**PAPER EXCELLENCE**

# Authorization for Services

**Mill Name** : Skookumchuck

**Date of Request** : 15-Sep-17

**Request Title** : EEM Cycle 8 Design Document - Ecometrix

**Request Type** Training [ ] Consultant [x]

**Estimated Total Cost** : 6,906

**Expected Benefits:** Please specify:

: Every 3 years, pulp and paper mills are required to complete an enviromental effects monitoring report

: Compliance with Federal regulations, PPER

:

:

**Justification for Request:**

A study design must be submitted 6 months prior to starting work for EEM to Environement Canada. Fish studies which were recommended in our EEM Cycle 7 report and accepted by Environment Canada typically are completed in April, so our submission needs to take place in October 2017. Quotes are also for the study which will take place in 2018 and is budgetted for in that year. Only study design needs to take place in 2017. Vendor was choosen on overall project cost however.

**Dates of Service:** from 18-Sep-17 to 10-Oct-17

**Approvals:**

| Mill Side | | | | Headquarters | | | |
|---|---|---|---|---|---|---|---|
| Title/Name | Signature | | Date | Title/Name | Signature | | Date |
| **Originator** **Brandy Craig** | Craig | | Sept. 15, 2017 | | | | |
| **Department Manager** **Roger Puar** | | | SEPT. 18/17 | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **Mill Head** **Alan Scalet** | | | Sept 19/17 | | | | |

Hatfield
CONSULTANTS

HCP Ref #: SKPI8788

September 14, 2017

Brandy Craig C.E.T. BTECH
Environmental Coordinator
Paper Excellence
4501 Farstad Way, Skookumchuck B.C., V0B 2E0
Phone: (250) 422-4007

**Re: Proposed Cycle Eight Biological Monitoring Program.**

Dear Brandy:

This letter outlines a plan for a combined provincial Aquatic Receiving Environment Monitoring Program (AREMP) and federal Environmental Effects Monitoring (EEM) Program next year (2018). The combined program will include both a fish study (required by EEM) and a benthic invertebrate study (required by both EEM and the AREMP).

This cost estimate includes all necessary components to complete the combined program:

1) A biological interpretive program study design document, which must be submitted to Environment and Climate Change Canada (ECCC) six months in advance of fieldwork;
2) Time to attend telephone conference calls to discuss the design document with ECCC and British Columbia Ministry of Environment (BCMOE);
3) A small-bodied fish study, conducted in mid-April, 2018;
4) A benthic macroinvertebrate study, conducted in September 2018;
5) An interpretive report to satisfy AREMP requirements (benthic invertebrate results only); and
6) An interpretive report to satisfy EEM Cycle Eight requirements (both fish and benthic invertebrate results, and incorporating PPER sublethal toxicity testing results conducted separately by Paper Excellence).

The small-bodied fish and benthic invertebrate samples will be collected and analyzed in accordance with EEM and provincial requirements and will follow the same design used in EEM Cycle Seven[1]. The Cycle Seven study was a control/impact survey focusing on the reference, near-field and far-field erosional zones.

As per recommendations made in Cycle Seven, the far-field zone will be dropped from the investigation, given the results appear to be confounded by differences in habitat relative to the reference and near-field areas.

[1] Ecometrics, 2016. EEM Cycle 7 Interpretive Report for Skookumchuck Pulp Inc. prepared for Skookumchuck Pulp Inc., A Paper Excellence Company, P.O. Box 4000, Cranbrook, British Colombia, March 2016.

# 1.0 SMALL BODIED FISH STUDY

Consistent with the Cycle Four and Seven programs, the small-bodied fish study will focus on torrent sculpin. Proposed sampling locations include Canal Flats, Torrent and Nearfield. Mid-April is proposed for the field program given that torrent sculpin is sexually mature at this time, and to provide consistency with historical sampling.

## 1.1 SAMPLE COLLECTION

Torrent sculpin will be collected from two reference areas and a near-field area using backpack electrofishers and dipnets or pole seines. Post-hoc power analysis done on Cycle Four results indicates that a minimum 26 females, 31 males from each area should be targeted to achieve sufficient statistical power; however, prior experience suggests that collection of more than 20 fish from each category from each area will be difficult.

Collected torrent sculpin will be euthanized by placing them in a pail containing effervescent sodium bicarbonate and then immediately put on ice.

## 1.2 SAMPLE ANALYSIS

Daily, fish will be measured (weight and length) and dissected to determine fish health and weights of livers and sexual organs. Otoliths will be collected from each fish and sent to North South Consultants, Winnipeg for fish aging.

## 1.3 DATA ANALYSIS

Measurements will be used to calculate fish health indices including gonadotrophic-somatic index (GSI), liver-somatic index (LSI), size-at-age and condition. Statistical analysis will be done following EEM guidance to assess statistical and biological significance. Mature males, females and immature fish will be assessed separately.

## 1.4 STATISTICAL ANALYSIS

All analyses of fish health data will be completed using R statistical software[2]. Summary statistics, including mean, median, standard deviations, standard error, and minimum and maximum values will be calculated for each key fish health metric for each study area. ANOVAs and ANCOVAs will be used to assess statistical and biological significance of differences between the reference and near-field areas. The following variables/indices will be statistically assessed: age, condition, relative liver size, body length, body weight, relative gonad size, length-at-age, LSI and GSI.

# 2.0 BENTHIC INVERTEBRATE COMMUNITY STUDY

Proposed study areas are Torrent and the nearfield area. Late September is proposed for the field program given annual open-water flows in the Kootenay River water are generally at their lowest, and to provide consistency with historical sampling.

## 2.1 SAMPLE COLLECTION

At both of the two study areas, samples will be collected at six sampling sites to ensure sufficient statistical power for comparison between areas (i.e., $\alpha = \beta = 0.01$). Each sample, will consist of a composite of five

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[2] R Core Team 2016. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/

subsamples. This is an increase from previous programs, which only assessed the results of a composite of three subsamples. This increase in subsamples will improve accuracy, without an associated increase in cost.

All samples will be collected from erosional habitat using a Hess sampler (screen size of 500 µm or smaller).

