FWCP
Fish & Wildlife
COMPENSATION PROGRAM
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PUNTLEDGE 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.

BC Hydro Power smart · British Columbia · Fisheries and Oceans Canada

The Fish & Wildlife Compensation Program is conserving and enhancing fish and wildlife impacted by BC Hydro dam construction in this watershed. Cover photos clockwise from top left: Steelhead, Credit: Aquarium of the Pacific; ecosystem restoration at Courtenay Airpark Lagoon funded by FWCP; Northern Pygmy Owl, Credit: Jack Binch; and Chinook, Credit: NOAA.

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: PUNTLEDGE RIVER WATERSHED ACTION PLAN

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 Puntledge River watershed. The focus of the next five-year period will be Priority Actions identified for fish, wildlife and habitats in three broad ecosystem categories:

1. Rivers, Lakes & Reservoirs;
2. Wetland & Riparian Areas; and
3. Upland & Dryland.

These ecosystem categories are described in the Ecosystem Chapters, and proposed Priority Actions are captured 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. Priority Actions eligible for FWCP funding fall into one or more of the following action types:

- **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.
- **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.
- **Land Securement** – These actions will contribute to the establishment of easements or covenants or the purchase of private land for conservation purposes.
- **Species-based Actions** – These actions will alleviate limiting factors for a species. Examples include restoration planning, captive breeding/rearing and reintroduction.
- **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 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 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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PUNTLEDGE 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 reflect FWCP's vision and mission. The Action Plans describe the strategies and Priority Actions needed to support FWCP objectives. Please refer to the Action Plan Overview for more information on the on the process that was followed to develop Action Plans. The structure of this Action Plan is shown in Figure 1.

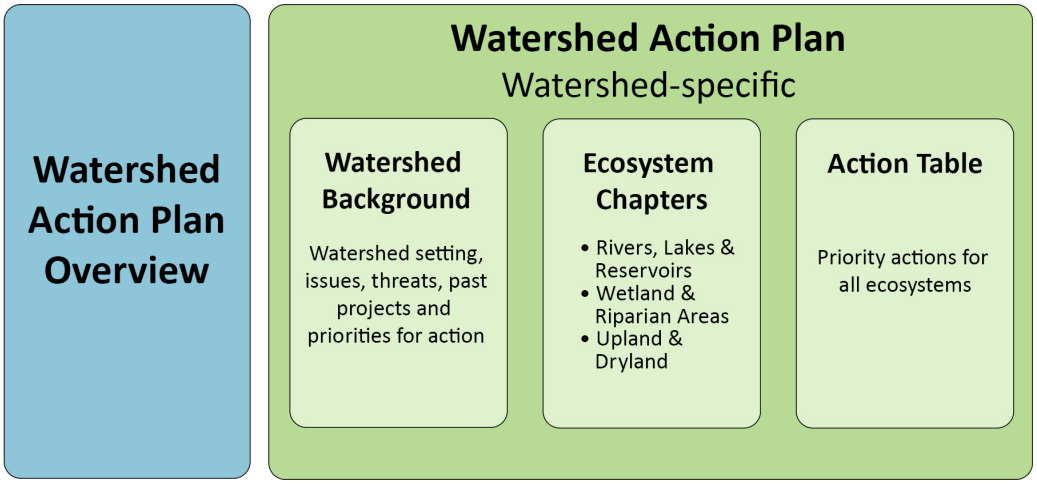

Figure 1: Structure of FWCP Action Plan Overview and Action Plan components.

Setting

The Puntledge River basin lies on the eastern side of the Vancouver Island Mountain Range approximately midway along the length of the island (Figure 2). The upper portion of the basin is very rugged with mountain peaks rising to 2134 m. It typically receives considerable snow pack and glaciers (above 1310 m) cover approximately 4 km^2 of the basin. The head waters of both the Puntledge and Cruikshank Rivers are in Strathcona Provincial Park.

The Cruikshank River contributes a mean annual inflow of 18 m^3/sec to Comox Lake from the west. Most of Comox Lake is surrounded by relatively steep terrain, except at the northeast end where the terrain is relatively low and flat. Comox Lake drains into the Puntledge River, which flow west, joining the Tsolum River and flows into the Courtenay River prior to flowing into the estuary in the city of Courtenay.

The Puntledge system experiences a 'spill-over' effect from systems moving off the Pacific and heavy rains can occur from October through March. The hydrology is predominantly dominated by spring snow melt and fall/winter storms. The average monthly precipitation in November is 300 mm, but monthly precipitation can be as high as 550 mm.

Hydroelectric facilities include a storage dam at the outlet of Comox Lake and a diversion dam 3.7 km downstream. Water is carried 5 km by an overland penstock to a powerhouse on the lower Puntledge River. The project was first developed in 1912. From 1953-56, shortly after BC Hydro acquired the assets, the dams and powerhouse were

redeveloped and Comox Lake storage was increased. Both Comox Dam and the Diversion Dam have fishways to facilitate upstream fish passage.

The watershed has a diverse group of users. Industry uses other than hydro-electric generation include forestry and mineral exploration. The watershed is used recreationally by hunters, anglers, hikers, boaters, off-road motorized recreationists, swimmers and tubers. There is shoreline development on portions of Comox Lake and BC Hydro day-use facilities at the outlet of the reservoir. Urban development and human use of the lower watershed is relatively high, given its proximity to population centres. The Puntledge hydroelectric facilities are in the traditional territories of the Hupacasath, K'ómoks, Qualicum, We Wai Kai and Wei Wai Kum First Nations. The main population centres are the city of

Courtenay, and towns of Cumberland and Comox.

