



# Cheakamus River Adaptive Stranding Protocol Workshop Summary Report

(held on December 5, 2019 in Squamish, B.C.)

## **Prepared for**

BC Hydro

## **Prepared by**

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## Executive Summary

On December 5<sup>th</sup>, 2019, Compass Resource Management facilitated a one-day workshop focused on BC Hydro's Cheakamus River Adaptive Stranding Protocol (CASP), which was implemented in 2018. BC Hydro convened the workshop to share information and review the first year of CASP monitoring results and to discuss additional mitigation measures implemented this past fall (outlined in the CASP Addendum), which were a result of the Pink salmon stranding event that occurred in September 2019.

Workshop participants were provided with background information through a series of presentations along with a pre-reading package that was sent out two days prior to the workshop, which included the draft CASP Monitoring Results report (Instream Fisheries Research). Workshop participants discussed the stranding protocol and the preliminary monitoring findings highlighting concerns and offering improvements for the next year of the program. A few key points raised during the discussions included limitations on the current CASP methodology to (a) assess whether population-level impacts may be occurring in relation to stranding, (b) properly assess stranding risk at low fish abundance numbers associated with some life stages and species (e.g., Coho fry), and (c) assess pool stranding risk given the timing of field crew observations. The bulk of the workshop was focused on the preliminary findings from the monitoring report specific to bar and pooling stranding risk and the relative benefit of different mitigation options. Workshop participants discussed improvements to the methodologies to assess stranding risk, which included continuing observer efficiency trials and electrofishing studies, increasing understanding of pool survival throughout the year, and ensuring that pool stranding sampling sites are an accurate representation of the highest-risk sites on the river.

At the workshop, BC Hydro also shared preliminary details for the upcoming Water Use Plan Order Review (WUPOR) planning process that will get underway in 2020. The timeline for the Cheakamus WUPOR has been accelerated in response to concerns from First Nations, community residents and stakeholders. Workshop participants expressed some concerns in relation to BC Hydro's operations for the Cheakamus system and on the proposed WUPOR process including the termination of several monitoring studies; ramp down rates and base flow releases to the Cheakamus River originally approved in the original WUP; the opportunity to explore non-operational measures (related to stranding losses); and opportunities for improved engagement and collaboration with the Squamish Nation in light of recent provincial policy and legislative changes (related to reconciliation, UNDRIP, etc.).

Compass Resource Management Ltd. (Compass) was hired to facilitate the workshop, which included carrying out some preliminary interviews to assist in the scoping and structuring of the workshop. Compass was also responsible for note keeping and writing up a Workshop Summary Report.

Following the workshop, a summary table was made based on recommendations and requests raised and discussed during the workshop. BC Hydro subsequently reviewed the table and highlighted its response and commitments for how they were planning to proceed. It is intended that this table could be regularly updated as to the status of these items in the lead up to the WUPOR. The summary table can be found at the end of this report.

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# 1 Overview

## 1.1 Introduction

This report summarizes the proceedings and discussions from a one-day workshop held on December 5, 2019, to review and discuss BC Hydro’s Cheakamus Adaptive Stranding Protocol (CASP), draft CASP Addendum, results from the first year of monitoring of the program, and the upcoming Water Use Plan Order Review (WUPOR) planning process. The workshop was convened by BC Hydro in response to fish stranding concerns on the Cheakamus River and, in particular, a Pink salmon stranding event in September 2019, which drew additional attention on fish stranding risks and led to changes and additional mitigation measures in the CASP.

Workshop participants included representatives from the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), Fisheries and Oceans Canada (DFO), Squamish Nation, Squamish River Watershed Society, Squamish-Lillooet Sportfish Advisory Committee, Sea to Sky Fisheries Roundtable, Federation of Fly Fishers, and the South Coast Steelhead Society. Instream Fisheries Research attended and presented their findings from the first year of the CASP monitoring program (2018 to 2019).

Throughout the day, workshop participants reviewed and discussed different aspects of the CASP, draft Addendum, upcoming WUPOR, and offered suggestions for improving BC Hydro’s operations on the Cheakamus River. Following the workshop, a summary table was generated by Compass listing all the requests and recommendations they heard being raised by participants during the workshop (refer to the *Summary Table of Workshop Recommendations* at the end of this report).

Compass Resource Management supported the design and facilitation of the workshop, including a number of preliminary interviews with participants to help prepare for and structure the workshop. Compass was also responsible for documenting the proceedings of the workshop, including summarizing a post workshop recommendations table. The documentation for the workshop has been written up in this Summary Report and begins with some background information and context provided to participants in advance of the workshop and in the introductory presentations.

