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Kugluktuk

Bathurst Inlet
Kingaok

Bay Chimo
Umingmaktok

Cambridge Bay
Ikaluktutiak

Gjoa Haven
Okhoktok

Taloyoak

Kugaaruk

Phyllis Beaulieu
Manager of Licencing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B1J0

December 4th, 2015

Re: KIA's Technical Review of TMAC Resources Inc. Amendment Application No. 1 of Project Certificate No.003 and Water Licence 2AM-DOH1323 for the Doris North Project.

Dear Phyllis Beaulieu, KIA has completed its technical review of the *TMAC Resources Inc. Amendment Application No.* of Project Certificate No. 003 and Water Licence AM-DOH1323 for the Doris North Project.

The KIA's consultants have reviewed the amendment package in detail in the subject matter areas of wildlife, fisheries, aquatic environment, and geotechnical engineering. Our Information Requests were provided to both the NWB and the NIRB to which TMAC Resources Inc. had replied. KIA had also provided its comments on TMAC's responses to submitted IRs to both the NWB and NIRB.

During the course of KIA's technical review of the amendment package, our consultants made direct enquires with TMAC's consultants on several issues raised in our Information Requests. Several of these issues have been resolved to KIA's satisfaction while others are being brought forward for discussion at the Technical hearings in Cambridge Bay for January 26th to 29th.

The issues KIA wishes to address at the Technical Hearings in January are presented as follows:

1. TIA Expansion Capacity

Although TMAC's submitted amendment package concerns changes to the Doris North Project Certificate 003 and Water Licence 2AM-DOH1323, KIA believes some consideration for future developments such as the Madrid Advanced Exploration Program should be considered at this point. The Madrid Advanced Exploration Program requires the shipping of saline mine water from the Madrid North and South pollution control ponds to the TIA. TMAC should provide reasonable assurance that the TIA has the required expansion capacity for this future development.

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2. TIA Wildlife Attraction and Deterrence

The TIA water will have a higher chloride level than the surrounding environment and may attract ungulates. Adaptive management, including wildlife deterrence, may be required around the TIA. If sub-aerial floatation tailings have a higher salt and mineral content than the surrounding environment, adaptive management should be used to ensure that wildlife do not feed on tailings may be required.

3. TIA Floatation Tailings Dust Fall and Leaching

The sub-aerial floatation tailings may leach copper, lead and arsenic over the long term at a neutral pH. A strong monitoring program, which not only monitors dust falls from the tailings, but also the potential spread of leachate into soils and vegetation consumed by wildlife, may be required. KIA suggests that the tailings dust fall monitoring program be tied to monitoring of impacts to wildlife habitat (e.g., dust- related damage to vegetation, metal leachate in soils and vegetation) and to wildlife toxicity risk. A risk assessment and subsequent adaptive management may be required if monitoring detects that wildlife habitat is becoming damaged by dust, contaminated by leachates, and if wildlife are at risk due to ingestion of tailings, tailing water, or plants and soils contaminated by leached metals. For both wildlife attraction and tailings leaching, more information will be required in the updated management plans to ensure these potential issues can be detected, and protection against. KIA cannot agree with the conclusions of TMAC in their effects assessment prior to reviewing details of the monitoring and mitigation plans.

4. TIA Elevated Parameters of Potential Concern Upon Closure

The Site-Wide Water and Load Balance model uses median monthly background surface water quality and median release rates from humidity cell tests to calculate loadings from exposed tailings beaches as input parameters. KIA believes this may result in an underestimation of potential effects to surface water runoff and that 75th percentile concentration should be used as input parameters into the model.

5. TIA NPAG Tailings Cover Depth

The estimated 0.3 m of quarry rock for the tailing cover is based on median release rates from humidity cell tests used to calculate the loadings from exposed beaches in the Site Wide Water and Load Balance model. KIA believes this may result in an underestimation of potential effects to surface water and Doris Creek. KIA believes that the use of 75th percentile concentrations should be used as input parameters to determine loadings and the required depth of the tailings cover.

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6. Roberts Bay Discharge and AEMP Monitoring

Without details of the AEMP, to be updated prior to September 15, 2016, KIA cannot be assured that there will be no impacts on wildlife in Roberts Bay, due to potential modeling errors. To protect wildlife in Roberts Bay, additional sampling sites within the zone of influence of the new diffuser will be needed, as well as an increase in sampling frequency for water quality, dissolved oxygen, sediment quality, and contaminants in bivalves (a dietary item of many of the wildlife reported in Roberts Bay). For this issue, a review of the updated AEMP management plan will be needed to determine whether KIA agrees with the conclusions of TMAC's effects assessment regarding potential impacts of sub-sea diffusion on wildlife.

7. Potential Interaction with Marine Environment

Saline groundwater and water from the TIA have the potential to interact with the marine environment. Of particular concern is the variability of TIA discharge, salinity levels, and chemical differences between saline groundwater and seawater. Saline groundwater has significantly higher levels of hardness, ammonia, nitrate, phosphorus, calcium and iron than seawater. KIA believes that the variance in water discharge and chemical differences and their potential impact on seawater should be addressed in further detail by TMAC.

8. Mixing Zone Delineation

The KIA believes that TMAC's approach to deriving water quality targets for Roberts Bay and predicting effluent concentrations is not sufficient to evaluate the effects of the project. The approach used does not determine the size and properties of the mixing zone where water quality will be above the CCME guidelines. TMAC should use 75th percentile baseline concentrations for inputs into model predictions of water quality conditions. Mercury concentrations should also be added to groundwater and TIA effluent in predictions along with additional water sampling and analysis results. This will allow the model to be refined and updated.

9. Increasing Contaminants of Potential Concern in Roberts Bay

In relation to the TIA Expansion Capacity, the cumulative effects of additional effluent from the Madrid Advanced Exploration Program should also be taken into consideration in assessing and predicting discharge effects in Roberts Bay.

10. Hydrogeology

The groundwater inflow modeling undertaken by TMAC was used to predict Doris North mine groundwater inflow and water quality over the life of the mine, to

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provide input into the Site-Wide Water and Load Balance model, and to inform engineering on the site water management plan. One of the impacts predicted is the effect of groundwater inflow on the level of Doris Lake. KIA believes that further characterization of local heterogeneity of important hydrogeological features would enhance predictions of groundwater inflow in the mine site. Also additional details regarding the management of ground water inflows during mining operations would provide assurance that dewatering rates below 3,000 m^3/day would effectively handle predicted groundwater inflows.

11. Site-Wide Water and Load Balance

The KIA believes that both climate change and wet & dry hydrological conditions should be incorporated into the load balance modelling to determine the effect of wet and dry years on effluent quality. Also the use of the 75th percentile concentrations would improve predictions of TIA water quality under enriched conditions. This should also include additional analyses for mercury and selenium using low-level detection limits.

12. Prediction of Environmental Effects on Water Quality

KIA believes that the water quality model of mixing in Roberts Bay should also determine the concentrations of nitrate and other parameters previously mentioned in the immediate mixing zone, in the deep, and in the surface layers of the bay. TMAC should confirm the prediction that nitrate will not be available in Roberts Bay's surface waters and access the level of nitrate in ocean water beyond the bay.

13. Doris Lake Water Levels

Given the impact of ground water inflow has on Doris Lake water levels, KIA believes that the fisheries baseline for Doris Lake be updated in reference to spawning habitat and fish use. This should be done in conjunction with the update of the hydrological baseline data to accurately quantify potential effects and any mitigation and monitoring plans for the lake.

14. Attraction or Avoidance of Grizzly Bears to the Mine Site

The current WMMP design fails to allow for the determination of attraction or avoidance of grizzly bears with the mine, which was a compliance requirement of this plan. Other researchers have found avoidance effects for similar or comparable projects in the Arctic region. Therefore, we do not agree with conclusions of no impacts on grizzly bears, and suggest that enhancements to the WMMP camera monitoring program be made to enable the detection predicted impacts for grizzly bear made in the original FEIS (and such that this compliance requirement is met).

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The KIA would also like to remind both the NWB and NIRB that on March 30th, 2015 the Kitikmeot Inuit Association (KIA) and TMAC Resources Inc. entered into a comprehensive Framework Agreement for the development of the Hope Bay Greenstone Belt which includes the Doris North Gold Mine and the Madrid and Boston advanced exploration projects, among other exploration and development targets. The Agreement is intended to provide long term benefit and certainty to Inuit beneficiaries and long-term development and tenure certainty to TMAC.

One of the major features of this comprehensive agreement is a publicly available Inuit Impact and Benefit Agreement (IIBA) for activities on the Hope Bay Belt which addresses socio-economic interests of Inuit in the region, including employment, contracting, and training.

The purpose of the IIBA is to satisfy requirements under article 26 of the NLCA with respect to Doris North and any future Major Development Project in the Hope Bay Belt Area. It is intended by the IIBA to provide benefits to Inuit arising from TMAC's operations that may fall below the threshold of a Major Development Project.

Under the IIBA, TMAC has a commitment to inform the KIA on a regular basis on both the socio-economic and ecosystem effects of their operations in the Kitikmeot region. Socio-economic effects are to be reported on a regular and timely basis through the IIBA Implementation Committee, TMAC Liaison, and the IIBA Manager. Ecosystem effects are to be reported through the Inuit Environmental Advisory Committee (IEAC) that has been established. These are processes in addition to KIA's rights to comment to the NWB and NIRB on impacts.

