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FISH AND WILDLIFE  
COMPENSATION PROGRAM

PEACE BASIN

*RIPARIAN AND WETLANDS ACTION PLAN*

March 31, 2014

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# Peace Riparian and Wetlands Action Plan

## 1. Introduction

The Fish and Wildlife Compensation Program (FWCP) is a partnership between BC Hydro, the Province of British Columbia and Fisheries and Oceans Canada, First Nations and local communities and groups to conserve and enhance fish, wildlife and their supporting habitats affected by the creation of BC Hydro-owned and -operated generation facilities in the Coastal, Columbia and Peace regions of British Columbia. The FWCP program in the Peace region (see Figure 1) was initiated in 1988 and has been investing in fish and wildlife initiatives ever since.

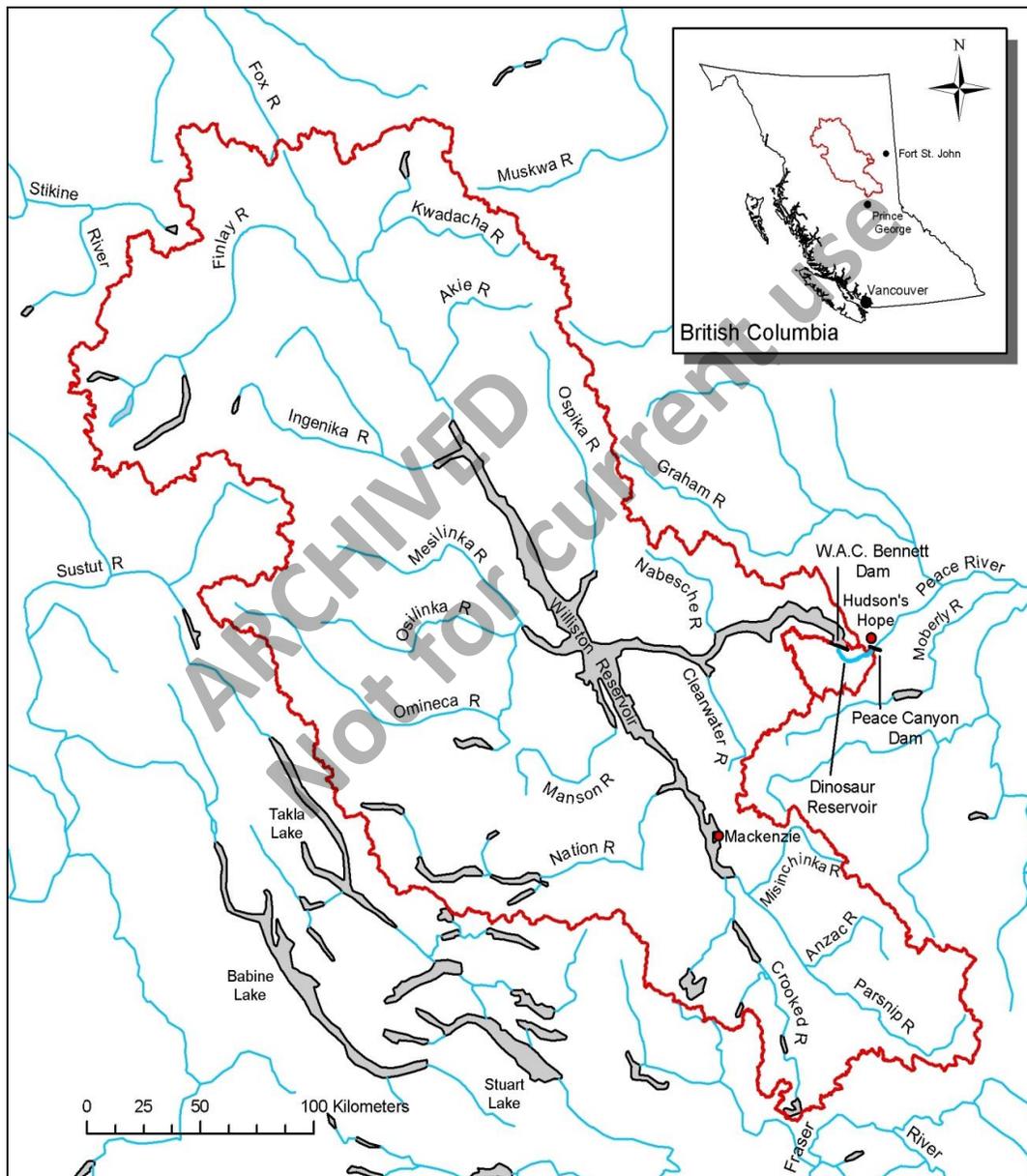
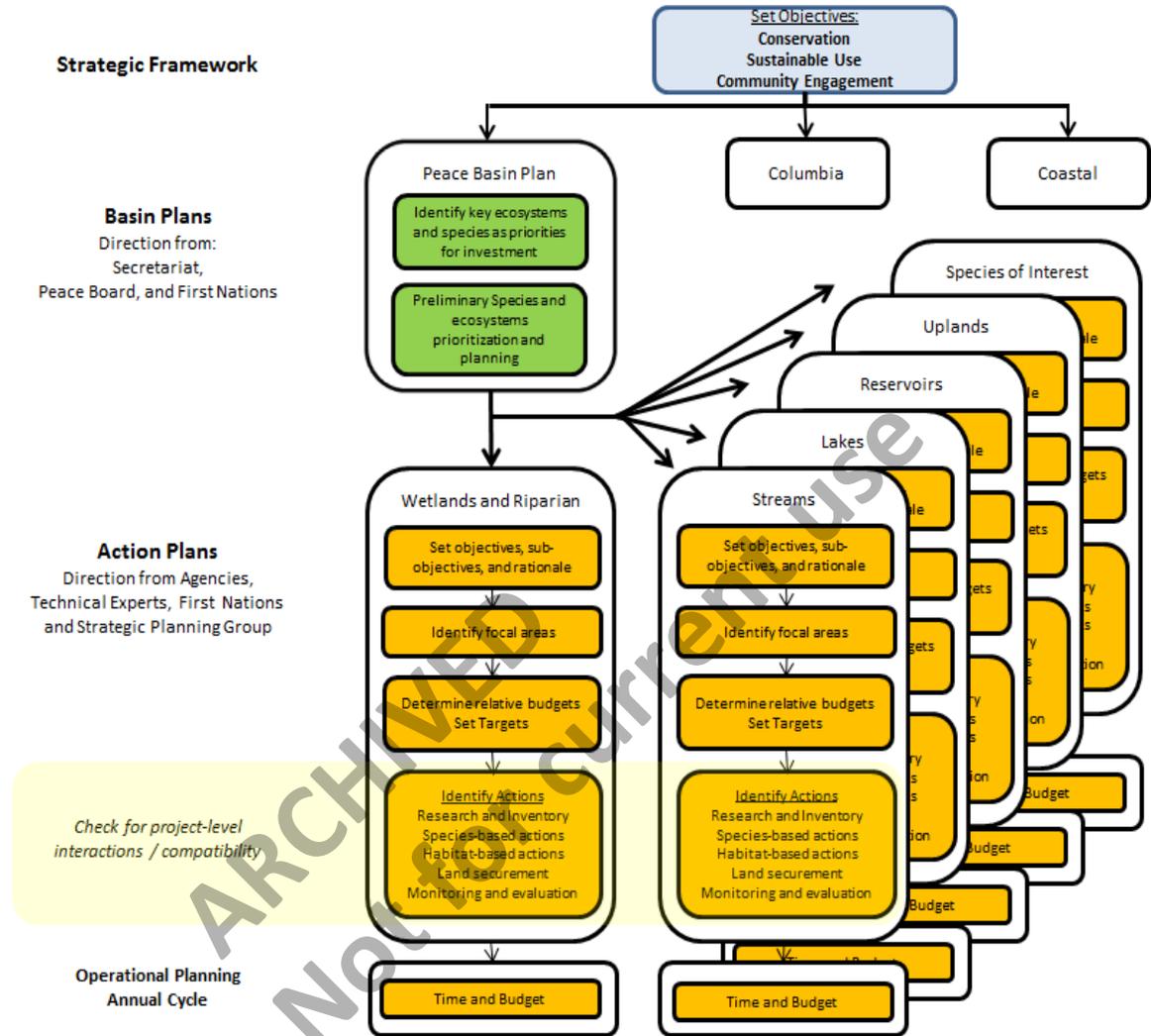