## 1.2 Workshop Objectives

The following draft objectives were reviewed and agreed to at the beginning of the workshop, as follows:

- To review and discuss the Cheakamus Adaptive Fish Stranding Protocol (CASP), draft CASP Addendum and recently collected information and monitoring; and
- To discuss next steps and share information about upcoming activities related to the Cheakamus System including the upcoming Water Use Plan Order Review (WUPOR).

## 1.3 Workshop Agenda

The workshop was held from 9:30am to 2:30pm on December 5<sup>th</sup>, 2019. The draft agenda was reviewed and agreed to at the start of the workshop, as follows:

9:30pm	<b>Welcome and Introductions</b>
10:00am	<b>Workshop Background and Context</b>
10:45am	<b>Break – 15mins</b>
11:00am	<b>CASP and Draft Addendum</b>

12:00pm	<b>Lunch</b> ( <i>provided</i> )
1:00pm	<b>Open Discussion – Fish Stranding Next Steps</b> <ul style="list-style-type: none"> <li>• General Approach</li> <li>• Upcoming workplan</li> </ul>
1:45pm	<b>WUPOR</b> <ul style="list-style-type: none"> <li>• Overview and process</li> </ul>
2:00pm	<b>Next Steps</b>
2:30pm	<b>Adjourn</b>

## 1.4 Workshop Participants

Participants	
<ul style="list-style-type: none"> <li>• Scott Babakaiff, FLNRORD</li> <li>• Mike Henry, Department of Fisheries &amp; Oceans</li> <li>• Dan Sneep, Department of Fisheries &amp; Oceans</li> <li>• Ray Natraoro, Squamish Nation</li> <li>• Tyler Gray, Squamish Nation</li> <li>• Kristen Davis, Squamish Nation</li> <li>• Chessy Knight, Squamish River Watershed Society</li> <li>• Randall Lewis, Squamish River Watershed Society</li> <li>• Dave Brown, Squamish-Lillooet Sportfish Advisory Committee, Sea to Sky Fisheries Roundtable</li> <li>• Clint Goyette, Federation of Fly Fishers</li> <li>• Steve Rochetta, FLNRORD</li> <li>• Brian Klassen, South Coast Steelhead Coalition</li> </ul>	<p>BC Hydro:</p> <ul style="list-style-type: none"> <li>• Sabrina Locicero, Community Relations</li> <li>• Alf Leake, Environment</li> <li>• Karen Popoff, Environment</li> <li>• Colin Rombough, Environment</li> <li>• Riley Hall, Environment</li> <li>• Maureen DeHaan, Generation Systems Operations</li> <li>• Leanne Todd, Generation System Operations</li> <li>• Esther Yu, Generation System Operations</li> <li>• Andrea Kennedy, Indigenous Relations</li> </ul> <p>Consultants:</p> <ul style="list-style-type: none"> <li>• Jody Schick, Instream Fisheries Research</li> <li>• Caroline Melville, Instream</li> <li>• Michael Harstone, Compass – facilitator</li> <li>• Elan Failing, Compass – notes</li> </ul>

## 1.5 Background & Context

### 1.5.1 CASP and the Cheakamus Water Use Plan

CASP is a fisheries monitoring management program developed in response to concerns over fish stranding that arose following the implementation of the Cheakamus Water Use Plan (WUP). The objectives of CASP are:

1. Better understand the risk of fish stranding on the Lower Cheakamus River:
  - a. Understand important variables (e.g., time of year, fish life stage present, discharge, etc.)
  - b. Define rampdown types based on key variable relationships
  - c. Evaluate the relative stranding risk associated with each rampdown type
2. Test the effectiveness of different mitigation measures during those types of operations that may strand fish, and
3. Identify effective fish stranding mitigation options for consideration for long-term implementation.

BC Hydro developed Water Use Plans (WUPs) for most of their hydroelectric generation facilities across the Province between 1999 and 2004. The goal of water use planning process was to find a better balance between competing uses of water which are environmentally, socially, and economically

acceptable to British Columbians. WUPs were developed through a consultative planning process involving government agencies, First Nations, local citizens, and stakeholders. WUPs were implemented by a *Water Act* Order issued by the B.C. Comptroller of Water Rights (CWR). Part of the Water Use Planning process is to review the WUP Orders to determine if Ordered requirements have been met and if any new issues have been identified.

The Cheakamus WUP Order Review (WUPOR) will begin in 2020 and will include engagement with agencies, First Nations and key stakeholders.

BC Hydro mentioned during the presentation how they are committed to reviewing CASP with First Nations, stakeholders and regulators annually with the aim to provide future opportunities for engagement and discussion of the CASP and other monitoring/operations issues.

