

**Louie Azzolini**

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**Sent:** Thursday, November 14, 2002 2:22 PM  
**To:** Louie Azzolini; Robin Johnstone (E-mail)  
**Cc:** Burgess, Margo; Hogan, Charlene; Clausen, Scott  
**Subject:** SNAP LAKE - NRCAN TECHNICAL ISSUES.WPD

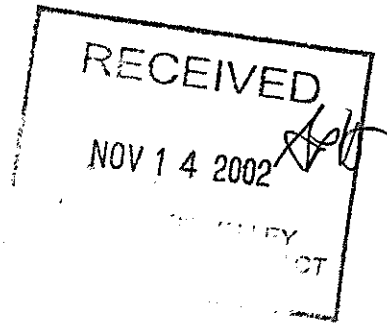


SNAP LAKE -  
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Louie and Robin,

Please find attached a list of the issues that Natural Resources Canada wishes to have discussed at the Technical Sessions.

Thank you.



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<<SNAP LAKE - NRCAN TECHNICAL ISSUES.WPD>>

## Natural Resources Canada's List of Issues for the Snap Lake Technical Sessions November /December, 2002

### Hydrogeology

#### **1. Deep ground water flow regime:**

*What is issue?* There is a lack of evidence to support De Beers' conceptual model of the deep ground water flow regime. New data is needed (head measurements and hydraulic conductivity) either through rehabilitating or redrilling monitoring well MW02-04. New reliable observations may lead to revisions to groundwater flow model.

*Why is it an issue?* Affects ground water flow regime assumed between Snap Lake and North Lakes, direction and quantity of flow. In turn this links to water treatment needs for mine inflows, as well as influx to North Lakes; also affects transport of trace metals post closure to adjacent lakes.

#### **2. Groundwater Flow Quantities and Directions**

a) *What is the issue?* Insufficient discussion to support proponent's assumptions in the mass balance calculations for North Lakes, in particular the assumption of steady-state conditions and perfect mixing of lake waters. Insufficient justification for rejection of higher groundwater flux estimates from numerical modeling. Stronger documentation required.

*Why is it an issue?* Dense, saline groundwater may accumulate in troughs on lake bottom and be retained in pore-water of fine grained sediment pores, invalidating the flux estimates.

b) *What is the issue?* Error in Table 5.1 Inflow to Northeast lake can not be greater than total outflow from North Lake.

#### **3. Mine inflow: model calibration**

*What is the issue?* Proponent's consultants, HCI were not aware of (and, therefore, did not use) head data to calibrate their numerical model of groundwater inflow to mine workings. This data needs to be provided to the consultants and their flow model calibrated.

*Why is it an issue?* Affects quantity of inflow to mine.

#### ***4. Mine Inflow: Uncertainty and Sensitivity***

*What is the issue?* Uncertainty estimates for parameters used in groundwater influx model have unrealistically low standard deviations (e.g. hydraulic conductivity).

*Why is this an issue?* May lead to underestimates of ground water inflow.

#### ***5. Mine inflow: Leakage factors***

*What is the issue?* Selection of parameter values for leakage formulas are too ad-hoc. More physically-based and defensible formulas are required for leakage.

*Why is this an issue?* The leakage is the most important parameter affecting modeling of groundwater influx to the mine.

### **North Lakes Water and Sediment Chemistry/Quality**

*What is the issue?* Proponent has discounted i) potential for lake thermal stratification, ii) fluctuations in dissolved oxygen content in water column, and as a result iii) fluctuations in oxygen penetration depth into sediments. Data available do not support i), seasonal measurements are lacking to support 2), and potential consequences of ii) have not been considered for metal mobility. Potential effects of shifting redox boundary cannot be ignored. Need for DeBeers to comment on:

- (1) the potential for thermal lake stratification and the consequences for water quality;
- (2) the possibility that DO profiles in the water column may shift seasonally with oxygen penetration into the sediments in summer and hypolimnetic anoxia under ice cover in winter; and
- (3) considerations of potential metal mobility through early diagenesis and possible factors affecting both the sequestration of metals into the solid phase and their release into the aqueous phase (both in pore water and the overlying water column).

