

Coquitlam-Buntzen Water Use Plan

Monitoring Programs and Physical Works Annual Report: 2016

Implementation Period: April 2015 to March 2016

- **COQMON-1 Assessment of Fisheries Access to Streams Tributary to Coquitlam River**
- **COQMON-2 Coquitlam Dam Flow Release Interim Ramping Rate Monitoring**
- **COQMON-3 Lower Coquitlam River Fish Habitat Requirements Study**
- **COQMON-4 Assessment of Pink Salmon Passage in Lower Coquitlam River**
- **COQMON-5 Coquitlam River Periphyton and Benthic Invertebrate Monitoring**
- **COQMON-6 Lower Coquitlam River Temperature Monitoring**
- **COQMON-7 Lower Coquitlam River Fish Productivity Index**
- **COQMON-8 Lower Coquitlam River Substrate Quality Assessment**
- **COQWORKS-1 Modification of Coquitlam Dam Release Facilities (Flow Release Valve)**

For Water Licences 119709, 119710 and 119711

April 30, 2016

BC Hydro Coquitlam-Buntzen Water Use Plan Monitoring Programs and Physical Works Annual Report: 2016

1 Introduction

This document represents a summary of the status and the results of the Coquitlam-Buntzen Water Use Plan (WUP) monitoring programs and physical works to March 31, 2016, as per the Coquitlam-Buntzen Order under the *Water Act*, dated April 21, 2005 and the amendment dated March 8, 2006. There are eight monitoring programs and one physical works.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Coquitlam-Buntzen WUP monitoring programs and physical works were submitted to and approved by the CWR.

Table: 2-1: Dates of Coquitlam-Buntzen 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 |
| COQMON-1 – Assessment of Fisheries Access to Streams Tributary to Coquitlam River | Schedule E.1 | Oct 24, 2005 | Jan 03, 2006 | | |
| COQMON-2 – Coquitlam Dam Flow Release Interim Ramping Rate Monitoring | Schedule E.2 | Oct 24, 2005 | Jan 03, 2006 | Feb 09, 2009 | Mar 23, 2009 |
| COQMON-3 – Lower Coquitlam River Fish Habitat Requirements Study | Schedule E.2 portion for COQMON-3 rescinded Mar 13, 2005 | Jan 10, 2007 | Feb 01, 2007 | Feb 09, 2009 | Mar 23, 2009 |
| COQMON-4 – Assessment of Pink Salmon Passage in Lower Coquitlam River | Schedule E.2 | Oct 24, 2005 | Jan 03, 2006 | Feb 09, 2009 | Mar 23, 2009 |
| COQMON-5 – Coquitlam River Periphyton and Benthic Invertebrate Monitoring | Schedule E.2 | Oct 24, 2005 | Jan 03, 2006 | Feb 09, 2009 | Mar 23, 2009 |
| COQMON-6 – Lower Coquitlam River Temperature Monitoring | Schedule E.2 | Oct 24, 2005 | Jan 03, 2006 | Feb 09, 2009 | Mar 23, 2009 |
| COQMON-7 – Lower Coquitlam River Fish Productivity Index | Schedule E.2 | Feb 08, 2006 | Mar 08, 2006 | Mar 07, 2016 | Pending |
| COQMON-8 – Lower Coquitlam River Substrate Quality Assessment | Schedule E.2 | Oct 24, 2005 | Jan 03, 2006 | Dec 04, 2015 | Dec 10, 2015 |
| COQWORKS-1 – Modification of Coquitlam Dam Release Facilities (Flow Release Valve) | Schedule B | Oct 24, 2005 | Dec 02, 2005 | Apr 29, 2009 | App not required |

3 Schedule

The following table outlines the current schedule for the monitoring programs and physical works being delivered for the Coquitlam-Buntzen WUP.

