

Columbia River Water Use Plan

Lower Columbia River Fish Management Plan Monitoring Programs and Physical Works

Annual Report: 2018

Implementation Period: August 2017 to July 2018

- **CLBMON-42A Lower Columbia River Fish Stranding Assessment and Ramping Protocol**
- **CLBMON-42B Lower Columbia River Physical Habitat Recontouring**
- **CLBMON-43 Lower Columbia River Sculpin and Dace Life History Assessment**
- **CLBMON-44 Lower Columbia River Physical Habitat and Ecological Productivity Monitoring**
- **CLBMON-45 Lower Columbia River Fish Population Indexing Surveys**
- **CLBMON-46 Lower Columbia River Rainbow Trout Spawning Habitat Assessment**
- **CLBMON-47 Lower Columbia River Whitefish Spawning Ground Topographic Survey**
- **CLBMON-48 Lower Columbia River Whitefish Egg Monitoring & Life History Study**
- **CLBMON-49 Lower Columbia River Effects of Whitefish Flows on Great Blue Heron & Winter Use of Waldie by Great Blue Heron**

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

August 31, 2018

BC Hydro Columbia River Project Water Use Plan Lower Columbia River Fish Management Plan Monitoring Programs and Physical Works Annual Report: 2018

1 Introduction

This document represents a summary of the status and the results of the Lower Columbia River Fish Management Plan of the Columbia River Water Use Plan (WUP) monitoring programs and physical works to July 31, 2018, as per the Columbia River Order under the *Water Act*, dated January 26, 2007. There are nine monitoring programs.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Lower Columbia River Fish Management Plan of the Columbia River WUP monitoring programs and physical works were submitted to and approved by the Comptroller of Water Rights (CWR).

Table: 2-1: Dates of Lower Columbia River Fish Management Plan of the Columbia River WUP TOR Submissions and Approvals by the Comptroller of Water Rights

Monitoring Programs TOR	Order Clause	Original TOR Submission		Most Recent TOR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
CLBMON-42A Lower Columbia River Fish Stranding Assessment and Protocol	Schedule E.2.a	Sep 10, 2007	Oct 29, 2007	Feb 16, 2018	Feb 28, 2018
CLBMON-42B Lower Columbia River Physical Habitat Recontouring	Schedule E.2.a	Aug 22, 2016	Aug 25, 2016		
CLBMON-43 Lower Columbia River Sculpin and Dace Life History Assessment	Schedule E.2.b	Oct 26, 2007	Dec 03, 2007		
CLBMON-44 Lower Columbia River Physical Habitat and Ecological Productivity Monitoring	Schedule E.2.c	Oct 26, 2007	Dec 03, 2007		
CLBMON-45 Lower Columbia River Fish Population Indexing Surveys	Schedule E.2.d	Sep 10, 2007	Oct 29, 2007		
CLBMON-46 Lower Columbia River Columbia Rainbow Trout Spawning Habitat Assessment	Schedule E.2.e	Oct 26, 2007	Dec 03, 2007	Jan 09, 2009	Mar 26, 2009
CLBMON-47 Lower Columbia River Whitefish Spawning Ground Topographic Survey	Schedule E.2.f	Oct 25, 2007	Dec 03, 2007	Nov 22, 2017	Dec 04, 2017
CLBMON-48 Lower Columbia River Whitefish Egg Monitoring & Life History Study	Schedule E.2.g	Oct 26, 2007	Dec 03, 2007		
CLBMON-49 Lower Columbia River Effects of Whitefish Flows on Great Blue Heron and Winter Use of Waldie by Great Blue Heron	Schedule E.2.h	Oct 26, 2007	Dec 03, 2007	Oct 08, 2015	Nov 12, 2015

3 Schedule

The following table outlines the current schedule for the monitoring programs being delivered for the Lower Columbia River Fish Management Plan of the Columbia River WUP.