Figure 1. The Upper Peace Basin and the FWCP-Peace Program Area

The FWCP developed a strategic framework that guides overall planning for compensation investments (MacDonald 2009). The framework has guided the development of strategic plans for each basin within the program area, which in turn inform Action Plans that focus on specific priorities within each basin (Figure 2).



**Figure 2. Relationship between the Riparian and Wetlands Action Plan and higher level planning and objectives**

This Riparian and Wetland Action Plan sets out priorities for the FWCP to guide projects within the Peace region program area (Figure 1). The plan builds on the FWCP’s strategic objectives and the FWCP-Peace Basin Plan (FWCP 2013). Action Plans have also been developed for Species of Interest, Uplands, Streams, Lakes, and Reservoirs<sup>1</sup>. While the habitat and species focus among plans differ, some actions are complementary across the different plans.

<sup>1</sup> All of the FWCP Plans are available at:  
[http://www.bchydro.com/about/sustainability/environmental\\_responsibility/compensation\\_programs.html](http://www.bchydro.com/about/sustainability/environmental_responsibility/compensation_programs.html)

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Riparian areas and wetlands are semi-terrestrial habitats that are influenced by seasonal changes in the water table. Wetlands are flooded for most or all of the year while riparian areas might experience seasonal, shallow flooding. These dynamic ecosystems are some of the most productive in British Columbia, providing diverse habitats for a disproportionate number of wildlife and plant species (Bunnell and Dupuis 1995).

Riparian habitat in the Peace Basin is distinguishable from upland areas by the abundance of deciduous trees and shrubs such as Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*), Balsam Poplar (*Populus balsamifera* ssp. *balsamifera*) and willow (*Salix* spp.).

A wetland is defined as an area where the soil is saturated with water either permanently or seasonally. Wetlands are a general habitat category that includes a diverse array of specific habitat types, such as fens, bogs, marshes and swamps (MacKenzie and Moran 2004). Each of these habitats is associated with a set of characteristic plant and animal species.

This Action Plan proposes objectives and actions mostly focus on improving wetland and riparian habitat conditions in the Peace Basin, in the context of the FWCP's strategic framework. Public feedback received during the planning process indicated that habitats and improvements related to the Riparian and Wetlands Action Plan were more important to stakeholders than Uplands habitats but less important than actions proposed for the Species of Interest Action Plan.

The actions and priorities described in this Action Plan have been developed with input from the BC Ministry of Environment (MOE), BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO), BC Hydro, First Nations and local stakeholders. The planning priorities within Action Plans may not translate immediately into funded projects because limited program funding requires priority-setting across the program as a whole. The process of selecting which actions will be implemented in any given year will occur during the annual implementation planning cycle.

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## 2. Overview Context

### 2.1. Purpose and Scope

The Riparian and Wetlands Action Plan aims to restore or enhance the functioning of riparian and wetland ecosystems through habitat improvements, reducing threats, and encouraging compatible uses. Although much has been accomplished to date through the FWCP and Water Use Planning (WUP) programs, there are areas in the basin where additional information needs to be collected to understand the current distribution and function of these habitat types.

### 2.2. Focal Areas

The upper Peace Basin is approximately 70,000 km<sup>2</sup> and includes three sub-basins. The Finlay River drains the northern portion of the trench with an original mainstem length of around 295 km. The Parsnip River drains the southern portion of the trench with an original mainstem length of about 210 km. The two rivers converged at Finlay Forks to form the Peace River which flows east through the Rocky Mountains and runs by the Omineca, Parsnip and Finlay Rivers to the Peace Canyon.

