

Columbia River Water Use Plan

Arrow Lakes Reservoir Wildlife Management Plan Physical Works

Annual Report: 2017

Implementation Period: March 2016 to February 2017

- **CLBWORKS-29A Arrow Lakes Reservoir: Wildlife Physical Works Feasibility Study**
- **CLBWORKS-29B Arrow Lakes Reservoir: Study of High-Value Wildlife Habitat for Potential Enhancement and Protection**
- **CLBWORKS-30A Arrow Lakes Reservoir: Implementation of Wildlife Physical Works – Revelstoke Reach**
- **CLBWORKS-30B Arrow Lakes Reservoir: Implementation of Wildlife Physical Works –Arrow Reservoir**

Conditional Water Licences for Kinbasket storage (27068 and 39432), Mica diversion (39431), Revelstoke diversion and storage (47215), and Arrow storage (27066)

March 31, 2017

BC Hydro Columbia River Project Water Use Plan Arrow Lakes Reservoir Wildlife Management Plan Physical Works Annual Report: 2017

1 Introduction

This document represents a summary of the status and the results of the Arrow Lakes Reservoir Wildlife Management Plan Water Use Plan (WUP) physical works to February 28, 2017, as per the Columbia River WUP Order under the *Water Act*, dated January 26, 2007 and the Amended Order dated August 23, 2007. There are two studies and two physical works.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Arrow Lakes Reservoir Wildlife Management Plan WUP studies and physical works were submitted to and approved by the CWR.

Table 2-1: Dates of Arrow Lakes Reservoir Wildlife Management Plan WUP TOR Submissions and Approvals by the Comptroller of Water Rights

Physical Works TOR	Order Clause	Original TOR Submission		Most Recent TOR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
CLBWORKS-29A Arrow Lakes Reservoir Wildlife Physical Works Feasibility Study	Schedule C, Clause 6.a Schedule D, Clause 6.a	Jan 24, 2008	Feb 20, 2008	Apr 30, 2009	Aug 05, 2009
CLBWORKS-29B Arrow Lakes Reservoir Study of High-Value Wildlife Habitat for Potential Enhancement and Protection	Schedule C, Clause 5.h Schedule D, Clause 5.c	Jan 24, 2008	Feb 20, 2008	Apr 15, 2009	May 11, 2009
CLBWORKS-30A Arrow Lakes Reservoir Wildlife Physical Works (Revelstoke Reach)	Condition List, Clause 4.a	Jun 27, 2011	Aug 02, 2011	May 13, 2016	Jun 27, 2016
CLBWORKS-30B Arrow Lakes Reservoir Wildlife Physical Works (Arrow Reservoir)	Condition List, Clause 7.a	Jul 07, 2016	Jul 26, 2016	Sep 23, 2016	Oct 04, 2016

3 Schedule

The following table outlines the current schedule for the WUP studies and physical works being delivered for the Arrow Lakes Reservoir Wildlife Management Plan WUP.

Table 3-1: Physical Works Schedule as of February 28, 2017

Physical Works	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6 Interim Review	WLR YR7	WLR YR8	WLR YR9	WLR YR10	WLR YR11	WLR YR12	WLR YR13
CLBWORKS - 29A Arrow Lakes Reservoir Wildlife Physical Works Feasibility Study	✓	✓F											
CLBWORKS - 29B Arrow Lakes Reservoir Study of High-Value Wildlife Habitat for Potential Enhancement and Protection				✓					✓F				
CLBWORKS - 30A Arrow Lakes Reservoir Wildlife Physical Works-Revelstoke Reach						✓	✓	✓	✓	■			
CLBWORKS - 30B Arrow Lakes Reservoir Wildlife Physical Works-Arrow Reservoir ¹									✓	■	■		

4 Physical Works Terms of Reference

The Physical Works being implemented under the Arrow Lakes Reservoir Wildlife Management Plan WUP are described in Terms of Reference. These Terms of Reference and the reports for work completed to date can be found here:

http://www.bchydro.com/about/sustainability/conservation/water_use_planning/southern_interior/columbia_river/arrow-wildlife.html

5 Status of Physical Works

5.1 CLBWORKS-29A Arrow Lakes Reservoir: Wildlife Physical Works Feasibility Study

This feasibility study was initiated in 2008 and completed in 2009.

The purpose of this study was to identify and assess wildlife physical works opportunities in Revelstoke Reach and provide guidance towards the implementation of those works by defining treatment options, methods and schedule. Phase I started with sites originally identified by the Consultative Committee during the development of the Columbia Water Use Plan. BC Hydro established a Wildlife Physical Works Committee (WPWC) with representation from BC Hydro, Ministry of Environment, Ducks Unlimited, First Nations, and local stakeholders to assess 45 potential sites.

