

Peace River Water Use Plan

Monitoring Program Terms of Reference

- **GMSMON-14 Dinosaur Tributary Habitat**

July 30, 2008

Terms of Reference for the Peace River Water Use Plan Monitoring Program: Dinosaur Tributary Habitat

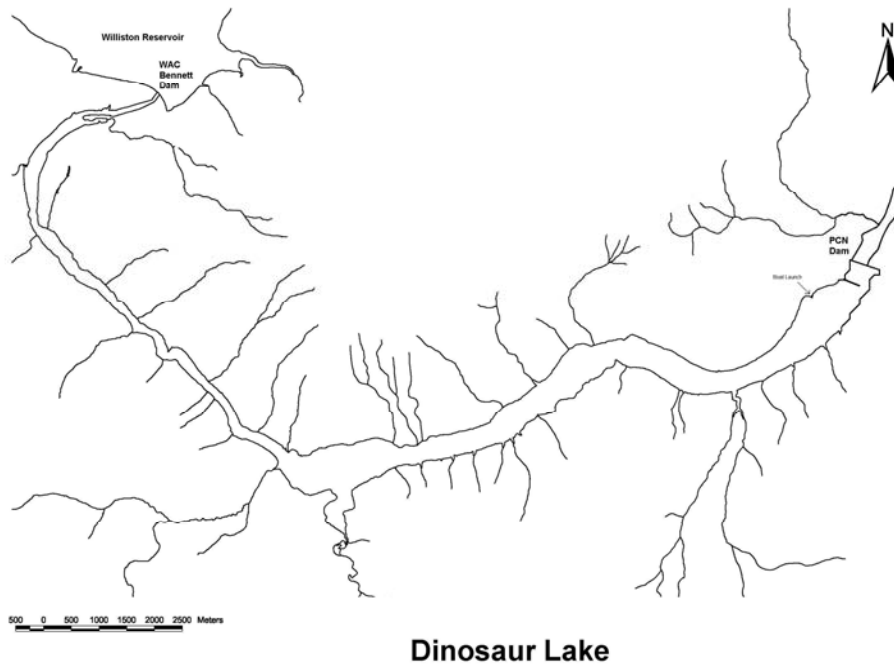
1.0 Monitoring Rationale

1.1 Background

The productive capacity of fish populations in Dinosaur Reservoir (Figure 14-1) is constrained by habitat conditions. Dinosaur Reservoir supports 22 known fish species including sportfish such as Arctic grayling, bull trout, rainbow trout, burbot, lake trout, lake whitefish, mountain whitefish, and kokanee (BC Hydro 2003). A number of habitat-related factors are limiting fish production. As a run-of-the-river reservoir, the resulting short water retention time (~three days) and steep topography of the reservoir limits the littoral zone (Pattenden and Ash 1993). In addition, a sparse amount of aquatic vegetation and structural diversity further reduces quality of fish rearing habitat. Where topography is less steep, such as in shallow bay areas, available habitat is of limited use due to dam operations which cause water levels to fluctuate by up to 2 metres. Within tributaries, quantity of habitat is limited by fish barriers such as waterfalls, and habitat quality is affected by debris flows and silt loads from upland areas. Consequently, rearing and spawning habitat in and around the reservoir is poor. These factors, as well as increased fishing pressure, have resulted in low sportfish recruitment in the reservoir (BC Hydro 2003). The greatest potential for improving fish productivity in the reservoir is believed to be through enhancement of tributaries (BC Hydro 2003). However, only two tributaries, Johnson Creek and Gething Creek, have been identified as significant spawning and rearing habitat for fish (Pattenden and Ash 1993).

The Peace Water Use Plan Committee (hereafter known as the Committee) recognized that access to tributaries and fish habitat quality within the tributaries is impacted by dam operations and debris from upstream logging. To address their concerns on tributary access for reservoir fish, the Committee developed the Dinosaur Tributary Enhancement management plan as a component of the Peace River WUP. Part of this plan includes a trial project to improve access and/or enhance fish habitat in selected tributaries. The purpose of the Dinosaur Tributary Habitat monitoring program is to assess whether the enhancement is successful in improving and maintaining fish access/habitat in these tributaries. Other tributaries may be selected for enhancement if Dinosaur Tributary Enhancement management plan proves to be effective over the next five years.

