Indigenous and Northern Affairs Canada
Affaires autochtones et du Nord Canada

Your file - Votre référence
2AM-DOH1323

July 25, 2016

Our file - Notre référence
IQALUIT-#1084722

Licensing Department
Nunavut Water Board
GJOA HAVEN, NU X0E 1J0

Sent via email: licensing@nwb-oen.ca

Re: Amendment Application No. 1 to Nunavut Water Licence No. 2AM-DOH1323, 2016 Interim Dike Trade-Off Study

To Whom It May Concern,

Thank you for the Nunavut Water Board's July 5, 2016 notice of the above mentioned trade-off study that was submitted by TMAC Resources Inc. as part of its current water licence amendment application.

Attached are two memorandums that are being provided for the for the Nunavut Water Board's consideration. One has been prepared by Amec Foster Wheeler, a consulting firm that has been retained to assist the Department in its review of the water licence amendment application, and the other was prepared by Departmental staff. Comments and recommendations have been provided pursuant to Indigenous and Northern Affairs Canada's mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

The number of recommendations is continued from the format used in the Department's June 22, 2016 review memo[1] on other management plans provided by TMAC Resources Inc.

Please do not hesitate to contact me by telephone at 867-975-4555 or email at David.Abernethy@aandc-aadnc.gc.ca for further information.

Sincerely,

David Abernethy
Regional Coordinator
Water Resources Division
Resource Management Directorate
Indigenous and Northern Affairs Canada

[1] Indigenous and Northern Affairs Canada. *Re: 2AM-DOH1323 – Review of Tailings Area Operations Maintenance and Surveillance Manual, Groundwater Management Plan and Aquatic Effects Monitoring Plan and Proposed Surveillance Network Program Revisions submitted by TMAC Resources Inc. for their Amendment Application – Doris North Gold Mine Project.* File No. CIDM#10740858. From Ms. Sarah Forté, Indigenous and Northern Affairs Canada, to Ms. Ida Porter, Nunavut Water Board. June 22, 2016.

IQALUIT, NU X0A 0H0

Encl.

Cc. John Roberts, TMAC Resources Inc.
Sharleen Hamm, TMAC Resources Inc.

MEMO

To	**David Abernethy, INAC**	File no	**TV154012**
From	**Jane Doucette, Amec Foster Wheeler**	cc	**Chris Milley, Amec Foster Wheeler**
Tel	**902-564-1110**		
Fax	**902-564-6318**		
Date	**July 25, 2016**		

Subject **Review of TIA Interim Dike Trade-off Study**
Nunavut Water Board Licence No. 2AM-DOH1323
Doris North Project
Kitikmeot Region, Nunavut

This memo provides a review of the Doris Tailings Impoundment Area (TIA) Interim Dike Filter Trade-off Study. The review has been carried out to assist Indigenous and Northern Affairs Canada (INAC) in the Technical Review of TMAC Resources Inc.'s (TMAC) application amendment No. 1 to Nunavut Water Board Licence No. 2AM-DOH1323.

The TIA is contained by the North and South Dams. Tailings will be discharged from the South Dam and points along the east shore, and water will be retained against the North Dam. The objective for constructing the Interim Dike is to retain tailings solids and allow water to pass through the dike, and allow the northern portion of the TIA to act as a reclaim pond. It will also result in a smaller tailings footprint. The Dike will be constructed of run-of-quarry (ROQ) rock. To optimize tailings containment an engineered filter will be constructed across the upstream face of the Dike. A study was carried out by SRK Consulting (Canada) In. on behalf of TMAC to consider the construction of the filter using either a geosynthetic fabric or a graded rock filter.

The document presents the design basis for the Interim Dike, including data on other sources of suspended solids, the migration of tailings through the Dike, expected hydraulic gradient, tailings settlement rate, and tailings freezeback.

With respect to the filter design and construction, we offer the following comments:

- Construction Timing: It is stated that it will take about 2.5 years for the tailings to reach the Interim Dike after the start of deposition, a distance of 1,500 m from the South Dam.

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INAC R37 It should be confirmed that deposition from the east shore (closer than 1500 m to the Interim Dike) will not occur within the first 2.5 years.

- Construction Methodology:

  - It is proposed to defer construction of the graded rock filter until the Dike structure has stabilized. Consideration should be given to constructing the Dike sooner than later. This will avoid potential conflicts with trying to place a continuous filter layer while significant settlement may still be occurring.
  - For run of quarry (ROQ) placement on top of the geotextile or graded rock filter, as the slope is built out to 3H:1V, the slope length could be in the order of 20+ m. It is not clear how the proposed equipment (11.5 m reach) can reach the bottom of the slope.

