Bridge River Water Use Plan

Monitoring Program and Physical Works

Annual Report: 2018

Implementation Period: February 2017 to January 2018

- **BRGMON-1 Lower Bridge River Aquatic Monitoring**
- **BRGMON-2 Carpenter Reservoir Riparian Vegetation Monitoring**
- **BRGMON-3 Lower Bridge River Adult Salmon and Steelhead Enumeration**
- **BRGMON-4 Carpenter Reservoir and Middle Bridge Fish Habitat and Population Monitoring**
- **BRGMON-5 Downton Reservoir Riparian Vegetation Monitoring**
- **BRGMON-6 Seton Lake Aquatic Productivity Monitoring**
- **BRGMON-7 Downton Reservoir Fish Habitat and Population Monitoring**
- **BRGMON-8 Seton Lake Resident Fish Habitat and Population Monitoring**
- **BRGMON-9 Seton River Habitat and Fish Monitoring**
- **BRGMON-10 Carpenter Reservoir Productivity Model Validation and Refinement**
- **BRGMON-11 Lower Bridge River Riparian Vegetation Monitoring**
- **BRGMON-12 Bridge-Seton Metals and Contaminant Monitoring Program**
- **BRGMON-13 Seton Sockeye Salmon Smolts Monitoring Program**
- **BRGMON-14 Effectiveness of Cayoosh Flow Dilution, Dam Operation, and Fishway Passage on Delay and Survival of Upstream Migration of Salmon in the Seton-Anderson Watershed**
- **BRGMON-15 Seton Lake Erosion Mitigation Program**
- **BRGMON-16 Lower Bridge River Spiritual and Cultural Value Monitoring**
- **BRGWORKS-1 Carpenter Revegetation**
- **BRGWORKS-2 Seton Lake Erosion**

For Water Licences FWL 126279, 126278, 126280, 126281, 126286, 126287, 126288, 126282, 126283, 12680, 126250 and 126259.

February 28, 2018

BC Hydro Bridge River Project Water Use Plan Monitoring Programs and Physical Works Annual Report: 2018

1 Introduction

This document represents a summary of the status and the results of the Bridge River Water Use Plan (WUP) monitoring programs and physical works to January 31, 2018, as per the Bridge River Order under the *Water Act*, dated March 30, 2011. There are 16 monitoring programs and two physical works.

2 Status

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

Table: 2-1: Dates of Bridge River WUP TOR Submissions and Approvals by the Comptroller of Water Rights

Monitoring Program & Physical Works TOR	Order Clause	Original ToR Submission		Most Recent ToR Resubmission	
		Date Submitted	Date Approved	Date Submitted	Date Approved
BRGMON-1 Lower Bridge River Aquatic Monitoring	Schedule A.9	Jan 30, 2012	Apr 12, 2012		
BRGMON-2 Carpenter Reservoir Riparian Vegetation Monitoring	Schedule A.6	Jan 30, 2012	Jun 26, 2012	Mar 06, 2017	Mar 21, 2017
BRGMON-3 Lower Bridge River Adult Salmon and Steelhead Enumeration	Schedule A.10	Jan 30, 2012	Feb 07, 2012		
BRGMON-4 Carpenter Reservoir and Middle Bridge Fish Habitat and Population Monitoring	Schedule A.7	Jan 30, 2012	Jun 06, 2012	Mar 23, 2015	May 01, 2015
BRGMON-5 Downton Reservoir Riparian Vegetation Monitoring	Schedule A.2	Mar 30, 2012	Jul 11, 2012		
BRGMON-6 Seton Lake Aquatic Productivity Monitoring	Schedule A.14	Mar 14, 2014	Apr 23, 2014		
BRGMON-7 Downton Reservoir Fish Habitat and Population Monitoring	Schedule A.3	Jan 30, 2012	Jun 06, 2012	Mar 23, 2015	Jun 02, 2015
BRGMON-8 Seton Lake Resident Fish Habitat and Population Monitoring	Schedule A.15	Jan 30, 2012	Jun 07, 2012	Mar 23, 2015	May 01, 2015
BRGMON-9 Seton River Habitat and Fish Monitoring	Schedule A.16	Jan 30, 2012	Jun 07, 2012		
BRGMON-10 Carpenter Reservoir Productivity Model Validation and Refinement	Schedule A.5	Mar 14, 2014	May 01, 2014	Oct 21, 2014	Nov 04, 2014
BRGMON-11 Lower Bridge River Riparian Vegetation Monitoring	Schedule A.8	Mar 30, 2012	Jun 27, 2012		
BRGMON-12 Bridge-Seton Metals and Contaminant Monitoring Program	Schedule A.1	Mar 30, 2012	Jul 24, 2012		
BRGMON-13 Seton Sockeye Salmon Smolts Monitoring Program	Schedule A.17	Jan 30, 2012	Apr 05, 2012		
BRGMON-14 Effectiveness of Cayoosh Flow Dilution, Dam Operation, and Fishway Passage on Delay and Survival of Upstream Migration of Salmon in the Seton-Anderson Watershed	Schedule A.18	Jan 30, 2012	Jun 26, 2012	Nov 30, 2017	Dec 15, 2017
BRGMON-15 Seton Lake Erosion Mitigation Program	Schedule A.13	Mar 30, 2012	Jul 13, 2012		
BRGMON-16 Lower Bridge River Spiritual and Cultural Value Monitoring	Schedule A.11	Mar 30, 2012	Jul 26, 2012	Mar 19, 2013	Apr 08, 2013
BRGWORKS-1 Carpenter Revegetation	Schedule A.4	Mar 14, 2014	May 02, 2014	Mar 06, 2017	Mar 21, 2017
BRGWORKS-2 Seton Lake Erosion	Schedule A.12	Not yet submitted			

