore habitat capacity and population viability of fish & wildlife.	Open	Throughout
8	All	Monitoring & Evaluation	CMS.ALL.ME.08.01 Assess success of habitat-based actions supported by FWCP-P1	1	Fish & Wildlife	Assess success of habitat-based actions supported by the FWCP. Success could be assessed through monitoring of biological and/or physical habitat responses. Success could be assessed on a graduated schedule such as every 1, 3, 5 and 10 years or based on high flow events or other natural or human-caused disturbances.	Assess success of habitat-based actions and support future planning and prioritization.	Open	Throughout
9	All	Monitoring & Evaluation	CMS.ALL.ME.09.01 Conduct condition assessments and/or maintenance on habitat enhancements-P1	1	Fish & Wildlife	Conduct condition assessments and/or maintenance on habitat enhancements supported by the FWCP. This could include the development of an inspection and maintenance schedule if required. If part of a multi-year study, provide information about future objectives and actions.	Maintain functioning of habitat enhancements supported by the FWCP.	Open	Throughout
10	Rivers, Lakes & Reservoirs	Research & Information Acquisition	CMS.RLR.RI.10.01 Conduct an inventory, evaluation of success, & options assessment for constructed side channel....P1	1	Anadromous & Resident Salmonids	Conduct an inventory, evaluation of success, and options assessment for constructed side channel and off-channel habitats in the Cheakamus watershed. Work should inform prioritization of sites for side channel and off-channel restoration and development. Any assessment/inventory should meet the criteria outlined in action 20.	Determine prioritization of sites for side channel and off-channel restoration.	Open	Lower Cheakamus

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
11	Rivers, Lakes & Reservoirs	Research & Information Acquisition	CMS.RLR.RI.11.01 Conduct an inventory & assessment of Bull Trout/Dolly Varden & Coastal Cutthroat Trout-P1	1	Bull Trout & Cutthroat Trout	Conduct an inventory and assessment of Bull Trout/Dolly Varden and Coastal Cutthroat Trout population status and identify restoration opportunities and priorities for future FWCP investment. Any assessment/inventory should meet the criteria outlined in action 20.	Support prioritization of future work on Bull Trout and Cutthroat Trout.	Open	Throughout
12	Rivers, Lakes & Reservoirs	Research & Information Acquisition	CMS.RLR.RI.12.01 Assess opportunities for restoration of Brohm Creek-P2	2	Anadromous & Resident Salmonids	Assess opportunities for restoration of Brohm Creek , in particular to support Steelhead. This is an important tributary for Steelhead, but is also used by Coho Salmon.	Support prioritization of restoration for Steelhead in Brohm Creek.	Open	Lower Cheakamus
13	Rivers, Lakes & Reservoirs	Research & Information Acquisition	CMS.RLR.RI.13.01 Conduct monitoring of groundwater flow & requirements for salmonids in tributary habitats...-P1	1	Anadromous & Resident Salmonids	Conduct monitoring of groundwater flow and requirements for salmonids in tributary habitats of the Cheakamus River , in particular, areas of spawning habitat and juvenile rearing habitat that rely heavily on groundwater upsurge.	Support prioritization of actions associated with groundwater flow and requirements for salmonids.	Open	Lower Cheakamus
14	Rivers, Lakes & Reservoirs	Habitat-based Actions	CMS.RLR.HB.14.01 Implement habitat restoration, enhancement...Anadromous section of the Lower Cheakamus Riv-P1	1	Anadromous & Resident Salmonids	Implement habitat restoration, enhancement and/or protective measures within sub-basins of the Cheakamus watershed (refer to priorities of sub-basins above) to improve salmonid migration, spawning, incubation or rearing habitat. If a restoration plan has been completed under Action 3 , please reference that plan for more information.	Sustain and restore habitat capacity and population viability of anadromous and resident salmonids.	Open	Throughout

