Peace Project Water Use Plan

WILLISTON TARGETED DEBRIS MANAGEMENT

Implementation Year 11

Reference: GMSWORKS-22

Study Period: 2019

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GMSWORKS#22 – Final Report

2019

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GMSWORKS#22 – Final Report: 2019

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Chu Cho Environmental has prepared this report using sound technical and professional judgment based on our extensive expertise and experience in developing and conducting works of this nature. We have identified and developed this report in order to provide clear and concise information regarding the debris management works completed during the 2019 season.

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1 Introduction

This report documents the annual operations of the GMSWORKS#22 debris management program. This report provides detail on the scope of work completed during the spring, summer and fall months including the methodologies, timing and cost of the work. Specifically, this report identifies the equipment used, work locations, the total volume of debris managed and the cost per cubic meter to complete the management. This report will also provide descriptions of the archaeological and environmental work that was completed during each stage of operations. GMSWORKS#22 is managed and implemented by Chu Cho Industries LP with environmental services being provided by Chu Cho Environmental LLP.

1.1 Overview of Activities

In general, debris management activities included:

- Accessing numerous beaches via truck, crew boat and barge,
- Removing debris from the shores of these beaches using a rock truck, excavator and bulldozer,
- Piling the debris at the high-water mark for removal or burning,
- Communication with local stakeholders regarding the extent to which they require/desire debris management in their high use areas,
- Managing amphibians that would be potentially disturbed by moving the debris,
- Managing other environmental issues,
- Managing archaeological and other heritage concerns, and;
- Conducting spill prevention and response measures.

1.2 Summary of Measurements

The following Table 1 provides a summary of parameters that describe the program in 2019:

Table 1: Key Parameters Describing 2019 Program

Number of Beaches	Total Volume Piled	Total Number of Piles	Avg. Cost per Pile	Avg. Cost per Cubic Meter
5	78,382.48 m^3	264	$2,674.28	$9.01

1.3 Before and After Debris Management Pictures

The following series of images show several beaches before and after debris management.

Figure 1: Corless / Tear Creek Beach prior to debris management.

Figure 2: Corless / Tear Creek Beach during debris management.

Figure 3: Corless plug before debris management.

Figure 4: Corless Plug during debris management.

Figure 5: Debris piles on Corless Beach.

Figure 6: Stromquist before debris management.

Figure 7: Stromquist after debris management.

Figure 8: Middle Creek North / Horn Creek before debris management.

Figure 9: Middle Creek North / Horn Creek after debris management.

2 Work Locations and Volume of Debris Managed

In 2019, all work was completed in the Finlay Arm of the Williston Reservoir. Debris removal occurred along 5 beaches in this zone, with work focused on piling the debris above the high-water mark. Chu Cho Industries LP (CCI) developed an Operational Work Plan (OWP) that was revised throughout the season in response to changing water levels and beach accessibility. The OWP describes the order in which beaches are to be managed and the equipment that will be used. The OWP also outlines the environmental and archaeological issues that must be managed at each location.

2.1 Work Locations

The following table details the 5 locations where CCI conducted debris management activities in 2019. The beach names provided in Table 2 are the most commonly used colloquial names.

Table 2: GMSWORKS#22 Work Locations 2019

Location	Equipment Used	Days on Site	Notes:
Corless Plug / Tear Creek	2 Excavators, 1 Rock Trucks (Volvo A20), 1 Cat DH6 Dozer, Crew Boat, ATV, Boom Logs, and Barge / Tugboat.	36 Days	New cut blocks provided access to this previously inaccessible area. The debris plug in this area is so severe that the creeks are not at all visible.
Stromquist to Mica Creek	2 Excavators, 1 Rock Truck (Cat 730C), 1 Cat DH6 Dozer, Crew Boat, ATV, and Barge / Tugboat.	11 Days	Completed Sections: North (64km), Middle (62km) and South (57km)
Factor Ross South to Stromquist Point	2 Excavators, 1 Cat DH6 Dozer, Crew Boat, ATV, and Barge / Tugboat.	5 Days	Debris was moved off the shore away from the steep banks.
Middle Creek North	2 Excavators, 1 Rock Truck (Cat 730C), 1 Cat DH6 Dozer, Crew Boat, ATV, and Barge / Tugboat.	14 Days	This was not previously accessible but is with lower water and new cut blocks that provide easier access.
Horn Creek North	2 Excavators, 1 Rock Truck (Cat 730C), 1 Cat DH6 Dozer, Crew Boat, ATV, and Barge / Tugboat.	8 Days	Wood was stacked and removed from the beach to avoid being re-rafted during fall pools.

The following series of images shows an overview of work locations for typical beaches within the Finlay Arm of the reservoir. Figure 10 shows an excavator and rock truck piling debris on Corless Beach. Figure 11 shows two excavators and a dozer piling debris on Stromquist Beach.

Figure 10: Debris piling by excavator and rock truck on Corless Beach.

Figure 11: Stromquist Beach during debris management.

