

TAHERA DIAMOND CORPORATION
QUALITY ASSURANCE/QUALITY CONTROL PLAN.
WATER LICENCE *NWB1JER0410*.
JERICO DIAMOND MINE NUNAVUT CANADA APRIL 2005

A REVIEW

Submitted by

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1.0 INTRODUCTION

Nunavut Water Board Water Licence NWB1JER0410 Type A (the “Licence”) was issued to Benachee Resources Inc. (the “Licensee”), a wholly-owned subsidiary of Tahera Diamond Corporation, on 21 December, 2004. It expires on 31 December, 2010. Its purpose is industrial water use and waste disposal for mining and processing. The maximum authorized quantity of water is 350,400 cubic metres annually.

The Licence entitles the Licensee to use water and to dispose of waste associated with the construction and operation of the Jericho Diamond Mine in the Kitikmeot Region of Nunavut (65°59’50”N; 111°28’30”W).

Part L of the Licence establishes the conditions applying to general and aquatic effects monitoring plans. Article 5 of Part L specifies that

The Licensee shall submit to an Analyst for approval within three (3) months of the effective date of this License, a Quality Assurance/Quality Control (QA/QC) Plan that includes field and laboratory procedures and requirements. This report shall be developed in accordance with Schedule L, Item 2.

The effective date of the Licence was 21 December, 2004 (Murdock November 14, 2006).

Schedule A to the Licence defines “Analyst” to mean an analyst designated by the Minister of Indian and Northern Affairs Canada under Section 85(1) of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*.

Table 1 of Schedule K specifies the water quality parameters to be measured in general and aquatic effects monitoring.

Tables 2 and 3 of Schedule K establish the monitoring requirements for each of the 18 receiving environment water quality monitoring stations and each of the 14 site water quality and thermal monitoring stations.

Schedule L specifies the conditions applying to general and aquatic effects monitoring plans. Article 2 states that

The detailed QA/QC plan referred to in Part L, Item 5 of the Licence shall include but not necessarily be limited to the following:

- a. consideration of the INAC “QA/QC Guidelines for Type “A” Licenses”;*
- b. approval of the plan by an analyst;*
- c. information on the analyst;*
- d. introduction on Quality Assurance/Quality Control and its principles and how the Plan elements will be implemented on site;*
- e. field sampling, locations, frequency, sample types, sample containers;*

- f. logging of samples, sample handling, preservation, transportation requirements, information requirements, chain of custody;*
- g. field measurements, calibration of field equipment;*
- h. sampling and analysis, use of field blanks, replicate samples, spiked samples and split samples;*
- i. laboratory analysis and information methods used for analysis;*
- j. laboratory QC and reporting of data.*

The Quality Assurance/Quality Control Plan (the “Plan”) (AMEC April 2005) was prepared by AMEC Earth and Environmental of Burnaby, B.C., and was submitted to Tahera Diamond Corporation (“Tahera”) in April, 2005.

Tahera submitted the Plan to the Nunavut Water Board (the “NWB”) on 22 April, 2005. That was four months after the effective date of the Licence. The Licensee was therefore in technical breach of Article 5 of Part L of the Licence by submitting the Plan one month after the expiration of the three-month deadline specified therein.

The NWB mandated Paul F. Wilkinson & Associates Inc. (“PFWA”) to review the Plan. PFWA conducted its review in collaboration with Met-Chem Canada Inc. and Environnement Illimité inc.

Mary Jean Buchanan is a geological engineer with a Master’s degree in Environment. She has been with Met-Chem Canada Inc. for 13 years and she has some 20 years of experience in project management, environmental impact assessment and environmental audits, mostly in overseas mining and industrial projects. She was responsible for reviewing the overall compliance of the Plan with the requirements of the Licence.

Stéphane Lorrain is a geologist with a Master’s degree in oceanography. He has been involved in studies about water and sediment physico-chemical characterization and aquatic habitat characterization in the context of dredging, sediment restoration and maritime infrastructure projects. He is also managing physical oceanography and aquatic technical surveying (bathymetry, river discharge and sediment load, current distribution pattern) projects in the context of environmental impact assessments of hydroelectric and maritime infrastructure projects. He was responsible for reviewing sampling methods and approaches.