3 Schedule

The following table outlines the current schedule for the monitoring programs and physical works being delivered for the Bridge River WUP.

Table 3-1: Monitoring and Physical Works Schedule as of January 31, 2018

Monitoring Programs	2012 WLR YR1	2013 WLR YR2	2014 WLR YR3	2015 WLR YR4	2016 WLR YR5	2017 WLR YR6	2018 WLR YR7	2019 WLR YR8	2020 WLR YR9	2021 WLR YR10	2022 WLR YR11
BRGMON-1 Lower Bridge River Aquatic Monitoring	✓	✓	✓	✓	✓	✓	■	■	■	■	
BRGMON-2 Carpenter Reservoir Riparian Vegetation Monitoring		✓	✓	✓	✓	✓	■	■	■	■	■
BRGMON-3 Lower Bridge River Adult Salmon and Steelhead Enumeration	✓	✓	✓	✓	✓	✓	■	■	■	■	
BRGMON-4 Carpenter Reservoir and Middle Bridge Fish Habitat and Population Monitoring		✓	✓	✓	✓	✓	■	■	■	■	■
BRGMON-5 Downton Reservoir Riparian Vegetation Monitoring		✓					■				■
BRGMON-6 Seton Lake Aquatic Productivity Monitoring			✓	✓	✓	✓F					
BRGMON-7 Downton Reservoir Fish Habitat and Population Monitoring		✓	✓	✓	✓	✓	■	■	■	■	■
BRGMON-8 Seton Lake Resident Fish Habitat and Population Monitoring		✓	✓	✓	✓	✓	■	■	■	■	■
BRGMON-9 Seton River Habitat and Fish Monitoring		✓	✓	✓	✓	✓	■	■	■	■	■
BRGMON-10 Carpenter Reservoir Productivity Model Validation and Refinement				✓	✓	✓F					
BRGMON-11 Lower Bridge River Riparian Vegetation Monitoring	✓	✓	✓		✓		■		■		
BRGMON-12 Bridge-Seton Metals and Contaminant Monitoring Program		✓	✓	✓	✓F						
BRGMON-13 Seton Sockeye Salmon Smolts Monitoring Program	✓	✓	✓	✓	x[1]	x[1]	■	■	■	■	
BRGMON-14 Effectiveness of Cayoosh Flow Dilution, Dam Operation, and Fishway Passage on Delay and Survival of Upstream Migration of Salmon in the Seton-Anderson Watershed	✓	✓	✓	✓	✓	✓	■	■	■		
BRGMON-15 Seton Lake Erosion Mitigation Program		✓				x[2]	■	■		■	
BRGMON-16 Lower Bridge River Spiritual and Cultural Value Monitoring		✓	✓	✓	✓	■					
Physical Works											
BRGWORKS-1 Carpenter Revegetation			✓	✓	✓	✓	■	■	■		
BRGWORKS-2 Seton Lake Erosion				x	x[2]						

Legend:
- ■ = Program to be undertaken/initiated in identified year
- ✓ = Program completed for the year
- x = Program start delayed
- 1 = High flows in Seton River caused the program to be cancelled in 2016 due to safety and equipment concerns
- 2 = Program start delayed due to complexities in identifying erosion sites and setting priorities.
- ✓F = All field work for this project is complete. No further field work is planned.

