

Bridge River Water Use Plan Monitoring Program and Physical Works

Annual Report: 2019

Implementation Period: February 2018 to January 2019

- **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-11A Lower Bridge River Riparian Vegetation Monitoring**
- **BRGMON-11B Lower Bridge River Riverine Wildlife 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, 2019

BC Hydro Bridge River Project Water Use Plan Monitoring Programs and Physical Works Annual Report: 2019

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, 2019, as per the Bridge River Order under the *Water Act*, dated March 30, 2011. There are 17 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 CWR

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	Nov 30, 2018	Feb 05, 2019
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	Nov 30, 2018	Jan 02, 2019
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	Nov 30, 2018	Feb 07, 2019
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-11A Lower Bridge River Riparian Vegetation Monitoring	Schedule A.8	Nov 30, 2018	Jan 25, 2019		
BRGMON-11 B Lower Bridge River Riverine Wildlife Monitoring	Schedule A.8	Nov 30, 2018	Jan 25, 2019		
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	Apr 24, 2018	Jun 06, 2018
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, 2019

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-11A Lower Bridge River Riparian Vegetation Monitoring	✓				✓					■	
BRGMON-11B Lower Bridge River Riverine Wildlife Monitoring	✓	✓	✓		✓		✓		■		
BRGMON-12 Bridge-Seton Metals and Contaminant Monitoring Program		✓	✓	✓	✓F						
BRGMON-13 Seton Sockeye Salmon Smolts Monitoring Program	✓	✓	✓	✓	x	x	✓	■	■	■	
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	✓	■		■	
BRGMON-16 Lower Bridge River Spiritual and Cultural Value Monitoring			✓	✓	✓	✓	✓F				
Physical Works											
BRGWORKS-1 Carpenter Revegetation			✓	✓	✓	✓	✓	■	■		
BRGWORKS-2 Seton Lake Erosion								■			

Legend: ■ = Program to be undertaken/initiated in identified year
 ✓ = Program completed for the year
 x = Program delayed/postponed
 ✓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.BC Hydro.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 the BRGMON-1 monitoring is to quantify the response of key physical and biological indicators in the Lower Bridge River to different instream flow regimes to determine which variables explain any changes in aquatic productivity.

This program was initiated in August 2012 and will be carried out annually for ten years.

On February 5, 2019 the CWR approved TOR Revision 1 for this study. The TOR revision will help address concerns regarding early emergence of Chinook salmon and help determine juvenile rearing locations by analyzing juvenile otolith microchemistry.

Since 2016, with CWR approval, BC Hydro has implemented modified operations at Downton Reservoir which has resulted in discharges down the Lower Bridge River during freshet that are higher than the targets under the WUP Ordered operations.

During these modified operations, BC Hydro has added monitoring to capture other changes in fish, habitat and productivity during this high flow periods (not included in the WUP budget). This additional modified operations monitoring is complementary to BRGMON-1 WUP monitoring and the results of both programs have been integrated into the 2017 (Year 6) WUP report.

The monitoring reports from 2015 (Year 4) report dated February 7, 2018 and the 2017 (Year 6) dated November 7, 2018 are attached. Note the 2016 (Year 5) report was submitted last year. The 2018 (Year 7) 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 the BRGMON-2 monitoring program are:

- To monitor the effects of Carpenter Reservoir operations on vegetation response (including substrates and natural revegetation) within the drawdown zone of Carpenter Reservoir, and
- To monitor the effectiveness of revegetation treatments in the Gun Creek Fan and adjacent area, completed under the physical works program BRGWORKS-1.

This program was initiated in April 2013 and will be carried out at intervals over ten years.

Revegetation treatment methods have continued to evolve since 2014 and now include alteration of terrain in areas where substrates are severely compacted (TOR Revision 1 dated March 21, 2017). 2018 was the first year to collect data on the altered terrain areas (installed in 2017), including the collection and analysis of terrain elevation change, natural vegetation regeneration, planted vegetation survival, and soil temperature and moisture parameters.

The monitoring reports are attached for the following years: 2013 (Year 1) dated September 5, 2014, 2015 (Year 3) dated March 5, 2018, 2016 (Year 4) dated

March 20, 2018 and 2017 (Year 5) dated January 9, 2019. Note there was no field work in 2014 (Year 2).

