

Peace Water Use Plan

Williston Reservoir and Communications Management Plan

Monitoring Programs and Physical Works

Annual Report 2017

Implementation Period: June 2016 to April 2017

- GMSMON-15 WLL Wetland Habitat
- GMSMON-16 WLL Debris Trends
- GMSMON-17 WLL Tributary Habitat
- GMSMON-18 WLL Dust Control
- GMSMON-19 WLL Erosion Control
- GMSMON-20 WLL Recreation Use
- GMSWORKS-14 WLL Air Photos & DEM
- GMSWORKS-16 WLL Wetland Inventory
- GMSWORKS-17 WLL Trial Wetlands
- GMSWORKS-18 WLL Debris Field Survey
- GMSWORKS-19 WLL Trial Tributaries
- GMSWORKS-20 WLL Dust Source Survey
- GMSWORKS-21 WLL Dust Control Trial
- GMSWORKS-22 WLL Debris Management
- GMSWORKS-23 WLL Erosion Control Trial
- GMSWORKS-24 WLL Finlay Reach Access
- GMSWORKS-25 WLL Reservoir Bathymetry
- GMSWORKS-26 WLL Communications/Safety
- GMSWORKS-27 WLL Finlay River Access Information Plan
- GMSWORKS-28 Industry Feasibility & Design Study
- GMSWORKS-28A District of Mackenzie Effluent Discharge Feasibility & Design Study
- GMSWORKS-31 Kwadacha
- GMSWORKS-33 Boat Ramp Design Ingenika
- GMSWORKS-34 Boat Ramp Design Finlay Bay
- GMSWORKS-35 Boat Ramp Design 6 Mile Bay
- GMSWORKS-36 Boat Ramp Design Cut Thumb Bay
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- GMSWORKS-58 Mackenzie Maintenance
- GMSWORKS-59 Ingenika Maintenance
- GMSWORKS-60 Finlay Bay Maintenance
- GMSWORKS-61 6 Mile Bay Maintenance
- GMSWORKS-62 Cut Thumb Bay Maintenance

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

May 31, 2017

**BC Hydro Peace Water Use Plan
Williston Reservoir and Communications Management Plan
Annual Report: 2017**

1 Introduction

This document represents a summary of the status and the results of the Peace Project Williston Reservoir and Communications Management Plan Water Use Plan (WUP) monitoring program and physical works projects to April 30, 2017, as per the Peace Order under the *Water Act*, dated August 9, 2007. This annual report includes GMSWORKS-26 as well as those projects in Schedule A of the Order. There are six monitoring programs and thirty-four physical works.

2 Status

The following table outlines the dates that Terms of Reference (TOR) for the Williston Reservoir and Communications 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 Williston Reservoir and Communications Management Plan 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
GMSMON-15 WLL WETLAND HABITAT	Schedule A.6.b	Aug 08, 2008	Sep 15, 2008		
GMSMON-16 WLL DEBRIS TRENDS	Schedule A.3.c, Schedule A.5.a	Nov 26, 2008	Dec 17, 2008	Jan 10, 2014	Deferred - BCH to provide further info
GMSMON-17 WLL TRIBUTARY HABITAT	Schedule A.6.c	Aug 08, 2008	Sep 15, 2008	Jul 24, 2015	Jul 31, 2015
GMSMON-18 WLL DUST CONTROL	Schedule A.6.d	Apr 02, 2008	Apr 28, 2008	Apr 09, 2014	Jun 17, 2014
GMSMON-19 WLL EROSION CONTROL	Schedule A.6.e				
GMSMON-20 WLL RECREATION USE	Schedule A.6.f	Aug 08, 2008	Sep 15, 2008	Nov 05, 2015	Nov 24, 2015
GMSWORKS-14 WLL AIR PHOTOS & DEM	Schedule A.3.d	May 09, 2008	Jun 02, 2008		
GMSWORKS-16 WLL WETLAND INVENTORY	Schedule A.2.a	May 09, 2008	Jun 02, 2008	Aug 07, 2009	Jan 20, 2010
GMSWORKS-17 WLL TRIAL WETLANDS	Schedule A.2.a	May 09, 2008	Jun 02, 2008	Feb 25, 2014	Mar 13, 2014
GMSWORKS-18 WLL DEBRIS FIELD SURVEY	Schedule A.3.c	Nov 26, 2008	Dec 17, 2008	Jan 10, 2014	Feb 17, 2014
GMSWORKS-19 WLL TRIAL TRIBUTARY(S)	Schedule A.2.b	May 09, 2008	Jun 02, 2008	Feb 25, 2014	Mar 12, 2014
GMSWORKS-20 WLL DUST SOIL MAPPING	Schedule A.3.a	Apr 02, 2008	Apr 28, 2008	Apr 13, 2011	Jun 01, 2011
GMSWORKS-21 WLL DUST CONTROL TRIAL	Schedule A.3.a	Apr 02, 2008	Apr 28, 2008	Mar 04, 2014	Mar 13, 2014
GMSWORKS-22 WLL DEBRIS REMOVAL	Schedule A.3.c, Schedule A.5.a	Nov 26, 2008	Mar 23, 2009	Nov 26, 2008	Mar 23, 2009
GMSWORKS-23 WLL EROSION CONTROL TRIAL	Schedule A.3.b				
GMSWORKS-24 WLL BOAT ACCESS	Schedule A.4	May 09, 2008	Jun 02, 2008	Aug 07, 2009	Jan 20, 2010
GMSWORKS-25 WLL BATHYMETRIC MAPPING	Schedule A.3.d	May 09, 2008	Jun 02, 2008	Jun 08, 2011	Oct 12, 2011
GMSWORKS-26 WLL COMMUNICATIONS/SAFETY	Schedule A.5.b, Schedule A.5.c, Schedule B.2.b, Schedule C.3.a	May 09, 2008	Jun 02, 2008	Oct 21, 2015	Nov 03, 2015
GMSWORKS-27 WLL FINLAY RIVER ACCESS INFORMATION PLAN	Schedule A.6.a	Aug 08, 2008	Sep 15, 2008	Aug 07, 2009	Jan 20, 2010
GMSWORKS-28 INDUSTRY FEASIBILITY AND DESIGN STUDY	Schedule A.1	Nov 30, 2009	Jan 11, 2010	Dec 22, 2015	May 20, 2016
GMSWORKS-31 KWADACHA (Fort Ware)	Schedule A.4.b	Apr 16, 2010	May 07, 2010		
GMSWORKS-33 BOAT RAMP DESIGN INGENIKA (Billy's Bay)	Schedule A.4.b	Apr 15, 2010	Jun 28, 2010	Apr 18, 2011	Apr 3, 2012 Deferred - pending further submissions
GMSWORKS-34 BOAT RAMP DESIGN FINLAY BAY	Schedule A.4.c	Apr 15, 2010	Jun 28, 2010	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward
GMSWORKS-35 BOAT RAMP DESIGN 6 MILE BAY	Schedule A.4.c	Apr 15, 2010	Jun 28, 2010	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward
GMSWORKS-36 BOAT RAMP DESIGN CUTTHUMB BAY	Schedule A.4.c	Apr 15, 2010	Jun 28, 2010	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward
GMSWORKS-37 BOAT RAMP DESIGN MACKENZIE LANDING	Schedule A.4.c	Apr 15, 2010	Jun 28, 2010	Aug 14, 2013	Aug 15, 2013
GMSWORKS-43 BOAT RAMP INGENIKA (Billy's Bay)	Schedule A.4.b	Apr 18, 2011	Apr 3, 2012 Deferred - TOR to be resubmitted		
GMSWORKS-44 BOAT RAMP FINLAY BAY	Schedule A.4.c	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward		
GMSWORKS-45 BOAT RAMP 6 MILE BAY	Schedule A.4.c	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward		
GMSWORKS-46 BOAT RAMP CUTTHUMB BAY	Schedule A.4.c	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward		
GMSWORKS-47 BOAT RAMP MACKENZIE LANDING	Schedule A.4.c	Apr 18, 2011	Apr 03, 2012	Nov 21, 2013	Nov 29, 2013
GMSWORKS-49 BOAT RAMP DUNLEVY	Schedule A.4.a	Apr 18, 2011	Apr 3, 2012 Deferred	Dec 19, 2014	Feb 04, 2015
GMSWORKS-54 CAP BOAT RAMP DESIGN DUNLEVY	Schedule A.4.a	Apr 15, 2010	May 07, 2010	Jul 12, 2013	Jul 16, 2013
GMSWORKS-57 DUNLEVY MAINTENANCE	Schedule A.4.a	Apr 18, 2011	Apr 3, 2012 Deferred	May 07, 2013	May 15, 2013
GMSWORKS-58 MACKENZIE MAINTENANCE	Schedule A.4.c	Apr 18, 2011	Apr 03, 2012		
GMSWORKS-59 INGENIKA MAINTENANCE (Billy's Bay)	Schedule A.4.b	Apr 18, 2011	Apr 3, 2012 Deferred TOR to be resubmitted		
GMSWORKS-60 FINLAY BAY MAINTENANCE	Schedule A.4.c	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward		
GMSWORKS-61 6 MILE BAY MAINTENANCE	Schedule A.4.c	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward		
GMSWORKS-62 CUTTHUMB BAY MAINTENANCE	Schedule A.4.c	Apr 18, 2011	Apr 3, 2012 CWR does not approve moving forward		

