Attachment 1 – NRCan's Technical Review of Round 2 Information Request Responses – Lynn Lake Gold Project

IR Number	Context and Rationale	Specific Question / Comment
IAAC-R2-58	The proponent has provided a suite of water quality predictions in the receiving environment under expected and upper case scenarios under wet and dry climate conditions upstream (QM02) and at several water bodies downstream of the McLellan site. In general, predicted affected areas are KEE3-B1 and Minton Lake (i.e. groundwater seepage from MRSA and TMF). However, predicted maximum levels of Cu, Zn and Ni in the expected case to be above water quality criteria in Cockeram Lake, which collects drainage from Keewatin and Minton Lake water sheds during the entire lifecycle of the mine. It is noted that PAG mine rock will be blended at both sites and that the proponent rely on existing pile to support blending. NRCan would recommend that the proponent segregate PAG from non-PAG rock to limits loading to the receiving environment as a precautionary measure. PAG material could then be placed in the open pit at closure. This is recommended because once waste rock is blended, it would be difficult to remove the source term and incur important costs.	The response is sufficient and no further information is required.
IAAC-R2-59	NRCan acknowledge the justification of the proponent to prefer blending/encapsulation to manage PAG waste rock over backfill in open pits. The proponent responded that backfill in open pits are costly because of double handling, the segregated PAG rock can get oxidized during operations and lead to ARD/ML, and that it prevents future mining. In addition, historical waste rock piles have not identified concerns as of yet.	While NRCan understands the proponent position, it still recommends continuing assessing PAG rock/tailings backfill during operations through their mine waste management plan. NRCan also recommends to mining out one pit first followed by the second one, which could provide backfill opportunities. The reason for this recommendation is as follow: 1- For consistency and fairness in technical reviews across Canada, as this recommendation is made to all Gold projects. 2- There remains uncertainty and challenges with blending non-PAG and PAG waste rock. First, examples of blending are difficult to retrieve in the open literature. There is an example at the proof-of concept level (See Day 2022 Small-scale field evaluation of geochemical blending of waste rock to mitigate acid rock drainage potential). Researchers at UQAT have also presented the likelihood of building waste rock piles in way to limit the generation of acidity (Effect of material variability and compacted layers on transfer processes in heterogeneous waste rock piles - ScienceDirect). This is why the INAP

		has sponsored the development of guidance (See Research - INAP.) In addition, Pedretti et al. 2016 (Blending as an effective option to reduce risk of water acidification from waste rock pile: a stochastic analysis) identified challenges and parameters to consider when blending/encapsulating PAG rock. It is therefore not a straightforward approach, which will require meticulous site coordination between mine geologist, and people responsible for the building of the rock pile. 3- Future mining potential of open pits is a valid argument, but it needs to be thoroughly justified, as it is the requirement in Ontario and Quebec for instance. 4- Oxidizing of segregated waste during operation is a valid argument, but drainage can be managed on-site with current water management infrastructure and management on surface in perpetuity post-closure may have prolonged impacts. 5- While 20 years of water quality monitoring has not indicated ARD/ML issues, the onset on ARD/ML may take several years.
IAAC-R2-60		NRCan's IAAC-R2-57 is included as part of IAAC-R2-60 (b)(i). Considering that component the response is considered sufficient. No further information is required.
IAAC-R2-61		The response is sufficient and no further information is required.
IAAC-R2-62	The description of the hydrogeological context of the project should include the delineation of stratigraphic and hydrogeological boundaries and the physical properties of the hydrogeological units. Hydraulic conductivity tests have not been completed within the deep bedrock at the Gordon Site, nor within the lower 100 m of the deep bedrock at the MacLellan Site. Groundwater wells used in the calibration of the groundwater model extend to a maximum total depth of 80 m for the Gordon site, and 30 m for the MacLellan site. The calibration of the model and the sensitivity analysis does not address any uncertainty in the hydraulic conductivity of the lower 90% of the MacLellan Pit, and the lower 50% of the Gordon Pit.	A) As Rock Quality Designation (RQD) is being used as a proxy for the hydraulic conductivity of the intermediate and deep bedrock, provide data showing the site-specific relationship between RQD and hydraulic conductivity. B) Although, as demonstrated in IAAC-R2-62, increasing the hydraulic conductivity of the lower bedrock units has a negative effect on the calibration of the model, improved calibration may be achieved with adjustment of the recharge parameterization.

