Indigenous and Northern Affairs Canada | Affaires autochtones et du Nord Canada

Water Resources Division
Resource Management Directorate
Nunavut Regional Office
P.O. Box 100
Iqaluit, NU, X0A 0H0

Your file - Votre référence
2AM-DOH1323

August 3, 2016

Our file - Notre référence
CIDM#1086040

Licensing Department
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0

Sent via email: licensing@nwb-oen.ca

Re: Final Written Submission for Amendment Application No.1 to Nunavut Water Licence 2AM-DOH1323 – TMAC Resources Inc.'s Doris North Gold Mine Project

To whom it may concern,

Thank you for the Nunavut Water Board's July 7, 2016 Pre-Conference Hearing Report requesting final written submissions on the above referenced application. We also appreciate your patience for the one-day delay in our submission due to computer network problems.

The Water Resources Division of Indigenous and Northern Affairs Canada (INAC) retained the services of Amec Foster Wheeler to assist in the review of the water licence amendment application and have included the report prepared by Amec in our final submission.

Comments and recommendations have been provided pursuant to INAC's mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

INAC appreciates the opportunity to participate in this review. If there are any questions or concerns, please do not hesitate to contact David Abernethy by phone at (867) 975-4555 or email at david.abernethy@aandc-aadnc.gc.ca or myself by phone at (867) 975-3876 or by e-mail at sarah.forte@aandc-aadnc.gc.ca.

Sincerely,

Sarah Forté
Water Management Coordinator

cc. John Roberts, Sharleen Hamm, TMAC Resources Inc.
John Roesch, Kitikmeot Inuit Association

Canada

Final Submission Regarding TMAC Resources Inc.'s Type A Water Licence Amendment Application for Doris North Gold Mine Project

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Indigenous and Northern Affairs Canada

Final Submission to the Nunavut Water Board

August 3, 2016

EXECUTIVE SUMMARY

Indigenous and Northern Affairs Canada (INAC) has participated in the ongoing review of the TMAC Resources Inc.'s (TMAC) application for amendment #1 of its Type A Nunavut Water Board water licence 2AM-DOH1323 for the Doris North Gold Mine Project. This project is situated on Roberts Bay off Melville Sound in Nunavut's Kitikmeot region.

During the technical review, issues discussed six topics:

- Water quality and quantity predictions
- Waste rock and tailings
- Mitigation measures
- Water treatment
- Management plans and reports
- Closure and reclamation planning

Most of the issues have been resolved through discussion with TMAC. Those that remain are relatively minor and principally concern management plans submitted within the last two months. INAC has recently submitted a revised reclamation cost estimate and is engaging in discussions on this topic with TMAC and KIA.

Comments not related to technical issues are also provided on minor corrections to the licence, security management and TMAC's compliance record.

Based on the information available, it is recommended that the amendment application be accepted with due consideration given to INAC's comments.

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INTRODUCTION

Indigenous and Northern Affairs Canada (INAC, or the Department) has participated in the ongoing review of the TMAC Resources Inc.'s (the Licensee, or TMAC) application for amendment #1 of its Type A Nunavut Water Board (NWB, or the Board) water licence 2AM-DOH1323 for the Doris North Gold Mine Project(the application). This project is situated on Roberts Bay off Melville Sound in Nunavut's Kitikmeot region.

On September 18, 2015, INAC conducted its completeness review of the application which included information requests and comments regarding proposed changes to the water licence. Following further submissions by TMAC and others, INAC submitted a technical review of the application on December 8, 2015 and participated in a Technical Meeting on January 28 and 29, 2016 in Cambridge Bay, Nunavut. A Pre-Hearing Conference was held by teleconference on June 24, 2016, following which the NWB distributed the Pre-Hearing Conference Decision on July 7, 2016, inviting interested parties to provide final written submissions by August 2, 2016, which was extended to August 3, 2016.

The scope of the licence amendment includes[1]:

- Proposed extension of mine life by four (4) additional years;
    - Proposed mining of Doris Central and Doris Connector zones via the existing Doris North portal instead of only mining the Doris Hinge zone;
- Increase of both mining and milling rates from 720 tonnes/day (t/day) and 800 tonnes/day, respectively, to 2,000 t/day;
- Increase total 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 approximately midway in the TIA.
        - Proposed south dam construction and operations to change from frozen core to frozen foundation.
- Discharge of up to 7,000 cubic metres/day (m^3/day) directly into Roberts Bay:
    - Direct discharge of up to 3,000 m^3/day of saline groundwater from underground year round.
    - Discharge of up to 4,000 m^3/day from the TIA during summer months.
    - Construction/installation, operation, and eventual decommissioning of a 550 metre (m) access road at Roberts Bay and installation of 5.64 kilometres (km) of overland pipeline, 2.3 km long marine outfall pipeline.

[1] Nunavut Impact Review Board, Public Hearing Report, Doris North Project : 2015 Amendment Application, TMAC Resources Inc., NIRB File No. 05MN047, June 2016

    - Installation, operation, and eventual abandonment of a 95 m long marine diffuser and approximately 900 m long marine outfall berm.
- Alternative disposal option for saline groundwater from underground workings to the TIA prior to the deposition of TIA water in Roberts Bay;
- Construction, operation, and eventual decommissioning of two (2) additional vents (Doris Central Vent and Doris Connector) and associated spur roads;
- Construction, operation, and eventual decommissioning of Pad U, which would be a 31,000 m^2 pad and associated pollution control pond for use as ore storage and temporary laydown area;
- Increase camp capacity from 180 to 280 persons to accommodate project personnel;
- Replace existing sewage treatment plant with a new plant with an increased capacity for the larger camp and retrofitting of existing sewage treatment plant for backup;
- Use of existing quarries A, B, D, and 3 to supply foundation materials for additional proposed infrastructure;
- Relocation of proposed landfill from Quarry A to Quarry 3 once the resources have been exhausted;
- Construction, operation, and eventual decommissioning of three (3) additional laydown areas at Roberts Bay (Roberts Bay Extension Laydown Area West, Southwest, and Southeast);
- Relocation of explosives facility from pad adjacent to Quarry 3 to Quarry A;
- Over-wintering fuel barges in Roberts Bay as required to support operations; and
- Removal of the requirement for TMAC to install and operate an on-site laboratory to test TIA water onsite in real time prior to release into Doris creek as previously required under Term and Condition 9 of the NIRB Project Certificate No. 003.

The NWB requested that the final written submission follow the list of issues used at the technical meeting. The next section follows this list and three additional sections have been added to discuss consequential amendments to the licence, security management and the compliance record.

Comments in this submission are made in the context of INAC policy and mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*. Comments are structured as issues and supported by observations made during the course of the application review and recommendations are made directly to the Board.

COMMENTS ON TECHNICAL ISSUES

The Technical Meeting, as well as comment exchanges and discussions with the Licensee have allowed the Department to resolve most of its concerns regarding the proposed amendment to the Doris North Gold Mine Project. A few issues remain outstanding and most of these are related to materials submitted in the last two months. Three different types of comments are identified:

1) Information requests (INAC IR#) from Completeness Review memoranda submitted on September 18, 2015;
2) Technical comments (INAC TC#) from Technical Review memoranda submitted on December 8, 2015; and
3) Recommendations (INAC R#) from Plan and Study Reviews submitted on June 22, 2016 and July 25, 2016.

Different comments submitted by the Department have been assigned to the headings proposed by the Board, but we note that several comments could be assigned to more than one heading. All comments are listed but only those unresolved or requiring follow-up are discussed.

Responses for a subset of comments are also found in a report produced by Amec Foster Wheeler, included as Appendix A. These are marked with an asterisk (*) for ease of reference.

1.0 Water Quality and Quantity Predictions

Predicting the quantity of water collected in various retention ponds and inflow of surface, ground or connate water into the underground workings, as well as the quality of these waters and those coming from the mill, is critical for project planning. It helps ensure that all necessary measures are taken to protect water resources on and around the mine site.

INAC provided several comments regarding the documents submitted by TMAC regarding water quality and quantity predictions as summarised in Table 1. All of these issues but one are considered resolved, though two require follow-up actions.