3 Schedule

The following table outlines the current schedule for the monitoring programs and physical works being delivered for the Williston Reservoir and Communications Management Plan WUP.

Table 3-1: Monitoring Programs and Physical Works Schedule as of April 30, 2017

Monitoring Programs	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	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
GMSMON-15: WLL Wetland Habitat			Del	✓	✓	✓	✓	✓	✓	u/w	■	■	■
GMSMON-16: WLL Debris Trends			✓						Del	u/w	■		
GMSMON-17: WLL Tributary Habitat			Del	✓	✓	✓	✓	✓	✓	Del	■	■	■
GMSMON-18: WLL Dust Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	u/w			
GMSMON-19: WLL Erosion Control ¹													
GMSMON-20: WLL Recreation Use		✓	✓	✓	✓	✓	✓	✓	✓	u/w	■		
GMSWORKS-14: WLL Air Photos & DEM		✓	✓	✓							■		
GMSWORKS-16: WLL Wetland Inventory		✓	✓F										
GMSWORKS-17: WLL Trial Wetlands			✓	✓	✓	✓	✓	✓	✓	u/w *	■*	■*	■*
GMSWORKS-18: WLL Debris Field Survey		✓	✓	✓			✓F						
GMSWORKS-19: WLL Trial Tributaries	Del	✓			✓	✓	✓	✓	✓	u/w *	■*	■*	■*
GMSWORKS-20: WLL Dust Source Survey		✓	✓	✓	✓F								
GMSWORKS-21: WLL Dust Control Trial	✓	✓	✓	✓	✓	✓	✓						
GMSWORKS-22: WLL Debris Management		✓	✓	✓	✓	✓	✓	✓	✓	u/w	■		
GMSWORKS-23: WLL Erosion Control Trial ¹													
GMSWORKS-24: WLL Boat Access	Del	✓	✓F										
GMSWORKS-25: WLL Bathymetric Mapping			✓	✓	✓F								
GMSWORKS-26: WLL Communications/Safety	Del	✓	Del	✓	✓	✓	✓	✓	✓	u/w *	■*	■*	■*
GMSWORKS-27: WLL Finlay River Access Information Plan		✓	✓F										
GMSWORKS-28: Industry Feasibility & Design Study	Del	Del	Del	Del	✓	✓	✓	✓F					
GMSWORKS-28a: District of Mackenzie Effluent Discharge Feasibility & Design Study			✓	✓	✓				✓F				
GMSWORKS-31 Kw adacha Boat Launch Maintenance			✓	✓	✓	✓	✓			■*	■*	■*	■*
GMSWORKS-33 Boat Ramp Design Ingenika ¹			✓	✓									
GMSWORKS-34 Boat Ramp Design Finlay Bay			✓	✓									
GMSWORKS-35 Boat Ramp Design 6 Mile Bay			✓	✓									
GMSWORKS-36 Boat Ramp Design Cut Thumb Bay			✓	✓									
GMSWORKS-37 Boat Ramp Design Mackenzie Landing			✓	✓	✓	✓F							
GMSWORKS-43 Boat Ramp Ingenika ¹													
GMSWORKS-44 Boat Ramp Finlay Bay													
GMSWORKS-45 Boat Ramp 6 Mile Bay													
GMSWORKS-46 Boat Ramp Cut Thumb Bay													
GMSWORKS-47 Boat Ramp Mackenzie Landing							✓						
GMSWORKS-49 Boat Ramp Dunlevy							✓	✓F					
GMSWORKS-54 Boat Ramp Design Dunlevy			✓	✓	✓	✓							
GMSWORKS-57 Dunlevy Maintenance						✓		Del	✓	u/w *	■*	■*	■*
GMSWORKS-58 Mackenzie Maintenance							Del	✓	✓	u/w *	■*	■*	■*
GMSWORKS-59 Ingenika Maintenance ¹													
GMSWORKS-60 Finlay Bay Maintenance													
GMSWORKS-61 6 Mile Bay Maintenance													
GMSWORKS-62 Cut Thumb Bay Maintenance													

Legend:

- = Program to be undertaken/initiated in identified year
- ✓ = Program completed for the year
- x = Project not undertaken as planned for this year
- * = Maintenance only in identified year
- ✓F = All field work for this project is complete. No further field work is planned.
- PCR = Project Completion Report submitted
- u/w = Project is under way
- Del = Project is delayed for the year

Footnotes:

1. Pending agreement between BC Hydro and the Tsay Keh Dene First Nation.

4 Monitoring Programs and Physical Works Terms of Reference

The monitoring programs and physical works being implemented under the Williston Reservoir and Communications 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:

https://www.bchydro.com/about/sustainability/conservation/water_use_planning/northern_interior/peace_river/williston_reservoir.html

5 Status of Monitoring Programs

5.1 GMSMON-15 Williston Wetland Habitat

The objective of this ten year monitoring project is to assess the biological effectiveness of two wetland enhancement trials intended to improve foreshore habitat for fisheries, wildlife, and riparian areas. The key management questions addressed by this monitoring program are:

1. Are the enhanced (or newly created) wetlands used by fish?
2. Are the enhanced (or newly created) wetlands used by waterfowl and other wildlife?
3. Is there a change in the abundance, diversity, and extent of vegetation in the enhancement area?
4. Is the area and quality of fish and wildlife habitat created by the wetland enhancement maintained over time?

Pre-construction monitoring work began in April 2011 and continued after the construction of trial wetlands (under GMSWORKS-17 Williston Trial Wetlands) was completed at Airport Lagoon in 2013 and Beaver Pond in 2014. Monitoring to the end of the project will be required to confirm what changes to fish, wildlife and vegetation are associated with the enhancement projects. The Year 6 report is in draft and will be submitted with the 2018 Annual Report.

5.2 GMSMON-16 Williston Debris Trends

The objective of this monitoring project is to assess the effectiveness of GMSWORKS-22 (Williston Targeted Debris Management). The key management questions addressed by this monitoring program are:

1. How is the volume of woody debris in Williston Reservoir changing over time?
2. Is woody debris collecting at trial and project sites associated with the Peace River Water Use Plan?
3. What are the primary sources for woody debris recruitment into Williston Reservoir and what is the rate of debris recruitment from these sources?