The Peace Basin is a large and diverse basin dominated at low elevations by the Williston Reservoir, and downstream by the smaller Dinosaur Reservoir. Riparian and wetland areas directly adjacent to these reservoirs are limited. The Mugaha Marsh is located on the east side of the Parsnip Reach north of the town of Mackenzie. It is a naturally occurring wetland of considerable ecological importance and community interest. Also near Mackenzie is Airport Lagoon, which is separated from the reservoir by a causeway. Culverts provide a measure of water level control in the lagoon.

“Perched” wetland areas have been identified on the Parsnip Reach and occur elsewhere, although they have not been surveyed. Perched wetlands are areas that are flooded when water levels in the Williston Reservoir are high, and hold water when levels drop. These areas are candidates for restoration, if water levels can be further controlled to promote productivity.

At higher elevations in the basin there are largely intact, major river systems, including the Finlay, Kwadacha, Ingenika, Ospika, Osilinka, Omineca, Nation and Parsnip. These rivers and their tributaries are associated with riparian areas as well as wetlands, bogs, fens and swamps, although the distribution and abundance of these habitats have not been systematically surveyed.

### 2.3. Impacts and Threats

The abundance and distribution of riparian and wetland habitat in the Peace Basin has been altered significantly by the construction of dams and consequent changes to flood regimes. Extensive floodplain areas along the main stems of the lowland portions of the Basin’s rivers and smaller creeks and tributaries were permanently lost when the reservoir was flooded. Smaller riparian and wetland habitats that remain near the full pool operating level of the reservoir have been affected by altered seasonal flows and siltation that have impaired their function.

A detailed analysis of riparian and wetland habitat losses that resulted from dam construction and operation has not been conducted.

### 2.4. Limiting factors

Factors limiting riparian and wetland habitat fall into three broad categories:

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## Habitat Extent

The contribution of riparian and wetland habitats to broader ecological function is ultimately limited by the extent of the habitats on the land base. Habitats have been lost through inundation. This is generally considered the most important limiting factor.

## 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. Distribution is directly related to extent and to land uses in other habitats.

## Productivity

The productivity of an ecosystem is defined as its ability to grow or yield native plants and animals. Even where riparian and wetland habitats are adequately represented and connected, there are several factors that can negatively 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). Hydrologic conditions also influence the extent and distribution of habitats where changes in hydrology result in succession to other habitat types (e.g., reservoir drawdown zone).
- 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, loafing sites to turtles.

## 2.5. Trends and Knowledge Status

Basin-wide trends in the abundance, distribution and productivity of riparian and wetland habitats, as well as the species dependent on them, have not been compiled; however, there have been a variety of WUP- or FWCP-sponsored projects that have addressed inventory and/or enhancement of riparian and wetland habitats in the Peace Basin, including:

- Inventory of existing wetlands in the Parsnip Reach of the Williston Reservoir and identification and monitoring of sites for possible enhancement (Golder Associates 2010, Cooper Beauchesne and Associates Ltd. 2013);
- Inventory and enhancement (e.g., nesting islands) of existing wetlands (e.g., Corbould 1992, Martin 1992);
- Weir installation to enhance wetlands (Hengeveld and Corbould 1998); and,
- Experimental blasting trials to create wetlands (Dawson 1990).

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### 3. Action Plan Objectives, Sub-objectives and Targets

Clear and realistic management objectives are necessary to guide information acquisition and prioritize restoration actions. Priority actions and information needs will change as both improvements to the system are realized and information is gained. The current plan reflects the current information and opinion collected through:

- Interviews with BC Hydro staff, First Nations community members, agency biologists and FWCP board members;
- FWCP strategic planning meetings: Strategic Planning Group, Wildlife Technical Working Group, First Nations Working Group;
- Public feedback received during three public sessions held in June 2013 and through an on-line public survey carried out through most of June; and,
- Survey of past FWCP reports and Water Use Plan program reports.