Table 1 Status of comments pertaining to water quality and quantity predictions

Comment #	Issue	Status
INAC IR2	Location of document: Geochemical characterization of tailings	Resolved
INAC IR3	Location of document: Hydrogeological modeling	Resolved
INAC IR5	Water inflow to underground mine	Resolved
INAC IR6	Water losses from Doris Lake	Resolved

Comment #	Issue	Status
INAC IR7	Sensitivity analyses	Resolved
INAC TC1*	Process water source terms	Resolved
INAC TC2*	Underground mine water loadings	Resolved
INAC TC5*	Ore and waste rock source terms	Resolved
INAC TC6*	TIA storage capacity	Resolved
INAC R8*	Reference point monitoring	Unresolved
INAC R10*	Sulphate and major ions analysis	Resolved. Follow-up required.
INAC R22	Numerical analysis to demonstrate robustness of management plan	Resolved. Follow-up required.

* Further discussion included in Appendix A

Reference point monitoring: INAC R8 resulted from TMAC's request to remove reference station monitoring from the Aquatic Effects Monitoring Plan (AEMP) because of the limited anticipated project influence on the freshwater system in the absence of point-discharges to freshwater. They also argue that reference data would only provide some additional ability to preclude the project as a possible source of any change observed in the Doris Lake data. In the absence of concurrent reference lake data, changes observed in Doris Lake water quality must conservatively be attributed to a potential Project effect, thereby triggering the response framework and associated further investigation and/or mitigation.

The Department is of the opinion that removing the reference station monitoring undermines the potential for determining effects resulting from widespread environmental changes. Additionally, according to Figure 5.2-1 of the AEMP, the response framework is triggered when there is a statistically defined change from baseline conditions. The presence of a reference site should not have an effect on the frequency at which the response might be triggered.

The lack of reference sites will have an impact at the "Low Action Level" of the response framework, specifically when trying to identify the cause of change. This may be difficult to do without data from a reference station and consideration of re-establishing reference site is only found at the "Medium and High Action Levels." The delay before reference stations could be sampled would therefore be significant which might create an avoidable delay in implementing management and mitigation measures.

It is recommended that reference stations in the current AEMP be maintained.

Sulphate and major ion analysis: INAC R10 recommended that all water samples submitted for inorganic testing include analyses for sulphate and major ions in solution, to allow for the opportunity to assess the quality of the data and identify potential matrix interferences that may not be noticeable otherwise (i.e., quality control). Additionally, sulphate is an indicator for sulphide oxidation. TMAC agreed to expanding the parameter suite for underground mine water and station ST-7. This is satisfactory and the follow-up required is to check its inclusion in the AEMP.

Numerical analysis to demonstrate robustness of management plan: INAC R22 discussed the uncertainty in the groundwater model which leads to an uncertainty in the predicted volume of water to be extracted from the mine. TMAC have stated that their maximum estimate of 3,000 m^3/day of mine inflow water is conservative and have not predicted potential impacts of higher extraction rates. During discussions, it was agreed to modify the AEMP to increase monitoring assessments if the predicted maximum inflow rate is exceeded for a significant period of time. The addition would be as follows: "*if groundwater pumping exceeds 3,000 m^3/day for a prolonged period, specifically 200,000 m^3/quarter, the NWB be notified and the analyses and assessment described in the Aquatic Effects Monitoring Plan be carried out and reported quarterly.*" We need to confirm this addition in a revised AEMP and we recommend keeping consistent quarters that fit within a reporting year.

2.0 Roberts Bay Discharge Monitoring

The amended project includes discharging water from the Tailings Impoundment Area (TIA) and saline groundwater into the marine environment in Roberts Bay. A single comment was submitted by INAC regarding the water quality criteria for marine discharge in Roberts Bay (INAC IR11).

During the Technical meeting the Nunavut Water Board confirmed that the discharge to the marine environment is not within the scope of the water licence. This matter will be addressed by Environment and Climate Change Canada, which will require that the effluent meets the requirements of the Metal Mining Effluent Regulations prior to discharge to the marine environment. INAC may also be involved in Roberts Bay discharge monitoring through the implementation of the *Arctic Waters Pollution Prevention Act*.

3.0 Waste Rock and Tailings

Two types of tailings will be produced in the amended project; flotation tailings (forming approximately 94%) and cyanide leach detoxified tailings (forming approximately 6%). The application presents sub-areal deposition of flotation tailings in a modified TIA that includes two dams and an interim dike. Waste rock and detoxified tailings are to be stored underground.

INAC submitted several comments regarding the TIA structures and waste rock handling, as summarised in Table 2. For this topic more issues are unresolved as we submitted comments on the Interim Dike Trade-off Study on July 25, 2016 and have not yet had interactions with TMAC regarding these comments. Five issues require follow-up and seven are unresolved.

Table 2 Status of comments pertaining to waste rock and tailings

Comment #	Issue	Status
INAC IR4	Supporting document not included in the application	Resolved
INAC IR10	Backfilling of ANFO and hydrocarbon impacted materials	Resolved. Follow-up required
INAC IR12	Excavated and available underground volumes	Resolved. Follow-up required.
INAC IR13	Groundwater contamination by PAG material and detoxified tailings	Resolved
INAC TC7*	Criteria for using rock for construction purposes	Resolved
INAC TC8*	Monitoring mineralized rock	Resolved
INAC TC9*	Interim dike filter	Resolved
INAC R1*	References for TIA OMS Manual	Resolved. Follow-up required.
INAC R13	Interim dike/filter	Resolved. Follow-up required.
INAC R14	Geochemical characterization of tailings deposited in impoundment area	Resolved. Follow-up required.
INAC R15	South Dam as water retaining structure	Resolved
INAC R37	Position of tailings deposition before and during interim dike construction	Unresolved
INAC R38	Construction methodology	Unresolved
INAC R39	Construction of interim dike	Unresolved
INAC R40	Timing of dike construction	Unresolved
INAC R41	Characterization of tailings for filter design - 1	Unresolved
INAC R42	Characterization of tailings for filter design - 2	Unresolved
INAC R43	Interim dike crest elevation	Unresolved

* Further discussion included in Appendix A

Backfilling of ANFO and hydrocarbon impacted materials: INAC IR10 resulted from a concern that if material impacted by ammonium nitrate and fuel oil (ANFO) and hydrocarbon spills was used in the mine, there might be contaminant migration into groundwater and potentially surface water bodies. During meetings in June 2016, it was agreed that this disposal method would be suitable if impacted material is buried in the portion of the underground mine that is contained in permafrost, as the ice would act as a barrier to contaminant migration. The follow-up required is to ensure that this is captured in the Waste Rock and Ore Management Plan.

Excavated and available underground volumes: INAC IR12 arises from the plan to dispose of all waste rock and detoxified tailings in underground mine cavities. In the Nunavut Impact Review Board (NIRB) process, the following term and condition was agreed on: *The Proponent shall monitor the underground backfill use and mine waste placement underground during operations to confirm that targets of backfill compaction and filling of void spaces are achieved*. However, in its Public Hearing Report the NIRB determined that this condition would be more appropriately handled in the water licence amendment. We are therefore recommending to the NWB that it be added as a condition in the amended water licence.

References for TIA OMS Manual: INAC R1 recommended modifying the TIA Operation, Maintenance and Surveillance (OMS) Manual to include references to where detailed information mentioned in the manual can be found. TMAC agreed and the follow-up required is to review the TIA OMS Manual to verify action is completed.

Interim dike/filter: INAC R13 requested modification to the wording of the TIA OMS Manual so that the interim dike was discussed as an integral feature. TMAC have agreed and the follow-up required is to ensure this change is made to the TIA OMS Manual.

Geochemical characterization of tailings deposited in impoundment area: INAC R14 relates to characterising the tailings being deposited in the TIA throughout the mine life. TMAC has proposed including weekly sample collection for the preparation of a monthly composite to be analysed for total metals, sulphur and total inorganic carbon. This will be used to calculate the neutralisation potential/acid potential ratio of the tailings to verify that they are not potentially acid generating. The follow-up required is to check its implementation in the TIA OMS Manual.

Position of tailings deposition before and during interim dike construction: INAC R37 relates to the need to maintain sufficient distance between tailings deposition areas and the Interim Dike construction area. The submitted Interim Dike Trade-Off Study states that it will take about 2.5 years for tailings to reach the Interim Dike after the start of deposition, a distance of 1,500 m from the South Dam. The Licensee should confirm that deposition from the east shore (closer than 1,500 m to the Interim Dike) will not occur within the first 2.5 years of operations. This information should also be included in the TIA OMS Manual.