Following aerial photography of 2009 from GMSWORKS-14 (Williston Air Photo and DEM), a reservoir debris survey was completed in 2010 which is a joint deliverable of both GMSMON-16 and GMSWORKS-18 (Williston Debris Field Survey) projects.

Further to your letter dated February 17, 2014, the office of the CWR deferred a decision on BC Hydro's request to reduce the study from three years to two years pending further consultation. After a comprehensive review of this program, a reduction in the number of study years is no longer required. Year 1 of this program was completed in 2009 as a joint deliverable with the GMSWORKS-18 project. Attached is the 2010 report, dated June 10, 2010.

Year 2 work will be completed in 2017, using inventory information from the 2011 low water aerial photographs (from GSMWORKS-14), and to the extent possible, include any notable trend analysis compared to the 2010 baseline report (field work completed in 2009). Year 3 will be based on the final debris survey and debris trend analysis following scheduled 2018 aerial flights.

5.3 GSMON-17 Tributary Habitat Review

The objective of this effectiveness monitoring program is to determine the response of fish and selected indicator groups to the tributary enhancements undertaken in under GMSWORKS-19 (Williston Trial Tributaries) project. This ten year monitoring program began in pre-works monitoring April 2011 and continued following construction of enhancement work at Ole Creek and Six Mile Creek in 2014.

Despite study design revision in 2015, uncertainty remains regarding the ability of the design to answer the management questions. This program has been paused for 2017 to assess the current study design and the Order requirements. Following the outcome of this review, a submission to the CWR office will be made to seek approval for the recommended next steps.

The current management questions for this program are:

1. Does access for spring spawners (i.e. rainbow trout and/or arctic grayling) improve as a result of enhancement?
2. Is the area and quality of fish habitat created by the tributary enhancement maintained over time?
3. Does riparian vegetation along tributaries increase in abundance and diversity as a result of enhancement?
4. Does abundance and diversity of song birds (passerines) around tributaries change as a result of enhancement?
5. Does amphibian abundance and diversity in tributaries change as a result of enhancement?
6. Does tributary enhancement change the area and quality of amphibian breeding habitat over time? If so, is the area and quality maintained over time?

The Year 5 (2015) report is attached. The Year 6 (2016) report is in draft and will be submitted with the 2018 Annual Report.

5.4 GSMON-18 Williston Dust Control

The objective of this monitoring project is to provide long-term data on airborne particulate matter concentrations in the upper Finlay Arm air shed and to evaluate the effectiveness of dust mitigation treatments in the drawdown zone of Finlay Arm.

This work was initiated in April 2008 and will be undertaken every year for ten years (completed in 2017).

There have been a number of revisions to this program during implementation. In 2008 and 2009, data collection occurred from early May through late June, a period coinciding with the lowest water levels and greatest potential for dust emissions from Williston beaches. In 2010, air monitoring was extended to the end of August. In 2011, the instrumentation was replaced with more suitable monitoring units. The revisions outlined above are included in Terms of Reference Addendum 3, which was approved on June 17, 2014.

The Year 8 (2015) report is attached. The Year 9 (2016) report is in draft and will be submitted with the 2018 Annual Report.

5.5 GMSMON-19 Williston Erosion Control

The objective of this project is to monitor the effectiveness of any constructed erosion works under GMSWORKS-23 (Williston Erosion Control Trials). On December 5, 2014, the CWR approved a delay in this project pending further discussions between Tsay Keh Dene First Nation and BC Hydro. There is no change in status at this time.

5.6 GMSMON-20 Reservoir Recreation Use

The objective of the monitoring project is to assess boat ramp usage on the Williston Reservoir. This work was initiated in May 2009 and will be undertaken every year for ten years (completed in 2018). Vehicle counters and remote cameras are being used concurrently to evaluate the following management questions:

The key management questions addressed by this monitoring program are:

1. Does the recreational use of the Williston Reservoir boat ramps increase after boat access has been improved?
2. What is the frequency of use of newly constructed boat ramps?

As part of the deliverables for Year 8 of this program, the analytical framework and preliminary analyses are being developed to inform the results. These analyses will be provided in the Year 8 report, which is in draft and will be submitted with the 2018 Annual Report.

6 Status of Physical Works

6.1 GMSWORKS-14 Williston Air Photos and DEM

The objective of this project was to:

1. Conduct a mapping inventory to compile a bibliography of all existing maps of the Williston Reservoir;
2. Acquire aerial photos of Williston Reservoir at low pool in 2009 and develop a bare earth digital elevation model (DEM); and
3. Acquire aerial photos of the Williston Reservoir in 2013 and 2018 and re-compile the DEM based on new data.

The imagery obtained from this project is designed to support other management plans within the Williston Reservoir. Spatial data and information will support a number of Peace projects including, but not limited to, debris management, dust mitigation, wetlands and tributaries and bathymetry.

The first stage of work was initiated in April 2009 and completed in December 2010. The second set of air photos was scheduled to be acquired in 2013, but those photos were taken in spring of 2011 to take advantage of the very low reservoir level. The third set of photos is scheduled to be acquired in 2018.

6.2 GMSWORKS-16 Williston Wetland Inventory

The objective of this project was to identify a list of candidate sites within the Williston Reservoir for wetland habitat creation as the conceptual feasibility for GMSWORKS -17 Williston Trial Wetlands project. The work was undertaken in 2009 and 2010 and summarized in a 2010 report.

The GMSWORKS-16 report identified 42 potential sites, and a recommendation of five candidate sites. The basis for shortlisting to the five sites included consideration of: 1) benefits to fish and wildlife; 2) likelihood of success (engineering); 3) regulatory requirements; 4) land ownership; and 5) estimated costs.

This project is complete.

6.3 GMSWORKS-17 Williston Trial Wetlands

The objective of this project is to create wetland habitats in areas that may be dewatered for long periods to improve reservoir habitat and increase the utility of the drawdown zone for fish species. The feasibility study was undertaken as part of GMSWORKS-16 Williston Wetland Inventory project.

From the five sites recommended under GMSWORKS-16 (Williston Wetland Inventory) project, BC Hydro selected two sites (Beaver Pond and Airport Lagoon) to be taken forward to detailed design based on the following rationale:

1. They represented different strategies to enhancing wetlands;
2. They were considered relatively cost effective in terms of the estimate of construction costs and the area affected by the trial;
3. The constructed berm approach at Beaver Pond was considered readily transferrable to future sites should the trial be successful; and
4. The existing causeway at the Airport Lagoon site meant that minimal new fill and footprint would be needed to create the new wetland areas. This would streamline the process for regulatory approvals, as well as reduce material costs over construction of new dykes.

Detailed design occurred in 2011 with permitting and planning continuing through 2012.

The work at the Airport Lagoon site consisted of replacing two culverts under the forestry road causeway to raise the invert elevation. This allowed for water storage and creation of wetted habitat which may facilitate colonization of vegetation in the perimeter of the treatment area and enhancement of the riparian zone. Construction at the Airport Lagoon site was completed in 2013.

The work at Beaver Pond work involved construction of two geo-synthetic berms to retain water, installation of a downstream log boom and riprap placement of a spillway apron. Construction was completed in May 2014. The construction completion report for Beaver Pond (prepared by the engineers) is included with this Annual Report.

A TOR Addendum for maintenance will be submitted to your office by June 30, 2017. Once approved, BC Hydro will undertake inspections and maintenance accordingly.

6.4 GMSWORKS-18 Williston Debris Field Survey

The objectives of the Williston Debris Field Survey are to collect baseline information on volume of debris within the reservoir and recruitment of debris to the reservoir, as well as to assess the feasibility of alternative means of debris management to pile and burn.

The project consists of two components; 1) a debris field survey (shared deliverable with GMSMON-16 Williston Debris Trends); and 2) a debris management strategy. The debris survey was completed in June 2010 using the aerial photography from GMSWORKS-14 (Williston Air Photos & DEM) in April 2009, and is included with this Annual Report.

