

Peace River Water Use Plan

Monitoring Program Terms of Reference

- **GMSMON-16 Williston Debris Trends**

**Schedule A 6(g) of the Peace Order
(Water Act, section 88, File No. 76975-35/Peace)**

November 14, 2008

Terms of Reference for the Peace River Water Use Plan Monitoring Program: Williston Debris Trends

1.0 Monitoring Rationale

1.1 Background

Reservoir operations result in a cycle of deposition and floatation of woody debris. Annually, the reservoir reaches its maximum elevation around the end of August and its minimum elevation around the end of April. The annual drawdown of the reservoir is about 12 metres. As water levels recede during the drawdown in the autumn, floating woody debris is deposited along the shoreline. During recharge in the spring and summer, stranded debris will again float as the water rises above the elevation at which the debris is situated. In cases of unusually high pool, debris may be deposited at the higher reservoir elevations and will remain stranded on the shoreline of the lake for years until the water reaches that elevation again. At full or high pool, the floating debris is transient on the reservoir depending upon prevailing winds. The wind driven debris will often gather in large rafts as it accumulates at reservoir extremities and or embayments such as Ospika Arm. Prevailing winds will often cause accumulation of debris at the north end of the Finlay near Tsay Keh village or at the eastern end of the Peace Arm at Geddes Bay near the WAC Bennett Dam. However, it is just as likely that the wind will blow the rafts elsewhere causing an even distribution of debris along the shoreline of the reservoir, plugging tributaries, or become locked in residual wetlands.

The current standing stock of debris in the reservoir is significant yet little information is available about volume and the relative contributions of different sources of debris into the reservoir. The sources of debris to the reservoir are assumed to be:

- timber not cleared from area prior to flooding
- recruitment from the foreshore due to erosion and blow down
- recruitment from tributaries during the spring freshet
- recruitment from industrial operations such as log booms

The Peace Water Use Plan Committee (hereafter known as the Committee) recommended a package that included operating constraints and non-operating programs for the Peace system. Three non-operating programs recommended by the Committee are directly related to debris. This ToR is for the Williston (WLL) Debris Trends monitoring program for Williston Reservoir. The purpose of the WLL Debris Trends monitoring program is to assess the (i) volume of debris and recruitment into the reservoir over time and (ii) effectiveness of the WLL Targeted Debris Management project. The WLL Targeted Debris Management project will manage debris in the reservoir over a 10-year period to address navigational hazards and minimize damage to Water Use Plan trial sites. The WLL Debris Field Survey has similar objectives to WLL Debris Trends but collects data in the first year providing the baseline information.

1.2 First Nations Involvement in ToR Development

Pursuant to contractual commitments between BC Hydro and Tsay Keh Dene First Nation (TKD), this ToR was developed through a joint planning process between BC Hydro and TKD. The ToR underwent an initial joint review by BC Hydro and TKD. An external review process followed which provided First Nations and government agencies (i.e., Fisheries and Oceans Canada, Ministry of Forests, and Ministry of Environment) with an opportunity to comment on this document.

1.3 Management Questions

The key management questions 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?

1.4 Detailed Hypotheses about the Ecological Impacts

No specific hypothesis was recommended by the WUP Committee, however the primary hypothesis¹ being tested by this study is:

H₁: Total volume of debris in Williston Reservoir is decreasing over time;

This hypothesis addresses the first management question in Section 1.3. The remaining management questions will not be analyzed through hypothesis testing.

1.5 Key Water Use Decision Affected

Information from this monitoring program, in combination with other programs within the Williston Reservoir management plans will be used to inform future decisions on reservoir operating elevations. Any future decisions on limiting drawdown of the reservoir would have implications for reservoir fish, dust, wildlife, and power generation.

2.0 Monitoring Program Proposal

2.1 Objective and Scope

The objective of the monitoring program is to address the management questions identified in Section 1.3 and to collect the data necessary to draw inferences and to test the hypothesis outlined in Section 1.4. The monitoring program will focus on assessing the effectiveness of the WLL Targeted Debris Management project in reducing debris-related navigational hazards, minimizing debris-related destruction to WUP project sites, and decreasing overall volume of debris fields

¹ For clarity, the hypotheses are stated as the alternate hypotheses. Analyses will test the null hypotheses of no effect or difference.

The study area will encompass the Williston Reservoir including those areas selected as project/trial sites by other projects within the Peace Water Use Plan project. Monitoring will occur in Years 3, 5 and 10. Data collection, analyses, and reports will also be completed for each monitoring year. A final study report will be produced in Year 10 that summarizes the results of the entire monitoring program and the conclusions that can be drawn pertaining to the management questions and hypothesis.