2.2 Volume of Debris Managed

The debris tends to accumulate along the shoreline of the reservoir. Debris is piled using excavators fitted with a rotating grabber or a bucket and a thumb. The rotating grabber can circle through 360 degrees and can open and shut to grab and move debris, the bucket and thumb are similar but cannot rotate through 360 degrees. Once the excavators create a sufficiently large pile, a D6 Cat fitted with a rake blade pushes the stray debris towards the center of the pile to pack it tight in order that it burns with greater intensity. This process is simple, proven efficient and was replicated along the shoreline.

After the management of each beach was complete, two technicians visited the beach in order to count and measure the debris piles. The technicians independently counted and measured the piles in order to minimize bias and ensure that the numbers are accurate.

Debris piles are inherently misshapen, porous, and dissimilar. Our team consulted a number of industry professionals as well as primary research sources in search for the best methodology for measuring debris piles and calculating an accurate assessment of the volume of debris contained within. Typically, the technician measuring the debris would envision the pile as a geometric shape to calculate the volume and then use a porosity factor to estimate the actual volume. The shape of the debris varies greatly, depending on the size and homogeneity of the debris. Porosity is a disputed factor amongst professionals who regularly measure debris pile volumes. Porosity factors that practitioners commonly used in debris pile volume estimation ranged from 20% to 39%.

For this project, we have reasoned that estimating the debris piles as rectangular prisms is sufficiently accurate. In order to estimate porosity, we have chosen 30%, which is a rough average of the most commonly used numbers. This is consistent with the recommendations provided by the independent contractor that BC Hydro hired for the project in 2016 (P.Comm J. Kostyshyn, 2017). A technician would measure the Length, width and height dimensions of 5 piles on a given beach. The total volume would be calculated ($V = L \bullet W \bullet H$). Then the average of the five volumes would be calculated ($V_1 + V_2 + V_3 + V_4 + V_5 / 5) = V_{AVG}$. Then V_{AVG} would be multiplied by 70% or (100% - 30%). $V_{AVG} * 0.7 = V_{FINAL}$.

In 2019, CCI created 264 piles of debris on the beaches of the Finlay Arm of the Williston Reservoir. Piles ranged in size from 100 m^3 to 600 m^3, the average being approximately 255 m^3. Larger piles were created on flatter wider beaches where conditions allowed the equipment operators to efficiently pile the debris. Smaller piles were created in areas where there was little beach to work with and where the high-water mark was a concern. In general, larger piles are burned more efficiently.

The following table provides the number of piles and volume of debris collected on each beach in 2019:

Table 3: Volume of Debris Managed in 2019

Location	Number of Piles	Volume of Debris (m^3)	Notes:
Corless Plug / Tear Creek	30	21,315	
Factor Ross to Stromquist to Mica Creek	169	50,730	Stromquist Beaches combined
Middle Creek North and Horn Creek North	65	6,338	Middle Creek and Horn Creek combined
TOTALS	264	78,382	-

2.3 Estimated Costs

Table 4 provides an estimate of the average cost per beach to manage the debris. The costs are highly variable across beaches and depend on the size of the beach, the density of the debris, the access and the precariousness of the operations (i.e. how close to water, how steep the beach gradient, etc.). The costs presented in the following table were derived using the value on each invoice and the debris pile counts conducted by CCI. The average cost per pile was $2,674.28 and the average cost per cubic meter was $9.01. Compare these values to 2018 where the average cost per pile was $1,649.85 and the average cost per cubic meter was $12.14. The cost per cubic meter was higher in 2018 because 10 beaches were completed resulting in more frequent equipment movement. In 2019, 4 beaches were completed, and several beaches did not require equipment movement as they worked down the beach into new beaches, for example, the Stromquist complex of beaches.

Table 4: Debris management cost estimate per beach in 2019.

Location	Total Cost/Beach	Cost/Debris Pile	Cost/Cubic Meter
Corless / Tear Creek	$388,922.49	$21,315.08	$18.25
Factor Ross to Stromquist to Mica	$156,792.63	$150,730.00	$3.09
Middle Creek and Horn Creek North	$160,295.33	$2,466.08	$25.29
Total/Average	$706,010.45	$2,674.28	$9.01

3 Environmental Management

3.1 Environmental Issues

Chu Cho Environmental provided environmental monitoring services for GMSWORKS#22. The Environmental Management Plan specifies procedures for ensuring that potential environmental issues that might arise due to debris program operations are minimized. This includes standard items such as spill prevention and management and a detailed procedure for amphibian management.

The amphibian management plan is based on avoidance through surveying and flagging no work zones. The avoidance-based plan is meant to reduce the potential harm to amphibians and to avoid all handling. Prior to conducting debris removal, each beach is surveyed for amphibians and reptiles. On a typical beach there may be 5 – 10 zones where amphibians are either found or where there is good amphibian habitat. There were amphibians found many beaches in 2019 but due to the continued dry conditions continuing from 2018, their prevalence was reduced relative to 2017. Where they are found, a 30 m no work zone is flagged in order to protect the amphibians and or reptiles. In addition to amphibians, other reptiles and wildlife are observed regularly. These include, garter snakes, grizzly bears, black bears, moose, elk, wolves and other small carnivores. Figure 12 shows an example of a zone flagged for no-work where an amphibian was discovered.