Through these committees, the KIA is being adequately consulted by TMAC Resources Inc. on socio-economic and environmental effects and the potential impacts on the rights of Inuit beneficiaries.

Also the comprehensive Framework Agreement and other regulatory processes related to the Hope Bay Project provide additional opportunities to mitigate potential adverse effects on Inuit people and the environment.

The comprehensive Framework Agreement and the IIBA satisfies all present and future obligations required under the NLCA for the duration of the agreement.

The successful execution of the Framework Agreement and the IIBA in conjunction with the Net Smelter Royalty Agreement, the Water and Wildlife Compensation Agreement, the Mineral Rights Agreement with Nunavut Tunnigavik Incorporated

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(NTI), and KIA's significant shareholding in TMAC creates substantial benefit for all Inuit in the Kitikmeot region. There will also be further opportunities for spin-off benefits for local municipal governments, the Government of Nunavut, and the Government of Canada.

Given this, KIA believes that all remaining technical issues identified can be successfully resolved through continued cooperation between KIA and TMAC Resources Inc. at the technical hearing and on an ongoing basis.

KIA's Technical Review comments for the Amendment to Project Certificate 003 and 2AM-DOH1323 Type A Water licence are attached with this letter in the format required by NIRB. These comments and requests are to supplement our review summary presented above.

Yours Truly

John Roesch

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Department of Lands and Environment
Kitikmeot Inuit Association

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Technical Review Comments for Amendment to Project Certificate 003 and Water Licence 2AM-DOH1323 for Doris North Mine Site.

Technical Comment No:	KIA - 1
Subject/Topic:	**TIA Expansion Capacity**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 1, Section 1.7.1; Package 6-13, Appendix B
Summary:	TMAC states "The Doris North Project and the Madrid/Boston (Phase 2) Hope Bay Belt Project are separate but related neighboring projects...To minimize overall project footprint and potential for impact, and to maximize the existing investment TMAC has designed the Madrid/Boston project to use facilities that already exist at Doris to the extent possible. However, it is important to note that the revisions to Doris facilities listed in this Amendment Application are in support of the Doris Mine itself. Additional changes will later be required to support the Madrid/Boston project, but any such changes will be outlined and permitted separately as part of the Part 5 review of the Madrid/Boston (Phase 2) Hope Bay Belt Project." The current Tailings Impoundment Area (TIA) plan has been re-scoped in the amendment to use sub-aerial deposition designed to accommodate a greater volume of tailings than the originally permitted sub-aqueous deposition would have been able to hold within the current project footprint. It is unclear if this new shift to sub-aerial deposition would eventually require an even larger project footprint at the time of the Madrid and Boston (phase 2) project permitting. Does proceeding with this updated deposition strategy allow for the accommodation of the tailings generated from the expanded project? For example, alternative #5 presented in the Tailings Management Strategies Alternatives Assessment has the reported benefit of permitting a larger "volume of tailings within a smaller footprint, [generating] an overall more stable landform unit". A smaller footprint would provide more space for future expansion.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	KIA Request: Will the proposed sub-aerial TIA need further expansion if TMAC proceeds with phase 2? Can TMAC provide a discussion on the TIA's capacity to handle additional tailings from Doris North (if additional resources are discovered), and the other proposed projects in the Hope Bay Belt (Madrid and Boston)? What will this expansion, if built, eventually mean to the final build out

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	of the tailings disposal facility? Does it enhance or jeopardize the need for any further expansion? TMAC Response: While the Doris facilities have the capacity to support use by future development in the Hope Bay Belt, the scope of the Amendment Application is limited to the Doris Mine. Consideration of future developments in the Hope Bay Belt and their associated impacts should be considered as either a separate application or a future amendment to existing licences, as appropriate. Accordingly, TMAC respectfully requests that the consideration of the use of Doris infrastructure in the Madrid, Boston and Phase 2 projects be considered in their respective regulatory processes.
Recommendation/ Request:	We are concerned with the proponent's response. Consideration of future development in the Hope Bay Belt and their associated impacts should be included as part of the cumulative effects assessment for this application. The NIRB defines a "regional study area" as: "The area within which there is the potential for indirect or cumulative biophysical and socio-economic effects" (Nunavut Impact Review Board. 2011. Guidelines for the Preparation of an Environmental Impact Statement for AREVA Resources Canada Inc.'s Kiggavik Project (NIRB File No. 09MN003).) NIRB's requires that the significance of a project's interaction with the environment must consider "the potential for cumulative adverse effects given past, present and future relevant events" (Nunavut Impact Review Board. 2007. Guide to Terminology and Definitions). The Madrid/Boston projects are separate but related neighbouring projects and would meet the NIRB definition of "future relevant events", as TMAC plans to develop the resources in the Belt in a series of phases, continuously producing mines over time. Approval of the TIA for this project may predetermine, to some extent, the location of future tailings management areas and it is reasonable to consider the cumulative foot print and land uses associated with the future expansion. While Doris Mine is operating, TMAC plans to commence the permitting and development of the Madrid/Boston project (Project Description, Section 1.7.1). It is therefore reasonable, and a requirement under the NIRB's environmental impact statement framework, for TMAC to include the cumulative effects from all projects in this application.

Technical Comment No:	KIA - 2
Subject/Topic:	**TIA Wildlife Attraction and Deterrence**
References to NIRB EIS Guidelines and Amendment Proposal (package	Engineering Design Plans: Pk 6-Pt 7; Section 6.3.1, Table 6-2, Page 41; Predicted Water Quality in the TIA; Appendix A; Page A-1, Table A-1; WQ levels @ TL-1 (located at the TIA discharge pump); and

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number/section, page number:	Appendix B; Figure B-1
Summary:	TMAC has changed the way in which tailings will be handled, and some tailings (floatation tailings) will be spread sub-aerially between the south Dam and a new Interim Dike, confining tailings to the southern limit of the TIA. Some water will cover a portion of the TIA to the north of this area; Mean monthly background water quality concentrations of chloride at TL-1, measured at the TIA discharge pump, are estimated between 33 and 57 mg/L between June to October; From 2015 to approximately 2022, chloride levels in the TIA are predicted to be above background water quality levels, reaching peak levels of > 100 to 200 mg/L (Figure B-1); From 2023 to 2035, chloride in TIA will fluctuate above the background water quality levels, with peak levels above 100 mg/L (Figure B-1); Chloride can combine with other molecules to form salts, including sodium chloride, calcium chloride, or potassium chloride, which may attractant northern herbivores such as caribou and muskox; and We could not find estimates of salt levels in dry floatation tailings to be deposited sub-aerially. However, elevated salts in those tailings could also attract northern herbivores if above levels in the surrounding environment, and this problem could persist post-closure.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Moderate: Caribou and muskoxen may be attracted to the TIA water (or solid tailings and vegetation or soils dusted with solid tails), if mineral and salt levels are higher than ambient. This prediction is based on observations of previous researchers observing ungulate behaviours around other mines; Attraction of caribou to this site could be problematic to caribou if it causes them to be exposed to higher metal loads (see KIA-2 for a discussion of metal exposure of wildlife from tail leaching). Attraction to the area could also be problematic if the tailings act as "quicksand material" to wildlife; If caribou and muskoxen are attracted to the area, they may also increase their exposure to noxious stimuli associated with the mine while it is operational; and More likely, issues may occur post-closure, when there is less mine activity to cause wildlife to avoid the area. After closure, caribou may dig at the 0.3 m of cover material to access tails, or they may access tailings materials where boils form through cover material, if the floatation tailings contain minerals that attract them. Feeding on sub-aerially deposited flotation tailings intentionally or unintentionally (e.g., if tailings spread and are dusted on plants and soils, or if

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	leachates are taken up by vegetation), could lead to an increased exposure of wildlife to metals (see KIA-2).
Detailed Technical Comment:	1. Gap/Issue: In general, a consideration of the sub-aerial floatation tailings and tailings water as a potential attractant for caribou, muskoxen, and other salt-limited northern herbivores is warranted but absent from the application. Contingency measures for wildlife deterrence during operation and post-closure phases may be needed as part of the updated WMMP. A clear answer about chloride and mineral levels in floatation tailing to be sub-aerially deposited should also be provided (it was requested of TMAC during this technical review period). 2. Disagreement with amendment conclusion: It is difficult to accept that this change in tailings management will not potentially pose issues over the long term for wildlife, without first having in place a contingency plan for wildlife deterrence or other suitable mitigation around the TIA during all mine phases, in the case that wildlife is attracted to the area. 3. Reason for disagreement with proposal conclusion: Wildlife (particularly ungulates) are known to be attracted to areas with elevated chloride, as seen in other areas impacted by mining. Caribou in the Arctic have been observed to intentionally consume soil (geophagy), and water, snow, ice and tails with elevated salts due to their need for minerals. Mineral/salt limitations often occur in spring due to reproductive demands combined with low-mineral foods being available in the winter. In the NWT, Heard and Williams (1990) reported the use of ice and mineral licks during the winter by caribou at four lakes where caribou were observed licking and gnawing on the ice. Other researchers have reported caribou behaving similarly around tailings facilities, where they may be attracted to higher levels of salt in tailings water and solid tailings. For example, caribou was observed in the abandoned Colomac mine drinking water or feeding on tailings. During the colder months, they were seen cratering through snow to access ice and tailings with higher levels of sodium chloride and calcium sulphate (MacDonald and Gunn, 2004). Results of a study by MacDonald and Gunn (2004) suggested that ca. 20 % of the diet of caribou in the area around the abandoned Colomac mine were ingested tailings (and up to 50% in one individual); Without a year- round adaptive management/deterrence plan to prevent wildlife attraction to the TIA, or to areas impacted by tails, a worst case scenario assessment would assume some degree of attraction and feeding in the area could occur, which could lead to population level impacts over the long term.
Recommendation/ Request:	As part of an updated WMMP program, design a monitoring program and adaptive management plan, including clear thresholds, that will instigate the use of deterrents to keep wildlife from accessing TIA water, ice, and sub-aerial tails (including vegetation-dusted areas), during operation, closure, and post- closure periods. See also recommendations for KIA-2, which is related to this issue, but focuses on the potential for metal leachates.