Paul F. Wilkinson, who holds a doctorate in archaeology and anthropology and has some 30 years of experience in environmental impact assessment, largely in northern Canada, acted as project coordinator, was responsible for liaison with the NWB and prepared a synthesis of the reports prepared by Buchanan and Lorrain.

The review focused on comparing the Plan against the requirements listed under Schedule L, Item 2 of the Licence.

2.0 DISCLAIMER

The present report is directed solely at the development and presentation of data and recommendations to permit the NWB to reach informed decisions about the adequacy of the Plan. While the study was performed by competent individuals, NWB acknowledges that the services of PFWA are advisory only and that PFWA disclaims any liability for losses, damages and claims that may result or be alleged to result from any application or use that NWB and/or others may make of such data and recommendations provided by PFWA.

The disclosure or the use of this report to third parties for any reason, and any use or reliance on this report by a third party, shall be at such third party's risk.

NWB hereby waives releases and agrees to hold harmless, defend and indemnify PFWA from and against any and all liability for all losses, damages and claims by NWB or any third party arising out of the report or the data and recommendations therein or as a result of any act or failure to act by NWB or others based on such report, data and/or recommendations supplied by PFWA hereunder.

3.0 EVALUATION

3.1 Overview

3.1.1 *Authors and Qualifications*

The Plan does not identify its authors or list their relevant qualifications and experience. That omission should be rectified when the Licensee modifies the Plan.

3.1.2 *Definitions*

Given that the Plan will be read by many persons who are not specialists in QA/QC, it would have been useful for it to state clearly what it means by *Quality Assurance* and *Quality Control*. It could usefully have adopted the definitions of INAC & NWTWB (July 1996), as follows:

***Quality Assurance:** is the system of activities designed to better ensure the quality control is done effectively; while*

***Quality Control:** is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy and reliability.*

The next version of the Plan should contain appropriate definitions.

3.1.3 Coherence and Convenience

The Plan is 11 pages long and is divided into four sections followed by a list of the references cited: Introduction; General Monitoring; Aquatic Effects Monitoring Program; and Data Verification and Reporting.

The List of Appendices refers to a single appendix (Appendix A), described as “General and Aquatic Effects Monitoring Plans” (the “GAEMP”). The GAEMP seems to be composed of AMEC (March 2005), SRK (August 2004) and Mainstream Aquatics (March 2005). The GAEMP contain over 480 pages, but only six pages explicitly address QA/QC (AMEC (March 2005) pp 13-16; Mainstream Aquatics (March 2005) pp 20-21).

It is unnecessarily complex for the reader to have to refer to several documents and almost 500 pages of text to find what can be expressed in less than 20 pages. We recommend that the next iteration of the Plan be self-contained and without unnecessary appendices.

3.1.4 Structure and Focus

The Plan itself is poorly structured, making it difficult for the reader to grasp the overall objectives and methods. It contains much unnecessary information. Given its length, it devotes too much attention to general principles and statements, often at the expense of detailed specifications. For example, Section 3.2.3 states, that *Strict sampling protocols are adhered to...* for nonvertebrate aquatic biota, but it does not specify what those protocols are. In the same vein, AMEC (March 2005: Section 3.1.6) fails to specify the instrumentation that will be used.

When the Licensee revises the Plan, we recommend that it contain numbered and labelled subsections corresponding to the 10 elements identified under Schedule L, Item 2 and that descriptions of general principles be kept to a minimum.

A series of flow charts describing the sampling program (what, when, where and how) would facilitate the understanding of the reader.

3.2 Consideration of the INAC & NWTWB “QA/QC Guidelines for Type “A” Licenses” (INAC & NWTWB July 1996)

INAC & NWTWB (July 1996) proposes minimum requirements that must be included in QA/QC plans with respect to: field sampling (identifying station location, description of and rationale for sampling equipment, details of sampling methods and equipment, detailed information on the quantities and concentrations of preservatives, description of sample identification system and transportation protocol to ensure the maintenance of sample integrity and rapid delivery); analysis at outside laboratories (proof of accreditation, identification of detection limits for all parameters, description of all methodologies not specified in APHA, AWWA & WPCF (1989)); analysis at in-house laboratories (identification of analytical laboratory/detection limits for all parameters, description of measures to ensure precision and

accuracy, description of all methodologies not specified in APHA, AWWA & WPCF (1989)); and reporting requirements distinguishing between outside and in-house laboratories.