4 Monitoring Programs and Physical Works Terms of Reference

The monitoring programs and physical works being implemented under the Bridge River WUP are described in TOR. These TORs and the reports for work completed to date can be found here:

http://www.bchydro.com/about/sustainability/conservation/water_use_planning/lower_mainland/bridge_river.html

5 Status of Monitoring Programs

5.1 BRGMON-1 Lower Bridge River Aquatic Monitoring

The objective of this monitoring program is to measure the functional relationship between flow release from the dam and key physical and ecological indicator variables. This program was initiated in August 2012 and will be carried out annually for ten years.

BC Hydro implemented modified operations in the Bridge River system for the second year (2017) resulting in peak flows of 127 m^3/s which are higher than the peak flows observed under the WUP Ordered operations. The modified operations required a variance to the flow release for Terzaghi Dam. BC Hydro continued with additional monitoring to capture the incremental impact of these higher spring-summer flows on fish, habitat and productivity. As well, additional effort was put into the regular data collection and methods associated with completing BRGMON-1 under high flow conditions. After two years of monitoring the physical and ecological variables associated with the ordered flows and the modified flows, BC Hydro has drafted a revised Terms of Reference that will include all these variables and guide the remainder of the monitoring program. The TOR will be submitted to your office by November 30, 2018. The results of this work, as well as upcoming monitoring, will provide a basis for adaptive management of the current Bridge River Water Use Plan (WUP) projects to accommodate the flow changes and continue to collect data to inform management questions.

Discussions related to operations in the Bridge River system and the flow release strategy on the Lower Bridge River are ongoing with St'at'imc and agencies.

The 2016 (Year 5) monitoring report dated October 2, 2017 is attached. The 2015 (Year 4) and 2017 (Year 6) report is in draft and under review, and will be included in the next annual report

5.2 BRGMON-2 Carpenter Reservoir Riparian Vegetation Monitoring

The objectives of this monitoring program are to monitor vegetation response within the drawdown zone of Carpenter Reservoir, and the effectiveness of revegetation treatments in the Gun Creek Fan and adjacent area, completed by the physical works program BRGWORKS-1. This program was initiated in April 2013 and will be carried out at intervals over ten years.

In 2017, BC Hydro continued to monitor the effects of Carpenter Reservoir operations and the effectiveness of BRGWORKS-1 revegetation treatments on riparian enhancement in the Gun Creek Fan area. Revegetation treatment methods have continued to evolve since 2014 and now include, alteration of terrain in areas where substrates are severely compacted (TOR Revision March 21, 2017). The data from this project will be used to analyse the effects of Carpenter Reservoir operations on soil substrates and natural vegetation regeneration, and effectiveness of the treatments.

In 2018, BRGMON-2 will continue to evaluate the effectiveness of the physical works program BRGWORKS-1, and provide recommendations for effective physical works methods to be completed in 2019.

Reporting for the 2013 (Year 1), 2014/2015 (Year and Year 3), 2016 (Year 4) and 2017 (Year 5) field seasons are in draft and under review. These reports will be included in the next annual report.

5.3 BRGMON-3 Lower Bridge River Adult Salmon and Steelhead Enumeration

The objective of this monitoring program is to evaluate effects of flow on spawning habitat, spawning distribution, and numbers of returning spawners under the alternative test flows. This information will allow interpretation of the relative aquatic productivity of the Lower Bridge River as a flow effect rather than an artefact of external factors such as abnormally low or high spawning population abundance due to changes in ocean survival. This monitoring program, which supports BRGMON-1, was initiated in August 2012 and is being implemented for ten years.

In 2017, modified operations in the Bridge River system resulted in higher annual average flows than the 6 m^3/s required by the Order. These operations required a variance to the flow release for Terzaghi Dam. BC Hydro completed additional monitoring to capture the potential incremental impact of these higher spring-summer flows on steelhead spawner distribution, spawning gravel movement, and fish access to spawning grounds. As well, additional effort was put into the regular data collection and methods associated with completing BRGMON-3 under high flow conditions. The results from this work, as well as upcoming monitoring, will provide the basis for adaptive management of the current Bridge River Water Use Plan (WUP) projects to accommodate the flow changes and continue to collect data to inform management questions.

Methods for data collection were refined in 2017 due to the second year of higher spring/summer flows. The permanently installed resistivity fish counter again sustained damage during the 2017 flows. BC Hydro has developed a plan to repair the fish counter before 2018 freshet. BC Hydro is drafting a TOR revision to include the variance related monitoring that will guide the remainder of the monitoring program. The TOR will be submitted to your office by November 30, 2018.

The 2016 (Year 5) monitoring report dated December 31, 2016, is attached and includes the findings from the first year of high flow monitoring. The 2017 (Year 6) report is in draft and under review and will be included in the next annual report. This report also includes findings from the second year of high flow monitoring.

