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NRCan File # NWT-080

Mr. Martin Haefele
Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
Box 938, 5102-50th Ave.
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By email: mhaefele@mveirb.nt.ca

Re: Submission from Natural Resources Canada for the Terms of Reference and Work Plan for the proposed Gahcho Kué Project

Dear Mr. Haefele;

As per your request of June 1, 2007, Natural Resources Canada (NRCan) is pleased to provide comments on the draft Terms of Reference (ToR) and Work Plan for the proposed Gahcho Kué project. As you are aware, NRCan is likely a Responsible Minister under the *Mackenzie Valley Resource Management Act* (MVRMA) for the Gahcho Kué project with respect to our regulatory role under Section 7(1) of the *Explosives Act*. Further, during the scoping sessions that were part of the environmental assessment process, NRCan submitted evidence to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) outlining the department's information requirements for conducting an environmental assessment of an explosives factory.

NRCan's submission is structured in three parts: comments on the Work Plan; process comments on the ToR; and technical comments on the ToR. Comments on technical matters are provided by scientists in the Geological Survey of Canada from the Earth Sciences Sector of NRCan in the areas of hydrogeology, groundwater, permafrost and seismicity. NRCan's CANMET Mining and Mineral Sciences Laboratories have provided comments on metal leaching.

If you have any questions regarding NRCan's submission, please do not hesitate to contact me at (613) 947-1591 or by e-mail at jcoulson@nrcan.gc.ca.

Sincerely,

Jessica Coulson
Senior Environmental Assessment Officer

Enclosure (1)



NRCan Comments on the draft Terms of Reference and Work Plan for the EIS for the Gahcho Kué Diamond Mine

PART 1 – WORK PLAN

1. With respect to engaging experts at technical sessions, it will be important to plan strategically in order to ensure appropriate experts are notified in a timely manner to ensure their participation.

PART 2 – PROCESS COMMENTS ON TOR

Section 1.3: The draft Terms of Reference provided are not typical of those associated with other projects and instead are structured around key lines of inquiry and subjects of note and other issues identified in scoping sessions. It is understood that the intent is to ensure attention on areas of greatest concern and also to take a more holistic approach to the environmental assessment. The TOR however appear to focus more on the impact assessments related to these issues and do not provide guidance on specific requirements for such things as description of the existing environment. As suggested below (s.3.1.3) more details on baseline conditions are required.

NRCan acknowledges the reasoning for organizing the EIS by key lines of inquiry, however, NRCan concurs that this will result in a great deal of duplication and overlap. This could lead to difficulty for experts and the public to locate and understand all of the information in the document. Also, impact assessment of a particular Valued Ecosystem Component could become misinterpreted when applied within the ‘holistic’ context of a key line of enquiry without a clear methodology for linking the ‘two separate ways’. As a result, any expert reviewer whether scientific or a traditional knowledge holder will have difficulty in knowing how to confine their review comments to within their individual areas of expertise and knowledge. A clear structure will be essential to avoid a cumbersome document.

Section 1.4 – Cumulative Impacts:

NRCan notes that the MVEIRB Cumulative Effects Guidelines imply that the definition of ‘reasonably foreseeable’ includes both ‘proposed developments’ and development that have not been ‘formally proposed but can be reasonably foreseen’. However, extending Cumulative Effects Assessment (CEA) beyond the generally accepted concept of reasonably foreseeable future developments, based on knowledge of potential/known impacts of existing projects or those that have applied for regulatory approval, could introduce unconstructive speculation about future cumulative effects, CEA must first be built on the concept of reasonably foreseeable activities where impacts can be predicted with confidence to avoid excessive demands for information, unnecessary conjecture and ultimately, faulty assessments of future environmental or socioeconomic impacts. This is particularly true in a region where most of the mineral exploration projects are at too



early a stage to predict future advancement and the current pace of diamond mine development is likely to slow.

If CEA is to consider more speculative future activities, this analysis should be clearly separated, limited in scope and structured in a manner that clearly reflects the underlying assumptions for different development scenarios. Clarity on the scope of the cumulative effects assessment needs to be established as early as possible in the EIR process

Section 2.2.1 - According to the ToR, the end of the temporal scale is when reclamation is achieved. This should include post-reclamation monitoring, which would ensure that reclamation is in fact achieving its goals.

