Peace Project Water Use Plan

Physical Works Terms of Reference

• GMSWORKS#21 – Williston Dust Control Trials

Addendum 1

March 27, 2009
A1 Addendum 1 to GMSWORKS #21 WLL Dust Control Trials

A1.1 Addendum Rationale

In 2008, BC Hydro completed year one of the Williston Dust Mitigation Program as part of which year one of the Dust Trials took place. The initial year of the Dust Trials project included assessment of four different dust mitigation methodologies through a tillage trial as well as feasibility studies and design of additional trials relating to irrigation, native vegetation, and wetlands (hereafter we refer to the wetland trials as “vegetation protections” to more accurately reflect the work). As noted in the TOR, work scope for 2009 and 2010 for the Dust Trials would be defined following completion of the Year 1 feasibility studies. Due to the continuing experimental nature of the project, we propose to provide the work scope and budget of the project for the 2009 season only and intend to finalize the work scope and budget for the trials in 2010 following the 2009 dust season.

This amendment describes the work scope and methodology for tillage, irrigation, native vegetation, and vegetation protection trials for the 2009 season as well as a revised budget for 2009.

A1.2 Revised Work plan for GMSWORKS #21 WLL Dust Control Trials

A.1.2.1 Tillage Trial

The tillage trials remain under the direction of Drs. Bill Schillinger, Bill Fryrear, and Bill Nickling. Several modifications have been made for the 2009 dust season:

- Tillage treatment trials will be carried out on Davis Flats Beach
- Tillage treatments will use the twisted chisel shovel tool (lister shovel discontinued)

A.1.2.2 Irrigation Trial

The overall objective of the irrigation trial is to test the feasibility of using an irrigation system to control wind erosion by keeping the beach wetted in front of Tsay Keh Dene village.

Methodology:

Irrigation System:

An irrigation system will be set up in the drawdown zone (i.e., the area between the water line of Williston Reservoir and the high pool elevation of the reservoir) at Tsay Keh Dene beach in the following manner:

- Install small wells at selected locations with portable pumps (axial flow pump, low head, and high discharge). Pumps will sit on an impervious base (i.e. plastic or similar platform) to eliminate the risk of the pump sinking into the sand and leakage of fuel on to the beach during operation.
- Pumped water will flow under gravity through aluminum or PVC pipes from higher to lower areas wetting the beach. The range of discharge (flow) rate for each pump will be approximately 0.001–0.005 m$^3$/s (or 1–5 L/s). Pumping rate will vary with the head (suction head) and pump efficiency.
- Water will be delivered to desired locations by pipes from the pump location.
- The pipes will either be gated or perforated to spread the water onto the beach area (see Figure 2 below as an example).

The irrigation system will keep approximately a 40-ha area wetted. All equipment will be removed prior to reservoir inundation of the beaches.
Effectiveness Monitoring: The following assessment procedures will be used to assess the efficacy of the irrigation system during the test during 2009 dust season.

1. Beach conditions will be photographed. The dryness (water content) of the beach’s surface (0 to 10 cm) will be measured by using a moisture probe. Only the top 10 cm is of interest as no windblown dust will occur if the top layer of soil is wetted.

2. Flow rate of a single outlet in a gated pipe will be measured by using a container and a stop watch. At least 5 measurements along a gated pipe will be made to get an average flow rate along the gated pipe.

3. Total area wetted by water supplied from a single outlet in a gated pipe within a given time period will be measured by using normal tape measurement and a stop watch.

4. Photographs will be taken recording the beach’s conditions (i.e. dust or no dust occurred at areas covered by surface irrigation) during any wind storm event. A control area will also be monitored for comparison purposes.

5. Visual observations will also be made to record the environmental conditions, particularly during a wind storm event.

The treatment method will be considered “effective” if the beach area under the surface irrigation is wetted (or moist) during the test and the windblown dust is reduced significantly or not generated at all (relative to untreated areas, area B) from the irrigated area during a wind storm event.