Table 3-1: Monitoring Programs and Physical Works Schedule as of March 31, 2016

| Monitoring Programs | | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|--|--|------------------|------------------|------------------|---------|---------|---------|---------|---------|---------|----------|----------------|-----------------------|
| | | WLR Yr1 | WLR Yr2 | WLR Yr3 | WLR Yr4 | WLR Yr5 | WLR Yr6 | WLR Yr7 | WLR Yr8 | WLR Yr9 | WLR Yr10 | WLR Yr11 | WLR Yr12 ³ |
| COQMON-1 – Assessment of Fisheries Access to Streams Tributary to Coquitlam River | | ✓ | ✓ | ✓ | | | | | | | | | |
| COQMON-2 – Coquitlam Dam Flow Release Interim Ramping Rate Monitoring | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ■ | ■ |
| COQMON-3 – Lower Coquitlam River Fish Habitat Requirements Study | | DEL ¹ | DEL ¹ | DEL ¹ | ✓ | ✓ | ✓ | ✓ | | | | ■ ³ | |
| COQMON-4 – Assessment of Pink Salmon Passage in Lower Coquitlam River | | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | |
| COQMON-5 – Coquitlam River Periphyton and Benthic Invertebrate Monitoring | | ✓ | DEL ¹ | DEL ¹ | ✓ | ✓ | ✓ | ✓ | | | | | |
| COQMON-6 – Lower Coquitlam River Temperature Monitoring | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| COQMON-7 – Lower Coquitlam River Fish Productivity Index | Smolt and Fry Outmigration Assessment | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ■ | ■ |
| | Fry and Juvenile Standing Stock Assessment | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ■ | ■ |
| | Fall Adult Salmon Escapement Surveys | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ■ | ■ |
| | Steelhead Redd Surveys | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ■ | ■ |
| | Recruitment Analysis | ✓ | ✓ | ✓ | | | | | | | | | ■ ³ |
| COQMON-8 – Lower Coquitlam River Substrate Quality Assessment | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ■ | ■ |
| Physical Works | | | | | | | | | | | | | |
| COQWORKS-1 – Modification of Coquitlam Dam Release Facilities (Flow Release Valve) | | DEL ² | DEL ² | ✓ | ✓ | | | | | | | | |

Legend: ■ = Program to be undertaken/initiated in identified year
 ✓ = Program completed for the year
 DEL = Program is delayed for the year

Footnotes:
 1. Program delayed due to postponement of required flow release structure modification and associated modified flow regime to October 23, 2008.
 2. The installation of the release valve was delayed due to existing dam seismic upgrade repairs.
 3. No field work, data results analysis only.

4 Monitoring Programs and Physical Works Terms of Reference

The monitoring programs and physical works being implemented under the Coquitlam-Buntzen WUP are described in Terms of Reference. These Terms of Reference and the reports for work completed to date can be found here:

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

5 Status of Monitoring Programs

5.1 COQMON-1 Assessment of Fisheries Access to Streams Tributary to Coquitlam Reservoir

This program was initiated in 2006 and completed in 2008.

This program was initiated in July 2006 with three fish sampling and habitat surveys completed according to schedule. The final program report was completed in January 2008. The Coquitlam Monitoring Committee supported full removal of the fish migration barrier at the mouth of the main tributary (Meech Creek) which was completed in August 2009.

5.2 COQMON-2 Coquitlam Dam Flow Release Interim Ramping Rate Monitoring

This monitoring program was initiated in 2006 and will be carried out over 11 years. The Year 9 and Year 10 reports are attached. The Year 11 report is currently being prepared, and will be included in next year's annual report.

5.3 COQMON-3 Lower Coquitlam River Fish Habitat Requirements Study

This monitoring program was delayed several years due to the inability to provide the required modified flow release from Coquitlam Dam. Based on the provision of the modified flow release in October 2008 this monitoring program was initiated in November 2008 to observe habitat requirements for chum and coho salmon. The two other components: steelhead spawning and juvenile rearing commenced in 2009.

Fieldwork is complete and data analysis is underway. The objective of the analysis is to update the habitat-flow model that predicts the effects of flow on fisheries habitats specific to the Lower Coquitlam River. We expect to complete this analysis during fiscal year 2017, and a report will be submitted in next year's annual report.

5.4 COQMON-4 Assessment of Pink Salmon Passage in Lower Coquitlam River

The objective of this monitoring program is to monitor the migration of returning pink salmon in odd years to determine if there are any flow-related partial or complete migration barriers in the Lower Coquitlam River corridor.

