Cheakamus Project Water Use Plan

Monitoring Program Terms of Reference

- **CMSMON-8 – Monitoring Channel Morphology in Cheakamus River**

Addendum 2

June 25, 2015

A2 Addendum to CMSMON-8 – Monitoring Channel Morphology in Cheakamus River

A.2.1 Addendum Rationale

The Cheakamus Water Use Plan (WUP) was approved by the Comptroller of Water Rights (CWR) and Order was received under the Water Act February 17, 2006. The consultative process of the WUP concluded without consensus being reached on the operating parameters. The WUP and the covering letter for the Order both state that the WUP is to be reviewed within five years of implementation. Terms of Reference for the monitoring approved by the CWR were for up to a five-year period from implementation with completion in 2012. The most critical studies (juvenile and adult salmonid abundance studies) were intended as outlined in the approved WUP for duration of 10 to 20 years.

BC Hydro met with the contractors and members of the Cheakamus WUP Monitoring Advisory Committee (MAC) to review the Cheakamus WUP monitors in Squamish on October 2 and 3, 2012. The MAC discussed the objectives of the monitoring program and what, if any, changes should be made to the scope of the program. Based on the findings to date and the importance of this monitor's potential link to production and reproduction of fish in the Cheakamus, the MAC agreed that CMSMON-8 should continue for another five years in order to answer the management questions.

The project has a10-year duration (2007 through 2018). Following the sixth year of project work (2013-2014, Year 6 of the CMSMON-8 monitor), and review with the Cheakamus WUP Monitoring Committee on July 24, 2014, BC Hydro in consultation with the contractor for CMSMON-8 determined that the scope of the project should be modified to better address the Management Questions.

A.2.2 Study Design

The following revisions to the scope of the project have been identified:

- Propose a modified method to address Management Question 1 (MQ1).
- Complete the Morphologic Mapping Analysis to address Management Question 2 (MQ2).
- Discontinue hydrometric monitoring program.
- Perform an analysis based on existing hydrometric data to provide an answer to Management Question 3 (MQ3).

Management Question 1:

Following implementation of the WUP, has there been a change in the overall availability of suitable fish spawning substrates from the present state? If so, can this change be clearly attributed to Daisy Lake Dam operations vs. other environmental or anthropogenic factor?

During the course of background information review and consultation with other Cheakamus River monitors it became evident there is maybe limited pre-WUP data available to support an approach to answer MQ1. In addition, consultants in charge of other Cheakamus River monitors were of the expert opinion through numerous roving snorkel surveys under clear-water conditions that spawning habitat in the lower Cheakamus River is abundant and not limiting.

In response to these issues, BC Hydro will be conducting an analysis to evaluate whether there has been degradation in spawning habitat (aerial extent) via erosion and reduced gravel recruitment. This assessment will rely on the available record of flow releases from Daisy Lake dam to represent the pre-WUP vs. post-WUP condition (grain size information for the pre-WUP period is limited). BC Hydro's existing 2012 2D model for the lower Cheakamus River, existing flow data, field collected surface grain size data and field collected bedload measurements will be used to develop a sediment transport model to estimate the total sediment transport for the pre-WUP and post-WUP conditions (KWL 2015). :

Reporting for Year 8 will address MQ1 and provide the following:

- summary of input data and methods used to estimate sediment transport,
- estimated flow thresholds for sediment transport,
- summary totals of time under which sediment transport would be predicted for the pre-WUP vs. post-WUP period,
- assessment of MQ 1 (and associated impact hypotheses) in light of the data analysis,
- discussion of MQ1 in context of larger complications (e.g., flood flows, sediment inputs, Daisy Reservoir gravel trapping etc.),
- identification of remaining data gaps, and commentary on whether, and what, further monitoring data is required to answer MQ 1.

Management Question 2:

Following implementation of the WUP, has there been a change in the overall length, access and utility for fish of naturally occurring side channels from the present state? If so, can this change be clearly attributed to Daisy Lake Dam operations vs. other environmental or anthropogenic factors?

The Morphologic Channel Mapping originally proposed will be completed to address MQ2. Orthophotos will be produced in 2016 or 2017 to support morphologic channel mapping to allow time to complete channel mapping, ground-truthing and analysis by the end of the monitor. The schedule for orthophoto collection has been extended from Year 5 to allow the most time for channel changes to occur. The methodology has not changed and a low flow period with good visibility will be targeted to provide a good comparison to orthophotos that were produced in 2008.

Management Question 3:

To what extent does the hydrology of Rubble Creek, Culliton Creek, and Swift Creek contribute to the general hydrology of lower Cheakamus River and how does it attenuate the effects of Daisy lake dam operations.

The hydrometric monitoring program will be discontinued. The hydrometric stations do not appear to provide a great deal of additional value when attempting to answer the Management Question due to uncertainties in measuring the tributary flows. The Management Question can be interpreted as a question related to general tributary inputs downstream of Daisy Lake dam. "Attenuation" speaks to the degree to which the tributary inputs downstream of the dam increase the Cheakamus River flow beyond what is released from Daisy Lake. An analysis of existing BC Hydro, Water

Survey of Canada, and CMSMON-8 hydrometric data will be conducted to address Management Question 3.

A.2.3 Budget

Changes to the monitor will remain within the approved budget.

A.2.4 References

KWL 2015. Kerr Wood Leidal Consulting Engineers. CMSMON-8 Cheakamus River Channel Morphology Monitoring Revised Work Program and Budget to Address Scope Revision File 0478.164-120. April 13, 2015.