Technical Comment No:	KIA - 3

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Subject/Topic:	**TIA Floatation Tailings Dust Fall and Leaching**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Environmental Effects and Mitigation, Pk 6, Pt 7 P6-12; Tailings Geochemistry; Section 4.3.1, Table 4.9, Page 24 P6-13; Tailings Management System Design
Summary:	TMAC proposes to deposit all detoxified cyanide leach tailings underground as part of the mine backfill. However, an estimated 2, 350, 000 tonnes of flotation tailings are proposed to be sent to the TIA, which exceeds the volume licensed to be deposited under water. Therefore, TMAC has proposed sub-aerial tailings deposition between the south Dam and a new Interim Dike, confining tailings to the southern limit of the TIA. Their preferred closure strategy is a dry cover (0.3 m over the tailings and breaching of the North Dam, which impounds the Reclaim Pond during the operational stage). Long term humidity cell tests done on flotation tailings (to be sub-aerially deposited), indicated that after the initial flushing of the samples of contaminants of concern (of Arsenic, Lead, Phosphorus, Chromium, Copper, Selenium, Cadmium, Aluminum, Molybdenum, and Zinc) there was still an increased tendency for long term neutral pH metal leaching of arsenic from the Doris North flotation tailings, and of copper and lead from the central flotation tailings. If the tails spread, therefore, the risk of long term neutral pH leaching of these three metals would also increase, potentially leading to issues if caribou and other wildlife feed in the area, and particularly if they are attracted to feed directly on tailings (see KIA-1). Copper can have a wide range of lethal and sub-lethal effects on invertebrates, plants, fish, birds, and mammals (reviewed in Eisler, 1998). Ingested lead is also a significant hazard to wildlife, as it can affect the central nervous system of animals and inhibit their ability to make red blood cells. Grazing animals are directly affected by the consumption of forage contaminated by airborne lead and somewhat indirectly by the up-take of lead through plant roots. Invertebrates may also accumulate lead at levels toxic to their predators (US EPA, 1986). Finally, arsenic can have multiple toxic effects in wildlife and fish (reviewed in Eisler, 1988). Arsenic levels have been shown to accumulate in tissues in disproportionately bio-toxic forms (Bears *et al.* 2006). Low levels of arsenic have also been shown to impair the ability of fish to turn on genes needed to deal with environmental stressors, suggesting a very low dose mechanism of sub-lethal toxicity, which may occur across many species due to parallel mechanisms of stress-mediated gene translation (Bears *et al.* 2006). Table 3.4-1 in Section 3.4.2, Pk 4, pt 2 identifies an area of 465.5 ha with the potential to be affected by dust fall from the TIA. Part of Ogama Lake and its connection to Doris Lake is included in the potential dust fall area. While Pk 6, pt

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	7, Section 6.3 presents mitigation plans to apply chemical dust suppressants, to use packed snow as a natural dust suppressant, and to use a water cannon as necessary to minimize dusting of surrounding vegetation by tailings, concerns remain about the potential for arsenic, copper and lead to leach from the solid tailings into the surrounding environment. Heavy winds, the mixing of tails with snow and ice and subsequent melting and spreading, logistical failures in the mitigation plan to adequately suppress dust in a timely manner, and the formation of boils through the 0.3 m of waste rock to be placed over the tailings on closure, could all lead to tailings spreading and long term leaching of these metals. In order to ensure that tailings dust mitigation is working, and leachates do not contaminate the surrounding environment, a strong monitoring program and adaptive management plan must be in place. The wildlife effects assessment, Pk 4, pt 2, Section 3.5.1, page 3-15, cross references the Air Quality Management Plan provided in Package 5-1 for more details on the dust monitoring programs to be implemented at site. However, Table 3-1 of Package 5, pt 1 indicates that the Tailings facility dust fall monitoring program is currently under development. The tailings facility dust fall monitoring section in the current certificate amendment application reads: "*A dust fall monitoring program will also be developed specifically to monitor dust mobilization and disposition to surrounding areas from subaerial tailings in the TIA. This program is currently in development and transects and specific sample locations are yet to be determined, but will include areas upwind and downwind of the TIA along a transect aligned with the prevailing wind direction. An update to this program will be included in the next iteration of this plan.*" The details of this program will be of great relevance in providing assurance that unpredicted dusting of tailings will not occur over the short or long term and will not affect the surrounding soil, plants, water, land, fish, and wildlife. A strong tailings dust fall monitoring program will be critical in ensuring the new tailings facility is managed appropriately. The conceptual tailings dust fall monitoring program should be provided for review, ideally more than 3 months prior to the start of operation, as confidence in the current assessment ratings partially hinge on the presumed appropriateness of the final design of this program.
Importance of Issue to Impact Assessment (High, Medium, or Low):	High: If grazing animals are attracted to consume tailings, as they were in MacDonald and Gunn's (2004) report on caribou feeding in the area of the abandoned Colomac mine, or if sub-aerially deposited tailings become spread over the landscape beyond the extent predicted, unimpeded foraging in the area could lead to physiological problems due to arsenic, lead, and copper exposure; and If the mitigation plans do not eliminate the spreading of tailings via wind deposition, or if they spread via mixing with water and snow and melting, tails may become distributed over vegetation, soils and within water in the

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	surrounding landscape, impacting more vegetation, watercourses, and soils than predicted. This could impact wildlife, wildlife habitat, and other important receptors in the area.
Detailed Technical Comment:	1. Gap/Issue: The potential for tailings spread over the landscape and to leach contaminants (lead, arsenic, and copper) at a neutral pH over the long term increases the need for a wildlife risk assessment and mitigation or offset program to be tied into the results of a strong tailings dust fall monitoring program (currently under development by TMAC). Inclusion of details regarding how the tailings dust fall monitoring program will be linked to assessing impacts to wildlife habitat (soils and forage vegetation) and to wildlife risk and mitigation would fill this gap. 2. Disagreement with amendment conclusion: Without the details of a tailings dust fall monitoring program that can detect changes in wildlife forage contamination and wildlife risk over time, we cannot be assured that dust control mitigation (which can fail in effectiveness) and generic dust fall monitoring for tails will lead to the full protection of wildlife and wildlife habitat. The monitoring must also detect the spread of sub-aerial tailings and their leached metals over the long term into surrounding vegetation or soils, as this could lead to an increased risk to wildlife, particularly if caribou are attracted to the area (see KIA-1) or begin calving in or near the affected area again in the future. A review of the new management plans to be released 3-6 months prior to project operation and the updated WMMP will be required to determine whether we agree with the conclusions of TMAC in the present application. 3. Reason for disagreement with proposal conclusion: The issue of long term neutral pH leaching of arsenic, copper and lead from tailings, and the potential for tails to spread despite mitigation efforts, highlights the need for the development of a monitoring program that ties together tailings dust fall measurements, the spread of leachates into soils and wildlife habitat (which can occur via windblown dust, but also via mixing with and movement in melting snow), and wildlife contamination risk. Until the monitoring plan is available for review, and is shown to have these components, we cannot agree or disagree with the conclusions that the changes to the TIA management plan will not impact wildlife over the long term.
Recommendation/ Request:	As suggested in KIA-2, we suggest that an adaptive management program be developed, which ties together monitoring and thresholds that will instigate a wildlife risk assessment, the use of deterrents to keep wildlife from accessing sub-aerial tails (including vegetation-dusted areas), or other suitable mitigation or offsets, during operation, closure, and post- closure phases; We recognize that TMAC has committed to providing a revised Tailings Management Plan at least six months prior to the start of Operations, and a revised Air Quality Management Plan at least 3 months prior to operation, or before Sept 15, 2016. We suggest that one of these plans include a strong dust fall monitoring program for the sub-aerial tailings that is clearly tied to adaptive management triggers for wildlife and wildlife habitat protection. If dusting from tailings is found to extend beyond the potential area identified for the TIA,

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	monitoring could trigger a wildlife risk assessment, an adaptive management plan (e.g. expanded wildlife deterrence program to prevent unhealthy levels of exposure to copper, lead and arsenic), monitoring of long term leachates in soils and vegetation, and/or habitat loss or wildlife loss compensation or offsetting programs; and We suggest dedicating a technical session focusing on the proposed design of the sub-aerial tailings dust fall monitoring program during the upcoming technical meeting/hearing. We also suggest that a working group be founded to provide input on the design of this program from multiple stakeholders and disciplines that could be affected by tailings dust or leachates in various ways.

