

FOR REFERENCE ONLY
Version from 2014 now archived.
Updated 2020 Peace
Region Action
Plans available at:
fwcp.ca/region/peace-region/

PEACE BASIN PLAN

FISH AND WILDLIFE
COMPENSATION PROGRAM

March 31, 2014

BChydro 
FOR GENERATIONS


BRITISH
COLUMBIA
The Best Place on Earth

Canada



Fisheries and Oceans
Canada

Pêches et Océans
Canada

ARCHIVED
Not for current use

Contents

| | | |
|-----|---|----|
| 1. | Introduction | 1 |
| 1.1 | Fish and Wildlife Compensation Program..... | 1 |
| | Vision | 2 |
| | Principles | 2 |
| | Partners | 2 |
| | Policy Context..... | 2 |
| | Program Delivery..... | 4 |
| | Project Investment Criteria | 4 |
| 2. | The Peace Basin | 6 |
| 2.1 | Setting | 6 |
| 2.2 | Hydro Facilities | 10 |
| 2.3 | Footprint Impacts Summary..... | 11 |
| 2.4 | FWCP-Peace Accomplishments to date | 13 |
| 3. | Strategic Objectives for FWCP | 20 |
| 4. | Priorities | 22 |
| 4.1 | Introduction..... | 22 |
| 4.2 | Priority Setting in the Peace Basin | 23 |
| 4.3 | Stewardship and Education Funding..... | 25 |
| 5. | Action Plan Summaries | 26 |
| 5.1 | Species of Interest Action Plan..... | 27 |
| 5.2 | Uplands Action Plan | 29 |
| 5.3 | Riparian and Wetlands Action Plan..... | 31 |
| 5.4 | Streams Action Plan | 33 |
| 5.5 | Lakes Action Plan..... | 35 |
| 5.6 | Reservoirs Action Plan..... | 37 |
| 6. | Conclusion..... | 39 |
| 7. | Literature Cited | 40 |

List of Tables

| | |
|--|----|
| Table 1 – Summary of Past FWCP-Peace Wildlife Projects..... | 14 |
| Table 2 – Summary of Past FWCP-Peace Fish Projects..... | 18 |
| Table 3 – Action Plan Categories chosen for the Peace Basin..... | 23 |

List of Figures

| | |
|---|---|
| Figure 1 – The FWCP Strategic Framework for Developing Basin and Action Plans | 1 |
| Figure 2 – The Upper Peace Basin and FWCP-Peace Program Area..... | 9 |

ARCHIVED
Not for current use

1. Introduction

This Peace Basin Plan sets forth the strategic direction for the Fish and Wildlife Compensation Program (FWCP) in the Peace Region of north-central British Columbia.

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

The priority setting process is then described, followed by a short synopsis of the proposed Action Plans. Taken together, this Basin Plan and the accompanying Action Plans present the FWCP priorities for investments in compensation activities within the Peace Basin.

1.1 Fish and Wildlife Compensation Program

The Fish and Wildlife Compensation Program - Peace (FWCP-Peace) was originally created in 1988 when a fund was established to offset the footprint impacts of BC Hydro dams and reservoirs on fish and wildlife species in the basin (MacDonald, 2009). In 1990 the initial monies were leveraged to create a notional fund to generate an annual budget in perpetuity indexed to inflation, after which, an administration agreement was developed between the Province and BC Hydro to implement the program.

In 2009, the FWCP Partners (i.e., BC Hydro, BC Ministry of Environment, Department of Fisheries and Oceans) developed a strategic framework that guides overall planning for compensation investments (MacDonald, 2009). The framework has guided the development of strategic plans for the FWCP-Columbia and FWCP-Coastal areas, which are in turn informing action plans that focus on specific priorities within the component watershed(s) (Figure 1).

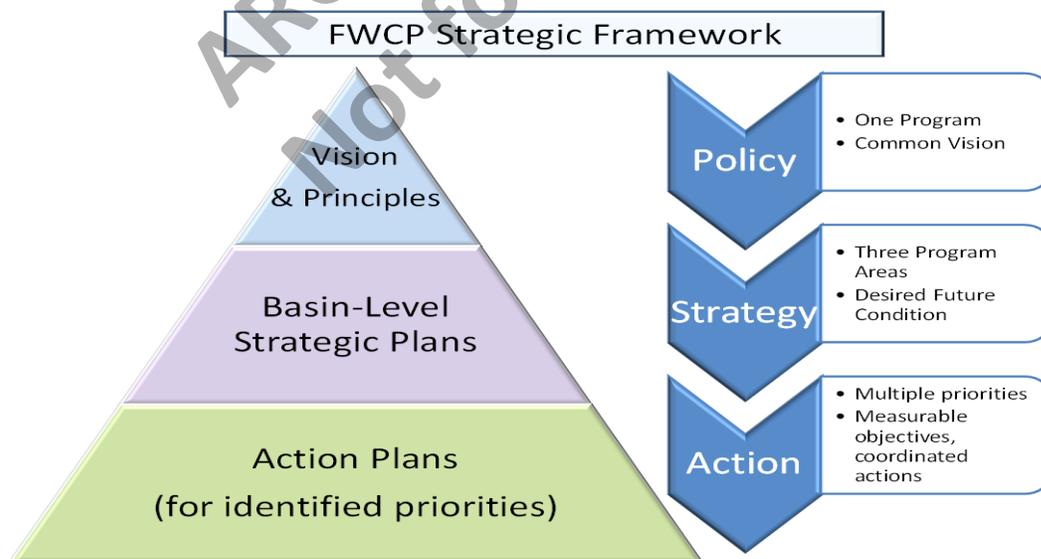


Figure 1 – The FWCP Strategic Framework for Developing Basin and Action Plans

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

Vision

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

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

Principles

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

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

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

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

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

Partners

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

Policy Context

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

BC Hydro

BC Hydro is a Crown Corporation committed to producing, acquiring and delivering electricity in an environmentally, socially and financially responsible manner,¹ through managing impacts from its operations, and weighing environmental values with social and economic interests. Where negative impacts cannot be avoided, it will work to mitigate or offset them, enhance affected habitat and sustain resources over the long term. The compensation programs are water license conditions in the Peace and Columbia regions. BC Hydro also has voluntarily initiated the compensation program for the Coastal region in partnership with DFO and MOE. The compensation programs are committed to developing positive projects, such as investments to improve fish and wildlife, and building relationships to encourage stakeholder and aboriginal community engagement, particularly where their input can contribute to better decisions.

BC Provincial Government

The BC Ministry of Environment (MOE) and BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO) manage and deliver a wide range of programs and services that support the Province's environmental and economic goals². The Ministry encourages environmental stewardship, develops innovative partnerships, engages First Nations, stakeholders and the public and actively promotes the sustainable use of British Columbia's environmental resources. Within this broader context, the Ministry has a number of responsibilities that are particularly relevant to the development and implementation of actions under the FWCP including:

- Management and conservation of the province's biodiversity;
- Protection of fish, wildlife, species-at-risk and their habitats;
- Protection and restoration of BC's watersheds; and,
- Provision and management of fish and wildlife-based recreation.

A number of policies and plans guide the Ministry in delivering on these goals and objectives. The **Conservation Framework**³ is British Columbia's approach for maintaining the rich biodiversity of the province, providing a set of science-based tools and prioritized actions for conserving species and ecosystems in B.C. **Program Plans for Freshwater Fisheries, Wildlife and Ecosystems**⁴ articulate a clear set of strategies supported by actions to achieve both conservation-based outcomes and the provision of recreational opportunity. **Recovery Strategies and Management Plans** continue to be developed to guide the maintenance, recovery and/or use of specific species and ecosystems. These plans may include specific performance measures and targets.

¹ BC Hydro Social Responsibility Policy.

² <http://www.bcbudget.gov.bc.ca/2011/sp/pdf/ministry/env.pdf> (MOE Service Plan)
<http://www.bcbudget.gov.bc.ca/2011/sp/pdf/ministry/flnr.pdf> (FLNRO Service Plan)

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

⁴ <http://www.env.gov.bc.ca/esd/>

Fisheries and Oceans Canada

The FWCP in the Peace and Columbia regions are conditions of the provincial water licenses, and the program is implemented primarily through the partnership of BC Hydro and its provincial regulators. DFO has participated as an interested observer, however does not directly participate as Board or committee members. DFO does actively engage as a full partner in the Coastal region, due to their interest in and oversight of the salmon fishery, and participate actively on the Board and Fish Technical Advisory Committees.

Program Delivery

The overall vision and common principles above drive the FWCP program and projects, and provide a foundation for determining strategic priorities at the basin level (i.e., this Basin Plan), which are used to inform the development of Action Plans. The bulk of projects undertaken by the FWCP will be delivered under Action Plans, which present a suite of key actions to achieve specific goals associated with priority species and ecosystems. Actions may include research, enhancement activities, monitoring and evaluation activities, and communication mechanisms. Program applicants are encouraged to use this Basin Plan and accompanying Action Plans to develop proposals that meet the overall objectives of the FWCP program. The Peace Board⁵ and Technical Review Committees, together with FWCP staff, will use the plans to guide investments toward the highest priority projects.

A portion of the FWCP program activities will include small-scale and/or short-duration, strategic projects that target specific issues identified by program partners or others (e.g., community members). These could include projects not yet identified in any action plans, or lower priority actions that require timely response to take advantage of an investment or partnership opportunity. This includes projects related to community stewardship and education initiatives which are described later in this document (Section 4.3).