The 2018 (Year 6) report will be submitted with the next annual report.

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

The main objective of the BRGMON-3 monitoring program is to provide rigorous estimates of the abundance and distribution of salmon and steelhead spawning in the Lower Bridge River. The BRGMON-3 program will also address data gaps associated spawning timing, spawning distribution, and spawning habitat quality and quantity.

This monitoring program was initiated in August 2012 and is being implemented annually for ten years.

On January 2, 2019, the CWR approved the revised TOR for BRGMON-3. This TOR revision defines new management questions related to the quality and quantity spawning habitat and address methodological gaps that were not included in the original TOR.

Since 2016, with CWR approval, BC Hydro has implemented modified operations at Downton Reservoir which has resulted in discharges down the Lower Bridge river during freshet that are higher than the targets under the WUP Ordered operations.

During these modified operations, BC Hydro has added monitoring related to steelhead spawner distribution, spawning gravel movement, and fish access to spawning grounds. This additional modified operations monitoring is complementary to BRGMON-3 WUP monitoring and the results of both programs will be integrated into future annual WUP reports.

As well, additional effort was put into the regular data collection and methods associated with completing BRGMON-3 under high flow conditions.

The 2017 (Year 6) monitoring report dated December 31, 2017, is attached. The 2018 (Year 7) report is in draft and under review and will be included in the next annual report.

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 to determine whether there is a relationship between operating parameters and productivity.

This monitoring program was initiated in October 2012 with fieldwork starting in 2013 and will be carried out annually over ten years.

The Bull Trout mark-recapture study area was expanded in 2017 (Year 5) following TOR resubmission in 2015 to include the entire reservoir (as opposed to the western half as in previous years). Data from Years 1 through 4 were retrospectively adjusted for the mark-recapture analysis.

In 2018 (Year 6), BC Hydro continued to monitor fish movement, distribution and stranding within the entire reservoir area.

The 2017 (Year 5) monitoring report dated March 1, 2018 is attached. The 2018 (Year 6) 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.

Since 2016, with CWR approval, BC Hydro has implemented modified operations at Downton Reservoir which has decreased Downton's maximum reservoir elevation by 16 vertical metres from 750 m to 734 m. In 2018, BC Hydro implemented vegetation monitoring in the zone between 734m and 750m. This additional year is not included in the WUP expenditures.

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. The final field season was completed in 2016.

The 2016 (Year 3) final monitoring report is in draft and under reviewed and will be included in next year's annual report. It will include a comprehensive review of the program.

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.

In 2018, BC Hydro continued to monitor fish population and habitat and with about over 4000 fish sampled to date.

The monitoring report for 2016 (Year 4) dated February 5, 2018 and 2017(Year 5) dated January 25, 2019 are attached. The 2018 (Year 6) 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 to establish whether there are links to reservoir operations on fish populations.

This monitoring program was initiated in October 2012 with fieldwork starting in 2013 and will be carried out annually over ten years.

In 2018, BC Hydro continued to compare the species composition, relative abundance, distribution and habitat use between Seton Lake and Anderson Lake.

The monitoring reports for 2016 (Year 4) dated February 21, 2018 and 2017 (Year 5) dated January 22, 2019 are attached. The 2018 (Year 6) monitoring report is 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.

This monitoring program was initiated in November 2012 with fieldwork starting in 2013, and will be carried out annually over ten years.

On February 7, 2019, the CWR approved the TOR Addendum 1 for BRGMON-9 that added new geographical locations 200km downstream of SON between Mission and Hope of the Fraser River to identify potential stranding locations for an additional 4 years.

The monitoring reports for 2017 (Year 5) and 2018 (Year 6) are currently under review and will be submitted with 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 used two types of models to determine rates of biological production in Carpenter Reservoir. The first model was- a habitat model and the second was a physical/chemical model. The models were linked together to predict the biological productivity response to reservoir operations.

This monitoring program was initiated in May 2015 and was implemented over 3 years to 2017.

The 2017 (Year 3) final report dated October 31, 2018 is attached.

This project is complete.

5.11 BRGMON-11A Lower Bridge River Riparian Vegetation Monitoring

On January 25, 2019, the CWR approved BC Hydro's request to separate BRGMON-11 into two separate projects -BRGMON-11A: Lower Bridge River Riparian Vegetation Monitoring and BRGMON-11B: Lower Bridge River Riverine Wildlife Monitoring. The approved separate TORs now reflect the distinct management questions and methodologies associated with each component of work.