#### 3.1. Objective Setting

The following definitions are used for setting objectives in this report:

**Objectives:** Objectives are high-level statements of desired future conditions (outcomes), consistent with FWCP partner mandates and policies.

**Sub-objectives:** Sub-objectives are detailed statements of desired future conditions within objectives, from which performance measures can be derived and alternative management actions evaluated. They may be arranged hierarchically within objectives, and usually indicate conditions necessary to attain the objective to which they refer.

**Performance Measures:** Measures are specific metrics that indicate the degree to which desired future conditions have been achieved.

**Targets:** Targets are the value of the performance measure that indicates the attainment of a desired condition.

**Actions:** Actions are management activities, plans or policies for achieving the objectives.

Objectives are the “ends” or the outcomes we ultimately care about. Actions are the “means,” or the things we do to achieve them. This report focuses on describing the actions required to achieve the objectives in relation to riparian and wetland habitats. Complementary actions may also be identified in the separate Species of Interest Action Plan.

Current information was insufficient to establish performance measures and targets as part of the Action Plans; however, implementation of proposed actions could lead to the development of clear performance measures and targets in future iterations of the plans.

#### 3.2. Objectives and Sub-objectives

The FWCP program has the following over-arching strategic objectives:

1. **Conservation** - Maintain or improve the status of species or ecosystems of concern

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2. **Conservation** - Maintain or improve integrity and productivity of ecosystems and habitats
  3. **Sustainable Use** - Maintain or improve opportunities for sustainable use, including harvesting and other uses
  4. **Community Engagement** - Build and maintain relationships with stakeholders and aboriginal communities

Based on input with partners, First Nations and stakeholders, the following objectives and sub-objectives were identified for riparian and wetland habitats in the Peace Basin:

**OBJECTIVE 1: IMPROVE THE UNDERSTANDING OF THE ABUNDANCE, DISTRIBUTION, TREND, AND CONNECTIVITY OF RIPARIAN AND WETLAND ECOSYSTEMS.**

*Sub-objective 1a: Improve understanding of the abundance, distribution, trend and connectivity of riparian ecosystems.*

*Sub-objective 1b: Improve understanding of the abundance, distribution, trend and connectivity of wetland ecosystems.*

**Rationale** - Wetlands on the Peace Arm have been inventoried and some are being monitored in advance of conducting enhancement activities under the WUP program (Golder Associates 2010, Cooper Beauchesne and Associates Ltd. 2013); however, there has been no systematic analysis of the status of riparian and wetland habitats basin-wide. This is regarded as a critical first-step in identifying opportunities to restore or enhance existing habitat, or create new riparian and wetland habitat. Once an understanding of current status is established, feasible performance measures and targets can be drafted.

**OBJECTIVE 2: CONSERVE OR ENHANCE THE ECOLOGICAL INTEGRITY OF RIPARIAN AND WETLAND ECOSYSTEMS.**

*Sub-objective 2a: Restore the function and connectivity of remaining riparian and wetland ecosystems.*

**Rationale** - Where the function of riparian or wetland ecosystems has been compromised by altered flood regimes, there may be opportunities to restore function through activities that improve hydrologic function (e.g., installing water control structures). Beyond restoring function, there could be enhancements that could improve the capacity of habitat to provide habitat for wildlife (e.g., nesting islands).

*Sub-objective 2b: Create or enhance riparian and wetland habitat.*

**Rationale** – The creation of new riparian and wetland habitat to compensate for lost habitat is also an option. There are many example of successful wetland creation projects that provide important ecosystems services that otherwise would not exist in an area. Creating wetlands is expensive because of engineering and construction costs, and they require ongoing operational management and maintenance. For reasons that are not well understood, the productivity of created wetlands is often lower than natural wetlands (e.g., Atkinson et al. 2010).