2.2 Approach

The approach to this monitoring program includes:

- (i) a debris distribution and amount inventory of Williston Reservoir;
- (ii) a contribution analysis to determine the recruitment rate of debris into Williston Reservoir.

2.3 Methods

2.3.1 Task 1: Project Coordination

Project coordination will involve the general administrative and technical oversight of the monitoring program. This task will include but not be limited to: 1) budget management, 2) study team management, 3) logistic coordination, 4) technical oversight of field and analysis components, and 5) facilitation of data transfer among other investigators associated with the Williston Tributary Access, Riparian Wetland Habitat Enhancement, Erosion Control, Dust Control, as well as Access, Navigation & Safety management plans.

In particular, coordination with the Erosion Control, Wetlands Habitat, Dust Control and Tributary Habitat monitoring programs will be necessary to determine location of trial and project sites. Aerial photos and digital elevation model (DEM) will be available through BC Hydro or by contacting the project coordinator for the Williston Reservoir Aerial Photos and DEM implementation project.

Cost efficiencies will be sought out among the various monitoring components of this program and other programs in the Williston Reservoir management plans to reduce project costs of working in this remote location.

2.3.2 Task 2: Debris Survey

A debris field survey will be conducted to estimate the (i) debris volume, (ii) sources of recruitment, (iii) rate of recruitment to the reservoir from each of the sources, and (iii) potential wood value categories of the debris. The objectives of the debris field survey are to:

- 1) carry out a debris distribution and amount inventory by estimating standing stock of existing debris in terms of:
 - a) quantity/volume and location of existing debris

- b) quality or potential value of existing debris
- 2) carry out a contribution analysis that determines the recruitment rate of debris from:
 - a) shoreline erosion
 - b) blowdown of trees
 - c) in-flow from tributaries
 - d) industrial activities such as logging operations including log boom losses
 - e) timber not cleared from area prior to flooding
 - f) other potential sources
 - 3) assess/quantify debris accumulations at WUP project sites and key navigational sites (e.g., around boat ramps)

One suggested methodology for completing these objectives is based on BC Hydro (1993) and Northwest Hydraulic Consultants Ltd. et al. (1992). This methodology is based on reviewing and analyzing existing data (e.g., published studies, maps, air photos, and expert judgement). Field visits will provide a useful supplement to this data. Alternative methods will be considered as these objectives may be met in a number of ways. Methodology should be consistent with the WLL Debris Field Survey conducted in Year 1 unless data suggests otherwise.

The survey will be conducted in Years 3, 5, and 10. Air photos will be taken in the spring (around May) in Years 1, 5, and 10 as part of the WLL Air Photo and DEM project.

2.3.3 Task 3: Data Entry and Analysis

The proponent will develop a Microsoft Access database to enter, check and store all data collected during the monitoring program. Data analysis will focus on determining changes over time in debris volume, distribution, and recruitment.

2.3.4 Task 4: Reporting

Project reporting will occur in each monitoring year with a final project report in Year 10 at the conclusion of the monitoring program. In each year, a comprehensive report will be prepared that collates all of the data and includes:

- a) An executive summary of the project;
- b) Re-iterates the objective and scope of the monitor;
- c) Presents the methods of data collection (including map of sites and photodocumentation);
- d) Describes the compiled data set and presents the results of all analyses;
- e) Discussion of the consequences of these results as they pertain to future debris management;
- f) Recommendations for future monitoring (if any) needed.

A report will be provided in hard-copy and as Microsoft Word and Adobe Acrobat (*.pdf) format. The required maps and figures will be included as embedded objects in

the report. All maps and figures will also be provided in their native format as separate files. Raw data will be submitted in a Microsoft Access database. All photos will be submitted electronically.

2.4 Interpretation of Monitoring Program Results

The results of the monitoring program will provide support in the decision-making process to determine the effectiveness of the WLL Targeted Debris Management implementation project in improving access and navigation around the reservoir, and minimizing damage to project/trial sites. If debris trends indicate that debris volume has not declined over the 10-year period, then this will suggest a need to assess the debris management strategy.

2.5 Schedule

Monitoring is scheduled to begin in Year 3 (expected to be 2011) and will be repeated in Year 5 and 10.

2.6 Budget

The estimated total cost for the monitoring program over the 10-year study period is \$168,704. Annual costs are inflated from 2003 dollars (as per the Peace WUP Committee Report). In accordance with BC Hydro's new Aviation Policy, the budget includes the additional cost (\$18,000) of using a dual engine helicopter over a single engine helicopter one day per year.

Table 16-1: Estimated costs for the Williston Debris Trends monitoring program.

Debris Monitoring		\$129,000
Inflation	2%	\$31,670
Contingency	5%	\$8,034
Total		\$168,704