Figure 12: Pink flagging indicates discovery of an amphibian and marks a no-work zone.

3.2 Spill Prevention and Management

Spill prevention and management is an ongoing process that CCI takes seriously and goes to great lengths to ensure that there are zero spills to ground. Good spill prevention management is rooted in good equipment management through maintenance and regular checks. All equipment is inspected before, during and after each shift to ensure that hydraulic lines and other potential leak points are all secure. The vehicle inspections are completed using a standard form, which is stored in the field office for the program. Regular maintenance occurs before during and after each crew shift. The following sequence of images shows some examples of good spill prevention management. During the 2019 season, there were no major fluid spills and 5 small non-reportable spills to ground that were cleaned up by CCI. There were no spills to watercourses or the reservoir. Figure 13 and Figure 14 show the fuel bowser located along the shore away from the reservoir an outfitted with a large spill kit for use while refueling as well as repairs. Figure 15 shows the spill kits being used during field-based repairs of the equipment.

Figure 13: Fuel bowser with large spill kit.

Figure 14: Refueling away from water with a spill kit next to refueling.

Figure 15: Managing and replacing leaking hoses with spill kit and tray.

4 Archaeological Management and Chance Finds

4.1 Archaeological Procedures

The archaeological monitor uses a GPS loaded with archaeological site data that were supplied by Millennia Archaeology. The GPS helps the monitor identify areas that are marked as no work zones as well as areas where artifact collection has occurred or where artifacts have been identified but not collected. Figure 16 shows a previously recorded but not collected artifact on Stromquist Beach. This artifact was discovered using the GPS and was flagged so that crews would not work in this area.

Prior to commencing work on any beach, the archaeological monitor has a quick debrief with the management crews to help identify no work zones or areas of potential concern. The archaeological monitoring works ahead of the debris crews to conduct searching and investigation activities to clear the area for work. The debris management work is conducted under the archaeological site alteration permit SAP 2016-0363 that was approved on October 31, 2016 and is valid to December 31, 2021.

Figure 16: Previously marked but uncollected artifact on Stromquist Beach.

5 Debris Pile Burning

Debris pile burning was not completed during the winter of 2018/2019. Due to drier conditions, debris piles are piled high on the beach above flooding levels and not burned.

In the event of pile burning, each beach is assessed according to substrate type, road beach access, and nearby water sources, such as creeks and reservoir. At each beach, creeks close to piles were identified as a water source for fire suppression in the event the reservoir is low and further away from the piles above high water. Roads to beaches and along the beaches are located between piles and the adjacent forest to create a fire guard behind the piles.

6 Conclusions

The GMSWORKS#22 Debris Management Program piled 78,382.48 m^3 of debris in 264 piles at an average cost of $9.01 per cubic meter. Generally, the 2019 season was successful and CCI is well prepared to initiate the 2020 program in June 2020.

During the reconnaissance flight in May 2019 it was identified that there are still numerous areas where debris accumulations exist in both the Parsnip and Finlay arms of the reservoir. Table 5 is the edited and updated table from the Operational Work Plan 2019 as reconnaissance flight identified beaches with accumulated debris. The beaches not completed in 2019 will be reassessed in Spring 2020 for debris accumulation and management potential.

Table 5: Edited and updated Operational Work Plan table from Spring 2019 indicating beaches completed in 2019 as bold and italicised.

Beach Name	Location	Approx. workdays	Access	Priority Level
Pete Toy and Teare Creek Debris Plug areas	***41 - 45 km: Chunamon FSR***	***20+***	***Road***	***Highest***
Stromquist Point to Mica Creek	***65 - 55 km: Chunamon FSR***	***20+***	***Barge and Road***	***High***
Middle Creek North	***65 km: Davis FSR***	***10+***	***Road and Barge***	***High***
Horn Creek North	***65 - 70 km: Davis FSR***	***10+***	***Road and Barge***	***High***
Factor Ross South to Stromquist Point	***65 - 80 km: Chunamon FSR.***	***10 – 15***	***Barge and road***	***Medium / High***
West Side South of Billy's Bay	90 km: Chunamon FSR	5	Barge and Road	Medium / High
Frank Creek South	85 km: Chunamon FSR	3 – 5	Barge and Road	Medium / High
Davis south	42 km: Davis FSR	5	Road	Medium
North Corless to Pete Toy Area	45 - 54 km: Chunamon FSR	10	Barge	Medium
Police Meadows Zone	80 km: Davis FSR	5 - 10	Barge	Medium
Bruin Beach	32 km: Davis FSR	-	Road	Low
Shovel	53 km: Davis FSR	-	Barge	Low
Middle Creek South	65 km: Davis FSR	2	Barge	Low
Chowika South	70 km: Davis FSR	3	Barge	Low
Chowika North	75 km: Davis FSR	2	Barge and road	Low