Bridge-Seton Water Use Plan

Monitoring Program Terms of Reference

- BRGMON-11 Lower Bridge River Riparian Vegetation Monitoring
1 Monitoring Program Rationale

1.1 Background

The Bridge-Seton Consultative Committee (BRG CC) recommended that adaptive management flow trials be conducted to determine the most appropriate instream flow releases to protect and enhance the aquatic and riparian ecosystem in Lower Bridge River, downstream of Terzaghi Dam. The 10-year program was proposed to test alternative instream flow release regimes. Continuous instream flow releases for the purpose of testing the response of the aquatic ecosystem to flow changes were initiated with a water budget of 3 m$^3$/s on August 1, 2000. The flow was changed to 6 m$^3$/s May 1, 2011 once the Water Use Plan was approved and the Order was received on from the Comptroller of Water Rights. Detailed monitoring of physical aquatic habitat, aquatic productivity, and fish population response has been proposed and will be covered in separate proposals (Monitoring program BRGMON-1 and BRGMON-3).

Through discussion and development of the flow regimes, the BRG CC identified a concern that while the flow testing was focused on learning about the response of the aquatic ecosystem to instream flow management strategies the test program needed to explicitly evaluate the impacts of the flow regime on riparian habitat conditions. Since the temporal dynamics of the riparian plant community occur over much longer time scales than the aquatic community and with the planned duration of each flow trial extended it was recognized that an annual evaluation was not appropriate. The BRG CC then recommended that a monitoring program be implemented to document how the riparian community was affected by the flow trials and how the changes in flow regime (or treatment) impacted the riparian community in terms of the spatial extent, relative recruitment rate of plant species, and the overall relative productivity of the riparian community. The focus was on the growth of Black Cottonwoods, which are the dominant riparian vegetation along the Lower Bridge River.

1.2 Management Questions

The fundamental management questions addressed by the Lower Bridge River Riparian Vegetation Monitoring are:

1) What is the influence of instream flow regime on the spatial extent, species diversity, and relative productivity of the riparian community of the Lower Bridge River?

2) How will the changes in riparian community and instream flow conditions influence the capability of the Lower Bridge River corridor to support wildlife (riverine bird) populations?
Higher flows will limit colonization of marginal areas because inundation thresholds will be exceeded and it is expected that lower flow levels will increase the spatial extent of riparian vegetation. However, it is also believed that very low flows may limit riparian vegetation because of insufficient groundwater or hyporheic flow to support vegetation development or sustain high levels of productivity over the entire floodplain of the river.

The BRG CC agreed to provide flow treatments at the required decadal scale to observe response of species such as cottonwood, but there was also a need to develop some monitoring methods that could evaluate the short term response of plant species to flow changes. Examples of key short term response indicators were: sapling recruitment rate and growth rate (Hall et al. 2009). A second uncertainty was relating wildlife population response to the changes in riparian conditions. The BRG CC understood that the linkage between wildlife population productivity associated with riparian zones of rivers are neither well documented nor fully understood. They also recognized that there are a large number of species that differentially depend on riparian habitats of the Lower Bridge River corridor and it is not feasible to consider all possible populations. Thus it was recommended that observations of wildlife and wildlife habitat use be collected during the program with the focus on habitat use by Riverine Birds. These studies will be used to support a subjective assessment of the influence of the alternative flow levels on key wildlife populations.

1.3 Detailed Hypotheses about the Impacts of Instream Flow on Riparian Vegetation in Lower Bridge River

The explicit hypotheses to be tested from the results of the monitoring program relate both to the entire community as well as focusing on differential success of annual and perennial species. These hypotheses include:

- \( H_0 \): (null hypothesis) There is no relationship between the magnitude of instream flow release and riparian vegetation along the Lower Bridge River.

- \( H_1 \): The population increase of riverine birds in the Lower Bridge River corridor is directly related to the instream flow release from Terzaghi Dam.

- \( H_2 \): The species composition of the riparian vegetation community in the Lower Bridge River corridor is related to the instream flow release from Terzaghi Dam.

- \( H_3 \): The relative productivity (biomass) of the riparian vegetation in the Lower Bridge River corridor is related to the instream flow release from Terzaghi Dam.

- \( H_4 \): The abundance of annual plant species in the Lower Bridge River corridor is related to the instream flow release from Terzaghi Dam.

- \( H_5 \): The relative rate of recruitment of perennial plant species and especially woody plants in the Lower Bridge River corridor is directly related to the instream flow release from Terzaghi Dam.

- \( H_6 \): The rate of growth of perennial plant species in the Lower Bridge River corridor is directly related to the instream flow release from Terzaghi Dam.
1.4 Key Water Use Decision Affected

The key water use planning decision affected by this monitoring program will be establishment of a long term instream flow regime for the Lower Bridge River that considers the overall aquatic and riparian objectives for the area. The objective of the recommended program was to evaluate impacts of the flow trials on the riparian community and to use these data to help make predictions about the long term response of the plant community to each treatment level and to assess how these factors may impact wildlife (riverine bird) populations. Ultimately this information will contribute to the decision about the long term flow regime for the Lower Bridge River.

2 Monitoring Program Proposal

2.1 Objective

The objective of this monitoring program is to document the impacts of alternate flow regimes from Terzaghi Dam on the productivity of riparian vegetation and the population and usage response of Riverine Birds in the Lower Bridge River.

2.2 Approach

The proposed monitoring program will have four components:

1) Aerial photograph analysis at three separate intervals within the 10-year study to estimate the change in riparian communities that have resulted from the 6 m$^3$/s flow regime.

