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**Technical Peer Review  
Proposed Ajax Mine  
Final Report**

**City of Kamloops**

**June 9, 2017  
SLR Project No.: 201.12000.00000**

# TECHNICAL PEER REVIEW PROPOSED AJAX MINE FINAL REPORT

Prepared for the City of Kamloops

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**PROPOSED AJAX MINE**

**FINAL REPORT**

**SLR Project No.: 201.12000.00000**

Prepared by  
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for

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June 9, 2017

Prepared by:

A handwritten signature in blue ink, appearing to read "Paul Draycott", is written over a light blue circular stamp.

**Paul Draycott, JD., LLB., Esq., EP**  
Project Manager and Lead Technical Expert

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## EXECUTIVE SUMMARY

### ***Process Overview***

KGHM Ajax Mining Inc. (KGHM) is the proponent proposing to design, construct, operate, decommission, and reclaim the proposed Ajax Mine Project (the Project). The Project is a nominal 65,000 tonne per day open pit copper/gold mine, with an estimated 23-year mine life producing copper/gold concentrate. The Project is required to undergo a review under the BC *Environmental Assessment Act, 2002* (BCEAA) and the former *Canadian Environmental Assessment Act* (CEAA) using the transitional process for comprehensive projects under the new *Canadian Environmental Assessment Act, 2012*.

The final Application Information Requirements (AIR) issued by the BCEAO and the Environmental Impact Statement Guidelines (EISG) issued by the CEA Agency identifies the provincial and federal information that must be included in the Environmental Assessment Application. Prior to the release of the final AIR and EISG, the City of Kamloops participated in both the review of the draft AIR and the Project screening. The BC EAO and the CEA Agency established the EA Working Group for the Project to have representatives of Aboriginal Groups and local, provincial, and federal government agencies review and provide input to inform the development of the Environmental Assessment Application. This input is expected to be integrated into the Environmental Assessment Application as an iterative process.

The City of Kamloops retained SLR Consulting (Canada) Ltd. to undertake a peer review of the technical components of the Environmental Assessment Application for the Project. On behalf of the City of Kamloops, SLR Consulting (Canada) Ltd. undertook the following activities during the peer review process:

1. Commencing in January of 2016, the Environmental Assessment Application and the Technical Supporting Documents (TSD) including methodologies, impact assessments, mitigation, and residual impacts prepared in support of the Environmental Assessment Application, in concordance with the final AIR, was reviewed to identify and evaluate potential issues of concern to the City of Kamloops and its residents for subsequent discussion with the BCEAO Working Group, KGHM and its consultants;
2. Preliminary peer review findings were presented to the City of Kamloops Council and the public in March of 2016;
3. Working Group technical meetings were attended with the City of Kamloops, BCEAO, KGHM and its consultants to discuss the Environmental Assessment Application and TSDs. At these meetings, missing information, discrepancies and ambiguities in the TSDs and the Environmental Assessment Application were discussed and clarified and areas in the TSDs and the Environmental Assessment Application were identified where additional information or analysis was, in our opinion, required;
4. Input into KGHM's EA process was provided, on behalf of the City of Kamloops, to benefit and add value to the Environmental Assessment Application as it pertained to potential issues of concern for the City of Kamloops;
5. Advice was provided to City of Kamloops staff to assist in understanding technical issues and reports;
6. Draft and final reports of the peer review findings were prepared; and
7. The final peer review findings will be presented to the City of Kamloops Council and the public in June of 2017.

SLR Consulting (Canada) Ltd., in consultation with the City of Kamloops, based the technical peer review of the Environmental Assessment Application and the supporting TSDs on an evaluation of how the Environmental Assessment Application and the supporting TSDs addressed:

- The completeness of the Environmental Assessment Application and the TSDs;
- The methodologies, identification and characterization of the environmental impacts of the project;
- The sufficiency of applied mitigation;
- The characterization of residual effects and the likely cumulative effects related to other projects or activities that have been or will be undertaken, and the significance of these effects;
- The requirements of follow-up management and monitoring programs in respect of the Project predicted outcomes;
- The application of the principles of Sustainable Development, the Precautionary Approach and Climate Change; and
- The certainty of and confidence in the conclusions of the Environmental Assessment Application.

The scope of the peer review work did not include a review of KGHM's pre-feasibility and financial investment decisions, the Project consultation program, the monetary quantification of purported Project Benefits, or the details of any direct Project agreements between the City of Kamloops and KGHM. Additionally, the scope of the peer review did not include a review of the Environmental Assessment Application and its supporting TSDs with regards to Aboriginal interests as this was completed by the Aboriginal communities under a separate and distinct process.

### ***Findings Overview***

In general, KGHM expended considerable effort in compiling the Environmental Assessment Application and the Technical Supporting Documents for the Project. It is consistent with our experience and expectations for a project of this size and complexity.

In terms of the confidence or certainty of the Project conclusions, our findings are generally consistent with those of KGHM with respect to aquatic environments and species, acoustics and vibration, water balance, accidents and malfunctions, municipal infrastructure, and some of the socio-economic conclusions. Where we have heightened uncertainties and/or low confidence in the Environmental Assessment Application conclusions are found in the technical assessments for air quality, human health, dark sky, water quality, terrestrial environments and species, and some socio-economic conclusions. Not all of these uncertainties directly relate to potential impacts within the City of Kamloops boundaries; some relate to amenities used by City of Kamloops residents such as recreational pursuits that would include Jacko Lake or the Stake Lake Observatory. Some key findings related to the concerns of the City of Kamloops and its residents are summarized below and discussed more fulsomely in the various report sections.

## ***Air Quality Overview***

Following our initial air quality findings in March of 2016, a sub technical working group, which included SLR Consulting (Canada) Ltd.'s air modelling group, met several times with KGHM to discuss opportunities and methodologies to improve the sensitivity of the air modelling and to ensure that model inputs were as representative as possible to minimize perceived uncertainties in the model and the predicted results in the Environmental Assessment Application.

KGHM developed, in consultation with the sub technical working group, an addendum modelling plan that was approved by the sub group. This updated Air Quality modelling work incorporated correcting original dispersion modelling errors, revising the model assumptions as well as adding additional sensitivity to the mitigation effectiveness by adding 70% and 80% active mitigation scenarios to the 90% active mitigation scenario and providing a worst-case 0% active mitigation event.

The results from these new model scenarios show that for annual average  $PM_{2.5}$ , as active mitigation effectiveness decreases from 90% to 80% to 70%, the ambient concentration increases at the Project boundary. While still within or at the threshold of the ambient air quality objective, this does demonstrate that any appreciable loss in the 90% active mitigation leads to a doubling of the concentrations over background under the 80% scenario and greater still under the 70% scenario. As distances increase away from the Project boundary, the Project's contribution decreases, and the updated model predictions are intangibly different from the original model predictions at the Upper Aberdeen area.

Notwithstanding the above findings, our opinion is that because the dispersion modelling is based, except for the TSF emissions which were re-modelled on an hourly basis, on constant emissions rates from all other sources, the findings may, on an hourly basis, underestimate short term air quality effects during dryer months and, conversely, overestimate air quality effects in the winter months. This potential effect is not captured using the 24-hour ambient air quality objective and does increase the uncertainty of the modelling results as it pertains to short duration (one to several hours) exceedances of the ambient air quality objectives. As an example, under a temporary loss of mitigation capability to 0% mitigation, the  $PM_{10}$  concentrations rise in Upper Aberdeen to approximately the same level as North Kamloops.

An underlying concern remains in achieving the 90% active mitigation commitment for two reasons. First, the cited examples of other mining projects that purport to achieve this mitigation threshold are not local and it is uncertain whether there is a direct application to the unique Project conditions to increase certainty that 90% can be achieved on this Project. Second, our interpretation of achieving 90% active mitigation, because it is atypically high and because the predominant emissions source is the haul roads, is that the measures used to achieve this level of mitigation are considered to be the most that could be done to achieve 90%. In other words, if 90% cannot be achieved, there is not any new or additional mitigation measures that can be applied to achieve 90% short of paving over all disturbed surfaces or prohibiting the use of the haul roads. These do not seem plausible from a long-term Operations or financial perspective however road prohibitions may be viable under short-term scenarios.

As stated above, the 90% active and annually constant mitigation commitment, exclusive of natural mitigation such as precipitation, from KGHM remains aggressive and uncertainty surrounding KGHM's ability to comply with this threshold is approached through the development of a Fugitive Dust Mitigation Plan that accompanied the updated Air Quality modelling work, outlining dust control strategies, the timing and frequency of the application of

the strategies and which sources they would be applied to, and trigger events based on particulate matter levels for TSP, PM<sub>10</sub> and PM<sub>2.5</sub> and the corresponding range of short-term and long-term actions that would be initiated in response to those exceedances. Critical to the success of this plan will be the ability to forecast combinations of operational and meteorological conditions that cause dust generation and poor dispersion and mixing and to act appropriately and expediently to mitigate air quality exceedance events.

As with any predictive approach to impact assessment, the follow-up monitoring and the ability to respond effectively and expediently to actual results that differ negatively from predicted results is paramount. In the case of KGHM's commitment to a 90% active mitigation compliance target, cessation of dust generating operations may be required on those days where meteorological conditions interact with Project activities to create exceedances in the air quality objectives.

### ***Human Health Overview***

The re-assessment of human health under the amended air quality modelling work has decreased uncertainties in the risk assessments and provided a more conservative assessment of potential exposures to metals and air pollutants. Several health concerns remain however including;

- Notwithstanding that both Baseline (0.9 µg/L) and Future Case (1.8 µg/L) groundwater arsenic concentrations are predicted to be below the Canadian Drinking Water Guidelines (10 µg/L) and within average naturally occurring background arsenic levels in BC, long-term effects of low-level arsenic contamination can increase the risk of developing cancer. The predicted increase in arsenic concentrations in groundwater at Knutsford leads to an increase in the calculated Incremental Lifetime Cancer Risk that is 6 times the acceptable risk level. Also, the Hazard Quotient (HQ) for non-cancer risk is predicted to increase from 0.133 to 0.22.
- The Hazard Quotient for consumption of mercury from fish in Jacko Lake is greater than the Health Canada benchmark of 0.2 for the Aboriginal toddler cohort for Baseline and Future Case however there is no significant change due to the Project.
- The remodeling of PM<sub>2.5</sub> with varying levels of haul road dust mitigation effectiveness (at 70% to 90% mitigation effectiveness) showed that, at the northern Project boundary, the annual average PM<sub>2.5</sub> concentrations exceed the ambient air quality objective (8 µg/m<sup>3</sup>). However, with distance from the Project boundary, exceedances diminish and there are no annual average exceedances detected in Upper Aberdeen nor further into the City. The annual average PM<sub>2.5</sub> concentration in North Shore Kamloops is already higher than the ambient air quality objective due to background and other sources, but the Project would not substantially contribute to the exceedance. These findings are conditional however with respect to the air modelling concern we identified above regarding the use of constant emissions rates and the lack of seasonal sensitivity that accompanies that approach and the uncertainty surrounding what effect shorter duration concentrations (< 24 hours) might have on City of Kamloops neighbourhoods.
- In all dust mitigation effectiveness scenarios, the 24-hour PM<sub>2.5</sub> air quality objective (25 µg/m<sup>3</sup>) is also not predicted to be exceeded in Upper Aberdeen and beyond. However, without dust mitigation there are a few days per year where the Project emissions, when interacting with meteorological conditions, will result in an exceedance of the 24-hour PM<sub>2.5</sub> air quality objective in Upper Aberdeen. Health risks due to

inhalation of PM<sub>2.5</sub> from the Project have been estimated to be negligible by KGHM. However, PM<sub>2.5</sub> is a non-threshold air pollutant and therefore any modelled increase in its concentration at receptor locations in Upper Aberdeen should be of some concern. Similarly, there are exceedances of the 24-hour averaged PM<sub>10</sub> guideline predicted for Upper Aberdeen, which increase in number of days per year and geographic extent with decreasing road dust mitigation effectiveness.

- There were no human health risks predicted from the inhalation of metals in dust or from the inhalation of diesel particulates within the City of Kamloops. Exposure to metals in dust was calculated for combined exposure pathways from direct skin contact, incidental ingestion of soil, and ingestion of country foods or garden produce. Some metals were calculated to exceed the applicable Hazard Quotient; however, the same exceedances are pre-existing under Baseline exposures and the Project is not predicted to contribute significantly. We accept that the metals in dust used to model the potential human health effects were appropriate based on the approach used. However, we disagree with the approach used for screening for contaminants of potential concern (COPCs), which was based on the relative toxic potential of contaminants in ore dust, a method used by the US EPA to identify the most significant, but not necessarily all, chemicals in a medium. This method is rarely used in Canada and only when baseline and predicted (through modelling) exposure concentrations in media are not available. For this Project, baseline and future case COPC concentrations were available through measurements and modelling, respectively, for all exposure media (soil, water, air, food). SLR recommended using the Health Canada-accepted approach where maximum exposure concentrations are compared to appropriate risk-based screening criteria in all media. We are unable however to state that there would have been any difference in results between the two approaches without seeing the results of the two approaches but the Health Canada approach would have in our opinion better met the intent of incorporating the Precautionary Principle in the Environmental Assessment Application.

### ***Socio-Economic Overview***

KGHM relied on the Input-Output (I/O) model as an accepted method for estimating the economic contributions of projects at provincial and national levels. For this stated purpose, the I/O model was appropriately used. KGHM worked with Statistics Canada to build production functions using available project expenditure data. We consider this approach as good practice for provincial and national level effects. However, the I/O model does not allow for estimation of economic benefits on a more granular basis (i.e., City of Kamloops). As such, we believe that uncertainty exists with respect to the magnitude of benefits likely to accrue to the City of Kamloops.

For the effects analysis at the local level, KGHM has stated that the direct, indirect and induced job estimates were derived using simple multipliers developed by Statistics Canada and applied to the high and local hire scenarios. The use of such multipliers is commonplace and reasonable. Nevertheless, local beneficial effects on employment, income and business activity are likely to be overstated. The analysis assumes that the workers who would gain employment at the mine will be individuals who are not presently working and unemployed in the City of Kamloops area. For example, KGHM does not consider that some people who are already working in the City of Kamloops area would leave their existing jobs to seek potentially higher wages or career advancement at the Project. Overall the analysis fails to adequately recognize that additional in-migration might occur to fill vacated jobs, and therefore additional population growth that will place additional service demands on City of Kamloops services.



Overall, we agree with KGHM that the Project is expected to positively contribute to economic growth and diversification within the Region throughout the Project's economic life however these contributions are weighted to the shorter Construction phase and dropping substantially during Operations and dropping even further during Decommissioning and Reclamation. We also agree with KGHM that the experience gained by individuals and businesses in the study area that become engaged with the Project will have a positive effect on the economy. Much of the skills and capabilities to be gained through involvement with the Project are those that are widely applicable, in high demand and available for sustained economic benefits beyond the life of the Project.

Overall, achieving the high local hiring scenario is fundamental to avoiding significant adverse effects on the City of Kamloops and the services it provides its residents. It is well understood that if there is an insufficient local labour pool available, the increased in-migration has the potential to 1) increase demand for housing and accommodations, 2) increase stress on community infrastructure and services, and 3) increase traffic volumes and effects on public road infrastructure. Proposed mitigation measures that minimize potential adverse effects on infrastructure, public facilities and services, because of Project-related in-migration, are described in the Application however it is our opinion that while these are common and standard mitigation measures for large industrial projects, the effectiveness of the measures for this Project and in the City of Kamloops carries uncertainty due to a lack of detail available now.

As an assessment of potential effects of the Project on municipal finance is not within the scope of the Environmental Assessment Application, as defined in the AIR, the Environmental Assessment Application does not quantify the costs to the City of Kamloops for the delivery of additional services required by the Project, its workforce or other potential in-migrants. Nor does the Environmental Assessment Application sufficiently address the issue of "timing", namely the delay between when costs are incurred by the City of Kamloops to address additional service demands and the time when sufficient revenues are generated from the Project to offset costs.

The City of Kamloops is not the local government taxing jurisdiction; hence it is not fully understood how the City of Kamloops will be compensated for its costs incurred during all mine phases (such as additional EMS, Fire, or policing resources required during the influx of the mine workforce). KGHM indicates that project contributions to overall BC government revenue are expected to support the provision of public services in the City of Kamloops however this raises uncertainty as to the quantum and timing of this support. KGHM has indicated that it has initiated discussions with the City of Kamloops regarding collaboration mechanisms to address issues related to service delivery in the City of Kamloops. We support the development of a Community Agreement between KGHM and the City of Kamloops that is external of the City of Kamloops' participation in the proposed CLG. We believe that this level of agreement would not only confirm the mitigation identified in the Environmental Assessment Application, but would also foster a pro-active, corporate culture on the part of KGHM to collaboratively develop tailor-made solutions with the City of Kamloops to improve the delivery of municipal services to residents and improve overall corporate-community relations.

The effects on the delivery of health services are largely related to potential population growth because of the Project. KGHM has concluded that up to 400 workers and their families are expected to migrate to the City of Kamloops because of direct, indirect, and induced employment, creating an increase in demand for health care services. In addition, there is the possibility that existing medical professionals may personally choose to leave the community should the Project be developed. The potential for these effects to occur is acknowledged by

KGHM but has not been fulsomely evaluated nor has sufficient mitigation, beyond KGHM's commitment to provide a general Physician for Project employees to minimize the strain on general practitioners in the City of Kamloops, been identified to indicate that significant adverse effects will not occur.