Following collection, samples will be transferred to individual pre-labeled 1-L plastic containers. Samples will be preserved with buffered formalin and subsequently shipped to the consulting taxonomist (Zaranko Environmental Assessment Services, Nobleton, Ontario).

## 2.2 SAMPLE ANALYSIS

Samples will be re-sieved in the laboratory using 500-µm screens. Identification and data analysis will be conducted on the 500-µm fraction of composite samples from each station. Specimens will be identified to family, or possibly to genus, as recommended by the EEM Technical Guidance document.

## 2.3 DATA ANALYSIS

The following benthic community metrics will be used to assess benthic invertebrate community structure: density, taxa (family) richness, evenness and Bray-Curtis.

These metrics will be calculated as described in the Pulp and Paper EEM Technical Guidance document[3]. The total surface area of sediments collected for benthic invertebrate survey will be adjusted to correct for the surface area of sediment removed from each grab for chemical analyses, to allow for more accurate benthic invertebrate density estimates. Major differences in presence/absence or densities of specific taxonomic groups will also be examined and discussed in relation to effluent exposure and/or habitat characteristics of each station.

## 2.4 STATISTICAL ANALYSES

All analyses of benthic invertebrate data will be completed using R statistical software[4]. Summary statistics, including mean, median, standard deviations, standard error, and minimum and maximum values will be calculated for each key benthic community metric for each station and each area. ANOVAs will be used to assess statistical and biological significance of differences between the reference and near-field areas.

# 3.0 SUPPORTING ENVIRONMENTAL DATA

Hatfield field staff would collect a set of periphyton and water quality samples in parallel with benthic community samples. The analysis of these samples will aid in the interpretation of the benthic community assemblage results.

A single Periphyton sample will be collected from three rocks at each benthic community sampling site. Periphyton will be scraped from rocks onto a filter paper, placed into an opaque container and put on ice. These samples will be shipped to ALS environmental, Burnaby, BC for chlorophyll-a analysis.

In addition to Kootenay River samples, additional water samples will be collected from two significant tributaries, Skookumchuck Creek and Lussier River, to assess possible confounding influences of these streams on Kootenay River water quality. This is consistent with the EEM Cycle Four and Seven programs.

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[3] Environment Canada, 2010. Pulp and Paper Environmental Effects Monitoring (EEM) Technical Guidance, Government of Canada. http://www.ec.gc.ca/esee-eem/default.asp?lang=En&n=3E389BD4-1

[4] R Core Team 2016. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/

### 3.1.1 Water Quality

In-situ water quality analysis (pH, conductivity, dissolved oxygen and temperature) will be assessed at all benthic community sampling sites. In addition, water samples will also be collected at all stations for a subset of laboratory analysis, including hardness, sodium (as a tracer), colour (as an alternate tracer) and key nutrients.

In addition, effluent grab samples, collected on each day of fieldwork in the near-field (i.e., likely two samples collected during the benthos survey) will be analyzed for all water quality variables. Laboratory analyses will be conducted by ALS Environmental, Burnaby, British Columbia.

## 4.0 QUALITY ASSURANCE/CONTROL (QA/QC)

A variety of quality assurance and control (QA/QC) procedures will be used in the field, office, and laboratory to ensure the quality of the data collected. Data will be collected following QA/QC guidance provided in the EEM technical guidance document and well as applicable provincial guidance documents. Benthic community assessment QA/QC will include resorts, sample splits and ID verification. Water quality analysis QA/QC will include duplicates (on 10% of samples), as well as field and travel blanks.

## 5.0 REPORTING

The project will result in three reports:

- A study design document (a requirement of the PPER), which must be delivered to ECCC at least six months ahead of field sampling;
- An interpretive report designed to satisfy BCMOE requirement for the AREMP (containing only benthic invertebrate study results); and
- An interpretive report designed to satisfy EEM Cycle Eight requirements under the PPER, which will include a mill process and water treatment update, results of biological studies (i.e., benthic invertebrate, small fish and water quality investigations), and a summary of twice-annual sublethal toxicity test results conducted by Paper Excellence during Cycle Eight.

## 6.0 PROPOSED SCHEDULE

Table 1 outlines the proposed program schedule.

**Table 1 Proposed schedule for EEM Cycle Eight and the 2018 AREMP study.**

| Date | Tasks |
|---|---|
| Mid-September 2017 | Project kick-off |
| Mid-October 2017 | Design document submitted to ECCC |
| Mid-April 2018 | Fish study conducted |
| Mid-September 2018 | Benthic invertebrate study conducted |
| March 31, 2018 | Final reports submitted to ECCC and BCMOE |

## 7.0 OUR QUALIFICATIONS

Hatfield Consultants has the most extensive experience of any consultant in Western Canada in the design and implementation of EEM programs for pulpmills; we have undertaken these studies for the majority of pulpmills in BC since the advent of the EEM program in 1993. At Skookumchuck, this includes design and implementation of EEM cycles One through Six, as well as development of the design for the mill's 2017 provincial monitoring (AREMP).

John Wilcockson, Hatfield's proposed Project Manager, has direct field experience on the Kootenay River with the proposed studies, having led field programs in two previous EEM studies. Martin Davies, who will provide senior oversight as Project Director, has 24 years of experience implementing numerous EEM studies throughout BC and also is familiar with the Skookumchuk study area, having participated in field work for EEM Cycle Three.

## 8.0 COST ESTIMATE

The estimated total cost of the combined EEM Cycle Eight and 2018 AREMP, including EEM design document and associated meetings, is **$124,534** excluding GST (Table 2). This estimated cost includes $95,332 for professional time and $29,202 for analytical costs and disbursements. This cost does not include costs of sublethal toxicity testing during Cycle Eight, which we have assumed Paper Excellence has been and will continue to undertake directly.

Thank you for providing us with the opportunity to work with you and Skookumchuck Pulp. If you have any additional questions or comments regarding this program, please contact me at your earliest convenience.