INAC R38

- Geotextile Survivability: To limit the potential damage as ROQ is being placed on the geotextile to complete the 3H:1V upstream slope geometry, consideration can be given to limiting the maximum rock size.

We trust this meets your present requirements.

Memorandum

To: Licensing Department, Nunavut Water Board

From: Sarah Forté, Water Management Coordinator, Water Resources Division (WRD), Indigenous and Northern Affairs Canada (INAC)
David Abernethy, Regional Coordinator, WRD, INAC
Amjad Tariq, Regulatory and Science Advisor, WRD, INAC

Cc: John Roberts, TMAC Resources Inc.
Sharleen Hamm, TMAC Resources Inc.

Date: July 25, 2016

Re: Amendment Application No. 1 to Nunavut Water Licence No. 2AM-DOH1323, 2016 Interim Dike Trade-Off Study

Licensee: TMAC Resources Inc.
Project: Doris North Gold Mine
Region: Kitikmeot

Comments:

A. Background

On July 5, 2016, the Nunavut Water Board (NWB or Board) provided notification of TMAC Resources Inc.'s (TMAC or the Licensee) submission of an Interim Dike Trade-Off Study, dated July 5, 2016. Interested parties were asked to provide comments by July 25, 2016. The instructions specified that the Department indicate whether the information provided is sufficient to meet commitment #24, from the Updated Table of Commitments presented in the NWB's July 7 Pre-Hearing Conference Decision Report (Appendix C of Report). This commitment states:

> "TMAC to submit the Interim Dike filter design trade-off study and detailed design of the selected filtering method in June for distribution, review and discussion by interested parties prior to the Water Licence Public Hearing; final draft should be available before the issuance of the licence."

The Tailings Impoundment Area (TIA) Interim Dike is presented in the Licensee's Project Certificate and Water Licence amendment application as a feature of the proposed restructuring of the TIA that will retain tailings on the upstream side and allow water to flow through its body into the downstream Reclaim Pond. Through correspondence between Indigenous Affairs and Northern Development Canada (INAC or the Department) and the Licensee during the Project Certificate amendment application review, the Licensee confirmed that the upstream face of the Interim Dike would be clad with layer of graded rock or a geotextile to act a filter to ensure

tailings solids will not migrate through the dike.

Comment No. FC-#5 of the Department's March 14, 2016 Final Written Submission to the Nunavut Impact Review Board regarding the Licensee's application to amend its Project Certificate recommended that:

> "The Proponent provide, for review, the necessary detail to determine if the Interim Dike final filter design is appropriate and adequately incorporates environmental considerations.
>
> Proposed Term and Condition (if approved):
>
> The Proponent shall provide the Interim Dike filter design trade-off study and the detailed design of the selecting filtering method for review during the water licensing process."

B. Results of Review

On behalf of INAC's Water Resources Division, the following comments and recommendations are provided.

Please note that the principle concern with the submitted document is that it suggests the Interim Dike is optional.

1. Construction of Interim Dike

Reference:

- Doris Tailings Impoundment Area Interim Dike Filter Trade-off Study, SRK Consulting (Canada) Inc., July 7, 2016, Sections 2.3 & 6
- Public Hearing Report, Doris North Project: 2015 Amendment Application, Nunavut Impact Review Board, June 2016, Section 2.2

Comment:

Section 2.3 of the study is entitled "*Alternative to not constructing Interim Dike*" and outlines how the TIA closure cover requirements would be 60% greater without a dike than with one. This presents one of the consequences of not constructing the dike and the conclusion then makes the dike's construction appear optional. Specifically, the wording used includes: "*Should the Interim Dike not be constructed, …*" and "*…, if the Interim Dike is constructed, …*".

The Interim Dike is an integral part of the project amendment presented to the Nunavut Impact Review Board (NIRB). This is evident in the project description of the Public Hearing Report which describes additional project components and activities:

- *Increase volume of deposited tailings in the Tailings Impoundment Area (TIA) from*

458,000 tonnes to 2.5 million tonnes;

- *Proposed modification to the destruction of cyanide in process tailings from Caro's Acid (hydrogen peroxide and sulfuric acid) to the INCO process;*
- *Proposed change to the disposal of tailings from subaqueous to subaerial tailings at the south end of the TIA*
- *Proposed restructuring of the TIA:*
  - ***Installation of an interim dam in the TIA approximately midway.***
  - *Proposed south dam construction and operations to change from frozen core to frozen foundation*

If TMAC decides to change the project description to remove the Interim Dike, they are required to get approval from the NIRB before it can be discussed in the water licensing process.

Recommendation - INAC R39:

The Licensee should remove statements regarding the optional construction of the Interim Dike in the tailings impoundment area in their submissions, as the submission to the NIRB, as part of the amended project certificate, indicated an interim dike was to be constructed.