Technical Comment No:	KIA - 4
Subject/Topic:	**TIA Elevated Parameters of Potential Concern Upon Closure**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 5-2, Section 6, Section 10.1; Package 6-10 Table 6-2, Appendix B
Summary:	"Water quality in the TIA Reclaim Pond is arguably the biggest uncertainty identified to date, with potentially the largest impact on the closure cost and schedule. The water quality model will be updated and refined, as site water quality data becomes available." Modelling for different project phases has been summarized in Package 6-10 Table 6-2, providing mean and maximum concentrations of water quality parameters in the TIA until the end of the modelling period in 2035. The modeled monthly values are then graphed in Package 6-10 Appendix B which indicates chloride, arsenic aluminum, copper and iron will be elevated above the CCME WQG and above background concentrations at TL-2, the outlet from Tail Lake into Doris Lake. While we agree "The comparison [between TIA water quality and CCME guidelines] is for reference purposes only as the CCME guidelines apply to natural watercourses, whereas the TIA is a designated tailings impoundment facility", once the North Dam is breached, water from the TIA will be in direct contact with the freshwater environment. At that point, CCME criteria would be a valid comparison. TMAC provides a contingency stating, "In the case where water quality standards cannot be met by the end of the post-closure period specified in the water management plan, the monitoring time may be extended as required. Alternatively, water treatment options could be explored once the cause of the delay is known and quantified."

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	However, TMAC has neither discussed how elevated parameters in the TIA will impact Doris Lake, or Doris Creek during post closure, nor what treatment options are proposed or feasible if water quality standards are not met.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	KIA Request: Please include a discussion on the impacts elevated parameters in the TIA may have on freshwater quality once the North Dam has been breached, and what treatment options can be applied if water quality standards are not met and when they would be applied. The latter is particularly important, as no treatment has currently been proposed for the Project and we note that treatment of a high concentration waste stream at the time of generation is more feasible than treatment of tailings water at lower concentrations at a later date. Please model the TIA discharge water quality assuming that process waters were treated prior to discharge to the TIA and how this would influence water quality at closure. TMAC Response: The expected closure water quality in the TIA prior to breach of the North Dam is discussed in the Site-Wide Water and Load Balance Report (document P6-10). The current closure plan incorporates breaching of the North Dam once the TIA effluent quality meets closure objectives and the information presented within the application support this approach. An alternative assessment in the FEIS 2006 (SRK 2006. Water Quality Model, Doris North Project, Hope Bay, Nunavut, Canada. October) included consideration of treatment of TIA effluent prior to discharge to Doris Creek, however, in revisiting the mine plan and proposed Project components and activities, the proposed change to subaerial deposition reduces the effluent capacity within the TIA and separating the detoxified tailings (disposed underground) and the cleaner tailings (disposed in TIA) changes the effluent quality such that treatment prior to discharge is not needed. The only water quality parameters for which exceedances to CCME guidelines have been identified post closure in the TIA are aluminum, copper and iron. These exceedances are marginal at between 1.3 and 3.4 times background values. These exceedances are however within the TIA, which is a designated tailings impoundment. At the receiving environment compliance point in Doris Creek, downstream of the waterfall, the concentrations will be below CCME and therefore protective of aquatic life.
Recommendation/ Request:	The Site-Wide Water and Load Balance model uses **median** monthly background surface water quality and **median** release rates from the humidity cell tests (to calculate the loadings from the exposed tailings beaches) as input parameters. Using median values, as opposed to 75th percentile concentrations, is not a conservative approach and may underestimate the predicted TIA quality, thereby underestimating potential effects to surface water quality and aquatic life in Doris Creek and Roberts Bay. Since no additional treatment has been proposed, we

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	request that TMAC predict TIA water quality under enriched conditions, using 75th percentile background concentrations for input parameters.

Technical Comment No:	KIA - 5
Subject/Topic:	**TIA NPAG Tailings Cover Depth**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 5-2 Section 3.7; Package 6-10, Section 4.2.6
Summary:	TMAC indicates "At the end of operations the tailings area in the TIA will be closed by construction of an isolation cover, consisting of a single layer of non-acid generating quarry rock. Most of the contaminated water retained in the Reclaim Pond will be pumped through the Roberts Bay Discharge System for undersea discharge. The pond will then be allowed to re-flood naturally to pre-disturbance levels (elevation 28.3 masl). The North Dam will then be breached to re-establish the natural drainage path through an engineered spillway structure." The "single layer" is later defined as "0.3 m of quarry rock." However, no rationale as to why 0.3 m of quarry rock is sufficient to cap the tailings beach is provided and 0.3 m is not sufficient depth to allow the establishment of a stable permafrost cap.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	KIA Request: Please provide an assessment as to why 0.3 m of quarry rock is an acceptable depth of cover for the subaerial tailings area and beach given other mines in Nunavut have used up to 3 m of non-acid generating rock (NAG) to cover their tailings. TMAC Response: The tailings have been classified as non-acid generating with potential for neutral metal leaching. A source load associated with the tailings has been developed and incorporated into the site wide water and load balance model [Document P6-10]. The model indicates that the design of the tailings cover does not need to reduce water infiltration or oxygenation as contamination of surface or subsurface waters are not predicted. Based on these results, TMAC believes that all of the information needed for the review is included in the Application. The design of the final cover will be provided to the NWB prior to its construction.

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Recommendation/ Request:	The model used to predict the source load from the tailings uses **median** release rates from the humidity cell tests (to calculate the loadings from the exposed tailings beaches) as input parameters. Using median values, as opposed to 75th percentile concentrations, is not a conservative assessment, does not consider the full range of conditions and may underestimate predicted contaminant release from the TIA, thereby underestimating potential effects to surface water quality and aquatic life in Doris Creek and Roberts Bay. 1) Predict TIA water quality under enriched conditions using 75th percentile concentrations for input parameters. 2) Please use the results of the requested calculations to assess if a 0.3 m is still adequate to cap the TIA.

Technical Comment No:	KIA - 6
Subject/Topic:	**Roberts Bay Discharge and AEMP Monitoring**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Environmental Effects and Mitigation, Package 4, Part 7; Section 4.5.8.1, Page 4-65 (Aquatic Effects Monitoring Program)
Summary:	In this section of the application, TMAC states that: "*There is currently an approved (by Environment Canada and the Nunavut Water Board) AEMP in place for the Doris North Project, with two near-shore sites in Roberts Bay and one reference site in Ida Bay. TMAC is intending to modify the monitoring in Roberts Bay to include the geographical area of the proposed diffuser and potential area of influence of the TIA effluent and groundwater. An additional deep-water marine reference site will also be included. The final marine AEMP sites will be determined in consultation with Environment Canada and with due consideration of the requirements of the Environmental Effects Program as required under the Mining and Metals Effluent Regulations...The marine portion of the current Doris North AEMP monitors water quality, dissolved oxygen, sediment quality, phytoplankton biomass, benthic invertebrates, and marine bivalves. The proposed new monitoring locations could be adjacent to the proposed diffuser location (100 m) and seaward of the proposed diffuser location, perhaps half way between the southern shoreline of Roberts Bay and Melville Sound. The frequency of the current marine AEMP sampling is four times per year for water quality, dissolved oxygen, and phytoplankton biomass. Sediment quality and benthic invertebrates are sampled one time per year during the summer. Marine bivalves are sampled one time every three years. The final monitored endpoints and*

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	frequency for the modified plan will be determined in consultation with Environment Canada." While we understand that sampling locations will be added to the AEMP, the former frequency and seasonality of approved sampling also needs to be updated to protect wildlife (and other receptors) as it is not likely to be sufficient given project changes, the wildlife species observed in Roberts Bay, and the potential for modeling errors that monitoring data will serve to test.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Moderate: The impact assessment contains many assumptions derived from modeling. Assumed patterns need to be tested in a way that will allow for rapid feedback between field monitoring data and adaptive management to ensure that no environmental damage due to water or sediment quality deterioration occurs, and ultimately to protect marine wildlife, fish, and other receptors.
Detailed Technical Comment:	1. Gap/Issue: The additional AEMP monitoring changes should expand sample locations for diffuser outfall monitoring (as TMAC has indicated they will do in the updated AEMP), and should increase the frequency of sampling near the diffuser, including sampling of marine sediments and wildlife dietary items such as bivalves. 2. Disagreement with amendment conclusion: We agree with TMAC that new inputs into Roberts Bay will not likely harm marine wildlife, if model assumptions hold true. However, we recognize that there are many points at which the models could fail to accurately predict circulation patterns and upwelling in Roberts Bay correctly in the future (i.e., recognized uncertainty). Therefore, non-significant impacts of the project may rely on the quality of the updated AEMP, which should include more sites, and more frequent water quality, sediment, and bivalve monitoring in areas associated with maximum diffuser impacts will be critical for managing this process and protecting wildlife and other marine resources, and is considered needed to guarantee a non-significant impact. It is therefore difficult to agree with the non-significant impact prior to seeing the detailed changes in the AEMP. Therefore, agreement or disagreement with the conclusions of TMAC regarding impacts of the updated project on marine wildlife in Roberts Bay must be reserved until the details of the updated AEMP are made available for review. 3. Reason for disagreement with proposal conclusion: Assumptions regarding seasonal flushing of contaminants from Roberts Bay into Melville sound rely on seasonal deep and surface water circulation patterns, temperature stratification, and wind patterns derived from data previously collected in Roberts Bay. Models applied to predict water quality in Roberts Bay assume that past patterns will largely represent future conditions. However, there are factors that could impact the circulation patterns in Roberts Bay that could change during the life of the project. For example, the area may experience a change in Arctic Oscillation mode, climate change may impact circulation patterns, and subsea permafrost melting and associated gas upwelling may occur (for example, as coastal permafrost beneath the Arctic ocean has started to melt in