Section 1.6 of the Plan states that the INAC & NWTWB (July 1996) was followed ...*as a general guide*. That seems to be an acceptable interpretation of Article 2 of Schedule L to the Licence, which requires ...*consideration*... of INAC & NWTWB (July 1996).

Most of the requirements of INAC & NWTWB (July 1996) are addressed in the Plan, but insufficient details are provided in some areas, as highlighted below. Subsequent revisions of the Plan should provide more information, as indicated in the following sections.

3.3 Approval of the Plan by the Analyst

Section 1.3 of the Plan notes that the Analyst had not been appointed when the Plan was drafted. The NWB (Murdock November 14, 2006) has corroborated that such was in fact the case. The Analyst has now been appointed but has not yet reviewed the Plan.

3.4 Information on the Analyst

Given that the Analyst had not been appointed, the Plan was unable to fulfill this requirement.

3.5 Introduction on Quality Assurance/Quality Control and its Principles and how the Plan Elements will be Implemented on Site

Section 1.5 of the Plan provides adequate references to general QA/QC principles through reference to the eight management principles recognized by the ISO 9001 standard (International Standards Organization 2000). The Plan recognized that the principles apply primarily to manufacturing industries, but we share its view that several of them have a broader application. That said, it must not be forgotten that they address management issues rather than scientific rigour. Adhesion to the practices set out in INAC & NWTWB (July 1996) helps to ensure an acceptable level of scientific rigour.

The Plan discards Principle 1 (customer focus) and Principle 8 (mutually beneficial supplier relationships) on the basis that they do not apply to environmental monitoring at the Jericho Mine. It would not be unreasonable, however, to consider the population of Nunavut, as represented in this case by the NWB, as the customer. In the same vein, Principle 8 could be applied to the relationship with external laboratories.

The following items should have been identified as an integral part of the Plan:

- quality assurance organization: personnel (Tahera) responsibilities and qualifications;
- quality assurance policies;
- quality control procedures and forms;
- sample custody and documentation (field operations and laboratory operations);
- calibration procedures;

- analytical procedures and methods;
- internal quality control checks;
- performance and system audits;
- corrective actions.

All of the foregoing must be addressed fully and satisfactorily when the Licensee modifies the Plan.

According to Schedule L, Item 2, Sub-paragraph (d), the Licensee must indicate how the elements of the Plan will be implemented on site. As indicated in the ISO 9001 standard, completed forms constitute the most appropriate evidence of compliance. The Plan does not include any examples of written procedures or field forms. That omission must be corrected when the Plan is modified pursuant to Part L, Item 6 of the Licence.

It is recommended that future updates of the Plan should provide more details regarding quality assurance organization (responsibilities and qualifications), quality control procedures/forms and corrective actions in the event of non-conformant results.

3.6 Water and Sediment Chemistry

Section 2.1 of the Plan lists the monitoring of water and sediment chemistry among its elements. There is, however, no description of sampling techniques for either suspended sediments or bottom sediments. The statement in Section 3.2.1 that *Sediment QA procedures will be similar* to those for water quality is inadequate.

Bottom sediments can illustrate change over time: core sampling prior to or at the start of a project provides baseline, or reference, data; periodic subsequent sampling at intervals to be determined according to accumulation rates can then illustrate any changes in the chemistry of the sediments over time. Changes in water chemistry are more difficult to interpret because their variability is greater.

Subsequent versions of the Plan should describe sampling techniques for sediment and should discuss the strengths and weakness of water and sediment samples.

3.7 Field Sampling

3.7.1 Comments on Compliance

Schedule L, Article 2 of the Licence requires that the Plan describe field sampling locations, frequency, sample types and sample containers. Some information regarding field sampling is provided in Appendix A. Subject to our view that all required information should be contained in the Plan itself, the following summarizes our evaluation of its compliance with the Licence.

3.7.2 Field Sampling

a) Location and frequency

Information regarding field sampling locations, project phase and frequency for receiving environment water quality monitoring is provided in Table 2 of Schedule 1 of AMEC (March 2005), which also lists the water quality test group parameters to be analyzed. Table 2 is complete and is in compliance with Table 2 of Schedule K of the Licence. The Plan does not, however, provide information on the types of markers used to identify the locations of all sampling stations, as required by INAC & NWTWB (July 1996).