The effect of the Project on property values remains one of the biggest uncertainties with the Project, and has been acknowledged as such by KGHM in the Environmental Assessment Application. Effects on property values were raised by the public, including residents and administrators from the City of Kamloops, real estate agents, developers and landowners in the vicinity of the Project. Specific areas of concern included, but were not limited to, the Aberdeen, Upper Sahali, Knutsford and Pineview Valley neighbourhoods. The project is atypical in BC in its proximity to built-up areas. KGHM acknowledges that specific properties and residential areas are likely to be affected. KGHM acknowledges that certain environmental effects of the project Construction and Operations phases could influence the desirability of various properties. They further acknowledge that there could be a short-term decline in residential property values until buyers are confident that mitigation measures to which KGHM has committed are effective. However, KGHM also concedes in the Environmental Assessment Application that their confidence level in the property values impact assessment is low.

KGHM will primarily rely on the implementation of on-site mitigation measures to address changes in the biophysical environment that might contribute to reduced property values (i.e., air quality, blasting noise, vibration, dark sky, traffic, visual/aesthetics, groundwater) along with effects monitoring. For example, KGHM has proposed to use real-time monitoring systems as a means of reporting monitoring results for parameters such as air quality and vibration. There may be potential for variability or uncertainty in the blast noise and vibration predictions, with relevance to the assessment of human annoyance and hence property values. KGHM has also expressed its willingness to consider options for off-site mitigation, including screening to mitigate visual effects. However, most of the adaptive management strategies identified do not directly address financial losses to property owners resulting from potential diminished property values. Although meeting the human annoyance thresholds for various nuisance effects should be a condition of the Project, and compliance would be enforced, KGHM does not propose to implement a property value protection plan that might be triggered should nuisance or other effects be greater than predicted. In the absence of such a protection plan, there remains low confidence with respect to a conclusion of no significant adverse effects on residential property values and significant uncertainty if these effects, if realized, can be mitigated.

KGHM has concluded that up to approximately 400 workers and their families are expected to migrate to the City of Kamloops because of direct, indirect, and induced employment, creating a short-term increase in demand for housing. KGHM concludes that some residential development would take place, but that would be a gradual process, being unlikely above the current rate of development. KGHM concluded that the local housing stock is sufficient to meet the potential demands of the workforce. Notwithstanding the uncertainty associated with predicting in-migration, we agree with KGHM's prediction and recommend monitoring of housing availability as part of the SEMP. In contrast, KGHM's analysis of effects on tourist accommodations clearly predicts a shortage of such accommodations under the low local hire scenario. From our perspective, this is equivalent to an exceedance of a threshold, yet a significant adverse effect was not predicted. Given the uncertainty associated with local hiring predictions and in estimating in-migration, we do not agree with KGHM's conclusion that there will be no significant adverse effect on tourist accommodation, particularly during peak seasons in the Construction phase and that due to the unknown factors surrounding in-migration, the confidence in their conclusion is low.

We agree with KGHM's conclusion that widespread adverse effects on the tourism industry are unlikely while the Project is being constructed, operated and decommissioned in strict compliance with all of the terms and conditions that will attach to the Project through Project Certification and regulatory approvals. Notwithstanding uncertainties with impact modelling and predictions discussed elsewhere in this report, KGHM has asserted that changes in air quality, blasting noise, vibration, dark sky, traffic, visual/aesthetics, and groundwater, would not be of sufficient magnitude or be noticeable across the City of Kamloops and at most individual tourist related operations to make them unattractive to tourists. In addition, KGHM reported that tourism industry stakeholders engaged during their research did not identify potential concerns regarding the economic viability of their operations. Nevertheless, there remains the potential for adverse effects on tourism related accommodations due to the likely competition for temporary accommodations during the Construction phase. If demand for tourist accommodation increases as projected, and supply does not increase to meet demand, there is a strong potential that room rates would increase. Should the situation with high competition and higher room rates persist, it can be concluded that the competitiveness of attracting events and tourists could be effected. However, we agree that if there are changes in hotel pricing because of the Project, these will be short-lived.

With respect to potential changes in the community's image, we conclude that adverse changes in the City of Kamloops' community image are possible but are not inevitable outcomes of the Project. Concerns have been raised about the possibility of an effect of the Project on community image if the city is viewed as an unattractive industrial city with diminished environmental quality and well-being and that such views would be contrary to the vision of the City of Kamloops and its brand as "the Tournament Capital of Canada". KGHM will primarily rely on the implementation of on-site mitigation measures to address changes that might contribute to reduced environmental quality (i.e., air quality, blasting noise, vibration, dark sky, traffic, visual/aesthetics, groundwater) along with effects monitoring. While some changes to environmental quality because of the Project have a higher potential, it is our experience that changes to a community image are not, except in the instance where there is demonstrated poor Project environmental performance and/or a major Project accident resulting in widespread public concern both among residents and others outside the community. We note that in a review of economic development materials publicly available, the City of Kamloops lists mining as a core industry of the City.

KGHM has proposed the establishment of a Community Liaison Group (CLG) as a key mitigation element for the socio-economic impact management. It is held up as a mechanism to address virtually all the key impacts and issues discussed above. The Environmental Assessment Application presented a very conceptual vision for the CLG. KGHM has subsequently offered a more detailed draft Terms of Reference however, given the critical role that this group will need to play to assist in managing effects of the Project, it is essential that its Terms of Reference be acceptable to the City of Kamloops and other stakeholders and encompass the full range of potential Project impacts and mitigation that is attributed to the CLG in the Environmental Assessment Application.

### ***Accidents and Malfunctions Overview***

KGHM took a two-stage approach to evaluating potential impacts from Projects accidents and malfunctions. The Environmental Assessment Application process focuses on credible accidents and malfunctions and we agree with the scope of the impact assessment which included:

In the first stage, KGHM conducted a Failure Modes and Effects Analysis (FMEA) workshop covering relevant Project activities and components except a TSF failure. The FMEA included the hypothetical failure of structures, equipment, or processes and the consequences of failures on Project receivers. The second stage evaluation focused on the effects of a catastrophic failure of Project dams associated with the TSF. The dam failure modes assessment and dam breach inundation evaluation followed the Canadian Dam Association Dam Safety Guidelines.

In the first stage, KGHM considered scenarios for accidents and malfunctions that included; a Kinder Morgan Pipeline leakage or failure; the accidental leakage of effluent; power outages; flying rock from blasting; unplanned explosion; motor vehicle accidents; flooding or erosion because of containment structure failures; failure of the pit integrity; erosion and sedimentation into waterbodies; and spill contamination to waterbodies or soils. In the second stage, the assessment focused on the failure of the TSF, seepage collection and runoff ponds and failure of the waste rock storage facilities.

We found that the approach and scope of the accidents and malfunctions impact assessment was appropriate for the Project and that the scenarios investigated are both credible and preventable. We also note that detailed designs of the TSF, seepage collection and runoff ponds and waste rock storage facilities were not available for review during the Environmental Assessment Application process so our peer review is limited in this regard. Detail Designs will be prepared during the mine permitting process and should be reviewed at that time.

We reviewed the proposed TSF concept and found that the design considerations available in the Environmental Assessment Application phase were appropriate in that KGHM has used a “belt and suspenders” approach to the TSF construction. The structural elements are fortified through the addition of rock buttressing to the embankment walls through siting of the mine rock storage facilities, increasing the dam safety margins and incorporating design recommendations from the Mount Polley dam failure review. Buttressing will be constructed concurrently with the TSF construction to match heights except for the initial years of the Construction phase. Seepage control elements were appropriate for the design, again based on the details available at the time.

The TSF is proposed to be limited in its ability to retain water as KGHM will be using a closed loop, recycled contact water system for mine water use. This further mitigates the potential for an unplanned release of contact water to be extensive given that the TSF is graded to a shallow point inside the structure where the water is collected and pumped back through the mine for reuse. Freeboard design incorporates the ability to manage flood events and there is no discharge of TSF surface water to the environment. This concept extends through Operations to Decommissioning and Closure phases where TSF water is pumped to the pit. Where the TSF is vulnerable is in the early Project stage of Construction, year -1 to year 1, where the TSF will be used to capture make-up water to be ready for mine operations. At this stage, water is directly against the dam structure with no buffering of the thickened tailings between water and the dam. In the dam breach analysis, the impact of this failure is leakage flows through the dam structure, captured in the seepage collection pond. For this response plan to be successful, the emergency pumping infrastructure must already be constructed and tested to respond to a failure mode event.

The proposed use of thickened tailings further reduces the water content in the TSF during Operations and Closure phases. The proposed use of dry cover over the TSF again reduces the potential for the loss of contact water following the decommissioning and closure. We agree with this approach. However, we have identified a concern with the approach to maintain the

thickened tailings in a wetted condition, not submerged, as a mitigation measure for dust control. We understand that the tailings will be deposited into the TSF using a spigot system that will be set up around the perimeter of the TSF so that the tailings beaches do not dry and generate dust emissions. We have not seen the detail of this spigot system however we have a concern that the volume of tailings being deposited in the later years of Operations will be insufficient to create full wetted conditions sufficient to mitigate dust generation in, what will be at that time, a very large TSF. We have a similar concern in the early years of operation whereby more water may be in the TSF, given the full year of water storage prior to Operations and additional water being deposited from Operations, than will need to be drawn down for mine Operations. This could lead to a scenario where the TSF continues to function as a pond for longer than modelled under the failure mode analysis.

An unplanned release of contact water to Peterson Creek would result in poor quality water moving down Peterson Creek under flood-like conditions, with associated effects of erosion and sedimentation. The predicted water quality within mine site ponds is poor and, based on the worst-case scenario, the impacts to water users in the Peterson Creek watershed would be immediate and severe enough to require an alternate water source until the impacts have been remedied, however the impacts would not be widespread. Notwithstanding the severity of the above surface water release scenario, more concerning in our review is the potential for a discharge directly to groundwater. This is a typical failure event for lined collection ponds holding contact water. Failures of the liner are harder to detect since they are underground and usually in this case the discharge will have been ongoing for some time before it is detected. Prompt detection is accomplished through a comprehensive understanding of the groundwater pathways in the footprint of and outside of the collection ponds so that groundwater monitoring wells and seepage containment systems are properly situated and with an appropriate number of monitoring wells to accurately detect changes that would indicate a problem with the liner. What we did not see discussed in the Environmental Assessment Application is what KGHM's mitigation plan is for dealing with seepage collection pond or trench water during the lengthy time to replace a pond liner.

KGHM has identified potential impacts to human health in terms of water quality should the unplanned release of contaminated water occur. Effects would be most acute in the area closest to the Project, and would dissipate further downstream; however, effects are modelled to impact Peterson Creek, Jacko Lake and continue down to Kamloops Lake, where quicker dilution would occur. This release will primarily affect the quality of ground and surface water whereby it would make current sources of drinking water and water used for livestock or irrigation unusable. KGHM categorizes these effects as having a short duration, 1 to 5 years, and would provide alternate sources of clean water to those affected while the effects were reversed. However, it is our opinion that none of the affected water users who suddenly found their water supply to be contaminated would consider 1 to 5 years a short duration particularly in consideration that KGHM has only a moderate degree of certainty that the effects of a contaminated water supply could be reversed.

In summary, notwithstanding that we found KGHM's design prevention approach to be acceptable to mitigate the potential for accidents or malfunctions from occurring and impacting human health, the fact is that accidents and malfunctions continue to happen on mining and other industrial projects despite design mitigation using the same or similar design features as KGHM proposes, except for the TSF in which KGHM has incorporated more robust approaches following the Mount Polley review.

### ***Recommended Conditions of Project Certification***

Given the reliance on a significant level of predictive modelling to undertake the environmental impact assessment for this Project, our recommendations for conditions should this Project be issued an Environmental Assessment Certification focus on the importance of undertaking a robust, effective and transparent monitoring and adaptive management program to continually assess predicted impacts against actual impacts during all phases of the Project. This will be critical to understand how the Project is interacting with the surrounding environments.

In the individual technical peer review findings presented in this report, we have provided technically-specific monitoring and management recommendations based on our peer review findings however we have also recommended conditions of a more general nature should the Project receive Environmental Assessment Certification to proceed including;

- Retaining an Independent Environmental Monitor, the qualifications of which are subject to the approval of the BCEAO and the City of Kamloops, to report to the BCEAO and the City of Kamloops on compliance or non-compliance with the terms and conditions of all Project permits and approvals, with all conditions of an Environmental Assessment Certificate, and with all Project commitments to environmental mitigation.
- Having KGHM develop and implement an Environmental Monitoring Plan in consultation with and to the satisfaction of the City of Kamloops. The plan should clearly describe KGHM's commitments and methodologies by which all predicted Project impacts, negative, neutral or positive, identified in the Environmental Assessment Application and any new or revised predicted Project impacts, negative, neutral or positive, identified prior to or during Construction, Operations and Decommissioning will be monitored and verified during Construction, Operations and Decommissioning. Emphasis of this plan will focus on monitoring the potential impacts to adjacent neighbourhoods and their sensitivities including the slope stability in Aberdeen, light and noise trespass, and air quality and potential health concerns.
- Having KGHM develop and implement an Adaptive Management Plan in consultation with and to the satisfaction of the City of Kamloops. The plan shall clearly describe KGHM's commitments and methodologies by which all predicted Project impacts, negative, neutral or positive, identified in the Environmental Assessment Application and any new or revised predicted Project impacts, negative, neutral or positive, identified prior to or during Construction, Operations and Decommissioning shall be managed during Construction, Operations and Decommissioning where it is identified that any prescribed mitigation measure implemented for the Project fails to achieve compliance with any term or condition of any Project permit or approval, the Environmental Assessment Certificate, or any commitment to mitigation agreed to by KGHM.
- Requiring KGHM to establish an Inter-Agency Working Group, of which the City of Kamloops shall be a member, under an Inter-Agency Working Group Terms of Reference to be established by the BCEAO. KGHM shall be required to implement and maintain the IAWG prior to and throughout Construction, Operations and Decommissioning and Reclamation phases to solicit and incorporate input from the City of Kamloops prior to and during any and all permitting and approval requirements for the Project, prior to and during the implementation of all mitigation measures, prior to and during the development and implementation of all Construction, Operations and Decommissioning and Reclamation environmental management plans including but not limited to those identified in Section 11 of the Environmental Assessment Application,

and prior to and during the development and implementation of all Construction, Post-Construction, Operations, and Decommissioning and Reclamation environmental monitoring and adaptive management plans.

- Requiring KGHM to establish a Multi-Stakeholder Jacko Lake Users Group, of which the City of Kamloops shall be a member, under a Jacko Lake Users Group Terms of Reference to be established by the BCEAO to solicit and incorporate input from the City of Kamloops prior to and during any and all permitting and approval requirements for the Project that are relevant to Jacko Lake, prior to and during any impacts to the use of or access to Jacko Lake, and prior to and during the implementation of all mitigation measures and management planning.

### ***Benefits Overview***

Anticipated beneficial effects of the Project may be realized by the City of Kamloops during the approximately 25-year Construction and Operational phases of the Project. The Project will or has the potential to:

1. Contribute to the maintenance of the social structure and stability of the City of Kamloops and the other municipalities within the Thompson-Nicola Regional District and serve as a positive contributor to population growth in these areas;
2. Create new apprenticeship opportunities serving the mining and other industries that will generate new certified trades people available for the Project itself and/or British Columbia's labour market subsequently;
3. Serve to maintain the skilled employment base of the construction, mining and support sectors throughout the short term and contribute to the expansion of the skills base over the long term;
4. Stimulate increased enrolment in post-secondary educational programs that provide mining related degrees or certificates and other training programs that support certification in a professional or skilled trade;
5. Be a catalyst for increased local and regional economic development during each of the Project's phases through the potential establishment of new business operations and/or the expansion of existing business operations in the City of Kamloops that are involved in the mining service industry;
6. Create new direct, indirect and induced employment opportunities for the existing labour market in the City of Kamloops and potential in-movers to the City of Kamloops and other Thompson-Nicola Regional District municipalities and positively influence employment growth. The Project is anticipated to require 1800 employees during the initial years of construction and 500 employees during operational years;
7. Create new indirect business activity and opportunities due to increased spending associated with Project employment, and expenditures on goods and services;
8. Contribute to increased total household income throughout the Region including the City of Kamloops;
9. Serve as a catalyst for the initiation of new housing developments in the City of Kamloops and other communities within the Thompson-Nicola Regional District;
10. Contribute in whole or in part to the tax bases of the City of Kamloops and the Thompson-Nicola Regional District.

Notwithstanding the potential benefits of the Project outlined above, the City of Kamloops will be in competition for these benefits such as employment opportunities, business development, economic growth of local businesses, and residential growth. Should the Project receive Environmental Assessment Certification, it is recommended that the City of Kamloops continue to work with KGHM to identify opportunities for these and other additional direct benefits of the Project to accrue to the City of Kamloops. It is also recommended that the City of Kamloops develop an internal program and strategies to maximize the benefit potential of the Project for the City of Kamloops.

### ***Summary***

In our opinion, KGHM has gained additional insight into the proposed Ajax Mine project from the thorough technical review undertaken by the City of Kamloops and SLR Consulting (Canada) Ltd. The Environmental Assessment Application has benefited from the detailed analysis provided through this process, as evidenced by the many comments, questions, technical contributions, revisions and additions to the Environmental Assessment Application technical information and methodologies.

As outlined above and the main body of this report, we have outlined persistent concerns surrounding potential impacts to the City of Kamloops and low levels of confidence in the conclusions derived by KGHM for these potential impacts. We also acknowledge, that additional details to be provided during the permitting and approvals phase of this Project may ameliorate our concerns and heighten confidence however that is not factored into our current findings. As stated in several technical subject reviews, ongoing monitoring and timely and responsive adaptive management will be critical to Project performance and in strictly achieving compliance requirements.