5.4 BRGMON-4 Carpenter Reservoir and Middle Bridge Fish Habitat and Population Monitoring

The objective of this monitoring program is to collect comprehensive information on the life history, biological characteristics, distribution, abundance and composition of the fish community in Carpenter Reservoir and Middle Bridge River. The information collected is required to link the effects of reservoir operation on fish populations and inform future decisions regarding preferred operations. This monitoring program was initiated in October 2012 with fieldwork starting in 2013 and will be carried out annually over ten years.

Based on the Year 1 analysis it was identified that the original monitoring program would not adequately answer management questions as outlined in the

TOR and BC Hydro initiated a review and redevelopment of the TOR based on results of Years 1 and 2. The 2014 (Year 2) field season was used to continue field activities from Year 1 (i.e., tributary spawner surveys and mark-recapture activities) and to test alternative survey and data capture methods including closed mark-recapture modeling, short set gill netting, the use of a sonar camera in the Middle Bridge River, and Bull Trout radio telemetry.

Monitoring in 2015 (Year 3) included: a second year of Bull Trout radio tracking in the Carpenter Reservoir watershed, installation of acoustic telemetry gates in the reservoir and at the boundary of the reservoir and the Middle Bridge River, an open mark-recapture period for Bull Trout in the upper reservoir, visual surveys for spawning Rainbow Trout and kokanee, and a short survey of spawning habitat quality in visual survey stream sections. Radio telemetry was continued in Year 3 to determine weekly positions of 30 radio-tagged Bull Trout tagged in Year 2 in the Carpenter Reservoir watershed

Monitoring in 2016 (Year 4) included a pilot short-set gill netting program in four reservoir habitat zones, acoustic tagging and tracking of Bull Trout in the reservoir and into the Middle Bridge River, a second year of the Bull Trout open mark-recapture program, visual surveys for spawning kokanee, and monthly juvenile electroshocking surveys in three Carpenter Reservoir tributaries.

The 2015 (Year 3) monitoring report dated January 1, 2017, and the 2016 (Year 4) monitoring report dated May 2017 are attached. The 2017 (Year 5) report is in draft and under review, and will be included in the next annual report.

5.5 BRGMON-5 Downton Reservoir Riparian Vegetation Monitoring

The objective of this monitoring program is to document the response of the riparian community on the Upper Bridge River Fan and in the immediate adjacent drawdown zone of Downton Reservoir to determine if Downton operations have had any negative impact on riparian vegetation and the overall quality of the habitat for wildlife in the area. This monitoring program was implemented in 2013 and will be implemented again in 2022.

BC Hydro implemented modified operations in 2016 which included decreasing Downton's maximum reservoir elevation by 16 vertical metres from 750 m to 734 m for a period of ten or more years. This is a lower maximum target reservoir elevation than originally anticipated under the WUP. Due to the lower maximum reservoir levels, a TOR resubmission letter is being drafted and will be submitted to your office by December 15, 2018 to include an additional year of monitoring that will be used to gather new baseline data. Aerial photography is scheduled for June 2018 targeting vegetation during the spring growing season.

The 2013 (Year 1) dated January 23, 2014 report is attached.

5.6 BRGMON-6 Seton Lake Aquatic Productivity Monitoring

The objective of this monitoring program was to document the impacts of Carpenter Lake Diversion on the biological productivity of Seton Lake Reservoir. Sediment cores taken from the bottom of Seton Lake were analyzed for biological, physical, and chemical parameters to reconstruct past environmental conditions in the aquatic ecosystem, thereby informing whether future operational decisions might be made to potentially mitigate impacts of the diversion. This

monitoring program was initiated in 2014 and was carried out annually over three years, ending in 2016.

The 2015 (Year 2) monitoring report dated May 16, 2016 are attached. The 2016 (Final Year) monitoring report is underway and will be submitted with next year's annual report.

5.7 BRGMON-7 Downton Reservoir Fish Habitat and Population Monitoring

The objective of this monitoring program is to collect comprehensive information on the life history, biological characteristics, distribution, abundance and composition of the fish community in Downton Reservoir. The information collected is required to link the effects of reservoir operation on fish populations and inform future operational decisions. This monitoring program was initiated in October 2012 with fieldwork starting in 2013 and will be carried out annually over ten years.

The 2015 (Year 3) monitoring report dated January 9, 2018 is attached. The 2016 (Year 4) and the 2017 (Year 5) monitoring report is underway and will be submitted in next year's annual report.