Section 3.1.2 - Suggested rewording under *Alternative means for carrying out the development* - “The EIS should provide a (reasonably) detailed analysis of alternatives....”.

The addition of the qualifier ‘reasonably’ will provide necessary flexibility in the EIS to adjust the level of detail in the alternatives assessment. It should be considered that the process for arriving at a final project design does not typically require equally detailed engineering and impact studies for all the interim abandoned or modified design elements. Requests for detailed information on project alternatives should be justified if the analysis requires producing new data or studies.

Section 3.1.3 – This section indicates that a detailed description of the environment is required and that it should be of sufficient detail for the parties to assess potential impacts from the environment. An adequate description of baseline conditions is required to conduct an assessment of environmental impacts and this information is also required to enable MVEIRB and reviewers of the EIS to understand how the proponent reached conclusions regarding impacts. The proponent is directed to specific sections (4 to 6) in the TOR that deal with impact assessment for the level of detail required and is also encouraged to contact individual parties to the EIR to inquire about specific information needs. Not including specific guidance on the requirements for description of the existing environment could potentially lead to some important aspects being missed in the EIS and also lead to a lengthening of the review process as detailed information is acquired through information requests. It is suggested that MVEIRB include in the TOR more specific requirements or guidance for description of the present environment.

NRCan further notes that in encouraging the developer to directly contact individual parties for information needs could raise some concerns:

1. transparency: the transparency of the EIR process must be maintained. This can be accomplished through posting all official proceedings (i.e., meeting minutes, correspondence, etc.) on the MVEIRB registry.
2. whom to contact: This could be subjective and depending on the party, information needs may vary. What assurances are there that the correct parties will be contacted? There needs to be some additional guidance in the ToR on how this will be achieved in the absence of environment description information in the ToR or further direction on



information requirements for the environment description should be provided in the ToR. Information requirements in the area of permafrost and related issues are discussed further in Part 3 of this submission.

Section 3.2.2 - Earlier in the document, the proponent is asked to provide significance determinations for key lines of inquiry and subjects of note, along with the conventional component specific format. The criteria to be used for significance determinations provided in Section 3.2.2 is based on conventional environmental assessment best practices. Drawing clear conclusions on the significance of certain key lines of inquiry or subjects of note that don't lend themselves to this structure may be challenging.

Section 4.5- The final paragraph attempts to define the limits to which the proponent can be made responsible for resolving existing social problems in communities. However, the TOR does demand detailed analysis of social issues and the facilitation by the proponent of a 'cooperative approach' to solving problems beyond what could be considered a project-related impact mitigation. The TOR should, therefore, seek information on the roles and responsibilities of government agencies, communities and the proponent in providing information and implementing solutions. This will help define the extent to which the proponent can provide analysis, probe the social issues of communities and control initiatives for mitigating social impacts.

Section 4.7 Given that Impact Benefit Agreements (IBAs) are being used as a 'vehicle for addressing social, cultural and economic impacts', the TOR should provide guidance on how the EIS can distinguish impact mitigation measures external to IBAs and those likely to be included in IBAs. Although public knowledge of the details of these private agreements is limited, the panel will need sufficient information to have confidence that socioeconomic impact mitigation and monitoring is complete and not duplicative.

Section 5.13 Aboriginal Rights and the Interconnectedness of Issues

The TOR demands that the EIS provide an analysis of how Aboriginal rights may be affected by the proposed development. The panel review will certainly provide the opportunity for first nations to express how Aboriginal rights may be impacted. However, NRCan concurs with INAC's conclusions that this responsibility rests with the Crown. Please refer to INAC's more detailed comments on this section.

Section 9 – NRCan recommends that once conformity on the EIS is completed, the number of hard copies for each party be determined prior to distribution.



PART 3 – TECHNICAL COMMENTS ON THE DRAFT TERMS OF REFERENCE

A – Metal Leaching (CANMET MMSL)

NRCan recommends that the potential metal leaching of waste rock and processed kimberlite (under either acid or neutral conditions) be included. This should be placed with the acid generating potential of waste rock as they are usually linked.

B – Seismicity (Geological Survey of Canada)

There is not much risk from earthquakes, as the lowered lake reduces the dyke heights, and the hazard is low. NRCan suggests that the proponent should be aware about the recommended level of seismic design of the shield (NBCC 2005), and ensure that the proponent is comfortable with the performance of the dykes at weak shaking levels.