Information regarding field sampling locations, project phase and frequency for site water quality and thermal monitoring stations is provided in Table 3 of Schedule 1 of AMEC (March 2005). Table 3 is complete, but it shows slight differences from Table 3 of Schedule K of the Licence. The test group water chemistry identified for stations JER-SW1, JER-SW2, JER-SW3, JER-SW4 and JER-SW5 refers to the Pre-Construction Phase according to Table 3 of Schedule K of the Licence. Table 3 of AMEC (March 2005) proposes sampling at those stations for the construction and operation phases but does not refer to the pre-construction phase. It does make sense to collect data at those sampling stations at the construction and operation phases, but the Plan should mention that what is proposed is slightly different from what is required in the Licence, and this difference should be formally approved by the NWB¹.

In addition to chemical analysis, acute toxicity tests on rainbow trout and *Daphnia magna* to be conducted monthly on the PKCA discharge (as per Part G of the licence) and chronic toxicity testing on *Ceriodaphnia dubia* using water collected at the edge of the 200-m mixing zone in Lake C3 (as per Schedule L/Section 4, paragraph d, item iv of the licence) are included in the monitoring plan as mentioned in Section 3.3.2 of AMEC (March 2005).

Information regarding water quality parameters is provided in Table 1 of Schedule 1 of AMEC (March 2005). This table is generally compliant with Schedule K of the License, but it should be modified to reflect the exact requirements of Schedule K, such as by adding a reference to a 24- or 32-metal scan or equivalent and replacing the reference to “orthophosphate” by a reference to “orthophosphorus”.

¹ Murdock (December 5, 2006) agrees that the License is probably in error and that what the Plan proposes makes good sense.

b) Sample Types and Sample Containers

The Plan identifies the following sample types: site water quality (Section 2.2.1); receiving water body water quality (Section 2.2.2); water and sediment quality (Section 3.2.1); nonvertebrate aquatic biota (Section 3.2.3); and fish tissues (Section 3.2.4). The last three form part of the Aquatic Effects Monitoring Program.

Section 2.1 of the Plan states that solids geochemistry, thermal monitoring and ground ice will form part of the monitoring programme, but it contains no QA/QC procedures for them. AMEC (March 2005: 5-6) provides some details, but they do not include any QA/QC procedures. The Plan must be amended to identify QA/QC procedures for all of the parameters forming part of the monitoring programme.

The Plan does not provide any details regarding sampling procedures for sediments (Section 3.2.1), including the containers used to collect them. Its statement that *Sediment QA procedures will be similar* to those for water quality is inadequate. The applicable procedure should be described in full when the Plan is revised.

More details regarding sampling procedures for nonvertebrate aquatic biota and fish tissues are provided in the Mainstream Aquatics Ltd (March 2005: section 3.8.1) which was attached as Appendix A to the Plan. The Plan does not, however, refer to the relevant provisions of Mainstream Aquatics Ltd (March 2005). It is not clear, therefore, if the sampling methods and QA procedures identified there are intended to form part of the Plan.

We have already expressed our strongly held view that the Plan should be a comprehensive, independent and self-contained document issued by a single author.

Information regarding sample containers and preservation is provided on page 6 of the Plan by means of a reference to the protocols of the United States Environmental Protection Agency. The References section does not, however, direct the reader to the relevant documents.

c) Duplicate Water Samples

Section 2.2.2.1 of the Plan states that duplicates for some of the water samples taken will be submitted for analysis *To check on the precision of the samplers*.

Field duplicates provide insights into variability at the sampling sites, but they do not assist in judging the precision of the samplers. The precision or effectiveness

of the samplers is verified by such means as checking for full closure, adequate sample volume, checking the depth at which the sample was taken, confirming that the sampler was properly oriented relative to the direction of currents and looking for the presence of debris in the sample that might affect the chemistry of the sample.