Sincerely,

John Wilcockson, MSc RPBio
Environmental Specialist
**HATFIELD CONSULTANTS**

Table 2 Estimated Cost of the Skookumchuck EEM Cycle Eight program and 2018 AREMP.

| Task | Activity | Person Hours[1] or Quantity | Rate | $ Subtotal | $ Total |
|---|---|---|---|---|---|
| 1.0 | **Project Planning/ Project Management/ Supervision/ Client and Government Liaison/ Meetings** | | | | |
| | • Mr. Martin Davies (Program Director) | 8 | $ 181.00 | $ 1,448 | |
| | • Mr. John Wilcockson (Project Manager) | 24 | $ 130.00 | $ 3,120 | $ 4,568 |
| 2.0 | **Creation of EEM Cycle Eight Design Document and ECCC Conference Call** | | | | |
| | • Mr. Martin Davies (Program Director) | 8 | $ 181.00 | $ 1,448 | |
| | • Mr. John Wilcockson (Project Manager) | 40 | $ 130.00 | $ 5,200 | $ 6,648 |
| 3.0 | **Coordination of Chemical and Analytical Services; Quality Assurance and Quality Control** | | | | |
| | • Hatfield Biologist | 24 | $ 110.00 | $ 2,640 | $ 2,640 |
| 4.0 | **Mobilization of Project Equipment and Consumables/ Collection Permit Application/ Local Travel/ Project Demobilization** | | | | |
| | • Hatfield Biologist | 32 | $ 110.00 | $ 3,520 | $ 3,520 |
| 5.0 | **Field Collection Phase (12-hr days)** | | | | |
| | 4.1 Fish Survey/ Supportive Receiving Environment Measurements/ Sample Collections | | | | |
| | • Hatfield Biologists (4 Biologists x 3 reaches x 2.5 days/reach) includes travel | 408 | $ 120.00 | $ 48,960 | |
| | 4.2 Benthic Invertebrate Survey/ Supportive Receiving Environment Measurements/ Sample Collections | | | | |
| | • Hatfield Biologists (2 Biologists x 3 days, incl. travel) | 72 | $ 120.00 | $ 8,640 | $ 57,600 |
| 6.0 | **Report Preparation (Progress Reports/ Data Synthesis and Analyses/ Writing/ Editing/ Submission of Draft Reports/ Report Revisions/ Submission of Final Report)** | | | | |
| | • Mr. Martin Davies | 8 | $ 181.00 | $ 1,448 | |
| | • Mr. John Wilcockson | 40 | $ 130.00 | $ 5,200 | |
| | • Hatfield Biologist/Statistician | 100 | $ 110.00 | $ 11,000 | |
| | • Computer Graphics | 8 | $ 110.00 | $ 880 | |
| | • Computer Database/EEMERS | 8 | $ 110.00 | $ 880 | |
| | • Word Processing/Production Services | 12 | $ 79.00 | $ 948 | $ 20,356 |
| 7.0 | **Estimated Cost (Professional Time)** | | | | **$ 95,332** |
| 8.0 | **Laboratory Analytical Phase** | | | | |
| | • Fish Aging: 100 fish structures @ $13.25 (includes QA/QC) | 100 | $ 13.25 | $ 1,325 | |
| | • Benthic Invertebrate Taxonomy: 12 samples @ $225 | 12 | $ 225.00 | $ 2,700 | |
| | • Benthic Invertebrate QA/QC and Verifications | | | $ 850 | |
| | • Water quality analyses: 12 benthic stations @ $260 | 12 | $ 260.00 | $ 3,120 | |
| | • Water quality analyses: 2 fish areas x 3 @ $60 | 6 | $ 60.00 | $ 360 | |
| | • Water quality analyses: 2 tributaries x 3 @ $260 | 6 | $ 260.00 | $ 1,560 | |
| | • Effluent quality analyses: 4 @ $260 | 4 | $ 260.00 | $ 1,040 | |
| | • Effluent sublethal toxicity tests: *Assumed to be paid directly by Paper Excellence* | 4 | $ - | $ - | $ 10,955 |
| 9.0 | **Estimated Disbursements** | | | | |
| | Accommodation/ subsistence/ vehicle rental/ communications/ equipment rental// freight/ user's fees/ courier services/ report printing/ local travel costs/ archiving of samples/ computer time/ consumables/ permit fees/ miscellaneous expenses | | | $ 18,577 | $ 18,577 |
| 10.0 | **Estimated Cost (Analyses and Disbursements)** | | | | **$ 29,532** |
| 11.0 | **Total Estimated Cost[2] (Time, Analyses, Disbursements)** | | | | **$ 124,864** |

[1] Field time is calculated on a 12-hr day (Section 5.0); remaining professional time categories are based on a 8-hr day.
[2] Total Estimated Cost does not include 5% GST.

EcoMetrix
INCORPORATED

# Cost Proposal for Completion of EEM Cycle 8 for the Skookumchuck Mill

**Proposal prepared for:**

**SKOOKUMCHUCK PULP INC.**
A Paper Excellence Company
4501 Farstad Way
Skookumchuck, BC
V0B 2E0

**Proposal prepared by:**

**ECOMETRIX INCORPORATED**
6800 Campobello Road
Mississauga, Ontario
L5N 2L8

August 25, 2017

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# 1.0 INTRODUCTION

EcoMetrix Incorporated is pleased to provide this proposal of service in association with the implementation of the EEM Cycle 8 program at the Skookumchuck Pulp Inc. (SPI) mill at Skookumchuck, BC. EcoMetrix' involvement in the Environmental Effects Monitoring (EEM) program dates back to our participation in the first studies that formed the technical basis of the program. Since this time we have conducted EEM studies from coast to coast for pulp and paper industry, including at the SPI mill in Cycle 7. This experience has provided us with a broad perspective of what is required to meet EEM program requirements.

We believe EcoMetrix is well-suited to take on this assignment on behalf of SPI, and if selected will provide SPI excellent products and deliverables and an exceptional level of service. We are committed to providing adequate staffing and resources to this assignment to ensure adherence to the agreed-upon work scope, budget and schedule. Additionally, our overall commitment to Quality Assurance and Quality Control in all of our work processes is demonstrated by our Quality Assurance System, which is ISO 9001:2008 compliant.