**OBJECTIVE 3: REDUCE THREATS TO ECOSYSTEM FUNCTION.**

*Sub-objective 3a: Reduce impacts of non-native species.*

**Rationale** - Somewhat distinct from specific actions that restore, enhance or create riparian and wetland habitat are actions that reduce ongoing threats to these ecosystems. These include

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actions to reduce invasive weeds or mitigate impacts to native plants caused by domestic stock (e.g., grazing, browsing and trampling).

*Sub-objective 3b: Reduce human-caused impacts.*

**Rationale** – Some areas can benefit from measures to reduce motorized or non-motorized access that can damage native vegetation and disrupt wildlife behaviour.

*Sub-objective 3c: Support conservation of riparian and wetland ecosystems on private land.*

Because riparian and wetland habitats are located predominantly in valley bottoms that are often dominated by private land, one option for improving habitat conditions in the basin is to invest in management of privately owned wetlands. This can often be very cost effective compared to restoring or creating wetlands.

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## 4. Action Plan

### 4.1. Overview

The Action Plan outlines individual actions by objective and sub-objective. Actions are assigned priorities from 1-3, based on their estimated feasibility, cost-effectiveness, and alignment with FWCP strategic objectives. The priority ratings are provided to guide investment planning efforts, but it should be noted that low priority actions are not included in the plan. A proposal method is also identified for each action, and includes either 'open' proposal invitations, 'directed' contracts, or 'either'. Proponents are encouraged to develop proposals to address some or all components of 'open' projects; whereas, directed proposals will be developed by FWCP staff and partners and released as RFPs for proponents to bid on.

Actions are stratified by different action categories:

1. **Research and information acquisition** - actions to inventory resources or research critical effect pathways and relationships;
2. **Habitat-based actions** - activities focused on improving general habitat conditions or ecosystem function;
3. **Species-based actions** - activities that improve conditions or address specific life requisites for particular species;
4. **Land securement** - contributing to the establishment of easements or covenants or the purchase of private land for conservation purposes; or,
5. **Monitoring and adaptive management** – activities focused on assessing the outcomes of management actions.

Action categories (along with the action rationale text) provide a general guide for the sequencing of actions. In general, research and information acquisition actions will occur first in sequence. Habitat- and species-based actions typically occur following prioritization and recommendations from research- and/or monitoring-based actions, and monitoring and adaptive management may occur before, during and/or after the implementation of on-the-ground actions. Land securement actions are mostly independent of other action categories, although post-securement monitoring activities may occur within an acquired area. In the tables below, the 'pre-requisite' column highlights those actions that should not be carried out until the identified preceding actions have been completed.

It should be noted that community involvement and education activities are encouraged where there are opportunities in the identified actions outlined in the Action Plans. In addition, there is a separate Stewardship and Education category (described in Section 4.3 of the Peace Basin Plan) that provides another avenue for interested proponents.

#### 4.1.1 Cross-Plan Actions

Several broad 'cross plan' actions are relevant to all terrestrial and aquatic Action Plans, but are not readily nested under any particular sub-objective:

1. **Conduct a high-level review of past FWCP-Peace projects.** Existing data consolidation and summarization is a top priority across all Action Plans. An understanding of the work that has been done in the past, results, recommendations, and information gaps are necessary for developing new actions and avoiding repetition of ineffective past actions. Capturing "institutional memory" from published reports and past program staff will be an important exercise for ensuring that historical information is retained in a concise and accessible format for informing future projects.

2. **Evaluate success of FWCP projects.** An independent performance audit will serve to evaluate the success of each FWCP-Peace project. This action is designed to assess the effectiveness of the program in meeting its objectives.