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
14 cont.			CMS.RLR.HB.14.02 Implement habitat restoration, enhancement...- Upper Cheakamus below Daisy Lake Dam-P3	3					
			CMS.RLR.HB.14.03 Implement habitat restoration, enhancement...- Upper Cheakamus above Daisy Lk Dam, incl. Daisy Lk, Upper Cheakamus Riv&tributaries-P2	2					
			CMS.RLR.HB.14.04 Implement habitat restoration, enhancement...- Squamish River below the Powerhouse-P2	2					
			CMS.RLR.HB.14.05 Implement habitat restoration, enhancement...- Squamish River estuary-P1	1					

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
14 cont.			CMS.RLR.HB.14.06 Implement habitat restoration, enhancement...- Cheakamus watershed – P3	3					
15	Rivers, Lakes & Reservoirs	Habitat-based Actions	CMS.RLR.HB.15.01 Implement habitat enhancements in Lower Cheakamus Rive-P1	1	Anadromous & Resident Salmonids	Implement habitat enhancements in Lower Cheakamus River. If a restoration plan has been completed under Action 3, please reference that plan for more information.	Sustain and restore habitat capacity and population viability of anadromous and resident salmonids.	Open	Lower Cheakamus
16	Rivers, Lakes & Reservoirs	Habitat-based Actions	CMS.RLR.HB.16.01 Improve existing side channels and off channel areas for all salmonid-P1	1	Anadromous & Resident Salmonids	Improve existing side channels and off channel areas for all salmonids. Priority locations for off channel improvements include the Lower Cheakamus and Squamish River and estuary. If an options assessment has been completed under Action 9, please reference that assessment for project prioritization.	Sustain and restore spawning and rearing habitat capacity for anadromous and resident salmonids.	Open	Lower Cheakamus, Squamish River/Estuary
17	Rivers, Lakes & Reservoirs	Habitat-based Actions	CMS.RLR.HB.17.01 Conduct habitat restoration activities in the Squamish River estuary-P1	1	Anadromous & Resident Salmonids	Conduct habitat restoration activities in the Squamish River estuary. This would particularly benefit Chinook, but would also benefit all other salmonids. If a restoration plan has been completed under action 3, please reference that plan for more information.	Sustain and restore habitat capacity and population viability of anadromous salmonids.	Open	Squamish River estuary

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
18	Rivers, Lakes & Reservoirs	Habitat-based Actions	CMS.RLR.HB.18.01 Improve fish passage between the Squamish River and the Squamish River estuary-P1	1	Anadromous & Resident Salmonids	Improve fish passage between the Squamish River and the Squamish River estuary. Currently, the estuary is split by a dike and this may reduce estuary rearing of salmonids.	Restore the rearing habitat capacity of the Squamish estuary.	Open	Squamish River Estuary
19	Rivers, Lakes & Reservoirs	Habitat-based Actions	CMS.RLR.HB.19.01 Conduct habitat restoration activities in the Upper Cheakamus above Daisy Lake Dam-P3	3	Resident Salmonids	Conduct habitat restoration activities in the Upper Cheakamus above Daisy Lake Dam. If a restoration plan has been completed under Action 3 , please reference that plan for more information.	Sustain and restore habitat capacity and population viability of resident salmonids.	Open	Upper Cheakamus
20	All	Research & Information Acquisition	CMS.ALL.RI.20.01 Inventory for species of interest that are likely in the watershed-P2	2	Wildlife	<p>Inventory for species of interest that are likely in the watershed. Inventory actions must meet the following criteria:</p> <ul style="list-style-type: none"> • The data collected will clearly inform a specific natural resource management decision or conservation action; this includes a clear understanding of: <ul style="list-style-type: none"> - The data or knowledge gap that is currently limiting a decision-maker or party(ies) from making a conservation decision or undertaking a conservation action; - How the inventory has been specifically designed to fill the above-noted data/knowledge gap; and - The decision-makers' commitment to using the data or information to support a specific decision. • The data collection is well informed by a clear and specific management objective (land use plan, recovery plan etc.) that also informs the management decision or conservation action; this includes clarity of: <ul style="list-style-type: none"> - How the inventory work has been designed to specifically assess the status or condition of the objective; and, - How the data will be used to inform/improve/clarify the management objective. <p>Species of interest reflect engagement from FWCP partners and</p>	Habitat enhancement opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout

CHEAKAMUS RIVER WATERSHED ACTION TABLE							Version: 21July2020		
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
20 cont.						<p>include, but are not limited to:</p> <ul style="list-style-type: none"> • Mesocarnivores. Conduct risk assessment and evaluate population sustainability through monitoring program as part of multi-carnivore surveys in the watershed. Species of interest: Pacific Marten, Bobcat. If necessary, implement enhancement strategies to maintain sustainable populations. • Management plan for the Mountain Goat (<i>Oreamnos americanus</i>) in British Columbia (B.C. Ministry of Environment 2010). Potential recreational conflict in Callaghan Valley. • Porcupine. Evaluate distribution and abundance of porcupines in coastal forests and examine potential causes for apparent declines over past 25 years. • Sharp-tailed Snake. Inventory required (install Artificial Cover Objects, could do hand surveys of suitable microhabitat). If found, refer to the Recovery Strategy for the Sharp-tailed Snake (<i>Contia tenuis</i>) in British Columbia (Sharp-tailed Snake Recovery Team 2008) for priority species- and habitat-related conservation actions within the Cheakamus watershed. • Coastal Tailed Frog. More inventory may be necessary to determine locations. If found, refer to priorities in the Management Plan for the Coastal Tailed Frog (<i>Ascaphus truei</i>) in Canada [Proposed] (Environment and Climate Change Canada 2016). Coastal Tailed Frogs were detected in FWCP project #10.W.CMS.01. Pursue protection of occupied sites (e.g., Wildlife Habitat Areas). 			

CHEAKAMUS RIVER WATERSHED ACTION TABLE								Version: 21July2020	
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
21	All	Habitat-based Actions	CMS.ALL.HB.21.01 Implement priority species- and habitat-related conservation actions....-P1	1	Wildlife Species at Risk	<p>Implement priority species- and habitat-related conservation actions in the following (or most recent) Recovery Strategies and Management Plans for species at risk that are known to be in the watershed. Conservation actions must be well informed by a clear and specific management objective and must be well informed by previous inventory in the watershed.</p> <ul style="list-style-type: none"> • Roosevelt Elk. Management Plan for Roosevelt Elk in British Columbia (Ministry of Forests, Lands and Natural Resource Operations 2015) for priority species- and habitat-related conservation actions within the Cheakamus River watershed. • Recovery plan for the Western Screech-Owl, kennicottii subspecies (Megascops kennicottii kennicottii) in British Columbia (Ministry of Environment 2013). • Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada (Environment Canada 2016). • Amphibians. Species of interest include Northern Red-legged Frog, Western Toad and Coastal Tailed Frog. Build upon surveys conducted in FWCP-funded project 10.W.CMS.01 Amphibians in the Cheakamus River Watershed (all 3 species were found). Develop mitigation strategies for protection of wetlands and amphibian habitats during BC Hydro's maintenance activities in their right-of-way and access roads within the Cheakamus watershed. Refer to species' relevant management plans and recovery strategies for priority species- and habitat-related conservation actions within the Cheakamus River watershed. 	Habitat enhancement opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout
22	Upland & Dryland	Research & Information Acquisition	CMS.UAD.RI.22.01 Monitor populations and assess impacts on Grizzly Bears in the Callaghan Valley-P2	2	Grizzly Bear	Monitor populations and assess impacts on Grizzly Bears in the Callaghan Valley. See FLNRO's Southern Coast Ranges Grizzly Bear study.	Maintain or, where feasible, increase the abundance of species of interest.	Open	Callaghan Valley

