16-Dec-16

ESS IRs for the Whaletail Project - Nunavut

Information Requests- 16MN056- Whale Tail Pit Project Proposal and Associated Water License Application

IR Sources	IR number	IR Directed to:	Subject:	Reference:	Issues/Concerns:	Information Request:
Permafrost and terrain stability and their relevance to design of project components and potential impacts						
NRCan	1	Proponent	Baseline data on terrain and permafrost conditions	Vol. 1 (1.2.3, 1.2.5), App. 1-C, Vol. 5 (5.3.2, 5.3.6), App. 5-A	Information on terrain and permafrost conditions is essential to adequately design project components to ensure that they perform as intended. In particular, knowledge of ground ice conditions is required to assess terrain stability and determine if thawing of permafrost due to project activities (surface disturbance, impoundment of water), will have an impact on ground stability and performance of structures such as those required for water management (e.g. dams and dikes). Terrain mapping has been done for the project area including the area surrounding the proposed pit and the access road (App. 5-A Fig C-2 to C-23). However, there does not appear to be much detailed information on permafrost conditions including ground ice content beyond references to national scale maps (e.g. Heginbottom et al. 1995; Smith and Burgess 2004) which are not appropriate for assessments of conditions at a local scale. The Proponent has indicated that a key uncertainty (V. 5, sec. 5.3.6) is the thickness of the active layer and the ground ice content. NRCan realizes that detailed site investigations are usually done to support detailed engineering. However, NRCan would like clarification on any field investigations such as geotechnical boreholes that have been done to support design of project facilities such as water management structures and the waste rock storage facility. Information is also required on how the Proponent plans to address uncertainties with respect to permafrost such as active layer thickness and ground ice conditions.	(a) Please provide clarification on field investigations (including geotechnical borehole drilling) conducted to provide detailed information on permafrost conditions such as ground ice content to support design of project components (b) Please also provide information on plans to address uncertainties with respect to active layer thickness and ground ice conditions to support final design of project components.
NRCan	2	Proponent	Permafrost and talik distribution	Vol 6 (6.2.2.2), App. 6-A, 6-B, App. 8-A	Permafrost can provide an impermeable barrier to groundwater flow and limit connections between surface and subsurface water. Unfrozen zones or taliks can exist beneath large water bodies that do not freeze to the bed in winter. If lakes are larger than a critical size, an open talik will exist providing a hydrologic connection between surface and groundwater. The Proponent has indicated that an open talik likely exists under Whale Tail Lake (V. 6, sec. 6.2.2.2), the site of the proposed pit, and this means that hydraulic connections may exist with surrounding lakes that also have open taliks. The Proponent presents an analysis to determine the critical size of lakes (V. 6 sec, 6.2.2.2, Att. A in App. 6-A) having open taliks and has identifed lakes potentially having taliks in Figure 6-B-1 of App. 6-B. However, it is not clear what value for ground temperature was utilized in the analysis to identify these lakes since the Proponent gives a value of -10.5°C in App. 6-A (Att. A) but also mentions that the mean ground temperature at the level of zero annual amplitude for the project area is -8°C (App. 8-A, sec. 2.6 of 8-A.1). Since the critical lake size is smaller when ground temperature is higher, it is important to know if all lakes potentially having open taliks have been identified and impacts on water quantity and quality have been adequately assessed. NRCan therefore requires clarification on the ground temperature values utilized in the analysis to complete its technical review.	Please clarify the ground temperature value utilized in the analysis to identify lakes having open taliks and whether the potential for higher ground temperature was considered in the analysis