### 1.5.2 **Draft CASP Report Summary** (as reviewed and discussed during the workshop)

The Cheakamus River Adaptive Stranding Protocol Monitoring Results study took place between August 2018 and September 2019. Instream Fisheries Research carried out the study, which was focused on two main research areas: bar stranding risk and pool stranding risk. Instream's key findings from the research are summarized as follows:

#### Bar Stranding – Key Findings:

- Risk highest when abundance of sensitive life stages highest.
- Risk reduced with lower ramp rates but is flow dependant.
  - Greater than 40 m<sup>3</sup>/s (CHB) – 5cm/h reduced risk from high to low
  - Less than 40 m<sup>3</sup>/s (CHB), 1.8-4.6 cm/h reduced risk from high to moderate, not low.
- No information for ramps >130 m<sup>3</sup>/s yet.
- No clear benefit of reducing daily ramp magnitude.
- High confidence in monitoring methods for assessing benefits of mitigation at high risk sites except when fish abundance is low.
- At low abundance levels, ramp impacts may be higher than indicated by risk level (fish/m<sup>2</sup>). Requires increased sampling effort and modifications to risk assessment approach.

#### Pool Stranding – Key Findings:

- Risk likely increases as spill discharge decreases.
- No clear benefit from current mitigation. Need to consider other mitigation approaches.
- Risk likely underestimated during October – November surveys due to low fish abundance.
- More difficult but possible to assess benefits of mitigation due to differences in the amounts of isolated habitat between compared ramps.
- Risk assessment will improve as survival and observer efficiency is better understood.
- Alternative monitoring methods could be more effective for assessing benefits of mitigation.

### 1.5.3 **September 2019 Pink Stranding Event**

On September 19-20, 2019, BC Hydro dam operations on the Cheakamus River resulted in a stranding event involving adult Pink salmon. Due to a fall rain event, BC Hydro was required to increase outflows from the Daisy Lake Dam in compliance with dam safety and integrity protocols. As the Daisy Dam has relatively small storage capacity, this increased outflow could not be maintained for the duration of the spawning and incubation periods for the Pink salmon spawning downstream of the dam. Therefore, BC Hydro reduced outflows back to base flow levels as soon as possible to prevent Pink salmon from spawning in areas that would later be dewatered.

Ramping rates implemented during this two day flow reduction operation were within the range permitted by the Cheakamus WUP and in line with DFO guidelines<sup>1</sup>. However, during the second day of reducing flows (on September 20, 2019) a significant Pink salmon stranding event took place with spawning adults.

## 2 Workshop Proceedings & Outcomes

### 2.1 Welcome and Introductions

- Ray Natraoro of the Squamish Nation provided opening remarks to start the workshop.
- BC Hydro welcomed participants and provided an overview and context about the workshop. Some workshop participants expressed the need for greater accountability and frustration over the lack of information and regular updates since the WUP monitoring committee stopped meeting. BC Hydro committed to greater public engagement and transparency in their operations for the Cheakamus system moving forward.
- Compass reviewed the workshop agenda, led the group introductions, and shared some guiding words and principles for the day's discussions.

### 2.2 Systems Overview

BC Hydro provided an overview of their Cheakamus River facilities and operations. Key points included:

- BC Hydro adjusts the discharge through the Daisy Dam spill gates depending on a number of factors including inflow levels, fisheries and other parameters (as per WUP), and generation requirements which vary throughout the year. The fall season is particularly variable, characterized by generally low inflows punctuated with sporadic high inflow events to Daisy Reservoir (i.e., rain or storm events).
- BC Hydro described 2019 operations on the Cheakamus River and reviewed the circumstances that led to the Sept 2019 pink salmon stranding event, which involved managing dam safety interests during a fall storm event while also wanting to minimize the risk of stranding redds and spawning adults.
- A question was raised surrounding the particularly dry winter, and why discharge from Daisy Dam was greater than inflow for a period in March 2019. BC Hydro explained that the discharge had to be higher in order to maintain minimum flow requirements on the Cheakamus River at Brackendale.
- Other points raised during the operations overview included climate change effects and the additional challenge this may pose on future operations (e.g., hydrological changes given the changing snowpack / receding glaciers), additional stresses from cumulative effects in the watershed (since the original WUP), and context was shared on historical operations and conditions. A request was made to include a hydrograph showing diversion flows to the Cheakamus power station (on the Squamish River) in relation to future operational overviews, which currently only summarize inflows and discharges to the Cheakamus River.

BC Hydro briefly outlined the process that led to the development of the CASP:

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<sup>1</sup> BC Hydro clarified that DFO ramping rate guidelines were followed (as per Cathcart 2005); which equated to 5cms/hr on the first day; and 2.5cms/hr on the second day.