The objective of the BRGMON-11A monitoring is to quantify the response of key physical and biological indicators in the Lower Bridge River to different instream flow regimes to determine which variables explain any changes in the riparian community.

This WUP monitoring program was initiated in 2012 followed by two more implementation years; 2016 and 2021.

During the modified operations on Downton Reservoir, BC Hydro has continued vegetation monitoring on the Lower Bridge River in 2017 and 2018 (but are not included in the WUP budget). This modified operations monitoring is identical to the WUP monitoring and the results will be summarized in additional modified operations monitoring reports.

The monitoring report for 2016 (Year 2) dated December 1, 2017 is attached.

5.12 BRGMON-11B Lower Bridge River Riverine Wildlife Monitoring

On January 25, 2019, the CWR approved BC Hydro's request to separate BRGMON-11 into two separate projects - BRGMON-11A: Lower Bridge River Riparian Vegetation Monitoring and BRGMON-11B: Lower Bridge River Riverine Wildlife Monitoring. The approved separate TORs now reflect the distinct management questions and methodologies associated with each component of work.

The objective of BRGMON-11B monitoring program is to document how riverine and riparian wildlife in the Lower Bridge River respond to alternate flow regimes.

This monitoring program was initiated in November 2012 and will be carried out at intervals over ten years.

In 2018, BC Hydro continued to monitor Riverine Birds in reaches 3 and 4 of the Lower Bridge River. Additionally, due to the modified operations at Downton Reservoir and subsequent flows on Lower Bridge River, BC Hydro has added monitoring related to beaver activity, and the American Winter Dipper that is not including in the WUP budget. This additional monitoring is complementary to the WUP monitoring and the results will be integrated with the WUP monitoring reports.

The 2016 (Year 4) monitoring report dated February 28, 2018 is attached. The 2018 (Year 5) monitoring report is underway and will be submitted in next year's annual report. Note 2017 was a skip year.

5.13 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.

This project is complete.

5.14 BRGMON-13 Seton Sockeye Salmon Smolts Monitoring Program

The objective of this monitoring program is to assess the effectiveness of Seton 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 was carried out annually to 2015. Three more years are expected for 2019, 2020 and 2021 field seasons.

In 2016 and 2017, monitoring was suspended due to safety and equipment concerns from the Seton River peak flows. For these years, trials were implemented to test the durability and suitability of alternate equipment configurations to ensure crews could operate the equipment safely and efficiently under the higher peak flows. Adjustments to the approach were made (still within the scope of the current TOR) and the monitoring program resumed in 2018.

The 2018 (Year 5) report is currently under review and will be submitted in next year's annual report.

5.15 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.
- Alternative 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 original monitoring program was initiated in August 2012 and concluded in 2016.

On December 15, 2017, the CWR approved Addendum 1 for BRGMON-14 to test alternative siphon scenarios at Seton Dam by extending enumeration of the Gates Creek Sockeye for up to additional four years (2017-2020) with a re-assessment after 2018 (two years).

The synthesis report for the 2012 to 2016 program is in draft form and will be submitted in next year's annual report. The 2017 (Year 6) monitoring report dated

June 15, 2017 is attached. The 2018 (Year 6) monitoring report is underway and will be submitted in next year's annual report.

5.16 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 due to the operation of BC Hydro facilities located on Seton Lake and Seton River and to develop conceptual designs for mitigation at priority sites.

Subsequent implementation of mitigation plans would be carried out under BRGWORKS-2 Seton Lake Erosion Management Program (SLEMP).

In 2018, meetings were held with affected St'at'imc communities for the preliminary identification of known cultural and heritage sites on Seton Lake and Seton River that are potentially affected due to operations.

The 2013 (Year1) report and the 2018 (Year 2) report are being drafted and will be submitted in next year's annual report.

5.17 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 2014 and was carried out over five years ending in 2018.

The reports for 2016 (Year 4) and 2017 (Year 5) are in draft and 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. Monitoring the effectiveness of this physical works program is undertaken as part of the BRGMON-2: Carpenter Reservoir Riparian Vegetation Monitoring.

This program was initiated in 2014 and will be carried out annually until 2020.

