Peace River Water Use Plan
Spill Protocol and Archaeology Management Plan

Monitoring Programs and Physical Works
Annual Report 2016

Implementation Period: June 2015 to August 2016

- **GMSMON-3 PCR Fish Stranding**
- **GMSMON-4 WACB Entrainment**
- **GMSMON-6 PCR Riparian Flooding**
- **GMSMON-8 PCR Side Channel Response**
- **GMSMON-9 PCR Spill Hydrology**
- **GMSMON-10 PCR Spill Photos**
- **GMSMON-11 PCR Spill TGP/Temperature**
- **GMSMON-12 PCR Wildlife Survey**
- **GMSMON-13 WLL Fish Index**
- **GMSMON-21A WLL Archaeological Overview Assessment**
- **GMSMON-21B WLL Erosion Monitoring of Archaeological Resources**
- **GMSWORKS-2 PCR Baseline TGP/Temperature**

For Water Licences 123018, 123019, 123020, 123021, 123025

September 30, 2016

BC Hydro Peace River Water Use Plan
Spill Protocol and Archaeology Management Plan
Annual Report: 2016

1 Introduction

This document represents a summary of the status and the results of the Peace Project Spill Protocol and Archaeology Management Plan Water Use Plan (WUP) monitoring program and physical works projects to August 31, 2016, as per the Peace Order under the *Water Act,* dated August 9, 2007. This annual report includes those projects in Schedule D of the Order, as well as those under Clause 7 (Archaeological). There are eleven monitoring programs and one physical works.

2 Status

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

Table 2-1 Dates of Spill Protocol and Archaeology Management Plan WUP 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
GMSMON-3 PCR FISH STRANDING	Schedule D.3.a	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension
GMSMON-4 WACB ENTRAINMENT	Schedule D.3.b	Feb 07, 2008	Apr 02, 2008	Apr 29, 2013	May 22, 2013
GMSMON-6 PCR RIPARIAN FLOODING	Schedule D.3.c	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension
GMSMON-8 PCR SIDE CHANNEL RESPONSE	Schedule D.3.d	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension
GMSMON-9 PCR SPILL HYDROLOGY	Schedule D.3.e	Feb 07, 2008	Apr 02, 2008		
GMSMON-10 PCR SPILL PHOTOS	Schedule D.3.g	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension
GMSMON-11 PCR SPILL TGP/TEMP	Schedule D.3.f	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension
GMSMON-12 PCR WILDLIFE SURVEY	Schedule D.3.h	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension
GMSMON-13 WLL FISH INDEX	Schedule D.e.i	Feb 07, 2008	Apr 02, 2008		
GMSMON-21A WLL ARCHAEOLOGICAL OVERVIEW ASSESSMENT	Clause 7.a	May 09, 2008	Jun 02, 2008	Aug 07, 2009	Jan 20, 2010
GMSMON-21B WLL EROSION MONITORING OF ARCHAEOLOGICAL RESOURCES	Clause 7.b	May 09, 2008	Jun 02, 2008	Aug 07, 2009	Jan 20, 2010
GMSWORKS-2 PCR BASELINE TGP/TEMP	Schedule D.1	Feb 07, 2008	Apr 02, 2008	Jul 24, 2015	Sep 8, 2015 CWR agrees to suspension

3 Schedule

The following table outlines the current schedule for the monitoring programs and physical works being delivered for the Spill Protocol and Archaeology Management Plan WUP.

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

Monitoring Programs	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	WLR YR1	WLR YR2	WLR YR3	WLR YR4	WLR YR5	WLR YR6	WLR YR7	WLR YR8	WLR YR9	WLR YR10	WLR YR11	WLR YR12	WLR YR13	WLR YR14
GMSMON-3: PCR Fish Stranding[1]					✓									
GMSMON-4: WACB Entrainment					✓				■	■	■	■	■	
GMSMON-6: PCR Riparian Flooding[1]														
GMSMON-8: PCR Side Channel Response[1]					✓									
GMSMON-9: PCR Spill Hydrology		✓			✓				■	■	■	■	■	
GMSMON-10: PCR Spill Photos[1]					✓									
GMSMON-11: PCR Spill TGP/Temperature[3]					✓				■	■	■	■	■	
GMSMON-12: PCR Wildlife Survey[1]		✓			✓									
GMSMON-13: WLR Fish Index	✓	✓												
GMSMON-21A: WLL Archaeological Overview Assessment		✓	✓											
GMSMON-21B: WLL Erosion Monitoring of Archaeological Resources		Del	✓	✓	✓	x	✓	u/w	■	■	■	■		
GMSWORKS-2: PCR Baseline TGP/Temperature	✓	✓	✓	✓	✓	✓	✓	u/w	■	■	■			
Legend	■ Program to be undertaken/initiated in identified year							■ Opportunisitc Program may be undertaken in identified year						
	u/w Project is under w ay							x Project not undertaken as planned for this year						
	✓ Project is completed for the year							Del Project is delayed for the year						
	* Maintenance only in identified year													

Footnotes:

1. Projects suspended as per CWR due to Site C.
2. Delayed due to delay of corresponding WORKS projects
3. Project partially suspended as per CWR due to Site C

4 Monitoring Programs and Physical Works Terms of Reference

The monitoring programs and physical works being implemented under the Spill Protocol and Archaeology Management Plan 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/northern_interior/peace_river.html

5 Status of Monitoring Programs and Physical Works under Schedule D: Protocols in the event of Spills

GMSMON-3, 4, 6, 8 – 12 are opportunistic studies that were to be implemented in the event of a spill. The last time that these studies were conducted was in 2012. These studies were not triggered in 2015.