Project Investment Criteria

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

FWCP does:

- Fund actions to create, restore, or otherwise improve the function of ecosystems that have been impacted by BC Hydro activities;
- Fund actions to create, restore, or otherwise improve the function of alternate ecosystems that provide a better opportunity for investment;
- Participate as a team member in species of interest planning;

⁵ Formally known as the “Peace Steering Committee”.

- Fund specific management actions for species of interest as identified by recovery teams and action/implementation groups;
- Fund baseline inventory that contributes to the development of habitat or species based actions within Action Plans;
- Fund monitoring programs designed to measure the effectiveness of FWCP funded habitat and species actions; and,
- Contribute to all aspects of managing co-operatively managed conservation lands.

FWCP does not:

- Fund core activities of government or non-government agencies or programs;
- Lead the development of species recovery goals;
- Fund, co-ordinate or lead National Recovery Teams for species at risk;
- Develop policy related to land or wildlife management;
- Administer government regulations;
- Engage in enforcement and compliance activities, except in relation to co-operatively managed conservation lands; and,
- Fund programs designed exclusively to address government harvest objectives.

ARCHIVED
Not for current use

2. The Peace Basin

2.1 Setting

The headwaters of the Peace River, a tributary of the Mackenzie River, are located in north-eastern British Columbia (Figure 2). The Peace River is formed by the confluence of the Finlay and Parsnip rivers flowing in opposing directions in the Rocky Mountain Trench. At the confluence, the Peace River flows east and is the only river in Canada to cut through the Rocky Mountains. Once out of the canyon the river maintains an easterly direction, crossing the B.C./Alberta border. The Peace River enters the Slave River downstream of Lake Athabasca and flows north into Great Slave Lake, which drains into the Mackenzie River en route to the Arctic Ocean.

The FWCP program area only includes the upper Peace Basin (the portion of the watershed upstream of the Peace Canyon outlet). The upper Peace Basin is approximately 70,000 km² 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 Peace Canyon. The construction of W.A.C. Bennett Dam flooded the entire mainstem portion of the Peace River above the dam, as well as a substantial portion of the Finlay and Parsnip rivers forming the Peace, Finlay and Parsnip reaches of the reservoir. The lower portions of all of the tributaries draining into these three reaches were also flooded. The Peace Canyon dam flooded the mainstem Peace River upstream to the foot of the W.A.C. Bennett Dam

The watersheds' topography varies from low elevation forests around the Williston Reservoir (670 m) and along the major rivers, to rugged mountainous terrain (Mt. Ulysses 3,024 m). There are south and west facing side hills which lose their snow and green up first in the spring and north facing side slopes, which hold snow until later in the spring and provide moister, cooler summer habitats. Vegetation varies from mature forests of spruce and pine to shrubby areas, grassland and deciduous forests of aspen, cottonwood and paper birch. Marshes, small and large streams, acid bogs, lakes and the reservoir foreshore all provide wetland habitats that are used by wildlife.

Inhabiting the streams, reservoirs, and lands of the watershed are 24 species of fish and 295 terrestrial vertebrate.

The climate of the Peace River drainage is characterized by cold, snowy winters with deep snow, and mild, rainy summers with a short growing season. The mean annual temperature is 0.5°C, while the means for January and July are -18°C and 13°C respectively. Temperatures extremes of -47°C and 32°C are common in the winter and summer respectively. Snow accumulations range from approximately 1m in the valleys to more than 4m in the mountains. The corresponding water equivalent ranges from approximately 250mm to 1300mm. Average annual precipitation is approximately 800mm, which is fairly evenly distributed between snow and rain.

Major Centers

The largest settlements in the region, Fort St. John, Dawson Creek, and Hudson's Hope, lay outside the geographic boundaries of the FWCP Peace program area, which has been historically focused above Peace Canyon Dam. Smaller communities in or near the boundary of the program area include McLeod Lake, Bear Lake, Kwadacha (Fort Ware), Mackenzie, Manson Creek, Germansen Landing, and Tsay Keh Dene,.

First Nations

Twelve First Nations have traditional territories that include portions of the upper Peace Basin, several of which belong to the Treaty 8 Tribal Association. The First Nations are the Tsay Keh Dene, Kwadacha, McLeod Lake, Blueberry River, Doig River, Fort Nelson, Prophet River, Halfway River, Saulteau, West Moberly, Nak'azdli, and Takla Lake. A Memoranda of Understanding has been developed and signed by the province, BC Hydro and participating First Nations that defines a partnership approach with respect to program implementation.

Community Engagement

A number of community groups and local residents have historically been involved in the delivery of the program. This participation and support has included the BC Trappers' Association, the Chetwynd Rod and Gun Club, the Chetwynd Environmental Society, Ducks Unlimited, Foundation for North American Wild Sheep, the Guide-Outfitters Association of BC, the Mackenzie Air Cadets, the Caledonia Ramblers Hiking Club, the Mackenzie Boy Scouts, the Mackenzie Fish and Game Association, the Mackenzie Nature Observatory, Mackenzie Senior Secondary School, the Prince George Naturalists, the Rocky Mountain Elk Foundation, the Rocky Mountain Riders Association, the Spruce City Wildlife Association and Wilderness Watch. The FWCP Peace Board, which provides guidance on the priority setting and implementation of the program, is represented by at least two public members along with participants from Partner agencies and partner First Nations. Fostering ongoing community engagement is a key objective of the Board.

Protected Areas and Recreation

Parks and protected areas in or near the Peace Basin include:

- Charlie Lake Provincial Park
- Beatton Provincial Park
- Milligan Hills Provincial Park
- Prophet River Hotsprings Provincial Park
- Redfern-Keily Provincial Park
- Finlay-Russell Provincial park
- Ed Bird-Estella Lakes Provincial Park
- Bijoux Falls Provincial park
- Pine Le Moray Provincial Park
- Bocock Peak Provincial Park
- Klin-se-za Provincial Park
- Butler Ridge Provincial Park
- Peace River Corridor Provincial Park
- Taylor Landing Provincial Park

- Buckinghorse River Wayside Provincial Park
- Pink Mountain Provincial Park
- Graham-Laurier Provincial Park
- Chase Provincial Park
- Muscovite Lakes Provincial park
- Omineca Provincial Park (portion)
- Northern Rocky Mountains Provincial Park
- Monkman Provincial Park
- Wapiti Lake Provincial Park
- Swan Lake Provincial Park
- Beatton River Provincial Park
- Kistatinaw Provincial Park
- Moberly Lake Provincial Park
- Pine River Breaks Provincial Park
- East Pine Provincial Park
- Sukunka Falls Provincial park
- Hole-in-the-Wall Provincial Park
- Gwillim Lake Provincial Park
- Bearhole Lake Provincial park
- One Island Lake Provincial Park

These parks, as well as smaller regional parks and recreation areas, provide significant environmental, social and some economic value to the area, while fishing and hunting are important social, spiritual, recreational, and commercial pursuits across the region.