A debris management strategy was prepared in 2011 but did not reflect the moratorium on burning due to localized air quality concerns that existed at the time. Following a TOR addendum approval in February 17, 2014, a second report in 2015 expanded on the operational requirements for the alternative debris management methods.

This project is complete.

6.5 GMSWORKS-19 Williston Reservoir Trial Tributaries

The overall objective of the physical works is to improve or restore the access to rivers that are tributary to Williston Reservoir in cases where fish access to the mouth of tributaries has been impeded by a build-up of debris and/or by the seasonal fluctuations in water levels in the reservoir.

A site selection report (i.e., feasibility study) was undertaken in 2010 to identify and prioritize possible locations for this project. This report is submitted with this Annual Report. The report recommended the Chichouyenily Creek and the Six Mile sites. However, the Chichouyenily Creek site was relatively expensive to build, and the lesson(s) learned from this trial would likely not be transferrable to other sites given the unusual site-specific conditions and enhancement approach.

Instead, Ole Creek site was chosen in addition to the Six Mile site as they represented two different types of fish access restrictions (e.g. Ole Creek had large woody debris accumulation and Six Mile had a perched mouth from sedimentation) and would provide the best range of information on what types of physical works achieved the intended benefits.

Designs for the Six Mile Creek and Ole Creek tributary improvements were developed on 2011. The design report from 2011 is submitted with this Annual Report.

Following detailed design, permitting, and constructability reviews, the tributary improvements were constructed in early 2014. As Ole Creek was impeded by unconfined channel flow and large woody debris, restoration efforts included the installation of low-level gravel berms and the installation of debris catchers using on-site woody debris. Approximately 1500 m³ of debris was removed from the creek channel.

The works at Six Mile Creek consisted of the creation of a single deep channel by the placement of a series of geogrid soil wrap berms, which would cut off flow bifurcations and concentrate and confine creek flow to within a single main channel. It also included the installation of similar debris catchers made from on-site large woody debris.

A construction completion report (prepared by the engineers) for these works is also submitted with this Annual Report.

Construction of works at Ole Creek and Six Mile Creek was completed in 2014. Both locations were inspected and surveyed by the design engineers in 2016. The site inspection reports are currently in draft and will be submitted with the 2018 Annual Report.

A TOR Addendum for maintenance will be submitted to your office by June 30, 2017. Once approved, BC Hydro will undertake inspections and maintenance accordingly.

6.6 GMSWORKS-20 Williston Dust Mapping

This is a feasibility study to assess the practicality of using satellite technology to predict dust emission potential based on soil characteristics of Williston beaches. The four objectives of the study were to:

1. Assess the ability of satellite technology to predict near surface soil moisture and surface roughness, which critically control the wind erosion threshold, at appropriate spatial and temporal scales on a representative beach;
2. Assess the ability of satellite technology to differentiate the textural characteristics of the surface sediments;
3. Characterize the wind erosion threshold and dust emission potential of selected GMS beach surfaces and evaluate the relationship between those measurements and the satellite signals for soil moisture, roughness, and texture; and
4. Develop a preliminary near real-time algorithm to predict potential dust emission for typical wind speeds at Williston Reservoir based on weekly satellite scenes.

This work was initiated in May 2009 and the final season of field data was collected in 2012. This project is complete.

6.7 GMSWORKS-21 Williston Dust Control Trials

Aerial movement of fine particles of silts and clays ("dust") from the exposed drawdown zone in the Finlay Reach of the Williston Reservoir have been a concern of Tsay Keh Dene and Kwadacha First Nations. An adaptive management program of dust mitigation was implemented on a beach-by-beach basis. Seven years of dust control trials were completed (from 2008-2014) which included assessments of several different dust methodologies including:

- Various tillage techniques;
- Irrigation, using gravity-fed distribution in 2011 and a high output pump in 2014;
- Native vegetation;
- Vegetation protection using protective debris berm; and
- Engineering roughness.

The Williston Dust Control Trials are complete. The outstanding report for the engineered roughness and irrigation trials are in draft and under review.

6.8 GMSWORKS-22 Williston Targeted Debris Management

The Williston Targeted Debris Management project provides debris management in the reservoir over a ten year period. Debris is managed to: (i) minimize damage to Peace Water Use Plan (WUP) study sites; (ii) improve navigation; (iii) improve fish access to tributaries; and (iv) reduce shoreline erosion and destruction to riparian vegetation.

The project entails conducting an annual aerial debris reconnaissance survey, collecting debris (on land or water) at selected sites, and managing debris to prevent negative impacts to WUP projects, navigational safety, fisheries, and shorelines.

Work was initiated in May 2009 and will be completed in 2018. In 2016, 45,746 m³ of debris was piled and burned. The Year 8 (2016) report is in draft and will be submitted with the 2018 Annual Report.

6.9 GMSWORKS-23 Williston Erosion Control Trial

The objective of this project is to investigate the feasibility of erosion controls at Tsay Keh Dene village site and implement any chosen solution on a trial basis. On December 5, 2014, the CWR approved a delay in this project pending further discussions between Tsay Keh Dene First Nation and BC Hydro. There is no change in status at this time.

6.10 GMSWORKS-24 Finlay Reach Access

The objectives of this project were to complete feasibility studies on options for recreational access to the Williston Reservoir or for improvements to the existing access points to the reservoir, and to make recommendations.

Two feasibility studies were completed in March 2010 for seven sites on the Parsnip Reach of the Williston Reservoir (GMSWORKS-24B) and two sites at Finlay Reach (GMSWORKS-24A).

The seven sites on Parsnip Reach were as follows:

- One existing boat launch site located in the BC Hydro campsite (Alexander Mackenzie's Landing Recreation Area);
- Two existing boat launch sites located at Forest Service campsites (Cut Thumb Bay and Finlay Bay); and
- Four locations with, at most, informal gravel ramps (Six Mile Bay, Strandberg, Manson Dump, and Black Water).

The sites on Finlay Reach included potential boat launch ramp locations at the following locations:

- Ingenika; and
- In the vicinity of Tsay Keh Village, including the existing barge landing.

The feasibility studies included engineering technical feasibility, archaeological feasibility, and environmental criteria, and cost in their evaluations.

This project is complete.

6.11 GMSWORKS-25 Williston Reservoir Bathymetry

The objective of this project was to map the reservoir between full pool and 652.27 m.

Between 2010 and 2012, twenty-five bathymetric charts of the reservoir were created. This project is complete.

6.12 GMSWORKS-26 Williston Communication and Safety

The objective of this project is to enhance safe navigational access of Williston reservoirs and the Peace River by the installation of a marine radio repeater systems and related information signage.

Feasibility work was initiated in 2009 with an inventory and assessment of existing radio resource in the area, and options for developing a marine communication network. BC Hydro Telecommunications engineering subsequently reviewed and refined the options based on a more in-depth understanding of BC Hydro's own system. As a result, designs were developed to:

- modify three existing repeater sites to accommodate marine VHF (Deception Cone, Wolverine and Carbon Creek sites);
- add two new repeaters to existing microwave sites (Morfee and Bullhead); and
- construct one new site (Portage Mountain).

The installation and commissioning of these sites occurred from 2011 to 2013. With the five VHF repeaters, two marine VHF channels are available that provided area-dependent reservoir coverage. Signage has been posted at each boat launch on the Williston and Dinosaur reservoirs to provide information on the VHF system and to warn users of potential hazards. Simplified signage referring to the two channels installed at identified boat launches will be installed prior to the 2017 recreation season.

In a letter dated November 3, 2015, the CWR approved pausing further development of the communication system under this project, pending additional assessment of the options. After further discussions with BC Hydro's telecommunications engineers, we are currently reviewing the most cost-effective options for meeting the Peace River radio repeater requirements (as per Schedule C, clause 3(a) of the Peace Order).