Construction methodology: INAC R38 addresses potential challenges the Licensee will encounter when constructing the TIA Interim Dike. 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 for run of quarry placement on top of the geotextile or graded rock filter. The Licensee should clarify how it will construct the TIA Interim Dike considering the anticipated slope length and the type of equipment that will be used.

Construction of interim dike: INAC R39 concerns references made to the possibility of not constructing an Interim Dike contained within the submitted TIA Interim Dike Filter Trade-Off Study. The Interim Dike is an integral part of the project amendment application presented to, and recommended for approval by the NIRB. If the Licensee decides to change the project description to remove the Interim Dike, it would be required to seek approval from the NIRB. The Licensee should remove statements regarding optional construction of the Interim Dike in future submissions to the NWB.

Timing of dike construction: INAC R40 recommends that the Licensee confirm it intends to follow the construction schedule where the bulk of the Interim Dike's structure is completed at the end of the 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. It is noted that the dike needs to be in place no later than 2.5 years after tailings deposition starts, at which time the toe of the tailings beach will reach the dike location.

Characterization of tailings for filter design – 1: INAC R41 requests that the Licensee provide the physical and chemical properties of the three tailings categories referenced in Figure 1 (Graded Rock Filter Material Specification) of its Interim Dike Trade-Off Study.

Characterization of tailings for filter design – 2: INAC R42 recommends that the Licensee specify which type of tailings of the three presented in Figure 1 (Graded Rock Filter Material Specification), it considers relevant to the filter design.

Interim dike crest elevation: INAC R43 requests that the Licensee explain how tailings solids will be retained in the TIA’s southern portion should the Interim Dike overtop during operations. The study states that the Interim Dike was intentionally not designed with a full supply level crest elevation (33.5 m), as it would not matter if the Interim Dike (31 m) was overtopped during operations because the tailings solids would be retained.

4.0 Mitigation Measures

Mitigation measures ensure that the project's impacts are minimized. Four comments were provided. Presently three are resolved, one of which requires follow-up, and one is outstanding, as presented in Table 3.

Table 3 Status of comments pertaining to mitigation measures

Comment #	Issue	Status
INAC TC11*	Dust control for tailings	Resolved
INAC R6*	Sediment sampling	Resolved. Follow-up required.
INAC R17	Mitigation strategy for load balance concern	Resolved
INAC R18	Approval of dust suppressants	Unresolved

* Further discussion included in Appendix A

Sediment sampling: INAC R6 is regarding sediment sampling. TMAC had proposed to remove this from the AEMP. The Department is of the opinion that this sampling could provide information on effects to the aquatic environment that would not be captured otherwise and TMAC has committed to including surficial sediment sampling at a 3 year frequency. The follow-up required is to verify its inclusion in the AEMP.

Approval of dust suppressants: INAC R18 stems from an earlier request about dust suppressants to be used on exposed tailings if necessary. TMAC provided a list of three possible dust suppressants that are all deemed suitable. To retain operational flexibility, TMAC is requesting that other products could be used if approved by an Inspector. The Department agrees that the possibility of using other products should be included in the management plan but recommends that the approval of alternate dust suppressants be made by the Board and this modification be made in the TIA OMS Manual.

5.0 Water Treatment

Planned water treatment on site includes sewage treatment and cyanide destruction in process water. No treatment is planned for the TIA water though the TIA's retention capacity is sufficient to hold water whilst a treatment plan is developed, should the need arise. As outlined in Table 4, all comments are considered resolved.

Table 4 Status of comments pertaining to water treatment

Comment #	Issue	Status
INAC IR1	On-site laboratory	Resolved
INAC IR8	Proposed sewage treatment plant	Resolved
INAC TC12*	Sewage treatment	Resolved
INAC TC13*	TIA water treatment	Resolved

* Further discussion included in Appendix A

6.0 Management Plans and Reports

Management plans describe how concepts and strategies will be implemented. Most of the material which is not yet resolved is covered under this heading and it is further subdivided into comments, plan equivalencies and reporting.

6.1 Comments on management plans

There are a number of comments regarding management plans and many are outstanding because INAC and TMAC are still discussing them . Of the 26 comments, four are resolved; thirteen are resolved but require follow-up; two are partially resolved; and seven are unresolved. Table 5 lists all the comments and their status.

Table 5 Status of comments pertaining to management plans and reports

Comment #	Issue	Status
INAC IR9	Module B of Waste Rock and Ore Management Plan	Resolved
INAC R2*	Contingency plans for greater mine inflow	Resolved. Follow-up required.
INAC R3*	Monitoring mine inflow water	Resolved. Follow-up required.
INAC R4*	Downstream monitoring	Unresolved
INAC R5*	Cross referencing between SNP and AEMP reports	Resolved
INAC R7*	Testing parameters	Resolved. Follow-up required.
INAC R11	Surface Emergency Response Plan	Unresolved
INAC R no number	Tailing impoundment area responsible persons	Resolved. Follow-up required.
INAC R16	Interim Dike earthquake design	Resolved
INAC R19	Shoreline erosion monitoring transects	Resolved. Follow-up required.
INAC R20	Discharge of TIA water to Doris Creek	Partially resolved. Follow-up required.
INAC R21	Detoxified tailings management	Partially resolved. Follow-up required.
INAC R23	Remedial stage actions for mine inflow management	Resolved. Follow-up required.
INAC R24	Mine discharge management	Resolved. Follow-up required.
INAC R25	Source of increased mine inflow	Resolved. Follow-up required.
INAC R26	Doris Lake sampling stations	Unresolved
INAC R27	Chlorophyll *a* monitoring	Resolved. Follow-up required.
INAC R28	Monitoring during care and maintenance	Resolved. Follow-up required.
INAC R29	Station at the TIA discharge pump (TL-1)	Resolved. Follow-up required.

Comment #	Issue	Status
INAC R30	Contact water disposal locations	Unresolved
INAC R31	Doris Creek monitoring stations (TL-2, TL-3, TL-4)	Unresolved
INAC R32	Water component of tailings discharged into TIA (TL-5)	Resolved. Follow-up required.
INAC R33	Sampling station TL-9 – barren bleed solution	Unresolved
INAC R34	Underground mine water (TL-11 and TL-12)	Resolved. Follow-up required.
INAC R35	Discharge from sumps (ST-3, ST-4, ST-5, ST-6, ST-11 and ST-13)	Unresolved
INAC R36	Runoff from sediment controls (ST-10)	Resolved

* Further discussion included in Appendix A

Contingency plans for greater mine inflow: INAC R2 requested details on contingency plans should mine inflow rates exceed 3,000 m^3/day. TMAC described its standby pumping capacity to remove excess water to the TIA. The follow-up required is to ensure that this is described in the TIA OMS Manual.

Monitoring mine inflow water: INAC R3 relates to monitoring mine inflow water. TMAC has proposed to integrate in the Groundwater Management Plan mine water monitoring requirements consistent with those outlined in Schedule J of the water licence for periods of continuous mine discharge. We need to confirm this addition in the modified Groundwater Management Plan.

Downstream monitoring: INAC R4 recommended keeping a monitoring station on Doris Creek because it was thought that water from the TIA would be discharged to the creek if the mine entered care and maintenance. TMAC has clarified that there would be no discharge to the creek once tailings deposition begins until the North Dam is breached following closure. The recommendation has therefore been modified to only request sampling on the creek if the dam does not perform as expected.

Testing parameters: INAC R7 pertains to the adding of sulphate and major ions to the parameters tested in freshwater. TMAC has agreed and the follow-up reaction is to check the modifications of the AEMP and Groundwater Management Plan.

Surface Emergency Response Plan: INAC R11 pertains to a reference in the TIA OMS Manual to the Surface Emergency Response Plan in preparation, to replace the current Emergency Response Plan (ERP). TMAC has stated that they see no need to provide a new Surface Emergency Response Plan and proposes to submit updates to the existing ERP if/when needed. Cross-references between plans need to be up to date. If an update to the Surface Emergency Response Plan is not in preparation, the TIA OMS Manual should reference the current ERP.