Should this Project be Certified by the BCEAO, there is a requirement for continued involvement by the City of Kamloops during the detailed design phase, the permitting and approvals phase, the operations and monitoring phase, and the decommissioning and reclamation phase to ensure that the City's concerns and requirements are continually communicated and dispositioned.



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## 1.0 INTRODUCTION

### 1.1 Project Description<sup>1</sup>

KGHM Ajax Mining Inc. (KGHM) is the proponent proposing to design, construct, operate, decommission, and reclaim the proposed Ajax Mine Project (the Project). The Project is a nominal 65,000 tonne per day open pit copper/gold mine, with an estimated 23-year mine life producing copper/gold concentrate.

In general, the Project consists of an open pit mine, on-site ore processing facilities, a tailings storage facility (TSF), mine rock storage facilities (MRSFs), water management facilities, including seepage collection ponds, a diversion system to convey water from Jacko Lake around the site, low-grade and medium-grade ore and overburden stockpiles, ancillary facilities, mine haul roads, sewage and waste management facilities, a 4-km access road between the Project and Highway 5, a 15-km pipeline for water supply connecting to the existing New Afton facilities, a 5.3-km natural gas pipeline connecting to the Fortis system near Knutsford, and a 10-km power line connecting the Project Site to the BC Hydro transmission line corridor. Ore will be processed on site through a conventional crushing, grinding, and flotation process to produce a copper/gold concentrate. The concentrate will be transported via truck using the existing highway network to the existing storage, handling, and loading facilities located at Port Metro Vancouver for shipment to overseas smelters.

### 1.2 Environmental Assessment Authority

The Project is required to undergo a review under the BC *Environmental Assessment Act, 2002* (BCEAA) and the former *Canadian Environmental Assessment Act* (CEAA) using the transitional process for comprehensive projects under the new *Canadian Environmental Assessment Act, 2012*. The BC Environmental Assessment Office (BCEAO) initiated the provincial environmental assessment (EA) process in February of 2011 due to the Project being a new mine facility that, during operations, will have a production capacity of 75,000 tonnes or more per year of mineral ore which constitutes a reviewable project pursuant to the Reviewable Projects Regulation (BC Reg 370/2002). An Order was issued by the BC EAO in January of 2012 and in July of 2015 which established the scope, procedures and methods for the EA of the Project.

The scope, procedures and methods for the EA of the Project is detailed in the final Application Information Requirements (AIR) issued by the BCEAO and the Environmental Impact Statement Guidelines (EISG) issued by the CEA Agency and are directly related to the Project description detailed above. For the purposes of the EA, the Project description has been crystalized, meaning that the Environmental Assessment Application submitted for the Project does not contemplate changes to the Project description.

The BC EAO and the CEA Agency established the EA Working Group (the Working Group) for the Project for the purpose of having representatives of Aboriginal Groups and local, provincial, and federal government agencies review and provide input to inform the development of the

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<sup>1</sup> - ERM. 2015. *Ajax Project: Environmental Assessment Certificate Application / Environmental Impact Statement for a Comprehensive Study*. Assembled for KGHM Ajax Mining Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.

Environmental Assessment Application. This input is expected to be integrated into the Environmental Assessment Application as an iterative process.

### **1.3 Environmental Assessment Process**

The final Application Information Requirements (AIR) issued by the BCEAO and the Environmental Impact Statement Guidelines (EISG) issued by the CEA Agency identifies the provincial and federal information that must be included in the Environmental Assessment Application. Prior to the release of the final AIR and EISG, the City of Kamloops participated in both the review of the draft AIR and the Project screening.

While the AIR and the EISG provide a framework for preparing a complete and accessible Environmental Assessment Application, it is the responsibility of KGHM to provide sufficient data and analysis on any potential environmental impacts to the Valued Components to permit proper evaluation by the BCEAO, CEA Agency, the Working Group, the public, and technical and regulatory agencies. The AIR and EISG outline the minimum information requirements to compile and analyze data for the Environmental Assessment Application.

The Environmental Assessment Application for the Project was not completed under a bounding scenario due to the Environmental Assessment Application proponent, KGHM, being both owner and operator and being able to provide all Project-specific information into the Environmental Assessment Application. KGHM is required however to continue to develop site-specific details and planning for the Project during the detail design and the application for regulatory permitting and approvals for the Construction, including site preparation, Operations and Decommissioning phases of the Project.

### **1.4 City of Kamloops Peer Review**

The City of Kamloops, as a Working Group member, retained SLR Consulting (Canada) Ltd. to undertake a peer review of the Environmental Assessment Application for the Project. The findings of the technical peer review will be considered and accounted for by the City of Kamloops Council in their formal submission to the BCEAO and the CEA agency and Council's formal submission will then be incorporated into the final Joint Assessment Report to be submitted by the BCEAO and the CEA Agency to their respective Ministers for dispositioning of the Environmental Assessment Application.

The peer review was initiated in January of 2016 under the final Application Information Requirements issued by the BCEAO and the Environmental Impact Statement Guidelines issued by the CEA Agency.

## 2.0 GLOSSARY OF DEFINED TERMS

AIR	Application Information Requirements
AMP	Adaptive Management Plan
BC	British Columbia
BCEAA	<i>British Columbia Environmental Assessment Act</i>
BCEAO	British Columbia Environmental Assessment Office
CCME	Canadian Council of Ministers of the Environment
CEAA	<i>Canadian Environmental Assessment Act</i>
CEA Agency	Canadian Environmental Assessment Agency
CEMP	Construction Environmental Management Plan
Certificate	Environmental Assessment Certificate
CLG	Community Liaison Group
DEMP	Decommissioning Environmental Management Plan
DFO	Fisheries and Oceans Canada
DW	Drinking Water
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EISG	Environmental Impact Statement guidelines
EMP	Environmental Monitoring Plan
FLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
FMEA	Failure Modes and Effects Analysis
GW	Groundwater
HA	<i>Canada Health Act</i>
HC	Health Canada
IAWG	Inter-Agency Working Group
IEM	Independent Environmental Monitor

IHA	British Columbia Interior Health Authority
IRB	Independent Review Board
JLUG	Jacko Lake Users Group
KGHM	KGHM Ajax Mining Inc.
LSA	Local Study Area
MEM	British Columbia Ministry of Energy & Mines
MRSF	Mine Rock Storage Facility
MOE	British Columbia Ministry of Environment
OEMP	Operations Environmental Management Plan
QP	Qualified Professional
RSA	Regional Study Area
SEMP	Socio-Economic Monitoring Program
TSD	Technical Supporting Document
TSF	Tailings Storage Facility
TSP	Total Suspended Particles

### 3.0 PEER REVIEW TEAM

The author would like to recognize the following technical experts and City of Kamloops staff, all of whom added incredible value and professional insight into the City of Kamloops' peer review of the Environmental Assessment Application for the proposed Ajax Mine.

#### **City of Kamloops**

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Allan Michener, P. Ag., Environmental Services Supervisor  
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Glenn Reynolds, M.Sc., P. Geo., Senior Hydrogeologist  
Steve Usher, M.Sc., P. Eng., P. Geo., Senior Hydrogeologist  
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#### **Parsons Inc.**

Patrick Cruickshank, M. Eng., P. Eng., Senior Transportation Engineer  
Dr. Shamsul Chowdhury, Ph.D., P. Eng., Senior Hydraulics and Hydrology Engineer

## **4.0 PEER REVIEW TERMS OF REFERENCE**

### **4.1 PURPOSE OF THE PEER REVIEW**

The City of Kamloops retained SLR Consulting (Canada) Ltd. to undertake a peer review of the technical components of the Environmental Assessment Application for the Project. The disposition of our formal peer review comments will be incorporated into the City of Kamloops final decision concerning the Environmental Assessment Application to be submitted to the BCEAO and the CEA Agency to, in turn, be incorporated by both the BCEAO and the CEA Agency into their Joint Assessment Report which will be provided to both the provincial and federal Ministers charged with dispositioning the Environmental Assessment Application.

The primary objective of our peer review was to ensure that the interests and concerns of the City of Kamloops, including its residents and its social, economic, natural, cultural, and atmospheric environments, have been properly identified in the preparation of the Environmental Assessment Application for the Project and that any potential Project impacts were satisfactorily addressed through the development of sufficient mitigation or, where any potential Project impacts could not be satisfactorily addressed through the development of sufficient mitigation, that any residual impacts were properly categorized in terms of severity and significance.

### **4.2 SCOPE AND PROCESS OF THE PEER REVIEW**

On behalf of the City of Kamloops, SLR Consulting (Canada) Ltd. undertook the following activities during the peer review process:

1. Reviewed the Environmental Assessment Application and the Technical Supporting Documents (TSD) including methodologies, impact assessments, mitigation, and residual impacts prepared in support of the Environmental Assessment Application, in concordance with the final AIR, to identify and evaluate potential issues of concern to the City of Kamloops and its residents for subsequent discussion with the BCEAO Working Group, KGHM and its consultants;
2. Presented the preliminary peer review findings to City of Kamloops Council and the public in March of 2016;
3. Attended Working Group technical meetings with the City of Kamloops, BCEAO, KGHM and its consultants to discuss the Environmental Assessment Application and TSDs. At these meetings, missing information, discrepancies and ambiguities in the TSDs and the Environmental Assessment Application were discussed and clarified and areas in the TSDs and the Environmental Assessment Application were identified where additional information or analysis was, in our opinion, required;
4. Provided input into KGHM's EA process, on behalf of the City of Kamloops, to benefit and add value to the Environmental Assessment Application as it pertained to potential issues of concern for the City of Kamloops;
5. Provided advice to City of Kamloops staff to assist in understanding technical issues and reports;
6. Prepared a draft and final report of the peer review findings; and
7. Will be presenting the final peer review findings to City of Kamloops Council and the public in June of 2017.



The technical components of the Environmental Assessment Application reviewed under the scope of SLR's scope of engagement with the City of Kamloops included the following disciplines:

- Acoustics and Vibration
- Air Quality
- Human Health and Ecological Risk
- Socio-Economics
- Groundwater
- Surface Water
- Water Quality and Mine Effluent
- Aquatic Environment
- Terrestrial Environment
- Dark Sky and Artificial Light at Night (ALAN)
- Slope Stability
- Tailings and Mine Waste Management
- Transportation
- Accidents and Malfunctions

SLR Consulting (Canada) Ltd., in consultation with the City of Kamloops, based the peer review of the Environmental Assessment Application and the supporting TSDs on an evaluation of how the Environmental Assessment Application and the supporting TSDs addressed:

- The completeness of the Environmental Assessment Application and the TSDs;
- The methodologies, identification and characterization of the environmental impacts of the project;
- The sufficiency of applied mitigation;
- The characterization of residual effects and the likely cumulative effects related to other projects or activities that have been or will be undertaken, and the significance of these effects;
- The requirements of follow-up management and monitoring programs in respect of the Project predicted outcomes;
- The application of the principles of Sustainable Development, the Precautionary Approach and Climate Change; and
- The certainty of and confidence in the conclusions of the Environmental Assessment Application.

The scope of the peer review work did not include a review of KGHM's pre-feasibility and financial investment decisions, the Project consultation program, the monetary quantification of purported Project Benefits, or the details of any direct Project agreements between the City of Kamloops and KGHM. Additionally, the scope of the peer review did not include a review of the Environmental Assessment Application and its supporting TSDs with regards to Aboriginal interests as this was completed by the Aboriginal communities under a separate and distinct process.

## 5.0 PEER REVIEW FINDINGS

SLR Consulting (Canada) Ltd. engaged in an iterative peer review process on behalf of the City of Kamloops and as a member of the BCEAO Working Group for this Project. During our initial review of the Environmental Assessment Application, we developed a considerable number of questions, clarification requests, missing information requests, and Project issues to be discussed with KGHM, 800 in total, regarding the content of the Environmental Assessment Application. Our preliminary findings were presented, at an overview level, to the Kamloops City Council with an open invitation to the public at Thompson Rivers University on March 18, 2016 and again in City Council chambers on March 23, 2016.

Following the presentation of our initial submission through the Working Group review process and as expected based on our peer review process experience, the clear majority of the questions, clarification requests, missing information requests were resolved with KGHM through their responses. More complex issues for discussion with KGHM were carried forward to technical working group discussions which included topical discussions for air quality, human health, acoustics, slope stability, groundwater, surface water, water quality, aquatic environment, terrestrial environment, and socio-economics.

Based on the outcomes of these technical working group sessions, additional information requests were submitted to KGHM as well as the identification of additional work that was outstanding for the Environmental Assessment Application or revisions to assessment approaches in the Environmental Assessment Application. During March of 2016, the federal review period was suspended to allow KGHM more time to respond to the information requests. In May of 2016, the BCEAO suspended the provincial review period for similar reasons.

Between April of 2016 and July of 2016, the Working Group members continued to work with KGHM to address their responses to the initial peer review findings and further information requests from the Working Group. This process was completed at the end of July, 2016. In August of 2016, SLR Consulting (Canada) Ltd. provided a second submission identifying the remaining issues still to be resolved through further discussion with KGHM.

Between August of 2016 and March of 2017, we continued to participate in technical working group meetings and review incoming materials from KGHM as they were made available and we provided our final peer review input on the Environmental Assessment Application at the end of March, 2017.

The peer review findings presented below represent the final findings from SLR Consulting (Canada) Ltd., distilled down from working through our initial 800 questions, clarification requests, missing information requests, and Project issues to be discussed with KGHM back in March of 2016. The considerably smaller number of final findings are again expected based on our experience working through these iterative peer review processes.

This report and its final findings will be presented to the Kamloops City Council with an open invitation to the public at Thompson Rivers University on June 19, 2017 and again in City Council chambers on June 22, 2017.

In presenting our final findings in this report, we have separated the findings into the various technical categories that were peer reviewed. For Human Health and Ecological Risk, we discuss our findings in each of relevant technical categories, as applicable, rather than provide a separate Human Health and Ecological Risk technical category that speaks to all the other

relevant technical categories. This way, the reader can directly relate our Human Health and Ecological Risk findings in the context of the technical category findings.

## 5.1 AIR QUALITY

Air quality is a Valued Component because of the potential risks to human health. The City of Kamloops is aggressive in managing ambient air quality. In collaboration with local stakeholders, the City of Kamloops struck a technical committee to develop an Airshed Management Plan (KAMP) to foster and maintain good air quality in the City and surrounding areas. Air quality is valued as an essential requirement for human and environmental health. For years, health concerns such as cardiovascular and respiratory conditions have been linked to poor air quality. The KAMP frames the rationale and strategies to preserve and improve air quality in the City of Kamloops through collaboration with provincial and local governments, business, industry, and residents. KGHM in consideration of the provincial and federal air quality objectives, modelled the predicted air quality impacts from the Project in the Environmental Assessment Application. The modelling of the air quality impacts from the Project is critical as it forms the basis from which other impact assessments are performed including human health and water quality.

### 5.1.1 *Modelling Predicted Impacts*

Following our initial air quality findings in March of 2016, which mirrored many of the other Working Group member's input, a sub technical working group, which included SLR Consulting (Canada) Ltd.'s air modelling group, the MOE and Environment Canada, met several times with KGHM to discuss opportunities and methodologies to improve the sensitivity of the air modelling and to ensure that model inputs were as representative as possible to minimize perceived uncertainties in the model and results in the Environmental Assessment Application.

KGHM developed, in consultation with the sub technical working group, an addendum modelling plan that was approved by the sub group. This updated Air Quality modelling work incorporated correcting original dispersion modelling errors, revising the model assumptions as well as adding additional sensitivity to the mitigation effectiveness by adding 70% and 80% active mitigation scenarios to the 90% active mitigation scenario and providing a worst-case 0% active mitigation event.

The results from these new model scenarios show that for annual average  $PM_{2.5}$ , as active mitigation effectiveness decreases from 90% to 80% to 70%, at the Project boundary, the ambient concentration increases from  $6.5 \mu g / m^3$  to  $7.3 \mu g / m^3$  to  $8.2 \mu g / m^3$  at the Project boundary against an ambient air quality objective of  $8 \mu g / m^3$ , and a background of  $3.8 \mu g / m^3$ . While still within or at the threshold of the air quality objective, this does demonstrate that any appreciable loss in the 90% active mitigation leads to a doubling of the concentrations over background under the 80% scenario. As distances increase away from the Project boundary, the Project's contribution decreases, and the updated model predictions are intangibly different from the original model predictions between the 90%, 80%, and 70% scenarios at the Upper Aberdeen area.

Notwithstanding the above findings, our opinion is that because the dispersion modelling is based, except for the TSF emissions which were re-modelled on an hourly basis, on constant emissions rates from all other sources, the findings may, on an hourly basis, underestimate short term air quality effects during dryer months and, conversely, overestimate air quality effects in the winter months. This potential effect is not captured using the 24-hour air quality

objective and does increase the uncertainty of the modelling results as it pertains to short duration (one to several hours) exceedances of the air quality objectives. As an example, under a temporary loss of mitigation capability to 70% mitigation, the PM<sub>10</sub> concentrations rise in Upper Aberdeen to approximately the same level as North Kamloops.

An underlying concern remains in achieving the 90% active mitigation commitment for two reasons. First, the cited examples of other mining projects that purport to achieve this mitigation threshold are not local and it is uncertain whether there is a direct application to the unique Project conditions to increase certainty that 90% can be achieved on the Project. Second, our interpretation of achieving 90% active mitigation is, because it is atypically high and because the predominant emissions source is the haul roads, the measures used to achieve this level of mitigation are considered to be the most that could be done to achieve 90%. In other words, if 90% cannot be achieved, there is not any new or additional mitigation measures that can be applied to achieve 90% short of paving over all disturbed surfaces or prohibiting the use of the haul roads. These do not seem plausible from a long-term Operations or financial perspective however road prohibitions may be viable in short-term scenarios.