There are several 'cross-plan' actions that are relevant to two or more Action Plans and will require the consideration of multiple ecosystems. The details of such actions are presented in other Action Plans, but those that address objectives and sub-objectives defined for riparian and wetlands ecosystems are summarized below:

1. **Undertake a Kokanee assessment study to summarize status, and aquatic and terrestrial ecosystem impacts and potential ecological risks associated with Kokanee introductions. Develop appropriate recommendations for actions, as needed (Reservoirs Action Plan).** The introduction of Kokanee is affecting riparian and wetland ecosystems in the Peace Basin through the introduction of additional nutrients in watersheds where Kokanee are spawning. The impacts (positive and/or negative) are not well understood but they could be altering predator-prey relationships or vegetation communities. For example, scavenger distribution or populations may be altered by the additional food source, which could have cascading effects on riparian and wetlands ecosystems. This project is common to all Action Plans and is designed to gain a basin-wide understanding of the effects Kokanee introductions, and to develop and evaluate potential responses, as needed. This will be either an open or directed study.
2. **Partner with other organizations to assess cumulative effects (Uplands Action Plan).** The construction of reservoirs enabled incremental industrial development in the reservoirs by improving access to formerly remote areas. Subsequent development has likely led to unintended cumulative impacts. FWCP cannot influence the tenuring or permitting of crown land, but can partner with other organizations to understand cumulative effects in the Peace Basin in order to more clearly define future priorities that would be eligible for funding through the FWCP. This will be an open proposal invitation.

## 4.2. Actions

Actions for wetlands and riparian areas in the Peace Basin are presented in the following tables. Proposals will be sought through either an open call for proposals or through a directed call for quote to pre-qualified bidders. Separate tables are provided for each objective and sub-objective.

### Objective 1: Improve the understanding of the abundance, distribution, trend, and connectivity of riparian and wetland ecosystems.

**Sub-objective 1a: Improve understanding of the abundance, distribution, trend and connectivity of riparian ecosystems.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Research and information acquisition</b>					
1a-1	Inventory the distribution, abundance, current function and connectivity of remaining	Before feasible targets can be established for riparian ecosystem restoration or enhancement, an inventory of	1	Direct	na

	riparian ecosystems.	existing habitats within the Peace Basin is required to identify potential sites and their current status.			
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**Objective 1: Improve the understanding of the status, trends, and connectivity of riparian and wetland ecosystems.**

**Sub-objective 1b: Improve understanding of the abundance, distribution, trend and connectivity of wetland ecosystems.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Research and information acquisition</b>					
1b-1	Inventory the distribution, abundance, current function and connectivity of remaining wetland ecosystems.	Before feasible targets can be established for wetland ecosystem restoration or enhancement, an inventory of existing habitats within the Peace Basin is required to identify potential sites and their current status. Note that this has been completed for a portion of the basin (Parsnip) under WUP-sponsored projects.	1	Direct	na

**Objective 2: Conserve or enhance the ecological integrity of riparian and wetland ecosystems.**

**Sub-objective 2a: Restore the function and connectivity of remaining riparian and wetland ecosystems.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Habitat-base actions</b>					
2a-1	Plant flood and drought resistant plant species for bank stabilization.	Some existing wetland and riparian areas may be threatened by erosion caused by reservoir drawdown.	3	Open	1a-1, 1b-1

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
		Excessive erosion may compromise the ability of these areas to hold water during low water periods. Stabilizing banks by planting vegetation may mitigate this risk. Note that this action is dependent on identifying suitable sites for treatment. There might also be the opportunity to leverage WUP-sponsored planting trials (e.g., Vaartnou 2010).			
2a-2	Install water control structures to regulate water levels in existing wetlands.	Regulating water levels to prevent deep flooding or excessive drying can improve the productivity of existing wetlands. These projects are typically expensive because of engineering, earthworks, maintenance and operational requirements. Partnering with other organizations can provide additional financing and logistic resources. Mugaha Marsh was suggested by the public as an example of a wetland that could benefit from a water control structure. A WUP-sponsored project has been completed at Airport Lagoon.	1	Open	1a-1, 1b-1

**Objective 2: Conserve or enhance the ecological integrity of riparian and wetland ecosystems.**

**Sub-objective 2b: Create or enhance riparian and wetland habitat.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Habitat-base actions</b>					