Table 3-1: Monitoring Programs Schedule as of July 31, 2018

Monitoring Programs	2007 WLR YR1	2008 WLR YR2	2009 WLR YR3	2010 WLR YR4	2011 WLR YR5	2012 WLR YR6	2013 WLR YR7	2014 WLR YR8	2015 WLR YR9	2016 WLR YR10	2017 WLR YR11	2018 WLR YR12	2019 WLR YR13
CLBMON-42A Lower Columbia River Fish Stranding Assessment and Protocol	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	■
CLBMON-42B Lower Columbia River Physical Habitat Recontouring										x	x	■	■
CLBMON-43 Lower Columbia River Sculpin and Dace Life History Assessment			✓	✓	✓	✓	✓F						
CLBMON-44 Lower Columbia River Physical Habitat and Ecological Productivity Monitoring		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	■	■
CLBMON-45 Lower Columbia River Fish Population Indexing Surveys	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	■
CLBMON-46 Lower Columbia River Columbia Rainbow Trout Spawning Habitat Assessment		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓F		
CLBMON-47 Lower Columbia River Whitefish Spawning Ground Topographic Survey					✓	✓	✓F						
CLBMON-48 Lower Columbia River Whitefish Egg Monitoring & Life History Study		✓	✓	✓	✓	✓F							
CLBMON-49 Lower Columbia River Effects of Whitefish Flows on Great Blue Heron and Winter Use of Waldie by Great Blue Heron							✓	✓	✓F				
Legend: ■ = Program to be undertaken/initiated in identified year u/w = Project is underway ✓ = Program completed for the year ✓F = All field work for this project is complete. No further field work is planned. x = Program started, but encountered operational or other delays													

4 Monitoring Programs Terms of Reference

The monitoring programs works being implemented under the Lower Columbia River (LCR) Fish Management Plan of the Columbia River WUP are described in Terms of Reference. These Terms of Reference can be found here:

http://www.bchydro.com/about/sustainability/conservation/water_use_planning/southern_interior/columbia_river/lower-columbia-fish.html

5 Status of Monitoring Programs

5.1 CLBMON-42 Lower Columbia River Fish Stranding Assessment and Ramping Protocol

CLBMON-42 is being reported on as two parts:

- CLBMON-42A LCR Fish Stranding Assessment and Ramping Protocol, and
- CLBMON-42B LCR Physical Habitat Recontouring.

5.1.1 CLBMON-42A Lower Columbia River Fish Stranding Assessment and Ramping Protocol

This monitoring program was initiated in May 2007 and will be carried out over 13 years. The Year 11 report will be submitted in the next annual report.

Discharge reductions and flow ramping from Hugh L. Keenleyside Dam/Arrow Lakes Generating Station (HLK/ALH) and Brilliant Dam/Expansion (BRD/X) can result in

stranding of fish species of the lower Columbia and Kootenay rivers. This study assesses fish stranding at pre-determined sites between HLK/ALH and the Canada/USA border.

5.1.2 CLBMON-42B Lower Columbia River Physical Habitat Recontouring

As part of the CLBMON-42 TOR, physical works were proposed as potential mitigation for fish stranding. Three sites on the LCR were identified as high priority for recontouring to minimize the stranding risk:

- Genelle,
- Kootenay River Left Upper Bank, and
- Tin Cup Rapids.

Kootenay River Left Upper Bank and Tin Cup Rapids recontouring work was cancelled due to significant concerns raised by First Nations during the First Nation engagement in spring 2017.

First Nations have concerns about the potential impacts of recontouring at the Genelle site. An Archaeological Impact Assessment (AIA) is planned for fall 2018 pending permitting. BC Hydro and the private landowner have negotiated use of the access route to the site. The recontouring work is tentatively scheduled for 2019 depending on the results of the AIA.

5.2 CLBMON-43 Lower Columbia River (LCR) Sculpin and Dace Life History Assessment

This monitoring program was initiated in 2009 and carried out over five years. This project is complete.

The main objective of this study was to collect information on the life history, timing, and habitat use of four sculpins (Prickly, Torrent, Columbia, and Shorthead) and two dace (Umatilla and Longnose) species that may be affected by water level fluctuations resulting from daily and seasonal operations of Hugh L. Keenleyside (HLK) dam.

5.3 CLBMON-44 Lower Columbia River Physical Habitat and Ecological Productivity Monitoring

This monitoring program was initiated in 2008 and will be completed in early 2019. 2017 was a non-sampling year therefore a report will not be submitted with this annual report. The next report is expected in 2019.