Figure 14-1: Map and location of Dinosaur Reservoir



1.2 Management Questions

The key management questions are:

- 1) Is the tributary enhancement work effective at increasing usable habitat?
- 2) Is the area and quality of fish habitat created by the tributary enhancement work sufficient to noticeably increase spawning and rearing opportunities in the reservoir?
- 3) Is the area and quality of fish habitat created by the tributary enhancement maintained over time?

This monitoring program will determine if the enhancement projects in Dinosaur Reservoir tributaries were effective in creating and maintaining usable fish habitat over the life of the project.

1.3 Detailed Hypotheses about the Ecological Impacts

The primary hypotheses to be tested are:

H₁: Total spawning/rearing area in the enhanced tributaries is not different from the pre-enhancement state;

H₂: Total area of fish habitat created by the enhancement does not change over time;

H₃: Fish abundance in the tributary does not change following enhancement.

The effectiveness of the tributary enhancement project will be based on the (i) amount of habitat created and (ii) enhancement area maintaining its function over time. In particular, testing of H₁ and H₂ will require a measure of m² gained. Changes in fish abundance will be tested on target species in H₃; however, any conclusions drawn will consider the limitation in project scope and experimental design (unsuitable control sites).

The wording of hypotheses may require adjustment depending on the exact nature of the enhancement project.

1.4 Key Water Use Decision Affected

Information from this monitoring program, in combination with other projects within the Dinosaur Tributary Enhancement management plan will be used to inform future decisions on reservoir operating elevations, and in particular limiting drawdown to optimize fish access to key tributaries. Any future decisions on limiting drawdown of the reservoir would have implications for fish 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 1.2 by collecting the data necessary to draw inferences and to test the hypotheses outlined in Section 1.3. Monitoring will include collection of at least one year of pre-enhancement data and up to four years of data from the enhanced tributary. Implementation of this study is conditional on the outcome of the Dinosaur Tributary Inventory and Feasibility project. If the Dinosaur Tributary Inventory and Feasibility project identifies that enhancement of tributaries is feasible then this monitoring program will proceed.

The study area will encompass those tributaries selected for enhancement as part of Dinosaur Tributary Inventory and Feasibility implementation project). Monitoring will occur every second year over the 10-year study period, beginning the same year as the enhancement work but prior to its start of work in the tributaries. Data collection, data analyses, and report will be completed for each study year and 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 hypotheses.

2.2 Approach

The approach is to conduct a habitat assessment on select tributaries of Dinosaur Reservoir to determine the effectiveness of enhancement activities. The habitat

assessment will estimate total area and quality of fish habitat, distribution and relative abundance of fish, as well as identify habitat conditions limiting fish production. The monitoring program will also recommend if any future mitigative actions are required.

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 Dinosaur Tributary Enhancement management plan.

In particular, coordination with the Dinosaur Tributary Inventory and Feasibility implementation project will be necessary to identify study locations as well as with the Dinosaur Demonstration Tributary project to determine the enhancement design and timing of construction and maintenance activities. The project coordinator will ensure that the first year of monitoring will be complete prior to any enhancement activities.

2.3.2 Task 2: Site Selection

Monitoring will occur in tributaries selected for enhancement by the Dinosaur Tributary Inventory and Feasibility implementation project. Existing information indicates that no suitable control sites will be available (Pattenden and Ash 1993).

2.3.3 Task 3: Habitat Assessment

A habitat assessment will be conducted in each tributary to estimate total area and quality of fish habitat (e.g., for spawning and rearing), as well as accessibility of the tributary for reservoir fish. Habitat conditions will be evaluated to identify factors (including accessibility to tributary) that are limiting fish production. Field methods and data requirements for the assessment are referenced to Fish Habitat Procedures (Johnston and Slaney 1996). A Level 1 Field Assessment will be conducted. The change in habitat area over time will be calculated based on the habitat assessment. Field data forms will be prepared in advance to capture all relevant information (please review the fish habitat assessment procedures [Johnston and Slaney 1996] for more information).