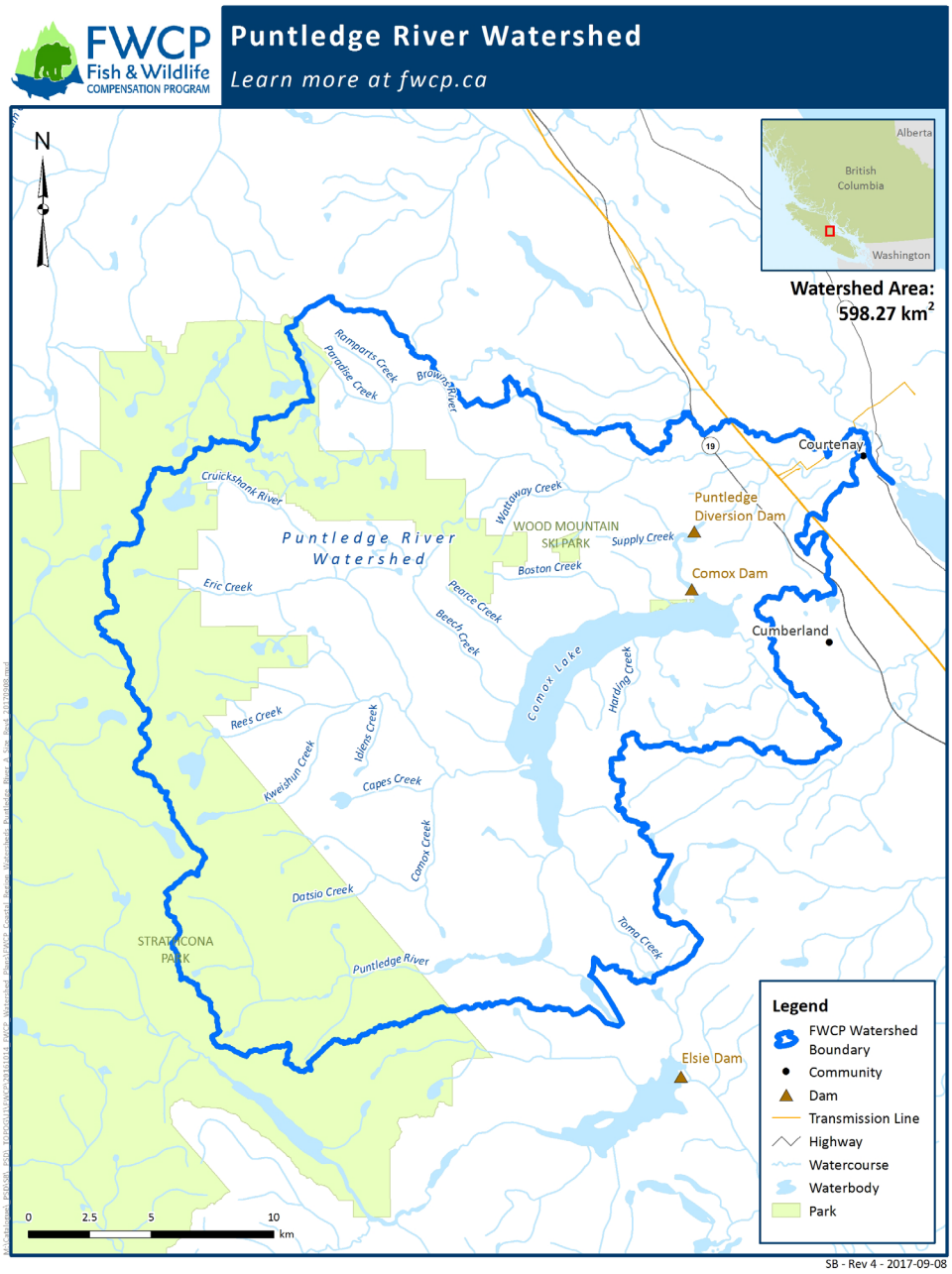

Figure 2: The FWCP Puntledge River watershed boundary.

Land Ownership in the Puntledge River Watershed

The headwaters of the watershed are located in Strathcona Provincial Park and there is some Crown Land to the south of Comox Lake but the majority of the upper watershed is privately-held land (owned by TimberWest Forest Corp.) and access is controlled. Grant applicants should consider land ownership and access when developing grant applications.

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: Comox Lake was a natural lake prior to impoundment. The reservoir area measures 2,118 hectares after flooding 250 hectares of land: a 13% increase in area from the original lake. The reservoir shoreline length is now 41 km.

Habitat loss: Comox reservoir flooded 1 km of mainstream channel and 2.1 km of lower tributary channel, as well as associated riparian zones including coniferous, deciduous, and wetland habitats. Comox Dam reconstruction removed a large volume of sediment, which degraded the spawning habitat downstream. Dams have reduced, though not eliminated, large woody debris recruitment downstream. Periodic spills due to naturally high inflows have scoured gravel and diminished the spawning habitat capacity in the mainstream. The backwatering created by the construction of the Diversion Dam reduced water velocities and increased depths, impacting spawning habitat in this reach. Fluctuations in reservoir levels limit the establishment of riparian and/or aquatic vegetation in drawdown area.