5.8 BRGMON-8 Seton Lake Resident Fish Habitat and Population Monitoring

The objective of this monitoring program is to collect comprehensive information on the life history, biological characteristics, distribution, abundance and composition of the fish community in Seton Lake. The information collected is required to link the effects of reservoir operations on fish populations and to inform future operational decisions. This monitoring program was initiated in October 2012 with fieldwork starting in 2013 and will be carried out annually over ten years.

The 2015 (Year 3) dated February 6, 2018 is attached. The 2016 (Year 4) and 2017 (Year 5) monitoring report are still under review and will be included in the next annual report.

5.9 BRGMON-9 Seton River Habitat and Fish Monitoring

The objective of this monitoring program is to monitor the response of fish habitat and fish populations to Seton Dam operations. The information gained from this study will help evaluate the selection of a preferred hydrograph, and provide information to support future operational decisions and the trade-offs with water management in other parts of the Bridge River-Seton system. This monitoring program was initiated in November 2012 with fieldwork starting in 2013, and will be carried out annually over ten years.

In 2017, operations in the Bridge River-Seton system required flows from Seton Dam into the Seton River above the targets indicated in the Order for the second consecutive year. Although excursions above the target flows as experienced in 2017 are allowed under the Order and are expected as part of normal operations, the duration of these excursions in 2017 have affected the ability of the study team to access certain sites on the river. Alternatively, effort was directed at examining the presence and distribution of juvenile fish in the Seton River during high discharge periods. Four side channel habitats were identified and 10 fish species were observed. `

The 2016 (Year 4) monitoring report dated February 26, 2018 is attached. The 2017 (Year 5) monitoring report is underway and will be submitted in next year's annual report.

5.10 BRGMON-10 Carpenter Reservoir Productivity Model Validation and Refinement

The objective of this monitoring program is to collect the information required to validate and refine models of the effects of reservoir operation on the biological productivity of Carpenter Reservoir. Reservoir operations drive physical conditions such as light, temperature, nutrient concentrations, and turbidity, which translate to a biological response. Using data collected under BRGMON-6, BRGMON-10 is using two types of models to determine rates of biological production in Carpenter Reservoir. The first model is a habitat model and the second is a physical/chemical model. The models are being linked together and will be used to predict the biological productivity response to reservoir operations and support future operational management decisions.

This three-year monitoring program was initiated in May 2014, and field work began in 2015/16.

The study is on track to answering the management question with additional data in 2017-2018 using the current approach/study design.

The 2015 (Year 1) monitoring report dated May 30, 2016 and the 2016 (Year 2) monitoring report dated April 7 2017 are attached. The 2017 (Year 3) monitoring report is underway and will be submitted in next year's annual report.

5.11 BRGMON-11 Lower Bridge River Riparian Vegetation Monitoring

The objective of this monitoring program is to document the impacts of alternate flow regimes from Terzaghi Dam on the productivity of riparian vegetation and wildlife in the Lower Bridge River. The focus of this study is on the growth of Black Cottonwoods, which are the dominant riparian vegetation along the Lower Bridge River, and key wildlife species potentially influenced by flow and changes to the riparian vegetation community on the Lower Bridge River. This monitoring program was initiated in November 2012 and will be carried out at intervals over ten years.

In 2016, seismic safety concerns at the La Joie Dam upstream altered the capacity to store water in the Downton Reservoir, and the regulation of flows down the LBR needed to be modified to pass additional water downstream. Due to these modified operations, no riparian vegetation WUP monitoring was implemented in 2017 as per the Order; however, modified flow monitoring was continued in 2017 to assess the impact of high flows on riparian habitat extent and response, cottonwood seedling establishment, and cottonwood seed release timing. A modified flow report was produced from data collected in 2016 and 2017. The results of this modified flow work will be incorporated into the WUP work in a revised TOR (that will be submitted to your office by November 30, 2018) that will include all these variables and guide the remainder of the study. Field data will continue to be collected for the merged monitoring program in 2018 and 2020.

The 2013 (Year 2) monitoring report dated March 14, 2014, and the 2014 (Year 3) monitoring report dated August 2014 are attached. The 2016 (Year 4) monitoring report is underway and will be submitted in next year's annual report.

5.12 BRGMON-12 Bridge-Seton Metals and Contaminant Monitoring Program

The objective of this monitoring program was to document water quality and potential heavy metal contamination in the Bridge River system. It was also intended to determine if reservoir operations resulted in a change to the concentration and/or distribution of metals and other contaminants. If redistribution occurred, the program was to assess if it resulted in an increased bioaccumulation of metals and contaminants in fish in the system.

This monitoring program was initiated in May 2013 and final reporting was completed in 2016. All management questions for this program have been answered and this project is complete.