The habitat assessment will also include a survey of fish distribution and relative abundance. Study sites in the tributary will include enhancement sites and non-enhancement sites. Field methods and data requirements for this task are, again, referenced to Fish Habitat Procedures (Johnston and Slaney 1996). Captured fish will be enumerated, identified by species and have length (to the nearest 1 mm) and weight (to the nearest 1 g) measurements taken. Methods of surveying will be specific to site conditions and the enhancement (e.g., for spawning habitat enhancement, a spawner/redd count would be appropriate) but should be consistent for each location and among years. Sample size and location of sampling within the

study sites is at the discretion of the researcher and subject to the available budget; however, a clear rationale of these decisions will be provided. The following information will be collected to provide an indication of the reliability of the catch data:

- Date and time
- Crew
- Capture method and equipment specifications
- Effort

Information on the sampling protocol will be analyzed and/or stored for future reference.

The habitat assessment is recommended to occur mid-summer; however, the type of enhancement project to be implemented on the tributary may dictate a more suitable time; the timing should nonetheless be consistent among years. A map of the area will be prepared to summarize key information including the locations of access issues, sampling locations, and photopoints.

2.3.4 Task 4: 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 the ability of the enhancement project to maintain the enhanced area. Metrics such as total spawning area (e.g., m²) and total fry rearing area (m²) will be analyzed to determine if amount of habitat is changing over time. Additional metrics will describe relative abundance (fish/m² for each species for a given habitat type) and will be analyzed to determine change over time. The type of statistical analysis used to test for these trends will depend largely on the nature of the data, and can include simple non-parametric correlation tests as well as more complex time series analyses to determine changes over time. Standard life history summaries will also be provided; this will include length-frequency distribution and length-weight relationships. If possible, statistical analysis will be used to determine the likelihood that the enhancement caused the observed difference at the trial sites based on the pre-enhancement data

2.3.5 Task 5: Reporting

Project reporting will consist of a data report in each monitoring year with a single final report at the conclusion of the monitoring program. The data reports will document the methodology, findings of the year, and include a discussion on how the year's data compare with that collected in previous years. Included in this discussion will be the results of all pertinent hypothesis testing.

The final report will be compiled following the conclusion of the monitoring program that collates all of the data and includes:

- a) an executive summary of the project;
- b) field methods, including maps that indicate sampling locations, and photos;
- c) analytical methods used in assessing trends of habitat change or fish usage as well as any assumptions made;
- d) description of the results of field program including data in graphical and tabular form where appropriate;

- e) an assessment of the findings as they relate to the management question and hypotheses;
- f) any recommendations towards future monitoring (if any) and/or restoration projects .

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

Interpretation of monitoring results should place greater emphasis on the total area and quality of habitat created by the enhancement than on fish distribution and abundance. The natural variability of the fish populations restricts the low-intensity survey from providing sufficient data to draw strong conclusions on the distribution and level of fish usage that tributaries may experience. Instead conclusions on fish usage should be inferred by the area and quality of habitat observed. If significant improvements in fish habitat are observed, then this supports future maintenance of the enhanced sites and consideration of enhancement at other suitable sites.

2.5 Schedule

Monitoring is scheduled to begin in 2010 and will be repeated every other year during the 10-year study period. The first year of monitoring will be completed prior to the onset of physical works in order to acquire baseline data.

Monitoring program is conditional on the Dinosaur Tributary Inventory and Feasibility project finding suitable sites for enhancement.

2.6 Budget

The estimated total cost for the monitoring program over the 10-year study period is \$93,284. Table 14-1 summarizes the budget estimated in 2007 dollars.

Table 14-1: Estimated costs for the Dinosaur Tributary Habitat monitoring program.

Sub-total		\$77,250
Inflation	2%	\$11,592
Contingency	5%	\$4,442
Total		\$93,284

2.7 References

BC Hydro. 2003. Consultative committee report: Peace River water use plan. Prepared by the Peace River Water Use Plan Committee.

Johnston, N.T. and P.A. Slaney. 1996. Fish habitat assessment procedures. Watershed Restoration Technical Circular No. 8, revised April 1996. Watershed Restoration Program, Ministry of Environment, Lands and Parks and Ministry of Forests, Vancouver, B.C. 97 pp.

Pattenden, R. and G. Ash. 1993. Fisheries Enhancement Options for Dinosaur Lake, a Review. Peace/Williston Fish and Wildlife Compensation Program. PFWWCP Report No. 72. 38pp plus appendices.