Flooding caused the loss of 133 ha of coniferous forested slopes to the reservoir and 117 ha of riverine and riparian habitats and associated wildlife habitat along the shorelines of the original lake. There was further loss of terrestrial habitat at Comox and Puntledge Diversion Dam sites. Habitat change along 5 km of the penstock right of way has caused the loss of coniferous forest but created forest edge habitat.

Migration barriers: The layout and operation of the initial assets in the watershed impacted upstream fish migration due to barriers and lack of flow. DFO constructed fishways in the natural obstructions at Nib and Stotan Falls to improve upstream fish passage. Fishways were built at Puntledge Diversion Dam and Comox Dam during the refurbishment in 1955 to provide access for fish (Hirst, 1991). Both fishways are operated by DFO, who can manage fish distributions and access in the watershed. Under the Water Use Plan, BC Hydro now also releases 4 series of pulse flows to facilitate upstream fish passage at Stotan and Nib Falls. The above ground penstock is 5 km long and presents a direct barrier for the movement of terrestrial wildlife.

New Habitat: Due to high turbine mortality and loss of spawning area a compensatory spawning channel was built near the Puntledge Dam headpond but decommissioned in 2011 in lieu of other compensation. Habitat change along 5 km of the penstock Right of Way has caused the creation of edge habitat, and increased terrestrial habitat diversity.

Altered Flow Regime: The altered flow regime in various sections downstream of Comox Reservoir has had varying effects on aquatic wildlife.

Diversions: The diversion has altered the flow regime and habitat along the mainstream between the Diversion Dam and the Powerhouse, although the Water Use Plan flows were designed to improve rearing habitat.

Entrainment: Through the Fish Entrainment Strategy (BC Hydro, 2006), BC Hydro has been working with DFO and FLNRO on an Entrainment Action Plan following concerns with fish entrainment.

Non-hydro Impacts

Other impacts in the Puntledge River watershed include historic effects of logging, coal mining, flood protection, heavy recreation, warm summer temperatures, seal predation, and urbanization.

Objectives for the Puntledge 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. The objectives and sub-objectives provide details needed to translate policy and plans into actions and to evaluate the consequences of these actions. 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 (Chinook, Chum, Pink, Coho, Sockeye), Steelhead, sea-run Cutthroat Trout; and, (b) Resident salmonids (Rainbow, Cutthroat and Kokanee).	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: Puntledge River Watershed

FWCP has been funding projects in the Puntledge River Watershed since 1999 under the Bridge-Coastal Restoration Program (BCRP) and subsequently under the Fish & Wildlife Compensation Program[1] 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 during the 2010/2011 to 2015/2016 FWCP project years.

Rivers, Lakes & Reservoirs

A total of 30 Rivers, Lakes & Reservoirs projects were undertaken in the Puntledge River Watershed during the 2010/2011 to 2015/2016 FWCP project years with $1,489,203 of FWCP funding. Fisheries and Oceans Canada (DFO) considers the Puntledge River summer-run Chinook Salmon a population of high conservation concern. Significant FWCP investment has gone towards research, monitoring and Habitat and Species-Based Actions associated with rebuilding the Puntledge summer-run Chinook population. This includes two multi-year research projects, carried out in conjunction with the Fish Entrainment Strategy[2], which evaluated Chinook and Coho smolt migration and survival past

[1] The Program changed its name in 2011 from the BCRP to the FWCP.
[2] This was an extraordinary circumstance and not a normal FWCP undertaking.

the Puntledge Diversion Dam and the homing of adult hatchery returns into Comox Lake, and Species Based Actions to support hatchery activities that enhance the earliest returning Chinook adults. Over the last five years, these projects have provided valuable information on the survival and life history of Chinook and Coho populations, which has enabled new operational strategies to address entrainment and is supporting more productive hatchery rearing strategies. Current data collected from three years of tagging, however, suggests that point-of-release hatchery reared Chinook fry has no impact on adult migration behaviour in the lower Puntledge River and homing into Comox Lake. Continued actions are required to achieve management targets for summer-run Chinook and other high priority salmon species in the Puntledge River Watershed.

Six Research and Information Acquisition projects have also received FWCP support, which have provided a better understanding of the fish production limitations in the K'ómox estuary and in Comox Lake Reservoir and tributaries. These projects have provided recommendations for ongoing work and one led to a Habitat-Based Action to restore Airpark Lagoon in the K'ómox River estuary. Another Habitat-Based Action restored fish passage in Morrison Creek, which will benefit anadromous salmon, but also the Morrison Creek lamprey that is listed as Endangered under the Species At Risk Act.

Wetland & Riparian Areas

Three projects were undertaken during the 2010/2011 to 2015/2016 FWCP project years that addressed Wetland/Riparian species and habitat. Two of these projects, which were funded in 2011 and 2013 and received a total of $24,457 of FWCP funding, identified opportunities for restoration or creation of Category 2 habitats. The first of these involved the development of a management plan for a property that had already been acquired (McPhee Meadows). The second was a seed project that assessed amphibian use and developed a habitat restoration plan for the decommissioned Upper Puntledge River Fish Hatchery. The third project, with FWCP funding of $220,000, has the goal of purchasing land to offer long-term protection for riparian, wetland, and salmonid habitats that have been identified as limited and threatened in the Puntledge River Watershed.

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 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). Any proposals to study or mitigate entrainment issues are not eligible for FWCP funding.