There was no planting in 2018; however, BC Hydro continued to monitor the dust storm frequency within the reservoir along with collecting weather data. The information will be reported with the 2019 physical works report.

The 2016 (Year 3) physical works report dated March 5, 2018 and the 2017 (Year 4) physical works report dated December 01, 2018 are attached.

6.2 BRGWORKS-2 Seton Lake Erosion

The objective of this project is to implement the mitigation plans for erosion protection of the priority sites as developed under BRGMON-15: Seton Lake Erosion Mitigation Program. Once results from BRGMON-15 have been evaluated, a TOR for this physical works will be prepared and submitted.

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, 2019.

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

Monitoring Programs	Costs approved by CWR	Life to Date Actuals (LTD)	Estimated to Complete (Forecast)	Total Forecast (LTD and Forecast)	Variance Total to Approved	Explanation	Corrective Action
BRG Prepare Annual Report	\$25,112	\$9,760	\$9,060	\$18,820	\$6,292		
BRGM01A Low Bridge R Aquatic	\$3,427,450	\$1,960,968	\$1,464,085	\$3,425,053	\$2,397		
BRGM01A Low Bridge R Aquatic - OR DM	\$123,735	\$87,602	\$36,133	\$123,735	(\$0)		
BRGM01A Low Bridge R Aquatic - OR Imp	\$3,303,715	\$1,873,366	\$1,427,952	\$3,301,318	\$2,397		
BRGM02A Carpenter Rse Riparia	\$778,013	\$409,337	\$368,653	\$777,990	\$23		
BRGM02A Carpenter Rse Riparia - OR DM	\$81,253	\$61,048	\$51,941	\$112,989	(\$31,736)		
BRGM02A Carpenter Rse Riparia - OR Imp	\$696,760	\$348,289	\$316,712	\$665,001	\$31,759		
BRGM03A Low BR Salmon & Steel	\$3,537,716	\$2,070,731	\$1,379,052	\$3,449,784	\$87,932	Efficiencies found during project implementation	
BRGM03A Low BR Salmon & Steel - OR DM	\$87,650	\$57,745	\$37,527	\$95,272	(\$7,622)		
BRGM03A Low BR Salmon & Steel - OR Imp	\$3,450,066	\$2,012,986	\$1,341,525	\$3,354,512	\$95,554		
BRGM04A Carp Rse&Mld BR Fish	\$1,843,675	\$1,052,655	\$780,885	\$1,833,540	\$10,135		
BRGM04A Carp Rse&Mld BR Fish - OR DM	\$98,053	\$31,311	\$37,885	\$69,197	\$28,856		
BRGM04A Carp Rse&Mld BR Fish - OR Imp	\$1,745,622	\$1,021,344	\$743,000	\$1,764,344	(\$18,722)		
BRGM05A Downton Rse Riparian	\$355,756	\$181,469	\$157,772	\$339,241	\$16,515		
BRGM05A Downton Rse Riparian - OR DM	\$26,922	\$19,748	\$15,714	\$35,462	(\$8,540)		
BRGM05A Downton Rse Riparian - OR Imp	\$328,834	\$161,721	\$142,058	\$303,779	\$25,055		
BRGM06A Seton Lake Aquatic Pr	\$1,319,947	\$1,269,557	\$7,433	\$1,276,989	\$42,958	Project completed.	
BRGM06A Seton Lake Aquatic Pr - OR DM	\$32,524	\$24,224	\$7,433	\$31,656	\$868		
BRGM06A Seton Lake Aquatic Pr - OR Imp	\$1,287,423	\$1,245,333		\$1,245,333	\$42,090		
BRGM07A Downton Rse Fish Habi	\$1,063,401	\$573,419	\$471,075	\$1,044,493	\$18,908		
BRGM07A Downton Rse Fish Habi - OR DM	\$87,909	\$33,897	\$43,577	\$77,474	\$10,435		
BRGM07A Downton Rse Fish Habi - OR Imp	\$975,492	\$539,522	\$427,498	\$967,019	\$8,473		