- During the initial Cheakamus WUP process, fish productivity was identified as a primary objective among other interests such as integrity of Squamish Nation cultural values, flood impacts, and power generation. Fish stranding was identified as a potential concern in the WUP, however the anadromous portion of the Lower Cheakamus River was initially not identified as a stranding area<sup>2</sup>. A recent report on steelhead stranding highlighted the potential for summer ramp rates to have potentially a significant negative effect on early life stage survival rates of steelhead. This report, in conjunction with public reports of fry stranding and stranding assessment findings in the summer 2018, led BC Hydro to shift their focus to the anadromous region of the Cheakamus river and develop the CASP to mitigate stranding risk.

## **2.3 Cheakamus Adaptive Stranding Protocol**

BC Hydro and Instream reviewed the CASP, CASP Addendum, summary results of the Year 1 CASP monitoring, and the 2020 Workplan.

### **2.3.1 Cheakamus Adaptive Stranding Protocol (2018)**

BC Hydro provided an overview of the development and core elements of the CASP for discussion by workshop participants. Key points included:

- BC Hydro reviewed the options table used in their assessment and selection of a preferred approach to mitigate stranding effects, which led to the CASP. Questions were raised by some participants as to why the “Implement Blanket Ramp Rate” option wasn’t selected, as its score was effectively the same as the CASPs. BC Hydro explained that at the time, BCH didn’t fully understand the mechanisms causing fish stranding, and the CASP was determined to be the option best suited to investigating the relationship between BCH’s operations on the Cheakamus River and fish stranding events. Further, the CASP facilitated an adaptive management approach wherein mitigation strategies could evolve in accordance with results from monitoring studies.
- Participants reviewed the CASP’s objectives, namely: to better understand fish stranding risk on the Lower Cheakamus River, to evaluate the effectiveness of fish stranding mitigation measures, and to identify successful mitigation options for long-term implementation. It was noted that a key drawback of the CASP approach was its weakness in assessing potential population-level effects and characterizing the significance that stranding events may be having in Lower Cheakamus River. Some participants felt this limitation was problematic, especially given their view that population level effects were considered a possible trigger for DFO to authorize changes to BC Hydro’s operations. DFO clarified that demonstrating population level effects was not a pre-requisite for triggering regulatory action.
- It was noted that there is an implication embedded in the CASP concerning acceptable levels of stranding risk. Some participants were concerned with the CASP’s inability to characterize the significance of effects (i.e., to what degree were population-level impacts occurring) and how this would lead to gaps in the need for potential changes to operations in the future (i.e., WUPOR) and in order to better understand what acceptable limits of stranding would be. It was suggested that as a reference point, better understanding what the natural stranding risk was might be helpful context as a separate desktop study.

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<sup>2</sup> Three WUP monitoring studies including stranding risk areas to be studied: downstream in the Squamish (CMSMON3), downstream of Cheakamus dam (CMSMON4), and downstream of the CMS generation station (CMSMON5).

### **2.3.2 CASP Addendum (2019)**

BC Hydro reviewed the draft CASP Addendum developed in response to the September 2019 pink salmon stranding event. The Addendum outlined new measures to reduce stranding risk for the remainder of the fall spawning period: new measures included: slower ramp rates than typical for the season, pre- and post-rampdown reconnaissance, additional field crews on hand during rampdowns, and increased emphasis on fish salvage as a mitigation measure.

A discussion was had concerning the history of fish stranding on the Cheakamus River. Key points included:

- Members of the group requested clarity on whether stranding events of this magnitude are a novel phenomenon for the Cheakamus system, or a recurring event that until now had received little documentation or public attention. Several workshop participants highlighted that stranding events of this scale were known to have happened in the past (e.g., a pink stranding event of similar magnitude also occurred in 2011). At the same time, it was noted that BC Hydro has been operating in the watershed for decades and if stranding events were causing significant effects there should have been pretty clear evidence of salmon populations decreasing by now.
- One participant noted that pink salmon were not historically part of the Cheakamus River system. Given that they spawn at a different time of the year in the early fall, as Pink salmon populations increased in the system it would be expected that stranding risk would have also increased.
- Participants noted that stranding in rivers isn't the only potential cause of population-level impacts. Ocean survival was also identified as a contributing factor to current observed salmon population declines.
- It was mentioned that stranding risk became more of a focus following Josh Korman's (CMS MON3) report indicated that stranding may be significant and potentially having population level effects on early life stage survival of steelhead.
- The focus of the CASP was originally focused on the upper anadromous reaches because it was felt that this area was the most sensitive and be representative of the largest stranding risk. BC Hydro commented that there may be value in confirming our assumptions that the most sensitive sample locations are being chosen and that there may be value in looking at sites below Fergies.
- A comment regarding the potential for Tenderfoot Hatchery to be used to offset for past stranding impacts was raised (e.g., given focus on pinks). BC Hydro stated that they would be interested in having a conversation about this.
- The importance of fish stranding and potential operational changes through the Cheakamus facilities were highlighted at various points; with one participant emphasizing the importance of the upcoming WUPOR where there is a window for First Nations and stakeholders to recommend operational changes in a revised and updated water use plan for the Cheakamus River system.

