Peace Project Water Use Plan

Physical Works Terms of Reference

- **GMSWORKS#21 WLL Dust Control Trials**

Addendum 5

2013-04-02

A5 Addendum to GMSWORKS#21 WLL Dust Control Trials

A5.1 Addendum Rationale

The terms of reference (ToR) for GMSWORKS#21 WLL Dust Control Trials (Dust Trials), dated April 2, 2008 (with Addenda 1, 2, 3, and 4 dated March 26, 2009, March 15, 2010, April 6, 2011, and June 11 2012, respectively), revised the deliverable completion date of January 2013 for the dust mitigation trials. The Dust Trials completed its fifth year in 2012, having conducted assessments of several different dust mitigation methodologies:

1. Tillage techniques, including analysis of appropriate tools (e.g., chisel, lister) and methods (e.g., spacing experiment), completed in 2010, is proposing additional work in 2013
2. Irrigation, including pumped and gravity-fed distribution, and artificial pondage, was deferred in 2012 and is proposing additional work, if feasible, in 2013,
3. Native vegetation, including grasses and *Equisetum* sp. with and without soil enhancement, and
4. Vegetation protection using protective debris berms.

The results of those trials indicate:

1. Tillage is an effective short-term dust control method where soil, beach access, archaeological site density, and topography are suitable. Given these limitations, tillage is not suitable for all locations in the Finlay Arm. We are proposing to continue the 2012 test of the disc trencher, if possible test engineered roughness in 2013. The disc trencher will provide greater displacement of soil and ability to access previously inaccessible beaches. The engineered roughness may provide an option that does not require heavy equipment use on the beaches
2. The conclusion in 2011 that irrigation is impractical because of logistical requirements and soil conditions was valid at the time given the previous study methods. We are proposing that another method be tested, if feasible, in 2013.
3. Native vegetation shows potential for effective and efficient dust control in suitable areas. However, more extensive longer term studies are needed to identify the best species, planting technique, maintenance requirements, and survivability. Soil enhancement is required in most areas. Soil enhancement using debris to create compost is promising and longer term studies in conjunction with the native vegetation trial described above are needed. Our experience in 2012 with a high minimum reservoir elevation and a rapid reservoir rise to full pool indicates we may need to wait until later in the Water Supply Forecast before making a decision to invest in vegetation trials. A decision on 2013 vegetation trials will be made in late February or early March when the Water supply forecast is more certain.
4. Due to low reservoir levels in 2009 and 2010, vegetation protection techniques remain untested. In 2011, reservoir elevations were higher and the early indications are that vegetation protection techniques will need to be far more robust to protect against debris, wave action and winter weather conditions.
5. Adequate dust control in the region will likely not be achieved using only tillage and vegetation so additional dust control methods require identification and testing.

To address these knowledge gaps, BC Hydro and Tsay Keh Dene jointly propose to conduct further work as described in this ToR Addendum.

This Addendum describes a two-year work scope and a 1-year budget for:

continuing roughness trials that will assess disc trenching equipment and engineered roughness

a Vegetation Enhancement trial combining native vegetation trials and soil enhancement trials;

a continued Vegetation Protection trial; and

a feasibility assessment of soil binders as an alternative or complementary mitigation tool.

We propose to refine the work scope and submit a budget annually due to the experimental nature of these trials.

A5.2 Revised Work Plan for GMSWORKS#21 WLL Dust Control Trials

A5.2.1 Management Questions

Based on the results of the previous years' trials, the management questions are identified as:

1. Can vegetation be established on the beaches of the Finlay Arm of Williston Reservoir at a sufficient density and over a sufficient area to be an effective and efficient dust mitigation technique?
2. Are debris berms an effective mitigation technique for protecting vegetation on the beaches of the Finlay Arm of Williston Reservoir?
3. Can a soil binding agent be an effective and efficient dust mitigation technique on the beaches of the Finlay Arm of Williston Reservoir and be acceptable from regulatory, environmental, archaeological, and human health perspectives?
4. Are there additional more robust tillage techniques available that will add to the current techniques (lister, twisted chisel) available for dust mitigation

These management questions will be addressed through five sub-projects:

1. Vegetation Enhancement
2. Vegetation Protection
3. Soil Binder Feasibility Assessment
4. Irrigation (e.g. mobile sprinkler and pump)
5. Tillage Trials (e.g. disc trencher, engineered roughness)

A5.2.2 Revised Objectives

The objectives of these trials are to address the management questions by establishing appropriate hypotheses, identifying scientific methods, collecting data and providing findings and conclusions that confirm either the alternative hypothesis or the null hypothesis (e.g. H1: native vegetation exhibits higher growth rates when planted with a combination of compost and native soil rather than in native soil only; H0: native vegetation does not exhibit a higher growth rate when planted with a combination of compost and native soil rather than native soil only).