We will submit a TOR addendum by June 30, 2017 that will include ongoing monitoring and maintenance.

6.13 GMSWORKS-27 Finlay River Access Information Plan

The objective of this project was to conduct an investigation into sedimentation problems in the lower Finlay River that were potentially associated with fluctuating levels of the Williston Reservoir. This project is complete.

6.14 GMSWORKS-28 Mackenzie Industry Feasibility & Design Study

The objective of this engineering feasibility and design study was to determine practical and cost-effective solutions associated with lower reservoir levels at Mackenzie's three industrial plants for water supply, effluent disposal, and log supply.

The Phase Two report was submitted to the CWR which was accepted on May 20, 2016. This project is complete.

6.15 GMSWORKS-28A District of Mackenzie Effluent Discharge Feasibility & Design Study

This project objective was to conduct an engineering feasibility and design study to determine practical and cost-effective solutions to the issues associated with lower reservoir levels at Mackenzie and effluent disposal at the District of Mackenzie. The study was submitted to the CWR in December 2015. This project is complete.

6.16 GMSWORKS-31 Kwadacha Boat Ramp

This project is for the ongoing maintenance costs associated with the boat launch facility at Kwadacha, across from the village of Fort Ware, on the Finlay River

This project arises from a requirement under Clause (j) of the Final Water Licence 123021; BC Hydro is required to provide reservoir access on the Williston Reservoir. At the time of the WUP, the Williston Reservoir had no boat launch sites in the Finlay Reach and only an informal site on the Finlay River at Kwadacha. A location at Kwadacha (Fort Ware) was identified by the Consultative Committee as a priority site. Following the Consultative Committee report (2003) but prior to the WUP being approved and the Peace Order issued under the Water Act, agreement was reached between Kwadacha and BC Hydro to build a new boat ramp on the Finlay River at Kwadacha. The ramp was constructed in December 2007.

When the Peace Water Use Plan Order was issued on August 9, 2007, it included the direction to undertake a feasibility study for a ramp at Kwadacha (Fort Ware) Schedule A, Clause 4(b)). As the ramp had been built, no feasibility studies as required by the Order were undertaken.

In 2008, issues with the constructed ramp were identified. Significant upgrades were undertaken in February and March 2009. BC Hydro will continue to maintain the ramp.

6.17 GMSWORKS-33 Boat Ramp Design Ingenika

This project is for the design of boat launch facilities on the Ingenika Arm of Finlay Reach in the north end of the Williston Reservoir. The feasibility study was completed in March 2010, under GMSWORKS-24A (Finlay Reach Access) which considered two sites – one at Billy's Bay at the entrance of the Ingenika Arm, and the other at Thomas Trail further west along the Ingenika Arm and a more sheltered location than at Billy's Bay. There is an existing informal ramp on the gravel beach at Thomas Trail. Both were accessible by forest service roads.

In April 2012, BC Hydro indicated that the proposed options in the GMSWORKS-24 report did not meet the needs of the Tsay Keh Dene community and the CWR agreed to defer the project to allow for ongoing conversations with the community. There is no change in the status.

6.18 GMSWORKS-34 Boat Ramp Design Finlay Bay

This project is for a design of boat launch facilities at Finlay Bay. The feasibility study was undertaken in March 2010, under GMSWORKS-24B (Parsnip Reach Access).

The Finlay Bay boat launch is adjacent to the Finlay Bay Forest Service Campsite. The campsite and boat launch ramp are reached via 75 km of the rough gravel West Parsnip Forest Service Road. The boat launch ramp is reached along a gravel track that passes through a relatively wide, open area. There is an existing outhouse as well as picnic tables on the upland grassy area, but there are otherwise no significant facilities there.

The feasibility study identified challenging design options that required dredging of a channel approximately 90 m long to provide access to relatively low water (e.g., El. 659 m), which adds to the expense of the project and the ongoing maintenance costs.

Following an assessment under GSMON-20 (Williston Recreation Use) for Williston Reservoir, the CWR did not approve further implementation at the Finlay Bay site. If future recreation demand proves that greater reservoir access is needed, then this ramp development may be reconsidered as per letter from the CWR dated April 3, 2012.

6.19 GMSWORKS-35 Boat Ramp Design 6 Mile Bay

This project is for a design of boat launch facilities at 6 Mile Bay. The feasibility study was undertaken in March 2010, under GMSWORKS-24B (Parsnip Reach Access).

The 6 Mile Bay site has an existing gravel ramp with the lower part of the boat launch cut into the side of a bank and the upper portion angled around this bank. A design was prepared for a pre-cast concrete ramp accessible at water elevations of El. 657 m. Lower water access was not feasible due to the bathymetry of the reservoir at this location.

Following an assessment under GSMON-20 (Williston Recreation Use) for Williston Reservoir, the CWR did not approve further design (GMSWORKS-35) or implementation (GMSWORKS-45) at the 6 Mile Bay site. If future recreation demand proves that greater reservoir access is needed, then this ramp development may be reconsidered as per letter from the CWR dated April 3, 2012.

6.20 GMSWORKS-36 Boat Ramp Design Cut Thumb Bay

This project is for a design of boat launch facilities at Cut Thumb Bay. The feasibility study was undertaken in March 2010, under GMSWORKS-24B (Parsnip Reach Access).

Cut Thumb Bay accessed from the Parsnip West Forest Service Road. This is well-used site for launches into the Williston Reservoir at low water. There is a large area available for parking and turnaround. While there is a visible gravel track to the best launching spots, the entire area of the bay provides a driveable gravel surface.

BC Hydro began developing designs and estimates for upgrades to Finlay Bay boat launch in early 2011. However, following an assessment under GSMON-20 (Williston Recreation Use) for Williston Reservoir, which indicated that upgrades to Mackenzie Landing would adequate reservoir access for local communities, the CWR did not approve (in a letter dated April 3, 2012) further design (GMSWORKS-36) or implementation (GMSWORKS-46) at the Cut Thumb Bay. If future recreation demand proves that greater reservoir access is needed, then this ramp development may be reconsidered. Usage at Finlay Bay continues to be monitored under GSMON-20.

6.21 GMSWORKS-37 Boat Ramp Design Mackenzie Landing

This project was for the design phase of the boat launch at Alexander Mackenzie's Landing Recreation Site ("Mackenzie Landing"). Mackenzie Landing is located 8 km from Mackenzie on the West Parsnip forest service road off Highway 39 on the east side of the Williston Reservoir.

Under Clause (j) of Final Water Licence 123021, BC Hydro is required to provide reservoir access at areas as directed by the Comptroller of Water Rights (CWR). "Mackenzie Landing" was identified as a site for access as part of the WUP, and the feasibility study was undertaken in March 2010, under GMSWORKS-24B (Finlay Reach Access). This project was for the design phase associated with the design options selected from the feasibility study.

The design involved the development of an upper concrete ramp with a toe elevation at El. 662 m a lower ramp with a toe elevation of El. 654.4 m and a gravel access road between the two ramps, a gravel parking area and turnaround, and erosion protection along the ramp and roads.

The CWR approved this design on April 3, 2012, and work commenced on the upper portions of the ramp under GMSWORKS-47 (Boat Ramp Construction Mackenzie Landing).

In August 2013, a constructability review revealed there was a need for a significant coffer dam, which increased the costs estimates, and BC Hydro revisited the design.

Revised designs were prepared with a lower ramp to El. 658 m and were discussed and agreed with the District of Mackenzie and from the community through an open house. The revised design would also allow construction of the lower portion without the use of a coffer dam. The CWR approved this design on November 29, 2013.

This project is complete.

Construction of these facilities was undertaken as part of GMSWORKS-47. The maintenance is undertaken as part of GMSWORKS-58.