### **2.3.3 Year 1 CASP Summary Results (2018 – 2019)**

The CASP Year 1 Monitoring Report summarizes the findings of monitoring undertaken by Instream Fisheries Research throughout the first year following the implementation of CASP. Instream monitored 15 Cheakamus dam rampdowns throughout the year and used their findings to inform when mitigation measures are warranted; and, assess the relative benefits of mitigation options (namely, reduced ramp rates and stepped ramp rates over multiple days). Instream also provided a set of recommendations for

improving the CASP and monitoring methods moving forward for next year. The study focussed on two main fish stranding mechanisms – bar stranding and pool stranding.

Instream Fisheries Research (Instream) provided a summary of the methods, results, key findings, and recommendations from their CASP Year 1 Monitoring Program specific to both their approach to assess bar stranding and pool stranding risks. The group discussed the findings and expressed interest in exploring opportunities to improve the program in the upcoming workplan (2020). Key discussion topics during the presentation included:

- Site selection (bar stranding): It was clarified that study sites for CASP monitoring were not chosen at random. BC Hydro’s intention was to determine the maximum potential impact of dam operations, therefore what were viewed as the most sensitive sites (i.e., areas of highest stranding risk) were selected for the study.
- Stranding risk uncertainties: A concern raised by several workshop participants as well as the CASP Year 1 Summary Report is that the CASP methodology is not well suited to low abundance numbers. As shown by the 2019 Coho fry stranding rates, stranding risk can be underestimated at low fish abundances. The CASP uses average steelhead fry abundance numbers for the risk level benchmarks, which may not always be representative for all species and life stages.
  - To address concern over the use of Steelhead abundance numbers as a benchmark, workshop participants discussed the value of obtaining relative abundance estimates for each species. Species-specific abundance estimates would eliminate the need for using Steelhead abundance estimates as a blanket benchmark, thus preventing the underestimation of stranding risk. Abundance monitoring would also improve understanding of overwintering habitat use by Chinook, Coho, and Steelhead juveniles, reducing a key uncertainty related to the extent to which each species uses shallow habitat.
- Bar stranding uncertainties: A data gap was highlighted in relation to the number of high-risk bar stranding sites on the Cheakamus River at various discharge ranges. (i.e., to get a better sense of the overall order of magnitude of bar stranding occurring). Instream noted that this number is highly variable as it is dependent on the discharge. There seem to be fewer high-risk bar stranding sites at higher discharges however. Other uncertainties included limited information for Chum estimates, Chinook in general, and missing Chinook early emergence information.
- Pool stranding uncertainties: Instream noted limitations of the pool stranding monitoring methodology, including uncertainties related to seasonal variability in observer efficiency and pool stranding survival rates, and which pools are most at risk of isolation. Further research is needed to address these uncertainties, such as observer efficiency studies, pool stranding survival studies, a comprehensive pool stranding risk census, and trail camera studies to identify high risk pools and side channels.
  - The group briefly discussed the potential of skewing of pool stranding data through bird predation – if predation is high and there are time lags between rampdowns and stranding field assessments, which could lead to an underestimation of fish stranding. Studies from other areas have shown that predation can have a significant effect on findings from stranding field assessment. BC Hydro confirmed that they mobilize field crews as soon as possible following rampdowns and minimize total assessment time to minimize this effect.
- Comparing bar and pool stranding: Several workshop participants suggested that it is important to have a way of comparing bar and pool stranding risk. Instream noted that there are challenges associated with this given that bar and pool stranding measure two different effects, and impact different fish life stages (i.e., generally juveniles for bar stranding and adults for pool stranding).

However, the group agreed that establishing a metric for better understanding the significance of stranding risk in a relative sense between pool and bar stranding would be helpful to inform the prioritization of mitigation measures. Developing such a metric would require further research and discussion.

- **Bar Stranding Summary:** generally, stranding risk is reduced with lower ramp rates but it is flow dependent and risk cannot be lowered to zero. There was generally high confidence in monitoring methods for assessing mitigation except when fish abundance was low. At low abundance, ramp impacts may be higher than indicated than by risk level thresholds. Also, despite some uncertainty in the data, Instream offered an opinion that they did not believe there was evidence that stepped rampdown rates over days provided any clear benefit.
- **Pool Stranding Summary:** stranding risk likely increases as discharge decreases, but confounding effects prevented the study from identifying clear benefits of a reduced ramping rate or reduced daily magnitude. Therefore, other forms of mitigation, or alternative methods to better monitor existing mitigation options should be considered. Further, risks are suggested to be underestimated during Oct-Nov surveys due to low abundance numbers. Risk assessment will improve as observer efficiency and pool survival are better understood. While current risk assessment assumes similar survival in pools throughout the year, it is hypothesized that survival is higher during the winter due to lower water temperature and higher probability of pools being re-watered. One participant was concerned that under the current assumptions, survival may be underestimated in summer as well.
- It was noted that at this stage, monitoring data consists of relatively few data points. A suggestion was made that findings from this first year of monitoring be considered with caution in recognition of the many remaining uncertainties and preliminary nature of the monitoring results.