C – Hydrogeology / Ground water (Geological Survey of Canada)

Documents Consulted:

- DeBeers Canada Gahcho Kué Project, Application Report for the Mackenzie Valley Land and Water Board, November 2005.
- Mackenzie Valley Environmental Impact Review Board, Reasons for Decision and Report of the Environmental Assessment for the DeBeers Gahcho Kué Diamond Mine, Kennady Lake, NT, June 28th 2006.
- Mackenzie Valley Environmental Impact Review Board, Gahcho Kué Diamond Mine Environmental Impact Review, Terms of Reference for the Environmental Impact Statement (Draft), June 1st 2007.

All three documents were reviewed; however, the scope of this review is limited to issues of groundwater quantity and quality as addressed directly or indirectly in the following sections of the draft Terms of Reference (ToR): 4.2, 4.4, 5.5, 5.6 and 8.3. The Gahcho Kué ToR differs from other ToRs in that the MVEIRB review Panel requires the EIS to be structured according to general holistic areas of concern voiced by stakeholder communities rather than according to the usual Valued Ecosystem Components (VECs). The broad areas of concern related to the project have been prioritized into seven “Key Lines of Inquiry” encompassing multiple “category 1” issues as well as fourteen “Subjects of Note” encompassing multiple “category 2” issues of lesser concern. The review Panel requires that the EIS report predictions of impact and determinations of significance in the form of an overview analysis for each Key Line of Inquiry and Subject of Note, as well as in the conventional VEC format. Table 8.3 of the ToR identifies eight issues related to groundwater quantity and quality. In the following review, the Key Line of Inquiry and/or Subject of Note, and the specific EIS information requirements associated with each of these issues are summarized and located within the ToR.



Topic: Water – Permafrost

Issue: Effects of permafrost freezeback on exposed lake bed

Key Line of Inquiry: Water Quality and Fish in Kennady Lake

Subject of Note: Permafrost, Groundwater and Hydrogeology

ToR section(s): 8.3, 4.2, 5.5

Section 4.2 of the ToR, related to the Key Line of Inquiry “Water Quality and Fish in Kennady Lake”, requires that the EIS address the following information requirements:

- the hydrogeological dynamics of the lake bottom under freezing conditions, in particular the potential for highly concentrated deep ground water to be expelled into the remaining ponds during freeze up

Section 5.5 of the ToR, related to the Subject of Note “Permafrost, Groundwater and Hydrogeology”, requires that the EIS provide a detailed analysis of the feasibility of sequestering contaminants in the mined-out pits over the long term, including the following specific information:

- the dynamics of the lake bottom under freezing conditions, in particular the potential for highly concentrated deep ground water to be expelled into the remaining ponds during freeze up

Topic: Water – Groundwater/Hydrogeology

Issue: Impacts of pits on movement and quality of groundwater

Subject of Note: Permafrost, Groundwater and Hydrogeology

ToR section(s): 8.3, 5.5

Section 5.5 of the ToR, related to the Subject of Note “Permafrost, Groundwater and Hydrogeology”, calls for a comprehensive analysis of this issue in the EIS, including specific information on:

- simulations of the effects of lake dewatering and excavation of pits on ground water flow and quality in the Kennady Lake area in the short and in the long term as well as details on how groundwater flows will be managed

Topic: Water – Groundwater/Hydrogeology

Issue: Interaction between groundwater and submerged waste

Key Line of Inquiry: Water Quality and Fish in Kennady Lake

Subject of Note: Permafrost, Groundwater and Hydrogeology

ToR section(s): 8.3, 4.2, 5.5

Section 4.2 of the ToR requires that the EIS provide a detailed analysis of all impacts to fish abundance, health and fitness for consumption, as well as to water quality in general. In relation to groundwater, the following specific information requirements must be addressed:



- any interactions between ground water and submerged processed kimberlite and waste rock, including the possibility of the pits being a long term contamination source

Section 5.5 of the ToR requires that the EIS provide a detailed analysis of the feasibility of sequestering contaminants in the mined-out pits over the long term, including specific information on:

- the potential interaction between ground water and the open pits, as well as between ground water and submerged waste rock or kimberlite, including the possibility of the pits being a long term contamination source

Topic: Water – Groundwater/Hydrogeology

Issue: Relationships between taliks and groundwater water flow regime

Subject of Note: Permafrost, Groundwater and Hydrogeology

ToR section(s): 8.3, 5.5

Section 5.5 of the ToR requires that the EIS provide a detailed analysis of the feasibility of sequestering contaminants in the mined-out pits over the long term, including specific information on:

- the relationship between taliks (i.e. unfrozen sections of soil and a lake) and ground water flows in the project area, particularly potential for taliks acting as a pathway for contaminants, including the distribution of taliks in the project area and any connection or interactions between taliks of different lakes

Topic: Water – Groundwater/Hydrogeology

Issue: Short-term and long-term impacts on groundwater flow

Subject of Note: Permafrost, Groundwater and Hydrogeology

ToR section(s): 8.3, 5.5

Section 5.5 of the ToR requires that the EIS include specific information on:

- simulations of the effects of lake dewatering and excavation of pits on ground water flow and quality in the Kennady Lake area in the short and in the long term as well as details on how groundwater flows will be managed

Topic: Water – Groundwater/Hydrogeology

Issue: Management of groundwater flows by DeBeers

Subject of Note: Permafrost, Groundwater and Hydrogeology

ToR section(s): 8.3, 5.5

Section 5.5 of the ToR requires that the EIS include specific information on:

- simulations of the effects of lake dewatering and excavation of pits on ground water flow and quality in the Kennady Lake area in the short and in the long term as well as details on how groundwater flows will be managed



Topic: Water – Water Quality

Issue: Pits as long-term contamination sources

Key Line of Inquiry: Water Quality and Fish in Kennady Lake

Key Line of Inquiry: Long Term Biophysical Effects and Closure and Reclamation

Subject of Note: Permafrost, Groundwater and Hydrogeology

Subject of Note: Waste Rock and Processed Kimberlite Storage

ToR section(s): 8.3, 4.2 4.4, 5.5, 5.6

Section 4.2 of the ToR stipulates that the EIS must provide a detailed analysis of all impacts to fish abundance, health and fitness for consumption, as well as to water quality in general. In relation to groundwater, the following specific information requirements must be addressed:

- Any interactions between ground water and submerged processed kimberlite and waste rock, including the possibility of the pits being a long term contamination source.
- A detailed evaluation of potential contamination sources including: mill effluent, lakebed sediments, backfilled pits, use of explosives, spills (including cumulative effects of minor spills over time), waste rock and processed kimberlite, and deep ground water, including adequate information to evaluate the potential for dust generation from the exposed lake bed, e.g. substrate characteristics, particle size, sediment chemistry, as well as bench testing of drying behaviour.

Section 4.4 of the ToR, related to the Key Line of Inquiry “Long Term Biophysical Effects and Closure and Reclamation” calls for an analysis of the viability of the plan to encapsulate processed kimberlite and mine water in mined-out pits and its effects on the lake ecosystem after mine closure.

Section 5.5 of the ToR requires that the EIS provide a detailed analysis of the feasibility of sequestering contaminants in the mined-out pits over the long term, including the following specific information:

- the potential interaction between ground water and the open pits, as well as between ground water and submerged waste rock or kimberlite, including the possibility of the pits being a long term contamination source

Section 5.6 of the ToR related to the Subject of Note “Waste Rock and Processed Kimberlite Storage” is closely connected to the Subject of Note “permafrost, groundwater, hydrogeology” and to the Line of Inquiry “Water Quality and Fish in Kennady Lake”. However, the ToR calls for the storage of waste rock and processed kimberlite in the mined out pits and in on-land facilities to be treated as a subject in its own right. In particular, the EIS must provide a detailed description and analysis of how any water contamination will be avoided over the long term, over many decades or even centuries after mine closure.



Topic: Water – Water Quality

Issue: Geochemistry of waste rock and processed kimberlite

Key Line of Inquiry: Water Quality and Fish in Kennady Lake

Key Line of Inquiry: Long Term Biophysical Effects and Closure and Reclamation

Subject of Note: Waste Rock and Processed Kimberlite Storage

ToR section(s): 8.3, 4.2, 4.4, 5.5, 5.6

Section 4.2 of the ToR requires that the EIS contain the following specific information:

- A detailed evaluation of potential contamination sources including: mill effluent, lakebed sediments, backfilled pits, use of explosives, spills (including cumulative effects of minor spills over time), waste rock and processed kimberlite, and deep ground water, including adequate information to evaluate the potential for dust generation from the exposed lake bed, e.g. substrate characteristics, particle size, sediment chemistry, as well as bench testing of drying behaviour.