*Why is this an issue?* Water quality

### **Water quality - acid precipitation effect on run-off from terrain in entire watershed**

*What is the issue?* Proponent has limited the assessment of acidic precipitation to

surface water bodies. Calculation of critical loading treats entire watershed as inert material that delivers a quantity of runoff to the lake. Acidic precipitation to the entire watershed, including terrain and the project site, should be considered.

*Why is this an issue?* May have implications for buffering capacity or potential release of metals from the terrain to surface water bodies. Subsequent overland flow to surface waters could adversely affect water and sediment quality.

## **Geotechnical**

### **1. Thermal conditions of North Pile: Climate Data input and assumptions, climate change**

*What is the issue?* Air temperature conditions assumed for Snap Lake area and determination of trends from these are questionable and not strongly justified. Need to use more relevant recent data and warming trends and to revisit the thermal modeling. Climate change scenarios not adequately considered.

*Why is this an issue?* This has implications for North Pile freezeback (time required), North Pile active layer development, and hence seepage, as well as thermal condition of the pile itself (and hence its geochemical/geotechnical performance).

### **2. Impact of project on permafrost thermal regime**

#### **Current distribution of pf and taliks and impacts of development and climate change on this distribution**

*What is the issue?* Lateral and vertical extent of taliks and permafrost not well defined or presented, cross-section/maps lacking. Hence difficult to ascertain spatial impact of thermal regime changes on the above.

*Why is this an issue?* Implications for surface and groundwater interactions and flows, water balance and quality.

#### **a) Impact of mine on ground thermal regime**

*What is the issue?* Permafrost thaw associated with thermal disturbance from mine operations (e.g. ramps, ventilation raises) - and whether this affects frozen/unfrozen boundaries and configuration /size of taliks - has been noted but has not been estimated. These should be determined, and climate change affects on the above

should be considered in the analysis over the length of the project and beyond. Increased seepage resulting from permafrost thaw in turn can enhance thermal disturbance (feedback effect) leading to further thaw and seepage.

*Why is this an issue?* Potential for increased size of zones of seepage and additional seepage to mine.

***b) Impact of roads, airstrip, mill and ancillary facilities on ground thermal regime***

*What is the issue?* Magnitude of changes to ground thermal regime associated with the construction/operation of the above facilities/infrastructure, including consideration of climate change, has not been indicated.

*Why is this an issue?* May affect, active layer thickness, permafrost thaw, and hence affect level of terrain disturbance as well as drainage changes.

***c) Impact of Water Management Pond***

*What is the issue?* No consideration/estimate of the impact of expansion of the pond on the ground thermal regime and the size of the talik beneath. Also climate change impacts on talik size and dam performance not considered.

*Why is this an issue?* Affects talik size; warmer conditions could lead to larger taliks which in turn could lead to increased seepage from the WMP.

**3. Aggregate use - evidence for massive ground ice / impacts**

*What is the issue?* EA documentation provides evidence for massive ground ice in eskers to be used for aggregate, however this does not seem to have been considered in impacts of the aggregate extraction. Is there other evidence, for example, geophysical surveys or borehole data that would support a conclusion that massive ice is not a concern? Note: a further report that has been referenced is now requested to help complete the review on this issue: report needed is Golder (2000) referred to in Golder et al. 2001 Surface Engineering Optimization Study Geotechnical Factual Report.

*Why is this an issue?* Affects determination of terrain disturbance related to ground thaw, also may affect estimates of aggregate.

**4. Climate impacts on Contwoyto winter road(s) and other winter access**

**roads**

*What is the issue?* Last 20 years of climate data should be used for trend analysis rather than an entire 1944 to 2001 period, in order to ensure a conservative approach for estimating operational window. Need to revisit analysis using different climate input parameters.

*Why is this an issue?* Current method used by De-Beers may lead to an over estimate of the length of the operational window for winter roads.

**Ore Dilution Model**

*What is the issue?* DeBeers acknowledges that their ore dilution was estimated. This will be revised when information from the 2001 Advanced Exploration Program is synthesized and modeled.

*Why is this an issue?* Could affect volume of waste rock produced and hence tailings estimates/management volume estimates.

**Bedrock/structural geology**

*What is the issue?* Data dump approach to provision of bedrock and structural geology information, not well synthesized or well incorporated into overall assessment.

*Why is this an issue?* Implications of structural geology for overall hydrogeological assessment not discussed.