As stated above, the 90% active and annually constant mitigation commitment, exclusive of natural mitigation such as precipitation, from KGHM remains aggressive and uncertainty surrounding KGHM's ability to comply with this threshold is approached through the development of a Fugitive Dust Mitigation Plan that accompanied the updated Air Quality modelling work, outlining dust control strategies, the timing and frequency of the application of the strategies and which sources they would be applied to, and trigger events based on particulate matter levels for TSP, PM<sub>10</sub> and PM<sub>2.5</sub> and the corresponding range of short-term and long-term actions that would be initiated in response to those exceedances. Critical to the success of this plan will be the ability to forecast combinations of operational and meteorological conditions that cause dust generation and poor dispersion and mixing and to act appropriately and expediently to mitigate air quality exceedance events.

Transparent and constant monitoring is needed to provide confidence to the City of Kamloops that KGHM can achieve the target air quality objectives. In conjunction with the three, permanent air quality monitoring stations to be used for the Project, we recommend that these stations be equipped with real-time broadcasting capability that could be posted for example on the Project website.

As with any predictive approach to impact assessment, the follow-up monitoring and the ability to respond effectively and expediently to actual results that differ negatively from predicted results is paramount. In the case of KGHM's commitment to a 90% active mitigation compliance target, cessation of dust generating operations may be required on those days where meteorological conditions interact with Project activities to create exceedances in the air quality objectives.

### **5.1.2 Human Health**

The February 2017 Re-Assessment of human and ecological health has re-assessed uncertainties in the risk assessments and provided a more conservative assessment of potential exposures to metals and air pollutants.

Re-modelling of PM<sub>2.5</sub> with varying levels of haul road dust mitigation effectiveness showed that, at the northern plant boundary, annual average PM<sub>2.5</sub> concentrations exceed the ambient air quality objective (8 µg/m<sup>3</sup>). But with distance from the project site, exceedances diminish and

there are no annual average exceedances detected in the Upper Aberdeen neighbourhood, in any of 70%, 80% or 90% mitigation effectiveness models, nor further into the City of Kamloops. The annual average PM<sub>2.5</sub> concentration in North Shore Kamloops is already higher than the air quality objective due to background and other sources and the Project would not notably contribute to an increased exceedance over existing exceedance conditions.

Using the 70%, 80% and 90% dust mitigation effectiveness scenarios, the 24-hour PM<sub>2.5</sub> air quality objective (25 µg /m<sup>3</sup>) is also not predicted to be exceeded in Upper Aberdeen and beyond into the City. However, without dust mitigation (0% scenario) there are several days per year where the Project emissions will result in an exceedance of the 24-hour PM<sub>2.5</sub> air quality objective in Upper Aberdeen. Health risks due to inhalation of PM<sub>2.5</sub> from the Project have been estimated to be negligible by the Proponent, however PM<sub>2.5</sub> is a non-threshold air pollutant and therefore any modelled increase in its concentration at receptor locations in Upper Aberdeen should be of some concern. KGHM asserts that 0% dust mitigation is not a realistic scenario as KGHM has adamantly committed to a 90% mitigation threshold. However, these modelled impacts do not account for short duration exceedances less than 24 hours and this could result in increases in concentrations in Upper Aberdeen under these short duration scenarios. This remaining uncertainty reinforces the criticality of effective mitigation of Project emissions.

There are minimal exceedances of the 24-hour averaged PM<sub>10</sub> guideline predicted for the Upper Aberdeen neighbourhood, which are driven by meteorological conditions in conjunction with the Project emissions, which increase in number of days per year and geographic extent with decreasing road dust mitigation effectiveness. This highlights the uncertainty that remains with respect to the emissions rates used to model the Project effects and the use of constant emission rates throughout the model years.

There were no human health risks predicted from the inhalation of metals in dust or from the inhalation of diesel particulates predicted for the City of Kamloops. We accept that the metals in dust used to model the potential human health effects were appropriate based on the approach used. However, we disagree with the approach used for screening for contaminants of potential concern (COPCs), which was based on the relative toxic potential of contaminants in ore dust, a method used by the US EPA to identify the most significant, but not necessarily all, chemicals in a medium. This method is rarely used in Canada and only when baseline and predicted (through modelling) exposure concentrations in media are not available. For this Project, baseline and future case COPC concentrations were available through measurements and modelling, respectively, for all exposure media (soil, water, air, food). SLR recommended using the Health Canada-accepted approach where maximum exposure concentrations are compared to appropriate risk-based screening criteria in all media. We are unable however to state that there would have been any difference in results between the two approaches without seeing the results of the two approaches but the Health Canada approach would have in our opinion better met the intent of incorporating the Precautionary Principle.

Exposure to metals in dust was calculated for combined exposure pathways from direct skin contact, incidental ingestion of soil, and ingestion of country foods or garden produce. We accept that the metals in dust used to model the potential human health effects were appropriate. Some metals were calculated to exceed the applicable Hazard Quotient. However, the same exceedances were already calculated for Baseline exposures and the Project is not predicted to notably contribute to an increased exceedance over existing Baseline conditions.

### **5.1.3 Recommended Conditions of Project Certification**

As stated above, the commitment to achieve the target active mitigation threshold of 90% on a constant basis underpins KGHM's approach to mitigating Project generated air quality impacts in the City of Kamloops.

1. It is recommended that the BCEAO as a condition of Project Certification have KGHM be accountable for achieving 90% active mitigation constantly as a compliance threshold to be monitored and reported on by the IEM and that transparent, real-time air quality station data is provided via a broadcast mechanism for the City of Kamloops and its residents to remain consistently informed throughout the Project phases.
2. It is recommended that the BCEAO as a condition of Project Certification and prior to Construction including site preparation, have KGHM finalize the Project's air quality monitoring and management program including the dust mitigation plan and a plan for monitoring human health and ecological risk parameters, in consultation with Regulators and the City of Kamloops.
3. It is recommended that the BCEAO as a condition of Certification have KGHM cease all dust-generating activities on any day where Project activities interact with meteorological conditions to produce an exceedance of the 24-hour averaged PM<sub>2.5</sub> or PM<sub>10</sub> air quality objective in any neighbourhood of the City of Kamloops.

## **5.2 WATER**

Our review of the water technical component of the Project encompassed potential impacts to surface water resources, groundwater resources including aquifers and water wells, quality of water resources that interact with the Project, water balance, Climate Change, and human health as it relates to water resources that interact with the Project.

### **5.2.1 Groundwater**

The AIR establishes groundwater quantity and quality as a Valued Component of the Environmental Assessment Application for its importance to humans for drinking water, livestock and irrigation water as well as its importance to the support of healthy natural ecosystems that rely upon groundwater. The AIR requires KGHM to characterize the baseline groundwater quantity and quality in the study area including identifying groundwater monitoring well locations, analyzing groundwater findings to establish a groundwater quality baseline and concluding any potential relationships between groundwater quality results and geology as well as the identification of any potential spatial and temporal variations. Characterization of the local flow regime by KGHM was based on information collected from the installed wells and piezometers within the LSA, historical performance from past mining activities and the development and use of a watershed model, that combined surface water and groundwater components, as a predictive approach to the assessment of groundwater impacts from the Project.

#### **Jacko Lake**

Our peer review identified an uncertainty surrounding the Project's ability, as assessed, to accurately predict the potential loss of water from Jacko Lake to the pit during dewatering of the pit. In this respect, KGHM performed additional groundwater modelling which included scenarios with more permeable hydraulic conductivities for the Jacko Lake sediments,

overburden materials and bedrock between Jacko Lake and the proposed pit. SLR Consulting (Canada) Ltd. suggested that additional groundwater well locations would be required to more accurately assess this potential effect of the Project however the revised groundwater modelling was not based on new field data from the recommended additional well locations.

The revised modelling extended the potential range of seepage losses from Jacko Lake to the pit to 7.6 L/s, 2.4 times higher than the original predicted high range. KGHM concludes that even under the higher loss scenarios, the revised rate of seepage is still much lower than the net surface inflow into Jacko Lake, therefore mine pit dewatering should not impact Jacko Lake water levels. SLR Consulting (Canada) Ltd. suggests that uncertainty remains.

Groundwater seepage losses from Jacko Lake due to pit dewatering are likely to be relatively constant over the year compared to surface water inflows into Jacko Lake, which can vary depending on the season. The net seepage losses appear small compared to average net surface water inflows however this may not be the case during dry periods of the year, when seepage losses to the pit are likely to remain constant but net inflows to the lake may be significantly less than average. Therefore, there is potential that on a seasonal basis, water levels in Jacko Lake could be affected by seepage losses. An analysis of the potential effects of dewatering on Jacko Lake water levels during the drier periods of the year, when surface water inputs to the lake are diminished, should be undertaken and presented in conjunction with the revised groundwater seepage analysis.

KGHM has characterized the nature of the soil and bedrock materials between Jacko Lake and the proposed open pit from 18 boreholes. The critical area however for assessing the potential for seepage losses from Jacko Lake into the pit, particularly in the overburden, is in the area between the lake and the proposed edge of the pit and only 3 of the 18 boreholes are near the pit edge. A review of the overburden borehole logs from these locations indicates poor sample recovery in large portions of these boreholes, a condition that often accompanies permeable non-cohesive soils such as sand and gravel. This indicates there is greater uncertainty about whether the material is mainly glacial till with some smaller "discontinuous" interlayers of sand and gravel, as concluded by KGHM, or whether there are a greater number of potentially thicker, more permeable and continuous layers of sand and gravel in the till. Further, these 3 borehole locations are separated by a distance of between 500 and 1,000 metres. As the overburden in this area is mapped as glaciofluvial, the presence of a glaciofluvial channel is possible which would not be identified by boreholes at such a large spacing. If such a channel existed, it could result in a potentially significant, more permeable conduit between the lake and the pit, which could result in greater effects on the lake than predicted.

KGHM commits in the Environmental Assessment Application that groundwater levels and quality will be monitored near the western section of the Ajax pit near Jacko Lake at stations KAX-14-107, -108-, -114 and -128 however we note that only overburden monitoring is proposed for monitoring at KAX-14-107, -108 and -114. The only bedrock well proposed for monitoring in this area is KAX-14-128. Given the potential significance of pit dewatering effects on Jacko Lake, should this occur at greater than predicted levels the proposed level of bedrock monitoring is not considered adequate. It is acknowledged that details regarding monitoring will be finalized at the permitting stage, however, it is critical at the Environmental Assessment Application phase to recognize the importance of monitoring for dewatering effects adjacent to Jacko Lake and therefore, the monitoring program presented should reflect this significance and be enhanced.

KGHM identifies potential, conventional mitigation strategies such as low permeability cut-off walls, grouting, or interception wells and/or drains that could be installed if greater seepage of water from Jacko Lake occurs. The applicability of these mitigation measures should be evaluated based on the outcome of the additional studies we feel are warranted. Lining of portions of Jacko Lake is also listed as a potential mitigation measure however we would not consider this a conventional mitigation strategy and would recommend that the practicality of this approach be assessed in consideration of potential effects on other integrated Valued Components. Notwithstanding whether cut-off walls or lake lining or interception wells are used to address water loss from Jacko Lake, these measures are typically identified as components of the Project scope and assessed for environmental impacts against the relevant Valued Components and not characterized as mitigation for a potential impact as significant as having to address water loss from Jacko Lake.

### ***Peterson Creek***

The assessment of groundwater quality effects on the Peterson Creek (PC) Aquifer are based on predicted effects at private domestic water well RES-2, which is located near the eastern end of the PC Aquifer. This well is approximately 1.3 km downgradient from the East Mine Rock Storage Facility (EMRSF) and associated pond and therefore predictions of water quality effects at this location would not represent potential worst case effects on groundwater quality in the PC Aquifer. The PC Aquifer extends westward along the Peterson Creek Valley such that there are off-site portions of the aquifer that are located much closer to the EMRSF and the EMRSF Pond than RES-2. Greater effects would be expected in the off-site portions of the PC Aquifer at the closest downgradient point from the EMRSF and EMRSF pond than at RES-2. Groundwater quality effects decrease with increased distance from the source and therefore by assessing these effects at a distance of approximately 1.3 km from the EMRSF and associated pond, the predicted concentrations are likely lower than would be predicted to occur in the PC Aquifer at its closest point to the EMRSF and EMRSF pond. This is important, because, in the future, it is possible that off-site private water wells could be installed in the PC Aquifer at points closer to the mine site than RES-2.

The predictions of groundwater quality impacts at RES-2 are based on a combination of groundwater flow pathway analysis (from forward particle tracking done with the groundwater flow model) and analytical contaminant migration models. As noted in the Environmental Assessment Application, the particle tracks from the EMRSF and associated pond pass approximately 50 to 150 m north of RES-2. It appears that RES-2 is not located within the core of the predicted plume of impacted groundwater originating from the EMRSF and associated pond. RES-2 appears to be located on the southern edge of the predicted plume. Therefore, the predicted concentrations at RES-2 would likely be lower than would occur in the centre of the plume. This is important because: (1) the geology of the PC Aquifer is complex and therefore the actual path of flow from the EMRSF may not be as simulated meaning RES-2 could be less directly in-line with the centre of the predicted plume than assumed, and (2) in the future, it is possible that an off-site private water well could be installed in the PC Aquifer north of RES-2, at a location that is closer to or within the centre of the predicted plume.

We note that when the Edith Lake Fault Zone is included in the groundwater flow predictions, particle tracking suggests that some impacted groundwater originating from the east side of South Mine Rock Storage Facility (SMRSF) could flow to the PC Aquifer. This does not appear to have been taken into consideration in the assessment of groundwater quality impacts to the PC Aquifer. It is recommended that potential additive effects from the SMRSF be included in the evaluation of groundwater quality effects on the PC Aquifer and further, any additional



private water wells downgradient of the SMRSF should be evaluated and monitored for any impacts on the groundwater quality in these water wells.

KGHM has acknowledged that slope stability within the Aberdeen subdivision is a serious concern and may be sensitive to relatively minor increases in groundwater levels, notwithstanding that the impact assessment is not predicting any effect to the Aberdeen slopes. In revised submissions by KGHM, they have committed to the development and implementation of a groundwater monitoring plan in the area between the Project footprint and the Aberdeen Slope prior to the Construction phase, in consultation with the City of Kamloops. KGHM has also committed to providing the monitoring results to the City of Kamloops for their evaluation.

### **5.2.2 Surface Water**

Surface water quantity was identified as a Valued Component based on potential effects to existing water supplies used for drinking water, irrigation and livestock, and for its importance to aquatic and terrestrial ecosystems and species. The AIR requires KGHM to identify and analyze potential adverse effects resulting from the Project using a site wide water balance throughout the Construction, Operation, Decommissioning, and Post-Closure phases and activities.

Following initial peer review of the surface water modelling, additional unsaturated flow modelling for the MSRFs was conducted and additional low flow streamflow data was incorporated into the Project Water Balance Model (WBM), the model calibration was updated and additional sensitivity scenarios were analyzed. The results of this additional sensitivity analysis are accepted and we have additional confidence in the WBM, notwithstanding that a robust monitoring and management program during Construction, Operations and Decommissioning phases is required to confirm and adjust if necessary these predicted outcomes.

Potential impacts to Kamloops Lake (Thompson River) were evaluated by comparing the maximum abstraction rate (and predicted reduction in Peterson Creek flows) to average monthly inflows to the lake. The conclusions were that the 1,505 m<sup>3</sup>/h allotment from Kamloops Lake and reduced flows in Peterson Creek (Lower) constitute a minor component of the average monthly flow through the lake (< 0.25%). Flow reductions of this magnitude could potentially occur during Construction and Operation only. During Decommissioning and Closure, potential flow reductions would be significantly less as water requirements from Kamloops Lake (dust control and compaction) are expected to be on the order of 100 m<sup>3</sup>/h. At Post-Closure, the impacts to Kamloops Lake would be a result of minor streamflow reductions in Peterson Creek only, as make-up water for the Project would no longer be required and Peterson Creek flows would almost return to pre-existing conditions. Our review did not identify any compelling reasons to depart from KGHM's findings surrounding the Project impact to Kamloops Lake (Thompson River).

KGHM has provided further evaluation of the potential effects of Climate Change on surface water resources for the year 2085. While Climate Change predictive capability over this long timeframe has a lower degree of certainty, KGHM, using the General Circulation Model is predicting that all factors considered (temperature increase, higher evaporation, seasonally higher runoff, annually lower runoff), annual runoff will increase by approximately 19 to 25% within the Project footprint. Regardless, Climate Change is generally accepted to result in increased surface water runoff over time. In response to this generally accepted occurrence, infrastructure and water resources engineers are accounting for climate change in new project

design criteria and KGHM should be held to this approach for managing surface water for the Project. We do not however agree with KGHM's assertion that Climate Change will offset Project impacts from reductions in surface water flows as a conclusion of the Environmental Assessment Application given the temporal disconnect between the Project impacts and an unknown contribution from Climate Change somewhere in the future.

Existing water licenses on Peterson Creek and Jacko Lake will be impacted by the reduction in streamflow during the Operations and Decommissioning phases and KGHM will need to address these identified impacts. KGHM has identified several mitigation solutions to maintain or improve streamflow conditions in the Peterson Creek system that could require significant modifications to the Creek or elsewhere within the watershed to support the Creek. Corollary benefits of these schemes could provide improvements to other Valued Components including fish habitat. Given the complexity of the various solutions, we agree that the development of a preferred solution requires further dialogue with stakeholders and the development of engineering designs in support of regulatory approval review. Regardless of the solution ultimately developed, it will need to address KGHM's requirement and commitment to mitigate the reduction in streamflow as a direct result of the Project.