Section 4.4 of the ToR calls for an analysis of the viability of the plan to encapsulate processed kimberlite and mine water in mined-out pits and its effects on the lake ecosystem after mine closure.

Section 5.5 of the ToR requires that the EIS provide a detailed analysis of the feasibility of sequestering contaminants in the mined-out pits over the long term, including the following specific information:

- the chemical stability of co-disposed waste rock and processed kimberlite

Section 5.6 of the ToR related to the Subject of Note “Waste Rock and Processed Kimberlite Storage” is closely connected to the Subject of Note “permafrost, groundwater, hydrogeology” and to the Line of Inquiry “Water Quality and Fish in Kennady Lake”. However, the ToR calls for the storage of waste rock and processed kimberlite in the mined out pits and in on-land facilities to be treated as a subject in its own right. In particular, the EIS must provide a detailed description and analysis of how any water contamination will be avoided over the long term, over many decades or even centuries after mine closure.

In conclusion, the above list of eight groundwater issues identified in Table of 8.3 of the ToR appears comprehensive. Each of these issues is associated with one or more requirements for information under a ToR Key Line of Inquiry or Subject of Note and should, therefore, be thoroughly addressed in the EIS for the Gahcho Kué project.



C – Permafrost and Related Issues (Geological Survey of Canada)

Documents Consulted:

- Mackenzie Valley Environmental Impact Review Board Draft Terms of Reference for the Environmental Impact Statement of Gahcho Kué Diamond Mine (June 1 2007)
- Mackenzie Valley Environmental Impact Review Board Reasons for Decision and Report of Environmental Assessment for the DeBeers Gahcho Kué Diamond Mine, Kennady Lake NT (June 28 2006)
- DeBeers Canada Gahcho Kué Project Application report for the Mackenzie Valley Land and Water Board (November 2005)

Comments provided on the TOR generally focus on issues related to the physical environment including those related to permafrost and properties of geological materials (geotechnical conditions) and related impacts.

Note that in some cases, the suggestions have drawn on TOR for other projects including the Mackenzie Gas Project and also mining projects in both NWT and Nunavut. Since there is some overlap between the issues of concern and also the sections in the draft TOR, there is some repetition in the suggestions offered below and there has been no attempt to indicate which section is most appropriate. The comments are offered to identify gaps or the need for requirements to be stated explicitly rather than an attempt to provide precise wording for the TOR.

The intent of the comments and suggestions provided is not prescriptive but rather to ensure that the information provided is adequate to enable MVEIRB to determine whether the conclusions reached by the proponent regarding environmental impacts are supported by the information provided in the EIS.

Specific Comments

Note all comments are keyed to specific page numbers and sections in the draft TOR.

Section 3.2 Assessment Methods and Presentation

Specifically related to 3.2.1 Impact Predictions

The list of requirements presented appears to only apply to the assessment of impacts of the development on the environment. However, assessment of the impact of the environment on the project should also be considered. Although the last line in this section indicates that methods used to predict how the environment could change the development should be explained, it is suggested that this be moved to the preamble in the first paragraph. This would give the same emphasis to predictions of the impacts of the environment on the project and also make clear that the detail required in the description of the methodology is similar to that for the assessment of impacts of the project on the environment. It is also suggested that the impact of climate change and variability be included in this section as it should be considered in the impact assessment



(both the impact of the project on the environment and the impact of the environment on the project).

It is also suggested that the following points be added:

- Information must be sufficient to understand the nature of specific impacts and how conclusions were reached
- EIS should provide a clear traceable path of information from baseline conditions through identification of potential impacts, mitigation, residual impacts, and determination of significance
- Supporting documentation should be provided in separate volumes (appendices) and should be referenced by volume section and page number in the text of the EIS (this would include any reports submitted by consultants)
- In addition to identifying assumptions and specification of data collection methods, the EIS should also provide the input information (baseline data, definition of model parameters etc.) utilized in the impact analysis

Section 4.2 Water Quality and Fish in Kennady Lake

The 5th bullet dealing with hydrogeological dynamics of the lake bottom under frozen conditions should also include the following: Assessment of changes in the thermal regime of the lake bottom and the extent of freezing.