The effectiveness of the sampler can be determined from a series of observations made by the technical crew at the time of sampling. These observations should be checked on the field sample sheet and determined according to the type of sampler used.

d) Trip Blanks

Section 2.2.2.1 of the Plan notes that trip blanks, which it defines as *...a set of bottles filled with demineralized - de-ionized water (supplied by the lab) and processed in the same manner as a collected water sample*, will be employed to ensure that no contamination is introduced into water samples from the bottles or preservatives.

In order to provide valid comparative results, the source of water for the blanks should be analyzed, so that reference results are available to compare with the analysis of the trip blanks upon their return to the laboratory.

All blanks provided to the laboratory should come with a laboratory certificate stating the purity of the water used in them. This does not mean that all trip blank bottles have been analyzed, but that the batch of water used to prepare those blanks has been analyzed. If a certified laboratory is used to provide analytical services, they will have the proper procedure to produce such a certificate.

The Plan does not describe how the trip blanks will be treated in the field. They should be opened and should be exposed to the same conditions as the regular samples.

e) Handling Water Samplers

The Plan lacks important details on field practices relating to water sampling. For example, it does not specify that, if boats or vehicles are used, the engines must be turned off before samples are collected, and samples must be collected up-wind from the engines. If the person handling the outboard motor is also in contact with the samples or the containers, clean gloves must be worn when handling the samplers.

The Plan does not specify how samplers should be carried and handled in the field. For example, will they be wrapped in clean plastic bags?

The next version of the Plan must correct the foregoing deficiencies.

3.8 Sample Tracing

3.8.1 Comments on Compliance

Schedule L, Item 2 of the Licence requires that the plan include information regarding logging of samples, sample handling, preservation, transportation requirements, information requirements and chain of custody.

a) Logging of Samples

The Plan does not include a description of the system used to identify samples. Chain of custody records are referred to only in Section 2.2.2.2, which addresses quality assurance management for the laboratory. Chain of custody and proper identification of samples begin with field sampling data, and these are not addressed in the Plan.

Section 3.0 of Mainstream Aquatics (March 2005: 13) refers to methods and the proper procedure for sample identification with regard to phytoplankton, as follows: *All samples were labeled with the station and replicate identifier, time, date, depth, volume sampled, preservative amount, and name of the collector.*

The Plan should include similar instructions for all types of sample.

The Plan does not describe procedures regarding the maintenance of a log of samples delivered to the laboratory, as required by INAC & NWTWB (July 1996). The next version of the Plan must correct that omission.

b) Sample Handling and Preservation

As indicated in INAC & NWTWB (July 1996), the Plan must describe how samples from each station are to be preserved, including such details as the concentration and amount of preservatives to be used. Some information (sample containers and preservatives) is provided in Section 2.2.2.2, but there is no detailed description of the sample handling and preservation methods to be used for all field samples. That oversight must be rectified in the next version of the Plan.

c) Transportation Requirements

A description of how sample integrity will be ensured from the time of collection to completion of delivery, as required by INAC & NWTWB (July 1996), is not addressed in the Plan. The next version of the Plan should describe the steps to be taken to ensure sample integrity from collection in the field to delivery at the laboratory.

d) Information Requirements and Chain of Custody

Chain of custody and documentation are important components of a sampling program. Thorough documentation is required to adequately track samples from the field through the laboratory and to prevent sample loss. Procedures should be clearly established to provide information regarding the content and the location of all documents related to field samples, and they should specify how access to the samples is to be controlled.

Limited information regarding chain of custody documentation is provided in Section 2.2.2.2 (Laboratory) of the QA/QC Plan. Reference to field parameters information to be collected for each station is made in Table 3.2 of AMEC (March 2005).

Subsequent versions of the Plan must contain more detail, including an example of the Request for Analysis form that might be submitted to the selected Analytical Laboratory.

3.9 Field Measurements and Calibration

3.9.1 *Comments on Compliance*

INAC & NWTWB (July 1996) requires that the Plan provide information regarding the rationale behind the choice of field equipment, as well as a description of how the equipment is maintained and calibrated.

Some references to field instrumentation are made in the Plan, as follows: Section 2.2.2.1 addresses DO meter, pH meter, conductivity meter and thermometer; Section 2.3 addresses water height recorder; Section 2.4 addresses in-stream current meter.

Section 3.1.4 of AMEC (March 2005) refers to the use of thermistors, but the model to be used and the reason for its selection are not described.