## 1.1 Proposal Structure

To facilitate evaluation of this proposal, we have organized the content of the remainder of this proposal as follows:

- Section 2 – **Scope of Work**: presents the approach that the Project Team will implement to complete the proposed assignment
- Section 3 – **Project Schedule**: present the proposed schedule and lists the deliverables associated with the assignment.
- Section 4 –**Qualifications**: presents the corporate description of EcoMetrix and highlights several examples of recently completed projects that demonstrate our qualifications to execute the proposed assignment and presents the team of professionals who will be involved in the proposed assignment and their qualifications.
- Section 5 – **Commercial Terms**: present the proposed associated with the assignment.
- Section 6 – **Closure**.

# 2.0 SCOPE OF WORK

## 2.1 Background

The Skookumchuck Mill is located approximately 40 kilometers north of Cranbrook, British Colombia, on the Kootenay River. The mill began operations in 1968. Since then the mill has changed ownership twice, in 1999 when Tembec Inc. acquired the mill and in 2013 when Paper Excellence Canada Holdings Corp (Paper Excellence) purchased the mill from Tembec.

The mill conducted standard EEM studies during Cycles 1 through 4. The results of these studies were indicative of an enrichment effect associated with mill effluent.

In Cycle 5, the mill engaged in an investigation of cause and solution study. It was determined that the mill needed to lower phosphorus concentrations in the effluent to mitigate the enrichment effect. Since then, the mill has made the following changes to its operations:

- switching to a low phosphorus fertilizer blend;
- increasing monitoring for nutrient control;
- recycling effluent from Cell #3 back to Cell #1;
- removing a condensate stream from the sewers; and,
- using more efficient aerators in the effluent treatment system.

The results of the Cycle 7 field survey completed by EcoMetrix indicated that the upgrades to the treatment system appeared to be successful, as the magnitudes of differences seen in fish and benthic invertebrate health endpoints were less than those measured in previous cycles and in many cases below levels deemed to be ecologically meaningful by EEM technical guidance. It was recommended that the Cycle 8 survey be executed in a manner consistent with that of Cycle 7 to confirm the Cycle 7 results; though consideration to eliminating the far-field sampling was suggested.

Our proposed methods and level of effort are discussed below for each of the main study components: preparation of the Study Design Report; execution of the field survey; preparation of the Interpretive Report; and, submission of the electronic data. Additional information concerning technical support that EcoMetrix will provide to SPI concerning the EEM program, training and health and safety and quality management is also reviewed.

## 2.2 Preparation of the Cycle 8 Study Design Report

The initial step of Cycle 8 will be to update the pre-design information presented in the Cycle 7 Study Design and Interpretative reports (Hatfield 2014 and EcoMetrix 2016). This step requires some direct SPI involvement, as well as contacting local/regional/federal sources to identify any relevant material that has come to light since the completion of the last phase.

The types of information to be updated and reported on include:

- a description of mill processes and changes to them (if any), especially as they impact effluent quality and quantity;
- effluent quality data (chemistry and acute and sublethal toxicity);
- spill records (if any);
- habitat characteristics in receiving environment and potential reference sampling areas;
- aquatic resource uses in the study area; and
- effluent dispersion characteristics.

The proposed design for the field program and methods by which the data generated by the field program will be documented. The design of the Cycle 8 program will be based on the results of previous EEM monitoring cycles, the Environment Canada reviews of those studies, the results of the most recent sublethal toxicity tests, Environment Canada's technical guidance and other information that may be relevant.

Our EEM team will develop the Study Design in the following manner:

- review the conceptual study design plan with SPI (and present it to Environment Canada if appropriate);
- complete the draft study design report and forward it to SPI for review;
- revise the study design report as per SPI comments;
- finalize the study design report and submit it to Environment Canada for review; and
- review the Environment Canada comments, provide any additional documentation required to resolve outstanding issues as necessary, and come to agreement regarding the final scope of the Phase 5 field program.

## 2.3 Recommendation for the Cycle 8 Field Program Design

We recommend that the field component of the Cycle 8 program at the SPI site be consistent with that of the Cycle 7 program. We believe it is important that the Cycle 7 program be conducted in a similar fashion to confirm or refute the results reported in the Cycle 7 Interpretive Report. The only exception to maintaining the study the same between Cycles 7 and 8 is the removal of the far-field sample collection. The habitat in this location

is markedly different than both the near field and the two reference areas and therefore potential differences observed may not be related to the mill effluent exposure but more to these habitat differences and therefore provide little value for assessment of effluent exposure. The removal of this area from the sample design would need to be accepted by Environment Canada. As a result there is a cost provided with and without inclusion of this area in the study.

## 2.4 Execution of the Cycle 8 Field Program

All aspects of EEM fieldwork will be completed according to Standard Operating Procedures (SOPs). These SOPs have been reviewed and approved by Environment Canada for use in the EEM program and ensure that data generated in each study are of known and acceptable quality.

All components of the program will have significant direct involvement by senior EcoMetrix staff. Our crew leaders have conducted numerous EEM field sampling campaigns throughout Canada, and are therefore very familiar with the importance

### 2.4.1 Fish Sampling

The fish collection program will implemented April 2018. Fish will be collected from four areas, including a near field area (just downstream of the discharge), a far-field area (near Wasa; depending on Environment Canada feedback) and two reference areas (near Torrent and Canal Flats). All areas have been sampled in previous EEM cycles and will be sampled with similar methods (backpack electrofishing) to allow for temporal comparisons.

The survey will collect 78 Torrent Sculpin (29 female, 23 male, and 26 juvenile) from each area and measure the full suite of health related and reproductive endpoints.

### 2.4.2 Benthic Macroinvertebrate Collections

The Cycle 8 benthic study will be implemented in September 2018 and will include sampling at six stations in each of two (or possibly three depending on removal of the far field) areas using a Hess sampler. At each station a sample comprised of three subsamples will be collected. The samples will be collected from the locations used in previous EEM cycles, where possible, assuming similar habitat.