6.22 GMSWORKS-43 Boat Ramp Ingenika

This project is for the construction of a boat launch facility on the Ingenika Arm of Finlay Reach. As described in GMSWORKS-33 above (Boat Ramp Design Ingenika), this project has not been approved for implementation pending ongoing conversations with local First Nations, Tsay Keh Dene, in particular.

6.23 GMSWORKS-44 Boat Ramp Finlay Bay

This project is for the construction of the Finlay Bay boat ramp. As described in GMSWORKS-34 above (Boat Ramp Design Finlay Bay), this project has not been approved for implementation.

If future recreation demand proves that greater reservoir access is needed, then this ramp development may be reconsidered, per letter from the CWR dated April 3, 2012.

6.24 GMSWORKS-45 Boat Ramp 6 Mile Bay

This project is for the construction of the 6 Mile Bay boat launch. As described in GMSWORKS-35 above (Boat Ramp Design 6 Mile Bay), this has not been approved for implementation.

If future recreation demand proves that greater reservoir access is needed, then this ramp development may be reconsidered, per letter from the CWR dated April 3, 2012.

6.25 GMSWORKS-46 Boat Ramp Cut Thumb Bay

This project is for the construction of the Cut Thumb Bay boat ramp. As described in GMSWORKS-36 above (Boat Ramp Design Cut Thumb Bay), upgrades have not been approved for implementation.

If future recreation demand proves that greater reservoir access is needed, then this ramp development may be reconsidered, per letter from the CWR dated April 3, 2012.

6.26 GMSWORKS-47 Boat Ramp Mackenzie Landing

As described in GMSWORKS-37 above (Boat Ramp Construction Mackenzie Landing), the CWR approved the first design on April 3, 2012, and work commenced on upland work, upper portions of the ramp and procurement of the concrete ramp panels in spring 2013.

Following approval of the revised design for the lower ramp in November 2013, construction work on site started in March 2014, and was completed in May 2014. The construction team was able to take advantage of a natural ice coffer dam that arose during construction to complete the project under the approved budget.

This construction work is now complete.

6.27 GMSWORKS-49 Boat Ramp Dunlevy

This project is for the construction of the boat launch at Dunlevy as designed under GMSWORKS-54 (Boat Ramp Design Dunlevy) described below. The Dunlevy location is on the east shore of the Dunlevy Inlet approximately 30 km northwest of Hudson's Hope. It is located within Butler Ridge Provincial Park.

Permits and planning for ramp upgrade work were initiated in 2013. Work was planned for winter 2014 but was delayed due to early road restrictions. Work commenced in June 2014 on the upland work including the road, the parking areas, and the turnaround area. Materials for the 2015 work were delivered and stored on site.

Work commenced in February 2015 to demolish the existing ramp. Due to water elevations and construction challenges (e.g. large boulder that needed to be removed), construction of the ramp reached a toe elevation of 660.75 m, short of the planned elevation of 658 m.

The current elevation of 660.75 m provides access to the ramp 100% of the time from June 1 to October 31 and 91.8% of the time from May 15 to October 31 based on historical records.

An assessment for proceeding to El. 658 m that considers usage data of the newly improved ramp was completed over the last two years. GMSWORKS-54 – Boat Ramp Design Dunlevy

This project was for the design of boat launch facilities at Dunlevy and constructed under GMSWORKS-49 above (Boat Ramp Dunlevy).

Under Clause (j) of Final Water Licence 123021, BC Hydro is required to provide reservoir access at areas as directed by the Comptroller of Water Rights (CWR). Dunlevy was identified as a site for access as part of the WUP.

The initial feasibility study was undertaken in GMSWORKS-13 Peace and Williston Recreation Access Feasibility Study (March 2010) (described in the Annual Report for Peace River (Schedule C)), and explored two sites – the existing site and an alternative location on the west side of Dunlevy Inlet.

At the time of the feasibility study, the existing concrete ramp was in poor condition as a result of erosion and slumping and had been closed since 2009. The west side site was not considered feasible due to geotechnical conditions and it was recommended that further geotechnical investigations be undertaken at the existing location prior to determining a final design.

Following these additional extensive geotechnical investigations at the site, a second feasibility report was prepared (June 2013). This report looked at multiple design variations at the existing site.

The profile along the centerline of the existing boat ramp is comprised of two main gradients:

- From the top of the ramp towards the bottom of the ramp, the gradient is approximately 14% (1 in 7.2) between El. 674 m to El. 664 m; and
- From lake bed contour at El. 664 m, the gradient of the shoreline steepens sharply to 53.4% (1 in 1.9) to El. 631 m offshore.

While the upper portion of the ramp is at the preferred gradient for boat launch operations, the lower section of the ramp was too steep to function as a boat ramp without significant fill. As a result all design options in the 2013 report reviewed options at elevations El. 654 m plus options with higher elevations. The options with toe elevations below El. 664 m became increasingly more expensive the lower the toe.

On July 16, 2013 the CWR accepted a design to elevation El. 658 m, and work proceeded to develop the design specifications and issue for construction drawings.

This project is complete.

6.28 GMSWORKS-57 Dunlevy Maintenance

The current approved scope for Dunlevy Maintenance includes essential repairs for the ramp prior to completion of the design and construction of the upgraded ramp at Dunlevy (GMSWORKS-49). BC Hydro is currently developing a revised scope for ongoing maintenance at Dunlevy based on an appropriate inspection schedule and access-related maintenance consistent with other boat launches on BC Hydro reservoirs. A TOR for maintenance will be submitted before February 28, 2018.

6.29 GMSWORKS-58 Mackenzie Maintenance

The current scope for Mackenzie boat launch maintenance was developed prior to the upgrades at the site and was approved in 2012 for a period of ten years. Now that the upgrades are complete as described under GMSWORKS-47, BC Hydro will revise the scope for ongoing maintenance at Mackenzie based on an appropriate inspection schedule and access-related maintenance consistent with other boat

launches on BC Hydro reservoirs. A TOR for maintenance will be submitted before February 28, 2018.

6.30 GMSWORKS-59 Ingenika Maintenance

No maintenance is required at Ingenika as no ramp has been constructed as discussed in GMSWORKS-43 above.

6.31 GMSWORKS-60 Finlay Bay Maintenance

No maintenance is required for Finlay Bay, as no ramp upgrades have been constructed, as discussed in GMSWORKS-34 and 44 above.

6.32 GMSWORKS-61 6 Mile Bay Maintenance

No maintenance is required for 6 Mile Bay, as no ramp upgrades have been constructed, as mentioned in GMSWORKS-35 and 45 above.

6.33 GMSWORKS-62 Cut Thumb Bay Maintenance

No maintenance is required for Cut Thumb Bay, as no ramp upgrades have been constructed, as mentioned in GMSWORKS-36 and 46 above.

7 Monitoring Programs and Physical Works Costs

The following table summarizes the Williston Reservoir and Communications Management Plan WUP monitoring programs and physical works costs approved by the Comptroller and the Actual Costs to April 30, 2017.