ECOSYSTEM CHAPTERS
PUNTLEDGE RIVER WATERSHED

ECOSYSTEM CHAPTER: RIVERS, LAKES & RESERVOIRS

Actions for Rivers, Lakes & Reservoirs

The Action Table in this document (see page 22) 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 Puntledge River Watershed

The Puntledge River is a major tributary to the Courtenay River, and is an important salmon stream on the east coast of Vancouver Island, with stocks of Chinook, Coho, Chum and Pink Salmon and Steelhead, Cutthroat and Rainbow Trout and some Sockeye. Other species in the watershed include Kokanee, Coast Range Sculpin, Threespine Stickleback and Pacific Lamprey. There are two sets of natural falls, Stotan and Nib, that restrict migration of anadromous and resident fish. Improvements to their passability were made between 1923 and 1977 by selective blasting. Chinook, Coho and Steelhead likely accessed areas above the falls and above Comox Lake prior to passage changes at the falls. The lower Puntledge was an important spawning area for fall Chinook, Pink and Chum Salmon, but these stocks have declined and are now augmented by the Puntledge River Hatchery.

Limiting Factors

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

- **Passage at natural falls:** Two sets of falls, Stotan and Nib, are located between the diversion and the powerhouse on the lower river. Improvements to their passability were made between 1923 and 1977. Under the Water Use Plan, BC Hydro releases a series of pulse flows to facilitate upstream fish passage at these falls 4 times annually.
- **Access to historic habitats**: Agencies closed the fishway at the diversion dam in 1965 to reduce entrainment mortality and to secure broodstock quotas. Entrainment has been of less concern since 1993, after the installation of the Eicher Screens in the penstock. Since 1991, when BC Environment reconstructed the Comox Dam fishway, Steelhead have been allowed upstream of the diversion dam and into Comox Lake. Historic limited access has reduced diversity and abundance.
- **Access to mainstem and tributaries**: Adult access up the main river channel was reduced by the diversion flows, but under the Water Use Plan, pulse flows provide access opportunities regardless of natural conditions.
- **Habitat area**: Former spawning, rearing and overwintering areas are permanently lost or seasonally reduced due to dam footprint, reservoir flooding, flow diversions, or operating flows; or from non-hydro sources. Urban encroachment along banks of the lower river and estuary has alienated off-channel, riparian and wetland areas.
- **Habitat quality**: Habitats below the dams are altered by reduced sediment or wood recruitment. The diversion dam reduced flows in the diversion reach which affected wetted area and stream productivity, but minimum flows under the Water Use Plan were designed to address this.
- **Hatchery practices**: Intervention by the hatchery has probably had positive and negative effects on wild salmonid stocks.
- **Seal predation:** A population of harbour seals in the lower Puntledge River and estuary preys on adult and juveniles of anadromous fish stocks. Channelization has likely exacerbated predation by reducing cover for resident and out-migrating fish.

Knowledge Status

Habitat

In addition to present and historic hydroelectric impacts there are diverse impacts in the watershed from forestry, urbanization, highway development, recreation, and municipal drinking water infrastructure. High water temperatures in the Puntledge mainstem have been identified as a concern, one that may increase with climate change. The introduced algae *Didymosphenia geminata*, commonly known as didymo or "rock snot," is a species of diatom that can form large mats on the bottom of lakes and streams and can affect stream habitats and sources of food for fish. The species is now common in the Puntledge, but its effects are not known. Signal crayfish, *Pacifastacus leniusculus*, are also common and may have a negative influence on fish and their habitats.

Changes in operations agreed to by BC Hydro as a part the Water Use Plan (BC Hydro 2004) have likely improved habitat conditions. The WUP is expected to increase rearing and spawning habitat and opportunities for fish to migrate past natural barriers in the Puntledge River through the provision of minimum flows, pulse flows, and the placement of spawning gravel.

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
- The effect of predation by seals on salmon in the lower Puntledge and estuary and options to reduce this
- Fish passage into the upper Puntledge and potential effects to summer-run Chinook and coho salmon
- Population diversity of Chinook salmon and inheritance of run timing
- Actions that can improve salmonid rearing habitat in the K'ómox estuary
- Options for habitat restoration in the upper Puntledge including the main tributaries to Comox Lake (e.g., Upper Puntledge and Cruikshank rivers and Perseverance Creek)
- Additional locations for land securement that could support salmonid conservation

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:

- **Sustain and increase the population viability of anadromous salmon, steelhead and sea-run cutthroat trout**
  Summer-run Chinook salmon have been identified by DFO as having the highest conservation priority in the Puntledge River Watershed. Other priority salmonid species include fall-run Chinook, Coho, Pink, Chum, Steelhead and sea-run Cutthroat Trout. There is a small sockeye population in the Puntledge, but there is little information on this species and there is no target for escapement.
  Measures – Measures will be species and project-specific.

- **Sustain and increase the population viability of resident salmonids.**
  Resident rainbow trout and cutthroat trout reside throughout much of the watershed and kokanee occur in Comox Lake.
  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. As additional context, it should be noted that fisheries management agencies have an overall responsibility to manage the fisheries resource at a level of abundance and distribution to support First Nations' traditional uses and rights. These responsibilities are met through other ongoing processes and it is not the direct responsibility of FWCP to accommodate First Nations treaty rights and aboriginal interests. That being said, First Nations' interests in overall conservation and sustainable use benefits have been incorporated into the development of this plan.
Measures — There are no specific measures required at this time, aside from those associated with Objective 1 and 2. As part of their overall management responsibilities, DFO uses information such as abundance trends and escapement estimates to regulate angling and commercial harvest. MOE collects information on angler days, catch per unit effort, and number of fishing licences sold in the region, which informs decisions related to angling regulations.