All trials will take an adaptive management approach emphasizing both effectiveness at dust control and efficiency in terms of costs, logistics, personnel, and timing. This may require alterations to scope, schedule, or budget of the project over time as lessons learned suggest or require alterations to the approach.

Design and implementation of the project should also anticipate the need to acquire sufficient data within the next two years to, at minimum, provide as sound a scientific analysis as possible to allow a determination of the value of continuing, cancelling, expanding, or operationalizing the use of any or all of the aforementioned methods for dust control on Williston at the end of that 2-year period (end of the 2014 Field Season).

A5.2.2.1 Vegetation Enhancement

The objectives of the Vegetation Enhancement trial and Vegetation Protection trial build upon the results-to-date and include:

1. Determine if vegetation can be established using seeds, seedlings, or other form of transplant and determine the most effective and efficient means of doing so.
2. Identify under what conditions (e.g., elevation, soil conditions, species, soil amendments, etc.) vegetation would be expected to survive and establish a self-sustaining (or semi-self-sustaining) population.
3. Determine if Williston Reservoir debris-wood-fibre-based compost is an effective soil amendment/conditioner to assist in establishing self-sustaining (or semi-self-sustaining) populations of plant species, and, if the answer is yes, develop a plan for efficient composting.

A5.2.2.2 Vegetation Protection

The objective of this trial is to evaluate the use of woody debris berms to protect existing vegetation on the Finlay Arm of Williston Reservoir.

A5.2.2.3 Soil Binder Feasibility Assessment

The objectives of the Soil Binder Feasibility Assessment will include:

1. Identify potential soil binders suitable from regulatory, environmental, archaeological, and human health perspectives to be tested as a dust suppressant on the beaches of the Finlay Arm of Williston Reservoir and the conditions necessary for the application in test plots of such binders.
2. If an environmentally acceptable soil binding agent is available, assess the overall suitability for use in the Finlay Arm of Williston Reservoir given the remote location, archaeological interests, limited road access, and people living along the Finlay Arm. This assessment will consider but is not limited to dispersal options, health effects, environmental impact, archaeological impact, product life, and time and cost efficiency.
3. Determine the effectiveness of candidate soil binders in suppressing dust in the Finlay Arm of Williston Reservoir by appropriate scientific trials, the exact nature of which is to be determined.

A5.2.2.4 Irrigation Trial

The objective of this trial is to evaluate the use of mobile sprinklers and pumps to reduce dust and to support irrigation needs of the vegetation trials.

A5.2.2.5 Tillage Trials

The objective of this trial is to evaluate the use of more robust tillage equipment (e.g. Disc Trencher) to determine if this equipment can compliment or surpass the performance of the current techniques (lister, twisted chisel). This trial will also test the effectiveness of engineered roughness and potential for reducing dust.

Project coordination between these trials is necessary as well as with other projects involved in the Williston Dust Mitigation Program and other BCH projects; therefore design and implementation should be flexible.

A5.2.3 Methodology

A5.2.3.1 Vegetation Enhancement

Vegetation Enhancement Trials Methodology:

Woody Debris Composting: The trial will continue to test on-site composting of woody debris in the Finlay Arm of the reservoir. The compost produced from this trial will supply the vegetation trials with a soil enhancer. Composting will occur near Tsay Keh Village and/or in the Finlay Arm near trial sites. Composting will entail:

- Creating feedstock by chipping/grinding the wood
- Amending feedstock using developed recipes
- Composting feedstock

Once ready, compost will be transported to beach trial sites as needed.

Effects of Different Re-vegetation Systems, Nutrient Regimes, and Elevation on Vegetation Establishment: The trial will test the effects of different nutrient enhancement strategies, elevation, species, and propagation alternatives on plant survival. Trials are intended to facilitate rapid learning and high-capacity treatment screening with both demonstrable results and statistical validity. The trials will follow an adaptive management approach where information garnered each year will assist in refining trial efforts in the following year.

The ability for plants to persist under inundated conditions is a fundamental question. The study area layout will reflect the importance of answering this question.

A tentative selection of proposed sites includes:

1. Davis Beach
2. Omineca Beach
3. Collin's Bay Beach
4. Raspberry Flats

Trials occurring in the autumn will coincide with high water elevations thereby restricting sowing/planting to high beach locations only. In 2011 and 2012 it was determined that an autumn program would be impractical due to high reservoir elevations (>670.8m from Sept 1 to Oct 30). There is a moderate probability that similar reservoir elevation conditions will occur again in 2013.

The planting/sowing trials will be monitored to assess if plant mortality is due to inundation or drought. Any significant survival of a plant species will indicate its potential use, at some elevation, in future years. In general, results will be used to guide revegetation operations in year 2014.