5.13 BRGMON-13 Seton Sockeye Salmon Smolts Monitoring Program

The objective of this monitoring program is to assess the effectiveness of powerhouse shutdowns to reduce the total entrainment mortality of sockeye salmon smolts leaving Seton Lake. This study also includes abundance, timing and biological characteristics of sockeye smolts leaving the lake, and the relationship between the dam water release and proportion of sockeye smolts through the Seton Dam into Seton River. This monitoring program was initiated in April 2012 and will be carried out annually over ten years.

The 2016 field season was cancelled due to the modified operations in the Bridge River system that required flows from Seton Dam into the Seton River above the targets indicated in the Order which were too high for the standard Rotary Screw Trap (RST) setup which compromised the safety of the BRGMON-13 crews.

In 2017, BC Hydro modified the RST so that they were more robust to withstand the pressures of the high flows and deployed them in the Seton River under the modified flow regime. It was concluded that the RST's could withstand the pressure of the high flows and that the RST's could be used in the future under high flow circumstances upon maintenance and safety inspection of the traps.

In 2018, BC Hydro will conduct maintenance and inspect the modified RST's to ensure that they are safe for deployment so that the monitoring of entrainment mortality of sockeye salmon smolts leaving Seton Lake can continue under the normal WUP.

There is no report from the 2016 season since it was cancelled. The 2017 report is currently under review and will be submitted in next year's annual report.

5.14 BRGMON-14 Effectiveness of Cayoosh Flow Dilution, Dam Operation, and Fishway Passage on Delay and Survival of Upstream Migration of Salmon in the Seton-Anderson Watershed

The objective of this monitoring program is to determine the effectiveness of current dam operations to ensure successful migration of adult salmon via Seton Dam to spawning grounds. The program aims to evaluate the sensitivity of salmon populations to variations in the level of Cayoosh dilution in Seton River.

The program will also identify operating strategies that will mitigate delays in upstream migration without conflicting with other water use goals for environmental protection, flood risk, and power production in the Bridge Seton generating system. The results of this program will be used to inform operational decisions at Seton Dam during the upstream migrations of salmon populations in the Seton-Anderson watersheds.

This monitoring program was initiated in August 2012.

The final year of fieldwork under the existing TOR was completed in 2016. However, data review in 2017 indicated that additional Sockeye salmon enumeration was necessary. An additional four years of monitoring has been approved (December 15, 2017) to test the siphon operations and monitor Sockeye numbers at Gates creek.

The 2016 monitoring report will be submitted in next year's annual report.

5.15 BRGMON-15 Seton Lake Erosion Mitigation Program Status

The objective of this monitoring program is to provide an inventory and assessment of erosion at identified sites around Seton Lake and the Seton River resulting from the water level fluctuations of Seton Lake and due to the operation of BC Hydro facilities located on Seton Lake, Cayoose Creek and Seton River.

Information from this project provides a preliminary inventory and assessment of erosion sites to inform BRGWORKS-2 Seton Lake Erosion Management Program (SLEMP).

The first phase of this monitoring program initiated in July 2013 focused on identification of visible erosion sites including sites adjacent to areas with known heritage, cultural and aesthetic resources. The contractor worked with St'at'imc Government Services and met with St'at'imc communities in an attempt to identify sites with potential shoreline erosion risks that are in proximity to heritage and cultural resources of interest to the communities. Fieldwork for the first phase of BRGMON-15 was completed in 2014; however, BC Hydro encountered challenges with understanding how to present and use the information gathered by the study team in a report format that could be used effectively to inform the identification and prioritization of sites for potential actions.

In 2017, BC Hydro staff worked closely with staff from St'at'imc Government Services to discuss further planning, erosion site identification, and criteria development. It was determined by BC Hydro and the St'at'imc Implementation Team that an Implementation Plan be developed that will identify known sites through historical knowledge and desk top analysis. The Implementation Plan will then be presented to communities to clarify objectives and prioritizing sites with St'at'imc input.For efficiency and consistency, BRGMON-15 and BRGWORKS-2 are now aligned with the BC Hydro Reservoir Archaeology Program (RAP) that shares similar objectives regarding heritage and cultural resources.

Additional meetings with St'at'imc communities are planned in 2018.

The report from the first phase of the field program is under final review and will be submitted in next year's annual report.

5.16 BRGMON-16 Lower Bridge River Spiritual and Cultural Value Monitoring

The objective of this monitoring program is to assess the response of St'at'imc spiritual and cultural values to the flow regime on the Lower Bridge River. This monitoring program was initiated in spring of 2013 and will be carried out over five years.