### **5.2.3 Human Health**

In working through the revised modelling plans and approaches for Air Quality, Dustfall, and Water Quality, SLR finds that the February 2017 re-assessment of human health and ecological risk provides a more conservative assessment of potential exposures to metals and air pollutants through water pathways. We do however have several remaining concerns that should be addressed through the continued management and monitoring plan for surface and groundwater through the Construction, Operations and Decommissioning phases.

The approach to mitigating potential groundwater quality impacts by designing the EMRSF, EMRSF pond, and the SMRSF to minimize infiltration, diverting seepage from the waste rock to the EMRSF pond, seepage collection trenches, and by lining the EMRSF pond to minimize leakage to groundwater from the ponds is a fundamental primary design approach. However, no mitigation measures are provided to describe what actions might be implemented in the event that groundwater quality monitoring finds that impacts in the PC Aquifer from these sources are occurring despite the in-design mitigation.

Arsenic (a parameter with a health based regulatory criteria) is predicted with the current approach (using RES-2 as the receptor point) to be only about five to eight times lower than the Canadian Drinking Water Quality Guideline (0.0013 to 0.0018 mg/L predicted at RES-2 versus a drinking water limit of 0.01 mg/L). This identifies a potential concern about whether predicted arsenic concentrations in the groundwater of the PC Aquifer could potentially exceed the drinking water criteria if the point used for predicting aquifer water quality were closer to the site sources and were within the core of the predicted plume. Both Baseline (0.9 mg/L) and Future Case (1.8 mg/L) groundwater (GW) arsenic concentrations for GW used for drinking water (DW) in Knutsford are predicted to be below the Canadian DW Guideline (10 mg/L) and within average naturally occurring background arsenic levels in BC. However, long-term effects of low-level arsenic contamination can increase the risk of developing cancer. The predicted increase in arsenic concentrations in GW at Knutsford leads to an increase in the calculated "Incremental Lifetime Cancer Risk" (ILCR) that is 6 times the acceptable risk level. Also, the Hazard Quotient (HQ) for non-cancer risk is predicted to increase from 0.133 to 0.22. While the ILCR and HQ are strictly health-based benchmarks, the Canadian DW guideline takes into account health as well as the level that is technically achievable.

Baseline sulphate concentrations in GW (AJGW02-S) and at one residential well (RES-2) are greater than the BC water quality guideline of 1000 mg/L to protect livestock. Sulphate concentrations at RES-2 are predicted to increase due to the Project and may therefore affect livestock health long-term.

Manganese concentrations were modelled to be greater than the most conservative CCME irrigation water guideline for the post-closure phase at Peterson Creek and may affect plant health long-term if GW is used for irrigation.

Selenium concentrations in surface water (Jacko Lake and Peterson Creek) may result in effects to fish-eating animals, especially birds. However, there are large uncertainties in the ecological risk assessment due to uncertainties in future selenium concentrations in water and in the food chain, and various uptake factors.

#### **5.2.4 Recommended Conditions of Project Certification**

1. With respect to the additional bedrock assessment provided by KGHM, four scenarios were examined in an effort to assess if leakage to the pit might be more significant than originally reported. An increase in leakage in three of the four scenarios was found, but KGHM reports that the modelling outputs were not as favourable as the original bedrock assessment. However, it is unclear whether these were the overall calibration statistics or just those in the vicinity of Jacko Lake and the Pit. We recommend that the BCEAO as a condition **prior to Certification** have KGHM undertake a comparison of observed heads to modelled heads in this area to be presented independently to gauge how well the model calibrated in this specific area. Should the comparison yield close results in the original calibrated condition, then this would provide greater confidence in KGHM's predictions. Should this area calibrate poorly, then it might indicate that the additional bedrock assessment resulting in higher seepage may be more representative. In either event, the Environmental Assessment Application's confidence would be strengthened by this knowledge.
2. With regards to the potential use of engineered cut-off walls, grouting, interception drains/wells or lining of Jacko Lake to prevent the loss of water from Jacko Lake, we recommend that the BCEAO as a condition **prior to Certification** have KGHM undertake additional studies to identify and evaluate the potential impacts of water loss at Jacko Lake sufficient to warrant such complex engineered measures and that these measures be considered as Project components to be assessed during the Environmental Assessment Application and not as adaptive management or mitigation or as a response to categorizing the unacceptable water loss from Jacko Lake as an accident or malfunction.
3. It is recommended that the BCEAO as a condition of Project Certification and prior to pit development, have KGHM conduct more detailed investigations of the overburden between Jacko Lake and the pit. This should include detailed stereoscopic interpretation of air photos and surface mapping to identify potential glaciofluvial channels; additional drilling with closer spacing; installation of additional monitoring wells for water level monitoring; and, completion of a pump test in the overburden (there has been no overburden pump test in this area, only a bedrock pump test). Also, the nature, hydraulic conductivity and thickness of the sediments in the bottom of Jacko Lake should be confirmed. The lake bottom sediments are assumed to be of low permeability in the modelling assessment however gaining increased certainty for this assumption is critical

to the current prediction of limited seepage out of the lake due to dewatering and needs to be confirmed.

4. It is recommended that the BCEAO as a condition of Certification and prior to pit development, have KGHM, in consultation with the City of Kamloops, identify additional locations and install bedrock monitoring wells for monitoring of pit dewatering effects on groundwater levels. The new monitors should be placed to provide good spatial coverage between the lake and the pit and they should also be placed at appropriate depths based on the hydrogeologic properties of the bedrock (i.e. be placed in the more permeable zones of the bedrock and at appropriate depths taking into consideration the elevation of the lake bottom – which may require monitors at more than one depth in the bedrock at each location). Existing locations that could be considered include the bedrock monitors at KAX-14-107, -108, -114 and -121, if these bedrock monitors are at appropriate depths and in appropriate (relatively more permeable) hydrogeologic features. Also, an overburden monitor should be installed and monitored between the northeast arm of Jacko Lake and the proposed edge of the pit (e.g. west of KAX-13-007, outside of the pit). The specific number, depth and location of monitors should be informed by the detailed study of the geology and hydrogeology of this area, as recommended above. It is also noted that a number of the proposed monitors are within the proposed pit area and therefore, will be destroyed when the pit advances into this area. These monitors will need to be replaced with equivalent monitors outside of the pit area.
5. It is recommended that the BCEAO as a condition of Project Certification, have KGHM develop and implement a comprehensive groundwater and surface water quality monitoring program for all DW wells and all GW wells and surface sources used for livestock and irrigation to assess changes in water quality with respect to, but not limited to, arsenic, sulphate, manganese, and selenium.
6. KGHM has committed to the development and implementation of a groundwater monitoring plan in the area between the Project footprint and the Aberdeen Slope prior to the Construction phase, in consultation with the City of Kamloops. KGHM has also committed to providing the monitoring results to the City of Kamloops for their evaluation. It is recommended that the BCEAO capture this commitment as a condition of Project Certification and recognize in the condition the importance of the City of Kamloops in the development of the scope of the monitoring program and the transparency and timeliness of the monitoring reporting to the City of Kamloops. In addition to this monitoring requirement, the City of Kamloops will identify to KGHM when the City of Kamloops can no longer maintain piezometric levels and Factors of Safety in the Aberdeen area under the pre-Construction groundwater withdrawal regime in the Aberdeen area and that KGHM shall undertake further investigations as necessary and modelling updates to determine whether Project activities are contributing to this scenario and, should they be, KGHM shall develop mitigation solutions to eliminate the Project impacts in the Aberdeen area.
7. It is recommended that the BCEAO as a condition of Project Certification require KGHM to revise the assessment to predict water quality effects on the PC Aquifer to evaluate potential effects at points at the Mine Site property boundary downgradient of the EMRSF and the EMRSF pond and that the points selected should be in the core of the predicted plume. The results of the revised assessment should be evaluated to determine if this alters the conclusion about the significance of the effects, and if more significant than originally concluded, what additional mitigation measures may be required. It is important to note that the Peterson Creek Aquifer is a complex

interlayered sequence of sands, gravels and silty materials with complex hydrogeology and therefore, predictions of impacts in this unit are subject to considerable uncertainty and this revised assessment should include concentration estimates and updated particle tracking simulations with the numerical groundwater flow model to reflect any pertinent updates to designs of Project facilities. Results from these evaluations should be used to define appropriate locations for groundwater monitoring wells and trigger levels as part of the commitment to monitor and mitigate impacts to groundwater quality.

8. It is recommended that the BCEAO as a condition of Project Certification require KGHM to develop and implement a mitigation solution, in consultation with stakeholders and regulators, to recover the identified loss of streamflow in Peterson Creek and Jacko Lake as a direct result of the Project.
9. It is recommended that the BCEAO as a condition of Project Certification require KGHM to incorporate Climate Change engineering design criteria for all water management features, natural or engineered, that are integrated with the Project including the Tailings Storage Facility.

### **5.3 TERRESTRIAL ENVIRONMENT**

KGHM is required under the AIR to provide detailed baseline information on terrestrial Valued Components including rare plants, rare and sensitive ecological communities, grasslands, terrestrial invertebrates, amphibians, reptiles, migratory birds, raptors, non-migratory gamebirds, and mammals, and the source of the information. Field surveys were used by KGHM to confirm presence/absence of the Valued Components and assess habitat associations of rare plant taxa within mapped areas. The surveys were to be conducted per recognized standards.

The AIR requires an assessment of the expected area of disturbance associated with all Project facilities, buffered by a minimum 500 m within the identified Local Study Area and within the Regional Study Area which includes the South Kamloops Landscape Unit and a portion of the Campbell Landscape Unit, including areas south of the Thompson River and west of Highway 97. The Environmental Assessment Application is required to identify and analyze potential adverse effects resulting from the Project in the Construction, Operations, Decommissioning, and Closure phases and is required to specifically detail the Proponent's commitment to undertaking the identified mitigation measures.

The Environmental Assessment Application is required to describe where project activities/disturbances associated with the Project are likely to cause a negative impact on any of the Valued Components and mitigation measures that follow a hierarchy of avoidance over mitigation then mitigation over compensation/offsetting. Potential impacts are best addressed by eliminating the cause rather than relying on constructed, replacement habitats or features later on. Mitigation strategies should be based on proven methods, Best Management Practices (BMPs), legislative requirements (provincial and federal Acts) and species-specific recovery strategies (where available, including those in draft).

The peer review process included two sub technical working group meetings with KGHM to discuss the terrestrial component of the Environmental Assessment Application. The findings below represent the outstanding issues that we have identified following these discussions.

### **5.3.1 Terrestrial Species and Habitat**

The Updated Wildlife Management and Monitoring Plan continues to be generally non-committal in the language used with respect to the proposed mitigation measures for terrestrial species and their habitat which minimizes the value of the mitigation, as presented, and creates uncertainty as to whether the identified impacts will be appropriately mitigated. This concern has been raised amongst the sub technical working group members including SLR Consulting (Canada) Ltd. and FLNRO. We have also identified that the Updated Wildlife Management and Monitoring Plan is still missing key information and lacking in clarity as to how monitoring of the proposed mitigation will be implemented.

The thresholds used for the magnitude of effects characterization in our opinion do not all follow industry standards and this departure is not fully rationalized by scientific justification. This could lead to an underestimation of the magnitude of the effects assessment which would also tend to underestimate the amount of mitigation required to fulsomely address the effects. The application of magnitude thresholds to the Local Study Area versus the Regional Study Area did not appear to conform to industry standards and in our opinion does not account for a complete review of the potential effect to regional species populations. The assessment of terrestrial habitat loss on a regional scale would have also facilitated an assessment of the potential impact on wildlife at the broader larger regional scale as indicated in the AIR. The cumulative effects assessment also did not appear to fully assess the potential for reasonably foreseeable projects and activities to cumulatively impact wildlife populations at the regional scale.

We are not fully appreciative as to how terrestrial significance and magnitude was determined however it appears that significance is assessed using habitat loss thresholds. As habitat is fundamental to this assessment we are unable to determine if the habitat suitability models that were used were statistically validated. Given the importance of the use of habitat loss in the significance and magnitude determinations, a determination of model reliability and certainty is still required.

We have identified that non-standard sampling protocols were utilized for some species including migratory birds, reptiles, and amphibians which may have resulted in an underestimate of the occurrence of these species. For example, the Environmental Assessment Application underestimated the amount of available habitat for amphibians because of the exclusion of ephemeral habitats and lake margins in the sampling protocol. In our opinion, the baseline survey effort within the protocols for some species, including bats and reptiles, appeared insufficient to appropriately characterize the baseline conditions and therefore the potential effects may be underestimated.

For one species, the sharp-tailed grouse, the permanent loss of lek sites is not identified as a significant residual effect. Given the limited number of known lek sites in the RSA and provincially, the loss of any of these sites in our opinion would be significant. The level of uncertainty around the ability to create artificial lek sites as mitigation to reduce the impact to lek sites would tend to corroborate our findings.

### **5.3.2 Recommended Conditions of Project Certification**

1. It is recommended that the BCEAO shall as a condition **prior to Project Certification**, have KGHM complete the Wildlife Management and Mitigation Plan to the acceptance of the Working Group members involved in the review of the plan, including the City of Kamloops, and including firm commitments to the identified mitigation measures.

2. It is recommended that the BCEAO shall as a condition **prior to Project Certification**, have KGHM complete more comprehensive studies on the ephemeral habitat for amphibians, which was identified as not being conducted during the other terrestrial baseline studies prior to submitting the Environmental Assessment Application, to obtain similar multi-year baseline data as the other baseline studies.
3. It is recommended that the BCEAO shall as a condition of Project Certification, have KGHM continue to implement the recommendations of the sub technical working group for terrestrial Valued Components with respect to supplementing baseline studies with additional seasonal study work where concerns have been raised on the sufficiency of this work, including but not limited to bats and reptiles.

## **5.4 AQUATIC ENVIRONMENT**

Fish populations and fish habitat was identified as a Valued Component based on its importance to the recreational fishery and as an indicator of ecosystem health. Under the AIR, KGHM is required to include in the Environmental Assessment Application the identification of measures to avoid or minimize adverse effects on fish and fish habitat and describe mitigation measures for protection of surface and groundwater quality and quantity contributing to fish and fish habitat health. Where KGHM's impact assessment identifies serious harm to fish or fish habitat, a conceptual fish habitat offsetting plan is required.

### **5.4.1 Aquatic Species**

The Project fisheries support several common sportfish and coarse fish species found in BC. Notwithstanding that there are no fish Species At Risk (SAR) in the Project waterbodies, the species present within the Project area carry importance for recreational sport and harvest as well as significant Aboriginal importance.

Fish mortalities may occur due to Project activities such as pile driving, blasting or dewatering. These losses can only occur under an authorization from DFO which KGHM would apply for concurrently with an authorization for the requirement to destroy fish habitat. For the peer review, our approach is to minimize the potential for any mortalities through proper mitigation for in-water Construction activities, primarily acoustics and vibration impacts. This has been addressed in Section 5.5 below.

### **5.4.2 Aquatic Habitat**

Serious harm to fish habitat is unavoidable because of the Project's designed pit footprint. In our review of the characterization of the loss of habitat in Jacko Lake, we did not concur with KGHM's approach to offsetting using Inks Lake, primarily because Inks Lake was not self-sustaining and there was a net loss of habitat in Peterson Creek, and we identified that a greater emphasis should be attributed to the impact of the loss of fish habitat in Jacko Lake as it relates to maintaining an existing fishery and protecting the recreational resource for residents of the City of Kamloops. It was also questioned whether a permanent loss in Jacko Lake was required or whether this could be avoided with Project design modifications.

A permanent loss of fish habitat in Jacko Lake is KGHM's preferred design alternative for various engineering and economic reasons. However, KGHM, on the input from several Working Group members, has revised the fisheries habitat offsetting plan to remove Inks Lake as an offsetting concept and replaced it with rehabilitation works in Peterson Creek and Jacko Lake to both maintain and enhance these two fisheries. At Jacko Lake, the west arm will be

enlarged to create new fish habitat, and a new access road, boat launch, parking area, and picnic area with restroom facilities will be constructed to enhance the recreational value of Jacko Lake.

In Peterson Creek, the Upper section will have barriers to fish movement removed as well as bank stabilization works and the creation of new salmon habitat, the Lower section will see improvements to channel morphology, the creation of new salmon habitat and bank and riparian restoration work, and the Peterson Creek Diversion will be improved through revised channel morphology designs, maintaining natural channel where possible and ensuring fish passage between the Jacko Lake outflow and the diversion.

We believe the revised fisheries offsetting plan is more representative of stakeholder concerns and emphasizes enhanced value to existing and important fisheries.

### **5.4.3 Human Health**

Selenium concentrations in the surface water of Jacko Lake and Peterson Creek may be bioaccumulating in fish and may result in effects to fish-eating animals, especially birds. However, there are uncertainties in the ecological risk assessment, particularly uncertainties in future selenium concentrations in surface water and in the food chain along with various uptake factors, that should continue to be assessed. Findings of continual re-assessment may identify human or ecological risks in the food chain that could require mitigation strategies.

The Hazard quotient for consumption of mercury from fish from Jacko Lake is greater than the Health Canada benchmark of 0.2 for the Aboriginal toddler cohort for Baseline and Future Case scenarios however the Project is not predicted to exacerbate this exceedance or to add in any new cohorts.

### **5.4.4 Recommended Conditions of Project Certification**

1. It is recommended that the BCEAO shall as a condition of Project Certification require KGHM to restrict all employees or any other person providing a service to KGHM within the Project boundary, from using any Project site access for the purpose of sport or harvest angling in the waterbodies within the Project boundary.
2. It is recommended that the BCEAO shall as a condition of Project Certification have KGHM continue to assess selenium concentrations in surface water in Jacko Lake and Peterson Creek and bioaccumulation in fish in these waterbodies with respect to potential Project interactions as they relate to human health or ecological risk in the food chain.