5.1 GMSMON-3 Peace River Fish Stranding

The purpose of this project was to inform future spill strategies by assessing stranding downstream of Peace Canyon Dam (PCN). This project was conducted in 2012. However, as the area for this project is located in the future Site C inundation zone and the outcome of the project will not be applicable to a reservoir environment, this project was suspended as per the Comptroller of Water Rights (CWR) letter of September 8, 2015.

5.2 GMSMON-4 WAC Bennett Dam Entrainment

The purpose of this project was to estimate fish entrainment through WAC Bennett Dam (GMS) and mortality rates of entrained fish. This project was conducted in 2012. The CWR approved additional budget (letter dated May 22, 2013) to allow for additional study in the event of a future spill. This project was not triggered in 2015.

5.3 GMSMON-6 Peace River Riparian Flooding

The objective of this project was to inform revision of future spill strategies by assessing riparian flooding downstream of PCN. This project was conducted in 2012. However, as the area for this project is located in the future Site C inundation zone and the outcome of the project will not be applicable to a reservoir environment, this project was suspended as per the CWR letter of September 8, 2015.

5.4 GMSMON-8 Peace River Side Channel Response

The purpose of this project was to inform future spill strategies by measuring effects to side channel fish, downstream of PCN. Work was completed in 2012. The sites monitored were based on the site selection process imbedded in GMSWORKS-3. However, as the sites for the project are located in the future Site C inundation zone and the outcome of the project will not be applicable to a reservoir environment, this project was suspended as per the CWR letter of September 8, 2015.

5.5 GMSMON-9 Peace River Spill Hydrology

The purpose of this opportunistic work was collection and reporting of hydrological data collected by companion spill projects. The pre-spill research was completed in

June of 2009. This project was triggered and completed in 2012. A review of the results of GMSMON-9 against the purpose of the project will be completed in 2016 to determine if additional years of study and data from a future spill are required.

5.6 GMSMON-10 Peace River Spill Photos

The objective of this project was to document PCN spill flow effect to the Peace River inundation of shoreline and riparian areas. Digital photography was acquired in 2012. However, as the area of the project is located in the future Site C inundation zone and the outcome of the project will not be applicable to a reservoir environment, this project was suspended as per the CWR letter of September 8, 2015.

5.7 GMSMON-11 Peace River Spill TGP and Temperature

The purpose of this project is to determine the PCN spill effects to Peace River temperature and total dissolved gas pressure levels. A portion of this study, downstream of Peace Canyon Dam, is within the future inundation zone of Site C and was suspended as per the CWR letter of September 8, 2015. The remaining upstream portion of the project will continue to assess performance of GMS and PCN spillway on tailraces and habitat upstream of PCN.

5.8 GMSMON-12 Peace River Wildlife Stranding Survey

The purpose of this project was to determine the effects on wildlife resulting from high flows below PCN. The pre-spill research component was conducted in May 2010 and the project was completed in 2012. However, as the area of the project is located in the future Site C inundation zone and the outcome of the project will not be applicable to a reservoir environment, this project was suspended as per the CWR letter of September 8, 2015.

5.9 GMSMON-13 WLL Fish Index

The objective of this project was to determine fish species, location and abundance in the Peace Reach, the population closest to the WAC Bennett Dam (GMS). This project was completed in 2008 and no further work is proposed.

5.10 GMSWORKS-2 Peace River Baseline TGP and Temperature

The purpose of this project is to collect baseline water temperature data in the vicinity of GMS and PCN. Temperature readings are downloaded quarterly and will continue until 2019. Attached is the report for Year 7 dated May 2016.

6 Status of Monitoring Programs under Order Clause 7

6.1 GMSMON-21A Heritage and Culture Information Plan: Archaeological Overview Assessment

The purpose of this project undertaken in 2009 was an archaeological overview assessment of the drawdown zones of the Williston and Dinosaur Reservoirs and the Peace River. This project is complete.

6.2 GMSMON-21B Peace River Erosion Monitoring – Archaeological Resources

The objective of this project is to collect quantitative measures of the magnitude, severity, rate of change and estimated duration of erosion effects caused by

reservoir operations on selected heritage sites within the Williston and Dinosaur Reservoirs and the Peace River. This monitoring project commenced in the spring of 2010.

A review of the schedule has determined that there was a decision in 2011 to skip the 2013 field season. Therefore, the schedule for the study will be extended one year to complete the nine years of field work as outlined in the Terms of Reference.