A.1.2.3 Native Vegetation Trial

The overall objective of the native vegetation trial is to assess the feasibility of re-establishing vegetation in the drawdown zone of Williston Reservoir as a strategy for dust control. The specific objectives for 2009 include:

1. Evaluation of vegetation (seeds planted in spring 2008) at Tsay Keh to get an approximate idea of the amount of winterkill during winter 2008/09;

2. Assess if native grasses can be established by seeding on a less-than-optimal growth medium;

3. Assess if goosegrass (i.e., a complex of four plant species: *Equisetum scirpoides*, *E. hyemale*, *E. arvense*, and *Hippuris vulagaris*) can be reintroduced to areas where it is currently absent without the use of greenhouse propagation.

Methodology:

(A) Assessment of Winterkill Trial:

Using the Daubenmire methodology, a detailed species by species assessment of ground cover production will occur in the study plots at Tsay Keh Beach in mid-August. Additionally, in each plot, the number of seeds of each species will be calculated using the best available extrapolation.

(B) New Grass Trial:

Native grass seeds will be divided into two mixtures, each containing five species and spread onto eight selected plots (plot size = 40 m²) at Davis North Beach. A seeding rate of 50 kg/ha and a fertilization application rate of 250 kg/ha will be used (expected total amount of fertilizer is 8 kg). After seeding & fertilization, each plot will be lightly raked with a garden rake to incorporate the seed & fertilizer into the soil. This trial must be established as early as possible in May to maximize the growing season. Plot corners will be demarcated by short stakes (preferable) or 12 inch spikes with forestry flagging ribbon attached. However, if the plot is inundated, these may be washed away; thus, GPS co-ordinates will also be taken.
Evaluation of the trial will consist of either counting the plants of each species or estimating ground cover production. Eight Daubenmire sub-plots per plot will be used in either case to provide an estimate success of the trial. This evaluation will occur just prior to inundation (i.e., sometime in June). If the plots are not inundated in 2009, a second evaluation will be undertaken in August. The following species are expected to be used in this trial:

- *Agropyron macrourum* – Macrourum’s wheatgrass
- *A. pauciflorum* – Slender wheatgrass
- *A. subsecundum* – Bearded wheatgrass
- *A. violaceum* – Violet wheatgrass
- *Festuca saximontana* – Rocky mountain fescue
- *Poa alpina* – Alpine bluegrass
- *P. glauca* – Glaucous bluegrass
- *P. palustris* – Fowl bluegrass
- *Agrostis scabra* – ticklegrass/ *Deschampsia caespitosa* – tufted hairgrass/ *Elymus glaucus* – blue wild rye

(C) Goosegrass Trial:

The study area for this trial will occur at either Davis North Beach or at Mile 8 on the Ingenika River. Soil will be removed from areas which have goosegrass rhizomes and deposited it in study sites which do not have any rhizomes. The volume of soil to be removed should be 1 m wide x 10 m long x 6-8” deep. The soil & rhizomes should then be placed at the trial location and hand raked to cover four plots (each plot: 5 m wide x 10 m long at an approximate depth of 1+ inches). Each of the plots should then be rototilled to incorporate the rhizomes into the existing soil. Plot corners will be demarcated and GPS co-ordinates recorded for both the plots where soil and rhizomes were added and the plots from where the soil was removed, as it is essential to see if goosegrass returns to areas from where the topsoil was removed.

The trial evaluation will occur at the latest possible time prior to inundation (i.e. sometime in June). The Daubenmire quadrat will be used to demarcate sixteen sub-plots within each plot. Total number of plants will be counted per sub-plot.

A.1.2.4 Vegetation Protection Trial

The objectives of this research plan are to:
- Investigate optimum nutrient conditions for biostimulating the growth of existing plants on the selected site;
- Develop recipes and composting process for debris to produce a nutrient-rich organic matter resource that can be used for the reclamation of the beaches;
- Test of different barriers for the protection of vegetation;
- Monitor the effectiveness of trials in enhancing plants’ growth, wetland restoration, and dust reduction.

The study site for this trial is Davis Flats beach in the Finlay Arm of the Williston Reservoir.