Tailing impoundment area responsible persons: INAC R no number (identification number omitted when recommendation made) is about updating the list of responsible persons in the TIA OMS Manual. The follow-up required is to check that this is done.

Shoreline erosion monitoring transects: INAC R19 suggested including a figure in the TIA OMS Manual identifying shoreline erosion monitoring transects. The follow-up required is to verify that it is included in an updated plan.

Discharge of TIA water to Doris Creek: INAC R20 relates to discharge of water from the TIA to Doris Creek. TMAC has clarified where excess water in the TIA meeting criteria will be discharged: to Doris Creek prior to tailings deposition, to Roberts Bay during operations and closure, and back to natural discharge to Doris Lake post closure. This response satisfies part of our concerns. Clarifications to be included in the Water Management Plan and TIA OMS Manual should explicitly state how the discharge from the TIA would be managed during interim care and maintenance.

Detoxified tailings management: INAC R21 is regarding the management of detoxified tailings, which are to be disposed of in an area of the underground mine in permafrost. Their management was not included in the TIA OMS Manual and TMAC has described how they will modify the Waste Rock and Ore Management Plan to include this information. The response satisfies part of our concerns, but leads to two additional questions.

1) The description provided states that waste rock and detoxified tailings will be mixed to ensure the appropriate structural backfill requirements are met. What will be done in the last two years of mining, when, according to Table A1 in the Waste Rock and Ore Management Plan, there will be no waste rock on surface but ore being processed?
2) What dust suppression measures would be used, if necessary, for the tailings prior to underground placement?
3) Will effluent from the containment ponds used to capture effluent from the processing facility and Pad T Waste Rock Storage Area be tested for cyanide?

The follow-up required is to confirm the addition in the Waste Rock and Ore Management Plan and verify if the three questions above are addressed.

Remedial stage actions for mine inflow management: INAC R23 requests that all remedial stage actions for mine inflow management that were included in the Groundwater Management Plan Framework agreed upon during the NIRB process be explicitly included in the Groundwater Management Plan. The follow-up necessary is confirming the changes in the revised plan.

Mine discharge management: INAC R24 addressed some inconsistencies between the Groundwater Management Plan and the Water Management Plan regarding discharge of groundwater to Roberts Bay as well as some missing references to standard operating procedures (SOPs) for operating facilities. TMAC committed to making the required revisions. The follow-up required is to check the changes made to the Water Management Plan.

Source of increased mine inflow: INAC R25 requested clarifications to the source of possible increased groundwater inflow to the mine. TMAC has provided a clear explanation and the follow-up required is to confirm its addition in the Groundwater Management Plan.

Doris Lake sampling stations: INAC R26 is pertaining to the proposal to reduce the number of sampling stations on Doris Lake from two to one (removing station Doris Lake North and keeping ST-7). During discussions, TMAC made the argument that the lake was well mixed and water quality results from both stations were equivalent. While trying to compare sample results from station ST-7 (from annual reports 2010-2013) and station Doris Lake North (from AEMP reports 2010-2013) we noted that the stations were sampled at different dates, with only four instances where they were sampled within a week of each other. As well the detection limits used are different between stations. It is therefore difficult to evaluate whether the sampled water is equivalent. Unless TMAC demonstrates that sampling stations Doris Lake North and ST-7 provide comparable data, sampling station Doris Lake North should be maintained in the AEMP.

Chlorophyll *a* monitoring: INAC R27 recommended the addition of chlorophyll *a* monitoring to the AEMP in order to include effects based monitoring to help detect possible changes to the aquatic environment. TMAC has agreed to sampling for this parameter once a year. The follow-up required is checking the addition to the AEMP.

Monitoring during care and maintenance: INAC R28 pertains to water sampling frequency at station ST-7 during care and maintenance. TMAC has clarified that though the AEMP reporting would be done every 3 years, sampling would be done at a minimum twice per year. The follow-up required is checking the modification to the AEMP.

Station at the TIA discharge pump (TL-1): INAC R29 recommended sampling of the TIA water (station TL-1) during operations and closure, and at an adjacent site post closure. Both biological and petroleum hydrocarbon parameters should form part of the parameters tested. TMAC will outline this sampling in a revised Water Management Plan. The follow-up action required is to verify the changes.

Contact water disposal locations: INAC R30 requested identification of contact water disposal locations and TMAC replied they wanted to maintain the flexibility of being able to discharge to the tundra if specific discharge criteria are met. The Department is not suggesting the flexibility of disposing of contact water meeting discharge criteria be removed. We are requesting that the locations used for disposal of this water be identified so that they are on record and can be inspected if necessary.

Doris Creek monitoring stations (TL-2, TL-3, TL-4): INAC R31 recommended keeping at least one station for water sampling on Doris Creek during all phases of the project to ensure downstream monitoring, as presently it is not planned for the operations phase. TMAC responded that the information gathered would be redundant because it would duplicate that already collected for Doris Lake, which is the most proximal receiving environment.

INAC accepts this argument but recommends a station on Doris Creek be retained in the Surveillance Network Program (SNP) for water level/stream flow monitoring. In section 4.6 of the Responses to Technical Comments, Nunavut Water Board (December 2015), TMAC states: "TMAC can confirm that Doris Lake and Outflow levels are currently monitored annually, and that TMAC commits to continuing to monitor these sites."

Water component of tailings discharged into TIA (TL-5): INAC R32 is regarding characterizing tailings process water sent to the TIA. TMAC has agreed to do this and the follow-up action required is checking the testing parameters TMAC proposes to characterize the water and the sampling frequency, as well as confirming their inclusion in a revised Water Management Plan.

Sampling station TL-9 – barren bleed solution: INAC R33 pertains to including an SNP station to monitor the efficacy of the cyanide destruction process. TMAC has described in detail the processes that will be used to monitor cyanide concentrations and has committed to making the data available to the Inspector.

The Department recommends that a well-defined station be maintained so that data can be shared with the Board in annual report submissions. If, as in other instances, TMAC wishes to transfer this monitoring to a management plan, INAC has no objections.

Underground mine water (TL-11 and TL-12): INAC R34relates to monitoring groundwater pumped from the mine to the TIA or to Roberts Bay. TMAC has agreed to do this as outlined in their response to INAC R3 and INAC R7. The follow-up action required is to verify the implementation of monitoring mine inflow groundwater in the Groundwater Management Plan.

Discharge from sumps (ST-3, ST-4, ST-5, ST-6, ST-11 and ST-13): INAC R35 is about reducing the sampling frequency for water discharged from sumps from once before discharge and every day during discharge to only once before discharge. TMAC made the argument that the volumes discharged were small and well mixed, sampling during discharge would bring no new information. Additionally, analysis turn-around times would not provide actionable information.

For the arguments TMAC presented, it appears logical not to continue sampling every day during discharge. INAC was requesting that TMAC demonstrate, with data they have already collected under the present licence, that sumps are well mixed and their discharge is of constant quality. We recommend maintaining the present sampling frequency until TMAC verifies their assumption.

6.2 Plan equivalencies

One of INAC's requests was for an explanation of where the type of information contained in various management plans used on other projects might be found in the Doris North management plans. TMAC provided a letter on June 14, 2016 with a list of equivalencies entitled *TMAC Resources Inc.'s Revisions to Amendment Application No. 1 of Project Certificate No. 003 and Water Licence No. 2AM-DOH1323: Clarification on Management Plans*.

The Department's comments on this information are provided in Table 6 below.