The project description (section 2.11.1) indicates that there is a requirement for any potentially reactive (i.e. acid generating) country rock, mine waters and barren kimberlite to be effectively encapsulated within waste rock in a location that will freeze and remain frozen. It is unclear from the project description whether this would include both the disposal in the waste rock pile to the southwest of Kennady Lake and the on-land processed kimberlite (PK) facility on the east side of Kennady Lake (i.e. is frozen encapsulation a requirement for these facilities). Since there appears from the project description some requirement for frozen encapsulation to isolate contaminants from the environment and reduce impacts on water quality of Kennady Lake, it is suggested that the TOR also include some requirements for the assessment of the maintenance of frozen conditions and containment of contaminants in these facilities and potential for impacts on the water quality of Kennady Lake. Specifically the TOR should require an assessment of the thermal conditions of the waste rock and PK piles and demonstrate the long-term maintenance of frozen conditions including incorporation of climate change.

Since knowledge of the subsurface thermal regime and permafrost distribution is required to assess the impact of the project on water quality, it is suggested that the TOR provide more specific requirements regarding the baseline conditions. These would include:

- a description of the present subsurface thermal regime within the project area including beneath and adjacent to Kennady Lake (understanding the present conditions is required to predict future conditions such as those occurring following lowering of lake level)



- a description of the current configuration and extent of permafrost and taliks within the project area including beneath and adjacent to Kennady Lake (important to understand linkages between surface water and groundwater)
- a description of the properties of subsurface materials including ice content (this is important to better understand stability of underlying materials and also potential linkages between surface and subsurface water flows and delineation of potential flow paths between waste management sites [waste rock and PK] and surface water bodies or groundwater).

There does not appear to be an explicit requirement for an assessment of the water balance for Kennady Lake in this section or others dealing with water quality or quantity. It is likely that a description of baseline conditions will also be required and MVEIRB should consider adding this to the TOR.

Note that these comments are also linked to Section 8.3 Water and 2 subjects of note Permafrost and Groundwater/Hydrology including relationships between taliks and ground water flow and effects of freeze-back of lake bed, freezing of processed kimberlite. There are also linkages with section 8.4 (other) and the subject of note of Physical Stability including waste rock and PKC disposal and impacts of changing permafrost

Section 4.4 Long Term Biophysical Effects and Closure and Reclamation

The first, second and ninth bullets deal with long-term stability of waste rock and processed kimberlite storage facilities. As mentioned above, the project description appears to indicate that encapsulation of this waste in a frozen state (particularly waste that is potentially acid generating) is required to isolate it from the surrounding environment. It is not clear from the TOR if physical stability is meant to include the maintenance of frozen conditions. It is suggested that the TOR include a specific reference to the demonstration of long-term maintenance of frozen conditions both within and beneath waste piles including under scenarios of climate change should the long-term waste storage be reliant on frozen conditions. With respect to the maintenance of frozen conditions, specific requirements for description of the existing environment should also include a description of the subsurface thermal regime and properties of the underlying materials (including ground ice conditions) in the vicinity of all proposed waste storage sites.

Note that these comments are also linked to Section 8.3 Water and 8.4 (other) and the subjects of note Permafrost and Physical Stability including problems associated with freeze-back of processed kimberlite, waste rock and PKC co-disposal and impacts from changing permafrost

Section 5.5 Permafrost/Groundwater and Hydrogeology



Some of the suggestions provided here are similar to those provided for section 4.2 and 4.4

It is suggested that the third bullet also include a baseline description of the ground thermal regime within the project area including a description of the current configuration and extent of permafrost and taliks (including frozen/unfrozen interfaces). This is suggested as an addition to the information that is required in this bullet (and is similar to that suggested for section 4.4) to provide a broader description of the current ground thermal regime and permafrost conditions.

As mentioned above, there is a need to ensure that adequate information on the current subsurface thermal regime (including that beneath Kennady Lake) is provided as it is required to assess potential changes in thermal conditions (and also permafrost conditions) and associated impacts. This information is also required to understand the extent of freezing that will occur in the lake bottom (bullet #5) and also for the long-term modelling of permafrost conditions that is required in bullet #6 as well as stability of waste rock and PK (should there be a reliance on thermal conditions).

It is suggested that bullet #5 be modified to indicate that an assessment is required of the changes in the thermal regime of the lake bottom and also the extent of freezing that will occur (see comments on section 4.2).