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	other locations, such as off the Eastern Siberian Arctic Shelf and Alaska, plumes of methane gas and carbon dioxide are being released from the ocean floor). As these factors are difficult to predict, frequent monitoring at appropriate locations will be critical to ensure that assumptions made for the discharge water modeling continue to hold over time, and to ensure that changes to the discharge regime can respond to monitoring results in a time frame that will protect wildlife and dietary items of wildlife.
Recommendation/ Request:	At present, marine AEMP sampling for water quality, dissolved oxygen, and phytoplankton biomass occurs four times a year. To allow for adaptive management, the new AEMP monitoring locations to be added near the subsea diffuser should be monitored far more frequently (at least monthly). We also recommend that sediment be sampled near the diffuser at least twice a year (once during the winter when the water is most stagnant), and that marine bivalves in the diffuser's ZOI be sampled annually, rather than once every 3 years, due to their importance in diet of the long-tailed duck, red-throated loon, yellow-billed loon, common loon, Pacific loon, common eider, king eider, and Tundra swan. All of these species were observed in Roberts Bay (Pk 4, Pt 7, Section 4.4.3, Table 4.4-5, p. 4-43). Bivalves are also very important in the diet of bearded seal and are a smaller component of the diet of ringed seal.

Technical Comment No:	KIA - 7
Subject/Topic:	**Potential Interaction with Marine Environment**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 2, Section 3.6.2; Package 3; Package 4, Section 2.5.1, Section 3.4.1; Package 5-3, Section 4; Package 6-10, Section 2.2, Section 7
Summary:	TMAC provides the following potential interactions with the freshwater aquatic environment resulting from the proposed Project changes: *"Potential alteration of Doris Lake outflow;* *Changes in surface water quality from runoff water from proposed expanded laydown area and ore storage pad;* *Reduction in or alteration of habitat (changes in flow) through water losses; and* *Removal or alteration of aquatic habitat for infrastructure, including culvert construction."* We note several additional potential interactions the project may have with the freshwater environment: **Saline groundwater** will be a significant water quality and quantity management issue under the proposed changes to the project; peak groundwater inflow has

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	been modelled at 3000 m^3/day and the proposed disposal method is ocean discharge. However, little discussion of how TMAC will handle saline groundwater in the event of prolonged diffuser and/or related infrastructure failure is provided. TMAC only indicates that *"intercepted groundwater inflows will be stored in the underground sumps and pumped to the Pollution Control Ponds for Temporary Management or to the TIA."* The impact of **fugitive dust** to surface water quality has not been assessed as a potential impact to water quality. *"Subaerial tailings have the potential to generate fugitive dust emissions..."* as does vehicular traffic. While we acknowledge *"there are proven mitigation measures that will be incorporated in tailings management to reduce emissions from the tailings"* we still stress the importance of this pathway as a potential influence to the freshwater environment. We also acknowledge that magnitude of this pathway is reduced as compared with open pit mining. The freshwater environment will also continue to be directly influenced by **water from the TIA** *"in 2015 and 2016 (Years -2 and -1)"* as well as after the North Dam has been breached and the natural flow from Tail Lake has been re-established.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	KIA Request: 1a) Please provide an analysis of alternatives for disposal of saline groundwater and a contingency plan should problems arise with the diffuser, marine outfall mixing box, or water transport infrastructure (pipeline) preventing ocean disposal of saline groundwater and please provide volume estimates of short-term storage availability in the event of a failure. If TMAC has insufficient short term storage capacity or treatment capacity, if required, for saline groundwater in the pollution control ponds or TIA and needs to discharge excess water to the freshwater environment or to the nearshore marine environment, an evaluation of environmental impacts to freshwater quality or the nearshore marine environment associated with the proposed saline water management should be addressed. 1b) Please provide an assessment of variance in the range of volume and concentrations of saline groundwater to be managed. 2) Please include an assessment of the impacts on water quality of fugitive dust stemming from the nearby transportation routes and sub-aerial tailings deposition. 3) Please provide an assessment of the impacts water from the TIA will have on Doris Lake and Doris Creek when an intentional connection has been established

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	from the waterbody (i.e.: prior to operations and after the North Dam has been breached). (Please also see KIA-TMAC-2.10). TMAC Response: 1a) Groundwater will not be treated but managed as discussed in document P6-6 (Roberts Bay Discharge System Water Management Options) submitted as part of the application package. The management scheme is based on collecting the groundwater in the underground workings and reusing for drilling; Excess groundwater will be pumped to the surface and discharged to Roberts Bay via a pipeline and diffuser. In the event that the saline groundwater cannot be discharged to Roberts Bay, mine water would be stored in the mine on a temporary basis. Once the matter has been resolved discharge to Roberts Bay would resume. Discharge to the surface freshwater environment will not occur. 1b) The range of effluent volumes and concentrations of saline groundwater is presented in application document P6-6 (Roberts Bay Discharge System Water Management Options) and document P4-1 Section 4.5.2. 2. Dust and effects to the environment is included in the application document 4 (Environmental Effects Assessment), Section 3.0. Dust will be generated due to project activities, however, the fugitive dust along road corridors was part of the 2006 FEIS and included in current authorizations with an associated Air Quality Monitoring and Management Plan. The change from subaqueous to subaerial tailings deposition will also result in dust generation, however, with design and mitigation measures dust generation will be minimized and no residual effects are anticipated including effects to surface freshwater. 3. Construction of the North Dam was completed in 2012. Catchment water in the Tail Lake outflow channel downstream of the dam are from the remaining natural catchment downstream of the dam. The system represents natural baseline conditions prior to operations and does not need assessment. At closure, the North Dam will not be breached until the TIA water quality is such that it will meet closure objectives. Treatment is currently not identified as being needed with discharge of excess TIA effluent directly to Roberts Bay via pipeline/diffuser. This discharge will be maintained until the TIA effluent meets discharge requirements for freshwater and the North Dam can be breached.
Recommendation/ Request:	1a) This response is adequate when cognisant of TMAC's response to KIA-TMAC-2.4 indicating the capacity of the TIA to manage effluent. We consider this issue resolved. 1b) We disagree with TMAC's assessment that section 4.5.2 of Package 4-1 or Package 6-6 provides the requested information. While TMAC has provided the peak volume of saline groundwater that will require management, they have not provided any assessment of the variance around this value. Should this value be

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	associated with a high degree of variance, TMAC may have less volume with which to dilute effluent from the TIA during discharges to the receiving environment resulting in a change to the mixing zone in Roberts Bay (also see KIA-TMAC-2.3). Alternatively, TMAC may have a greater volume to discharge under ice to Roberts Bay which may result in differing salinity in the receiving environment from the predictions presented in this amendment application. We further stress this request given the following differences between seawater in the receiving environment and the saline groundwater from the site. Note this comparison is based on maximum reported seawater concentrations in Roberts Bay as reported by TMAC in Package 4, Section 4.3.7 in Table 4.3.1, and the 95th percentile of groundwater concentrations from Table 4-2 in Section 4.2.3 of Package 6-10: Hardness - The 95 percentile in the groundwater is 2x the maximum concentration in Roberts Bay Ammonia – The 95 percentile in the groundwater is 22x the max of sea water Nitrate – The 95 percentile in the groundwater is about 3x higher than the max of sea water Total phosphorus - The 95 percentile in the groundwater is about 17x higher than the max of sea water Calcium - The 95 percentile in the groundwater is about 5.5x higher than the max of sea water Iron - The 95 percentile in the groundwater is about 7x higher than the max of sea water 2) This response regarding dust generation is adequate. We are also pleased with TMAC's statement in response to KIA-TMAC-2.8 that a dust fall monitoring station will be relocated southeast of the TIA in line with the prevailing winds of the project area. 3) In the Water Management Plan (Module A), section A5.3 TMAC states that once water quality in the TIA meets Doris Creek water quality guidelines, the North Dam in the TIA can be breached and flow resorted to Tail Lake Outflow. Provided the Doris Creek guidelines are those presented in Table A4 of the report, we are satisfied with this response.