ARCHIVED
Not for current use

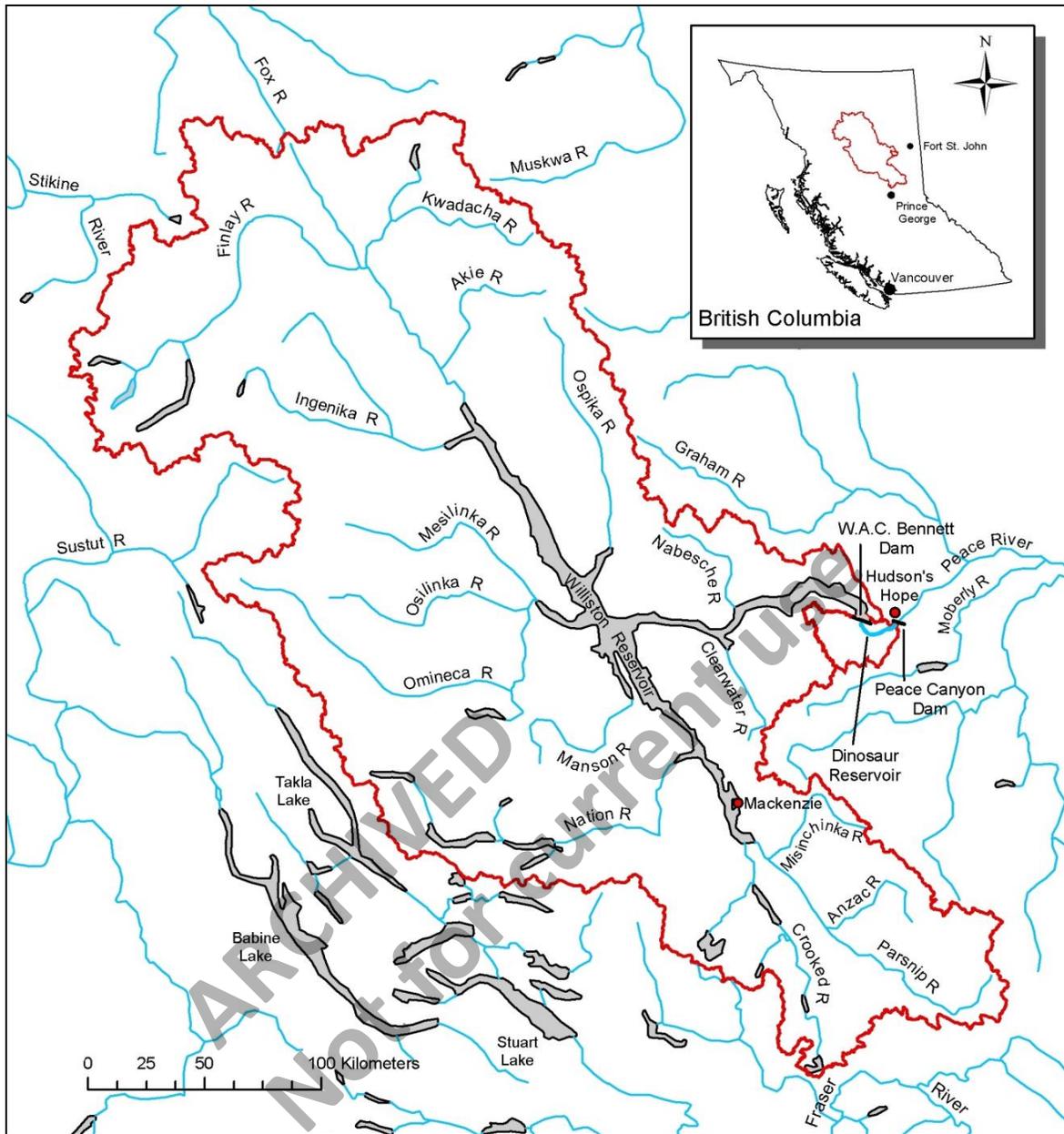


Figure 2 – The Upper Peace Basin and FWCP-Peace Program Area

2.2 Hydro Facilities⁶

The specific works comprising the Peace Hydroelectric system include:

Williston Reservoir

Williston Reservoir was created in 1968 by the construction of the W.A.C. Bennett Dam across the Peace River and is the largest body of fresh water in British Columbia, and the seventh largest reservoir in the world by volume. Williston Reservoir, resembles a 'T' laying on its side, with Finlay Reach to the North running 125km Parsnip Reach to the south running 110km (both within the Rocky Mountain Trench), and the Peace Reach extending east from Finlay Forks 122km through the rocky mountains to the dam site (Figure 2). Williston Reservoir covers approximately 1,773 km² at full pool, has 1,770 kilometres of shoreline and has an active storage of 39,471 Million cubic metres. The licensed operating range of the reservoir for power generation is between 672.08 m and 642.03 m.

W.A.C. Bennett Dam and G.M. Shrum Generating Station

The W.A.C. Bennett Dam is located at the head of the Peace River canyon forming Williston Reservoir. The earthfill dam is 2,040 m in length at the crest and 183 m high with a crest elevation of 679.7 m above sea level.

The underground G.M. Shrum Generating Station has 10 units with a total installed capacity of approximately 2,730 MW. Water is discharged through two manifolds into the upper end of Dinosaur Reservoir.

Peace Canyon Dam and Dinosaur Reservoir

In 1980 the Dinosaur Reservoir was created with the completion of the Peace Canyon Dam about 23 kilometres downstream of the W.A.C. Bennett Dam. This dam is located at the foot of the Peace River canyon and forms Dinosaur Reservoir. The Peace Canyon Dam consists of a concrete gravity dam and earthfill saddle dam on the right abutment. The main dam is 325 m long and 61 m high with a crest elevation of 507.5 m (1,665.0 ft) above sea level. The saddle dam is 200 m long and 20 m high. Dinosaur Reservoir covers approximately 9 km² at full pool. It has limited active storage (~24.69 Mm³). The shoreline length is 54.4 km. The normal operating range is between 502.92 m and 500.00 m.

⁶ Details in this section are summarized from Water Use Plan reports available at: http://www.bchydro.com/etc/medialib/internet/documents/environment/pdf/peace_river_water_use_plan.Par.0001.File.peace_river_wup.pdf

2.3 Footprint Impacts Summary

A detailed inventory has not been carried out to characterize the primary footprint impacts associated with the creation of BC Hydro's generation facilities in the Peace region. Accordingly, the remainder of this section provides more of a general overview of the nature and degree of impacts to fish and wildlife.

Habitat Loss

Williston and Dinosaur reservoirs inundated large areas of woodlands, wetlands, floodplain, riverine and lake habitat. These habitats were replaced with simpler, less diverse reservoir habitats.

Creation of the 1,773 km² Williston Reservoir resulted in the inundation of large areas of riverine and natural lake habitats within the reservoir footprint, which affected a large number of fish species. For example, the destruction of large river habitat was likely a major factor that led to the decline and eventual extirpation of a reported 24 populations of Arctic Grayling from the drainage (Stamford and Taylor 2005).

Terrestrial habitats were reduced by approximately 1,500 km², which affected important winter range and wildlife corridors for Woodland Caribou, Stone's Sheep, and Grizzly Bear; while more generally, the inundation of lowland habitat is considered a major limiting factor for many wildlife species because they were dependent on riparian ecosystems and, in some cases, because they must now forage in deeper snow conditions at higher elevations.

Reservoirs with large fluctuations in water levels result in seasonal impacts to stream and littoral habitat productivity. The Peace Water Use Plan of 2007 was developed to improve reservoir level and downstream flow conditions through incremental changes in dam operations.

New Habitat

As noted above, large amounts of riverine habitat were converted to reservoir habitat, which has relatively lower productivity. In some cases, such as in Williston Reservoir, this is due to large annual reservoir drawdowns that prevent establishment of a stable littoral (near-shore) community (Note. littoral areas are typically the most productive parts of natural lakes). In 'run-of-the-river' situations, such as in Dinosaur Reservoir, the problem is not drawdown, but rather the through-flow. In this case, the water in the reservoir is exchanged so quickly that a normal aquatic community cannot develop.

Converting rivers to reservoirs impacts stream-dependent species such as Mountain Whitefish and Arctic Grayling. Lake-dependent species that were not common in the river, such as Lake Trout and Lake Whitefish, can take advantage of the new habitat whereas habitat generalists like Bull Trout can adapt from a river to reservoir existence as long as other needs are met, such as optimal temperatures and access to stream habitat for spawning and early rearing.

Migration Barriers

Hydroelectric development in the Peace Basin has impacted fish and wildlife migration and movements for reproductive, foraging and other purposes. The dams and reservoirs serve as barriers to migration and contribute to fragmentation of previously connected habitats. For example, impaired access to traditional spawning and rearing areas has affected genetic diversity of some fish populations. The Scott Caribou herd was bisected by the creation of the Williston Reservoir, preventing seasonal movements.

Productivity and Nutrient Loss

Basin-wide losses in primary productivity (i.e., the conversion of solar energy into organic carbon) are related to the loss of ecosystems in the area inundated by Williston and Dinosaur reservoirs. A complex system of terrestrial and aquatic primary productivity has either been lost or modified to ecosystems that are generally less productive. This has included large areas of river, lake and tributary stream habitats which have been replaced by reservoir aquatic habitats that are generally less productive.

Greenhouse Gases

The carbon cycle in forests typically results in a net-zero greenhouse gas budget, because forests and wetlands act as natural balances between CO₂ and CH₄ (Rosenberg et al. 1997). The flooding of boreal forests and wetlands upsets these natural balances and results in a net release of greenhouse gases that may persist for up to 100 years. Factors which contribute to the volume of gas releases include: the amount of flooding involved, the age of the reservoir, the amount of biomass flooded, and the geographic location of the reservoir. Reservoir surfaces are also considered an additional potential source of GHG emissions (St. Louis et al. 2000).

Water Quality and Turbidity

Dams often affect water quality both within and downstream of reservoirs. Large reservoirs tend to keep water temperatures warmer in the winter and cooler in the summer than natural lake environments (BC Hydro, 2012). In most situations, reservoirs also block sediment transfer and reduce turbidity which can benefit some species but not others (Ministry of Environment, 2008). Drawdowns can expose large mud flats, which can also contribute to poor air quality.

Bioaccumulation of Methyl Mercury

Methyl mercury is a byproduct of the decomposition of organic materials flooded during the course of reservoir creation. First Nations have identified this as an important concern given its potential impact on human health. Methyl mercury accumulates in fish and is passed on to higher trophic levels through consumption. A 2010 report prepared for BC Hydro indicates that methyl mercury levels in the Williston reservoir have declined to

naturally occurring background levels, however, the level of methyl mercury accumulation in many fish species is unknown⁷.

Entrainment

Fish entrainment is the volitional or involuntary movement of fish into and through water intakes of generating stations and spillways during the operation of water storage and diversion structures. The major impacts of entrainment on fish populations are injury, mortality and displacement of fish. Fish entrainment can be considered both a footprint and operational issue as both the existence and design of the water control infrastructure and how it is operated over time influence the level of impact. The Peace Water Use Plan for the Peace Basin considered entrainment a footprint impact, although entrainment is being addressed at BC Hydro facilities through a separate fish entrainment strategy.

Transportation Routes and Non-Hydro Impacts

Compounding the impacts to wildlife and their habitats, the creation of Williston and Dinosaur reservoirs opened new transportation routes for industry, leading to further confinement of wildlife into the less productive areas of the watershed. For example, transportation of timber by boom or barge has enabled forestry companies to more easily harvest distant drainages, affecting habitat for caribou. In general, linear disturbances such as roads, bridges, and water bodies related in whole or in part to the creation of the reservoir have increased opportunities for forestry, mining, oil and gas exploration and extraction, contributing to the cumulative impacts on species habitat and migration corridors. This can include poorly maintained road culverts which can act as barriers to fish migration and movement.