ECOSYSTEM CHAPTER: WETLAND & RIPARIAN AREAS

Actions for Wetland & Riparian Areas

The Action Table in this document (see page 22) 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 Puntledge 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, soil conditions, and/or cattle grazing (e.g., Atkinson et al. 2010).

Knowledge Status

Habitat

Inundation following dam construction was the most significant source of permanent habitat loss, flooding 133 ha of coniferous forested slopes and 117 ha of riverine and riparian habitats. 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 because of BC Hydro operations and other stressors.

Knowledge Gaps

Options for wetland and riparian habitat securement, restoration or construction have not been assessed in the Puntledge River Watershed.

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 and Dryland Areas

The Action Table in this document (see page 22) 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 Puntledge 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 Puntledge River watershed, elevations range from sea level to 2134 m. At lower elevations, the climatic conditions are typified by moist, mild winters and cool but relatively dry summers. Upper elevations experience cooler temperatures, greater snowfall, and a shorter growing season. The watershed lies within the Georgian Depression Ecoprovince (Demarchi 1996) and variants of the Coastal Western Hemlock very dry maritime (CWHxm1 and CWHxm2) and moist maritime (CWHmm1 and CWHmm2) subzones at low elevations. Higher elevations are dominated by Mountain Hemlock (MHmm1) and alpine ecosystems (Green and Klinka 1994). 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*), Salal (*Gaultheria shallon*) and Dull Oregon-grape (*Mahonia nervosa*). 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, mining, recreation, 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

The Puntledge River watershed has a long history of intensive human use, in particular in the lower reaches of the watershed because of its proximity to population centres. Forest harvesting continues, in particular on private land holding above most of Comox reservoir. This has altered the distribution of forest ages and species composition. The extent of these landscape changes due to hydro-related infrastructure construction and operation has been quantified for the watershed (see *Footprint Impacts and Threats* above).

Knowledge Gaps

Knowledge of species and ecosystems in the Puntledge River Watershed is limited. There have not been extensive inventories specifically targeting the Puntledge and the eastern half of the watershed is privately owned land.

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., fishing, 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.

PUNTLEDGE 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	**PUN.ALL.RI.01.01 Develop a current habitat assessment map-P1**	**1**	Fish & Wildlife	Develop a **current habitat assessment map** for priority fish & wildlife species in the watershed. Habitats to be assessed & mapped include: • 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 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.). A few mapping exercises have already occurred in the watershed that could be built upon (e.g., Comox Lake Watershed Protection Plan, Aqua-Tex Scientific Consulting 2016) that require ground-truthing. Recommendations should be made through this work for future management actions and assessments.	Improved strategic planning for conservation and restoration opportunities.	Directed	Throughout

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Action #	**Ecosystem Chapter**	**Action Type**	**Priority Action Short Description**	**Priority**	**Target Species**	**Priority Action**	**Intended Outcome**	**Delivery Approach**	**Location**
2	All	Research & Information Acquisition	**PUN.ALL.RI.02.01 Conduct a limiting factors analysis-K'omoks estuary-P1**	**1**	Fish & Wildlife	**Conduct a limiting factors analysis** for priority fish and/or wildlife for the Puntledge River 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 K'ómoks estuary (Priority 1), the lower Puntledge River mainstem (Priority 1), Browns River (Priority 2), Morrison Creek (Priority 2), and the upper Puntledge including Comox Lake and tributaries (Priority 1). Analyses should build upon previous projects 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. Work should be done in cooperation with private landowners and other land managers. *Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.	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
			PUN.ALL.RI.02.02 Conduct a limiting factors analysis-lower Puntledge River mainstem-P1	**1**					
			PUN.ALL.RI.02.03 Conduct a limiting factors analysis-Browns River-P2	**2**					
			PUN.ALL.RI.02.04 Conduct a limiting factors analysis-Morrison Creek-P2	**2**					
			PUN.ALL.RI.02.05 Conduct a limiting factors analysis-upper Puntledge including Comox Lake&tributaries-P1	**1**					
			PUN.ALL.RI.02.06 Conduct a limiting factors analysis-Puntledge River Watershed-P2	**2**					

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Action #	**Ecosystem Chapter**	**Action Type**	**Priority Action Short Description**	**Priority**	**Target Species**	**Priority Action**	**Intended Outcome**	**Delivery Approach**	**Location**
3	All	Research & Information Acquisition	**PUN.ALL.RI.03.01 Develop a comprehensive habitat restoration&protection plan-lower Puntledge River mainstem-P1**	**1**	Fish & Wildlife	**Develop a comprehensive habitat restoration and protection plan** for fish and/or wildlife for the Puntledge River 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: • Baseline description of the watershed (hydrology, 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; • 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, Coho, and Chum Salmon, Steelhead, Cutthroat Trout and Morrison Creek Lamprey. High priority wildlife include bats, amphibians, and riparian-associated mammals and birds and high priority wildlife habitat includes Category 1 wetland and riparian areas. Note that all estuary, riparian and wetland projects should include inventory of rare plants and invertebrates to prevent the destruction of at-risk habitats while carrying out other projects. Plans should be developed in association with local agency, First Nation and BC	To determine high priority, cost-effective habitat and/or species-based actions that can be supported by the FWCP.	Directed	Throughout
			PUN.ALL.RI.03.02 Develop a comprehensive habitat restoration&protection plan-Browns River-P2	**2**					
			PUN.ALL.RI.03.03 Develop a comprehensive habitat restoration&protection plan-Morrison Creek-P2	**2**					
			PUN.ALL.RI.03.04 Develop a comprehensive habitat restoration...plan-upper Puntledge incl.Comox Lk&tributaries-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**
3 cont.			**PUN.ALL.RI.03.05 Develop a comprehensive habitat restoration&protection plan-Puntledge River Watershed-P2**	**2**		Hydro staff, landowners and other land managers. Sub-basins for fish plans include the lower Puntledge River mainstem (Priority 1), Browns River (Priority 2), Morrison Creek (Priority 2), and the Upper Puntledge including Comox Lake and tributaries (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. For fish, the K'ómoks estuary (Priority 1) already has a restoration plan and this plan must be consulted for priority habitat-based actions in that sub-basin. The Puntledge River Fish Entrainment Strategy Action Plan also should be consulted for actions related to summer-run Chinook and Coho Salmon. *Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.			
4	All	Habitat-based Actions	**PUN.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 21)**, 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	**PUN.ALL.SB.04.02 Implement high priority species-based actions-P1**	**1**					
5	All	Land Securement	**PUN.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 area to be protected through and land securement and identifies feasible mechanisms (e.g., fee-simple purchase, covenants, WHAs, etc.).	Prioritize locations and secure partnerships for land securement.	Open	Throughout

