



Cheakamus Water Use Plan

Monitoring Program Terms of Reference

CMSMON-3: Cheakamus River Steelhead Adult Abundance, Fry Emergence-timing and Juvenile Habitat Use and Abundance Monitoring Survey.

Addendum 2

January 31, 2018

2.0 Addendum 2 to CMSMON-3: Cheakamus River Steelhead Adult Abundance Fry Emergence-timing and Juvenile Habitat Use and Abundance Monitoring Survey.

2.1 Addendum Rationale

A key objective of CMSMON-3 is to improve our understanding of the effects of flow rates on Steelhead production in the Cheakamus River. Changes in river flow are influenced by the operation of Daisy Dam upstream of Steelhead spawning sites in the Cheakamus River.

The final year of planned implementation of the Cheakamus Water Use Plan (WUP) monitoring program was 2017. In preparation for the end of the WUP, BC Hydro reviewed the study results with the Monitoring Committee on August 3, 2017 in order to determine whether any remaining uncertainties should be addressed in advance of the Water Use Plan Order Review (WUPOR) scheduled for July 2020.

The results of this review and recommendations were that of the four management questions posed in the original terms of reference (TOR), two questions remain unanswered and require further review to better support future WUPOR decisions:

- Management Question 2: How do changes in flows affect habitat use of steelhead young-of-year and parr?
- Management Question 4: Do flows affect steelhead production?

Because of the limited amount of variation in flows observed during the monitoring period, these questions could not be answered using the current approach without extending and modifying the existing TOR.

The recommendations from the review included the need to complete:

- (a) an assessment of stranding effects on steelhead productivity in the Cheakamus River; and
- (b) an assessment of the stranding potential for juveniles in the Squamish River downstream of the Cheakamus Generating Station.

To facilitate these recommendations and in recognition that portions of the previous TOR are no longer needed, this addendum describes the changes to the monitoring program to be implemented prior to the WUPOR process (2018-2021).

2.2 Approach

2.2.1 Stranding effects on steelhead productivity

This Addendum includes changes made in TOR Addendum 1 (BC Hydro 2012) while maintaining the original scope of the CMSMON-3 TOR. The proposed field work to investigate juvenile survival at emergence in response to stranding will utilize the same methods as the original Terms of Reference, but with a focus on the effects of late summer flow changes on juvenile steelhead productivity.

Field surveys will assess Steelhead productivity in the Cheakamus River for two more years to test the hypothesis that late-summer high flows and their subsequent reduction, have population effects, i.e., is Steelhead productivity influenced by stranding during late-summer emergence from redds at specific flows or ramping rates. To optimize the effectiveness of this study, BC Hydro will endeavour to release annual "summer pulse" flows from Daisy Dam of at least 38 m³/s for at least four days just prior to August 31 in order to evaluate the effect of stranding from this operation.

As part of these TOR changes, fall and spring juvenile surveys will continue to be implemented as per the Terms of Reference. However, certain pieces of data collection have been dropped to focus on essential data. For example the radio telemetry on resident rainbow trout/steelhead component and Brohm Creek investigations will no longer be conducted. The overall program has been streamlined based on data analysis requirements to date.

2.2.2 Squamish River fish stranding potential

An additional task will be to address unfulfilled commitments made in 2012 at the CMS WUP Interim review (BC Hydro 2012). This study will undertake a desktop exercise to model effects of powerhouse operations on the Squamish River mainstem at low Squamish River flows and the potential risk of stranding fish. This work will compile historic Water Survey of Canada (WSC) data, Cheakamus powerhouse outflows as well as historic stranding reports from the Squamish River. There will be no field work as part of this assessment.

This desktop study, modelling flows of the Squamish River and powerhouse tailrace will occur in 2018, utilizing hydrological data supplied by BC Hydro and WSC.

2.3 Schedule and Reporting

Addendum 2 extends the CMSMON-3 TOR to continue monitoring Steelhead below Daisy Dam in the Cheakamus River until March 31, 2021. Annual reports will be submitted to BC Hydro by November 30 of each year. Results of data collection from the three additional years (2018 to 2020) will be added to the current 10 year dataset and a final report will all data will be submitted by January 31, 2021.

The program schedule for Addendum 2 is presented in Table 1 below.

Table 1: Schedule tasks for CMSMON-3, Addendum 2.

Task Description	2018	2019	2020	2021
Late Summer juvenile (fry) emergence	X	X	X	
Spring Parr and juvenile abundance	X	X	X	
Squamish River flow modelling	X			
Annual Data Report	X	X	X	
Final Report				X

2.4 Budget

Total Revised Program Cost: \$2,516,181

2.5 References

BC Hydro, 2012. CMSMON-3 Terms of Reference Addendum 1. Prepared for BC Hydro Water License Requirements program, Burnaby, BC.

Korman, J. and J. Schick (in draft). Summary of Adult and Juvenile Data to Evaluate Effects of the WUP Flow Regime on Steelhead in the Cheakamus River. Prepared for BC Hydro Water License Requirements program, Burnaby, BC.