Native seeds will be collected in the autumn to be used in future revegetation efforts. Seedlings will be acquired from a local greenhouse operation for the vegetation trial. Should the trial prove to be successful, then it would be cost effective to build a greenhouse in Tsay Keh in the future for the production of seeds, cuttings and plugs to be used in a long-term re-vegetation program.

Nutrient and Tillage Convergence: The trial will take place on a high dust production beach as identified by GMSWORKS#20 and will incorporate all the lessons learned to date from the tillage and vegetation experiments over the last five years.

Enhancement and Establishment of Permanent Vegetation Cover on a High Impact Beach: This is a demonstration site located on Tsay Keh Beach that will test several strategies for vegetation dust control. The site design and strategies will be determined by Tsay Keh Dene with advice of a soil and vegetation expert.

A5.2.3.2 Vegetation Protection

Vegetation Protection Trials Methodology:

In 2009, a debris bundle protection trial was established to test its effectiveness in protecting a beach area from debris scour. This structure was not assessed prior to 2012 as water levels did not reach the base of the debris bundles. In May 2012 the first observations after higher reservoir elevations in 2011 indicate that the debris bundles did not hold up under high reservoir elevation conditions. We will look for additional engineering solutions to make the debris bundles more robust. Should it prove effective, additional trial sites may be established.

Vegetation Protection Trials Effectiveness Monitoring:

The amount of debris trapped on both sides of the vegetation protection system will be evaluated. If time permits in 2013, debris volume will be assessed at the site before water rises this year and then again in spring 2014 after water levels have dropped to assess the effectiveness of the protection structures.

A5.2.3.3 Soil Binder Feasibility Assessment

Soil Binder Feasibility Assessment Methodology:

1. Assess feasibility of soil binder application to Williston Reservoir based on available literature, consultation with manufacturers and existing users of the product, consultation with government bodies in regards to environmental/health regulations, and consultation with BCH WDMP project managers.
2. Develop and implement a pilot study to test the effectiveness of the candidate soil binders on Williston Reservoir beaches

A5.2.3.4 Irrigation Trial Feasibility Assessment

Irrigation Trial Feasibility Assessment Methodology:

1. Assess feasibility of irrigation equipment to suppress dust mitigation by wetting the soil.
2. Integrate irrigation and vegetation trials to optimize use of irrigation equipment and increase the probability of success of vegetation trials

A5.2.3.4 Surface Roughening Trial Feasibility Assessment

Surface Roughening Trial Feasibility Assessment Methodology:

1. Assess feasibility of surface roughening equipment to suppress dust mitigation by displacing larger volumes of soil that could be accomplished using the lister and twisted chisel.
2. Test engineered roughness to control sand movement and dust emissions

A5.3 Revised Deliverables for GMSWORKS#21 WLL Dust Control Trials

This project includes the following deliverables:

- Any permits required to implement these trials.
- A comprehensive annual report that collates all of the data and includes:

  (a) An executive summary of the project;
  (b) The objectives and scope of the monitor;
  (c) Methods of data collection (including map of sites and photodocumentation), assumptions, and analysis;
  (d) A description of the compiled data set and results of all analyses,
  (e) A discussion of gaps, delays and/or deferrals of proposed work in the implemented program, and
  (f) A discussion of the consequences of all results as they pertain to the management questions.

  A report will be provided in hard-copy and electronically in 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 an appropriate format (e.g., Microsoft Access database, Microsoft Excel). All photos will be submitted electronically.
- A final report submitted at the end of the trial period that collates the data from the entire trial period. It will include conclusions and recommendations for future dust mitigation measures in addition to the requirements described above for an annual report.
- Annual presentations to the First Nations communities and Chief and Council of results-to-date.

A5.4 Revised schedule for GMSWORKS#21 WLL Dust Control Trials

Vegetation Enhancement and Vegetation Protection trials:

Fieldwork -May to October 2014.

Draft report(s) - November 2014.

Final report(s) - January 2015.

Soil Binder Feasibility Assessment:

Feasibility assessment and pilot study development - June/July 2014

Draft report - November 2014

Final report(s) - January 2015

Implement Pilot Study April - July 2015

Draft report(s) - November 2015

Final report(s) - January 2016.

Irrigation Trial Feasibility Assessment:

Fieldwork - May to July 2014.

Draft report(s) - November 2014.

Final report(s) - January 2015.

Tillage Trial Feasibility Assessment:

Fieldwork - May to July 2013.

Draft report(s) - November 2013.

Final report(s) - January 2014.

A5.5 Revised budget for GMSWORKS#21 WLL Dust Control Trials

There are no significant revisions to the budget from Addendum 4. We believe we can complete the revised Study/Works to March 31, 2014 within the approved allocation of $2,900,002. The budget does not include archaeological survey and environmental monitoring costs that may be required to complete the work.