2.4 FWCP-Peace Accomplishments to date

The FWCP-Peace program was established in 1988 to address the footprint impacts from the creation of the Williston and Dinosaur reservoirs. From its inception FWCP-Peace projects were carried out primarily by a staff of five full time biologists, supported by contractors and academia with extensive involvement of agency staff, as well as with some involvement of the public and First Nations.

The FWCP-Peace undertook a variety of projects aimed at improving conservation and sustainable use of species of interest and their habitats. Projects involved a variety of approaches, including research and monitoring projects, habitat enhancement trials, species recovery initiatives and land acquisition to protect high-value habitats. Conservation efforts were separated between Wildlife (Table 1) and Fish (

⁷ For full report details see: [BC Hydro Site-C Technical Memorandum Mercury Data Review and Planning Considerations.](#)

Table 2) related projects.

Table 1 – Summary of Past FWCP-Peace Wildlife Projects

| Project Type | Objective, Method, and Examples |
|----------------------------|---|
| Habitat Mapping | <p>Program biologists prepared biophysical habitat and wildlife suitability maps for areas within the Williston Watershed. Terrain, vegetation, and wildlife experts investigated field sites to obtain information on environmental features, terrain, soil, vegetation, and wildlife use. Site data, in conjunction with existing information and air photo interpretation, were used to describe and map terrain and biophysical habitat units for the study area. These units were then used to determine the area's capability and/or suitability for the various wildlife species.</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Dunlevy Property Mapping (1991) – Habitat capability ratings were developed for Moose, Elk, Mule Dee and White Tailed Deer, which informed habitat enhancement activities. • Omineca Mapping (1992 to 1993) – 126 sites were sampled and classified for their capability and suitability for the various wildlife species. • Ospika River Drainage Habitat Summary (1990) – developed habitat capability and suitability maps for the lower Ospika River Drainage. • Peace Arm Habitat Mapping (1992) – Biophysical habitat classes were determined and wildlife habitat capability ratings were assessed for the eastern half of the Peace Arm. |
| Habitat Enhancement | <p><u>Forage enhancement</u> - To increase the abundance and availability of forage for several wildlife species, primarily ungulates (e.g., moose, elk, sheep), bears, and birds (songbirds and waterfowl). Methods - Prescribed burning and manual thinning.</p> <p><u>Snag and Cavity Enhancement</u> - To create snags and cavities for numerous wildlife (e.g., woodpeckers, owls, fishers, bats) that are dependent on tree cavities for nesting or denning sites. Methods - Girdling and drilling holes into trees.</p> <p><u>Wetlands Enhancement</u> – Project objectives were to maintain, conserve, and enhance wetlands for the numerous wildlife species that rely on or use these unique habitats. Techniques used at a site were dependent on the objective for the site. Some specific examples of techniques used included creating a permanent water-control structure to maintain or conserve a wetland integrity, obtaining special management designation for wetlands, conducting level-ditching to create nesting and foraging habitat, conducting prescribed burns to increase forage availability, and erecting artificial nesting structures such as nest boxes and floating islands.</p> <p>Project Examples:</p> <p><u>Forage enhancement projects:</u> Using prescribed burning and manual thinning of forests forage opportunities were improved for ungulates, bears, and birds. Specific project</p> |

| Project Type | Objective, Method, and Examples |
|--------------|---------------------------------|
|--------------|---------------------------------|

examples include:

- Ingenika River Burn 2000-2001
- Pelly Lake Prescribed Burn 1993
- Pesika Creek Prescribed Burn 1993
- Mischinsinlika Burn 1995
- Branham Burn 1993 and 1995
- Butler Ridge Burn 1994
- Omineca River Enhancement (Manual Thinning) 1992-1994

Wildlife tree retention, snag and cavity enhancements: By conducting trials to retain snags and wildlife trees during logging or modifying living trees, several projects attempted to improve nesting and denning sites for birds and small mammals. Specific Project examples include:

- Tutu/Mugaha Aspen Girdling 1993
- Cottonwood Tree Enhancement Trial – treatments involved boring holes in Cottonwoods to increase available nesting habitat. A 2010 follow up report showed that the treatments did not result in increased habitat.
- Donna Creek Forestry/Biodiversity Project – was designed to test alternative forest techniques intended to benefit wildlife that utilizes tree cavities and to monitor wildlife use of the harvested treatments at successive seral stages

Wetlands Enhancements: Various wetlands in the Peace Basin were subjected to a variety of treatments to enhance nesting and foraging opportunities for native flora and fauna. Specific Project examples include:

- Neilson Lake Wetland Enhancement Project – treatments involved construction of weirs, level ditches and small islands, and the construction of habitat features such as small floating islands and nesting boxes
- Rocky Marsh Enhancement Project – treatments involved the construction of an earthen dam as a water control structure; the construction of floating islands, nesting boxes and nesting tunnels to enhance habitat; and the construction of nature trails and observation decks.

| | |
|--------------------------------|---|
| <p>Land Acquisition</p> | <p>Goal of the project was to secure, and thus protect from development, privately-owned parcels of land that have high wildlife value within the Williston Reservoir watershed. Using funds provided in part by the FWCP-Peace, privately-owned properties were purchased by the Nature Trust of BC.</p> <p>Property titles are held by the Nature Trust but the lands are leased back to the Ministry of Environment through a 99-year agreement, which ensures that the lands are managed for the benefit of wildlife in the area.</p> |
|--------------------------------|---|

| Project Type | Objective, Method, and Examples |
|----------------------------------|--|
| | <p>Project Examples:</p> <ul style="list-style-type: none"> • Adams Property • Beattie Property • Dunlevy Property |
| <p>Weather Monitoring</p> | <p>Goal of the projects were to confirm, or assist in determining, an area's ungulate winter-range capability, and/or to characterize the meteorological conditions of a study area for a PFWWCP project.</p> <p>Snow-depth surveys: undertaken on replicate sites throughout the Williston Reservoir watershed were visited once a year by helicopter or vehicle to manually measure snow depths.</p> <p>Weather Stations: Remote microclimate stations were established to measure snow depth, ambient temperature, relative humidity, wind (speed and direction), and precipitation.</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Snow Depth Surveys • Weather Monitoring Stations |
| <p>Wildlife Species</p> | <p>The bulk of the Wildlife projects were undertaken in this category. Approximately 32 different projects were undertaken by staff wildlife biologists investigating: Amphibians and Birds, Large Carnivores, Small Carnivores, "Multi-Species", and Ungulates (Caribou, Elk, Moose, Mtn Goats, Stone's Sheep and "Ungulates Multi-Species")</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Parsnip Caribou Recovery Project – was designed to evaluate the feasibility of increasing the Parsnip mountain caribou herd by reducing wolf predation through a reduction in area moose numbers. • Ingenika River Elk Transplant – intended to supplement a small existing herd of elk in the Ingenika River drainage and establish a viable population (100-150 animals) in the area by March 2000. • McLeod Lake Grizzly Bear Study – was designed to determine which bears, based on their age, sex, and reproductive status, pose the greatest threat to humans after closure of a landfill and which bears do not. • Inventory of Fishers in the Sub-Boreal Forest of North Central BC – FWCP-Peace supported a five year inventory study designed to examine habitat relationships, spatial organization, and behaviour of Fishers in an industrial forest landscape from 1996 – 2000. The final report (2008) suggested that the Fisher population in the Williston region was relatively stable and possible nearing the carrying capacity for the area at the time. |

| Project Type | Objective, Method, and Examples |
|-------------------------|--|
| | <ul style="list-style-type: none"> • McKenzie Migratory Bird Monitoring Program – designed to determine the status and trends of neotropical migratory songbird populations in the northern Rocky Mountain Trench (near Mackenzie), and to identify those species that may be at risk from habitat loss and degradation. <p><i>Note: Complete listings and descriptions of individual projects were too large to include in this table. For additional project examples see:</i> http://www.bchydro.com/pwcp/wildlife/species.shtml</p> |
| Wildlife Viewing | <p>To inform the public about wildlife and their habitats, points of interest, project activities, and/or the Peace/Williston Fish and Wildlife Compensation Program.</p> <p>Methods - Signs were designed, developed, and erected at sites to inform and educate the public.</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Dunlevy Property • Mugaha Marsh • Neilson Lake Wetlands Enhancement Project • Rocky Marsh Wetlands Enhancement Project |