Technical Comment No:	KIA - 8
Subject/Topic:	**Mixing Zone Delineation**
References to NIRB EIS Guidelines and Amendment Proposal (package	Package 2, Section 3.6.2, Package 6-6 Section 5

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number/section, page number:	
Summary:	TMAC states: "The proposed discharge criteria for the water from the TIA will be MMER limits in the discharge system and CCME Guidelines within Roberts Bay. Water quality modelling results show that the TIA discharge water quality would be in compliance with these criteria under a wide range of conditions without the need for additional water treatment." The distance designated as the "mixing zone" is not outlined. TMAC only states the "end of pipe discharged water quality for all three scenarios was determined to be below MMER limits (MMER 2015)... [and] To meet the CCME water quality guidelines within the marine environment mixing zone, a 20:1 dilution (i.e. 20 parts seawater to 1 part discharge water) would need to be achieved."
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	KIA Request: What is the distance from the diffuser at which CCME water quality guidelines will be met in Roberts Bay (i.e.: what is the size of the mixing zone)? Please demonstrate how the 20:1 dilution will be achieved. Please provide modeling results for all three discharge scenarios (groundwater only, groundwater and TIA, TIA only) in both the open water season when full exchange with Melville Sound is expected and under ice when the water exchange is negligible. We note these seasonal differences specifically as they were highlighted by TMAC in Package 2. TMAC Response: Dilution will be achieved rapidly given the pumping and small portals. Of the Canadian Council of Ministers of the Environment (CCME) metals in effluent, maximum predicted chromium concentrations (0.0062 mg/L; Table 4.5-3, document P4-1) will require the greatest dilution to meet CCME guideline levels (0.0015 mg/L; Table 4.5-1, document P4-1) in the receiving environment of Roberts Bay (baseline: 0.001 mg/L; Table 4.5-2, document P4-1), in this case a 9.2:1 dilution. This will be reached within 1 m of the diffuser portals, and given this parameter requires the greatest dilution, the 'CCME mixing zone' will be 1 m. Modeling results for the 3 requested scenarios during summer and winter can be provided during the technical review portion of the Amendment review process.
Recommendation/ Request:	TMAC's approach in the effects assessment (P4-1, Section 4.5.2) of deriving water quality targets for Roberts Bay and comparing predicted effluent concentrations (for all three discharge scenarios) is not sufficient to evaluate the effects of the project. This approach does not determine the size and properties of the mixing zone where water quality will be above CCME guidelines. We request that TMAC model the mixing zone (using effluent chemistry) for all three discharge scenarios (groundwater only, groundwater and TIA, TIA only) in both the open water season and under ice using effluent chemistry. This is

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	important because cadmium and copper are predicted to be above the CCME marine quality guidelines in the groundwater and TIA mixed effluent, and mercury in the TIA effluent (Water and Load Balance, Table 6-3). In addition, 75th percentile baseline concentrations (Robert's Bay, effluent concentrations) should be used as input to the model, to predict water quality under slightly enriched conditions. In addition, total mercury predictions for groundwater and TIA effluent, and TIA effluent should be included in the effluent predictions. High detection limits in the source terms do not negate the need to predict concentrations in the effluent and the receivers. Data from other studies and sites can be used in the model, while additional sampling and analysis (at low detection limits) is being completed. The model can be refined and updated, once site-specific data becomes available.

Technical Comment No:	KIA - 9
Subject/Topic:	**Increasing Contaminants of Potential Concern in Roberts Bay**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 4, Figure 4.5-1, 4.5-2, 4.5-3
Summary:	All parameters of potential concern in the referenced figures show increasing concentrations in Roberts Bay year over year due to effluent discharge. TMAC indicated that water in Roberts Bay was totally exchanged with Melville Sound during the open water months. We further note that all of these parameters (Nitrate-N, salinity arsenic, cadmium, chromium, mercury) are very close to or above their respective CCME WQG after 6 years of production for what appears to be up to a month.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	KIA Request: Please provide a discussion of why concentrations are increasing year over year despite annual full exchange with Melville Sound. Please clarify maximum concentrations that are expected after 6 years. Please provide a discussion of how CCME water quality criteria in Roberts Bay will be met if TMAC proceeds with Phase 2 of the project given that effluent will continue to be discharged to Roberts Bay.

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	TMAC Response: See response#3 to IR KIA-32 regarding increasing concentrations in Roberts Bay despite full annual exchange. TMAC appreciates the reviewer's comment but Phase 2 is beyond the scope of this Application and so is therefore not appropriate to be discussed herein.
Recommendation/ Request:	We disagree with the proponent's response. Consideration of future development in the Hope Bay Belt and their associated impacts should be included as part of the cumulative effects assessment for this application (see our response to KIA-1). The location of Phase 1 infrastructure predisposes, to some extent, the location of future infrastructure. The Madrid/Boston projects are separate but related neighbouring projects, and TMAC plans to develop the resources in the Belt in a series of phases, continuously producing mines over time. While Doris Mine is operating, TMAC plans to commence the permitting and development of the Madrid/Boston project (Project Description, Section 1.7.1). It is therefore reasonable, and a requirement under the NIRB's environmental impact statement framework, that TMAC includes a discussion of how the effluent from Phase 2 of the project will affect Roberts Bay in this application and to assess feasible means to maintain water quality in Roberts Bay under an expanded discharge scenario. Phase 2 expansion is a reasonably foreseeable project

Technical Comment No:	KIA - 10
Subject/Topic:	**Hydrogeology**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 6 Engineering and Design Documents P6-3 Groundwater Inflow and Quality Model (SRK, 2015) Package 4, Section 2
Summary:	The primary objectives of the Groundwater Inflow Modeling work undertaken by SRK (2015) was to predict the Doris Mine groundwater inflow rate and quality over the life of the mine, to provide input to the site water balance, and to inform engineering on the site water management plan. The results of the groundwater model were ultimately used to predict the 0.23 m decrease in Doris Lake surface water levels, and corresponding delay in outflow timing and volumes from the lake. Results of the Doris Mine groundwater model (SRK, 2015) suggest that mine inflow will increase to a maximum of 2,650 m3/day, decreasing when some sections of the mines are completed and sealed off from other areas of active mining. By year 6 (completion of mining), the total inflow to the mine is predicted to be about 1,630 m3 /d. About 70% of the mine inflow is associated with water from Doris Lake with the remainder coming from deep regional groundwater.

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	TMAC has requested a 3,000 m3/day maximum water taking, suggesting an approximately 13% factor of safety for mine inflow rates. Sensitivity analysis suggests that the predictions of inflows are sensitive to the hydraulic conductivities of volcanic rock and lake bed sediment. For example, changing the hydraulic conductivity values used in the model by 1 order of magnitude for the lake bed sediments results in a 2.9 times increase in inflow from Doris Lake. The modeling work according to SRK (2015) assumes that "the groundwater management plan will include active control measures such as advance probe drilling and pre-grouting of highly conductive structures prior to intersection with the mine workings, and additional pumping capacity to handle potentially higher than predicted inflows and may also need to consider ongoing assessment of where and how bulkheads and backfill are used." TMAC has indicated in review meetings that groundwater withdraw/dewatering cannot exceed 3,000 m^3/day, regardless of the mine inflow rates. Engineering solutions, including abandonment, were suggested as options to manage any increase in mine inflows.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium
Detailed Technical Comment:	1) Further characterization of local heterogeneity for important hydrogeologic features (e.g., thickness and hydraulic conductivity of indurated lake bed sediments; major structural characteristics of volcanic rocks including anisotropy of *K*, etc.,) would ideally provide more confidence in the predicted mine inflow rates. For example, there are only two samples for the indurated lake bed sediment. Given the very low *K* used for the indurated lake bed sediments in the model it is expected that this unit may play a significant role in controlling the mine inflow from Doris Lake. However, it is recognized that TMAC has restricted mine dewatering to 3,000 m^3/day, regardless of whether further studies indicated higher mean hydraulic conductivities for those sediments. 2) Given the range of measured *K* values shown in the report, and in the absence of additional field data, additional sensitivity simulations would ideally be performed which increase the *K* values of each of the two lake bed sediments and alteration zone by 1.5 to 2 orders of magnitude. However, given that the mine plan does not allow for greater than predicted dewatering rates, this exercise would be redundant. Greater than predicted flows will need to be managed through active control measures as described in SRK (2015). 3) Drawdown calculations for Doris Lake presented in Section 2.5.2 of Package 4 would typically be provided as a range, based on the range of inflows observed from the sensitivity simulations presented in the modeling report. Table 11

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	indicates that mine inflows could be as much as 2.9 times greater than those used for lake height calculations presented in Section 2.5.2 (Package 4). Typically, lake height values would be calculated based on the additional sensitivity simulations, however as noted above, TMAC will limit the dewatering and subsequent lake level impacts by taking active steps to limit dewatering to 3,000 m^3/day. 4) There is no indication of the spatial distribution of mine inflow from the modeling results. This would be useful to identify key portions of the design that may experience higher inflow rates and may require additional mitigation (as suggested by SRK, 2015) during construction and operation. It is assumed that this information will be part of the ongoing water management planning.
Recommendation/ Request:	It would be useful for TMAC to provide additional details regarding management of groundwater inflows during mining operations. These details should include specific methods, triggers, and mitigation/contingency measures for ensuring that mine operations can proceed at dewatering rates below 3,000 m^3/day and that groundwater inflow can be effectively managed.