Information regarding calibration requirements is provided in the Plan for DO meter, pH meter, conductivity meter, thermometer, water height recorder, in-stream current meter and multi-probe, but those for thermistors are not provided.

Section 3.2.2 does not, however, describe the procedure for calibrating the DO multi-probe and does not state whether it will be calibrated for saturation or concentration. The DO meter may have to be adjusted frequently if the multi-parameter probe does not adjust automatically for changes in barometric pressure. The Plan should describe a procedure for inter-calibration that will have to be performed to correct all data against a reference instrument when different brands of instrument are used for a single purpose.

The make and model of field instrumentation are generally not described or justified in the Plan. Information on a water level recorder and a radio link equipment is given in Appendix B of AMEC (March 2005), but Section 3.1.6 thereof states that the equipment shown may not be what is used in the monitoring program.

Section 2.3 of the Plan refers to calibrating the height-recorders by establishing a minimum of three benchmarks on bedrock near them. In keeping with our finding that the Plan provides general ideas and broad principles, we note that this is another instance in which it lacks detailed quality objectives.

Section 2.4 of the Plan specifies that calibration of the in-stream current meters will be undertaken at a minimum every two years in one of several towing tanks available in Canada. Without knowing what model of current meter will be used, it is impossible to know whether the proposed calibration frequency is adequate. If, for example, a Price IIA current meter is used, it needs to be calibrated annually and whenever the rotor is banged or damaged.

Notwithstanding the statement in the Plan, we are aware of only one towing basin in Canada that is recognized for purposes of calibrating current meters. It is located at Environment Canada's National Water Research Institute, Burlington, Ontario. It would be helpful for the next version of the Plan to give contact information for each organization that is qualified to calibrate current meters.

The Plan also states that the difference between sequential measurements using the area and flow method must be <10%. This is not required if a detailed survey of the discharge transect is performed with a procedure to account for outliers and may also be unrealistic due to the level of effort and time required.

We did not find any indication on the discharge method. How many verticals per section, what depths are measurements taken? What is the calculation approach? When are repeat measurements needed if strange measurements occurred (i.e. not respecting the vertical logarithmic distribution)? When are one or two measurements on a vertical required? Terzi (1983) provides most, if not all, of the information. At least, this QA/QC document should reference available procedures if applicable.

One series of measurements is acceptable when using a point measurement current meter and the multiple verticals approach. If using a Doppler, then four reciprocal transects are required, and the coefficient of variation should then be less than 5%. The Inland Water Directorate of Environment Canada has established procedures for such surveys.

The next version of the Plan must describe in appropriate detail all of the equipment that will be used, the reasons for selecting it and maintenance and calibration procedures.

3.10 Sampling and Analysis

3.10.1 Comments on Compliance

3.10.1.1 Field Checks

As indicated in INAC & NWTWB (July 1996), the Plan should provide information regarding the use of field blanks, replicate samples, spiked samples and split samples.

The Plan provides adequate information regarding methods of field checks, as follows: Section 2.2.2.1 for receiving water body water quality; Section 3.2.3 for nonvertebrate aquatic biota; and Section 3.2.4 for fish tissues. Information on field checks for solids geochemistry is found in Section 3.1.2 of AMEC (March 2005). There are, however, no field checks for sediment sampling.

Subsequent releases of the Plan should contain field checks for each sample type and analytical method.

3.10.1.2 Nonvertebrate Aquatic Biota

Section 3.2.3 of the Plan states that *Consistency of identifications for each indicator is achieved by using the same person.*

That approach may ensure consistency in the analysis of any given sample, but it does not contribute to ensuring accuracy. Moreover, even the between-sample consistency is lost if the person in question ceases to be available.

3.10.1.3 Sample Splitting

Section 3.2.3 of the Plan states that split samples collected from five per cent of the samples will be submitted as blinds. Splitting can be a major source of bias if it is not done properly. The Plan should describe in detail how it will be done, preferably by citing or reproducing the relevant parts of Environment Canada (2002).

3.10.1.4 Sample Identification

The Plan should describe in detail the system that will be used to number and identify samples.

3.11 Laboratory Analysis

3.11.1 Comments on Compliance

The name of the commercial laboratory that will be conducting the analysis for Jericho Diamond Mine was not identified in the Plan. Ideally, the laboratory should be accredited by the Canadian

Associated for Environmental Analytical Laboratories (“CAEAL”) and should provide a certificate describing the parameters for which it is accredited.