Note that these comments are also linked to Section 8.3 Water and 2 subjects of note Permafrost and Groundwater/Hydrology including effects of permafrost freezeback on exposed lake bottom and the relationships between taliks and groundwater flow

Section 5.6 Waste Rock and Processed Kimberlite Storage

As mentioned above, the project description indicates that waste rock and processed kimberlite storage will utilize frozen encapsulation. If there is to be a reliance on maintenance of frozen conditions, it is suggested that the TOR include the following (note these are similar suggestions to that provided for other sections):

- Description of current baseline subsurface thermal and permafrost conditions as well as characteristics of subsurface materials (including ground ice conditions) in the vicinity of the proposed waste storage sites.
- Demonstrate the long-term maintenance of frozen conditions both within and beneath the waste piles including consideration of climate change. This will include maintenance of integrity/stability of these facilities for decades or centuries following closure in order to avoid environmental impacts including those on water quality.

Note that these comments are also linked to Section 8.3 Water and 8.4 (other) and the subjects of note Permafrost and Physical Stability including problems associated with freezeback of processed kimberlite, waste rock and PKC co-disposal and impacts from changing permafrost



Section 5.7 Climate Change Impacts

It is suggested that the TOR also include climate variability as this is often more important to project design over periods of 10 to 20 years (eg. variability in water balance components such as evaporation and precipitation and lake levels). This section refers to the use of the Tibbit to Contwoyto ice road but only considers climate change with respect to greenhouse gas emissions. The length of the operating season of the road needs to be considered in terms of climate variability over the project life and whether the proponent will be able to meet their needs under the conditions expected. There are a number of users of the winter road and there may be years when the operating season is particularly short (extreme warm years for example) and the potential impacts of this will need to be assessed. During extreme years, alternative transportation methods may be required and potential impacts will need to be assessed (note that this also links to section 6 Cumulative Effects Assessment specifically infrastructure demands).

To assess environmental impacts including those that may be enhanced by climate change, a description of baseline climate conditions will be required as well as an assessment of future conditions. It is suggested the following be added to the TOR:

- The EIS provide a description of the current baseline climate conditions for the project area which should include climate parameters relevant to the project and anticipated impacts.
- The description of baseline conditions should include a description of the techniques utilized to apply climate data from an area outside the project area if adequate data are not available for the project area itself (i.e. techniques for extrapolation from other weather stations in the region).
- The description of baseline conditions should also include a description of the variability in relevant climatic parameters in order to fully describe the range in conditions in which the project will operate.
- A description of future conditions anticipated under climate change scenarios.

Note that these comments are also linked to Section 8.4 Other and the subject of note Climate change

Section 8.4 Other

Table 8-4 includes Physical Stability as a subject of note and refers to waste rock and PKC co-disposal and impacts from changing permafrost. Specific comments on gaps in the TOR related to these issues are outlined in comments on Sections 4.2, 4.4 and 5.6.

It is not clear however whether Physical Stability and impacts of changing permafrost includes other aspects of the project beyond waste rock and PKC co-disposal. It is suggested that MVEIRB consider adding to the TOR a general requirement related to description of subsurface materials and thermal regime within the project area and assessment of impacts on permafrost related to project activities. In addition, if project components other than waste containment facilities are to rely on frozen conditions, the TOR should require that the Proponent demonstrate that frozen conditions will be



maintained or that adequate mitigation is implemented, should thawing occur, to minimize either impacts of the project on the environment or the environment on the project.

The project description indicates that some construction materials may be acquired from eskers in the project area. Sediments in eskers may contain massive ice which may thaw when the surface is disturbed resulting in settlement and changes in drainage and associated impacts on ecosystems. The presence of massive ice is also a factor in the total area that may need to be disturbed to extract sufficient materials and therefore the magnitude of associated environmental impacts. It is suggested that the TOR include a requirement for a description of properties of potential borrow sources including ground ice contents and estimates of the area to be disturbed to meet the project's needs for construction materials.

Other comments

The stability and integrity of water retaining dykes do not appear to be covered anywhere in the TOR. One might expect that failure of these structures could have implications for safety and the environment (would need to be considered for emergency response plans). Adequate knowledge of the water balance and water levels of Kennady Lake would also be required for design of these structures. It is suggested that MVEIRB consider adding to the TOR a requirement for information on design of the water retaining structures and assurances of their stability during project operation (include impact of fluctuating water levels etc.). Requirements for emergency response plans could also be considered.