Table 6 Response on plan equivalencies

Item	Recommended Plan	Licensee's Response	Comments
1	*Freshet Action Plan*	See *Water Management Plan* (June 2015)	Unsatisfactory response, see discussion below.
2	*Groundwater Monitoring Plan*	Submitted on June 2, 2016	Satisfactory response
3	*Fuel Management Plan*	Plan not required through original and subsequent permitting No changes to fuel management considered in Amendment scope so not included in Amendment Application *OPPP/OPEP* in place for fuel offload management *Spill Contingency Plan* addresses PHC spill management	Satisfactory response

Item	Recommended Plan	Licensee's Response	Comments
4	*Hazardous Materials Management Plan*	Plan not required through original and subsequent permitting *OPPP/OPEP* in place for fuel offload management *Hazardous Waste Management Plan* in place, updated underway, submission planned for Sept. 2016, 90 days prior to the start of Operations *Spill Contingency Plan* addresses hazardous material spill management	Satisfactory response
5	*Road Management Plan*	Plan not required through original and subsequent permitting Dust, traffic and spill are managed under other existing plans	Satisfactory response
6	*Explosive Management Plan*	Plan not required though original and subsequent permitting No changes to existing permitted facilities in Amendment scope, so not included ion Amendment Application Explosives are managed in accordance with the *NU Mine Health and Safety Act and Reg*	Satisfactory response
7	*Risk Management and Emergency Response Plan*	*Emergency Response Plan* already in place so not included in Amendment Application Risk management planning involves implementation of all site management plans	Satisfactory response
8	*Spill Contingency Plan*	Plan already in place, so not included in Amendment Application Routine updated submitted with 2015 Annual Reporting (April 2016)	Satisfactory response
9	*Aquatic Effects Monitoring Plan*	Plan already in place, so not included in Amendment Application Following engagement of Working Group, revised Plan submitted June 1, 2016	Satisfactory response

Item	Recommended Plan	Licensee's Response	Comments
10	*Quality Assurance (QA) / Quality Control (QC) Plan*	In place, approved. No need for revisions due to Amendment scope	Satisfactory response
11	*Sewage Treatment and Management Plan*	*Domestic Wastewater Treatment Management Plan* already in place, so not included in Amendment Application Routine updated submitted with 2015 Annual Reporting (April 2016)	Satisfactory response

Discussion for Item 1 – Freshet Action Plan

The June 2015 Water Management Plan does not include specific actions that will be taken to manage spring freshet.

In its concordance table, the plan references Part D, Item 17 of the Licence that requires daily visual inspections for all construction activity during spring freshet and during and after remarkable rainfall events with sampling of runoff/seepage where turbidity is evident. The plan matches the management of Pollution Control Ponds with this licence condition. However, no mention of inspections during spring freshet is provided within the plan.

The effective management of the annual spring freshet, throughout all phases of the project, is necessary to prevent adverse environmental and operational impacts. Based on experiences at other operating mines in Nunavut, specific management actions need to be implemented during spring freshet. It is recommended that the Licensee revise its Water Management Plan to include such details.

Although the scope of the Doris North Project is different from that of other operating mines in Nunavut, the Licensee should review other proponent's Freshet Action Plans included in their Water Management Plans, as they demonstrate the proponent is managing areas of concern to the best of its ability during the annual freshet period.

6.3 Reporting

TMAC has requested that many SNP stations from Schedule J of the water licence be moved to management plans to allow for modifications that do not involve amending the licence. This would allow monitoring to be more easily adapted to changing conditions if it became necessary. INAC's principle concern is that the monitoring occurs, whether it is described in Schedule J or a management plan is secondary.

A complication arising from transferring monitoring requirements from the licence to management plans is the reporting obligations. Presently Part J, Item 21 of the licence requires the Licensee to submit a monthly report that includes all data and information required by this Part and generated by the Monitoring Program in the Tables of Schedule J.

INAC recommends that if monitoring of certain stations is moved to various management plans, the Licensee be required to keep and provide a single stand-alone list of monitoring stations found in their management plans and report the data as they would if the stations were in Schedule J.

Table 7 identifies stations that were proposed to be moved from Schedule J to various plans.

Table 7 Monitoring stations displaced to management plans

Station	Description	Proposed plan location
TL-1	TIA at the Reclaim Pump Barge	Water Management Plan
TL-5	Combined Tailings Discharged into TIA (Water Component)	Water Management Plan
TL-6	Combined Tailings Discharged into TIA (Solid Component)	TIA OMS Manual
TL-12	Underground Minewater	Water Management Plan or Groundwater Management Plan
ST-1	Discharge from Sedimentation Pond	Water Management Plan
ST-2	Discharge from Pollution Control Pond	Water Management Plan

7.0 Closure and Reclamation Planning

Closure and reclamation planning ensures that the project's conclusion of successful site reclamation is considered when developing all its stages. The licensee has developed an updated Interim Closure and Reclamation Plan, which will be finalised as per part L, item 7 of the licence and include a final tailings cover design. This heading is further subdivided into two sections: comments and reclamation cost estimate.

7.1 Comments on closure and reclamation planning

Comments on closure and reclamation planning are listed in Table 8. All of them have been resolved with three requiring follow-up.

Table 8 Status of comments pertaining to closure and reclamation planning

Comment #	Issue	Status
INAC IR14	Tailings cover design	Resolved
INAC IR15	Slope grades for reclaimed overburden dump	Resolved
INAC TC3*	Post closure groundwater quality	Resolved
INAC TC4*	Tailings beach source terms	Resolved. Follow-up required.
INAC TC10*	Ponding along pads	Resolved. Follow-up required.
INAC R9*	Doris Outflow Creek	Resolved. Follow-up required.
INAC R12	Tailings cover design at closure	Resolved

* Further discussion included in Appendix A

Tailings beach source terms: INAC TC4 requested information regarding the use of median laboratory release rates from the humidity cell tests on the tailings. In their response, TMAC provided a site-wide water and load balance model sensitivity analysis using the 75th percentile input values for water quality terms. The Department is satisfied with this response and wants to ensure adequate monitoring frequency for the water flowing from the TIA to Doris Lake after the North Dam is breached. Since this is planned 5 years post closure, it will occur after the term of this licence and could be further discussed during the licence's renewal process. The follow-up is therefore only for the renewal process in 7 years.

Ponding along pads: INAC TC10 requested a description of measures to be implemented to ensure that water would not pond against the edges of thermal rock fill pads after closure. The explanation provided, excavating to restore drainage in areas of prolonged ponding, is satisfactory and the follow-up action required is to check for the modification in the revised Interim Closure and Reclamation Plan.

Doris Outflow Creek: INAC R9 recommended increasing the sampling frequency of Doris Creek post closure, above the once a year sampling proposed. TMAC has stated the characterization will be described in a revision to the Water Management Plan and the follow-up required is verifying the inclusion and what it proposes.

7.2 Reclamation cost estimate

The Interim Closure and Reclamation Plan is used to produce a reclamation cost estimate. TMAC provided a detailed cost estimate in July 2015 and the Department submitted an estimate prepared by its consultant in December 2015. Following discussions at the Technical Meeting in January 2016 and since then, both TMAC and the Department have produced new estimates. The evolution of total reclamation cost estimates is presented in Table 9.

Table 9 Reclamation cost estimates

Intervener	Date	Total cost reclamation estimate	Source
TMAC	July 2015	$25,061,000	Doris North Mine, Interim Closure and Reclamation Plan, July 2015 – Detailed Cost Estimate, TMAC Resources Inc.
INAC	December 2015	$47,818,382	Reclamation Cost Estimate, Amendment No.1 to Nunavut Water Board Licence No. 2AM-DOH1323, Doris North Project, Kitikmeot Region, Nunavut, December 2015, Amec Foster Wheeler Environment & Infrastructure
TMAC	February 2016	$29,138,814	Spreadsheet AANDC_CostEstimateReview_Tables_transcript_Rev07_EMR_INAC_Review and Addendum to Document P5-2 – Interim Closure and Reclamation Plan, February 3, 2016, SRK Consulting (Canada) Inc.
INAC	July 2016	$43,421,405	2015 Reclamation Cost Estimate (2016 Update), Amendment No.1 to Nunavut Water Board Licence No. 2AM-DOH1323, Doris North Project, Kitikmeot Region, Nunavut, July 2016, Amec Foster Wheeler Environment & Infrastructure

Presently, the principle difference between the TMAC and INAC estimates is the period of time required to complete the reclamation work. The INAC estimate for the number of man-months required is approximately nine times that of TMAC, and this has a large incidence on the site operating costs, which differ by $8,535,000.

The Department is still discussing the cost estimate with TMAC and will inform the Board of any further modifications to our position.

8.0 Other

A comment was made regarding the Madrid Advanced Exploration Project (INAC IR16) because of cumulative effects to the Doris North Gold Mine. On June 24, 2016, the NIRB provided a notice of indication that TMAC's application for the "Madrid Advanced Exploration Program" is exempt from the NIRB's review of the larger Phase 2 Hope Bay Belt project proposal, pursuant to Section 12.10.2(b) of the *Nunavut Land Claims Agreement.*

INAC is of the opinion that the Type B water licence application requires further review. This Information Request is considered to be resolved, recognizing that the Madrid Advanced Exploration is not included in the Licensee's application to amend its Doris North Gold Mine NIRB project certificate and Type A NWB water licence.