BRGM08A Seton Fish Hab & Pop	\$947,702	\$497,714	\$399,954	\$897,668	\$50,034	Efficiencies found during project implementation	
BRGM08A Seton Fish Hab & Pop - OR DM	\$85,780	\$25,557	\$44,116	\$69,673	\$16,107		
BRGM08A Seton Fish Hab & Pop - OR Imp	\$861,922	\$472,157	\$355,838	\$827,995	\$33,927		
BRGM09A Seton R Habitat & Fis	\$1,444,712	\$813,869	\$628,000	\$1,441,869	\$2,843		
BRGM09A Seton R Habitat & Fis - OR DM	\$78,871	\$39,638	\$37,000	\$76,638	\$2,233		
BRGM09A Seton R Habitat & Fis - OR Imp	\$1,365,841	\$774,232	\$591,000	\$1,365,232	\$609		
BRGM10A Carp Rse Prod Model	\$995,981	\$995,981		\$995,981	\$0	Project completed.	
BRGM10A Carp Rse Prod Model - OR DM	\$23,991	\$26,547		\$26,547	(\$2,556)		
BRGM10A Carp Rse Prod Model - OR Imp	\$971,990	\$969,434		\$969,434	\$2,556		
BRGM11A Low BR Riparian Vege	\$694,899	\$460,419	\$358,180	\$679,695	\$15,204		
BRGM11A Low BR Riparian Vege - OR DM	\$55,213	\$25,000	\$15,010	\$40,010	\$15,203		
BRGM11A Low BR Riparian Vege - OR Imp	\$639,686	\$235,419	\$343,170	\$639,685	\$1		
BRGM11B Low BR Riverine Wild	\$237,723	\$115,507	\$117,141	\$232,648	\$5,075		
BRGM11B Low BR Riverine Wild - OR DM	\$20,837	\$8,263	\$7,500	\$15,763	\$5,074		
BRGM11B Low BR Riverine Wild - OR IMP	\$216,886	\$107,244	\$109,641	\$216,885	\$1		
BRGM12A Bridge-Seton Metals	\$481,257	\$117,247	\$3,017	\$120,264	\$360,993	Project completed.	
BRGM12A Bridge-Seton Metals - OR DM	\$65,889	\$12,809	\$3,017	\$15,826	\$50,063		
BRGM12A Bridge-Seton Metals - OR Imp	\$415,368	\$104,438		\$104,438	\$310,930		
BRGM13A Seton Powerhouse	\$1,958,221	\$1,060,680	\$643,696	\$1,704,376	\$253,845	Efficiencies found during project implementation	
BRGM13A Seton Powerhouse - OR DM	\$89,289	\$48,944	\$41,919	\$90,863	(\$1,574)		
BRGM13A Seton Powerhouse - OR Imp	\$1,868,932	\$1,011,737	\$601,777	\$1,613,513	\$255,419		
BRGM14A Cayoosh Flow Dilutio	\$2,564,557	\$2,386,378	\$161,015	\$2,547,393	\$17,164		
BRGM14A Cayoosh Flow Dilutio - OR DM	\$66,600	\$52,412	\$6,120	\$58,532	\$8,068		
BRGM14A Cayoosh Flow Dilutio - OR Imp	\$2,497,957	\$2,333,966	\$154,895	\$2,488,861	\$9,096		
BRGM15A SON Erosion Mitigate	\$301,842	\$137,586	\$42,289	\$179,875	\$121,967	Efficiencies found during project implementation	
BRGM15A SON Erosion Mitigate - OR DM	\$84,670	\$45,414	\$17,289	\$62,703	\$21,967		
BRGM15A SON Erosion Mitigate - OR Imp	\$217,172	\$92,172	\$25,000	\$117,172	\$100,000		
BRGM16A Spiritual & Cultural	\$495,211	\$452,048	\$23,803	\$475,851	\$19,360		
BRGM16A Spiritual & Cultural - OR DM	\$44,246	\$24,245	\$3,349	\$27,594	\$16,652		
BRGM16A Spiritual & Cultural - OR Imp	\$450,965	\$427,803	\$20,454	\$448,257	\$2,708		
BRGW01A Carp Re-Vegetation - OR	\$1,329,224	\$899,674	\$410,078	\$1,309,752	\$19,472		
BRGW01A Carp Re-Vegetation - OR DM	\$55,986	\$77,658	\$20,365	\$98,023	(\$42,037)		
BRGW01A Carp Re-Vegetation - OR Imp	\$1,273,238	\$822,016	\$389,713	\$1,211,729	\$61,509		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.