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6	All	Land Securement	**PUN.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. Implement habitat based actions or land securement as guided by the Puntledge River Watershed Riparian and Wetland Mapping Project (COA-F17-W-1253) or other strategic planning initiatives. Land securement could address ecosystem function objectives across the watershed plan chapters of Rivers, Lakes & Reservoirs, Riparian/Wetland, and Upland/Dryland. Priority habitats include wetlands, old growth forests and older second-growth forests. 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
7	All	Monitoring & Evaluation	**PUN.ALL.ME.07.01 Develop and implement an integrated monitoring plan-P1**	**1**	Fish & Wildlife	Develop and implement an **integrated monitoring plan** for fish and/or wildlife in the Puntledge 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	**PUN.ALL.ME.08.01 Assess success of habitat-based action 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	**PUN.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.	Maintain functioning of habitat enhancements supported by the FWCP.	Open	Throughout

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10	Rivers, Lakes & Reservoirs	Research & Information Acquisition	**PUN.RLR.RI.10.01 Conduct a preliminary assessment of fish passage into the Upper Puntledge-P1**	**1**	Chinook Salmon & Coho Salmon	Conduct a preliminary assessment of **fish passage into the Upper Puntledge**, primarily for summer-run Chinook Salmon and Coho Salmon. Determine the need for further fish passage monitoring and/or a restoration plan based on passage assessment.	Sustain and restore the earliest component of summer-run Chinook and develop a self-sustaining Coho population in the Upper Puntledge.	Open	Lower Puntledge/ Upper Puntledge
11	Rivers, Lakes & Reservoirs	Research & Information Acquisition	**PUN.RLR.RI.11.01 ... fish production limitations of habitats in Comox Lake and tributaries-P1**	**1**	Anadromous & Resident Salmonids	Improve on existing understanding of **fish production limitations of habitats in Comox Lake and tributaries.**	Support restoration/enhancement of the Upper Puntledge	Open	Upper Puntledge
12	Rivers, Lakes & Reservoirs	Research & Information Acquisition	**PUN.RLR.RI.12.01 Develop a better understanding of the effect of predation by seals and sea lions-P1**	**1**	Anadromous Salmonids	Develop a better **understanding of the effect of predation by seals and sea lions** and the means of addressing this limit to fish production in the watershed. Proponents must have support of the DFO marine mammal section and local First Nation prior to submission.	Sustain and increase population viability of anadromous salmonids.	Open	K'ómoks estuary
13	Rivers, Lakes & Reservoirs	Research & Information Acquisition	**PUN.RLR.RI.13.01 Conduct DNA analyses…Chinook & Steelhead-P1**	**1**	Chinook Salmon & Steelhead	**Conduct DNA analyses** to determine the inheritance of migration timing, Bacterial Kidney Disease presence, the contribution of hatchery production to the wild population, and maintenance of genetic diversity of Chinook Salmon & Steelhead.	Support species-based restoration plan for Chinook Salmon	Open	Throughout
14	Rivers, Lakes & Reservoirs	Habitat-based Actions	**PUN.RLR.HB.14.01 Implement habitat restoration, enhancement...-K'omoks estuary-P1**	**1**	Anadromous & Resident Salmonids	**Implement habitat restoration, enhancement and/or protective measures** within sub-basins of the Puntledge 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 A**ction 3**, please reference that plan for more information.	Sustain and restore habitat capacity and population viability of anadromous and resident	Open	Throughout

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14 cont.			**PUN.RLR.HB.14.02 Implement habitat restoration, enhancement...-lower Puntledge River mainstem-P1**	**1**			salmonids.		
			PUN.RLR.HB.14.03 Implement habitat restoration, enhancement...-Browns River-P2	**2**					
			PUN.RLR.HB.14.04 Implement habitat restoration, enhancement...-Morrison Creek-P2	**2**					
			PUN.RLR.HB.14.05 Implement habitat restoration, enhancement...-upper Puntledge incl.Comox Lk&tributaries-P1	**1**					
			PUN.RLR.HB.14.06 Implement habitat restoration, enhancement...-Puntledge River Watershed-P2	**2**					

