Mackenzie Valley
Review Board

April 3, 2012

Note to file

EA 0809-004
NICO Project, Fortune Minerals Limited

To parties:

Re: 2012 Supplementary Baseline Plankton Study Plan

Please find attached a submission from Fortune Minerals Limited (Fortune) titled, Fortune Minerals NICO Project 2012 Supplementary Baseline Plankton Study Plan.

During the technical meetings held February 7-9, 2012, Fortune committed to implementing a supplementary phytoplankton and zooplankton baseline survey at the NICO project site to supplement the existing data. Fortune also committed to supplying the proposed work plan for this survey to parties for review and comment.

Parties are invited to provide comments to Fortune on this baseline study plan. Fortune would appreciate comments by April 30.

Regards,

(original signed by)
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March 2012

NICO PROJECT PLANKTON BASELINE PROGRAM

Fortune Minerals NICO Project 2012 Supplementary Baseline Plankton Study Plan

Submitted to:
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Fortune Minerals Limited
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PROPOSAL

Proposal Number: P213280007
Distribution:

1 copy – Fortune Minerals Ltd., London, ON
1 copy – Golder Associates Ltd., Yellowknife, NWT

Golder Associates

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1.0 INTRODUCTION

During the technical sessions on February 8, 2012, for the Fortune Minerals Limited (Fortune Minerals) NICO project (the Project), the assessment of the seasonality of plankton communities during the baseline period was identified as an information gap. Fortune Minerals made the commitment to complete a plankton program that would assess the seasonality of these organisms at the NICO site. This work plan details the proposed scope of work, schedule, and associated cost estimate for the collection of seasonal baseline data for the plankton communities in selected waterbodies within the Project area.

1.1 Scope of Work

The 2012 plankton baseline program includes collection of plankton samples from three lakes expected to be directly influenced by the Project (i.e., Nico, Peanut and Burke lakes) as well as from a reference lake (i.e., Reference Lake). The objective of the proposed plankton program is to assess baseline seasonality in the phytoplankton and zooplankton communities within these waterbodies and to collect sufficient baseline data to allow for comparisons with potential future monitoring data. Additional plankton sampling will also be completed in Little Grid Pond to assess baseline conditions within this wetland area.

1.2 Background

The term "plankton" is a general term referring to small, usually microscopic organisms that live suspended in the water. For the purpose of this proposed baseline program, the term "phytoplankton" refers to the algal component of the plankton community, ranging between 2 and 20 micrometres (µm) in size. Based on the 2005 phytoplankton community data, it is anticipated that the 2012 data will be grouped into the following six major taxonomic groups:

- Cyanobacteria;
- Chlorophyceae (chlorophytes);
- Chrysophyceae (chrysophytes);
- Cryptophyceae (cryptophytes);
- Bacillariophyceae (diatoms); and
- Dinophyceae (dinoflagellates).

Additional major taxonomic groups (e.g., Euglenophyceae [euglenoids] and Xanthophyceae [xanthophytes]) will be included if present in the 2012 samples.

For the purposes of this proposed study, the term "zooplankton" refers to microscopic animals and includes Rotifera (rotifers) and three types of crustaceans, specifically Cladocera (cladocerans or water fleas), Cyclopoida (cyclopoid copepods), and Calanoida (calanoid copepods). Cyclopoid and calanoid copepods are considered separately because of taxonomic and ecological differences. Calanoids are typically herbivorous, feeding on phytoplankton; cyclopoids are typically omnivorous, feeding on phytoplankton and small zooplankton (Brönmark and Hansson 1998). Additionally, calanoids are almost exclusively pelagic (i.e., open-water), while cyclopoids

are dominated by littoral (i.e., near-shore) species, although a few pelagic species of cyclopoids can account for a major component of the planktonic community.

A full taxonomic analysis of phytoplankton and zooplankton community composition provides the best estimate of biomass through biovolume measurements (phytoplankton) and length-weight regression measurements (zooplankton). In addition, this type of analysis also provides taxonomic information that can be used to assess community changes that may occur as a result of the Project. Seasonal variation in both the phytoplankton and zooplankton community occurs under natural conditions, but changes in water quality resulting from discharge of treated effluent can also affect plankton community composition. The proposed plankton program is designed to assess baseline conditions, and variation in phytoplankton and zooplankton community structures under natural conditions. Future plankton monitoring data can be compared to these baseline conditions to assess potential Project-related changes.