Instream also reviewed a number of concluding recommendations to improve stranding risk assessment work in the future in relation to bar monitoring, pool monitoring, mainstem abundance monitoring, and updating the risk tables. There was general support for these recommendations based on the lack of comments generated during the workshop, but participants were invited to provide more detailed review and feedback over the next month based on Instream's draft report that was distributed prior to the workshop.

#### **2.3.4 2020 CASP Workplan & Opportunities for Improvement**

BC Hydro provided an overview of planned changes to their operations for the coming year based on the findings of the Year 1 CASP Monitoring Program. The three improvement areas included:

1) Increased CASP reconnaissance prior to rampdowns, including:

- Assessing conditions for rampdowns to mitigate for un-anticipated impacts.
- Identifying opportunities to influence the timing and extent of rampdowns.

2) Increased CASP assessment and monitoring throughout the year, including:

- December – April; there is a data gap for this period, as dry conditions last year meant there were no opportunities for collecting information through the winter.
- May – July; while low flow operations are relatively uncommon during this period, monitoring and assessment can inform management protocols in those scenarios.
- Pool monitoring; pool stranding risk can be informed by improving observer efficiency estimates and assessing pool use by time of year.

3) A more precautionary rampdown schedule based on operating recommendations from Instream's CASP Year 1 monitoring recommendations.

Compass facilitated a discussion of further opportunities for improving the CASP and CASP monitoring methods. These included:

- **Expanding the Scope of CASP Monitoring:** Workshop participants expressed interest in expanding CASP monitoring sites to include other critical habitat, such as steelhead rearing habitat (especially the pools and side channels below Fergie's). Interest in the continuation of steelhead monitoring (i.e., CMSMON 3), especially to tease out the effects of natural variability versus anthropogenic effects from dam releases to help inform decisions during the WUPOR was also noted.
- **Abundance monitoring:** Workshop participants discussed the value of obtaining a relative abundance estimate to better understand overwintering habitat use by Chinook, Coho, and Steelhead juveniles. Given the concern over the use of steelhead fry abundance numbers as a population benchmark to develop risk thresholds for all species, the group identified abundance monitoring as a key area of improvement.
- **Side Channel Engineering:** Workshop participants suggested that some side channels of the Lower Cheakamus River might be appropriate candidates for recontouring as a mitigation option to maintain flow and connectivity. As some pools and side channels represent a disproportionate stranding risk, these areas present a higher potential for mitigation to be explored. Further study would be warranted to determine the channels and pools best suited to this type of mitigation.
- **Squamish River stranding:** Stranding risk downstream on the Squamish River was identified as a key data gap. BC Hydro noted that a desktop study had been completed and posted on-line; workshop participants were invited to review and provide comments on the study. Workshop participants indicated interest in further research to better assess and characterize stranding risk on the Squamish River.

BC Hydro expressed interest in exploring these opportunities in the future.

## **2.4 Cheakamus Water Use Plan Order Review**

BC Hydro provided an overview of the Water Use Planning process. Between 1999-2005 BC Hydro undertook Water Use Planning for its facilities across the province to find a better balance between competing water uses and to incorporate a broader range of public and First Nations values and environmental priorities into their operations. During the Cheakamus WUP process, fish productivity, integrity of Squamish Nation cultural values, flood impacts, recreation and power generation were among the primary priorities identified.

Included in all WUPs was a recommendation for periodic review as per Step 13 of the Provincial WUP Guidelines. These reviews are referred to as WUP Order Reviews (WUPOR) and provide an opportunity to review operations, compliance with the WUP Order and identify specific priority issues that may have arisen during the plan's implementation. The WUPOR includes two core deliverables: a Monitoring Program Synthesis Report which summarizes the findings of the monitoring studies ordered under the WUP, and the WUPOR report which will make recommendations for the Comptroller of Water Rights (CWR) to confirm, revise, replace, or rescind BC Hydro's operating Order. BC Hydro anticipates that the Cheakamus WUPOR process may be more complex than others in the province due to the complexity of the system and the lack of consensus during the original WUP process.