Reports for field season 2011 (Year 2) and 2012 (Year 3) are attached as our records show that they have not previously been submitted. The report for 2014 (Year 4) was submitted with the last Annual Report (2015). Attached is the Year 5 monitoring report for 2015 dated February, 2016.

7 Monitoring Programs and Physical Works Costs

The following table summarizes the Spill Protocol and Archaeology Management Plan WUP monitoring programs and physical works costs approved by the CWR and the Actual Costs to August 31, 2016.

Table 7-1: Spill Protocol and Archaeology Management Plan 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
GMSM03A PCR Fish Stranding	$225,156	$143,800	$1,199	$144,999	$80,157	Project Suspended - Final completion reporting outstanding	
GMSM03A PCR Fish Stranding - OR DM	$12,272	$13,197	$1,199	$14,395	($2,123)		
GMSM03A PCR Fish Stranding - OR Imp	$212,884	$130,604		$130,604	$82,280		
GMSM04A GMS Entrainment	$468,168	$263,302	$1,661	$264,964	$203,204	Opportunistic study - may be implemented in event of a spill	
GMSM04A GMS Entrainment - OR DM	$45,505	$34,013	$1,661	$35,675	$9,830		
GMSM04A GMS Entrainment - OR Imp	$422,663	$229,289	$0	$229,289	$193,374		
GMSM06A PCR Riparian Flooding	$226,273	$4,254	$1,186	$5,439	$220,834	Project Suspended - Final completion reporting outstanding	
GMSM06A PCR Riparian Flooding - OR DM	$31,213	$4,254	$1,185	$5,439	$25,774		
GMSM06A PCR Riparian Flooding - OR Imp	$195,060		$0	$0	$195,060		
GMSM08A PCR Side Channel Resp	$138,752	$58,062	$1,186	$59,248	$79,504	Project Suspended - Final completion reporting outstanding	
GMSM08A PCR Side Channel Resp - OR DM	$9,652	$7,664	$1,186	$8,850	$802		
GMSM08A PCR Side Channel Resp - OR Imp	$129,100	$50,398	$0	$50,398	$78,702		
GMSM09A PCR Spill Hydrology	$68,979	$47,077	$1,919	$48,996	$19,983		
GMSM09A PCR Spill Hydrology - OR DM	$18,979	$20,389	$1,919	$22,308	($3,329)		
GMSM09A PCR Spill Hydrology - OR Imp	$50,000	$26,687		$26,687	$23,313		
GMSM10A PCR Spill Photos	$297,996	$123,969	$1,919	$125,888	$172,108	Project Suspended - Final completion reporting outstanding	
GMSM10A PCR Spill Photos - OR DM	$10,951	$11,171	$1,919	$13,090	($2,139)		
GMSM10A PCR Spill Photos - OR Imp	$287,045	$112,798	$0	$112,798	$174,247		
GMSM11A PCR Spill TGP/Temp	$77,856	$37,190	$695	$37,885	$39,971	Opportunistic study - may be implemented in event of a spill	
GMSM11A PCR Spill TGP/Temp - OR DM	$15,371	$13,044	$695	$13,740	$1,631		
GMSM11A PCR Spill TGP/Temp - OR Imp	$62,485	$24,145	$0	$24,145	$38,340		
GMSM12A PCR Wildlife Survey	$339,669	$141,133	$1,806	$142,938	$196,731	Project Suspended - Final completion reporting outstanding	
GMSM12A PCR Wildlife Survey - OR DM	$18,231	$17,295	$1,806	$19,101	($870)		
GMSM12A PCR Wildlife Survey - OR Imp	$321,438	$123,838		$123,838	$197,600		
GMSM13A WLL Fish Index	$124,909	$80,438	$2,108	$82,545	$42,364	Project Complete - Final completion reporting outstanding	
GMSM13A WLL Fish Index - OR DM	$14,296	$18,931	$2,108	$21,039	($6,743)		
GMSM13A WLL Fish Index - OR Imp	$110,613	$61,506	$0	$61,506	$49,107		
GMSM21A WLL Arch Overview	$113,614	$113,298	$2,804	$116,102	($2,488)	Project Complete - Final completion reporting outstanding	Request reallocation of funds before final completion reporting begins
GMSM21A WLL Arch Overview - OR DM	$16,186	$20,077	$2,804	$22,881	($6,695)		
GMSM21A WLL Arch Overview - OR Imp	$97,428	$93,220	$0	$93,220	$4,208		
GMSM21B B WLL Arch Monitor	$705,659	$332,687	$243,702	$576,389	$129,270	Current forecast does not include ninth year of field work. Will reassess after 2016 review.	
GMSM21B B WLL Arch Monitor - OR DM	$119,954	$23,849	$17,725	$41,575	$78,379		
GMSM21B B WLL Arch Monitor - OR Imp	$585,705	$308,838	$225,977	$534,814	$50,891		
GMSW02A Baseline TGP Temp	$254,554	$183,061	$39,886	$222,947	$31,607		
GMSW02A Baseline TGP Temp - OR DM	$77,340	$30,963	$4,029	$34,992	$42,348		
GMSW02A Baseline TGP Temp - OR Imp	$177,214	$152,098	$35,857	$187,955	($10,741)		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.