Technical Comment No:	KIA – 11A
Subject/Topic:	**Site-Wide Water and Load Balance – Consideration for Climate Change**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 6-10; Sections 3.2, 5.2
Summary:	**5.2 Modelling Approach** The water and load balance model for the Doris North Project was run from 2010 to 2035 on a daily time step. The run time was selected to cover multiple phases, including a calibration period from 2010 to 2014 (Years -7 to -3), mine operations from 2015 to 2021 (Years -2 to 5), closure in 2021 and post-closure. Post-closure conditions were modeled 15 years after closure. The water balance was run using probabilistic simulations, with multiple realizations and variable hydrology. During the calibration period, available measured climate and flow data were applied, including flows reporting to the TIA from mine site collection ponds and discharge to Doris Creek. For future predictions, climate data was generated based on the historical record, with discharge predicted based on empirical rating curves and/or pumping capacities. The load balance was run as a deterministic simulation under average hydrological conditions. This is consistent with the application of source terms derived based on an average hydrological year.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk

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Detailed Technical Comment:	The model predicts future water and load balance to year 2035. It used historical climate data from Cambridge Bay for future conditions, but makes no reference to how climate change was incorporated. Please explain how the effects of climate change were applied to the historical dataset used for future predictions. The water balance was run using probabilistic simulations, with variable hydrology. The load balance was run as a deterministic simulation under average hydrological conditions. The "variable" hydrology used in the water balance is not defined or referenced in the report. The effects of a wet or dry hydrological conditions on load balance are not considered if the load model was only run using average hydrological conditions. Concentrations of selected parameters (e.g. metals) may increase in during wet or dry years.
Recommendation/ Request:	What was the date range for the historical climate dataset? Explain how the effects of climate change were applied to the historical climate dataset used for future predictions. If climate change was not considered, please incorporate climate change effects into the modelling, as per latest guidance provided by the International Panel for Climate Change (IPCC), to determine the effect on effluent quality over the projected mine life. Please define "variable hydrology" as it was used in the water balance modeling. Incorporate wet and dry hydrological conditions into the load balance modeling to determine the effect of wet and dry years on effluent quality.

Technical Comment No:	KIA – 11B
Subject/Topic:	**Site-Wide Water and Load Balance – Input Parameters**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 6-10; Sections 4.2.2, 4.2.3, 4.2.6
Summary:	Modeling approach using median concentrations for inputs.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	To predict TIA water quality, the model uses **median** monthly background surface water quality and **median** release rates from the humidity cell tests (to calculate the loadings from the exposed tailings beaches) as input parameters. Using median values, as opposed to 75th percentile concentrations, is not a conservative approach as it does not consider enriched conditions and may underestimate the predicted TIA quality, thereby underestimating potential effects to surface water quality and aquatic life in Doris Creek and Roberts Bay.

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Recommendation/ Request:	Predict TIA water quality under enriched conditions. Use 75th percentile background for all input parameters.

Technical Comment No:	KIA – 11C
Subject/Topic:	**Site-Wide Water and Load Balance - Mercury, cyanide, and selenium predictions**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 6-10; 6.3.1
Summary:	Modeling approach precludes mercury, cyanide, and selenium in it predictions.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	Did not predict cyanide, mercury and selenium in TIA, and mercury in the effluent discharging to Roberts Bay from the Marine Outfall Box. Free-cyanide was not predicted due to "lack of data", and mercury and selenium were excluded due to high detection limits in the mill effluent water dataset. Cyanide, mercury and selenium are potentially parameters of concern for the site. The lack of data and high detection limits do not preclude the need to predict TIA concentrations for these parameters. Undertaking additional analyses with low detection limits, and/or and obtaining additional information should be provided, with the commitment to updating the model when the data becomes available.
Recommendation/ Request:	Complete additional analyses for mercury and selenium using low-level detection limits. Obtain additional information (or use information from other sites) to predict cyanide concentrations in the source terms to predict cyanide concentrations.

Technical Comment No:	KIA - 12
Subject/Topic:	**Prediction of Environmental Effects on Water Quality**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 4-1, Section 4.5.2
Summary:	Lack of nitrate prediction in modeling Roberts Bay's surface water.

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Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium Risk
Detailed Technical Comment:	Section 4.5.2.2 – "Nitrate" of the Environmental Effects report states..."by having the diffuser at 40 m depth, below the upper sun lit portion of the water column, nitrate in the TIA effluent and groundwater will not be readily available to phytoplankton, which will be photo-synthetically active in the upper water layers". However, according to Section 4.3.3 (Basin Circulation) of the report, deeper water flowed into Roberts Bay from Melville Sound, and the top layer flowed seaward for roughly 70% of the measurement period. Figure 4.3-3 also shows deeper water in Roberts Bay circulating into the upper layer. The movement of water between deep and surface layers and how this affects surface water concentrations of nitrate and other COPC is not clear. The proponent has not modeled a mixing zone, or the resultant concentrations in the deep or surface waters. A water quality model is needed to determine the concentrations of nitrate and other parameters in the immediate mixing zone, and any mixing between the deep and surface layers. The proponent relies on exchange of Roberts Bay with the main ocean body to reduce COPC concentrations in Roberts Bay each year. Nitrate from Roberts Bay will eventually enter the wider circulation of the Arctic Ocean in the confined and shallower waters of the large embayment at the mouth of Roberts Bay that is confined by the large peninsula. TMAC has not provided any assessment of expected concentrations or the potential for nutrient enrichment there.
Recommendation/ Request:	Provide a water quality model to determine the concentrations of nitrate and other parameters in the immediate mixing zone, and in deep and surface layers and confirm the prediction that nitrate will not be available in the surface waters of Roberts Bay. Please provide an assessment of nitrates in the ocean waters beyond Roberts Bay, from the Hurd Islands east to the head of the large bay, as shown in the Google maps image below.

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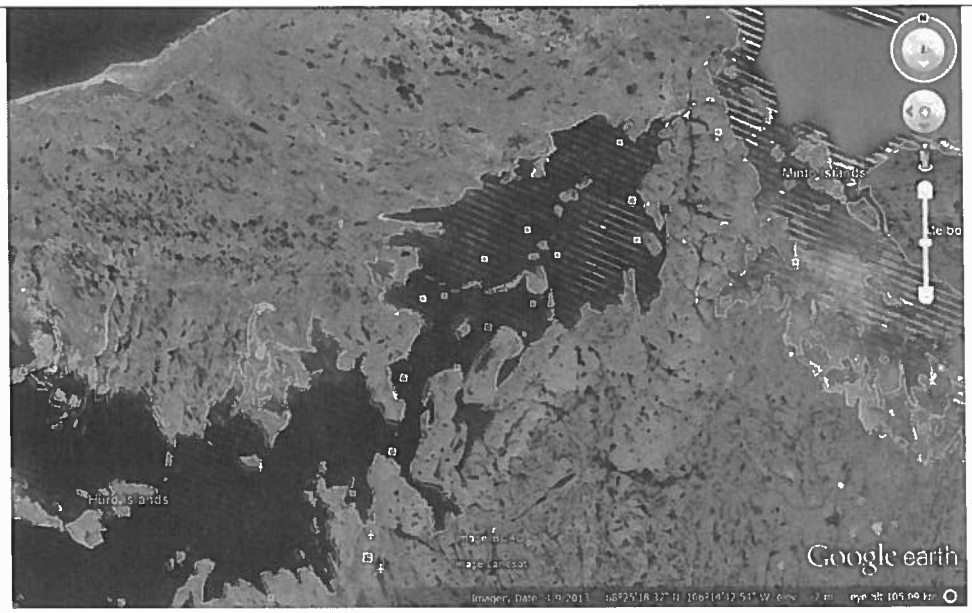

Technical Comment No:	KIA - 13
Subject/Topic:	**Doris Lake Water Levels**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Package 4-1, 4-2.
Summary:	Based on a peak water loss/use from Doris Lake, the maximum lake drawdown is determined to be 0.23m under ice for assessment. This is within the natural range of lake levels and the proponent (TMAC) anticipates no effects based on this reduction. However, in the Amendment Proposal, potential effects on eggs incubation are considered and a field study was conducted in Fall 2015 to confirm the effects assessment. The results of this study and updated effects assessment are not yet available to the review team.
Importance of Issue to Impact Assessment (High, Medium, or Low):	Medium
Detailed Technical Comment:	There is a good understanding of fisheries use in Doris Lake, but some data gaps in locations and use of spawning areas around the lake perimeter. Taking the maximum amount of water as permitted under the existing Water Licence (480,000m^3/year), combined with the peak estimated water from Doris Lake into

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	the mine underground workings (610,000 m^3/year), could result in a lake draw down amount during the winter (equivalent to 0.76million cubic meters). Although this is less than 4% of the lake volume under 2m ice, and within the natural variation, there should be a robust assessment of effects on fisheries as this could affect the shallow perimeters of the lake, where spawning habitat would be located. TMAC can adjust the water use from Doris Lake to reduce the maximum amount withdrawn, therefore the proponent notes that it would be unlikely that the maximum natural drawdown of 0.54m is realized in addition to the 0.23m drawdown due to water use and seepage into the mine workings. The proponent noted that a field study was completed in Fall 2015 to complete a detailed habitat survey of the entire lake perimeter, where eggs and larvae are left to overwinter. TMAC notes that if the lake is drawn down below the natural range, eggs and alevins close to the ice could perish. If this is the case, effects on fisheries in the lake are unknown. The results of the updated field assessment completed in 2015 has not yet been made available, and therefore a comprehensive effects assessment on fisheries in Doris Lake is not yet available. It is difficult to agree with the effects assessment as presented in the Amendment Proposal while baseline datagaps exist. It is however noted that the modeling represents worse-case scenarios and that this additional study has been completed to help inform appropriate effects and mitigation measures.
Recommendation/ Request:	Recommend that the updated fisheries baseline for Doris Lake be presented, particularly with reference to spawning habitat and fish use. This information should be assessed in conjunction with the hydrological baseline data to accurately quantity potential effects, and any subsequent protection/mitigation/offsetting and monitoring plans.