## **5.5 ACOUSTICS AND VIBRATION**

Due to the proximity of the Project to the City of Kamloops and to both urban and rural residences, noise and vibration effects have been identified as a Valued Component in the AIR. The noise and vibration assessment for potential human health effects encompasses both the LSA and the RSA with a wide array of residential receptors ranging from urban and suburban to rural and quiet rural locations as well as biophysical receptors. KGHM is required to address vibration (ground and air) and noise impacts from daily blasting and other mine activities such as pile driving, drilling, plant machinery and vehicles during the Construction, Operations and Decommissioning phases.



### **5.5.1 Explosives**

The Environmental Assessment Application describes mitigation measures including modification to the blast design to protect fish in Jacko Lake and minimize residential annoyance, and refers to the calculation of offset distances from blasting to achieve the controlling vibration limit. Since the standard formulae used the approximate average vibration level rather than the likely upper bound vibration level, there may be potential for the limits to be exceeded for some blasts, across all blast zones. The standard vibration prediction formulae used in the assessment are accepted as reasonable for predicting average vibration, but the potential for variation from the mean should be clarified including what this uncertainty might mean for compliance with the Jacko Lake fish protection limits, as well as potential implications for compliance with human annoyance thresholds at residential properties. KGHM has agreed that uncertainty does exist with respect to the actual impacts vs. the predicted impacts however they have committed to a Blasting Management Plan that identifies strict compliance with the blasting thresholds for the protection of fish and to mitigate annoyance noise effects and KGHM has to undertake all necessary measures necessary to comply with air blast overpressure thresholds which may include reducing the charge weight per delay to a lower value, if monitoring indicates that this is required. Key elements of this commitment are detailed in our recommended conditions of project certification.

Our peer review specifically analyzed the potential for blasting to impact the slope stability of the Aberdeen Hills area where the reported peak particle velocities (PPV) from site-specific blast attenuation relations vary from 0.6 to 0.8 mm/s. In comparison, simplified methods predict considerably larger values of 20 to 40 mm/s. Considering the topographic amplifications associated with the terrain and the larger distance from source to areas of instability, predictive methods may not be reliable for the Aberdeen Hills slope area.

### **5.5.2 Operations**

SLR Consulting (Canada) Ltd. agrees that the identified mitigation commitments in the Environmental Assessment Application to be implemented during the Operational phase of the project can, subject to confirmation through continuous monitoring and adaptive management, limit any noise or vibration impacts to below the target threshold.

Piling activities during the Construction phase however will require additional mitigation measures and effort. For underwater overpressure and its impact on fish, the target threshold is lower than for blasting, which has not been recognized in the Environmental Assessment Application. As identified in the Environmental Assessment Application, the vibration limit will control the blast design and compliance with this limit will mean compliance with the identified 100 kPa underwater noise threshold for blasting. However, the piling peak pressure level threshold used as the onset of physical injury to fish is 206 dB re 1  $\mu$ Pa, much less than the 100 kPa threshold, which corresponds to 220 dB re 1  $\mu$ Pa. KGHM has committed to an underwater monitoring program to protect against fish stress and mortality and we have captured this commitment in a recommended condition of project certification below. With regards to piling activities and potential effects on human health, we discuss this in the section that follows.

### **5.5.3 Human Health**

SLR Consulting (Canada) Ltd. reviewed the baseline information and impact assessment provided in the Environmental Assessment Application and found that the noise receptors and

vibration receptors used by KGHM were appropriate for the human health impact assessment. We are also in agreement with the Environmental Assessment Application conclusions that low frequency noise effects at residential receivers are unlikely and that sleep disturbance effects are also unlikely. The conclusion that vibration effects, other than blasting, will be comfortably within acceptable levels is also accepted.

The impact assessment conclusion that the potential for structural damage due to blast vibration will be remote is accepted, particularly given the commitment by KGHM to have blasting events comply with human comfort airblast and vibration limits as this means that even minor cosmetic damage to structures would be avoided.

Audible noise from the mine does not mean the noise guideline levels are being exceeded. The BC guidelines consider the interests of both residents and the operator and compliance with the guidelines does not guarantee noise will not be heard, particularly outside residences. Rather, the various noise guideline levels address indoor noise levels to prevent sleep disturbance and health impacts.

There is an expected heightened sensitivity to noise in quiet, rural areas and several Noise Standards suggest adjusting the predicted project noise and baseline levels by adding between 10 to 15 dBA to the predicted project noise level for all phases of the project in order to determine % HA as a human health endpoint. Our review determined that this was not initially completed for the Project however KGHM has since provided this additional noise impact assessment which shows that three locations will have this adjusted noise threshold exceeded, one rural residence, Inks Lake and the Jacko Lake Prayer Tree. The predominant noise source affecting the rural residence and the Jacko Lake Prayer Tree locations is the pile driving operations at Jacko Lake. The Jacko lake Prayer Tree is further affected during operational years while the Inks Lake location is only affected during the initial year of construction. KGHM has committed to the application of mitigation measures to ensure that these locations are not subjected to noise levels that exceed the target threshold. Key elements of this commitment are detailed in our recommended conditions of project certification.

#### **5.5.4 Recommended Conditions of Project Certification**

1. KGHM acknowledges that there will likely be variability between blast effect predictions in the EA and the actual blast effect. To reduce this variability, it is recommended that the BCEAO as a condition of Project Certification, have KGHM develop and implement a Blasting Management Plan that includes but is not limited to the commitments KGHM has made during the Working Group review which are that:
  - KGHM shall not exceed blasting thresholds for air blast, underwater overpressure and vibration as the thresholds relate to human health and animals, including fish.
  - KGHM shall “scale up” from a small blast in the initial project phase.
  - KGHM will establish vibration monitoring locations in a linear array from the pit to the closest residents in nearby City of Kamloops neighbourhoods and provide a daily record of blast effects at each location along the array(s).
  - KGHM shall review the Blasting Management Plan upon any blasting event exceeding the blasting thresholds and revise the Plan to ensure compliance with the target thresholds. To minimize the potential for a blasting threshold exceedance, KGHM shall review the Blasting Management Plan upon any blasting event that realizes 80% of the targeted ground vibration of 5 mm/s, and/or 80% of the targeted airblast level of 115 dBL and revise the Blasting Management Plan and blasting

- design, where required, to ensure that blasting effects do not trend upwards to an exceedance of the thresholds.
- KGHM shall monitor all blasting events and maintain daily blast records and provide these records to the City of Kamloops and the IEM on a weekly basis so that the City of Kamloops can monitor potential impacts to the slope stability in the neighbourhoods closest to the Project.
2. In quieter, rural areas, KGHM has adjusted the impact assessment to incorporate the recommended correction. KGHM has committed to ensuring that the predicted exceedances at these three rural locations will not experience noise effects above the target thresholds. Accordingly, KGHM has outlined measures to give effect to this commitment and it is recommended that the BCEAO as a condition of Project Certification have KGHM:
- During pile driving operations, implement all measures as necessary to mitigate noise effects to all assessed rural noise receptors so that any increase in noise levels at these receptors does not exceed 6.5%. These measures may include but not be limited to equipment shielding, using the best available equipment with noise reduction technology, and limiting the duration of pile driving operations to periods within the daytime only.
  - During construction, construct all measures as necessary to mitigate noise effects at Inks Lake so that any increase in noise levels at Inks Lake does not exceed 6.5%.
  - During mine operations, implement all measures as necessary to mitigate noise effects at the Jacko Lake Prayer Tree so that any increase in noise levels at this receptor does not exceed 6.5%.
  - Develop and implement a noise monitoring program at Residence ID#21, the Jacko Lake Prayer Tree, and at Inks Lake to measure the noise levels during the Project phases of Construction, including pile driving activities, and Operations and revise mitigation measures, where required to ensure that any increase in noise levels at these receptors does not exceed 6.5%.
3. KGHM has committed to an underwater monitoring program to protect against fish stress and mortality and we are recommending the following as the basis of a condition of project certification.
- It is recommended that the BCEAO shall as a condition of Project Certification have KGHM, during blasting, ensure that the target underwater overpressure threshold for blasting is not exceeded.
  - As noted above, it is recommended that the BCEAO shall as a condition of Project Certification have KGHM supplement and implement the Blasting Management Plan referred to above that also includes, but is not limited to, the identification of instrumentation to be used to monitor underwater overpressure, identification of instrumentation to be used to monitor vibration at the sediment-water interface, the location of monitoring stations in the lake for each blasting zone to measure attenuation of overpressure, observational monitoring of the lake surface for a period of approximately 30 to 60 minutes after each blast to assess fish condition and to identify fish mortalities.
  - It is recommended that the BCEAO shall as a condition of Project Certification have KGHM, during pile driving, ensure that the target underwater overpressure threshold for pile driving is not exceeded. A stand-alone pile driving management and

- monitoring plan shall be developed and implemented for the duration of the installation of the sheet pile in the northeast arm dam in Jacko Lake. The monitoring component shall detail the equipment, locations, and frequency under which the monitoring will be conducted.
- It is recommended that the BCEAO shall as a condition of Project Certification have KGHM commit that blasting and/or pile driving activities shall cease if obvious signs of stressed fish or fish mortality is observed or if monitoring identifies that blasting or pile driving activities exceed the target thresholds for underwater overpressure as a result of sheet pile installation until such time as additional mitigation measures to either reduce the level of the overpressure or prevent fish from entering the potentially harmful impact zone are sufficiently implemented.
4. It is recommended that the BCEAO as a condition of Project Certification have KGHM perform direct measurements in Stability Region A (including the full extent of the Aberdeen Hills slopes) for a blast with characteristics similar to a production blast to confirm the anticipated PPVs prior to Construction including site preparation.

## **5.6 DARK SKY**

The requirement for assessing the quality of darkness of the night skies as a stand-alone Valued Component in the Environmental Assessment Application was justified based on specific concerns expressed by the public, including residents of Kamloops and the Kamloops Astronomical Society (KAS).

The AIR directs KGHM to summarize existing light levels in proximity to the Project, including the Aberdeen, Knutsford, Sahali, and Pineview Valley subdivisions in the City of Kamloops, and existing light levels at the Stake Lake observatory, Edith Lake Road and Lac Le Jeune Provincial Park.

Based on the baseline analysis of existing light levels, KGHM is then required under the AIR, in consideration of the Construction, Operations and Decommissioning phases, to provide a description of the Project components that may contribute to changes to dark sky, identify the effects of 24-hour operations on the surrounding neighbourhoods (existing and proposed) with respect to mine lighting with a focus on light levels during non-daylight hours or Artificial Light at Night (ALAN), identify mitigation measures that will be utilized to minimize project effects, identify residual effects, and identify and provide an assessment of the significance of the cumulative effects.

### **5.6.1 Modelling Projected Impacts**

Based on the lack of detail and the methodologies used, and not used, in establishing the existing dark sky conditions, the lack of detail in the amount and types of light to be generated during Construction and Operations phases, and the impact assessment performed based on this lack of detail, it is not possible to conclude that the impact of ALAN from the project will be Not Significant. Our conclusion is based on the following peer review findings:

- The baseline information presented is too vague to permit a proper assessment of the Project's impact on the ecosystem and the southern suburbs of the City. To assess the impact of ALAN, the total lumen-output from mine lighting, the vertical angles at which this light is emitted, and the spectrum that will be used is required.

- The impact assessment conclusions are based on contours for illumination beyond the local study area but there is no quantitative information as to how they were determined. The isophot calculation did not use an industry standard model for atmospheric scattering, which is the primary cause of sky glow. Sky glow will extend the visible impact of the Project across the region even with the Project situated below the hill tops, as viewed from the City. This undermines the shielding-effectiveness of topological features leading to underestimating the extent of the luminance as seen from the City, and the illuminance the Project creates across the region. Predictive modelling programs and primary literature are commonly used to determine the impact of the designed lighting at a distance from a new project. These models and primary source literature were not used in the dark sky impact analysis for the Project.
- The dark sky analysis uses Worksafe BC illumination levels which are based on asphalt surfaces. These surfaces have an albedo (a measure of reflectance or optical brightness) of approximately 2-8%. However, the ground cover for the mine site will have a minimal area of paved surfaces, the predominant disturbed surfaces being more likely aggregates, which has an albedo range of 30-70% (about 50% average). The resulting ground luminance from applying the proper albedo will create greater surface glare in the vicinity of the sources and it will also increase sky glow levels by greater than 500% over asphalt-coated surfaces.
- The more representative measurement of luminance for the Project is the illumination on the vertical plane measured at the property boundary. This illumination is the result of light that is perceived as glare, light trespass and sky glow. This glare will have different intensities depending on the brightness of the source and the distance to the light and is measured as luminance.
- The impact assessment correctly identifies that dark sky impacts interact with other Valued Components including Health, Wildlife, Vegetation and Terrestrial Ecosystems. Although the impact of ALAN on the ecosystem is mentioned in *Chapters 6 and 8* there is no quantitative assessment of its impact on the various species. The Environmental Assessment Application refers to qualitative information and concludes that light from the Project may impact the environment to various degrees, however the Environmental Assessment Application does not present quantitative limits (glare due to luminance, light spill due to illuminance or due to sky glow) to compare the emitted light to the ecological thresholds. The literature sources used are not primary sources and they underestimate the sensitivity of animal species to ALAN. The primary literature contains the threshold light levels above which ALAN can affect the biochemistry and behaviour of animals and is a more accurate assessment of impacts. The approach used is neither conservative nor precautionary.
- The Highland Valley Mine cannot be used to demonstrate the benignity of mine-site lighting. This mine impacts approximately 300 Km<sup>2</sup> of countryside and comparisons add no demonstrative value to assessing the Project-specific impacts. The scattering properties of the atmosphere for the Highland Valley Mine regional sky glow readings were not characterized. The more appropriate use of comparison to the Highland Valley Mine however is as a case study of how far reaching typical mine-site lighting affects the region.
- The Bortle scale is a general classification for the limiting sky conditions at a site (best night, or as good as it gets). It classifies a site based on past sky glow and air transparency conditions. Taking measurements within a limited time frame amounts to a restricted number of sampled nights, which generally yields poorer readings than "the

best nights". As a result, the Bortle value of 4 for the Observatory assigned in the Environmental Assessment Application is lower than the accepted Bortle scale for the Observatory. A more appropriate Bortle class for the KAS Observatory is 2-3, not 4. This is a more accurate characterization of the sensitivity of the Observatory to sky glow.

- KGHM's assertion that mitigation strategies may limit the cumulative effects of ALAN is not sufficient. Without clear commitments to engineered mitigation strategies, limiting of the cumulative effects of ALAN is not ensured and there is no mechanism to ensure these strategies will be effectively implemented to minimize the impact of ALAN.
- Changes to the lighted environment in urban neighbourhoods is a key stressor on property values. Given that the Environmental Assessment Application indicates that there is a low certainty of the potential Project effects on property value, it places more importance on ensuring that a proper impact assessment is completed and that required information required to conduct a fulsome assessment is available at the EA phase.

### **5.6.2 Kamloops Neighbourhoods**

Our review of the limited information provided for the dark sky valued component analysis indicates that the illumination from the Project will expand the suburb level sky glow over a much larger area than concluded by KGHM. Residents in the south neighbourhoods of the City of Kamloops, who currently enjoy a dark southern sky, will lose this view. Their southern view of the sky will be more like looking north over the City. As stated above, the qualitative illumination impact assessment used in the Environmental Assessment Application does not include the effects of light scatter in the air (artificial sky glow) and reflection off clouds. This undermines the shielding-effectiveness of topological features, leading to underestimating the extent of the luminance as seen from the City, and the illuminance it creates across the region.

### **5.6.3 Stake Lake Observatory**

A simple scaling for distance ( $1/r^2$ ) indicates that the Project will impact the Observatory by 5 times the brightness of Highland Valley Mine, using a conservative assumption that the Project uses half the light. This is approximately 2 mag./sec<sup>2</sup>. The fact that observing the night sky is affected by contrast in the light levels against it (emission of artificial light) explains the need for quantifying the sky glow and glare from the Project.

Increasing the sky glow by 1 mag./sec<sup>2</sup> is to say increasing the sky glow by 2.5 times. The conclusion that the Project impacts are Not significant - Moderate may be applicable, subject to a fulsome analysis being completed, to only occasional viewing of the night sky by some residents. However, this increase in sky glow over an Astronomical Observatory will be very noticeable and will compromise the effectivity of the facility, which is Significant.

### **5.6.4 Human Health**

The Environmental Assessment Application states that the potential impacts of dark sky from the Project interact with other Valued Components such Human and Community Health. The Light Pollution Abatement Program of the Royal Astronomical Society of Canada is well out in front of this Environmental Assessment Application and now includes human health as a chief criterion for the reduction of light pollution. Scotobiology extends the study of the effects of ALAN from nuisances and potential effects on property values and ecosystems to the effects on animal/human biochemical processes resulting from changes in the lighted environment in times when our behavior is geared to darkness. Any potential effects of ALAN on human health would

not be able to be characterized based on the limited information developed for this Valued Component.

### **5.6.5 Recommended Conditions of Project Certification**

We are unable to recommend conditions for Project Certification as we believe that the impact assessment conducted in the Environmental Assessment Application is insufficient to meet the requirements of this stand-alone Valued Component in the AIR. To identify dark sky conditions of Project Certification would suggest that we believe the deficiencies and errors we have identified could be dealt with following Certification which is not the case.