Table 7-1: Williston Reservoir and Communications 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
GMS Prepare Annual Report - OR	\$43,074	\$29,787	\$13,286	\$43,073	\$1		
GMSM15A WLL Wetland Habitat	\$981,420	\$508,173	\$386,762	\$894,935	\$86,485	Efficiencies found during project implementation	
GMSM15A WLL Wetland Habitat - OR DM	\$157,922	\$58,422	\$19,845	\$78,267	\$79,655		
GMSM15A WLL Wetland Habitat - OR Imp	\$823,498	\$449,751	\$366,917	\$816,668	\$6,830		
GMSM16A WLL Debris Trends	\$215,564	\$13,416	\$130,508	\$143,924	\$71,640	Forecast is currently being reviewed against the remaining scope of the project	
GMSM16A WLL Debris Trends - OR DM	\$46,860	\$13,416	\$14,704	\$28,120	\$18,740		
GMSM16A WLL Debris Trends - OR Imp	\$168,704		\$115,804	\$115,804	\$52,900		
GMSM17A WLL Tributary Habita	\$1,467,158	\$924,380	\$465,947	\$1,390,327	\$76,831	Forecast is currently being reviewed against the remaining scope of the project	TOR submission
GMSM17A WLL Tributary Habita - OR DM	\$75,898	\$75,854	\$14,599	\$90,453	(\$14,555)		
GMSM17A WLL Tributary Habita - OR Imp	\$1,391,260	\$848,525	\$451,349	\$1,299,874	\$91,386		
GMSM18A WLL Dust Control	\$5,806,148	\$4,128,304	\$634,008	\$4,762,312	\$1,043,836	Forecast reflects narrowed scope as per approved TOR resubmissions	
GMSM18A WLL Dust Control - OR DM	\$184,905	\$92,048	\$24,008	\$116,056	\$68,849		
GMSM18A WLL Dust Control - OR Imp	\$5,621,243	\$4,036,257	\$610,000	\$4,646,257	\$974,986		
GMSM19A WLL Erosion Control	\$0	\$3,423	\$0	\$3,423	(\$3,423)	Project not yet approved	
GMSM19A WLL Erosion Control - OR DM	\$0	\$3,423	\$0	\$3,423	(\$3,423)		
GMSM19A WLL Erosion Control - OR Imp	\$0		\$0	\$0	(\$0)		
GMSM20A WLL Recreation Use	\$384,270	\$292,911	\$81,153	\$374,063	\$10,207		
GMSM20A WLL Recreation Use - OR DM	\$64,182	\$49,820	\$8,233	\$58,053	\$6,129		
GMSM20A WLL Recreation Use - OR Imp	\$320,088	\$243,090	\$72,920	\$316,010	\$4,078		
GMSW14A WLL Air Photos & Dem	\$2,804,180	\$1,740,797	\$638,712	\$2,379,510	\$424,670	Forecast is currently being reviewed against the remaining scope of the project	
GMSW14A WLL Air Photos & Dem - OR DM	\$30,295	\$28,015	\$9,453	\$37,468	(\$7,173)		
GMSW14A WLL Air Photos & Dem - OR Imp	\$2,773,885	\$1,712,783	\$629,259	\$2,342,042	\$431,843		
GMSW16A WLL Wetland Invent - OR	\$143,076	\$143,076	\$0	\$143,076	\$0	Project complete	
GMSW16A WLL Wetland Invent - OR DM	\$12,656	\$12,656	\$0	\$12,656	\$0		
GMSW16A WLL Wetland Invent - OR Imp	\$130,420	\$130,420	\$0	\$130,420	\$0		
GMSW17A WLL Trial Wetlands	\$2,323,692	\$2,062,448	\$123,722	\$2,186,169	\$137,523	Forecast is currently being reviewed against the remaining scope of the project	TOR submission
GMSW17A WLL Trial Wetlands - OR DM	\$30,273	\$38,420	\$9,622	\$48,042	(\$17,769)		
GMSW17A WLL Trial Wetlands - OR Imp	\$2,293,419	\$2,024,027	\$114,100	\$2,138,127	\$155,292		
GMSW18A WLL Debris Field	\$342,368	\$342,206	\$0	\$342,206	\$162	Project complete	
GMSW18A WLL Debris Field - OR DM	\$20,735	\$18,255	\$0	\$18,255	\$2,480		
GMSW18A WLL Debris Field - OR Imp	\$321,633	\$323,951	\$0	\$323,951	(\$2,318)		
GMSW19A WLL Trial Tributar	\$2,552,026	\$2,053,977	\$154,631	\$2,208,608	\$343,418	Forecast is currently being reviewed against the remaining scope of the project	TOR submission
GMSW19A WLL Trial Tributar - OR DM	\$40,649	\$46,352	\$10,121	\$56,473	(\$15,824)		
GMSW19A WLL Trial Tributar - OR Imp	\$2,511,377	\$2,007,625	\$144,510	\$2,152,135	\$359,242		
GMSW20A Dust Source Survey	\$733,672	\$714,406	\$1,931	\$716,337	\$17,335	Project complete	
GMSW20A Dust Source Survey - OR DM	\$35,587	\$37,537	\$1,931	\$39,468	(\$3,881)		
GMSW20A Dust Source Survey - OR Imp	\$698,085	\$676,869		\$676,869	\$21,216		
GMSW21A WLL Dust CtrlTrial	\$3,361,598	\$2,981,473	\$1,931	\$2,983,404	\$378,194	Efficiencies found during project implementation	
GMSW21A WLL Dust CtrlTrial - OR DM	\$140,246	\$121,871	\$1,931	\$123,802	\$16,444		
GMSW21A WLL Dust CtrlTrial - OR Imp	\$3,221,352	\$2,859,602		\$2,859,602	\$361,750		
GMSW22A WLL Debris Removal - ONR	\$5,470,099	\$3,694,203	\$1,687,502	\$5,381,704	\$88,395	Efficiencies found during project implementation	
GMSW22A WLL Debris Removal - ONR DM	\$75,919	\$101,680	\$24,502	\$126,181	(\$50,262)		
GMSW22A WLL Debris Removal - ONR Imp	\$5,394,180	\$3,592,523	\$1,663,000	\$5,255,523	\$138,657		
GMSW22A WLL Debris Removal - OR	\$5,470,099	\$3,690,736	\$1,687,502	\$5,378,238	\$91,861	Efficiencies found during project implementation	
GMSW22A WLL Debris Removal - OR DM	\$75,919	\$100,504	\$24,502	\$125,006	(\$49,087)		
GMSW22A WLL Debris Removal - OR Imp	\$5,394,180	\$3,590,232	\$1,663,000	\$5,253,232	\$140,948		
GMSW23A Erosion Ctrl Trial	\$0	\$106	\$0	\$106	(\$106)	Project not yet approved	
GMSW23A Erosion Ctrl Trial - OR DM	\$0	\$106	\$0	\$106	(\$106)		
GMSW23A Erosion Ctrl Trial - OR Imp	\$0		\$0	\$0	(\$0)		
GMSW24A WLL Boat Access	\$891,306	\$212,865	\$1,931	\$214,796	\$676,510	Project complete	
GMSW24A WLL Boat Access - OR DM	\$427,592	\$42,110	\$1,931	\$44,041	\$383,551		
GMSW24A WLL Boat Access - OR Imp	\$463,714	\$170,755	\$0	\$170,755	\$292,959		
GMSW25A WLL Bathymetric Ma - OR	\$1,379,386	\$1,379,386	\$0	\$1,379,386	(\$0)	Project complete	
GMSW25A WLL Bathymetric Ma - OR DM	\$50,979	\$50,979	\$0	\$50,979	(\$0)		
GMSW25A WLL Bathymetric Ma - OR Imp	\$1,328,407	\$1,328,407	\$0	\$1,328,407	(\$0)		
GMSW26A WLL Comm Safety	\$1,610,081	\$922,226	\$96,272	\$1,018,498	\$591,583	Forecast is currently being reviewed against the remaining scope of the project	TOR submission
GMSW26A WLL Comm Safety - OR DM	\$425,173	\$126,419	\$5,072	\$131,490	\$293,683		
GMSW26A WLL Comm Safety-OR Imp	\$1,184,908	\$795,808	\$91,200	\$887,008	\$297,900		
GMSW27A WLL Finlay River A	\$82,146	\$73,699	\$0	\$73,699	\$8,447	Project complete	
GMSW27A WLL Finlay River A - OR DM	\$21,284	\$12,198	\$0	\$12,198	\$9,086		
GMSW27A WLL Finlay River A - OR Imp	\$60,862	\$61,501	\$0	\$61,501	(\$639)		

* Red values in parentheses denote overage.