### 2.4.3 Supporting Information

During the Cycle 8 survey, measurements of temperature, dissolved oxygen, pH, conductivity, depth, and current velocity will be measured at each sampling station. In addition to this, one water sample will be collected from each sampling area (canal flats, torrent, near field, far-field, effluent, Skookumchuck Creek, and Lussier River [if far-field are included]) plus associated samples for quality assurance (duplicate, travel blank, field blank) for the analysis of total phosphorus, total nitrogen, hardness, sodium,

orthophosphate, total dissolved phosphorus, nitrate, nitrite, ammonia, and dissolved and total organic carbon.

Substrate will be classified during benthic invertebrate survey as it is an important habitat feature for the benthic invertebrate analysis. It will be evaluated in terms of particle size, interstitial material size and embeddedness.

Periphyton will be collected at three stations in each benthic area sampled as well as Skookumchuck Creek and Lussier River (if including far-field). It will be used an indicator of primary productivity and will help aid in the overall interpretation of the Cycle 8 results. It would be expected that higher levels of periphyton growth would be associated with areas of nutrient enrichment.

### 2.4.4 Laboratory Sample Analyses Laboratory Sample Analyses

All samples collected for chemistry (water, periphyton) with be analysed by Maxxam Analytics a CALA certified laboratory with which EcoMetrix has a long standing relationship. We will work with our project manager at Maxxam to ensure that all of analyses have adequately low detection limits to compare them against applicable guidelines.

Otoliths for fish age determination and eggs for fecundity estimates will both be analysed in the EcoMetrix fish lab located in Mississauga.

- Otoliths will be cracked and burned and viewed with the aid of immersion oil and a dissection microscope. Ageing checks will be conducted on 10% of the samples by an independent technician to ensure that the EEM QA/QC requirements of ± one year are met.

- Prior to laboratory processing, the ovaries will be gently rinsed in a 180 μm sieve to remove the preservative. Egg weights and fecundity estimates will be completed according to standard methods following EEM technical guidance, as follows. The weight of each ovarian sample, which was initially determined in the field, will be re-weighed to the nearest 0.001 g using an electronic balance to obtain a preserved mass. Generally, the mass of preserved eggs will be slightly greater than that of unpreserved eggs due to fluid uptake. Three subsamples from each ovarian sample will be removed, weighed and the number of eggs within each of the three subsamples will be counted with the aid of a dissecting microscope under a minimum of eight-times magnification. Each subsample will contain approximately 100 to 250 eggs. Once counted, the eggs will be re-preserved and archived. Fecundity will be determined by dividing the total laboratory (preserved) weight by the subsample weight multiplied by the subsample egg number. For each female, the three estimates will be averaged to determine the total fecundity. Fresh egg weight will be determined by dividing the total weight of the unpreserved ovaries (measured in the field) by the estimated fecundity (i.e., number of eggs per female). Fecundity counts and egg size will meet the precision of ±1.0% and ±0.001g, respectively as stated in the TGD.

Laboratory analysis of the benthic samples will be completed by a qualified taxonomist that will identify the macroinvertebrates to the lowest taxonomic level possible (genus and/or species). All laboratory methods utilized will be consistent with Environment Canada's 2010 Technical Guidance document.

## 2.5 The Cycle 8 Interpretive Report

The methods that are employed to collect and subsequently analyze the field program data, the results and analysis of these data and their interpretation will be documented in the Cycle 8 Interpretive Report.

The Cycle 8 Interpretive Report will be organized in a manner consistent with the execution of the proposed program. Individual sections of the report will be stand-alone to the extent possible (i.e., the benthic invertebrate and fish survey sections will include a summary of relevant past results, a detailed account of the Cycle 8 study and an evaluation of Cycle 8 results). The final section of the report will pull the results of the study components together to provide a clear indication of what the data as a whole mean in terms of both Cycle 8 and future monitoring requirements.

The sublethal toxicity samples collected by the mill will be used to help gain an understanding of the potential effects of mill effluent on fish and invertebrates and test results will be discussed in the interpretative report. It is noted that the sublethal testing program used for EEM is not designed to assess enrichment effects, as have been measure at SPI in previous cycles. EEM sublethal toxicity testing endpoints measure negative responses to effluent exposure so strictly speaking their utility as it relates to helping interpret EEM field program data is likely to be limited.

In all, as a group EcoMetrix staff have authored in excess of 75 EEM Interpretive Reports and are well aware of what information Environment Canada expects to see in the report and how they prefer to have it organized. Tables, figures, photographs, maps and charts will be used wherever possible to aid in the presentation of important material.

The draft version of the interpretive report will be supplied to SPI in whatever format (hard copy or electronic or both) is wished so as to facilitate its review. The final version of the interpretive report will be provided to SPI in both hard and electronic (PDF) formats, and submitted to Environmental Canada as required.

## 2.6 Electronic Data Submissions

As part of the program, the raw data collected as part of your Cycle 8 study must be entered into the government database and/or provided to the national and provincial EEM offices prior to 1 April 2019 (i.e., the final interpretive report deadline). We are very familiar with this process having used the system to input data for all of our clients. Our

commitment to SPI is to ensure that the data are successfully submitted to Environment Canada as required, well ahead of the report submission deadline.

## 2.7 Technical Support to SPI

Technical support will be provided to SPI following submission of the final report to Environment Canada on an as needed basis. Typically, Environment Canada can take up to six months to complete document review. In our experience, the review comments that our reports have received in the past have only been relatively minor in nature and have been addressed by a sending a follow-up letter to Environment Canada. Allowance for this type of response has been made in the proposed budget.

## 2.8 Training and Health and Safety

All EcoMetrix Staff that will be involved in the project will have appropriate training for sample collection based on our internal, Environment Canada approved, Standard Operation Procedures. Our Staff will also have the appropriate training and licenses to properly and safely operate any equipment required to complete the sampling program.

EcoMetrix has a detailed Health and Safety Program that has been custom designed for our business. We have policies that cover all aspects of the sampling that would be required and procedures that staff must follow to maintain a safe and productive work environment in the field.