In 2016 and 2017, modified operations in the Bridge River system resulted in annual average flows higher than 6 m^3/s. These operations required a variance to the flow release for Terzaghi Dam. The BRGMON-16 summer field survey coincided with the peak flow in the Lower Bridge River. The results of this work, as well as upcoming monitoring, will provide basis for adaptive management of the current Bridge River Water Use Plan (WUP) projects.

The 2016 and 2017 monitoring report will be included in next year's annual report.

6 Status of Physical Works

6.1 BRGWORKS-1 Carpenter Re-vegetation

The objective of this physical work program is to vegetate an approximately 400 ha area of the Carpenter Reservoir drawdown zone between Tyaughton Lake Road Junction and the Gun Creek Fan.

Physical manipulation of substrates, supplemental planting and dust monitoring was completed as part of 2017 physical works program. A TOR revision of BRGMON-02 monitoring program assessing the success for the BRGWORKS-1 program was also approved in January 2017, which included a 2 year extension due to the close linkage of these two programs. No treatment will be completed in 2018 to allow vegetation to respond to recent works.

Annual reports for 2016 and 2017 are underway and will be included in next year's annual report.

6.2 BRGWORKS-2 Seton Lake Erosion

This physical works has not yet been initiated.

The information regarding the identification of erosion sites including sites adjacent to areas with known heritage, cultural and aesthetic resources from BRGMON-15 Seton Lake Erosion Mitigation Program will inform plans for mitigation at priority sites as identified by BC Hydro in consultation with St'at'imc communities. The ongoing discussions and results from BRGMON-15 will inform the development of a TOR for this physical works.

7 Monitoring Programs and Physical Works Costs

The following table summarizes the Bridge River WUP monitoring programs and physical works costs approved by the Comptroller and the Actual Costs to January 31, 2018.