NRCan	3	Proponent	Design of water management/retention structures	Vol. 1, App. 1-C, Vol. 8, App. 8-A (8-A.1, 8-A.2), App. 8-B (8-B.2)	Frozen ground can provide a barrier to water flow and restrict seepage through the foundation of water management/retention structures. However, impoundment of water behind these structures can result in warming of the foundation and potentially thawing of permafrost leading to instability or seepage which may result in impacts on water quality. The Proponent indicates that they will take advantage of frozen conditions for some of the water management structures such as the waste rock storage facility (WRSF) dike and the Northeast dike (App. 8-A sec. 3.1.4 of 8-B.2). However, it is not clear whether the potential warming of frozen foundations, such as might occur due to impoundment of water in the pond behind the WRSF dike, has been incorporated into seepage and stability analysis. It is also not clear whether frozen foundation conditions are a requirement for performance of water management/retention structures. Clarification is also required on whether any thermal analysis has been conducted to support the design of the water management/retention structures.	(a) Please clarify whether frozen foundation conditions are required to ensure adequate performance of the water management/retention structures. (b) Please clarify whether the potential for thawing of foundations due to impoundment of water behind water retention structures (such as pond formation behind WRSF dike) has been considered in the stability and seepage analysis to support design of these structures. (c) Please provide any information on thermal analysis conducted to support design of water retention/management structures and/or information on plans for such analysis to support detailed design.
NRCan	4	Proponent	Design of Waste Rock Storage Facility (WRSF)	Vol. 1, App. 1-C, Vol 2, Vol. 8, App. 8-A (8-A.1)	The Proponent has indicated that they will take advantage of the cold conditions and have adopted freeze control and climate control strategies for the WRSF (App. 8-A, sec 9 of 8-A.1). Frozen conditions will be utilized to immobilize pore fluids, control acid mine drainage reactions and prevent potential migration of contaminated pore water outside the storage facility. Part of this strategy involves a cover of non acid generating waste rock of sufficient thickness to provide insulation and prevent thawing of the potentially acid generating rock and therefore maintain frozen conditions over the long-term. However, no information has been provided in the EIS regarding the design cover thickness or any thermal analysis conducted to demonstrate that frozen conditions will be maintained. NRCan understands that the Proponent will rely on experience regarding design of WRSF for Meadowbank. NRCan notes that new information may be available with respect to climate conditions and climate warming scenarios that could be considered in the preliminary design of the WRSF.	Please clarify whether any thermal analysis has been conducted to support design of WRSF including selection of design cover thickness and/or provide information on plans for any analysis to be conducted to support detailed design of the WRSF.
NRCan	5	Proponent	Impact of water level increase on shoreline erosion and permafrost	Vol. 1, Vol. 3, App. 3-C, Vol. 6, (sec 6.4.3.2)	Water diversions required to develop the pit will result in changes to water levels in other water bodies including the south basin of Whale Tail Lake and tributary lakes (Vol 6. Sec 6.4.3.2). High flows may also be associated with water diversions such as during the spring freshet or extreme precipitation events (App. 3-C, Table 3-C-2). Increases in water levels and high flows may result in thawing of permafrost around shorelines and also shoreline erosion leading to increased sediment input into water bodies potentially having implications on water quality (App. 3-C, Table 3-C-2). The Proponent has recognized that there may be potential impacts related to thawing permafrost and erosion. It is not clear however whether the Proponent has identified shoreline sections or sections of diversion channels that may be particularly susceptible to erosion to determine where mitigation may be required.	Please clarify whether any assessments have been done to identify shoreline sections or sections of diversion channels that may be susceptible to erosion and the need for mitigation measures.
Hydrogeology						
NRCan	6	Proponent	Groundwater recharge	Vol.6 App.6-A and App6-B	The proponent has provided information on the groundwater modelling. Recharge is an important component of the groundwater cycle. However, recharge is not sufficiently described in the report. Recharge zones and rates must be presented and applied to the model for a thorough assessment .	Please provide a map of recharge areas and rates. Apply the recharge rates to the model and provide the updated results.
NRCan	7	Proponent	Groundwater modelling	Vol.6 App6-B	As mentioned by the proponent: "density gradient provides a secondary control on groundwater flow". High TDS concentration has an effect on the water density and thus on groundwater flux and mass transport.	Explain the proponent's decision not to model the effect of density.

NRCan	8	Proponent	Groundwater modelling	Vol.6 App6-B	For modelling, the choice of the boundary conditions for concentrations is important and is questionable. The proponent has justified the imposed zero concentration flux boundary condition at the base of the model by stating that: "Mass flux from beneath this depth was considered to have negligible impact on model predictions." This statement should be clarified by the proponent. Also, by fixing a zero concentration boundary condition at the top of the model, the simulation result is too constrained and this affects the spatial variations of concentration.	Please review the predicted TDS concentration using different settings of boundary conditions. Fixed boundary conditions should be set at the bottom of the model to 200,000 mg/l as shown in Figure 5 (p. 12 of App.6 A Hydrogeology Baseline Part 1-IAAE.pdf) . The top boundary condition should be free flux condition. Groundwater flow model must be able to use switch boundary condition for this purpose (FEFLOW allows boundary constraints). Present the outflow concentration over the lifetime of the mine. Pond boundary condition should be linked to the calculated outflow concentrations. Provide concentration maps before exploitation, at the end of mining and at post-closure. Simulate time needed to get back to initial concentration from the time of closure. Use backward travel time to provide a map of the maximum distance to define the water origin envelope reaching the pit.
NRCan	9	Proponent	Groundwater modelling	Vol.6 App6-B	Pit dewatering will generate a drawdown cone that will cause hydraulic gradient changes and thus alter groundwater flow as well as affect groundwater-surface water interactions. A contoured drawdown map permits an assessment of the potential impact on surface water.	Please provide a 2D map of maximum drawdown area and describe the effect and impact on surface water.
NRCan	10	Proponent	Groundwater modelling	Vol.6 App6-B	Longitudinal and transversal dispersivity coefficients have an impact on the dispersion tensor of the mass transport equation affecting the concentration diffusion rate. The migration rate will thus be also affected. The uncertainty associated with these unmeasured parameters may affect the results of the modelled TDS concentrations. It is thus preferable to carry out a sensitivity analysis of these parameters in order to assess their impact on uncertainty.	Please add these parameters in the sensitivity analysis.
NRCan	11	Proponent	Groundwater modelling	Vol.6 App6-B	The validation of groundwater flow and mass transport models requires calibration with high quality observation data. Model calibration allows to validate the conceptual model on which the numerical model is based. The proponent's modelling contains very few calibration data, particularly in the vicinity of the pit. While the conceptual model as well as several of modelled hypotheses seem plausible, it is important that the proponent continues adjusting its model with the monitoring data acquired throughout the mine’s life cycle, such as dewatering discharge measurements or hydrochemical parameters from monitoring wells. Acquiring groundwater data (quantity and quality) will help to validate and calibrate the updated model.	The proponent will be required to update and calibrate the groundwater model based on groundwater quantity (inflow and head) and quality evolution. The monitoring plan must be regularly updated on the basis of the motoring results.