Before work begins at the site staff must perform a risk and mitigation assessment of all of the work that will be performed to complete the sampling program and it will be reviewed by EcoMetrix' Joint Health and Safety Committee.

While on site EcoMetrix staff will also abide by any health and safety policies requires by the Skookumchuck Mill.

Copies of our Health and Safety Program documentation, WSIB *Certificate of Clearance* and our *General Liability Insurance Certificate* can be provided upon request.

## 2.9 Quality Management

EcoMetrix' reputation has been founded on the quality of our work. We place great importance on QA/QC, from the earliest stages of the study design to the field collection methodologies and data interpretation, and also the preparation of the final report.

EcoMetrix was awarded ISO 9001 QA certification by NSF International in 2013, recognizing that the EcoMetrix Quality Management System adheres to international standards set by the International Organization for Standardization.

We will ensure the integrity of the study by following the corporate Quality Assurance Plan and the associated quality documentation, including standard operating procedures (SOPs). Standard operating procedures for report preparation and project management ensure that each phase of the project runs smoothly and according to established principles of quality. EcoMetrix has developed extensive SOPs for aquatic environmental effects monitoring. These SOPs meet or exceed QA/QC standards outlined in EEM technical guidance. In fact, many of the QA/QC guidelines and standards that are required by EEM are based on EcoMetrix SOP's or were developed by EcoMetrix staff specifically for the EEM program.

Specific QA/QC measures will be incorporated into every aspect of the study. These measures are consistent with those outlined in EEM technical guidance and include the following:

- **Field sampling**
  - all personnel involved in the field sampling will have appropriate training, experience with field equipment and objectives and will execute activities according to standard operating procedures (SOPs);
  - all safety measures will be identified, understood and adhered to;
  - contamination during chemical sampling will be checked with trip blanks;
  - detailed field notes will be maintained in a bound notebook; and
  - chain-of-custody forms and appropriate shipping and storage procedures will be used.

- **Benthic sample processing**
  - personnel involved in the sample processing and analyses will have appropriate training and experience,
  - the effects of subsampling (if done) on abundance estimates will be examined on a minimum of 10% of the samples and the effects of subsampling on the sample estimates will be documented,
  - resorting of randomly selected samples will be done to determine the success of initial sorting and ensure 90% recovery
  - appropriate taxonomic references will be used given the type of habitat and geographic location;
  - a voucher collection will be compiled; and
  - detailed sample processing and laboratory notes will be maintained in a bound notebook for six years.

- **Fish sample processing**
  - samples from fish (e.g., livers, ovaries) will be placed in appropriate containers;
  - suitable preservatives/fixatives will be used;
  - all samples will have appropriate labeling;
  - all measurements will be taken using appropriate equipment of acceptable accuracy and precision (this will be documented);

- instruments will be calibrated and maintained in good working order (records and methods will be available); detailed field notes will be maintained in a bound notebook; and
- chain-of-custody forms and appropriate shipping and storage procedures will be used.

- **Analysis and Reporting**
  - conduct screening exercises to identify transcription errors, outliers and other suspicious data points;
  - provide raw data in an electronic database format and appendices to reports which summarize the data;
  - document the methods (specific statistical tests) and software (as appropriate) used for analysis;
  - check for editorial, grammatical and spelling errors, data entry errors;
  - check for consistency of format and the completeness of each section;
  - check for data handling and reporting (entry checks, missing values, methods, QC);
  - ensure that pertinent information has been reported in detail (including field notes, accurate site locations);
  - ensure that changes in protocol, study design, or other components of the study have been reported; and
  - ensure that all QA/QC documentation is documented and included in the report.

Mandatory document review by senior EcoMetrix scientists (in this case the Project Principal) ensures that high standards are maintained. The Project Principal will ensure the overall technical quality of the project is high through all phases of the study - from field studies and interpretation, to report preparation, and submission by reviewing all study designs, data analysis methodologies and interpretation of results. The Project Principal will also review all draft reports prior to submission to Skookumchuck. The role of the Project Principal is to provide advice to the Project Managers on national and site-specific issues, provide QA/QC on all EEM reports to ensure technical integrity and a consistent product, and to provide input on negotiations with Environment Canada.

# 3.0 PROJECT SCHEDULE

A summary of the proposed project schedule is provided in Table 3.1. It is noted specifically that there is some urgency to complete and submit the Study Design Report so as to allow sufficient time (6 months according to the PPER) for regulatory review prior to the commencement of the field work program.

**Table 3.1: Summary of the Proposed Project Schedule**

| Activity | Associated Date |
|---|---|
| Draft Study Design Report | Submitted to Skookumchuck for review by 01 October 2017 |
| Final Study Design Report | Submitted to Skookumchuck, ready for submission to Environment Canada by 15 October 2017 (assumes one week for review and one week for revision) |
| Fisheries Field program | April 2018 |
| Benthic Field program | September 2018 |
| Sample analysis | April and September 2018 (sample submission) to end of January 2019 (receipt of all data associated with sample analysis including water, fish ageing, fecundity counts, benthic invertebrates) |
| Draft Interpretive Report | Submitted to Skookumchuck for review by 15 February 2019 |
| Final Interpretive Report | Submitted to Skookumchuck, ready for submission to Environment Canada by 15 March 2019 (assumes two to three weeks for review and one to two weeks for revision), well in advance of the 1 April 2019 final deadline. |
| Electronic data submission | 15 March 2019, well in advance of the 1 April 2019 final deadline. |
| Technical support | Following agency review of the report as needed |

# 4.0 QUALIFICATIONS

The founding members of EcoMetrix formed the environmental services group at Beak International Incorporated (Beak), Canada's oldest environmental consulting firm. We formed EcoMetrix in 2004 following the sale of Beak to Stantec Consulting Ltd in 2002.

We have a long history working for the pulp and paper sector!

EcoMetrix has served the pulp and paper sector throughout our 13 year history, and members of EcoMetrix have served this sector throughout their career. Table 4.1 provides a partial list of the clients and mills served. We've worked for many of the major mills in Canada, the United States and South America.