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
GMSW28A Industry Feasibili	\$1,594,520	\$1,103,671	\$0	\$1,103,671	\$490,849	Efficiencies found during project implementation	
GMSW28A Industry Feasibili - OR DM	\$114,520	\$147,208	\$0	\$147,208	(\$32,688)		
GMSW28A Industry Feasibili - OR Imp	\$1,480,000	\$956,463	\$0	\$956,463	\$523,537		
GMSW31A Kwadacha	\$354,136	\$133,668	\$41,335	\$175,002	\$179,134		
GMSW31A Kwadacha - ONR DM	\$165,469	\$10,963	\$1,759	\$12,721	\$152,748		
GMSW31A Kwadacha - ONR Imp	\$188,667	\$122,705	\$39,576	\$162,281	\$26,386		
GMSW33A BRD Ingenika	\$0	\$63,477	\$540,000	\$603,477	(\$603,477)	Project deferred. Costs associated with design prior to decision.	
GMSW33A BRD Ingenika - ONR DM	\$0	\$5,479	\$0	\$5,479	(\$5,479)		
GMSW33A BRD Ingenika - ONR Imp	\$0	\$57,998	\$540,000	\$597,998	(\$597,998)		
GMSW34A BRD Finlay Bay	\$0	\$62,736	\$0	\$62,736	(\$62,736)	Project deferred. Costs associated with design prior to decision.	
GMSW34A BRD Finlay Bay - ONR DM	\$0	\$5,854	\$0	\$5,854	(\$5,854)		
GMSW34A BRD Finlay Bay - ONR Imp	\$0	\$56,882	\$0	\$56,882	(\$56,882)		
GMSW35A BRD Six Mile Bay	\$0	\$55,535		\$55,535	(\$55,535)	Project deferred. Costs associated with design prior to decision.	
GMSW35A BRD Six Mile Bay - ONR DM	\$0	\$4,666		\$4,666	(\$4,666)		
GMSW35A BRD Six Mile Bay - ONR Imp	\$0	\$50,869		\$50,869	(\$50,869)		
GMSW36A BRD Cut Thumb Bay	\$0	\$59,186		\$59,186	(\$59,186)	Project deferred. Costs associated with design prior to decision.	
GMSW36A BRD Cut Thumb Bay - ONR DM	\$0	\$6,193		\$6,193	(\$6,193)		
GMSW36A BRD Cut Thumb Bay - ONR Imp	\$0	\$52,993		\$52,993	(\$52,993)		
GMSW37A BRD Mackenzie Landing	\$743,878	\$532,188	\$979	\$533,167	\$210,711	Project complete.	
GMSW37A BRD Mackenzie Landing - ONR DM	\$24,396	\$15,766	\$979	\$16,745	\$7,651		
GMSW37A BRD Mackenzie Landing - ONR Imp	\$719,482	\$516,422		\$516,422	\$203,060		
GMSW43A BRC Ingenika	\$0	\$113		\$113	(\$113)	Project deferred. Costs associated with design prior to decision.	
GMSW43A BRC Ingenika - ONR DM	\$0	\$113	\$0	\$113	(\$113)		
GMSW43A BRC Ingenika - ONR Imp	\$0		\$0	\$0			
GMSW44A BRC Finlay Bay	\$0	\$113	\$0	\$113	(\$113)	Project deferred. Costs associated with design prior to decision.	
GMSW44A BRC Finlay Bay - ONR DM	\$0	\$113	\$0	\$113	(\$113)		
GMSW44A BRC Finlay Bay - ONR Imp	\$0		\$0	\$0	(\$0)		
GMSW45A BRC Six Mile Bay	\$0		\$0	\$0	(\$0)	Project deferred.	
GMSW45A BRC Six Mile Bay - ONR DM	\$0		\$0	\$0	(\$0)		
GMSW45A BRC Six Mile Bay - ONR Imp	\$0		\$0	\$0	(\$0)		
GMSW46A BRC Cut Thumb Bay	\$0	\$113	\$0	\$113	(\$113)	Project deferred. Costs associated with design prior to decision.	
GMSW46A BRC Cut Thumb Bay - ONR DM	\$0	\$113	\$0	\$113	(\$113)		
GMSW46A BRC Cut Thumb Bay - ONR Imp	\$0		\$0	\$0	(\$0)		
GMSW47A BRC Mackenzie Landing	\$4,242,756	\$2,563,855	\$979	\$2,564,834	\$1,677,922	Project complete. TOR included costs for in-water construction, which was not required.	
GMSW47A BRC Mackenzie Landing - ONR DM	\$55,854	\$46,174	\$979	\$47,153	\$8,701		
GMSW47A BRC Mackenzie Landing - ONR Imp	\$4,186,902	\$2,517,681	\$0	\$2,517,681	\$1,669,221		
GMSW49A BRC Dunlevy	\$5,065,450	\$4,576,946	\$971	\$4,577,917	\$487,533		
GMSW49A BRC Dunlevy - ONR DM	\$15,000	\$15,546	\$971	\$16,516	(\$1,516)		
GMSW49A BRC Dunlevy - ONR Imp	\$5,050,450	\$4,561,401	\$0	\$4,561,401	\$489,049		
GMSW54A BRD Dunlevy	\$1,247,610	\$903,425	\$0	\$903,425	\$344,185	Project complete.	
GMSW54A BRD Dunlevy - ONR DM	\$46,765	\$29,283	\$0	\$29,283	\$17,482		
GMSW54A BRD Dunlevy - ONR Imp	\$1,200,845	\$874,143	\$0	\$874,143	\$326,702		
GMSW57A Dunlevy Maintenance	\$194,971	\$121,883	\$55,167	\$177,050	\$17,921	Forecast does not include a contingency for structural maintenance	TOR submission
GMSW57A Dunlevy Maintenance - ONR DM	\$13,000	\$11,674	\$5,167	\$16,841	(\$3,841)		
GMSW57A Dunlevy Maintenance - ONR Imp	\$181,971	\$110,209	\$50,000	\$160,209	\$21,762		
GMSW58A Mackenzie Maintenance	\$150,000	\$21,123	\$82,673	\$103,796	\$46,204	Forecast does not include a contingency for structural maintenance	TOR submission
GMSW58A Mackenzie Maintenance - ONR DM	\$0	\$10,755	\$12,673	\$23,428	(\$23,428)		
GMSW58A Mackenzie Maintenance - ONR Imp	\$150,000	\$10,368	\$70,000	\$80,368	\$69,632		
GMSW59A Ingenika Maintenance	\$0		\$0	\$0	(\$0)	Project not yet approved	
GMSW59A Ingenika Maintenance - ONR DM	\$0		\$0	\$0	(\$0)		
GMSW59A Ingenika Maintenance - ONR Imp	\$0		\$0	\$0	(\$0)		
GMSW60A Finlay Maintenance	\$0		\$0	\$0	(\$0)	Project not yet approved	
GMSW60A Finlay Maintenance - ONR DM	\$0		\$0	\$0	(\$0)		
GMSW60A Finlay Maintenance - ONR Imp	\$0		\$0	\$0	(\$0)		
GMSW61A 6 Mile Maintenance	\$0		\$0	\$0	(\$0)	Project not yet approved	
GMSW61A 6 Mile Maintenance - ONR DM	\$0		\$0	\$0			
GMSW61A 6 Mile Maintenance - ONR Imp	\$0		\$0	\$0	(\$0)		
GMSW62A CutThumb Maintenance	\$0		\$0	\$0	(\$0)	Project not yet approved	
GMSW62A CutThumb Maintenance - ONR DM	\$0		\$0	\$0	(\$0)		
GMSW62A CutThumb Maintenance - ONR Imp	\$0		\$0	\$0	(\$0)		

OR - Ordered Remissible
ONR - Ordered Non-Remissible

* Red values in parentheses denote overage.