ARCHIVED
Not for current use

Table 2 – Summary of Past FWCP-Peace Fish Projects

| Project Type | Objectives, Methods, and Examples |
|---|---|
| Habitat Assessments | A large number of habitat assessments were completed by program staff on rivers and lakes in the region, which are available on the project database. Habitat assessment projects were primarily related to reservoir water temperature studies, studies on water quality and quantity in benthic and pelagic depths, and limnological assessments of embayments in a variety of the reservoirs arms and reaches. |
| Habitat Enhancements | <p>Initial work during the mid-1990s assessed the suitability of various small lakes and reaches of the reservoir for habitat enhancement projects. Species-specific enhancement studies were conducted simultaneously. Enhancement projects included lake fertilization feasibility studies, and aquatic plant enhancement potential. Habitat enhancement assessments continued to be a focus of program activities from 1990-2010.</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Mesilinka River multi-year fertilization trial (1990s). • Dinosaur Lake aquatic plant enhancement potential (2000). • Carbon Creek side channel enhancement (1995). • Dinosaur Reservoir littoral fish population and habitat enhancement assessments (2004). |
| Reservoir Evaluations | <p>Initial work focused on the bathymetry of Williston and Dinosaur reservoirs and enhancement feasibility studies. Later work focused on population assessments of pelagic species. The latest document listed on the website is a history of fish introductions in the Williston Reservoir.</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Williston and Dinosaur reservoirs creel surveys to evaluate angler effort, catch and preferences (1989, 2000) • Limnological surveys to evaluate and report on the water quality and productivity of the reservoirs (multi-year) • Williston Reservoir Fish Assessments using hydroacoustic, trawl and gill net surveys (2000) |
| Small Lake Surveys, Assessments and Fish Stocking. | <p>Projects in this category include several project types such as inventory and research on rare fish species, evaluations for habitat enhancement, reconnaissance surveys to evaluate for stocking opportunities and the assessment of stocked lake fisheries to ensure they are achieving objectives.</p> <p>Project Examples:</p> <ul style="list-style-type: none"> • Artic Grayling distribution and habitat use in the Table and Anzac rivers (2004). |

-
- Pygmy Whitefish studies on Dina Lake (2001).
 - Fish stocking assessments (multi-year).
 - Small lake inventory and enhancement program (multi-year).
 - Fish population status assessments (multi-year).
 - Creel surveys to evaluate angler effort, catch and preferences (multi-year).
-

Note: Complete listings and descriptions of individual projects were too large to include in these tables. For additional project examples see the [FWCP-Peace Website](#).

ARCHIVED
Not for current use

3. Strategic Objectives for FWCP

Strategic objectives for the Fish and Wildlife Compensation Program reflect a synthesis of the core objectives and mandates of the partner agencies as they relate to mitigating impacts of hydropower dam and reservoir construction in British Columbia. Conservation and sustainable use are core objectives for both the BC Provincial Government and Fisheries and Oceans Canada.

Conservation includes actions taken to ensure the long term viability of fish, wildlife and their supporting ecosystems. Actions may include measures that protect, maintain or restore individual populations of species or their habitats. At a larger scale, actions may also focus on ecosystem integrity and productivity.

Sustainable use incorporates the human interest in utilizing species for sustenance, recreational, or cultural purposes. Actions would typically include various forms of enhancement that would improve the abundance or availability of desired species. Enhancement proposals for one species must carefully consider (and avoid) potential conservation impacts to other species.

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

The FWCP strategic objectives are:

Conservation

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

Sustainable Use

- **Maintain or improve opportunities for sustainable use, including harvesting and other uses.**
This objective focuses on the program's role in restoring or enhancing the abundance of priority species and in providing information to resource

management decision makers related to providing opportunities for harvesting and other uses. Harvesting includes First Nations, recreational, sport and commercial harvests. Other uses may include cultural, medicinal, or non-consumptive uses.

Community Engagement

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

ARCHIVED
Not for current use

4. Priorities

4.1 Introduction

Across all basins and watersheds where the FWCP operates, the general process of identifying priorities involves three basic steps:

Step 1 – Identification (Candidate Priority Species and Ecosystems)

The first step involves identifying and prioritizing the species and ecosystems against the core strategic objectives (conservation, sustainable use, and community engagement), and understanding how they have been affected by hydro-power development footprint impacts.

Step 2 – Preliminary Planning

This step consists of identifying action plans based on a review of the prioritized species and ecosystems. The scope of the action plans is defined by logical groupings of species and/or ecosystems. Other key considerations include: limiting factors, exploring the opportunity for multiple benefits, addressing specific local threats, the feasibility of implementing actions, and alignment with existing agency programs.

Step 3 – Final Planning and Prioritization

This step identifies specific actions within each action plan, stratified by focal area (where appropriate). Actions are selected according to cost effectiveness and technical feasibility criteria:

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

4.2 Priority Setting in the Peace Basin

The FWCP Strategic Objectives served as the foundation from which regional priorities and actions were framed and developed through a community based strategic planning process. The strategic planning process was guided by a Strategic Planning Group (SPG) consisting of the FWCP-Peace Board and technical working group members (which included representatives from the public, partner First Nations, government agencies, and BC Hydro). Three technical working groups (Fish, Wildlife, and First Nations) were established to provide input into the development of the plans. As well, the planning process was guided through broader public input received through three community meetings and a web-based survey. In total, there were approximately ten planning meetings supporting the strategic planning process towards the development of the strategic plans (Species of Interest, Uplands, Riparian and Wetlands, Streams, Lakes, and Reservoirs Action Plans).

Step 1 – Identification of candidate priority species and ecosystems involved a number of steps including: preliminary background research, discussions during Strategic Planning Group workshops, key informant interviews with past FWCP program staff and knowledgeable experts, and input from the technical working groups.

Step 2 – Preliminary planning was guided by the choice to assemble action plans by five major ecosystem categories and one species category (Table 3).

Table 3 – Action Plan Categories chosen for the Peace Basin

| Action Plan Category | Scope |
|-----------------------|--|
| Species of Interest | Focused on improving conditions for wildlife whose populations are at risk or of particular community interest. |
| Uplands | Focused on improving conditions in upland areas within the Basin but outside the direct influence of streams, lakes and reservoirs. |
| Riparian and Wetlands | Focused on improving conditions in wetlands and the highly productive habitats adjacent to streams. |
| Streams | Focused on improving conditions for aquatic species (fish, insects, etc.) in streams and tributary rivers that drain into the Williston or Dinosaur reservoirs. |
| Lakes | Focused on improving conditions for aquatic species found in small and large lakes in the upper Peace River Basin (does not include Williston or Dinosaur reservoirs). |
| Reservoirs | Focused on improving conditions for aquatic species found in Williston and Dinosaur Reservoirs. |

Within each ecosystem category, a preliminary review of existing information along with key informant interviews and technical working group (TWG) meetings was undertaken to

identify opportunities and limiting factors for fish and wildlife projects. Based on this understanding, a set of preliminary plan-specific objectives were developed to set the basis for identifying potential actions. These objectives were reviewed and refined at various points in the planning process⁸ and were influenced by a number of factors:

1. Importance to communities;
2. Vulnerability or rarity of the species or ecosystem;
3. Technical soundness/existing knowledge gap;
4. Feasibility of achieving the objective/sub-objective within the existing budget and a 5-year timeframe; and,
5. Limits and trade-offs within ecological systems⁹.

Guided by the preliminary plan-specific objectives, candidate actions (e.g. monitoring, studies, specific enhancement projects, etc.) were initially identified and then reviewed, screened, and refined during subsequent technical discussions and meetings; this led to a series of preliminary actions for each of the draft Action Plans.

Step 3 – Final planning and prioritization of the preliminary actions was based on assessments carried out by the TWG, feedback received during the public workshops and on-line survey, and as agreed to by the SPG. Prioritizing the preliminary actions was based on criteria related to technical feasibility, cost-effectiveness, policy alignment criteria, and the priorities identified during the public workshops and completed surveys.

Preliminary actions were also reviewed within the context of other known projects or planning initiatives. In some cases, preliminary actions were identified from other initiatives / plans given the common objectives with the FWCP-Peace Action Plans. For example, while woodland caribou was identified as a high priority in the Species of Interest Action Plan, one recommended action was to implement projects within approved recovery strategies such as the Peace Northern Caribou Plan¹⁰.

The relative priority of identified actions and Action Plans was discussed and it was generally agreed that an equal area of emphasis or effort should be placed between the fish (Streams, Lakes, and Reservoirs) and wildlife (Species of Interest, Riparian and Wetlands, Uplands) Action Plans. Within the Fish Action Plans, the Streams Action Plan was considered the highest priority followed by the Lakes Action Plan and finally the Reservoirs Action Plan. For the Wildlife Action Plans, the Species of Interest Action Plan was

⁸ During SPG workshops, technical working groups, public workshops, and based on feedback received through the on-line survey.

⁹ It needs to be emphasized that during the priority setting process, biological limits and trade-offs were acknowledged between some of the objectives, given the finite nature of ecosystems (i.e. projects that improve the status for one species or ecosystem, may have detrimental effects on others).

¹⁰ BC Ministry of Environment. 2013. Implementation plan for the ongoing management of south Peace northern caribou (*Rangifer tarandus caribou* pop. 15) in British Columbia. Victoria, BC.

considered the highest priority followed by the Riparian and Wetland and then the Uplands Action Plans.

An emphasis of the Action Plans was towards on the ground activities and enhancement projects that improve conditions for species and their habitats as soon as possible. As such, the concept of targeting a notional amount of funding towards these on the ground activities was agreed to with the further goal that these targets should increase over time (e.g. 25% growing to about 45% over five years). It was recognized that some studies or monitoring will be important pre-requisites to facilitate this and therefore these costs could be included within these targets under some conditions. Further, an improved understanding of the dynamics of species and ecosystems in the Peace Basin is an essential component to achieving the plans' conservation and sustainable use outcomes. Information and knowledge acquired through FWCP projects can (and has) influenced decisions made outside of the program.

Actions identified in the plans have resource requirements that in aggregate exceed the FWCP's ability to fund; therefore, setting priorities among actions will be required as the program is implemented on a year to year basis.