This monitoring program was initiated in August 2007 with the onset of pink salmon migration in the Coquitlam River, which continued through the low flow September period. Fieldwork for this monitoring program was completed in 2015. The final report for this program is attached.

5.5 COQMON-5 Coquitlam River Periphyton and Benthic Invertebrate Monitoring

This program was initiated in 2006 and completed in 2012.

The objective of this monitoring program was to develop a predictive model for evaluating periphyton and invertebrate benefits associated with Lower Coquitlam River flow alternatives.

5.6 COQMON-6 Lower Coquitlam River Temperature Monitoring

This program was initiated in 2006 and completed in 2012.

The objective of this monitoring program was to identify if and how temperature in the lower Coquitlam River is influenced by reservoir operations.

5.7 COQMON-7 Lower Coquitlam River Fish Productivity Index

This 12-year monitoring program was initiated in 2000. The report for Year 9 (2000 – 2014) is attached. The Year 10 report (2000-2015) is currently being prepared and will be included in next year's annual report.

The intent of the monitoring program is to develop a fish productivity index for target species, which compares the number of out-migrating smolts to the number of adults, in order to assess the fish productivity response of the flow trials underway in the Lower Coquitlam River.

Efforts were made to work within the current budget and find efficiencies in the program; however, after a detailed review of the program, it was evident that the remaining two years of data collection to deliver the outmigration assessment work will require additional budget. A budget increase request was submitted to the CWR office on March 7, 2016.

5.8 COQMON-8 Lower Coquitlam River Substrate Quality Assessment

This monitoring program was initiated in 2006 and will be carried out over 11 years. The Year 7 report (2013-2014) is attached.

As requested by the Coquitlam Monitoring Advisory Committee, the Year 5 report included recommendations for refining the study methods. In 2015, discussions were had with agencies and First Nations about whether an “opportunistic flushing flow” provided from the Coquitlam dam, in conjunction with high local inflows, is appropriate considering potential downstream flooding risks.

The objective of the current TOR is to identify whether an opportunistic flushing flow will improve substrate quality and fish productivity. BC Hydro's primary concern with the Consultative Committee definition of a flushing flow is that given the flashy nature of the Coquitlam system and limitations on meteorological forecasting, water could be released from the dam during peak flows from Or Creek only to find another, unexpected high inflow event immediately following. This situation occurs regularly in Coquitlam, and increases the risk of downstream flooding.

To support the discussion, in 2016, after high flow events on the Coquitlam River, measurements will be taken to assess substrate quality (e.g. particle size, embeddedness, pebble counts, turbidity and water velocity) to determine the effect

on substrate from this natural event that may include additional flows from the dam but which do not meet the TOR defined flushing flow criteria. As well, in 2016, the use of a freeze-core sampling method will be piloted to gather data at spawning depths.

Once the definition of the flushing flow is clarified and the freeze-core sampling testing is complete, a TOR addendum will be prepared. We plan to resubmit the COQMON-8 TOR by or before June 30, 2017.

6 Summary of Physical Works

6.1 COQWORKS-1 Modification of Coquitlam Dam Release Facilities (Flow Release Valve)

The replacement of the existing low level outlet gate was required to facilitate the releases to the Coquitlam River ordered by the CWR and recommended in the Coquitlam-Buntzen WUP. The new gate assembly was installed in October 2008. This physical works project was completed in 2009.

7 Monitoring Programs and Physical Works Costs

The following table summarizes the Coquitlam-Buntzen WUP monitoring programs and physical works costs approved by the Comptroller and the Actual Costs to March 31, 2016.