In Phase II, the WPWC narrowed the projects to 35 potential sites on the basis of technical feasibility and costs, then to eight on the basis of biological and operational criteria. The eight were presented at an open house in Revelstoke in December 2009, and preliminary designs were subsequently developed for five projects.

Following the review of project costs and anticipated benefits, the WPWC endorsed three of the projects:

- Site 6A at Airport Marsh: including construction of a riprap mattress to halt the erosion of the east arm of the outflow channel located near Airport Marsh and Machete Island. The work also included the installation of nest boxes in the Revelstoke Reach area.
- Site 14 at Cartier Bay: including filling in the breach in the old CP railway grade to retain water behind the grade and create seasonal shallow open water habitat.
- Site 15A at Cartier Bay: including removal of an old collapsed wooden box culvert and reconstruction of the dike to be one metre higher than the present elevation.

The implementation of these three wildlife physical works projects is carried out under CLBWORKS-30A.

5.2 CLBWORKS-29B Arrow Lakes Reservoir: Study of High-Value Wildlife Habitat for Potential Enhancement and Protection

This feasibility study was initiated and completed in 2011.

The purpose of this study was to conduct a preliminary feasibility assessment for wildlife physical works opportunities on the middle to lower Arrow Reservoir (outside of Revelstoke Reach). At a stakeholder meeting in 2010, the original five high-value

habitat sites identified were reviewed and the following three sites were recommended for further assessment:

- creation of new shallow wetland habitat at Burton Creek;
- creation of new shallow wetland habitat at Edgewood South; and
- enhancement of existing shallow wetland habitat at Lower Inonoaklin Road.

A feasibility assessment was complete in 2011 that assessed the following aspects: hydrological (including substrate, topography, and natural water sources), ecological (wildlife enhancement potential), regulatory (permitting requirements) and financial.

The 2011 feasibility assessment was updated in the summer of 2016 to incorporate the findings from several WUP monitoring studies (CLBMON 11B, 12, 33, 37) and existing conditions on site. As a result of the re-evaluation of the ecological opportunity and risks of each site, the Edgewood South site was evaluated as a highly productive wetland; therefore, modifications to Edgewood were eliminated from further consideration to protect the existing ecological functioning of the site.

Attached is the 2016 update to CLBWORKS 29B report.

5.3 CLBWORKS-30A Arrow Lakes Reservoir: Implementation of Wildlife Physical Works – Revelstoke Reach

The objective of CLBWORKS-30 is to implement the recommendations from the feasibility studies (CLBWORKS-29A and 29B). To ensure the work reflects the terms of the Order which are specific to Revelstoke Reach and Mid to Low Arrow Reservoir, CLBWORKS-30 was separated into:

- CLBWORKS-30A for Revelstoke Reach; and
- CLBWORKS-30B for Arrow Reservoir.

CLBWORKS-30A includes the detailed design, the construction, and ongoing maintenance of the three projects identified in CLBWORKS-29A:

- Site 6A at Airport Marsh,
- Site 14 at Cartier Bay, and
- Site 15A at Cartier Bay.

Site 6A was completed in October 2013. Nest boxes (wildlife enhancement structures) were installed in 2013 and 2014.

As summarized in depth in the 2015 Annual Report, an Ecological Impact Assessment (EIA) was completed in 2015 which concluded that it is very uncertain whether the proposed projects at Cartier Bay (Site 14 and 15A) would create net ecological benefits. The EIA recommended not proceeding with the original design for Site 15A, and identified very limited benefit of the works proposed for Site 14.

BC Hydro decided not to expand the Cartier Bay wetland as originally proposed in January 2013 based on public concerns, the results of the EIA, an independent review from a wetland restoration specialist and an extensive review of wildlife monitoring in the area. These reviews indicate that Cartier Bay currently has high quality wildlife habitat that may be put at risk by altering the wetland.

BC Hydro subsequently revised the scope of the project to eliminate Site 14 and modify the design at Site 15A to reinforce the existing rail bed at the site of the wood box culvert. This would maintain and protect the existing wetland as it is currently functioning. The Cartier Bay wetland (Site 15A), approximately 26 hectares in size, was created by a filled, collapsed box culvert at the bottom of a gap in the abandoned railbed that runs 300 metres west of the Cartier Bay peninsula and parallel to the old highway. The collapsed culvert holds back water and prevents the Cartier Bay wetland from draining as the Arrow Lakes Reservoir water levels drop. The box culvert was eroding, putting the wetland at risk from draining.