4.3 Stewardship and Education Funding

Although the bulk of FWCP project investments are expected to be guided by the six Action Plans, FWCP program activities may include small-scale and/or short-duration strategic projects that target specific issues identified by program partners or others (e.g., community members). It was agreed during the planning process to highlight some community based projects under a separate category of "Stewardship and Education" to better facilitate projects not (necessarily) directly aligned with the objectives of the Action Plans, but consistent with the overarching FWCP strategic objective for community engagement (see Section 3). Projects that fall under this category would have a high educational, volunteer and/or community engagement component. Previous examples include bird banding work that promoted education and depended on significant volunteer support, and was supported by multiple organizations, or educational actions that promote learning at a higher level and/or broadly within local communities and/or within school systems whether K-12 or college/university.

Review criteria will be developed by the FWCP-Peace Board for projects that are applied to under this new category. It should be highlighted that stewardship and education activities are still strongly encourage as components of all the actions identified within the Action Plans.

5. Action Plan Summaries

The six priority action plans for the Peace Basin are summarized below. The full plans can be accessed on the [FWCP website](#).

The Streams, Lakes, Reservoirs, Riparian and Wetlands, and Upland Action Plans focus on overall ecosystem health and diversity in support of multiple fish and wildlife species. The objectives and sub-objectives within these plans have an ecosystem focus, and the plans include habitat-based actions, supported by research, information acquisition, assessments and monitoring actions.

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

All six action plans in the Peace Basin provide broad support to the FWCP strategic objectives for conservation, sustainable use and community engagement. FWCP partners and interested parties may examine the action plans with a primary viewpoint stemming from an interest in either individual species or ecosystems and habitats. The action plans contain cross references, such as species-habitat association lists, that help to guide the interactions across action plans.

Each action plan provides information on the impacts and threats, limiting factors, and trends and knowledge status. Next, specific objectives, sub-objectives, and actions are outlined, described and prioritized. The individual actions for each objective provide direction to proponent proposals and, in general, are assigned to the following sub-categories:

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

During the 5-year implementation cycles for the Action Plans, the Board will periodically review the plans and will update and modify as necessary to ensure the Program continues to address current priorities. These updates to the action plan tables will then be forwarded to the Program Manager who will place them on the FWCP-Peace program website.

It is noted that some actions were broader than any one Action Plan and in these instances a number of 'cross plan' actions were highlighted in the relevant Action Plans (found in Section 4.1).

Below is a brief summary of the action plans highlighting the rationale, focus, and expected outcomes for each.

5.1 Species of Interest Action Plan

Rationale

The Species of Interest Action Plan aims to benefit specific terrestrial species that are of particular interest to First Nations and stakeholders by improving habitat conditions and addressing information needs. Because other agencies have direct responsibility for management of these ecosystems and associated species, the emphasis in this plan is on coordination with other organizations and supporting feasible management actions.

"Species of interest" are defined as terrestrial species or guilds that are important to communities or are of particular conservation concern, but are not adequately addressed by ecosystem-based management. These include some species-at-risk or some plants and animals used for food or cultural purposes.

The primary impacts and threats from dam construction on terrestrial species of interest are related to the initial impacts of inundation (habitat loss and fragmentation, migration barriers, and productivity losses). Secondary impacts result from new aquatic and terrestrial transportation routes that facilitated increased opportunities for economic activity in the region, resulting in both positive and negative impacts to species populations and their habitats, depending on the species under consideration.

Factors limiting the abundance and distribution of terrestrial species of interest are related to three broad categories: **habitat extent, distribution and productivity**. The extent of suitable habitat, affected by primary and secondary impacts above, may be improved by the creation of new habitat or by treatments that increase local carrying capacity. Connectivity among habitats is important for dispersal of plants and animals and for seasonal movements of some species; improving the connectivity of remaining habitats or transplanting individuals to unoccupied or underutilized habitats may improve distribution of habitats. The productivity of an ecosystem is defined as its ability to grow or yield native plants and animals. Even where habitat extent and connectivity is intact the productivity of habitats maybe affected by invasive species, soil erosion and changing drainage patterns among others. Addressing these factors can increase productivity by providing more suitable habitats for native species.

Long-term monitoring data are generally unavailable for terrestrial species; as a result, our knowledge of pre-dam populations is limited to anecdotal accounts or inferences made from general habitat impacts. Trend information for some species (e.g., ungulates) has become more available over the past 25 years. More recently, a focus on threatened and

endangered wildlife has improved our knowledge of the distribution and abundance of these species; however, there remain significant gaps in the Peace basin.

The primary aim of the Species of Interest Action Plan is to develop species-specific actions to maintain or improve the abundance, distribution and trends in species of interest populations in the Peace Basin. These actions will be developed and implemented in conjunction with the habitat-based actions in the other Action Plans described below.

Focus

Management for species of interest ultimately rests with provincial and federal government agencies, but FWCP contributes resources towards planning and implementation of management actions that benefit species within its program area, usually based on the outcomes of multi-agency planning processes. FWCP's mandate limits its involvement in species of interest management to activities that meet FWCP objectives.

The plan describes in detail the management objectives and actions required to meet (and revise) the program goals over time. There are four high level objectives with rationales defined for this action plan:

1. **Support conservation of species at risk:** there are 70 species within the Peace Basin which are classified as either blue- or red-listed species by the BC Conservation Data Centre. The FWCP-Peace endeavours to improve the understanding of abundance, distribution, and trend of species at risk and contribute to the conservation and enhancement of their habitats by working within its mandate.
2. **Protect and enhance populations of important furbearers:** First Nations and other resource users have expressed concern over observed declines in several important species of furbearers. The FWCP-Peace seeks to support actions and projects which improve the understanding of abundance, distribution, and trend, of important furbearers; and conserve or enhance existing habitat, and enhance populations where feasible.
3. **Protect and enhance populations of important ungulates:** Ungulates provide sustenance, cultural, and recreational opportunities for First Nations and the broader public. Their populations are affected by a number of habitat and non-habitat effects (e.g. predation, regulated and unregulated harvest, etc.). The FWCP-Peace supports the provincial mandate to manage the ungulate populations within the watershed and to restore and enhance important habitat where appropriate.
4. **Protect and enhance plants and animals that are culturally important:** In addition to species at risk, furbearers and ungulates, there are species used by First Nations for food, medicine and cultural purposes. Maintaining or improving the abundance, distribution, and trend of these species is seen as critically important by First Nations using the Peace basin.

Expected Outcomes

The Species of Interest Action Plan attempts to focus efforts on a few, key areas and consequently generate the following outcomes:

- Improve our understanding of the current abundance, distribution, and trend, of species at risk, furbearers, ungulates, and culturally important plants and animals;
- Improve habitat conditions for priority species of risk and ungulate populations, where appropriate; and,
- Improve coordination between FWCP objectives and other existing planning and management activities in the Peace basin.

5.2 Uplands Action Plan

Rationale

The Uplands Action Plan addresses the area within the Peace watershed above the direct influence of the Williston and Dinosaur reservoirs. This large and diverse area is comprised primarily of forests, subalpine and alpine habitats. Because of the size of the basin the Uplands Action Plan focuses effort on ecologically important habitats (e.g., wildlife habitat features and rare or endangered plant communities) and other areas heavily impacted by human use.

As a proportion of the basin the upland area directly affected by construction and operation of the Williston and Dinosaur reservoirs is relatively small, although most of the approximately 1,780 km² now inundated was lowland habitat consisting of riparian, wetland and upland areas. Because lower elevation upland habitat was flooded, these areas were likely the most productive of the upland habitats¹¹.

There have been a variety of stressors since dam construction and the creation of the reservoirs that have continued to affect adjacent uplands, including forest harvesting, mineral exploration, petroleum and natural gas exploration, and related secondary development. These activities have greatly expanded the regional road network, leading to additional human-related pressures such as erosion, increasing hunting and recreation pressures, and the introduction of invasive species.

¹¹ Pre-construction surveys were conducted to determine habitat extents and species composition however, they were not available at the time of writing.

Factors limiting upland habitat fall into three broad categories: **habitat extent, distribution and productivity**. The extent of suitable habitat, affected by primary and secondary impacts, may be improved by the creation of new habitat or by treatments that increase local carrying capacity. Connectivity among habitats is important for dispersal of plants and animals and for seasonal movements of some species; improving the connectivity of remaining habitats or transplanting individuals to unoccupied or underutilized habitats may improve distribution of habitats. The productivity of an ecosystem is defined as its ability to grow or yield native plants and animals. Even where habitat extent and connectivity is intact the productivity of habitats may be affected by invasive species, soil erosion and changing drainage patterns among others. Addressing these factors can increase productivity by providing more suitable habitats for native species.

Focus

The primary aim of the Upland Action Plan is to restore or enhance the functioning of ecologically important ecosystems through habitat improvements, reducing threats, and encouraging compatible uses. Because other agencies have direct responsibility for management of these ecosystems and associated species, the emphasis in this plan is on coordination with other organizations and supporting feasible management actions.