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15	Rivers, Lakes & Reservoirs	Habitat-based Actions	**PUN.RLR.HB.15.01 Implement habitat-based actions in the Comox Slough/Dyke Slough...K'ómoks estuary-P1**	**1**	Anadromous & Resident Salmonids	**Implement habitat-based actions in the Comox Slough/Dyke Slough area of the K'ómoks estuary** to allow for more fish access at a variety of tidal cycles. Explore and implement options, with relevant stakeholders, as outlined in the Courtenay River Estuary (Dyke Slough) Biophysical Assessment 2009-2010 (http://projectwatershed.ca/wp-content/uploads/2010/10/Final-Report_Dyke-Slough_Feb22_2011.pdf) and the Comox Road Dyke Slough Tide Gate Modifications Numerical Modelling and Conceptual Design Report http://projectwatershed.ca/wp-content/uploads/2010/10/300174-Comox-Road-Tide-Gates-Modelling-Update-DRAFT.pdf	Sustain and restore habitat capacity and population viability of anadromous salmonids.	Open	K'ómoks estuary
16	Rivers, Lakes & Reservoirs	2-Habitat-based Actions	**PUN.RLR.HB.16.01 Implement habitat-based actions in K'ómoks estuary as per CVPWS restoration plan...-P1**	**1**	Anadromous & Resident Salmonids	**Implement habitat-based actions in the K'ómoks estuary as prescribed in a report produced for the Comox Valley Project Watershed Society restoration plan** (http://projectwatershed.ca/wp-content/uploads/2016/11/Juvenile_Salmonids_Courtenay_Estuary_2011.pdf). Three high priority actions include: 1) the acquisition and restoration of the old Field's Sawmill site, 2) in-stream habitat enhancements in lower Mallard Creek and 3) reconfiguring and complexing the Glen Urquhart Creek ponds.	Sustain and restore habitat capacity and population viability of anadromous salmonids.	Open	K'ómoks estuary
17	Rivers, Lakes & Reservoirs	Habitat-based Actions	**PUN.RLR.HB.17.01 Implement habitat enhancements in Upper Puntledge & Cruickshank Riv, Perseverance Crk/other tributaries to Comox Lk**	**1**	Anadromous & Resident Salmonids	**Implement habitat enhancements in the Upper Puntledge and Cruickshank Rivers, Perseverance Creek, and other tributaries to Comox Lake.** If a restoration plan for the Upper Puntledge 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	Upper Puntledge
18	Rivers, Lakes & Reservoirs	Habitat-based Actions	**PUN.RLR.HB.18.01 Implement habitat enhancements in the Morrison Creek watershed-P2**	**2**	Anadromous & Resident Salmonids	**Implement habitat enhancements in the Morrison Creek watershed**. This could include management activities associated with Beaver. The recovery strategy for the Morrison Creek Lamprey, a SARA listed species, should be considered.	Sustain and restore habitat capacity and population viability of anadromous and resident salmonids and/or the Morrison Creek Lamprey.	Open	Lower Puntledge

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19	Rivers, Lakes & Reservoirs	Habitat-based Actions	**PUN.RLR.HB.19.01 Conduct habitat restoration in the Lower Puntledge mainstem-P1**	**1**	Anadromous & Resident Salmonids	**Conduct habitat restoration in the Lower Puntledge mainstem, Browns River and tributaries**. This could include gravel enhancement and stabilization activities to support Chinook and Chum Salmon spawning or restoration activities that improve upstream migration of adults. Actions in the Lower Puntledge mainstem are considered priority 1, while actions in Browns River and tributaries are considered priority 2.	Sustain and restore habitat capacity and population viability of anadromous and resident salmonids.	Open	Lower Puntledge
			PUN.RLR.HB.19.02 Conduct habitat restoration in Browns River and tributaries-P2	**2**					
20	Rivers, Lakes & Reservoirs	Species-Based Actions	**PUN.RLR.SB.20.01 Review the Puntledge River Entrainment Strategy...implement...priority chinook restoration-P1**	**1**	Chinook Salmon & Coho Salmon	**Review the Puntledge River Entrainment Strategy Action Plan and implement the high priority chinook restoration actions** that do not overlap with the Strategy or operational requirements (Connors and Parkinson 2015). Parts of this plan will be supported by BC Hydro's Fish Entrainment Strategy and therefore proponents should first consult with FWCP to determine project eligibility.	Sustain and restore population viability of summer run Chinook Salmon and Coho Salmon.	Open	Lower Puntledge/ Upper Puntledge
21	Wetland & Riparian	Research and Information Acquisition	**PUN.WAR.RI.21.01 Inventory for species of interest that are likely in the watershed-P2**	**2**	Wildlife	**Inventory for species of interest that are likely in the watershed.** Inventory actions must meet the following criteria: • The data collected will clearly inform a specific natural resource management decision or conservation action; this includes a clear understanding of: - 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: - How the inventory work has been designed to specifically assess the status or condition of the objective; and,	Maintain or, where feasible, increase the abundance of species of interest.	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**
21 cont.	Upland & Dryland	Research and Information Acquisition	**PUN.UAD.RI.21.02 Inventory for species of interest that are likely in the watershed-P2**	**2**	Wildlife	- How the data will be used to inform/improve/clarify the management objective. Species of interest reflect engagement from FWCP partners and include, but are not limited to: • Mesocarnivores (i.e., Ermine, Pacific Marten, American Mink and North American River Otter). Conduct risk assessment and evaluate population sustainability through a monitoring program as part of multi-carnivore surveys in Puntledge River watershed. Note that genetic analyses may be needed to determine Ermine subspecies (*anguinae*) validity. Liaise with Vancouver Island marmot researchers to access their motion-sensitive camera data. If necessary, implement enhancement strategies to maintain sustainable populations. If part of a multi-year study, provide information about future objectives and actions. • Western Water Shrew *(brooksi* subspecies). Inventory through environmental DNA or other innovative methods (e.g., hair collection). Environmental DNA methodology can also be used concurrently to survey for at-risk amphibian species. • Western Screech-Owl, *kennicottii* subspecies *(Megascops kennicottii kennicottii)*. Surveys need to broaden the habitats surveyed away from riparian areas. If present, refer to the Recovery plan for the Western Screech-Owl, *kennicottii* subspecies in British Columbia (Ministry of Environment 2013) for priority species- and habitat-related conservation actions within the Puntledge River watershed. • Northern Saw-whet Owls. Inventory is needed in upland & dryland habitat because there is currently little information on the species in the Puntledge River watershed. • Painted Turtle. If present, refer to the Recovery plan for the Painted Turtle – Pacific Coast Population (Chrysemys picta pop. 1), in British Columbia (Western Painted Turtle Recovery Team 2016) for priority species- and habitat-related conservation actions within the Puntledge River watershed.			