	The response to IAAC-R2-62 demonstrates that the groundwater assessment for the Gordon Site has limited sensitivity to the intermediate and deep bedrock hydraulic conductivity (within a range of one order of magnitude). With the additional data provided from recent packer testing at the Gordon Site. The uncertainty is reasonably quantified. There has been no additional packer testing completed for the MacLellan site, and as such, no hydrostratigrahpic information is available for the lower 100 m of the site. Sensitivity analysis presented in response to IAAC-R2-62 demonstrates that the groundwater assessment for this site is sensitive to the hydraulic conductivity assigned to the intermediate and deep bedrock within the numerical model. As the model is sensitive to the parameterization of these units, and no data is available, the uncertainty within the model should be further addressed to provide confidence in the quantity of groundwater intercepted by the open pit, the extent of drawdown associated with open pit dewatering, and the direction, timing, and quantity of seepage from mine storage facilities. This information is required to support the assessment of surface water as it relates to fish and fish habitat.	To reduce uncertainty in the assessment of effects to groundwater for the MacLellan site, please provide an updated sensitivity analysis in which recharge, along with intermediate and deep bedrock hydraulic conductivity are adjusted. Should an upper limit on recharge limit the calibration of the model, present site-specific evidence for the recharge limit.
IAAC-R2-63		Response is considered sufficient. Results of ongoing testing, including long term pumping tests should be used to validate and transiently calibrate the groundwater numerical model used to support the design of the interceptor well system.
IAAC-R2-64		The response is sufficient and no further information is required.
IAAC-R2-65		The response is sufficient and no further information is required.
IAAC-R2-66	EIS guideline 6.1.5 requires a description of the temporal changes in groundwater flow, including seasonal changes as part of the description of baseline conditions. As part of this description, a comparison between observed and simulated seasonal changes in groundwater elevations is provided in Section 4.4.2 of the assessment reports for both sites based on the results of transient numerical modelling. Neither model adequately represents the observed seasonal variability at the sites.	It is NRCan's view that the transient model performance does not adequately represents the observed seasonal variability at the site. NRCan recommends that the Proponent addresses this section of the EIS guideline by a qualitative discussion of seasonal variability as it relates to the forecasted effects to groundwater.

	These transient models cannot be relied upon for any related assessments (i.e., surface water, or fish and fish habitat), and should not be presented in the EIS.	
IAAC-R2-67		The response is sufficient and no further information is required.
IAAC-R2-68		The response is sufficient and no further information is required.
IAAC-R2-69		Notes apply to Parts A through C, as D and E are beyond the scope of GSC review. The proponent has provided a sufficient discussion and sensitivity analysis to address modelling representation of the interceptor well system. As the water quantity results show, it is possible that high proportion of the water needed to offset seepage losses from Gordon and Farely Lake may need to be sourced from the open pit, as the interceptor wells may not be able to provided the quantities required after the first two years of operations, nor during summer months.
IAAC-R2-70	EIS guideline 6.2.2 states that the assessment of groundwater should include the assessment of changes to groundwater fluxes. The use of groundwater interceptor wells within the faulted zone at the Gordon site has a strong influence on the groundwater flux to the open pit. The proper operation of this interceptor well system will ensure that flows to the open pits are controlled, and that water levels in Gordon and Farley Lakes are maintained through pump back. The simulated groundwater interceptor wells were optimized to intercept a large quantity of groundwater that would otherwise discharge to the open pit. The average (although conservative) rates for these wells is twice that of the peak groundwater inflow into the open pit at the end of operations. This result indicates a significant reliance on the interceptor wells to limit groundwater inflow to the open pit. Previous responses to IAAC-69 and IAAC- 70 suggest a reduction in the forecasted pumping rate from the interceptor wells, such that the total pumping rate appears to be on the order of 0.04 m^3/s (IAAC-69). The pumping rate used in the trade-off study to choose between interceptor wells and a grout curtain was based on previous pumping rates that ranged from 0.275 to 0.77 m^3/s. This lower rate would change the results of the trade-off study, and the assessment of interceptor wells as a mitigation option. As the water quantity results presented in IAAC-R2-69 show, it is possible that a high proportion of the water needed to offset seepage losses	NRCan requests that the Proponent revaluate the trade-off study using the updated pumping rates for the interceptor wells and the seasonal effects shown. The results of the trade-off study should also include a water balance for the lakes, showing the residual water loss to seepage from the lakes for each option.

	from Gordon and Farley Lake may need to be sourced from the open pit, as the interceptor wells may not be able to provide the quantities required after the first two years of operations, nor during summer months. Given these updated results, it is not clear that the interceptor wells should be relied upon as the main mitigation method.	
IAAC-R2-72		The response is sufficient and no further information is required.
IAAC-R2-73		The response is sufficient and no further information is required. As the updated results are more aligned with the conceptual model, and the assessment of other valued components, it is these results that should be presented in the effects assessment for groundwater quantity.
IAAC-R2-75		The response is sufficient and no further information is required.
IAAC-R2-76		The response is sufficient and no further information is required.
IAAC-R2-77	EIS guideline 8.0 requires that the follow-up program be designed to verify the accuracy of the effects assessment and to determine the effectiveness of the measures implemented to mitigate the adverse effects of the project. The groundwater monitoring program and trigger mechanisms will rely on changes observed at monitoring wells. As groundwater travel time can be slow, effects may not be observable at monitoring wells within the operation phase of the project, in particular as it relates to seepage from mine waste facilities. To ensure that the accuracy of the effects assessment can be verified, additional monitoring should be included in the monitoring program to ensure verification potential in the early stages of the project. This monitoring may include, but is not limited to, the quantity and quality of groundwater seepage intercepted by the ditch system.	NRCan recommends including information that can be used to verify the results of the groundwater effects assessment and the groundwater numerical model, in the early phases of the project development (i.e. during the initial years of the operation phase). to the follow-up monitoring program. This monitoring may include, but is not limited to, the quantity and quality of groundwater seepage intercepted by the ditch system.
IAAC-R2-78		The response is sufficient and no further information is required.
IAAC-R2-100		The response is sufficient and no further information is required.
IAAC-R2-101		The response is sufficient and no further information is required.

IAAC-R2-102		The response is sufficient and no further information is required.