DE BEERS
A DIAMOND IS FOREVER

April 29, 2003

Mackenzie Valley Environmental Impact Review Board (MVEIRB)
Box 938, 5102 – 50th Avenue
Yellowknife, NT X1A 2N7

Attention: Glenda Fratton, Environmental Assessment Coordinator

Dear: Glenda

SUBJECT: Destratification in Snap Lake

Based on our review of INAC's presentation titled, "Surface Water Hydrology Issues: Snap Lake Project", we anticipate a question on the potential for stratification in Snap Lake to persist from year to year (Slide 10).

The answer to this question was not provided in the environmental assessment report. To the best of our knowledge, no specific question regarding the potential for destratification was raised in the Information Requests, at the 2002 Technical Sessions, or in Intervener Technical Reports. Consequently, our response to this question will require the presentation of what could be interpreted as new information. To avoid the potential for surprises at the hearing, we are providing a technical note describing the basis for our response to this anticipated question.

If you have any questions concerning the information presented in this letter, please contact me at your convenience.

Sincerely,
SNAP LAKE DIAMOND PROJECT

Robin Johnstone
Senior Environmental Manager

cc. Sevn Bohnet, Indian and Northern Affairs Canada

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Snap Lake Diamond Project: Destratification Technical Note
Prepared by: Mark Digel, Golder Associates Ltd.
Date: April 29, 2003

The environmental assessment accounted for density stratification in Snap Lake under ice covered conditions caused by total dissolved solids (TDS) in the treated water discharge that are higher than in Snap Lake. Stratification is the layering of more dense water underneath less dense water, with a relatively sharp boundary between the two layers. We considered the potential for areas of Snap Lake to remain stratified into the open water period, and determined, based on professional judgment, that wind driven mixing would result in the destratification (breakdown of stratification) in Snap Lake during the open water conditions.

This determination was not described explicitly in the environmental assessment report. To the best of our knowledge, no specific question regarding the potential for destratification was raised in the Information Requests, at the 2002 Technical Sessions, or in Intervener Technical Reports. Consequently, the full answer to a question on the potential for destratification under open water conditions, requires presenting information that is not currently on the public record. The basis of our technical analysis is outlined below. This note does not provide a complete analysis, but does indicate the basis for our determination.

To confirm this judgment, we undertook an analysis of the potential for destratification and stratification in Snap Lake based on the Richardson Number (R). The Richardson Number governs Lake vertical mixing. Based on one dimensional steady state analysis, a lake is vertically well mixed when the R is less than 0.08 and remains stratified when the R is greater than 1.0. For R values between 0.08 and 1.0, a lake may intermittently stratify and destratify.

The Richardson Number is expressed as:

$R = [(Pb-Ps)/Ps] * (g*D)/V^2$

Where,
D = average lake depth (5.6 m)
Ps = density at lake surface (e.g., 1000.30 kg/m^3 at a TDS of 300 mg/L)
Pb = density at lake bottom (e.g., 1000.35 kg/m^3 at a TDS of 300 mg/L)
g = acceleration due to gravity (m/s^2)
V = estimated range of open water current velocities (0.1 to 0.4 m)

For the conditions expressed above, the R value ranges from 0.02 to 0.27. These calculations indicate that the lake will be vertically mixed most of the time, even in deep areas.

Based on this analysis and our professional judgment, we concluded that Snap Lake will remain well mixed during the open water period, and that this is valid throughout the life of the mine.

The best reference for this analysis is the book "Mixing in inland and coastal waters" - by Fisher, List, Koh, Imberger and Brooks; published by Academic Press (1979). The most relevant section is Chapter 7, Mixing in Estuaries. This chapter is most relevant because TDS driven stratification is a common occurrence in estuarine environments.