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
2b-1	Leverage WLR trial wetland program to create habitat.	A wetland creation project sponsored by WUP is being conducted in the Parsnip region (Golder Associates 2010) and recommendations could be leveraged to develop similar projects elsewhere in the basin.	1	Open	na
<b>Species-based actions</b>					
2b-2	Install artificial nesting or roost structures for wildlife species.	Suitable nesting or roosting habitat for wildlife species are sometimes limiting in specific habitat and adding structures can lead to increased nesting success and higher wildlife populations (e.g., Sargeant and Arnold 1984). Some examples include nesting islands for ground-nesting waterfowl and shorebirds that isolate nests from predators (e.g., Corbould 1991), nest boxes for cavity nesting waterfowl or other bird species, and roost structures for bats. The construction and installation nest boxes is a popular stewardship project with the public but creates an ongoing maintenance commitment.	2	Open	1a-1, 1b-1

**Objective 3: Reduce threats to ecosystem function.**

**Sub-objective 3a: Reduce impacts of non-native species.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Habitat-base actions</b>					

3a-1	Help protect riparian and wetland ecosystems from invasive plants.	Invasive plants pose a significant risk to the functioning of riparian and wetland ecosystems (e.g., Zedler and Kercher 2004) as well as other habitat types. Regions have local invasive plant committees that map and set priorities for treatment and working with these committees can leverage existing planning work and resources.	2	Open	na
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**Objective 3: Reduce threats to ecosystem function.**

**Sub-objective 3b: Reduce human-caused impacts.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Research and information acquisition</b>					
3b-1	Identify opportunities to control human-related access impacts in riparian and wetland habitat.	Motorized access in moist soil habitat can cause physical damage to sensitive plant communities, compact soil and introduce invasive species (Ouren et al. 2007). Identifying opportunities for provincial government agencies to control motorized access to sensitive areas can lead to protection or recovery of riparian and wetland areas.	2	Open	1a-1, 1b-1
<b>Habitat-base actions</b>					
3b-2	Provide extension materials/activities (e.g., BMPs, workshops) to industries, developments, communities and organizations.	Providing information on best practices to users of riparian and wetland areas can reduce impacts and improve the functioning of ecosystems without imposing additional regulation.	2	Open	na

**Objective 3: Reduce threats to ecosystem function.**

**Sub-objective 3c: Support conservation of riparian and wetland ecosystems on private land.**

ID	Action	Rationale	Priority	Proposal Method	Pre-requisite
<b>Habitat-base actions</b>					
3c-1	Provide extension materials/activities (e.g., BMPs, workshops) to private landowners.	Providing information on best practices to landowners can reduce impacts and improve the functioning of ecosystems without additional regulation.	2	Open	na
<b>Land securement</b>					
3c-2	Partner with organizations to purchase land or establish covenants.	Purchasing private land for conservation purposes, or establishing conservation-related covenants on private land, can protect important habitats from conversion to other uses or degradation through changes in land management. Land purchases (and subsequent management agreements with third parties) and negotiations of legal covenants can be expensive and areas protected are usually small. Partnerships with other organizations to finance purchases and/or take ownership of fee-simple lands will be required. Opportunities for private land purchase or management are limited in the Peace Basin because most of the program area is provincial crown land. First Nations land claims in the region are an important consideration regarding private land purchases.	2	Open	na

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## 5. Conclusions

This Action Plan for riparian and wetland ecosystems in the Peace Basin identifies objectives, sub-objectives and actions that address the goal of compensating for reservoir construction impacts in the context of FWCP's strategic objectives. A variety of FWCP and WUP-sponsored projects have addressed inventory requirements and have implemented a number of actions to improve ecosystem function. The proposed actions build on those projects and leverage their results to address outstanding needs in the Peace Basin. The expected outcomes of the Action Plan include:

1. Understanding the current distribution, function, and connectivity of existing riparian habitats and opportunities for restoration and enhancement;
2. Reducing threats to riparian and wetlands through direct habitat improvements (e.g., installing water control structures) or encouraging more compatible land uses (e.g., by providing extension resources); and,
3. Improved coordination with existing planning and management activities in the Peace Basin (e.g., addressing invasive plant infestations).

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