Chlorophyll *a* has been widely used as a surrogate for phytoplankton biomass. Chlorophyll *a* is the primary photosynthetic pigment contained in phytoplankton, although there are also a number of secondary pigments (e.g., chlorophyll *b*, chlorophyll *c*, and carotenoids) (Wetzel 2001). Chlorophyll *a* concentrations are known to vary seasonally and by taxon (Wetzel 2001), which results in uncertainty in the use of chlorophyll *a* as a measure of phytoplankton biomass. Despite the potential uncertainty, chlorophyll *a* has been included as a parameter in the baseline plankton program as it can be strongly correlated with phytoplankton biomass and, therefore, offers a potential alternative monitoring parameter. Chlorophyll *a* has also been included because it is typically incorporated into the water quality model.

Phytoplankton and zooplankton communities can be useful early indicators of environmental change, because of their rapid response to changes in water quality. However, the inherent variability within the plankton community poses a challenge and also limits their usefulness as a monitoring tool. Plankton density, biomass and species composition vary vertically and horizontally within the open water; therefore, estimates are sensitive to the number of stations, samples, and the depth of the water column sampled (Findlay and Kling 2001; Paterson 2002). Seasonal succession within the plankton community and natural year-to-year variation also contribute to the inherent variability of these communities (Wetzel 2001; Paterson 2002).

The proposed baseline plankton program consists of sampling five stations within each of the waterbodies, with the exception of Little Grid Pond. Individual samples for phytoplankton, chlorophyll *a* and zooplankton will be collected at each station. Five stations in each lake is anticipated to provide adequate spatial coverage of the waterbodies to document baseline conditions in the plankton communities. Golder recommends assessing the baseline data using both univariate and multivariate statistical methods. The variability within plankton communities is inherently high and this can preclude the use of univariate statistics for control/impact design. However, the baseline data collected in 2012 can be assessed using univariate methods (e.g., Analysis of Variance) to determine if it is possible to establish a quantitative critical effect size. Five sampling stations in each lake is anticipated to provide sufficient statistical power to detect effects as well as incorporate regulatory guidance for aquatic environmental monitoring. In addition, this level of effort is sufficient to evaluate the feasibility of developing action levels according to the Wek'èezhìi Land and Water Board's draft response framework for adaptive management (WLWB 2010), if required.

Little Grid Pond is a wetland area that will be permanently covered by Project-related activities, but it is not directly comparable to the larger lakes where Project-related effects are anticipated to occur. The purpose of the plankton community monitoring in Little Grid Pond is to assess and document the seasonal variation in a wetland

plankton community with elevated arsenic levels during baseline conditions. The data will be used in the design of the treatment wetlands that will be built during operations. Due to the small area of Little Grid Pond, it is recommended that a total of three sampling locations be established in this waterbody.

Supporting environmental information will be collected at all sampling stations. This will include the following:

- *in situ* profile measurements of dissolved oxygen, temperature, pH, conductivity, and turbidity;
- Secchi depth; and
- ambient weather conditions.

These data will be used as supporting information during the analysis of the plankton community data.

1.3 Work Plan

1.3.1 Approach and Logistics

The proposed plankton program will consist of three sampling events during the open water season in each of the identified waterbodies. Each sampling event is anticipated to take a maximum of five days in each of July, August and September 2012. This assumes a morning arrival at the Project site, allowing time to complete sampling at Little Grid Pond and four days of additional field sampling in the other lakes; return travel to Yellowknife is assumed to be late afternoon/early evening on the fifth day. Additional time may be required if flight times have to be adjusted. Golder estimates that each station will require approximately one to one and a half hours to complete the required sampling. However, slinging equipment between waterbodies with the helicopter is required, and it may not be possible to complete the collection and processing of samples in more than one lake per day. Therefore, the cost estimate assumes that one lake will be sampled each day, with the Little Grid Pond sampling being completed as time allows (e.g., in the afternoon of the day the crew arrives at the Project site). Every effort will be made to maximize efficiency and complete the sampling program in as short a time as possible.

One field crew, consisting of one Golder Yellowknife staff and one local assistant, will be required for each sampling event. All Golder staff, local assistants, and equipment will be transported to the NICO Project site by float plane from Yellowknife, Northwest Territories. Sample locations will be accessed by helicopter, boat, quad, and by foot, as required.