Technical Comment No:	KIA - 14
Subject/Topic:	**Attraction or Avoidance of Grizzly Bears to the Mine Site**
References to NIRB EIS Guidelines and Amendment Proposal (package number/section, page number:	Pk 4, pt 2, Section 3.4.3, Pages 3-13 to 3-16
Summary:	Grizzly bears are observed relatively frequently at the Roberts Bay site. TMAC suggests that the project amendment will have no impact on grizzly bears. No additional monitoring efforts are currently suggested or committed to in order to monitor impacts to this species. On page 3-14, Section 3.4.3, TMAC states that "*grizzly bears and wolverine are also the subject of ongoing DNA-based monitoring programs aimed at quantifying the number, habitat use, and effects on these species.*" While this suggests that DNA monitoring will detect effects on grizzly bears, TMAC is not proposing to undertake DNA monitoring in the future. As only two years of baseline data exist, the DNA monitoring program will not elucidate

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impacts to grizzly bears or changes in habitat use or population numbers unless the program is re-instated. As stated in the KIA's review of TMACs 2014 WMMP, the current camera monitoring program is not designed in a way that enables the detection of avoidance or attraction of grizzly bears to the project area (discussed in paragraph 3).

Grizzly bears may be at risk of experiencing mine-related impacts if they begin to avoid areas previously used as familiar seasonal foraging sites around or near Roberts Bay (e.g., near the fish barrier). Habitat avoidance could subsequently lead to a reduction in reproductive success (e.g., as speculated in Schoen and Beier, 1990). While waste management controls and some of the other site-specific monitoring efforts for the Doris North project amendment are important, they will not eliminate the overall effect of the project, along with past and foreseeable future project activities on grizzly bears in this area. There are currently no monitoring programs in place to evaluate avoidance or attraction of this species to the general area associated with the project. Yet, monitoring for potential attraction and avoidance of grizzly bears was a compliance requirement of the WMMP in the original EIS for this project.

While data from the camera monitoring program has been used to attempt to determine whether grizzly bears are attracted to or are avoiding the mine area, the program - as it has been designed - cannot truly address these questions to begin with, and results at present are spurious. The reasons that the camera program is not currently designed to allow for the detection of attraction or avoidance of the mine site area by grizzly bears are due to the following issues with the program:

Animals were not counted within the same spatial area at each camera (i.e., one camera may show 500 m^2 of open land while an adjacent camera may show 100 m^2 of land, hence there is a higher chance of counting more grizzly bears in the camera showing more area in their field of view). This issue could be corrected by placing posts at set distances from the cameras, such that only individuals between the camera and posts (i.e., within a set distance, that is equivalent between cameras) are counted;
Cameras are clustered more closely together near the project site, increasing the probability of capturing the same individual going from camera to camera closer to the project. Double counting bias should be made equivalent at different distances from the mine to allow for comparisons that can assume equal observer error (i.e., risk of double counting) during the analytical stage among location. For this reason, equal spacing of adjacent cameras is important;
'Control' cameras in the camera monitoring program were considered to be those cameras that were ≥ 1 km from the project. However, there is no support for this camera distance being considered as being a control [i.e., outside of the zone of influence of a mining project for grizzly bears, or for caribou (which cameras were also used to monitor originally)]. Harding and Nagy (1980) documented camp

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	avoidance distances at an Arctic coastal tundra site of 1 to 2.0 km for traveling grizzly bears in route to another location, and of 3.2 to 7.2 kilometers for bears that were foraging or leaving the den site. The Alaska Department of Fish and Game (ADF&G; 1987) found a 4.0 km zone of mining influence on grizzly bears in southeast Alaska. Johnson *et al.* (2005) collared grizzly bears in the arctic and showed that mineral exploration sites had a moderate influence in use of late summer and autumn habitats up to 23 km. Therefore, based on zones of avoidance/influence derived from other projects, the Doris North WMMP is not designed to measure avoidance or attraction to the project site, as most 'control' cameras are not likely to be measuring animals in true control areas; and Cameras were placed in different habitat types, which increased the number of variables considered and decreased the power to detect a spatial relationship between habitat use and the project (the original compliance question only sought to understand this spatial relationship). More details on suggestions for improvements to the camera monitoring program are included in the KIA's review of TMAC's 2014 annual WMMP compliance report, which has been shared with TMAC for their consideration.
Importance of Issue to Impact Assessment (High, Medium, or Low):	High: Without a properly designed monitoring program for grizzly bears, it is not possible to test predictions of avoidance or attraction, as required of the WMMP for meeting project compliance. As a result, the WMMP monitoring data cannot be used to predict impacts of the amended project activities. The KIA has already noted that the WMMP is unable to answer some of the monitoring plan compliance objectives without alterations to the plan, and that alterations to the WMMP are needed to test the original assumptions of the FEIS (which the project amendment is predicted to not alter, but which wildlife monitoring objectives would still apply to).
Detailed Technical Comment:	1. Gap/Issue: Impacts to grizzly bears caused by project, due to avoidance or general attraction to the area, are not presently being monitoring in a way that can detect these impacts. Predictions of no impacts to grizzly bears is not supported by other studies and cannot be presumed by extrapolation from the camera monitoring data, as collection methods to date have been flawed. This monitoring program requires further refinement and enhancement, particularly as the project moves forward into an operational mining phase. 2. Disagreement with amendment conclusion: A conclusion of no impact to grizzly bears largely assumes that grizzly bears are not attracted to or avoiding the project site. We cannot objectively reach the same conclusion using monitoring data produced for the project, and a review of other studies of grizzly bears around mining projects would suggest that avoidance may be expected. 3. Reason for disagreement with proposal conclusion: A review of the previously designed WMMP compliance monitoring program developed for this project showed that it does not allow for any conclusions to be made about avoidance or attraction of grizzly bears to the project area, despite this being one of the main goals of the WMMP. Results of other projects would suggest that such impacts

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	could occur and could impact the reproductive success of grizzly bears. Assessing for these potential impacts requires enhancements to the WMMP.
Recommendation/ Request:	A letter from TMAC to the NIRB and NWB issues on November 12, 2015, noted that there is a current Wildlife Mitigation and Monitoring Plan for the Doris North Site. TMAC states in this letter that only if, as a result of technical and public hearings, the plan content needs to be revised prior to the start of Doris Operations, TMAC will commit to providing any revision on or before September 15, 2016. The inability of the WMMP to monitor attraction and avoidance of the area by grizzly bears is one of the issues identified during the KIA's review of the annual WMMP, which we would like to be discussed during technical hearings. We suggest re-configuring the camera monitoring program, and adding additional cameras to enable detection of grizzly avoidance of the area. TMAC has committed to providing updated management plans three months prior to the start of operations, or before September 15, 2016. We feel that the WMMP should be included in the updated plans to be released for review prior to September 15, 2016. Some suggestions for enhancement of the camera monitoring program within the WMMP include the points below: • Set up monitoring cameras in transects of increasing distances from the mine site, ensuring that the outermost camera is at a "true control" distance, based on previous literature and research. Transects will allow for the nesting of cameras into different 'zones', which may have different overall use by grizzly bears (e.g., NE transect may have more grizzly bears than a SW transect); however, nesting will allow for the documentation of differences based on distance from the mine within each transect, and the average differences by distance can be determined using various analytical techniques; • Ensure that cameras are the same distances from one another such that the double counting effect is not greater at any particular distance from the mine site; • Ensure that the same land area is considered for counting animals at each camera. We recommend including coloured posts in the frame at a set distance from the camera, and counting only wildlife within that known, set distance for comparability; • Ensure that cameras take the same number of photos over the same time periods; • Purchase spare cameras such that cameras are not "swapped" from one location to another in the case that one is damaged, as occurred in 2014.

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	Swapping cameras decreases the power of the study design, and causes partial data sets in certain locations; • Try to situate all cameras in the same habitat type to minimize extra variables and to focus only on the question of distance by project avoidance; and • Analyze data using zero-inflated models, or other design-appropriate methods that are effective at analyzing data sets with a large number of zeros. • Establish study design with careful input from statisticians, and justify control distances using a review of existing, relevant literature on zones of avoidance by grizzly bears. Monitoring and establishing the zone of avoidance for grizzly bears will enable more realistic future predictions about indirect habitat loss and offset requirements for this species. Depending on the results of a well-designed WMMP to determine avoidance/attraction risks to grizzly bears, future contributions to a larger, government-led grizzly bear DNA hair study for cumulative effects on grizzly bears may be warranted.