Table 7-1: Coquitlam - Buntzen 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 |
|---|-----------------------|----------------------------|----------------------------------|-----------------------------------|----------------------------|---|----------------------------------|
| COQ Prepare Annual Report | \$32,353 | \$17,007 | \$6,077 | \$23,084 | \$9,269 | Efficiencies found during project implementation | |
| COQM01A Access to Streams | \$26,582 | \$20,615 | | \$20,615 | \$5,967 | Project Complete | |
| COQM01A Access to Streams - OR DM | \$16,322 | \$8,434 | | \$8,434 | \$7,888 | | |
| COQM01A Access to Streams - OR Imp | \$10,260 | \$12,181 | | \$12,181 | (\$1,921) | | |
| COQM02A Dam Flow Release R | \$160,791 | \$105,159 | \$32,660 | \$137,819 | \$22,972 | Efficiencies found during project implementation | |
| COQM02A Dam Flow Release R - OR DM | \$55,353 | \$27,597 | \$12,357 | \$39,954 | \$15,399 | | |
| COQM02A Dam Flow Release R - OR Imp | \$105,438 | \$77,562 | \$20,303 | \$97,865 | \$7,573 | | |
| COQM03A Fish Habitat Suitabil | \$115,374 | \$50,635 | \$24,388 | \$75,023 | \$40,351 | Efficiencies found during project implementation | |
| COQM03A Fish Habitat Suitabil - OR DM | \$31,018 | \$15,956 | \$9,388 | \$25,344 | \$5,674 | | |
| COQM03A Fish Habitat Suitabil - OR Imp | \$84,356 | \$34,679 | \$15,000 | \$49,679 | \$34,677 | | |
| COQM04A Pink Salmon Passage | \$70,698 | \$53,106 | \$4,360 | \$57,466 | \$13,232 | Project Complete - final reporting outstanding | |
| COQM04A Pink Salmon Passage - OR DM | \$32,947 | \$15,355 | \$4,360 | \$19,715 | \$13,232 | | |
| COQM04A Pink Salmon Passage - OR Imp | \$37,751 | \$37,751 | \$0 | \$37,751 | (\$0) | | |
| COQM05A Periphyton & Benthic | \$268,770 | \$238,560 | | \$238,560 | \$30,210 | Project Complete | |
| COQM05A Periphyton & Benthic - OR DM | \$29,883 | \$14,087 | | \$14,087 | \$15,796 | | |
| COQM05A Periphyton & Benthic - OR Imp | \$238,887 | \$224,473 | | \$224,473 | \$14,414 | | |
| COQM06A Lower COQ River Temp | \$62,539 | \$62,128 | | \$62,128 | \$411 | Project Complete | |
| COQM06A Lower COQ River Temp - OR DM | \$12,969 | \$12,547 | | \$12,547 | \$422 | | |
| COQM06A Lower COQ River Temp - OR Imp | \$49,570 | \$49,580 | | \$49,580 | (\$10) | | |
| COQM07A Fish Productivity Ind | \$2,870,711 | \$2,396,558 | \$574,518 | \$2,971,076 | (\$100,365) | Budget increase required to complete outmigration assessment component of the project | TOR resubmitted on March 7, 2016 |
| COQM07A Fish Productivity Ind - OR DM | \$116,638 | \$108,185 | \$12,295 | \$120,480 | (\$3,842) | | |
| COQM07A Fish Productivity Ind - OR Imp | \$2,754,073 | \$2,288,373 | \$562,223 | \$2,850,596 | (\$96,523) | | |
| COQM08A Substrate Quality Ass | \$416,664 | \$324,517 | \$66,924 | \$391,440 | \$25,224 | Efficiencies found during project implementation | |
| COQM08A Substrate Quality Ass - OR DM | \$80,392 | \$42,496 | \$10,816 | \$53,311 | \$27,081 | | |
| COQM08A Substrate Quality Ass - OR Imp | \$336,272 | \$282,021 | \$56,108 | \$338,129 | (\$1,857) | | |
| COQW01A Mod COQ Dam Release - OR L4 | \$867,977 | \$867,979 | | \$867,979 | (\$2) | Project Complete | |
| COQW01A Mod COQ Dam Release - OR DM | \$9,279 | \$57,185 | | \$57,185 | (\$47,906) | | |
| COQW01A Mod COQ Dam Release - OR Imp | \$858,698 | \$810,794 | | \$810,794 | \$47,904 | | |
| COQW01A Mod COQ Dam Release - ONR L4 | | \$212 | | \$212 | (\$212) | COQW01 was overspent without approval from CWR; overage was absorbed through ONR funds. | |
| COQW01A Mod COQ Dam Release - ONR DM OS | | \$212 | | \$212 | (\$212) | | |

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.