CLBMON-44 is a multi-year study of physical habitat and ecological productivity on the Lower Columbia River (LCR) between the outflow of the Hugh L. Keenleyside Dam (HLK) and the Birchbank gauging station. The aim of the study is to examine the influence of three different flow periods on select physical habitat and ecological productivity measures:

- January 1 – March 31, Mountain Whitefish (MWF);
- April 1 – June 30, Rainbow Trout (RBT); and
- September 1 – October 31, Fall fluctuating flows (FFF).

5.4 CLBMON-45 Lower Columbia River Fish Population Indexing Surveys

This monitoring program was initiated in September 2007 and will be carried out over 13 years. Attached is the Year 10 report dated August 1, 2017.

CLBMON-45 gathers baseline information on fish distribution, life history characteristics, and population abundance data for three index species (i.e., Mountain Whitefish, Rainbow Trout, and Walleye), and also monitors the effect of Mountain Whitefish and Rainbow Trout flows on these three species.

5.5 CLBMON-46 Lower Columbia River Columbia Rainbow Trout Spawning Habitat Assessment

This monitoring program was initiated in 2008 and all field work was completed in spring 2018. Attached is the report for Year 10 dated April 29, 2018.

The current Rainbow Trout (RBT) spawning assessment monitoring program, which commenced in 2008, was implemented to better understand the linkages between the spring flow regime and the abundance of the Rainbow Trout population and to assess population trends in this ecologically and recreationally important species.

A technical forum to discuss the Rainbow Trout Spawning Protection Flows and the results of CLBMON-46 was held on June 22, 2018 attended by MFLNRORD, DFO, First Nations, technical experts and BC Hydro. Some aspects of the field program may need to be extended or modified based on the outcomes of the forum. A Terms of Reference submission, if required, will be submitted in November 2018.

5.6 CLBMON-47 Lower Columbia River Whitefish Spawning Ground Topographic Survey

This monitoring program was initiated in 2011 and was carried out over three years. This project completed in 2015; however, recent discussions regarding the Mountain Whitefish Spawning Protection Flows resulted in a request from the regulatory agencies to have an independent review of the Mountain Whitefish Egg Loss Model that was updated as a part of this study. The review is in progress in 2018 and will be reported out to the Columbia Operations Fish Advisory Committee (COFAC) this fall. The report review will be provided to the CWR in the 2019 Annual Report.

A key data gap identified by the WUP Consultative Committee was the low quality and quantity of topographic data to describe characteristics of whitefish spawning locations, contributing to reduced confidence in the degree to which existing data represented the habitats of concern, and overall reliability of egg loss estimates. This monitoring program addresses these uncertainties by understanding how changes in dam releases influence the wetted channel area at key whitefish spawning locations.

5.7 CLBMON-48 Lower Columbia River Whitefish Egg Monitoring & Life History Study

This monitoring program was initiated in 2008 and was carried out over five years. This project is complete.

The purpose of this monitoring program was to collect and refine data on the location, timing, and depth distribution of mountain whitefish spawning in the Lower Columbia River below Hugh L. Keenleyside Dam to improve the annual estimate of egg mortality. Specifically, the key objectives are to: a) improve the understanding of whitefish life history and reproductive ecology; b) document topographic

characteristics of representative whitefish spawning locations; and, c) improve the understanding of seasonal changes in the distribution of eggs in the river channel.

5.8 CLBMON-49 Lower Columbia River Effects of Whitefish Flows on Great Blue Heron (GBH) and Winter Use of Waldie by Great Blue Heron

This monitoring program was initiated in November 2013 and field work is complete. Attached is the Year 3 report dated September 30, 2017.

CLBMON-49 changed from a count-based study to a habitat suitability study in the final two years of this project. GBH distribution and abundance, along with physicochemical and other habitat and environmental parameters were monitored at a variety of sites throughout the Kootenays during the winter months. Surveys were completed prior to, during, and after flows related to management of Mountain Whitefish (generally November 1 to February 28) in the Castlegar area, encompassing varied water elevations and flow rates resulting from known dam operations. The information collected throughout the Kootenays will be used to assess GBH habitat and use in the Lower Columbia River.