AMEC (March 2005: Section 3.1.7 pages 8-9) refers in very general terms to methods of analysis for general water parameters, total and dissolved metals and organic parameters. Additional information on methods of analysis is also provided in Section 3.2 of AMEC (March 2005) for acute toxicity and chronic toxicity.

Detailed methods of analysis for phytoplankton, zooplankton, periphyton, benthic macroinvertebrates and fish tissues are provided in Mainstream Aquatics Ltd. (March 2005).

The next version of the Plan should identify the laboratory that will be used, reproduce its accreditation and describe all of the analytical measures that will be used.

As required by INAC & NWTWB (July 1996), the commercial laboratory should provide descriptions of any methods of analysis that are not outlined in APHA, AWWA & WPCF (1989), and those descriptions should be added to the next version of the Plan.

3.11.2 Inter-laboratory Comparisons

Section 2.2.2.2 of the Plan notes that a laboratory certified by the Canadian Association for Environmental Analytical Laboratories Inc. (“CAEL”) will be used for analyses and that the same laboratory will be used year after year ...*for continuity*...

The implication that keeping the same laboratory will guarantee or contribute to repeatability is spurious. Any laboratory that is certified by the CAEL should provide the same quality of analytical performance.

3.11.3 Data Interpretation and Response

The Plan does not specify how the results of the laboratory analyses will be interpreted or what will be done in response to them.

The Plan should set out the proposed acceptance criteria and should state what action, such as collecting fresh samples or repeating the analyses, will be taken if the acceptance criteria are not met. The acceptance criteria should derive from clearly stated assumptions as to why certain types or degrees of change are deemed to be significant from an environmental perspective. They should also recognize that chemical results that are close to detection limits are likely to show high variability linked to the precision of the analytical method.

The Plan does not state if the chemist responsible for performing the analyses will be involved in evaluating and interpreting the results. That might be a good approach, primarily to ensure that they are not biased by analytical constraints.

3.12 Laboratory Quality Control and Reporting

3.12.1 Comments on Compliance

3.12.1.1 Commercial Laboratories

Section 2.2.2.2 of the Plan provides information regarding general requirements for quality control in commercial laboratories. This section should be modified in subsequent releases of the Plan in order to describe the actual quality assurance/quality control program of the commercial laboratory that will be selected to perform the work.

It is not clear if control samples will be submitted to a second commercial laboratory as recommended by INAC & NWTWB (July 1996).

The next release of the Plan should be clear on those matters.

3.12.1.2 Reporting

INAC & NWTWB (July 1996) mentions that the plan should indicate what information will be reported. The Plan should contain any control charts or graphs that will display the precision and accuracy of the methods used to analyze the samples. It should also indicate the number of replicate samples that will be collected and submitted with the report.

Section 4.2 of the Plan refers to reporting, but it is limited to the qualitative aspects of reporting, such as the review of reports by consultants and Tahera's environmental personnel.

The list of reports to be provided to NWB is given in section 5.2 of AMEC (March 2005).

The Plan itself should contain a comprehensive description of the proposed reporting protocols.

3.12.1.3 Data-Verification

The Plan does not describe how data will be verified. Will there be a system of double entries in the databases? Will a given percentage of the data be verified? Will standard field sheets be used?

3.13 Statistical Analysis

The Plan does not address techniques of statistical analysis, but there are reasons to believe that it could usefully do so.

AMEC (March 2005: Section 5.1.2.5) identifies the statistical techniques that will be used to examine the data on water chemistry. ANOVA is proposed for the quantitative analysis of spatial trends at the stations within the Jericho River.

Given that the water bodies in question are interconnected, it is possible that spatial autocorrelation occurs between the parameters measured. ANOVA is not an appropriate technique if there is spatial autocorrelation. The possibility of spatial autocorrelation should be examined when the data are processed, bearing in mind that the data from some stations could be discarded or pooled. ANOVA also requires that all data be available for each sampling station at each sampling event.

Given the numerous variables to be analyzed for each station and each sampling event, Principal Component Analysis might offer a simpler way of determining spatial and temporal trends.

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