CONSEQUENTIAL AMMENDMENTS – ERRATA

Following the issuance of licence 2AM-DOH1323 in 2013, a list of what appear to be errata was compiled by the Department's Field Operations in collaboration with the Licensee. At the time it was shared with the Board, it was decided to defer any modifications because of the upcoming amendment application.

At this stage of the amendment application, the Department would like to re-submit the table of errata (Table 10) so they might be considered when crafting the text of the amended licence. Three types of issues are presented. "Grammatical" and "cross-referencing" (in italics) are for information. Other comments (in bold) may require discussion.

Table 10 Proposed Consequential Amendments

PART	ITEM	ISSUE	DESCRIPTION	COMMENTS
Part B	*3*	*Cross referencing*	*Should only reference Schedule B (remove 'Item 1')*	Suggested changes to current licence condition: The Licensee shall file an Annual Report with the Board no later than March 31 in the year following the calendar year being reported. The Annual Report shall be developed in accordance with Schedule B ~~Item 1~~.
Part D	*2*	*Grammatical*	*Double negative*	Suggested changes to current licence condition: The Licensee shall implement preventative and mitigation measures to prevent any chemicals, fuel or wastes associated with the undertaking ~~to not enter~~from entering any water body.
	4	*Grammatical*	*Clarify*	Suggested changes to current licence condition: The Licensee shall ~~implement~~maintain sediment and erosion control measures prior to, ~~and maintained~~ during ~~the~~ construction, and during operation where necessary to prevent entry of sediment into water.
	13	**Obsolete**	**Condition satisfied on Sept. 16, 2013**	Current licence condition: The Licensee shall submit to the Board for review, thirty (30) days following issuance of the Licence, updated for construction drawings of the proposed all weather access road. This submission shall include the following: a) The thickness of the various materials used at the coarse rock drain locations and for the general road fill; b) Details for the management of surface water adjacent to the access roads, including any contingency plans should coarse rock drains fail to operate; and c) Be signed and sealed by the appropriately qualified Engineer.

PART	ITEM	ISSUE	DESCRIPTION	COMMENTS
	22	*Grammatical*	*Correct wording regarding metal leachate*	*Proposed wording is consistent with NWB Water Licence No. 2AM-MEA1525.* The Licensee shall use fill material for construction only from approved sources that have been demonstrated by appropriate geochemical analyses to not produce Acid Rock Drainage and to be Non-Metal Leaching, and free of contaminants.~~to by Metal Leaching properties.~~
Part G	**3 c.**	**Not specific**	**Phase is not specified. Contradicts 3 d.**	Greater detail regarding when effluent from the Wastewater Treatment Plan can be discharged approximately 1,000 metres north of the camp pad (e.g., during construction and care and maintenance phases with prior notification to an Inspector) should be provided.
	4	**Obsolete**	**The Wastewater Treatment Plant was already in use at the time of 2013 licence issuance.**	This condition can be removed.
	6	*Grammatical*	*Alternate wording should be considered.*	Suggested changes to current licence condition: The Licensee shall not open burn plastics, wood treated with preservatives, electric wire, Styrofoam, asbestos or painted wood in order to prevent the deposition of waste materials (e.g. products of incomplete combustion, ~~and/or~~ leachate from contaminated ash residual, etc) from impacting any surrounding waters, unless otherwise approved by the Board in writing.
	13	**Obsolete**	**The Landfarm was already in use at the time of 2013 licence issuance.**	This condition can be removed.
	21	**Unclear**	**Is the Licensee expected to maintain the identified 'facilities' or the 'sumps' to the satisfaction of the Inspector?**	Suggested changes to current licence condition: The Licensee shall operate ~~the Wastewater Treatment Plan, Landfill, Landfarm, Fuel Storage and Containment Facilities, Sedimentation Pond, Pollution Control Pond, and the Reagant and Cyanide Storage Facility sumps~~and maintain all waste management facilities to the satisfaction of the Inspector.

PART	ITEM	ISSUE	DESCRIPTION	COMMENTS
	23 c.	*Grammatical*	*Remove double reference to PART G*	Water from the Sedimentation Pond that is acceptable for discharge under ~~PART G~~PART G, Item 23(a), if directly discharged to the tundra, shall be discharged immediately south of the facility approximately 500m upstream of Doris Lake, or as designated by an Inspector.
	24 b.	*Grammatical*	*Insert "or as" designated by and Inspector*	Water from the Landfill Sump that is acceptable for discharge under PART G, Item 24(a) may be discharged to the tundra or as designated by an Inspector.
Part J	*21*	*Grammatical*	*Should read, "…hardcopy format."*	The Licensee shall, within thirty (30) days following the month being reported, submit to the Board a monthly monitoring report in an electronic and hardcopy format.
Part K	*7*	*Grammatical*	*"… Gold **Mind** Project"*	The Licensee shall submit to the Board for review, six (6) months prior to Operations, a revised Doris North Gold ~~Mind~~ Mine Project: Aquatic Effects Monitoring Plan (AEMP) that has been developed in consultation with Environment Canada. The revised AEMP shall consider modifications and advances in schedule which are consistent with the objectives and requirements of MMER.

PART	ITEM	ISSUE	DESCRIPTION	COMMENTS
Part L	4	Deadlines	Inconsistency in deadlines prior to commencing operations. The Licensee is required to provide updates to the following plans six months prior to the start of Operations: • PART K, Item 6 - Aquatic Effects Monitoring Plan; • PART L, Item 6 - Interim Care and Maintenance Plan; • PART G, Item 25 – Tailings Management Plan; The Licensee is required to provide updates to the following plan three months prior to the start of Operations: • PART G, Item 10 – Hazardous Waste Management Plan However, PART L, Item 4 requires the Licensee to provide the NWB at least 30 days advanced notification in writing, of the initial start or change of Operations.	It is recommended that the deadline for providing updated plans and notification prior to recommencing Operations be consistent.
	7	*Error*	*2007 rather than 2006, as per PART L, Item* 6	The Licensee shall submit to the Board for approval, within eighteen (18) months of the start of Operations, a Final Mine Closure and Reclamation Plan prepared in accordance with the *mine Site Reclamation Guidelines for the Northwest Territories, ~~2006~~* 2007 and consistent with… It is noted that this timeline is no longer applicable based on the submitted amendment application.

PART	ITEM	ISSUE	DESCRIPTION	COMMENTS
Definitions		**Operations**	**A concrete definition for Operations is requested because it is a trigger for numerous actions. At what moment in time would the project be considered operational?**	Current licence condition (no changes made): "Operations" means the entire set of site activities (excluding construction, care and maintenance, and decommissioning activities) associated with mining, processing and recovery of gold at the Doris North Project, as described in the Revised Water Licence Application, Supporting Documents, and Technical Meeting Information Supplement documents submitted to the Board throughout the regulatory process. INAC Recommendation: Further definition of the beginning of operations would be helpful and might be tied to commencement of a specific activity.
Schedule J	**Table 2**	**Phase**	**Care and Maintenance is not listed as a 'Phase' in Column 3 although it is included in Column 4: Frequency during Care and Maintenance <u>prior</u> to any deposit of Tailings to the TIA**	
		ST-1	**No requirement to monitor during Care and Maintenance?**	ST-1: Discharge from Sedimentation Pond taken at a depth of ~0.25 m
		ST-7	**No requirement to monitor during Care and Maintenance?**	ST-7: Freshwater pumped from Doris Lake taken from a valve on the discharge end of the freshwater pump
		ST-7a	**No requirement to monitor during Care and Maintenance?**	ST-7a: Freshwater pumped from the Windy Lake freshwater intake (~~Appendix H of the Application).~~
		ST-8	**No requirement to monitor during Care and Maintenance?**	ST-8: Discharge from the Wastewater Treatment Plant bio-membrane
		ST-9	**Not required during Operations and Closure?**	ST-9: Runoff from Wastewater Treatment Plant discharge – downstream of wastewater treatment plant discharge point just prior to flow entering Doris Lake

PART	ITEM	ISSUE	DESCRIPTION	COMMENTS
	Table 3	**Thermistors listed as inactive during Operations**	**Several thermistors are listed as inactive during Operations.** **The NWB should confirm what thermal monitoring requirements should be included in the Water Licence and confirm that thermistors will be inactive during the project's Operations phase.**	

SECURITY MANAGEMENT

Both the original water licence and the amendment being discussed require the Licensee to post security with the Crown to cover reclamation costs. Security may also be required by the Kitikmeot Inuit Association under their land leases and commercial lease agreements with TMAC. Discussions between the Kitikmeot Inuit Association and INAC on an Agreement to manage the security are ongoing. An update on these discussions and any associated additional information for the board's consideration will be provided either prior to or during the scheduled public hearings.