6 Monitoring Programs Costs

The following table summarizes the Lower Columbia River Fish Management Plan of the Columbia River WUP monitoring programs costs approved by the Comptroller and the Actual Costs to July 31, 2018.

Table 6-1: Lower Columbia River Fish Management Plan WUP Monitoring Programs 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 MP8 Lower CR Fish Annual Report	\$13,121	\$12,067	\$1,668	\$13,735	(\$614)		A TOR submission for additional funds will be submitted by September 2018.
C08M42A LC: Fish Strand	\$1,208,040	\$966,702	\$199,808	\$1,166,510	\$41,530	Efficiencies found during project implementation.	
C08M42A LC: Fish Strand - OR DM	\$172,176	\$143,335	\$26,896	\$170,231	\$1,945		
C08M42A LC: Fish Strand - OR Imp	\$1,035,864	\$823,366	\$172,912	\$996,279	\$39,585		
C08M42B LC: Recontouring	\$455,799	\$94,304	\$161,272	\$255,576	\$200,223	Implementation has been delayed.	
C08M42B LC: Recontouring - OR DM	\$60,871	\$62,755	\$18,724	\$81,480	(\$20,609)		
C08M42B LC: Recontouring - OR Imp	\$394,928	\$31,549	\$142,548	\$174,097	\$220,831		
C08M43A LC:Sculpin&Dace	\$990,546	\$962,983	\$2,270	\$965,253	\$25,293	Project is complete.	
C08M43A LC:Sculpin&Dace - OR DM	\$64,043	\$61,865	\$2,270	\$64,136	(\$93)		
C08M43A LC:Sculpin&Dace - OR Imp	\$926,503	\$901,117		\$901,117	\$25,386		
C08M44A LC:Phys Hab&Eco	\$2,162,010	\$1,886,852	\$258,756	\$2,145,608	\$16,402		
C08M44A LC:Phys Hab&Eco - OR DM	\$171,319	\$165,514	\$23,020	\$188,534	(\$17,215)		
C08M44A LC:Phys Hab&Eco - OR Imp	\$1,990,691	\$1,721,338	\$235,737	\$1,957,075	\$33,616		
C08M45A LC: Fish Pop	\$2,744,109	\$2,007,104	\$364,774	\$2,371,878	\$372,231	Efficiencies found during project implementation.	
C08M45A LC: Fish Pop - OR DM	\$180,037	\$103,899	\$21,212	\$125,111	\$54,926		
C08M45A LC: Fish Pop - OR Imp	\$2,564,072	\$1,903,205	\$343,561	\$2,246,767	\$317,305		
C08M46A LC: Rainbow Tro	\$734,980	\$733,150	\$5,868	\$739,018	(\$4,038)	Field program may need to be extended or modified.	TOR resubmission will be prepared, if necessary, by December 2018.
C08M46A LC: Rainbow Tro - OR DM	\$115,994	\$119,854	\$5,868	\$125,722	(\$9,728)		
C08M46A LC: Rainbow Tro - OR Imp	\$618,986	\$613,296		\$613,296	\$5,690		
C08M47A LC: Whitefish Spwn	\$292,267	\$264,645	\$18,131	\$282,775	\$9,492	QA of model is underway.	
C08M47A LC: Whitefish Spwn - OR DM	\$38,246	\$19,313	\$1,131	\$20,444	\$17,802		
C08M47A LC: Whitefish Spwn - OR Imp	\$254,021	\$245,332	\$17,000	\$262,332	(\$8,311)		
C08M48A LC: Whitefish Egg	\$912,415	\$876,702	\$1,876	\$878,578	\$33,837	Project is complete.	
C08M48A LC: Whitefish Egg - OR DM	\$62,520	\$47,961	\$1,876	\$49,837	\$12,683		
C08M48A LC: Whitefish Egg - OR Imp	\$849,895	\$828,741		\$828,741	\$21,154		
C08M49A LC:EFF WFish GBH	\$336,448	\$335,319	\$1,129	\$336,448	\$0	Project is complete.	
C08M49A LC:EFF WFish GBH - OR DM	\$68,211	\$67,082	\$1,129	\$68,211			
C08M49A LC:EFF WFish GBH - OR Imp	\$268,237	\$268,237		\$268,237	\$0		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.