We've provided a wide variety of services to the pulp and paper sector over the years, including: alternative assessments, cumulative impact studies, due diligence reviews, ecological risk assessments, effluent plume delineations, environmental compliance reviews, environmental effects monitoring studies, environmental impact assessments, environmental performance reviews, evaluations of dioxins and furans, natural resource damage assessments, permits and approvals, sludge surveys, sludge management evaluations, social performance reviews, tainting studies, and waste assimilative capacity assessments.

**Table 4.1: Partial List of Pulp and Paper Projects**

| Company | Location | Service Provided |
|---|---|---|
| Abitibi | Kenora | Permits and approvals<br>Phosphorus management plan |
| Arauco | Valdivia, Chile | Assessment of discharge alternatives |
| AV Group | Nackawic | Environmental effects monitoring<br>Effluent plume delineation |
| | Terrace Bay | Environmental effects monitoring<br>Effluent plume delineation |
| Botnia S.A. | Fray Bentos, Uruguay | Cumulative impact assessment<br>Environmental performance monitoring |
| Bowater | Dalhousie | Effluent plume delineation<br>Environmental effects monitoring |
| | Liverpool | ASB hydraulic assessment |
| | Thunder Bay | Permits and approvals |
| Cascades | Thunder Bay | Sediment remediation |
| Domtar | Dryden | Environmental effects monitoring<br>ASB sludge inventory and management plan<br>Waste assimilative capacity |
| | Espanola | Environmental effects monitoring<br>Effluent plume delineation<br>Phosphorus management plan |
| Eurocan | Kitimat | Environmental effects monitoring<br>Tainting assessment and monitoring |
| Kruger | Corner Brook | Environmental effects monitoring<br>Effluent plume delineation |
| Montes del Plata | Colonia, Uruguay | Environmental impact assessment<br>Permits and approvals |

| | | |
|---|---|---|
| Neenah Paper | Pictou | See Northern Pulp |
| NewPage Corp. | Port Hawkesbury | See Port Hawkesbury Paper |
| Northern Pulp Nova Scotia | Pictou | Environmental effects monitoring<br>Environmental impact assessment |
| P.T. Adindo | Indonesia | Environmental impact assessment |
| Port Hawkesbury Paper | Port Hawkesbury | Environmental effects monitoring |
| Sonoco Canada | Trenton | Environmental effects monitoring<br>Effluent plume delineation |
| Skookumchuck Paper Inc. | Skookumchuck | Environmental effects monitoring<br>Bathymetric survey |
| St. Marys Paper | Sault St. Marie | Environmental effects monitoring<br>Effluent plume delineation |
| Stora Enso | Port Hawkesbury<br>Montes del Plata | See Port Hawkesbury Paper<br>Environmental impact assessment<br>Social impact assessment |
| Suzano | Imperatriz, Brazil | Environmental due diligence |
| Tembec | Kapuskasing | Waste assimilative capacity |
| | Marathon | Environmental effects monitoring<br>ASB sludge inventory and management plan<br>Waste assimilative capacity |
| | Smooth Rock Falls | Closure planning<br>Permits and approvals<br>Waste assimilative capacity |
| UPM S.A. | Fray Bentos | Environmental performance monitoring |
| Weyerhaeuser | Columbus | Hydrodynamic model development |
| | Kamloops | Environmental impact assessment |
| | New Bern | Waste assimilative capacity |
| | Plymouth | Ecological risk assessment<br>Waste assimilative capacity |

## 4.1 Project Team

The key study team members that will be involved in the Cycle 8 EEM study have been involved in the implementation of numerous EEM programs. Our staff has developed excellent reputations for the quality of their work and has strong working relationships with Environment Canada Personnel. We believe we have compiled a study team with relevant experience and technical depth, which is unparalleled in Canada.

Profiles of the key study team members and their role (*in parentheses*) in the Cycle 8 EEM program are provided below. Detailed resumes are provided in Appendix A.

**Carolyn Brown, M.Sc., Environmental Scientist (*Project Manager*)**

Ms. Brown is an Environmental Scientist with over 7 years of experience in environmental assessments. She completed her undergraduate degree in 2007 in Environmental Toxicology and her Masters of Science in biology in 2010. With EcoMetrix Carolyn has assisted with a number of EEMs for pulp and paper and mining across Canada, including the field work, statistical analysis, and report writing of the Skookumchuck Mill Cycle 7 EEM. Other EEM's that Carolyn has assisted with have included the use of artificial substrates and sampling fish and benthic invertebrates in a variety of habitats. She has been a crew supervisor responsible for the daily operation of a number of aquatic projects, as well as been responsible for technical preparation of projects, data collection and

analysis and report preparation. She has conducted habitat assessment on a number of waterbodies throughout Canada and is very proficient in fish and macroinvertebrate identification. Carolyn's skills in identification, and habitat assessment give her the ability to complete surveys needed to determine fish community and habitat structure in all types of waterbodies.

During the field program, Carolyn will be your direct contact with EcoMetrix. She will also be responsible for data analysis and will be involved in the preparation of the Study Design and Interpretive reports.

**Joe Tetreault, B.Sc., Aquatic Biologist (*Project Principal*)**

Joseph Tetreault has over 16 years of experience in the aquatic sciences including extensive field experiences conducting EEM sampling at pulp and paper mills and mines in North, South and Central America, thus providing him with essential insight into developing successful environmental study plans. His area of expertise includes preparation of sampling plans, data collection and analysis, and technical report preparation. He has played a key role in developing Standard Operating Procedures for environmental investigations for EcoMetrix. He has sound knowledge of many types of fish, benthic invertebrates, water and sediment sampling equipment used to determine the potential effects of aquatic industrial discharges and has conducted habitat assessments on a number of waterbodies in both Canada and internationally.

"Environmental Effects Monitoring" (EEM) is one of Joe's main focuses. Joe has completed over 30 EEM studies at pulp and paper mills and mines across Canada, as required under the federal legislation (*Fisheries Act*). In addition to the field studies he has been responsible for the writing of documents to support the EA process for mines in Canada and has also produced documents to support amendments of or new provincial permits. Besides the mining and pulp and paper industries Joe has also worked on projects for the nuclear food and drug manufacturing and hydrogeneration industries and with various levels of government throughout Canada.