2. Timing of Dike Construction

Reference:

- Doris Tailings Impoundment Area Interim Dike Filter Trade-off Study, SRK Consulting (Canada) Inc., July 7, 2016, Sections 2.5 & 3.1.3
- Revisions to Amendment Application No. 1 of Project Certificate No. 003 and Water Licence No. 2AM-DOH1323: Proponent's Response to NIRB Technical Comments, TMAC Resources Inc., January 2016, Section 50.6

Comment:

Section 2.3 states that, based on deposition modelling, "*the dike needs to be in place no later than 2.5 years after tailings deposition starts*". This is the time at which the toe of the tailings beach will reach the dike location, so presumably the dike needs to be completed by then.

Completing the dike could conceivably take some time given the construction methodology described. "*Due to the soft unconsolidated sediments upon which the Interim Dike will be constructed, significant deformation and settlement of the structure is expected during construction. As a result, construction of the graded rock filter should be deferred until the structure has stabilized, as demonstrated through settlement monitoring.*"

An intended construction schedule was proposed by TMAC in their response to NIRB technical comments. It involved constructing "*the bulk of the structure, i.e., the Run-of-Quarry (ROQ) structure at the end of the 2016 open water season, around September 2016 (i.e., before tailings production starts). This will be the first stage of the structure, i.e., the in-water section as*

described in TMAC's response to AANDC- 23. This section of the Interim Dike will be left in place to allow the underlying sediments to consolidate and the structure to settle until the end of 2017 open water season when the TIA water level is at its lowest. At that time the upstream filter will be constructed (September 2017), there will be less than 1 year of tailings deposition in the TIA."

Recommendation - INAC R40:

The Licensee should confirm if it intends to follow the proposed construction schedule with the bulk of the structure completed at the end of 2016 open water season, or provide an alternate schedule. This would allow confidence that the settlement time required for the structure's construction is considered when planning for the completion date, 2.5 years after the start of tailings deposition.

3. Characterization of Tailings for Filter Design

Reference:

- Doris Tailings Impoundment Area Interim Dike Filter Trade-off Study, SRK Consulting (Canada) Inc., July 7, 2016, Figure 1

Comment:

Figure 1 included in the study, "Graded Rock Filter Material Specification," present three tailings categories: Tailings_1, Tailings_2, and Tailings_3. The physical and chemical properties for these tailings categories are not described in the study's text portion.

Recommendations:

INAC R41: The Licensee should provide the properties of the three tailings categories referenced in Figure 1: Tailings_1, Tailings_2, and Tailings_3 in the study report

INAC R42: The Licensee should specify the type of tailings that it considers is relevant to the filter design.

4. Engineering Aspects for Selection of Graded Rock Filter Design

Reference:

- Doris Tailings Impoundment Area Interim Dike Filter Trade-off Study, SRK Consulting (Canada) Inc., July 7, 2016, Section 4.2

Comment:

Section 4.2 of the submitted study states that, "based on the analysis of the design, deployment, cost, durability, and environmental consequences, the graded rock filter is favoured over the geotextile filter. In addition to the Licensee's analysis of this preferred option, additional engineering aspects should be considered when designing the Interim Dike.

When designing the Interim Dike, the following engineering aspects should be considered:

a) Filter ability (permeability);
b) Filter internal stability (movement of particles due to flow of water);
c) Self-healing (cracks/voids formed due to differential settlement and material gradation for self-healing);
d) Material segregation (coarser particles separate from finer particles); and
e) Filter material tests (material physical test including durability tests and chemical stability tests).

5. Interim Dike Crest Elevation

Reference:

- Doris Tailings Impoundment Area Interim Dike Filter Trade-off Study, SRK Consulting (Canada) Inc., July 7, 2016, Section 2.6

Comment:

Section 2.6 states, "*the pre-existing water level in the TIA, 28.3 m, was set as the static downstream water level. The design crest elevation of the Interim Dike is 31 m; however, to be conservative, SRK assumed an artificial upstream water elevation of 33.5, representing the TIA full supply level (FSL), to give a total head of 5.2 m (it should be noted that the Interim Dike was intentionally not designed with a crest elevation of 33.5 m, as it would not matter if the Interim Dike was overtopped during operations because the tailings solids would be retained.*"

It is not understood how tailings would be retained if the Interim Dike is overtopped during operations. Tailings are fine materials that can be suspended and transported in liquid.

Recommendation - INAC R43:

The Licensee should explain why it believes that tailings solids will be retained in the TIA northern portion should the Interim Dike be overtopped during operations. Changing the design crest elevation from 31 m to the 33.5 m FSL should be considered.

C. Adequacy of Submission for Commitment

This submission satisfies Commitment No. 24 from the list presented in the Pre-Hearing Conference Decision Report.