COMPLIANCE RECORD

Departmental inspectors designated under Section 85(1) of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (the Act) regularly inspect the Doris North Project to ensure compliance under the Act, the *Nunavut Waters Regulations*, and the Type A water licence issued by the NWB. A total of six inspections have occurred since the Licensee took ownership of the Doris North Project in 2013 (average of two inspections per year). Inspections reports are available on the NWB public registry. In general, the Licensee is taking adequate measures to comply with its licence conditions and minimize environmental impacts that may result from its project's development. Examples of this conduct include the implementation of measures to reduce water consumption for drilling purposes, efforts to remediate historic hazardous material spill sites, and the reporting of few hazardous material spills.

During the most recent site inspection (April 5-7, 2016), the inspector noted two issues that need to be addressed with the Licensee. They are as follows:

1. Water used for ice road construction was being reported separately from licensed water usage. This practice was allowed to continue in 2016 but will be reviewed under the definition of water use; and
2. The Licensee has been asked to resume seasonal backhauls of hazardous waste as per its Hazardous Waste Management Plan. Although there was adequate storage at the time of the inspection, hazardous materials appeared to have accumulated since 2014.

The Department will continue to work with the Licensee to ensure that it complies with the Act, the Nunavut Waters Regulations, and its Type A water licence through regular site inspections.

CONCLUSION

Based on the information available, INAC recommends that the amendment application be accepted with due consideration given to the Department’s recommendations.

APPENDIX A

Amec Foster Wheeler Report on
Review of Nunavut Water Board Licence No. 2AM-DOH1323

Report on
Review of Nunavut Water Board Licence No. 2AM-DOH1323
Doris North Project
Kitikmeot Region, Nunavut

Submitted to:

Indigenous and Northern Affairs Canada
P.O. Box 100, Building 918
Iqaluit, Nunavut
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Submitted by:
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July 2016

CONTENTS

1.0 INTRODUCTION

Indigenous and Northern Affairs Canada (INAC) has engaged the services of AMEC Foster Wheeler, Environment & Infrastructure to complete an expert review of TMAC Resources Inc. (TMAC or Licensee) application to amend the Nunavut Water Board (NWB) Licence No. 2AM-DOH1323 for the Doris North Project. This memorandum specifically addresses unresolved issues generated from the January 28-29, 2016 Technical Meeting, December 8, 2015 Technical Review submission, and September 9, 2015 Completeness Review submission. This Review is intended to support INAC in their determination of a final position to the NWB on many of the technical issues raised during the Licensee's water licence amendment application.

Specifically, Amec Foster Wheeler has:

- Determined if activities identified in the application include mitigation measures that will protect the quality and quantity of surrounding freshwater sources;
- Determined if commitments made by the Licensee during the application review process to date are sufficient for the protection of surrounding freshwater sources; and
- Identified any outstanding issues pertaining to water management that need to be addressed.

To conduct this work Amec Foster Wheeler undertook the technical review of management plans and related documents that the Licensee submitted to the NWB. This review included the management plans and related documents that the Licensee submitted to the NWB in June 2016:

- Groundwater Management Plan;
- Tailings Impoundment Area Operations, Maintenance, and Surveillance Manual;
- Interim Dike filter design trade-off study and detailed design of selected filtering method; and
- Aquatic Effects Monitoring Program and proposed Surveillance Network Program (SNP) revisions.

Amec Foster Wheeler found the documentation to be, for the most part, complete with the slight exception that some areas could have benefitted from enhanced detail. These matters were addressed through the Information Requests, Technical Comment (TC) and Recommendation (R) procedures.

Amec Foster Wheeler's specific comments are presented in the following narrative sections.

2.0 WATER QUALITY PREDICTIONS

2.1 INAC TC1 – Process Water Source Terms

This subject related to the methodology for the determination of process water source terms. The amount and chemical form of contaminants released from a specific source for a specific period of time was not clearly specified in the application.

Based on the response provided by TMAC with respect to metallurgical testing, sample selection, process water samples and process water effluent source terms, this issue is resolved.

2.2 INAC TC2 – Underground Mine Water Loadings

This issue related to the lack of information regarding the potential loadings to the underground mine water from water that has come in contact with mine walls, backfilled waste rock or tailings during operations.

Based on TMAC's response describing the rationale for not including underground source terms in the water quality models, this issue is resolved.

2.3 INAC TC5 – Ore and Waste Rock Source Terms

This issue related to the contaminant loadings from ore and waste rock stockpiles, and a request for detail regarding the basis for selecting source terms for waste rock and ore stockpiles and what can be expected in the future.

TMAC responded that discharges from the waste rock are a minor source of contaminant loading and that the current source terms for waste rock are adequate for evaluating potential loadings to the Tailings Impoundment Area (TIA). The issue is resolved.

2.4 INAC TC6 – TIA Storage Capacity

This issue related to a concern that the TIA may not have sufficient storage capacity for water in the event effluent fails discharge criteria, and must be stored until a water treatment plant is built.

TMAC responded that model simulations demonstrate that the TIA has sufficient capacity to retain water for an extended period, which in all cases is at least 5 years, and that water not meeting discharge standards can be retained in the TIA until a suitable mitigation strategy, such as water treatment, can be implemented. The issue is resolved.

2.5 INAC R8 – Reference Point Monitoring

This issue related to the elimination of the reference stations from the revised Aquatic Effects Monitoring Plan (AEMP).

The matter remains unresolved, since a reference point is considered to be an effective means to determine the general impact of the project on the aquatic environment. A reference lake can help determine if aquatic effects are project specific or wider environmental effects from regional changes due to global phenomenon such as climate changes or broad scale air/water interactions.

2.6 INAC R10 – Sulphate and Major Ion Analysis

This issue related to the request for additional testing for sulphate and major ions (e.g. Ca, Na, Cl) in underground mine water under the proposed SNP revisions.

TMAC agreed to the expansion of the semi-annual and monthly sampling suite for underground mine water to include sulphate and major ions in solution. Sodium, calcium, chloride, and sulphate will also be included in the AEMP sampling at ST-7 as well.

This issue is resolved pending review of an updated Groundwater Management Plan and AEMP.

3.0 WASTE ROCK AND TAILINGS

3.1 INAC TC7 – Criteria for Using Rock for Construction Purposes

This issue related to the basis for the criteria to determine whether diabase can be used as construction material outside the containment area.

TMAC clarified that all of the diabase samples from both the pre-mine characterization programs and underground monitoring programs have been classified as not-potentially acid generating (non-PAG) on the basis of NP/AP ratios. The issue is resolved.

3.2 INAC TC8 – Monitoring Mineralized Rock

This issue related to the approach to segregation of non-mineralized diabase from all other types of rock.

TMAC responded that diabase can readily be identified visually, and that the location of the diabase has also been included in the geological model for the site, and can therefore be anticipated with reasonable accuracy during mine development. The issue is resolved.

3.3 INAC TC9 – Interim Dike Filter

This issue related to the filtering capability of the Interim Dike and consideration of the effects of build-up of hydrostatic head on the upstream side.

TMAC provided a detailed evaluation of the filter criteria necessary to ensure adequate performance of the Interim Dike. The evaluation confirmed that the run-of-quarry material proposed for use in construction of the Interim Dike will not retain tailings and therefore a specific filter design as presented in the memo is required from the outset. This issue is resolved.

3.4 INAC R1 – References to OMS Manual

This issue related to the lack of information in the Operations, Maintenance and Surveillance (OMS) Manual for the TIA regarding where to access related documents.