The plan describes in detail the management objectives and actions required to meet (and revise) the program goals over time. There are three high level objectives with rationales defined for this action plan:

1. **Improve the understanding of the abundance, distribution, trend, and connectivity of ecologically important upland habitats:** Due to the vast size of the Peace Basin the Uplands Action plan will focus on “ecologically important habitats” such as mineral licks and wallows for ungulates, nesting sites for bird species at risk, roost sites for bats, and red- or blue-listed ecological communities. The current distribution of these features and ecosystems in the Basin is not well characterized.
2. **Conserve or enhance the integrity of ecologically important habitats:** Because ecologically important habitats are often vulnerable to human-related disturbance or modification, there may be opportunities to improve their function through habitat-related actions such as site rehabilitation (e.g., replanting native vegetation).
3. **Reduce threats to ecosystem function:** reducing threats from non-native species and other human caused impacts is an important mitigative step in the conservation of ecologically important habitats. Actions such as improving stewardship of private land are effective measures to achieve this.

Expected Outcomes

This Uplands Action Plan is ecosystem based and intended to achieve the following outcomes:

- Understanding the current distribution, function, and connectivity of ecologically important upland habitats and identifying opportunities to restore function;
- Reducing threats to ecologically important uplands through direct habitat improvements (e.g., by conducting prescribed burns) or encouraging more compatible land uses (e.g., by providing extension resources); and,
- Improved coordination with existing planning and management activities in the Peace basin (e.g., addressing invasive plant infestations).

5.3 Riparian and Wetlands Action Plan

Rationale

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 nor is one proposed for this Action Plan.

Factors limiting riparian and wetland habitat fall into the following three broad categories: **habitat extent** has been compromised due to losses from inundation and is considered the most important limiting factor; **distribution** is important for dispersal of plants and animals yet the distribution of riparian and wetland habitats is impacted by land uses and extent; **productivity** is defined as the ability to grow or yield native plants and animals, and is impacted by hydrological conditions, stressors such as invasive species, and loss of habitat features such as nesting cover and tree cavities, among others.

The primary aim of the Riparian and Wetlands Action Plan is 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 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. As such, collection of this baseline information will be a priority for the Riparian and Wetlands Action Plan (Objective 1 below).

Focus

The plan describes in detail the management objectives and actions required to meet (and revise) the program goals over time. There are three high level objectives with rationales defined for this action plan:

1. **Improve the understanding of the abundance, distribution, trend, and connectivity of riparian and wetland ecosystems:** This is regarded as a critical first-step in identifying opportunities to restore or enhance existing habitat, or to create new riparian and wetland habitat. Working in concert with the Peace Water Use Plan program the FWCP will support projects which improve the knowledge base of the current abundance, distribution and trend in species populations and their habitats in riparian and wetland ecosystems in the watershed.
2. **Conserve or enhance the ecological integrity of riparian and wetland ecosystems:** Based on the results of the inventory described above the FWCP-Peace may support projects which restore, enhance, and / or create riparian and wetland habitat.
3. **Reduce threats to ecosystem function:** 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 actions to reduce invasive weeds or mitigate impacts on native plants caused by domestic stock (e.g., grazing, browsing and trampling). Related to these actions, the FWCP-Peace may also invest in projects which reduce threats through the purchase or management of privately held land which is deemed to be ecologically significant.

The Riparian and Wetlands Action Plan highlights the need to inventory existing riparian and wetland habitats in the basin. The inventory is considered critical for undertaking future actions which seek to enhance or conserve the existing habitats.

Expected Outcomes

The expected outcomes of the Riparian and Wetlands Action Plan include:

- Understanding the current distribution, function, and connectivity of existing riparian habitats and opportunities for restoration and enhancement;
- 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
- Improved coordination with existing planning and management activities in the Peace basin (e.g., addressing invasive plant infestations).

5.4 Streams Action Plan

Rationale

The loss of functional stream habitat stands out as one of the most notable impacts from development of dams and reservoirs in the Peace basin¹². The creation of Williston and Dinosaur reservoirs resulted in large-scale habitat change, including a reduction of stream habitat that was converted to lake-like reservoir habitat. Although no formal inventory of the cumulative loss of stream habitat due to inundation has occurred, given the size and topography of the basin it is reasonable to assume that a large amount of natural stream habitat was lost due to inundation.

Impacts from dam construction can be categorized into hydro and non-hydro related impacts. Inundation resulted in large-scale habitat change as described above. In general, this change has favoured opportunistic lake-dwelling species and impacted stream-dependent species (Blackman et al. 1990). Changes in aquatic species abundance and distribution have likely influenced inter-specific competition and predation patterns (Beauchamp et al. 1995), which has likely had a positive effect on some species and a negative effect on others. Non-hydro impacts have occurred from increased access on BC Hydro roads and through water-based transportation routes. Forestry, oil and gas, mining, and pipeline-related activities may have contributed to increased siltation in stream beds, loss of stream bank vegetation, and other cumulative impacts, which result in additional stresses on aquatic ecosystems. These activities have not been specifically assessed as part of the Streams Action Plan, but they can result in habitat loss and direct effects on fish populations.

Limiting factors in streams include **extent, connectivity, and productivity of habitat**. There are many kilometers of remaining tributary habitat, but only short sections are accessible due to the presence of barriers. This is generally considered the most important limiting factor for streams. Connectivity among stream 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. Stream productivity is in turn limited by fluctuations in stream flow, nutrient levels, changes in temperature and various environmental stressors (e.g., invasive species, disruptive human activities).

Current knowledge on the trends and status of streams in the watershed has been developed through a review of previous program work and a review of the academic and grey literature. General stock trends show a decline in the abundance of stream-dependent species (such as Mountain whitefish and Arctic Grayling), while reservoir / lake-dependent species (such as Lake Whitefish, Peamouth Chub and Lake Trout) have "invaded" the reservoir from upstream lakes following inundation. Healthy populations of Arctic Grayling and Mountain Whitefish survive in tributaries to the reservoir, while Bull

¹² Streams, for the purposes of this action plan, include all tributaries within the Peace basin that flow directly into the Williston and Dinosaur reservoirs.

Trout, which are also dependent on remaining stream habitats for spawning and early rearing, have been able to use the reservoir for adult rearing and feeding.

The primary aim of the Streams Action Plan is to take a habitat-based approach to ensure a productive and diverse aquatic ecosystem. The plan also aims to improve the status of species of conservation concern.

Focus

The Streams Action Plan addresses all tributaries within the upper Peace basin that drain into the Williston and Dinosaur reservoirs. There are many, diverse streams within the upper Peace basin, ranging from small creeks to major river systems.

The plan describes in detail the management objectives and actions required to meet (and revise) the program goals over time. Below are the three high level objectives for this action plan, along with a rationale:

- 1. Conserve or enhance high priority species and habitats.** Williston and Dinosaur reservoirs inundated river and tributary habitat, which triggered a shift in species from those preferring riverine habitats (e.g., Arctic Grayling) to those adapted to large lake environments (e.g., Lake Trout). Native species and their habitats as well as species valued for human consumption are a FWCP-Peace priority. This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats.
- 2. Improve understanding of status and trends of aquatic ecosystem health.** The status and trends of many habitats and species (native and introduced) have shifted since the reservoirs were created, and a better understanding of these changes will facilitate effective enhancement. This work will require review of existing information, developing a cost-effective monitoring program, and monitoring key indicators of ecosystem health (i.e., species and/or habitats).
- 3. Sustain or enhance opportunities for human use of fish.** Streams are the most impacted aquatic habitat in the basin while also being the most used and highly valued aquatic habitat. This objective acknowledges the role the FWCP-Peace may play in supporting efforts to sustain or enhance sustenance and angling opportunities.

Expected Outcomes

The proposed actions in the Streams Action Plan build on past projects and leverage their results to address outstanding needs in the Peace basin. The expected outcomes of the Action Plan include:

- Understanding current distribution, function, and connectivity of ecologically important stream habitats and populations, and identifying opportunities to conserve and restore function;

- Improved ecological functions of streams through habitat improvements;
- Improved sustenance use and angling opportunities; and
- Improved coordination with existing planning and management activities in the Peace basin.

5.5 Lakes Action Plan

Rationale

Lakes play an important role and provide critical ecosystem components for many aquatic and terrestrial plant and animal species and are a valuable freshwater resource for humans (Schiefer & Klinkenberg 2004). The Peace basin contains 20 large lakes (>1,000 ha); 91 medium lakes (>100 & <1,000 ha); and 2,547 small lakes (<100 ha) (Blackman *et al.* 1990). There are no natural lakes larger than 10,000 ha within the watershed (Schiefer and Klinkenberg 2004). The number of Peace Basin lakes inundated by the reservoirs is unknown; however, it is considered that there has been a substantial loss of this habitat type. Small lakes are often productive, the fisheries resource is relatively easy to access, and this is the only habitat type where carefully managed fish stocking can be feasibly used to improve opportunities for use (however, this is a limited option and must meet provincial policy on stocking – see Lakes Action Plan Section 2.3). Habitat improvements are more likely to be meaningful at the scale of small lakes than at the scale of large reservoirs.

Non-hydro impacts from industry access roads have increased the angling pressure on once remote lakes. Roads and reservoir-based transportation provide additional routes for introduction of invasive species, while poorly built and maintained culverts can act as barriers to fish migration and movement.

Limiting factors in lake habitat fall into the following categories: **extent, connectivity, and productivity**. The extent of lake habitat declined as a result of inundation as lakes were replaced by more extensive but less productive reservoir habitat. Connectivity among lakes, and between lakes and streams is important for seasonal movement of some species and for spawning fish. The replacement of natural lake systems with reservoir habitat led to a decrease in productive lake habitat. This is because the Williston Reservoir, like all older reservoir systems, is ultra-oligotrophic affecting productivity of the region. As well the lower elevation lakes lost to inundation generally had higher species diversity than the higher elevation lakes that remain.