Table 7-1: Bridge River WUP Monitoring Programs and Physical Works Costs

Monitoring Programs & Physical Works	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
BRG Prepare Annual Report	$17,703	$16,503	$11,453	$27,956	($10,253)		
BRGM01A Low Bridge R Aquatic - OR	$2,126,171	$1,661,857	$1,235,823	$2,897,679	($771,508)	The TOR will be revised to better answer the Management Questions.	A TOR resubmission letter will be submited by November 30, ,2018
BRGM01A Low Bridge R Aquatic - OR DM	$92,854	$93,026	$37,043	$130,068	($37,214)		
BRGM01A Low Bridge R Aquatic - OR Imp	$2,033,317	$1,568,831	$1,198,780	$2,767,611	($734,294)		
BRGM02A Carpenter Rse Riparia - OR	$778,013	$322,244	$410,264	$732,508	$45,505	Efficiencies found during project implementation.	
BRGM02A Carpenter Rse Riparia - OR DM	$81,253	$51,640	$26,886	$78,526	$2,727		
BRGM02A Carpenter Rse Riparia - OR Imp	$696,760	$270,604	$383,378	$653,982	$42,778		
BRGM03A Low BR Salmon & Steel - OR	$1,975,352	$1,644,524	$1,532,629	$3,177,153	($1,201,801)	The TOR will be revised to better answer the Management Questions.	A TOR resubmission letter will be submited by November 30, 2018
BRGM03A Low BR Salmon & Steel - OR DM	$92,722	$43,032	$30,815	$73,847	$18,875		
BRGM03A Low BR Salmon & Steel - OR Imp	$1,882,630	$1,601,492	$1,501,813	$3,103,306	($1,220,676)		
BRGM04A Carp Rse&MId BR Fish - OR	$1,843,675	$855,757	$906,545	$1,762,302	$81,373	Efficiencies found during project implementation.	
BRGM04A Carp Rse&MId BR Fish - OR DM	$98,053	$28,062	$24,929	$52,991	$45,062		
BRGM04A Carp Rse&MId BR Fish - OR Imp	$1,745,622	$827,695	$881,616	$1,709,311	$36,311		
BRGM05A Downton Rse Riparian - OR	$355,756	$174,309	$312,664	$486,974	($131,218)	The TOR will be revised to better answer the Management Questions.	A TOR resubmission letter will be submited by Dec 15, 2018
BRGM05A Downton Rse Riparian - OR DM	$26,922	$13,823	$16,787	$30,611	($3,689)		
BRGM05A Downton Rse Riparian - OR Imp	$328,834	$160,486	$295,877	$456,363	($127,529)		
BRGM06A Seton Lake Aquatic Pr	$1,319,947	$1,266,920	$18,686	$1,285,607	$34,340	Project Completed	
BRGM06A Seton Lake Aquatic Pr - OR DM	$32,524	$21,587	$10,700	$32,287	$237		
BRGM06A Seton Lake Aquatic Pr - OR Imp	$1,287,423	$1,245,333	$7,986	$1,253,319	$34,104		
BRGM07A Downton Rse Fish Habi - OR	$1,063,401	$475,118	$553,319	$1,028,437	$34,964	Efficiencies found during project implementation.	
BRGM07A Downton Rse Fish Habi - OR DM	$87,909	$27,605	$30,935	$58,540	$29,369		
BRGM07A Downton Rse Fish Habi - OR Imp	$975,492	$447,513	$522,384	$969,898	$5,594		
BRGM08A Seton Fish Hab & Pop	$947,702	$416,114	$495,381	$911,495	$36,207	Efficiencies found during project implementation.	
BRGM08A Seton Fish Hab & Pop - OR DM	$85,780	$20,099	$29,984	$50,083	$35,697		
BRGM08A Seton Fish Hab & Pop - OR Imp	$861,922	$396,015	$465,397	$861,412	$510		
BRGM09A Seton R Habitat & Fis	$1,185,918	$678,562	$1,098,058	$1,776,620	($590,702)	The TOR will be revised to better answer the Management Questions.	A TOR resubmission letter will be submited by November 30, 2018
BRGM09A Seton R Habitat & Fis - OR DM	$85,924	$25,218	$29,220	$54,438	$31,486		
BRGM09A Seton R Habitat & Fis - OR Imp	$1,099,994	$653,345	$1,068,838	$1,722,182	($622,188)		
BRGM10A Carp Rse Prod Model - OR	$995,981	$935,522	$72,468	$1,007,990	$0		
BRGM10A Carp Rse Prod Model - OR DM	$23,991	$23,298	$3,984	$27,282	($3,291)		
BRGM10A Carp Rse Prod Model - OR Imp	$971,990	$912,225	$56,474	$968,699	$3,291		
BRGM11A Low BR Riparian Vege - OR	$567,076	$411,771	$183,614	$595,385	($28,309)	The TOR will be revised to better answer the Management Questions.	A TOR resubmission letter will be submited by November 30, 2018
BRGM11A Low BR Riparian Vege - OR DM	$33,052	$36,352	$25,547	$61,899	($28,847)		
BRGM11A Low BR Riparian Vege - OR Imp	$534,024	$375,419	$158,067	$533,486	$538		
BRGM12A Bridge-Seton Metals - OR	$481,257	$117,170	$6,206	$123,376	$357,881	Project Completed	
BRGM12A Bridge-Seton Metals - OR DM	$65,889	$12,732	$6,206	$18,938	$46,951		
BRGM12A Bridge-Seton Metals - OR Imp	$415,368	$104,438		$104,438	$310,930		
BRGM13A Seton Powerhouse	$1,958,221	$896,672	$815,982	$1,712,654	$245,567	Efficiencies found during project implementation.	
BRGM13A Seton Powerhouse - OR DM	$89,289	$41,858	$35,838	$77,697	$11,592		
BRGM13A Seton Powerhouse - OR Imp	$1,868,932	$854,813	$780,144	$1,634,957	$233,975		
BRGM14A Cayoosh Flow Dilutio	$2,564,557	$2,264,338	$53,397	$2,317,735	$246,822	Efficiencies found during project implementation.	
BRGM14A Cayoosh Flow Dilutio - OR DM	$66,600	$43,809	$3,735	$47,544	$19,056		
BRGM14A Cayoosh Flow Dilutio - OR Imp	$2,497,957	$2,220,529	$49,662	$2,270,191	$227,766		
BRGM15A SON Erosion Mitigate	$184,648	$127,484	$57,164	$184,648	$0		
BRGM15A SON Erosion Mitigate - OR DM	$17,403	$35,312	$5,664	$40,976	($23,573)		
BRGM15A SON Erosion Mitigate - OR Imp	$167,245	$92,172	$51,500	$143,672	$23,573		
BRGM16A Spiritual & Cultural - OR	$495,211	$393,754	$73,503	$467,258	$27,953		
BRGM16A Spiritual & Cultural - OR DM	$44,246	$23,883	$9,417	$33,300	$10,946		
BRGM16A Spiritual & Cultural - OR Imp	$450,965	$369,872	$64,086	$433,958	$17,007		
BRGW01A Carp Re-Vegetation - OR	$1,329,224	$835,646	$272,669	$1,108,316	$220,908		
BRGW01A Carp Re-Vegetation - OR DM	$55,986	$68,828	$7,009	$75,837	($19,851)		
BRGW01A Carp Re-Vegetation - OR Imp	$1,273,238	$766,819	$265,660	$1,032,479	$240,759		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.