BC Hydro discussed the upcoming WUPOR planning process and indicated how it has been accelerated in response to recent concerns from the community, Squamish Nation, and stakeholders. Key discussion points included:

- BC Hydro reviewed the next steps for the Cheakamus WUPOR highlighting the main WUPOR process; opportunities for stakeholder input, review and engagement; and provided a general overview of the CMS WUPOR timeline.
- BC Hydro also mentioned they are currently discussing the WUPOR with Squamish Nation and are developing a collaborative process with them.
- One participant noted that it would be helpful to indicate in the WUPOR timeline which steps are internal BC Hydro processes and which will involve input from DFO, FLNRORD, and other relevant external agencies.
- BC Hydro emphasized that the WUPOR overview presented in this workshop represents the start of an ongoing conversation about the future of water use planning in the Cheakamus River system and is intended to encourage and incorporate public feedback throughout this process. The WUPOR process will begin in earnest in 2020 with further discussions on the process for stakeholder engagement.

Workshop participants discussed various concerns and opportunities to be addressed in the WUPOR, as follows:

- Termination of monitoring studies: A number of participants expressed concern for data gaps created by the termination of monitoring studies prior to the WUPOR. They discussed the potential to have studies continued beyond the initial time frames identified in the WUP Terms of References and approved by the Comptroller of Water Rights (CWR). BC Hydro explained that the studies in the WUP Order were designed to answer specific management questions that were put forward by the original consultative committee. The TORs were developed to answer the management questions and were approved by the CWR prior to implementation. Where those management questions have been answered, further study was not deemed to be required. All ordered studies except three had answered the management questions by the end of the study period: one study was paused (MON1A) because management questions could not be answered prior to the WUPOR; and two studies were extended to gather more information to help reduce uncertainties with respect to the management questions: MON1B was extended for 2 years to evaluate benefits of pulse flows on chum spawning, MON3 was extended indefinitely to evaluate steelhead productivity during the WUP OR process. The WUPOR would allow for new management questions (and studies) to be asked and answered during the next phase of the program. BC Hydro made the decision to pause MON1A (and eventually MON1B) in anticipation of the upcoming WUPOR, with the intention that the WUPOR process would allow for unanswered management questions to be reviewed, refined, adapted or abandoned. BC Hydro noted that the Cheakamus WUPOR timeline was advanced, in part to minimize the data gap between the completion of the studies and the WUPOR.
  - Some participants raised questions about whether DFO may mandate the continuation of monitoring studies. DFO representatives clarified that this is outside the scope of DFO's duties. Further, DFO isn't resourced to conduct independent monitoring.
- Rampdown rates: There was a clarifying discussion surrounding the rampdown rates approved through the Cheakamus WUP process. Representatives from DFO noted that at that time, BC Hydro already had established preliminary rampdown rates which were briefly discussed and generally adopted by the WUP Consultative Committee; however, these rates were not subject to in-depth

research or review by the past committee. Higher minimum flows were also raised as a possible stranding mitigation measure to be considered during the WUPOR.

- Non-operational measures: The group discussed the potential for BC Hydro to implement non-operational measures such as physical works to offset for the 2019 Pink salmon stranding event. One participant suggested that this would go a long way to establishing BC Hydro as a responsible steward in the watershed. BC Hydro and DFO confirmed that such measures are within the scope of the WUPOR as it relates to physical works in lieu of operations and BC Hydro indicated they were open to exploring these kinds of opportunities.
- A number of comments were raised during the discussions specific to First Nations and to BC Hydro's facilities and operations on the Cheakamus system in relation to how Aboriginal Rights and Title are addressed, implications of UNDRIP, how traditional knowledge is incorporated, archaeological effects and traditional weirs, and past historical conditions in the watershed (e.g., logjams which provided large woody debris habitats for fish).
  - It was suggested that traditional knowledge can reduce the cost and effort of management and mitigation actions, as was demonstrated by the use of traditional knowledge in the identification of historical weir sites.
  - The implications of recent provincial UNDRIP legislation was briefly discussed. BC Hydro shared that they are engaging with the Squamish Nation on this topic, developing a collaborative process, and discussing the development of shared recommendations.

### **3 Next Steps**

Compass and BC Hydro outlined immediate next steps for the CASP following the workshop and in relation to the upcoming WUPOR:

- Compass will be preparing draft meeting notes that will be distributed to participants following the workshop.
- BC Hydro will be summarizing and updating their CASP work plan for the coming year based on workshop feedback, and further review and input from regulators and the Squamish Nation. In addition, workshop participants were invited to provide further comments on Instream's draft CASP Year 1 Study up to the middle of Jan 2020.
- BC Hydro will continue to work with the Squamish Nation in the development of a collaborative planning process for the WUPOR. It is expected that there will be a kick-off meeting in early 2020 to initiate the WUPOR.
- Workshop participants indicated an interest in the possibility of taking a tour of the river to see the state of the system; BC Hydro indicated that they are open to discussing this opportunity.