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
23	Upland & Dryland	Habitat-based Actions	CMS.UAD.HB.23.01 Determine presence, identify/protect bat maternity roosts & winter hibernacula-P1	1	Bats	1) Determine presence of bat species , especially those species potentially vulnerable to White Nose Syndrome; 2) Through acoustic monitoring or other methods (e.g., radio-tracking, DNA), identify maternity roosts and winter hibernacula ; 3) Pursue protection of hibernacula and maternity roosts (e.g., critical habitat, WHAs or wildlife habitat feature designations).	Increased knowledge of species' habitat requirements and habitat protection opportunities.	Open	Throughout
24	Upland & Dryland	Habitat-based Actions	CMS.UAD.HB.24.01 Restore and enhance the supply of cavities in trees for large cavity users-P2	2	Northern Flying Squirrel + Pacific marten	Restore and enhance the supply of cavities in trees for large cavity users (e.g., Pacific marten, flying squirrels) after mesocarnivore surveys have been completed.	Protect and/or restore rare and ecologically significant upland/dryland habitat.	Open	Throughout
25	All	Habitat-based Actions	CMS.ALL.HB.25.01 Conserve or enhance important habitats or mitigate habitat threats for priority bird species-P2	2	High priority birds	Conserve or enhance important habitats or mitigate habitat threats for priority bird species in the watershed. This watershed is within Bird Conservation Region 5 and falls under the Pacific Birds Habitat Joint Venture. See the lists of priority species under the North American Wetlands Conservation Act at: http://www.pacificbirds.org/nawca-priority-species/ . Proposed projects should refer to the priority lists and recommended conservation actions/guidance in the implementation plans (http://www.pacificbirds.org/science-and-planning/state-or-regional-plans/). The Cheakamus watershed contains Important Bird Area "Squamish River Area" (BC023) important for its large congregations (~3000) of Bald Eagles as well as other birds in winter, some of which are also attracted to the salmon runs: American Dipper (approximately 100 birds), mergansers, goldeneyes and ravens. A small wintering population of Trumpeter Swans (30 to 50 birds of the Pacific population) uses the Squamish estuary. A pair of Peregrine Falcons also use the Squamish estuary as hunting grounds.	Varied types of species and habitat conservation, protection and enhancement opportunities.	Open	Throughout

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
26	Wetland & Riparian	Habitat-based Actions	CMS.WAR.HB.26.01 Implement wetland&riparian restoration projects...through inventory, mapping or assesments-P2	2	Wildlife	Implement wetland and riparian restoration projects that are identified as high priorities through inventory, mapping or assessment in the watershed. Assess feasibility of constructing wetlands from list of suggested wetland construction sites in FWCP project #10.W.CMS.01 Amphibians in the Cheakamus River Watershed. If a restoration plan has been completed under action 3, please reference that plan for more information. This can include managing invasive plants as needed.	Protect, restore and/or create new wetland and riparian habitat.	Open	Throughout
27	Wetland & Riparian	Monitoring & Evaluation	CMS.WAR.ME.27.01 Determine whether 3 wetlands constructed in 2010 near Daisy Lake have been effective-P1	1	Amphibians	Determine whether three wetlands constructed in 2010 near Daisy Lake have been effective (see #10.W.CMS.01 Amphibians in the Cheakamus River Watershed).	Assess success of habitat-based actions and support future planning and prioritization.	Open	Daisy Lake area
28	All	Research & Information Acquisition	CMS.ALL.RI.28.01 Inventory & restoration for at-risk...and/or culturally important plant species-P3	3	At-risk Plants	Inventory and restoration for at-risk (e.g., SARA-listed, red- and blue-listed) and/or culturally important plant species and ecological communities. Potential species of interest: Northwest Waterfan, Spoon-shaped Moonwort, Dainty Moonwort, Peacock Vinyl, Whitebark Pine, Vancouver Island Beggartick).	Habitat restoration opportunities. Maintain or, where feasible, increase the abundance of species of interest. Prevention of destruction of at-risk habitats while carrying out other projects.	Open	Throughout

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