A revised approach for Site 15A was approved by the CWR on November 18, 2015. Delays associated with obtaining Provincial Dam Safety's approval of the new design and related water conservation license deferred the project construction until the fall of 2016.

In October 2016, BC Hydro installed rock rip rap on the river side of the old rail line at the box culvert to protect the wetland and reinforce the box culvert of Site 15A. The remaining wildlife enhancement structures are planned for installation in 2017.

The project report for CLBWORKS 30A will be submitted with the next Annual Report.

5.4 CLBWORKS-30B Arrow Lakes Reservoir: Implementation of Wildlife Physical Works – Arrow Reservoir

CLBWORKS-30B includes the detailed design, the construction, and ongoing maintenance of the three projects identified in the 2016 update to CLBWORKS-29B:

- Burton Creek,
- Edgewood South, and
- Lower Inonoaklin Road.

Burton Creek is located south of Nakusp, on the east side of Arrow Lakes Reservoir. The Lower Inonoaklin site is located south of the Fauquier ferry on the west side of Arrow Lakes Reservoir. Edgewood South is located immediately south of the confluence of Eagle Creek on the west side of Arrow Lakes Reservoir. As the Edgewood site is already a highly productive wetland, it was eliminated from further consideration as it carries the most risk that the existing functional wetland could be negatively impacted by any further modification.

Once the designs for these sites are available, BC Hydro will share them with local government, stakeholders and the public and will seek input on the proposed designs in the summer of 2017. BC Hydro expects to submit a Terms of Reference for the Implementation Phase of this project by September 15, 2017.

Implementation will require suitable conditions in terms of water levels, ground conditions, etc. Assuming all regulatory requirements are met, the earliest date of wetland modification would be in the spring of 2018.

6 Physical Works Costs

The following table summarizes the Arrow Lakes Reservoir Wildlife Management Plan WUP physical works costs approved by the Comptroller and the Actual Costs to February 28, 2017.

Table 6-1: Arrow Lakes Reservoir Wildlife Management Plan WUP Physical Works Costs

Monitoring Programs	Costs approved by CWR	Life to Date Actuals (LTD)	Estimated to Complete (Forecast)	Total Forecast (LTD and Forecast)	Variance Total to Approved	Explanation	Corrective Action
CLB MP7 Arrow Res WL Annual Report	\$4,889	\$3,929	\$2,724	\$6,654	(\$1,765)	Original forecast was conservative for annual report costs.	Request for increase in budget will be submitted prior to exceeding approved budget.
C07W29A Arrow Feas - OR	\$242,054	\$242,054		\$242,054	(\$0)	Project Complete	
C07W29A Arrow Feas - OR DM	\$34,038	\$35,586		\$35,586	(\$1,548)		
C07W29A Arrow Feas - OR Imp	\$208,016	\$206,468		\$206,468	\$1,548		
C07W29A Arrow Feas - ONR		\$1,031	\$1,339	\$2,370	(\$2,370)	CLBWORKS 29A was overspent without approval from the CWR; overage was absorbed through ONR funds.	
C07W29A Arrow Feas - ONR DM OS		\$1,031	\$1,339	\$2,370	(\$2,370)		
C07W29B ARR High Value	\$81,045	\$80,517		\$80,517	\$528	Project Complete.	
C07W29B ARR High Value - OR DM	\$15,387	\$8,517		\$8,517	\$6,870		
C07W29B ARR High Value - OR Imp	\$65,658	\$72,000		\$72,000	(\$6,342)		
C07W30A ARR Wildlife Pw	\$1,348,643	\$1,170,694	\$162,465	\$1,333,159	\$15,484	Project is largely complete. Remaining work relates to wildlife enhancement structures that are planned for 2017.	
C07W30A ARR Wildlife Pw - OR DM	\$214,376	\$203,227	\$10,909	\$214,135	\$241		
C07W30A ARR Wildlife Pw - OR Imp	\$1,134,267	\$967,467	\$151,556	\$1,119,024	\$15,243		
C07W30B ARR Wildlife Lower	\$385,233	\$188,741	\$192,906	\$381,647	\$3,586	Expenditure to date relates to the Design Phase of the project.	ToR for Implementation Phase of this project to be submitted by September 15, 2017.
C07W30B ARR Wildlife Lower - OR DM	\$142,671	\$60,832	\$78,253	\$139,085	\$3,586		
C07W30B ARR Wildlife Lower - OR Imp	\$242,562	\$127,909	\$114,653	\$242,562	\$0		

OR - Ordered Remissible
 ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.