### **4 Summary Table of Workshop Recommendations**

Following the CASP workshop held on December 5<sup>th</sup>, 2019, a summary list was compiled of requests and recommendations raised by participants during the workshop. BC Hydro subsequently reviewed the table and highlighted its responses and commitments. It is intended that this table will be regularly updated. It is noted that this table does not include all of Instream's recommendations from their draft monitoring study for making improvements to the CASP monitoring work plan in the coming year.

CASP Workshop Recommendations		Post - Workshop	
Topic	Description	BC Hydro Response and Commitments	Status
Engagement	A request was made for more opportunities to engage and receive operational and monitoring updates on a more regular and ongoing basis, especially in the lead up to the WUPOR.	BC Hydro commits to increasing engagement in anticipation of the WUPOR.	Ongoing
	There was interest expressed by participants to have a tour of the Cheakamus river, facilities, and stranding sites of concern.	BC Hydro agrees to explore and discuss opportunities for tours.	For Spring 2020
Operations	A request was made for inclusion of diversion flows (hydrograph) to the Cheakamus power station to be added to future operational summaries for the Cheakamus system.	BC Hydro agrees to include this information in future communications.	Ongoing
CASP	Comments were raised in relation to limitations of the current CASP methodology to assess whether stranding may be having population level effects.	BC Hydro will improve CASP monitoring to better provide results relative to a baseline of impact.	Initial changes implemented Dec 2019; final changes by Spring 2020.
	Comments were made in relation to developing species-specific abundance level benchmarks to better characterize stranding risk associated with low abundance levels. Related to this was the importance of carrying out abundance monitoring for the CASP.	BC Hydro will improve CASP monitoring – specifically electrofishing – to inform stranding rates during periods of low abundance.	
	To better understand the significance of current stranding risk a desktop study to assess natural stranding risk was recommended as a helpful reference point.	BC Hydro is open to using observations of natural stranding as a baseline for assessment of stranding risk during BC Hydro operations.	Likely for initiation in Spring 2020
	There was also a recommendation to carry out additional research (towards a metric) to better understand the significance of stranding risk between pool and bar stranding, as this may be helpful at prioritizing future mitigation efforts.	BC Hydro will incorporate results from their habitat model for the Cheakamus river into its estimate for bar stranding to provide better integration of pool stranding estimates.	By Spring 2020
	There was a request to test the assumption that the most sensitive and vulnerable reaches to stranding risk were in the upper sections of the river by assessing reaches below Fergie's.	BC Hydro will be reviewing the opportunity to expand its stranding assessments to ensure its index stranding sites are representative of stranding in the river as a whole	By Spring 2020.
	Participants expressed interest in the assessment of stranding risk on the Squamish River below the Cheakamus power plant tail race.	The supplementary report is available on BC Hydro WUP / WLR website.	N/A.
	There was interest expressed in further discussing non-operational mitigation measures related to CASP and mitigation for past/future stranding events (e.g.,	BC Hydro is open to reviewing these opportunities and options with DFO and stakeholders.	Initial conversation with DFO in Dec 2019; to



CASP Workshop Recommendations		Post - Workshop	
Topic	Description	BC Hydro Response and Commitments	Status
	Tenderfoot hatchery, side channel engineering).		continue in early 2020.
WUPOR	A request was made to better understand hydrological changes in the watershed since the original WUP (e.g., cumulative effects from other developments and land uses, etc.) and anticipated future changes (i.e., climate change, receding glaciers) to better be able to assess water resources and their availability for the WUPOR.	Inflow data will be updated as part of the WUPOR which will reflect the recent conditions in timing and magnitude of inflows.	
	It was requested that BC Hydro better highlight the proposed WUPOR steps that are internal (BC Hydro) and external involving other government agencies.	BC Hydro will clarify the involvement of external agencies in the future.	Ongoing.
	There was a suggestion that traditional knowledge be better built into the WUPOR.	BC Hydro will continue to work with the Squamish Nation on a collaborative WUPOR engagement plan.	Ongoing.
	A request was also made for the continuation of some WUP monitoring studies (e.g., CMSMON 3), which were considered critical for helping to differentiate fish population responses between natural versus anthropogenic effects. This information was considered central to informing potential future operational changes in the WUPOR.	BC Hydro clarifies that it is still implementing CMSMON3, but that it recommended pausing CMSMON1a and 1b until the WUPOR because continuing those studies would not further address management questions in support of WUPOR decisions. Future monitoring requirements will be revisited in the WUPOR process.	WUPOR
	A number of comments were made on the importance of increasing base flows in the Cheakamus River at certain times of the year.	BC Hydro acknowledges that increased base flows can be an effective way to mitigate stranding concerns and should be properly evaluated in the WUPOR process. There are significant tradeoffs and planning to consider in this decision, including flood risk, which are best suited for the WUPOR table to consider.	WUPOR