Our peer review was conducted by one of the most knowledgeable subject matter experts in Canada and internationally, at the recommendation of the Kamloops Astronomical Society. Our subject matter expert was available to discuss our findings with KGHM through the Working Group however, unlike the sub-technical working group meetings arranged and held by the BCEAO for other technical components, the BCEAO chose not to address our dark sky findings through a sub-technical working group process. This is unfortunate as our understanding is that this Environmental Assessment Application is one of, if not, the first project applications to incorporate a dark sky Valued Component impact assessment and rightfully so given that this Project is an atypical mining project in BC, being situated immediately adjacent to the City of Kamloops boundary and having an Astronomical Observatory in close proximity. It is our submission that this was an opportunity through technical dialogue to understand the issues around dark sky impact assessment and the level of information required to conduct a fulsome impact analysis that could have provided a body of knowledge for the BCEAO for future applications with a dark sky Valued Component.

Notwithstanding the above, it is recommended that the BCEAO shall as a condition **prior to Project Certification**, have KGHM complete the additional assessment components identified in Section 5.6.1 above and provide sufficient details to facilitate a fulsome dark sky assessment, in consultation with the City of Kamloops and the Kamloops Astronomical Society.

## **5.7 SOCIO-ECONOMICS**

The proposed mine will result in both beneficial and adverse effects on the City of Kamloops and its residents. The primary benefits of the project will be the potential for employment, increased business activity and incomes that will be generated throughout the Construction and Operation phases of the project. The key adverse effects stem from in-migration of workers and their families or others simply seeking work who will place demands on local housing, City of Kamloops services and local amenities. Other socio-economic effects will be the result of changes in the biophysical environment that can affect people and their neighbourhoods and changes in people's attitudes that can affect the image of the City of Kamloops.

### **5.7.1 Economics**

KGHM relied on the Input-Output (I/O) Model as an accepted method for estimating the economic contributions of projects at provincial and national levels. For this stated purpose, the I/O Model was appropriately used. KGHM worked with Statistics Canada to build production functions using available project expenditure data. We consider this approach as good practice for provincial and national level effects. However, the I/O model does not allow for estimation of economic benefits on a more granular basis (i.e., City of Kamloops). As such, considerable

uncertainty exists with respect to the magnitude of benefits likely to accrue to the City of Kamloops.

For the effects analysis at the local level, KGHM has stated that the direct, indirect and induced job estimates were derived using simple multipliers developed by Statistics Canada and applied to the high and local hire scenarios. The use of such multipliers is commonplace and reasonable. Nevertheless, local beneficial effects on employment, income and business activity are likely to be overstated. The analysis assumes that the workers who would gain employment at the mine will be individuals who are not presently working and unemployed in the City of Kamloops area. It does not consider that some people who are already working in the City of Kamloops area would leave their existing jobs to seek potentially higher wages at the Project. Moreover, some individuals may move back closer to home from other locations outside of the City of Kamloops. Overall the analysis fails to adequately recognize that additional in-migration might occur to fill vacated jobs, and therefore additional population growth that will place additional service demands on City of Kamloops services.

Overall, we agree with KGHM that the Project is expected to positively contribute to economic growth and diversification of the area throughout the Project's economic life. In total, between 1,510 and 1,850 total local positions (i.e., direct, indirect, and induced) are expected to be supported by the Project during the peak of the Construction Phase, and 933 total positions during the Operations Phase. It is acknowledged that as the Project transitions into the Decommissioning and Closure Phase, employment and project-related expenditures will be substantially reduced.

KGHM will consider providing the following education, training and career development support to enhance the potential for positive outcomes regarding employment and economic diversification:

- career counselling;
- workshops on skills transfer and employment transition;
- retraining programs for select employees, where practicable; and
- information packages identifying: scheduled date(s) of mine closure; employment insurance (EI); benefits accrued; employment websites and resources; known opportunities with other projects; resume writing, job searching and application techniques; and programs offered at local educational institutions.

KGHM will also work with local partners to identify key training needs and opportunities and will consider supporting training programs such as:

- heavy duty trades;
- heavy equipment;
- designated trades; and
- technical/professional and management/supervisory positions (e.g. advanced engineering)

KGHM's support may involve sponsorship, provision of used equipment, and/or co-op placements.

We agree with KGHM that the experience gained by individuals and businesses in the study area that become engaged with the Project will have a positive effect on the economy. Much of the skills and capabilities to be gained through involvement with the Project are those that are



widely applicable, in high demand and available for sustained economic benefits beyond the life of the Project.

### **5.7.2 City of Kamloops Services**

Overall, achieving the high local hiring scenario is fundamental to avoiding significant adverse effects on the City of Kamloops and the services it provides its residents. It is well understood that if there is an insufficient local labour pool available, the increased in-migration has the potential to 1) increase demand for housing and accommodations, 2) increase stress on community infrastructure and services, and 3) increase traffic volumes and effects on public road infrastructure. Proposed mitigation measures that minimize potential adverse effects on infrastructure, public facilities and services, as a result of Project-related in-migration, are described in the Application and include the establishment of a Community Liaison Group (CLG) to discuss potential issues and solutions (see additional comments below); communication of Project activities and timelines; development of a Construction Phase Workforce Accommodation Plan; development of a Code of Conduct for Project workers; implementing carpooling incentives; providing shuttle service from key locations; and staggering shifts. SLR is of the opinion that while these are common and standard mitigation measures for large industrial projects, the effectiveness for this Project and in the City of Kamloops carries uncertainty.

Because an assessment of potential effects of the Project on municipal finance is not within the scope of the Environmental Assessment Application, as defined in the AIR, the Environmental Assessment Application does not quantify the costs to the City of Kamloops for the delivery of additional services required by the Project, its workforce or other potential in-migrants. Nor does the Environmental Assessment Application sufficiently address the issue of “timing”, namely the delay between when costs are incurred by the City of Kamloops to address additional service demands and the time when sufficient revenues are generated from the Project to offset costs. KGHM acknowledges that Project-related costs to local government are anticipated to begin in the Construction phase. Revenue from property tax is anticipated to start primarily in the operations phase, as permanent workers purchase properties. Revenue from other sources, such as user fees, provincial grants, and other agreements may start earlier.

The City of Kamloops however is not the local government taxing jurisdiction, hence it is not fully understood how the City of Kamloops will be compensated for its costs incurred during all mine phases (such as additional EMS, Fire, or policing resources required during the influx of the mine workforce). KGHM indicates that project contributions to overall BC government revenue are expected to support the provision of public services in the City of Kamloops.

KGHM has indicated that it has initiated discussions with the City of Kamloops regarding collaboration mechanisms to address issues related to service delivery in the City of Kamloops. We support the development of a Community Agreement between KGHM and the City of Kamloops that is external of the City of Kamloops’ participation in the proposed CLG. We believe that this level of agreement would not only confirm the mitigation identified in the Environmental Assessment Application, but would also foster a pro-active corporate culture on the part of KGHM to collaboratively develop tailor-made solutions with the City of Kamloops to improve the delivery of municipal services to local residents and improve overall corporate-community relations.

### **5.7.3 Local Amenities**

SLR has focused on two key issues that relate to local amenities and influence of the project on community health and quality of life.

#### ***Jacko Lake and Local Recreational Amenities***

Changes in air quality, noise and vibration, visual impacts, dark sky, traffic, and visual effects are likely to disrupt recreational activities undertaken by local residents and visitors alike in close proximity to the Project and along access roads. The presence of the Project will remove certain areas and landscape features from public use and restrict access to other areas (temporarily or permanently) for safety or operational reasons. The quality of the angling, hiking, and mountain biking experience will be diminished in the vicinity of the mine site and at Jacko Lake in particular. In addition to temporary access restrictions to Jacko Lake during daily blasting activities over the first 13 years, the Project will result in partial impoundment of Jacko Lake, loss of privately held properties currently used for hunting purposes, removal of Goose Lake, and closure of Goose Lake road. While, these effects in themselves will not prevent people from engaging in recreational activities all together, they will make these local amenities less attractive and motivate current users to seek other accessible locations elsewhere in and around the City of Kamloops to undertake their recreational pursuits.

Because KGHM has not undertaken any primary research with recreational users (Jacko Lake users in particular) beyond their interview program, the significance of the effect on the recreational users and recreation in general remains uncertain. Moreover, the potential for mitigation is unknown, notwithstanding recreational facilities are proposed to be improved in conjunction with the fisheries offsetting concept.

Accordingly, we recommend the establishment of a Multi-Stakeholder Jacko Lake Users Group (JLUG), of which the City of Kamloops would be a member. The JLUG would operate throughout Construction, Operations and Decommissioning phases and assist with the development and implementation of all Construction, Post-Construction, Operations, and Decommissioning environmental and socio-economic management, monitoring and adaptive management plans relevant to Jacko Lake.

#### ***Health System Delivery***

The effects on the delivery of health services are largely related to potential population growth because of the Project. KGHM has concluded that up to 400 workers and their families are expected to migrate to the City of Kamloops because of direct, indirect, and induced employment, creating an increase in demand for health care services. In addition, there is the possibility that existing medical professionals may personally choose to leave the community should the Project be developed. The potential for these effects to occur is acknowledged by KGHM but has not been fulsomely evaluated nor has sufficient mitigation, beyond KGHM's commitment to provide a general Physician for Project employees to minimize the strain on general practitioners in the City of Kamloops, been identified to indicate that significant adverse effects will not occur.

The Environmental Assessment Application did not draw a definitive conclusion with respect to the potential for physician out-migration, but rather discussed uncertainties and potential difficulties in quantifying such out-migration. The issue was effectively dismissed by KGHM as a contributor to effects on Community Health Services. KGHM has not undertaken any primary

research beyond their interview program. While we acknowledge that research aimed at quantifying such out-migration is difficult, and agree that the survey conducted in 2012 by three Kamloops physicians is not conclusive evidence that physician out-migration will occur, KGHM has not offered any substantive evidence of its own to allow for a more definitive conclusion to be made. We also conclude that the Environmental Assessment Application identifies relevant mitigation measures that are within the control of the proponent (i.e., establishing a CLG to assist with effects management), but that KGHM has not provided any specific mitigation measures beyond recruitment efforts by others.

#### **5.7.4 Property Value**

The effect of the Project on property values remains one of the biggest uncertainties, and has been acknowledged as such by KGHM in the Environmental Assessment Application. Property Values were raised by the public, including residents and administrators from the City of Kamloops, real estate agents, developers and landowners in the vicinity of the Project. Specific areas of concern included, but were not limited to, the Aberdeen, Upper Sahali, Knutsford and Pineview Valley neighbourhoods. The project is atypical in BC in its proximity to built-up areas. KGHM acknowledges that specific properties and residential areas are likely to be affected. KGHM acknowledges that certain environmental effects of the project Construction and Operations phases could influence the desirability of various properties. They further acknowledge that there could be a short-term decline in residential property values until buyers are confident that mitigation measures to which KGHM has committed are effective. KGHM also concedes in the Environmental Assessment Application that their confidence level in the property values impact assessment is low.

KGHM will primarily rely on the implementation of on-site mitigation measures to address changes in the biophysical environment that might contribute to reduced property values (i.e., air quality, blasting noise, vibration, dark sky, traffic, visual/aesthetics, groundwater) along with effects monitoring. For example, KGHM has proposed to use real-time monitoring systems as a means of reporting monitoring results for parameters such as air quality and vibration. There may be potential for variability or uncertainty in the blast noise and vibration predictions, with relevance to the assessment of human annoyance and hence property values. KGHM has also expressed its willingness to consider options for off-site mitigation, including screening to mitigate visual effects.

KGHM proposes to establish a Community Liaison Group (CLG) to review the results of the Socio-economic Monitoring Program (SEMP), which includes Project effects on property values. KGHM has stated that if monitoring shows unforeseen effects to property values, KGHM will work with the CLG to develop adaptive management strategies to address any unforeseen Project effects. These may include:

- engaging with local real estate professionals and property appraisers to identify key factors influencing public risk perception in relation to City of Kamloops properties in the vicinity of the Project
- including public participation in ongoing monitoring to promote the public remaining engaged in the Project
- publicly communicating results of ongoing monitoring in accordance with risk communication best practices
- assessing perceived risk and evaluating efficacy of communication program
- contributing to the enhancement of amenities in affected communities to offset perceived community effects.

Most of the adaptive management strategies identified do not directly address financial losses to property owners resulting from potential diminished property values. Although meeting the human annoyance thresholds for various nuisance effects should be a condition of the Project, and compliance would be enforced, KGHM does not propose to implement a property value protection plan that might be triggered should nuisance or other effects be greater than predicted. In the absence of such a protection plan, there remains uncertainty with respect to a conclusion of no significant adverse effects on residential property values.

### **5.7.5 Tourism and Branding**

We agree with KGHM's conclusion that widespread adverse effects on the tourism industry are unlikely from potential changes in environmental quality. Notwithstanding uncertainties with impact modelling and predictions discussed elsewhere in this report, KGHM has asserted that changes in air quality, blasting noise, vibration, dark sky, traffic, visual/aesthetics, and groundwater, would not be of sufficient magnitude or noticeable across the City of Kamloops or at most individual tourist related operations to make them unattractive to tourists. In addition, KGHM reported that tourism industry stakeholders engaged during their research did not identify potential concerns regarding the economic viability of their operations. Nevertheless, there remains the potential for adverse effects on tourism related accommodations due to the likely competition for temporary accommodations during the Construction phase as noted below. If demand for tourist accommodation increases as projected, and supply does not increase to meet demand, there is a strong potential that room rates would increase. Should the situation with high competition and higher room rates persist, it can be concluded that at some point the competitiveness of attracting events and tourists could be reduced. However, we agree that, if there are changes in hotel pricing as a result of the Project, these will be short-lived.

With respect to changes in the community's image, we conclude that adverse changes in the City of Kamloops' community image are possible but are not inevitable outcomes of the Project. Valid concerns have been raised about the possibility of an effect of the Project on community image if the city is viewed as an unattractive industrial city with diminished environmental quality and well-being. Such views would be contrary to the vision of the City of Kamloops and its brand as "the Tournament Capital of Canada". Many of these concerns relate to the proximity of the Project to the community and potential adverse effects on environmental quality.

KGHM will primarily rely on the implementation of on-site mitigation measures to address changes that might contribute to reduced environmental quality (i.e., air quality, blasting noise, vibration, dark sky, traffic, visual/aesthetics, groundwater) along with effects monitoring. While some changes to environmental quality as a result of the Project are inevitable, it is our experience that changes to a community image are not. Changes in community image mostly occur in a situation where there is demonstrated poor environmental performance, a major accident and widespread public concern both among residents and others outside the community that is founded in Project performance.

To mitigate quality of life-related concerns, it is KGHM's intention to:

- participate in, and provide support to, the next stage of community planning;
- support the vision of the City of Kamloops through its Community Investment Program;
- undertake careful monitoring of environmental effects of the Project and undertake transparent communication of those monitoring results.

A Community Liaison Group is proposed as a vehicle for ongoing dialogue about monitoring results and environmental quality. We believe that in addition to a strong CLG as noted below, transparent and independent monitoring of the Project's compliance or non-compliance with all environmental permits, approvals and Certificate terms and conditions are also essential to ensure that an adverse community image does not manifest itself over time.

Closure Plan Objectives will effectively define the legacy of the Project on the landscape in the post-closure and long-term. The legacy the Project leaves on the landscape following closure can also affect a community's image. The Mine Closure and Reclamation Plan describes how KGHM intends to meet the statutory requirements for mine closure and reclamation of the Project. KGHM reports that end land use objectives following closure include agricultural, wildlife habitat and recreational uses. Post-mining land will be returned to the Agricultural Land Reserve after temporary non-farm use is complete. Wildlife habitat objectives will be achieved by creating wildlife habitat features within the predominantly agricultural grassland landscape. Recreation objectives will be met by re-establishment of vegetation communities that support the agriculture and wildlife objectives and restore aesthetic values.

We agree with KGHM that based on the closure and reclamation plans and objectives, the mine site is reasonably expected to return to a land capability that is like the current state, blending with the surrounding environment in both function and visibility. No post-closure implications for community image or quality of life are anticipated unless there is demonstrated poor environmental performance or a major accident such as a TSF breach that drives widespread public concern both among City of Kamloops residents and others outside the community.

#### **5.7.6 Accommodations**

KGHM has concluded that up to approximately 400 workers and their families (i.e., between 447 and 1,111 individuals) are expected to migrate to the City of Kamloops as a result of direct, indirect, and induced employment, creating a short-term increase in demand for housing. KGHM has stated that the City of Kamloops population is predicted grow to 120,000 by 2036, with an associated increase of up to 10,000 new residents in the Aberdeen neighbourhood. KGHM reported that a total of 4,000 new residential units are planned in Aberdeen. Considering 1) the number of available residential units for sale (approximately 2,000 units), 2) the rate of housing starts and completion (approximately 200 units in recent years), 3) planned development, and 4) the availability of rental units; the currently available rental apartments and active residential listings are more than enough to cover the potential housing demand and substantial residential development is not required. KGHM concludes that some residential development would take place, but that would be a gradual process, being unlikely above the current rate of development. KGHM concluded that the local housing stock is sufficient to meet the potential demands of the workforce. Notwithstanding the uncertainty associated with predicting in-migration, we agree with KGHM's prediction and recommend monitoring of housing availability as part of the SEMP.

In contrast, KGHM's analysis of effects on tourist accommodations clearly predicts a shortage of such accommodations under the low local hire scenario. From our perspective, this is equivalent to an exceedance of a threshold, yet a significant adverse effect was not predicted. Given the uncertainty associated with local hiring predictions and in estimating in-migration, we do not agree with KGHM's conclusion that there will be no significant adverse effect on tourist accommodation, particularly during peak seasons in the Construction phase.