Methodology:

(A) Nutrient Trials:

Twenty plots, ¼-hectare each in size, will be set-up at the study site. Four nutrient regimes (0%, 25%, 50% and full strength application rates) of NPK nutrients will be investigated. Each nutrient regime will be replicated five times in a randomized block design. Each of the twenty plots will be subdivided into two 1/8-hectare sub-plots for sub-treatments with organic (compost) and synthetic fertilizers. The sub-treatments will receive equivalent amounts of NPK but the source of the NPK
(compost or synthetic fertilizer) will differ between the sub-plots. Following application of the NPK, the top 6 inches of the soil plots will be tilled and then compacted to prevent wind erosion.

**Effectiveness Monitoring:** Random samples will be collected from the study area to assess above ground biomass as well as soil content for nutrients, organic matter, temperature and other soil attributes.

**(B) Vegetation Protection Trials:**

Two one-hectare plots will be created to test the feasibility of using protection structures to protect revegetated upland beach areas from log debris scour. The first plot will have no protection, and it will serve as the control plot. The second plot will be protected by a double row of banded bundled debris logs anchored to the ground to prevent floatation upon reservoir inundation.

**Effectiveness Monitoring:** The amount of debris trapped on both sides of the vegetation protection system will be evaluated. Debris volume will be assessed at the site before water rises this year and then again in spring 2010 after water levels have dropped to assess the effectiveness of the protection structures. Erosion and scouring effects of debris will be qualitatively evaluated by taking soil samples to evaluate the accumulation of organic matter in the soil before inundation in both 2009 and 2010.

**(C) Composting Trials:**

The intent of this aspect of the project is to develop compost recipes and compost using Williston Reservoir debris, and test compost in the Olds College Campus greenhouse on native plants from Williston Reservoir beaches.

A compost recipe will be formulated and tested at an off-site location which will include:

1. Analyzing the debris feedstock from Williston Reservoir
2. Formulating compost recipes using Williston debris as primary feedstock and NPK fertilizer as amendment
3. Testing recipes in in-vessel composting system, which is used for biodegradability testing and composting process development
4. Developing a process protocol for composting the chipped debris

**Effectiveness monitoring:** The composting trial will be evaluated based on the quality of compost produced. Compost quality will be measured against the Canadian Council of Ministers of Environment (CCME) compost quality guideline. As part of the monitoring of the greenhouse grow-out trials, data to be collected from the greenhouse trial will reinforce compost analytical data in terms of growth of Equisetum sp in a controlled environment. It will also provide tangible data on the levels of organic matter required in the soil to guarantee long time survival of the test species.

**Effectiveness monitoring for dust** - Dust monitoring will be conducted in all experimental trials (A–C). A laser particle counter, and respirable pizometric particulate monitors will be used to collect daily quantitative particulate measurements in the plots during the growth season (May – July) including PM10 and PM2.5 samplers. These portable samplers will be moved around the plots and areas outside of the plots to quantitatively and qualitatively determine dust characteristics on a daily basis during the two months of beach exposure. Data collected will complement other information collected by colleagues and will be used to determine the effectiveness of vegetation in dust control in comparison to other methods currently employed.
A1.3 Revised deliverables for GMSWORKS #21 WLL Dust Control Trials

This project includes the following deliverables:

- All data collected, in appropriate electronic format.
- Final report on the results of the 2009 work, including a description of field methodology, analytical techniques, assumptions, and detailed as-built drawings and maps where appropriate.
- A draft plan for post-2009 work for the irrigation, native vegetation, and wetlands portions of the project.
- Annual reports on the trial results, including a description of field methodology, analytical techniques, assumptions, and detailed as-built drawings and maps where appropriate.
- Final reports on all trials at the end of the trial period, including conclusions and recommendations for future dust mitigation measures.
- Presentations to the FNs communities and Chief and Council of results-to-date (annually), the post-2009 plans for irrigation, native vegetation, and wetlands, and the final conclusions and recommendations.

A1.4 Revised schedule for GMSWORKS #21 WLL Dust Control Trials

- Consultant annual final report on 2009 work, including post-2009 plans – February 2010
- Consultant annual final report on 2010 work and overall 3-yr project summary – February 2011

A1.5 Revised budget for GMSWORKS #21 WLL Dust Control Trials

The estimated total cost for the 2008 and 2009 project years is $1,397,906. Note that the budget includes FNs labour and equipment costs. It does not include archaeological survey and monitoring cost required to complete the work; such work will be completed as part of the dust mitigation work in the reservoir.