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22	Wetland & Riparian	Habitat-based Actions	**PUN.WAR.HB.22.01 Implement priority species- and habitat-related conservation actions-P1**	**1**	Wildlife Species at Risk	**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. • Recovery Strategy for the Vancouver Island Marmot (*Marmota vancouverensis*) in British Columbia (Vancouver Island Marmot Recovery Team 2008; being updated 2017). • Management Plan for Roosevelt Elk in British Columbia (Ministry of Forests, Lands and Natural Resource Operations 2015). • Management Plan for the Great Blue Heron *fannini* subspecies (*Ardea herodias fannini*) in Canada [Proposed] (Environment Canada 2016). • Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada (Environment Canada 2016). • Management Plan for the Wandering Salamander (Aneides vagrans) in British Columbia (BC Ministry of Environment 2017). • Management plan for the Western Toad (*Anaxyrus boreas*) in British Columbia (Provincial Western Toad Working Group 2014). • Management Plan for the Northern Red-legged Frog (*Rana aurora*) in Canada [Proposed] (Environment Canada 2016).	Stable or increasing population of at-risk species. Habitat enhancement opportunities.	Open	Throughout
	Upland & Dryland	Habitat-based Actions	**PUN.UAD.HB.22.02 Implement priority species- and habitat-related conservation actions-P1**	**1**	Wildlife Species at Risk				
23	Upland & Dryland	Habitat-based Actions	**PUN.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 bat maternity roosts and winter hibernacula**; and 3) **Pursue protection of bat hibernacula and maternity roosts** (e.g., critical habitat, WHAs or wildlife habitat feature designations) that are identified.	Maintain or, where feasible, increase the abundance of species of interest. Identification of which species are present in the watershed. This work should lead to identification and protection of maternity roosts and hibernacula.	Open	Throughout

PUNTLEDGE 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**
24	Upland & Dryland	Habitat-based Actions	**PUN.UAD.HB.24.01 Restoration/enhancement of American Marten denning-P2**	**2**	Pacific Marten	Evaluate options and implement **restoration/enhancement of American Marten denning** (or other) habitats in disturbed watersheds.	Protect and/or restore rare and ecologically significant upland/dryland habitat.	Open	Throughout
25	All	Habitat-based Actions	**PUN.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 K'omoks Important Bird Area (BC272; Bird Studies Canada 2016) covers the estuaries and inland both north and south of the city of Courtney. This Important Bird Area is designated for four species at the global level: Trumpeter Swan, Harlequin Duck, Thayer's Gull, Glaucous-winged Gull; one species at the continental level: Mew Gull; and two species at the national level: Great Blue Heron and Peregrine Falcon. Continentally significant numbers of Waterbirds occur each year and, in some years, globally significant numbers have been recorded for Surf Scoter and Western Grebe and continentally significant numbers for White-winged Scoter and Red-necked Grebe (Bird Studies Canada 2016). The Strathcona Provincial Park Important Bird Area (BC265; Bird Studies Canada 2016) overlaps the western side of the Puntledge watershed (important for White-Tailed Ptarmigan).	Varied types of species and habitat conservation, protection and enhancement opportunities.	Open	Throughout
26	Wetland & Riparian	Habitat-based Actions	**PUN.WAR.HB.26.01 Install nest boxes for Purple Martin-P2**	**2**	Purple Martin	**Install nest boxes for Purple Martin** in cooperation with existing enhancement programs.	Habitat enhancement opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout

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27	Wetland & Riparian	Habitat-based Actions	**PUN.WAR.HB.27.01 Implement wetland and riparian restoration projects-P2**	**1**	Wildlife	**Implement wetland and riparian restoration projects** that are identified as high priorities through inventory, mapping or assessment (e.g., Puntledge River Watershed Riparian and Wetland Mapping Project (COA-F17-W-1253)). 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
28	All	Research & Information Acquisition	**PUN.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: Salish Daisy, Snow Bramble, Olympic Aster, Western Hedysarum, Pointed Rush, Oldgrowth specklebelly, *Trematodon asanoi*, Olympic Onion, Smooth Douglasia, Sand-dwelling wallflower, Three-leaved *lewisia,* Corrupt spleenwart, and Upswept moonwort.	Habitat restoration opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout

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