2) Repeated vegetation transect surveys at fixed locations will be completed at three separate intervals within the 10-year study.

3) Dendrochronological surveys will be completed at three separate intervals within the 10-year study to gather data needed to estimate changes in productivity of a key perennial species under each flow treatment level and across years.

4) Riverine bird surveys will be conducted annually for the first 3 years and then biannually until the end of the 10-year study to assess how riverine birds are responding to habitat changes resulting from the 6 m$^3$/s flow regime.

The sampling design will be treated as a repeated measures design for sampling changes in riparian community associated with each of the planned flow levels. A baseline survey was conducted in 2000 which provided random site selection and baseline information for the “no flow release treatment” from Terzaghi Dam. And further studies in 2007 examined cottonwood growth and recruitment post flow release.

2.3 Methods

The proposed monitoring program has the following primary tasks:
Task 1 Project Coordination

Project coordination involves the general administrative and technical oversight of the program. This will include but not be limited to: 1) budget management, 2) staff selection, 3) logistic coordination, 4) technical oversight in field and analysis components; and 5) liaison with regulatory and First Nations groups.

Task 2 Riparian Vegetation and Bird Mapping, Data Collection and Analysis

Aerial Photography

To assess the overall impacts of the 6 m³/s flow regime on riparian vegetation aerial photography will be used during Year 1, 5 and 9 of the study. Low level spatial geo-referenced color air photos will be used to develop GIS based maps of the riparian vegetation and to compute changes in the spatial extent and location of vegetation occurring after 10 years. This task will be completed concurrently with the proposed aerial photography for the Carpenter and Downton Reservoir vegetation monitoring programs to reduce additional costs for duplicate flights.

Transect Surveys

Transect surveys are proposed to 1) ground truth assessments of general changes in species composition occurring over the entire spatial area of the reservoir; 2) provide detailed geo-referenced topographic data of the transect, and 3) provide a detailed assessment of the changes in species composition and relative productivity of riparian habitats resulting from the implementation of the flow treatment. During the 2009 study, analyses were carried out on cottonwood trees along the Lower Bridge and Yalakom Rivers to allow for comparison between free flowing and controlled river systems. The following activities are proposed: 1) permanent benchmarking of transects to allow repeated vegetation surveys through time, 2) supplemental sampling at the transects to quantify relative riparian productivity (biomass sampling); 3) repeating vegetation surveys (including the biomass sampling) after approximately 10 years, 4) based on the data collected undertake a quantitative assessment of the changes in species composition and growth in relation to flow regime.

Dendrochronology

Previous cottonwood research on the Lower Bridge River will be used as background information and provide a basis for continuing the studies for the next 10 years. Dendrochronology will be used to evaluate the effects of the naturalized yet reduced flow regime on relative productivity (measured as growth rate). Standard tree coring techniques are applied to measure growth increment of the trees based on annuli (i.e., tree ring) width. It is proposed that upon completion of the flow trials approximately 120 cores or disks will be taken in Reach 2, 3 and 4 of Lower Bridge River as well as along the Yalakom River as a control). These growth increments will be measured in the laboratory and then analyzed in relation to the flow regime as the previous study did (Hall et al. 2009).

Riverine Bird Surveys

Riverine bird surveys will be conducted to assess how riverine birds are responding to habitat changes resulting from the 6 m³/s flow regime for riparian-dependent birds
such as Harlequin Ducks, American Dippers, Spotted Sandpipers, etc. After each survey, the number of individuals of each species and their locations will be totaled and recorded. All bird locations will be marked onto field maps and later plotted using a GIS program.

**Task 3 Reporting**

A detailed technical report will prepared prior to the review of the Water Use Plan that outlines the findings from the program as they relate to the primary components described above.

**2.4 Interpretation of Monitoring Program Results**

The data and information collected in the proposed monitoring programs would ultimately be used to assess the degree to which management objectives and technical expectations were met by the implementation of the operational change.

Upon completion of the program and synthesis of data a report will be prepared for use in the next review of the BRG Water Use Plan. This synthesis will include, but may not be limited to:

1) Quantitative assessment of the *long term changes* in spatial extent, species composition, and relative productivity of riparian vegetation in the Lower Bridge River corridor associated with the implementation of *all* of the flow trials.

2) Quantitative assessment of the *short term changes* in spatial extent, species composition, and relative productivity of riparian vegetation in the Lower Bridge River corridor associated with the *each one* of the implemented flow trials.

3) Quantitative assessment of the effect of instream flow regime on growth rate of key perennial species in the Lower Bridge River riparian corridor.

The results of the monitoring program can also be used to better support more inferences of the expected influence of instream flow regime on wildlife habitat conditions and permit more defensible conjecture about impacts of flow regime on abundance and diversity of wildlife populations.

**2.5 Schedule**

The schedule for the annual activities is necessarily phased to accommodate the requirements of the program. The Riparian Vegetation Monitoring work will be primarily conducted over three years. In Years 1, 5, and 9 specific activities are proposed to meet the goals of the program in relation to the timing of the flow trials. In the final year of the program immediately prior to the review of the Water Use Plan, aerial photography and baseline vegetation transect surveys will be repeated to allow a final assessment of observed changes in the riparian area in the Lower Bridge River corridor. Riverine Bird surveys will occur annually for the first three years and then on a biannual basis until the end of the 10 year study period. The schedule for the proposed program is provided below in Table 1.

**Table 1 Schedule**
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### 2.6 Budget

The total estimated cost of the Lower Bridge River Riparian Vegetation and Riverine Bird Monitoring Program for the 10-year period is $534,024.

### 3 References Cited