TMAC confirmed that references to related documents would be provided, and that a revised TIA OMS Manual will be submitted prior to the Public Hearing.

This issue is resolved pending review of an updated TIA OMS manual.

4.0 MITIGATION MEASURES

4.1 INAC TC11 – Dust Control for Tailings

This issue relates to fugitive tailings dust emissions associated with sub-aerial disposal of tailings during operational phases.

TMAC responded that the primary dust control measures will be the use of environmentally suitable chemical dust suppressants. The Tailings Management Plan was revised to include details regarding the dust control suppressants. Details on application rates will depend on material-specific testing (of the tailings). This issue is resolved.

4.2 INAC R6 – Sediment Sampling

Given the dust generated by mine operations, this issue was related to the quality of sediment in Doris Lake, and that sediment sampling should be included as an integral activity in the AEMP.

TMAC committed to including surficial sediment sampling in Doris Lake as part of the AEMP program (3 year frequency). This issue is resolved pending review of an updated AEMP.

5.0 WATER TREATMENT

5.1 INAC TC12 – Sewage Treatment

This issue related to the lack of information on the Packaged Sewage Treatment Plants in terms of contaminant removal efficiency and the actual concentration of the required parameters (including pH, BOD5, TSS, fecal coliforms, oil and grease, etc.) to be discharged in the TIA.

TMAC confirmed that its 2014 Doris North Wastewater Management Plan provides details on the Packaged Sewage Treatment Plants that are used on site, and that they are satisfying the effluent discharge requirements for discharge to tundra as demonstrated through monthly and annual monitoring report submissions. This issue is resolved.

5.2 INAC TC13 – TIA Water Treatment

This issue related to the lack of information for additional treatment of water that comes into contact with ore and waste rock.

TMAC responded that it is not expected that water treatment will be needed. However, should the water quality in the TIA not be suitable for discharge, there is sufficient capacity in the TIA to retain water for a period of at least 5 years. This is sufficient time to design, procure, construct and commission a water treatment plant should one be required. This issue is resolved.

6.0 MANAGEMENT PLANS AND REPORTS

6.1 INAC R2 – Contingency for Greater Mine Inflow

This issue was related to the uncertainty with respect to groundwater inflow estimates into the mine workings, and the lack of information on contingency plans in the event that flow rates exceed 3,000 m^3/day.

TMAC responded should flows be in excess of 3,000 m^3/d, standby pumps would be available temporarily to remove the excess water to the TIA and/or emergency storage of water within mine sumps and the lower parts of the mine. TMAC committed to revising Section 8 of the Groundwater Management Plan to include this content prior to the Public Hearing.

This issue is resolved pending review of an updated Groundwater Management Plan.

6.2 INAC R3 – Monitoring Mine Inflow Water

This issue was related to the quality of mine water inflow into the mine workings.

TMAC responded that the water quality monitoring will be consistent with Schedule J of the water licence, and as reflected in the Groundwater Management Plan. TMAC committed to updating the Groundwater Management Plan to reflect the monitoring and submission prior to the Public Hearing.

This issue is resolved pending review of an updated Groundwater Management Plan.

6.3 INAC R4 – Downstream Monitoring

This issue related to the elimination of water quality monitoring downstream from Doris Lake in the revised Aquatic Effects Monitoring Plan (AEMP), particularly in the event that water would be discharged directly into Doris Creek if the mine enters into Care and Maintenance.

TMAC stated that post deposition of tailings in the TIA, water from the TIA will not be discharged to Doris Creek and so monitoring in Doris Creek is not warranted. Resolution of this issue is indeterminate, as there can be potential performance problems with the North Dam which could lead to unmeasured impacts in Doris Creek. Therefore, it is recommended that if there is an indication that the North Dam is not performing as expected (e.g. seepage, thermosiphons), TMAC should provide the NWB with an action plan to assess and address it, which could include water sampling in Doris Creek.

6.4 INAC R5 – Cross Referencing between SNP and AEMP Reports

This issue related to including water quality monitoring results from two Doris Creek sample locations (TL-2 and 3 from the SNP) in the AEMP report.

TMAC stated that post deposition of tailings in the TIA, water from the TIA will no longer be discharged to Doris Creek and so monitoring in Doris Creek is not warranted. The issue remains unresolved, as discussed in the preceding recommendation, INAC R4.

6.5 INAC R7 – Testing Parameters

This issue related to the request for additional testing for sulphate and major ions (e.g. Ca, Na, Cl) in solution for all water samples.

TMAC agreed to the expansion of the sampling program outlined in the Groundwater Management Plan to include electrical conductivity and major ions in monthly and weekly sampling, and to revise the Groundwater Management Plan to reflect this change and provide it to parties prior to the Public Hearing.

This matter is considered to be resolved, however an updated Groundwater Management Plan should be reviewed prior to the Public Hearing.

6.6 Interim Tailings Dike

This subject was related to the filtering capability of the Interim Dike. The dike is proposed to be constructed from run of quarry to retain tailings. There was a concern regarding the lack of detail for the construction of the filter layers, which is planned while the TIA is in operation.

TMAC submitted a technical and economic trade-off study report considering two proposed filter designs; a geosynthetic filter and a graded rock filter. The study also included proposed construction methods.

Review of the above mentioned study is provided in a separate memorandum.

7.0 CLOSURE AND RECLAMATION PLANNING

7.1 INAC TC3 – Post Closure Groundwater Quality

This issue related to the lack of information regarding mine flooding after operation of the mine is finished, the potential impacts of mine flooding on groundwater quality, and potential for groundwater discharge to Doris Lake after mine closure.

Information provided by TMAC at the Technical Meeting in late January 2016, and responses to the Department's Information Request and Technical Comments, supports the conclusion that the project will not have an adverse effect on groundwater quality. This issue is resolved.

7.2 INAC TC4 – Tailings Beach Source Terms

This issue related to the lack of information regarding the methodology for the selection of source terms for tailings beaches, particularly the rationale for using the median laboratory release rates from the Humidity Cell Tests.

TMAC described the rationale for the source terms selected and then undertook a sensitivity analysis for the Site-Wide Water and Load Balance Model. Based on these results, this issue is resolved. However, follow-up is required for closure and post-closure monitoring frequency for water reporting from Tail Lake to Doris Lake and this can be addressed when TMAC applies to renew its licence in 2023.

7.3 INAC TC10 – Ponding Along Pads

This issue related to the concern that post-closure, water may build up adjacent to the toe of the thermal rock fill pads, and thus alter the thermal properties of the permafrost maintenance system.

TMAC responded that the closure strategy will be that areas restricting flow will be excavated to restore drainage and thereby prevent ongoing ponding, and the Interim Closure and Reclamation Plan (Document P5-2 of the Amendment application) would be revised prior to Operations to reflect this commitment.

This matter is considered to be resolved however the date of revised closure plan submission must be confirmed by TMAC.

7.4 INAC R9 – Doris Creek Outflow

This issue related to the annual post-closure sampling frequency for the Doris Creek Outflow under the proposed SNP revisions, and the recommendation that monitoring be conducted more frequently (several times per year) before, and for a few years after, TIA discharge to Doris Creek restarts.

TMAC provided further rationale for the proposed SNP revisions that were questions. This issue is resolved pending review of the revised Water Management Plan. It is also noted that the concern associated with closure sampling can be addressed prior to implementation of the Closure Plan.

7.5 Security Cost Estimate

Analysis of, and comments on the security cost estimate are provided in a separate memorandum.

8.0 CONCLUSION

The majority of the technical comments and recommendations have been addressed through correspondence and/or discussion with TMAC. In many cases, more detail was provided to address the concerns. Several comments and recommendations should be resolved pending INAC's review of updates to the following management plans once received from TMAC: AEMP, Groundwater Management Plan, TIA OMS Manual, and Water Management Plan.

The following issues remain unresolved:

- INAC R8 – TMAC proposes eliminating both reference sites from AEMP; however, one reference site should be retained.

- INAC R4 and R5 – TMAC proposes to eliminate Doris Creek monitoring during operations and beginning of closure phases; however, it is recommended that Doris Creek monitoring be triggered if the North Dam is not performing as expected.

This Report was prepared exclusively for INAC by Amec Foster Wheeler. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in Amec Foster Wheeler's services and based on: i) information available at the

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