The primary aim of the Lakes Action Plan is to take habitat- and species-based approaches to ensuring a productive and diverse aquatic ecosystem capable of providing benefits like sustenance use and angling opportunities. The plan also aims to improve the status of species of conservation concern.

Focus

The Lakes Action Plan addresses natural lakes of all sizes within the Peace basin (Note, there is a separate Reservoirs Action Plan, which is specific to Williston and Dinosaur). The plan describes in detail the management objectives and actions required to meet (and revise) the program goals over time. There are three high level objectives:

1. **Conserve or enhance high priority species and habitats.** Natural lakes have been impacted by changes in fishing pressure. This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple fish species and habitats. Collating and reviewing existing information is regarded as a critical early step in identifying opportunities to restore or enhance native species.
2. **Improve understanding of status and trends of aquatic ecosystem health.** The status and trends of many habitats and species (native and introduced) have shifted since the reservoirs were created, and a better understanding of these changes will facilitate effective enhancement. This work will require review of existing information, developing a cost-effective monitoring program, and monitoring key indicators of ecosystem health (i.e., species and/or habitats).
3. **Sustain or enhance opportunities for human use.** This objective reflects the important sustainable use benefits that can be derived from a healthy fish population. Enhancement activities in lake systems may have either a species- or habitat-focus, and be developed in collaboration with agency partners, First Nations and all interested stakeholders.

Expected Outcomes

The expected outcomes of the Lakes Action Plan include:

- Understanding the current distribution, function, and connectivity of ecologically important lake habitats and populations, and identifying opportunities to conserve and restore function;
- Improved ecological functions of lakes through habitat improvements;
- Improved sustenance use and angling opportunities; and
- Improved coordination with existing planning and management activities in the Peace basin.

5.6 Reservoirs Action Plan

Rationale

The construction of the W.A.C. Bennett and Peace Canyon dams resulted in the creation of reservoir habitat in the Peace watershed. Due to geological conditions and background nutrient levels these reservoirs are ultra-oligotrophic (very low productivity). Williston Reservoir has a large annual drawdown and Dinosaur Reservoir has fast throughput of water, making both reservoirs very different ecologically relative to natural lakes in the region. Further, the inundation of terrestrial areas when a reservoir is created converts inorganic mercury into methyl mercury, and can ultimately result in elevated levels of mercury in the aquatic environment, especially in the first few years following reservoir creation. Mercury concentrations typically return to background levels 20-30 years later. Overall, the impact on fish populations from hydropower-related habitat changes in the Williston Reservoir is not well understood, and changes are likely still occurring. Some FWCP-Peace efforts have been initiated to address these knowledge gaps, but they have been limited by difficulties associated with monitoring fish (e.g., Kokanee) population sizes, structure, and trends in the large reservoir.

Limiting factors of the reservoir habitat in the Peace Basin are related to the steep topography of some reaches, entrainment of fish through the W.A.C. Bennett and Peace Canyon Dams, operational impacts to important rearing habitats, and generally low nutrient levels in the reservoirs which limit biological productivity.

The objectives of the Reservoirs Action Plan include an improved understanding of fish community interactions (e.g., between Kokanee and other species, and between Lake Trout and Bull Trout) to support managing for the long term viability of fish populations in the reservoirs. Another key objective is to improve understanding of fish impacts on human health through better understanding of trends in contaminant loads (e.g., mercury levels). The plan recognizes that the reservoirs support a variety of sustenance, recreation, and other activities for First Nations and local residents.

Focus

This Action Plan provides objectives and actions focused on improving reservoir habitat conditions in the Peace Basin¹³. The plan describes in detail the management objectives and actions required to meet (and revise) the program goals over time. There are four high level objectives with rationales defined for this action plan:

- 1. Conserve or enhance high priority species and habitats.** Williston and Dinosaur reservoirs inundated river and tributary habitat, which triggered a shift in species from those preferring stream habitats to those adapted to large reservoir environments. Native species and their habitats as well as species valued for human

¹³ Feedback received during development of the Action Plans indicated that reservoir habitats are of generally lower priority for FWCP investment than aquatic habitats in streams and lakes.

consumption are a FWCP-Peace priority. This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats.

- 2. Improve understanding of status and trends of aquatic ecosystem health.** The status and trends of many habitats and species (native and introduced) have shifted since the reservoirs were created, and a better understanding of these changes will facilitate effective enhancement. This work will require review of existing information, developing a cost-effective monitoring program, and monitoring key indicators of ecosystem health (i.e., species and/or habitats). A key component of this work will be to understand the role of Kokanee in the reservoir ecosystem, including past and likely future effects and trends.
- 3. Understand concentrations and pathways of mercury and other contaminants related to reservoir creation, and support defining risks for humans and the broader ecosystem.** This objective highlights the key concerns that local communities have related to mercury contamination in fish within the reservoir. Many local First Nations communities rely on fish for sustenance, some of which are long-lived, top predators (e.g., Bull Trout) with a propensity for bioaccumulation of toxins (BCMWLAP 2002).
- 4. Sustain or enhance opportunities for human use of fish.** Reservoirs are the lowest productivity aquatic habitats in the watershed and they are the hardest to evaluate or manipulate. There is nevertheless ongoing interest in the ecology of the reservoirs because they contribute to overall aquatic productivity in the region. This objective acknowledges the role the FWCP-Peace can play in supporting efforts to sustain or enhance sustenance and recreational fishing opportunities.

Expected Outcomes

The expected outcomes of the Reservoirs Action Plan include:

- Understanding the current distribution, function, and connectivity of ecologically important reservoir habitats and populations, and identifying opportunities to conserve and restore function;
- Improved ecological functions of reservoirs through habitat improvements;
- Understanding the effects of mercury and other contaminants on human health and the broader ecosystem, and addressing any potential effects in partnership with appropriate agencies;
- Improved sustenance use and angling opportunities; and
- Improved coordination with existing planning and management activities in the Peace basin.

6. Conclusion

There has been a significant loss of habitat and other related fish and wildlife impacts in the Peace Basin as a result of hydro-electric developments. To address these footprint impacts, the FWCP-Peace Basin Plan sets forth the strategic direction for the program in the Peace Region. It presents an overview of the program and its objectives derived from the mandates of the program partners and through the strategic planning process.

Overall program activities are summarized within six Action Plans, focused on Streams, Lakes, Reservoirs, Uplands, Riparian and Wetlands, and Species of Interest. The entire set of plans are intended to be living documents, updated and revised periodically as new information becomes available and priority projects are completed.

The latest status of all plans can be found on the [FWCP website](#).

ARCHIVED
Not for current use

7. Literature Cited

- Corbould, F.B., J.B. Ayotte, M.D. Wood, and G.W. Blackburn. 2010. Experimental evaluation of logging impacts on mineral-lick use by mountain goats, north-central British Columbia. Peace/Williston Fish and Wildlife Compensation Program Report No. 343. 65pp plus appendices
- Blackman, B.G., D.A. Jesson, D. Ableson and T. Down. 1990. Williston Lake Fisheries Compensation Program Management Plan, PFWWCP Report No. 58. 38 pp
- BC Hydro. 2012. Peace River Water Use Plan Peace River Baseline TGP/Temperature – GMSWorks-2 Year 3 Monitoring Program Interim Report January 2011 to December 2011
- Ministry of Environment. 2008. Ministry of Environment Fish and Wildlife Interim Objectives for Site C Project Area – Final Draft. MacDonald, David Andrew. 2009. Fish and Wildlife Compensation Program Strategic Framework Executive Summary.
- Baker, Douglas, Jane Young, and J. M. Arocena. 2000. "An Integrated Approach to Reservoir Management: The Williston Reservoir Case Study." *Environmental Management* 25 (5): 565–578. doi:10.1007/s002679910044.
- Rosenberg, D M, F Berkes, R A Bodaly, R E Hecky, C A Kelly, and J Wm Rudd. 1997. "Large-scale Impacts of Hydroelectric Development." *Environmental Reviews* 5 (1) (March): 27–54. doi:10.1139/a97-001.
- Schiefer, Erik, and Brian Klinkenberg. 2004. "The distribution and morphometry of lakes and reservoirs in British Columbia: a provincial inventory." *The Canadian Geographer/Le Géographe canadien* 48.3 (2004): 345-355.
- Stamford, M D, and E B Taylor. 2005. "Population Subdivision and Genetic Signatures of Demographic Changes in Arctic Grayling (*Thymallus Arcticus*) from an Impounded Watershed." *Canadian Journal of Fisheries and Aquatic Sciences* 62 (11) (November): 2548–2559. doi:10.1139/f05-156.
- Stockner, J., A. Langston, D. Sebastian, and G. Wilson. 2005. "The Limnology of Williston Reservoir: British Columbia's Largest Lacustrine Ecosystem." *Water Quality Research Journal of Canada* 40 (1): 28–50.
- St. Louis, Vincent L.; Kelly, Carol A.; Ducehmin Eric; Rudd, John W.M.; and Rosenberg, David. 2000. "Reservoir Surfaces as Sources of Greenhouse Gases to the Atmosphere: A Global Estimate." *Bioscience* Vol.50 No.9