He will use extensive field-based knowledge to inform environmental sampling aspects of the proposed Sampling Design and he will support the project manager and field crew in decision making related to sampling.

**Brian Fraser, M.Sc., Principal, Aquatic Ecologist (*Senior Advisor*)**

Brian is an aquatic scientist with particular expertise in aquatic effects assessment studies. Brian is a Principal at EcoMetrix and has 18 years of consulting experience. He has completed more than 50 EEM programs across Canada and participated in the development of the EEM programs for the mining and pulp and paper industries.

He has developed an excellent working relationship with Environment Canada by working with them to develop scientifically defensible studies for his client mills and mines. As the

Project Principal he will work closely with the project team and provide ultimate technical oversight of the study and final review of all reports.

Several other EcoMetrix staff have extensive experience within the EEM program and will be involved with Cycle 7 Program if necessary. These people include:

| Staff Member | Technical Specialty |
|---|---|
| Bruce Rodgers, B. Eng., M.A.Sc., Principal | Effluent plume dispersion, waste assimilative capacity, water quality |
| Don Hart, Ph.D., Principal | Statistics, toxicology, sediment quality |
| Paul Patrick, Ph.D. | Fisheries biology |
| Robert Eakins, Tech. Dipl., Associate | Fisheries biology |
| Elaine Mason, M.A.Sc. | Aquatic ecology |
| Nichole Wiemann, B.Sc. | Aquatic ecology |
| Justine Vanslingerland, B.Sc. | Aquatic ecology |
| Goran Ivanis, M.Sc. | Water quality, toxicology |

## 4.2 Subconsultants

Staff resources will be available to the extent that no subconsultants will be used in the completion of the Cycle 8 program.

As indicated in Section 2.3.4 analysis of fish (ageing and fecundity) will be completed by EcoMetrix staff in our in-house fish laboratory, analyses of water and periphyton samples will be completed by Maxxam Analytics and the benthic samples will be analyzed by ZEAS.

# 5.0 COMMERCIAL TERMS

## 5.1 Cost Estimate

We have prepared a detailed budget for this project based on our extensive experience with EEM programs, including at the SPI mill, and the level of effort required to complete the Cycle 8 EEM Study. The budget is broken down into professional fees, and disbursements for the major study tasks listed in Table 3.1.

The proposed budget if the far-field is included is presented in Table 5.1 and is $93,232, which includes all professional fees, and disbursements required to complete the Cycle 8 EEM.

The proposed budget if the far-field is excluded is $80,716 and is presented in Table 5.2.

**Table 5.1: Cost Summary for the EEM Cycle 8 Program**

| Task | Professional Time | Disbursements | Total |
|---|---|---|---|
| Study Design Report | $6,640 | $266 | $6,906 |
| Fisheries Field Program (Professional Time/Lab Analysis/Disbursements) | $24,300 | $20,840 | $45,140 |
| Benthic Field Program (Professional Time/Lab Analysis/Disbursements) | $10,200 | $15,438 | $25,638 |
| Data Compilation/Summary/Analysis | $3,750 | $150 | $3,900 |
| Interpretive Report | $11,200 | $448 | $11,648 |
| **TOTAL** | **$56,090** | **$37,142** | **$93,232** |

**Table 5.2: Cost Summary for the EEM Cycle 8 Program with the far-field excluded**

| Task | Professional Time | Disbursements | Total |
|---|---|---|---|
| Study Design Report | $6,640 | $266 | $6,906 |
| Fisheries Field Program (Professional Time/Lab Analysis/Disbursements) | $20,400 | $17,482 | $37,882 |
| Benthic Field Program (Professional Time/Lab Analysis/Disbursements) | $8,250 | $12,130 | $20,380 |
| Data Compilation/Summary/Analysis | $3,750 | $150 | $3,900 |
| Interpretive Report | $11,200 | $448 | $11,648 |
| **TOTAL** | **$50,240** | **$30,476** | **$80,716** |

## 5.2 Cost Projections

Quarterly cost projections from now until the end of the current EEM cycle are provided below in Table 5.3. These projections are associated with the timing of when it is expected the project costs will be accrued as the EEM Cycle 8 program is completed. The projections are provided to assist SPI with their own internal procurement planning process.

**Table 5.3: Cost Projection Summary for the EEM Cycle 8 Program**

| Quarter | With Far-Field | Without Far-Field |
|---|---|---|
| Oct - Dec 2017 | $6,906 | $6,906 |
| Jan - Mar 2018 | $0 | $0 |
| Apr - Jun 2018 | $37,772 | $32,356 |
| Jul - Sept 2018 | $7,368 | $5,526 |
| Oct - Dec 2018 | $25,638 | $20,380 |
| Jan - Mar 2019 | $10,889 | $10,889 |
| Apr - Jun 2019 | $4,659 | $4,659 |
| **Total** | **$93,232** | **$80,716** |

## 5.3 Equipment, Materials and Supplies

EcoMetrix has all of the equipment, material and supplies needed to carry out the work program as proposed. We are accepting of the notion that should Skookumchuck wish to provide some the equipment, material and/or supplies needed to carry out the work that the cost of these items can be removed from our overall cost quote. We would also be accepting of the situation whereby Skookumchuck would provide staff that would help to complete the field work. If these staff could replace a member of our field team in a supporting role our cost quote would be adjusted down by the appropriate amount (hourly rate times hours worked). The degree to which savings could be realized by any of these means can be explored more closely after awarding of the contract to complete the proposed work program.

While on site our goal is to be as self-sufficient as possible. That being said however, some allowance on site for temporary storage of equipment would be helpful (although not necessary).

# 6.0 CLOSURE

We trust that this scope of work and cost estimate meets your requirements at this time. Please do not hesitate to contact any of the undersigned with any questions or comments. Changes in the scope and associated costs can also be adjusted according to SPI's specific requests.

Carolyn Brown, M.Sc.

Joseph Tetreault, B.Sc.

Brian Fraser, M.Sc.