One phytoplankton, one chlorophyll *a* and one zooplankton sample will be collected at each sampling station. In addition, two duplicate chlorophyll *a* samples, to determine within sample variability for quality control purposes, will be collected during each sampling program. For phytoplankton and chlorophyll *a* samples, water will be collected using a Kemmerer sampler at 2 metre (m) intervals within the photic zone (e.g., surface, 2 m, 4 m), which will be estimated as twice the Secchi depth. If the estimated photic zone extends to the bottom, water will be collected 1 m from the bottom to avoid disturbing the bottom substrate and potentially contaminating the samples with benthic material. For zooplankton samples, a 153 µm Nitex mesh plankton net will be towed vertically through the entire water column; however, the bottom of the net will kept 1 m from the bottom to avoid disturbing the bottom substrate and potentially contaminating the samples with benthic material. *In situ* profile measurements will be taken at 1 m increments throughout the water column.

Plankton samples will be preserved and submitted for analysis of community composition, as well as enumeration and determination of biomass. Taxonomic identification will be to the lowest practical level. Chlorophyll *a* samples will be field-filtered and frozen prior to shipment to the analytical laboratory for analysis. Golder will inquire about alternative methods of chlorophyll *a* sample storage in case access to a freezer at the Project site is not possible.

1.4 Schedule and Deliverables

Proposed sampling dates in 2012 are provided below; however, these dates will be finalized in consultation with Fortune Minerals:

- July 7 to 11;
- August 6 to 10; and
- September 3 to 7.

It is Golder's recommendation that the sampling programs be completed approximately one month apart through the open water season. Golder also recommends that the September field program occur near the beginning of the month as weather conditions are likely to be more favourable at this time.

The deliverable will include a baseline plankton community report, which will include a summary of the 2012 field data as well as an interpretation of the plankton community results (including applicable statistical analyses) and chlorophyll *a* concentrations. This interpretation will include an assessment of the seasonality as well as a comparison among lakes. Community data from Little Grid Pond will be presented as baseline information and an interpretation of the seasonality will be included; however, no statistical comparisons will be completed on the plankton community within this waterbody.

The delivery date for this report is contingent upon the receipt of the taxonomy data. Golder requires approximately two months from the date the sample results are received to the submission of the baseline plankton report. Once the taxonomist(s) are selected and dates for delivery of results are confirmed, a final schedule for the report will be determined in consultation with Fortune Minerals. If there is an unforeseen delay in the receipt of the sample results, Fortune Minerals will be contacted to discuss a change in the reporting schedule.

This work plan assumes that electronic files will be submitted for client review and approval. Hardcopies of the report, as well as CD versions, will be prepared and submitted to Fortune Minerals for submission to the appropriate regulatory agencies.

1.5 References

Brönmark C, Hansson LA. 1998. The Biology of Lakes and Ponds. Oxford University Press, New York, NY, USA.

Findlay DL, Kling HJ. 2001. Protocols for Measuring Biodiversity: Phytoplankton in Freshwater. Available at http://www.ec.gc.ca/Publications/4F5B7AEF-0B67-4D81-8F3F-62C103C5C9A6%5CFreshwaterMonitoringProtocolPhytoplanktonFreshwater.pdf. Accessed: February 2011.

Paterson M. 2002. Ecological Monitoring and Assessment Network (EMAN) Protocols for Measuring Biodiversity: Zooplankton in Fresh Waters. Available at: http://www.ec.gc.ca/Publications/7A547B5A-FBD2-42BC-8C6E-98E826F4C9EE%5CFreshwaterMonitoringProtocolZooplanktonFreshwater.pdf. Accessed February 2011).

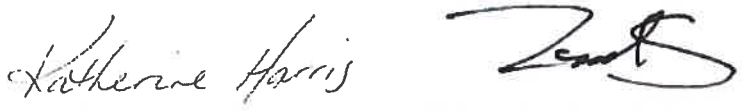
WLWB (Wek'èezhìi Land and Water Board). 2010. Draft: Guidelines for Adaptive Management – A Response Framework for Aquatic Effects Monitoring.

Wetzel RG. 2001. Limnology 3rd edition. Elsevier Science Academic Press, New York, NY, USA.

Proposal Signature Page

We trust that the above information meets your present requirements. If you have questions or require addition details, please contact the undersigned. Once again, I want to thank you for giving us the opportunity to provide services to your company.

GOLDER ASSOCIATES LTD.



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