### **5.7.7 Community Liaison Group**

KGHM has proposed the establishment of a Community Liaison Group (CLG) as a key mitigation element for the socio-economic impact management. It is held up as a mechanism to address virtually all the key impacts and issues discussed above. The Environmental Assessment Application presented a very conceptual vision for the CLG. KGHM has subsequently offered a more detailed draft Terms of Reference (February 2017). Given the critical role that this group will need to play to assist in managing effects of the Project, it is essential that its Terms of Reference be acceptable to the City of Kamloops and other stakeholders and encompass the full range of potential Project impacts and mitigation that is attributed to the CLG in the Environmental Assessment Application.

Our findings opine that the draft Terms of Reference does not provide an adequate basis for the functioning of an effective CLG for the following reasons:

1. In general, the draft Terms of Reference places too much responsibility on the CLG (particularly the Chairperson) that should rest with KGHM without the commitment of significant financial, logistical and other resource support from KGHM. The proposed responsibilities of the Chairperson and the CLG members are vast and time consuming. This can be a recipe for CLG poor performance if not managed. These individuals (and the CLG itself) will require technical, logistical and related financial support. The individuals on the CLG may not have the skills and resources to facilitate effective meetings, resolve conflicts and fulfill the onerous duties assigned to them.
2. The draft Terms of Reference does not sufficiently define the central role of the CLG in adaptive management and/or socio-economic impact management. The CLG should be a solution-oriented and forward-looking group charged with the identification of mitigation / solutions for identified issues and concerns. This must be a primary mandate of the group. At present, it appears that the CLG has a very large and broad set of responsibilities but not for adaptive management, but rather, for community liaison. At a minimum, the CLG should maintain a working group dedicated to oversee the design, implementation, review and recommendations for solutions related to the Socio-economic Monitoring Program (SEMP).
3. KGHM must remedy concerns, issues or matters raised by the CLG, to the satisfaction of the CLG and the BCEAO. It is counterintuitive to strike a CLG as a mitigation measure to Project socio-economic impacts if the suggestions and recommendations of the CLG can be completely rejected by KGHM if they choose to.
4. The draft ToR states that "members will be responsible for "disseminating information" between the CLG and other interested groups and the public". This is a substantial responsibility that should be placed on KGHM more than the CLG. Again, it appears that there is too much onus put on the CLG to be the sole conduit of information from the community to KGHM. Dissemination of information requires a sufficient budget and logistical support.
5. It will be essential for the CLG to review and comment on factual information / compliance reporting regarding KGHM's performance in regards to compliance with all relevant government legislation, permits, licenses and authorizations. Access to such documents must be guaranteed in the Terms of Reference. The Terms of Reference should identify specific documents that would be reviewed by the CLG on an annual basis in addition to monitoring results.

6. The CLG must have access to independent technical expertise to fulfill its role. Currently, the draft Terms of Reference requires that suggestions and recommendations be accompanied by relevant background information, objectives and anticipated outcomes, and estimated costs (where applicable). A CLG cannot effectively fulfill this requirement with “volunteers” alone. Access to independent technical expertise is essential.
7. It is common place in CLG Terms of Reference for large industrial projects that CLG meetings are open to the general public. This is currently not part of the draft Terms of Reference. Some closed working sessions or closed CLG meetings may need to be held, however at regular meetings members of the public should be able to address the committee in a delegation in relation to items on the agenda.

### **5.7.8 Recommended Conditions of Project Certification**

1. It is recommended that the BCEAO as a condition of Project Certification, have KGHM within 120 days of Certification establish a Community Liaison Group (CLG) under a Terms of Reference to be established by the BCEAO in collaboration with KGHM, the City and relevant stakeholders. The CLG shall be a solution-oriented and forward-looking group charged with the identification of mitigation / solutions for identified issues and concerns. KGHM shall solicit and incorporate input from the CLG members prior to and during the development and implementation of all Construction, Post-Construction, Operations, and Decommissioning environmental and socio-economic management, monitoring and adaptive management plans. KGHM must remedy concerns, issues or matters raised by the CLG to the satisfaction of the CLG members and the BCEAO and, at a minimum, encompass the full range of potential Project impacts and mitigation that is attributed to the CLG in the Environmental Assessment Application.
2. It is recommended that the BCEAO as a condition **prior to Project Certification** require KGHM and the City of Kamloops develop a mutually agreeable approach and details regarding issues of mutual concern, but particularly the approach to supporting the Project with municipal services and Kamloops residents and roles and responsibilities in respect to maximizing project benefits to the residents of Kamloops.
3. It is recommended that the BCEAO as a condition of Project Certification have KGHM, at least 120 days prior to commencing any activities in or within 500 metres of Jacko Lake, establish a Multi-Stakeholder Jacko Lake Users Group (JLUG), of which the City of Kamloops shall be a member, under a Jacko Lake Users Group Terms of Reference to be established by the BCEAO. KGHM shall be required to implement and maintain the JLUG prior to and throughout Construction, Operations and Decommissioning phases. KGHM shall solicit and incorporate input from the JLUG members prior to and during the development and implementation of all Construction, Post-Construction, Operations, and Decommissioning environmental and socio-economic management, monitoring and adaptive management plans. KGHM must remedy concerns, issues or matters raised by the JLUG to the satisfaction of the JLUG members.

## **5.8 ACCIDENTS AND MALFUNCTIONS**

KGHM took a two-stage approach to evaluating potential impacts from Projects accidents and malfunctions. The Environmental Assessment Application process focuses on credible accidents and malfunctions and we agree with the scope of the impact assessment which included:

In the first stage, KGHM conducted a Failure Modes and Effects Analysis (FMEA) workshop covering relevant Project activities and components except a TSF failure. The FMEA included the hypothetical failure of structures, equipment, or processes and the consequences of failures on Project receivers. The second stage evaluation focused on the effects of a catastrophic failure of Project dams associated with the TSF. The dam failure modes assessment and dam breach inundation evaluation followed the Canadian Dam Association Dam Safety Guidelines.

In the first stage, KGHM considered scenarios for accidents and malfunctions that included; a Kinder Morgan Pipeline leakage or failure; the accidental leakage of effluent; power outages; flying rock from blasting; unplanned explosion; motor vehicle accidents; flooding or erosion because of containment structure failures; failure of the pit integrity; erosion and sedimentation into waterbodies; and spill contamination to waterbodies or soils.

In the second stage, the assessment focused on the failure of the TSF, seepage collection and runoff ponds and failure of the waste rock storage facilities.

We found that the approach and scope of the accidents and malfunctions impact assessment was appropriate for the Project and that the scenarios investigated are both credible and preventable. We also note that detailed designs of the TSF, seepage collection and runoff ponds and waste rock storage facilities were not made available for review during the Environmental Assessment Application process so our peer review is limited in this regard.

We do have a concern with KGHM's definition of the expected severity of consequences related to the defined failure mode for the Community area of concern used in the FMEA approach. KGHM uses the following definitions:

**Minor Severity** – Tangible expressions of mistrust among a handful of community members with no influence on public opinion and decision-makers.

**Moderate Severity** – Tangible expressions of mistrust among a few community members with some influence on public opinion and decision-makers.

**Serious Severity** - Tangible expressions of mistrust among some community members with moderate influence on public opinion and decision-makers.

**Major Severity** – Tangible expressions of mistrust among most community members with significant influence on decision-makers.

**Catastrophic Severity** – Widespread loss of trust across the community setting the agenda for decision makers and key stakeholders.

From our peer review process, which included public presentations to City of Kamloops Council, it is doubtful that KGHM could reasonably conclude that the community of the City of Kamloops, which includes the elected City Council speaking on behalf of constituents and having significant influence, if not setting the agenda for, decision-makers, is already close to or at the Major Severity category before the Project has even received approval to proceed. The thresholds of handful, few and some community members is in our opinion not representative of the current community for this Project if a failure event were to occur. This leaves the thresholds of major and catastrophic as the only real viable levels of community concern for this analysis, indicating there may have been an underestimation of severity.



### **5.8.1 Tailings and Mine Waste**

We reviewed the proposed TSF concept and found that the design considerations available in the Environmental Assessment Application phase were appropriate in that KGHM has used a “belt and suspenders” approach to the TSF construction. The structural elements are fortified through the addition of rock buttressing to the embankment walls through siting of the WMRSF and the SMRSF, increasing the dam safety margins and incorporating recommendations from the Mount Polley dam failure review. Buttressing will be constructed concurrently with the TSF construction to match heights. Seepage control elements were appropriate for the design, again based on the details available at the time.

The TSF is proposed to be limited in its ability to retain water as KGHM will be using a closed loop, recycled contact water system for mine water use. This further mitigates the potential for an unplanned release of contact water to be extensive given that the TSF is graded to a shallow point inside the structure where the water is collected and pumped back through the mine for reuse. Freeboard design incorporates the ability to manage flood events and there is no discharge of TSF surface water to the environment. This concept extends through Operations to Decommissioning and Closure phases where TSF water is pumped to the pit. Where the TSF is vulnerable is in the early Project stage of Construction, year -1 to year 1, where the TSF will be used to capture make-up water to be ready for mine operations. At this stage, water is directly against the dam structure with no buffering of the thickened tailings between water and the dam. In the dam breach analysis, the impact of this failure is leakage flows through the dam structure, captured in the seepage collection pond. This pond would fill within a few days and would need to be continuously pumped so that the unplanned discharge from the TSF does not overflow the seepage collection pond. For this response plan to be successful, the emergency pumping infrastructure must already be constructed and tested to respond to a failure mode event. There is not sufficient time to acquire equipment and materials and then construct the emergency pumping operations to the pit before the seepage collection pond overflows, particularly in a failure mode event in flood or heavy rain conditions.

The proposed use of thickened tailings further reduces the water content in the TSF during Operations and Closure phases. The proposed use of dry cover over the TSF again reduces the potential for the loss of contact water following the decommissioning and closure. We agree with this approach.

We have identified a concern with the approach to maintain the thickened tailings in a wetted condition, not submerged, as a mitigation measure for dust control. We understand that the tailings will be deposited into the TSF using a spigot system that will be set up around the perimeter of the TSF so that the tailings beaches do not dry and generate dust emissions. We have not seen the detail of this spigot system however we have a concern that the volume of tailings being deposited in the later years of Operations will be insufficient to create full wetted conditions sufficient to mitigate dust generation in, what will be at that time, a very large TSF.

We have a similar concern in the early years of operation whereby more water will be in the TSF, given the full year of water storage prior to Operations and additional water being deposited from Operations, than will need to be drawn down for mine Operations. This could lead to a scenario where the TSF continues to function as a pond for longer than modelled under the failure mode analysis.

### **5.8.2 Water Quality**

As discussed below in Human Health, an unplanned release of contact water to Peterson Creek would result in poor quality water moving down Peterson Creek under flood-like conditions, with associated effects of erosion and sedimentation. The predicted water quality within mine site ponds is poor and, based on the worst-case scenario, the impacts to water users in the Peterson Creek watershed would be immediate and severe enough to require an alternate water source until the impacts have been remedied, however the impacts would not be widespread.

Notwithstanding the severity of the above surface water release scenario, more concerning in our review is the potential for a discharge directly to groundwater. This is a typical failure event for lined collection ponds holding contact water. Failures of the liner are harder to detect since they are underground and usually in this case the discharge will have been ongoing for some time before it is detected. Prompt detection is accomplished through a comprehensive understanding of the groundwater pathways in the footprint of and outside of the collection ponds so that groundwater monitoring wells and seepage containment systems are properly situated and with an appropriate number of monitoring wells to accurately detect changes that would indicate a problem with the liner. What we did not see discussed in the Environmental Assessment Application is what KGHM's mitigation plan is for dealing with seepage collection pond or trench water during the lengthy time to replace a pond liner.

As indicated below in the Human Health discussion, KGHM identifies unplanned discharges to surface and groundwater as short in duration, 1 to 5 years, and reversible within the same timeframe. Our concern however is that this finding is accompanied by only a moderate degree of certainty due to "unknown external variables". Once these variables are known, it could mean that the duration of the impact is much greater than assessed in the Environmental Assessment Application although the likelihood that it can be reversed should still be valid in most cases. Our preference is that in accident and malfunctions evaluation scenarios, the degree of uncertainty is reapplied to the assessment model rather than stating the uncertainty after the modelling as a degree of confidence.

### **5.8.3 Human Health**

Notwithstanding that we found KGHM's design prevention approach to be acceptable to mitigate the potential for accidents or malfunctions from occurring and impacting human health, the fact is that accidents and malfunctions continue to happen on mining and other industrial projects despite design mitigation using the same or similar design features as KGHM proposes, except for the TSF which has incorporated more robust approaches following the Mount Polley review.

KGHM has identified potential impacts to human health in terms of water quality should the unplanned release of contaminated water occur. Effects would be most acute in the area closest to the Project, and would dissipate further downstream; however, effects are modelled to impact Peterson Creek, Jacko Lake and continue down to Kamloops Lake, where quicker dilution would occur. This release will primarily affect the quality of ground and surface water whereby it would make current sources of drinking water and water used for livestock or irrigation unusable. KGHM categorizes these effects as having a short duration, 1 to 5 years, and would provide alternate sources of clean water to those affected while the effects were reversed. However, it is our opinion that none of the affected water users who suddenly found their water supply to be contaminated would consider 1 to 5 years a short duration particularly in

consideration that KGHM has only a moderate degree of certainty that the effects of a contaminated water supply could be reversed.

#### **5.8.4 Recommended Conditions of Project Certification**

The critical feature of an accidents and malfunctions mitigation approach is first recognizing that these scenarios are preventable, which focuses the Project on proper design of Project facilities and a robust monitoring program to pro-actively detect problems before they become reactionary events. Our recommendations focus on prevention.

1. It is recommended that the BCEAO as a condition of Project Certification require KGHM to have present fulltime at the Project site during the Construction of the TSF, including all incremental expansions of the TSF, and all ponds, dams, seepage control systems, and liners required to manage contact water, the Design Engineer of Record to be accountable for all of these facilities being constructed as per design and free from material defects and to approve any as-built modifications to the designs. With respect to any as-built modifications to the TSF, no construction of design modifications should occur without the Project's IRB first reviewing and approving the design modifications.
2. It is recommended that the BCEAO as a condition of Project Certification require KGHM to provide detailed designs to the City of Kamloops for review during the mine permitting process of the TSF, including all incremental expansions of the TSF, and all ponds, dams, seepage control systems, and liners required to manage contact water. Any as-built modifications to these facilities should be required to undergo the same level of stakeholder review as that of the mine permitting process.
3. We have identified elsewhere in this report recommendations for more appropriate GW monitoring scope and locations for other aspects of the Project. This will be equally important to establish proper well locations for monitoring seepage from contact water facilities to detect leakage or malfunctions of lined facilities. It is recommended that the BCEAO as a condition of Project Certification require KGHM to provide engineering detail designs of the proposed GW monitoring program of the TSF and all ponds, dams, seepage control systems, and lined facilities to the City of Kamloops for their review and input into the permitting process for the monitoring of these facilities.
4. It is recommended that the BCEAO as a condition of Project Certification require KGHM to incorporate the compliance monitoring of the TSF and all ponds, dams, seepage control systems, and lined facilities into the Terms of Reference for the IEM, to be reported on to the City of Kamloops and the BCEAO. To facilitate the IEM's role, the IEM must be provided access to all GW monitoring records generated for the Project.
5. It is recommended that the BCEAO as a condition of Project Certification require KGHM to provide full details of their committed actions to respond to an accident or malfunction resulting in any licensed water user losing the use of their source water due to contamination because of a Project accident or malfunction and that alternate, permanent solutions are implemented to provide clean water to impacted users where temporary solutions fail to fully reverse the impacts to these users within 6 months, due to the uncertainty that exists surrounding whether impacts can be reversed.
6. It is recommended that the BCEAO as a condition of Project Certification require KGHM to have on site and constructed in place prior to Operations, emergency pumping and piping infrastructure to pump out the seepage collection ponds in the instance of a failure, excess seepage or any other event that leads to the seepage collection ponds exceeding capacity. Further, KGHM shall fill all newly constructed ponds and conduct

an integrity test of the ponds' design and a pumping test to verify that in an emergency, these ponds can be pumped as claimed in the Environmental Assessment Application to avoid an unplanned discharge to the environment.

## 5.9 TRANSPORTATION

Project staff (direct employees and contract employees) accessing the mine site daily as well as the delivery of mine equipment, materials and plant machinery during the Construction phase and transporting waste (general and hazardous), sewage disposal, and mineral concentrate during the Operations phase will involve the use of the public road network. This will include an increase in personal and heavy vehicles using the roads around the Project to access the site, including heavy goods vehicles. In addition, during the Construction Phase, public road realignment, use, and maintenance is expected to interact with public road infrastructure and traffic. While road use will also occur during the Decommissioning and Closure and Post-closure phases, traffic volume is expected to decrease to the point where the interactions with the public road network are greatly diminished.

The Environmental Assessment Application has identified that during Construction, traffic volumes will have an adverse effect on the traffic flows at the Inks Lake Interchange and at the intersection of Lac Le Jeune Road and Ajax Mine Access Road. Intersection traffic through the Pacific Way/Hugh Allan Drive, Versatile Drive/Hugh Allan Drive, and Frontage Road/Copperhead Drive intersections may experience a decrease in the Level of Service during Construction, in some instances exacerbating pre-existing Level of Service deficiencies.

Proposed access plans for the Project include the construction of a new Inks Lake Interchange on Highway 5. Prior to the completion of the Inks Lake Interchange upgrades, local access will be temporarily routed via the Copperhead Interchange and Lac le Jeune Road. During this period, heavy loads will access the site from the south via the Walloper Interchange and Lac Le Jeune Road. During the Operations Phase, the effects on the transportation network will also include truck traffic transporting concentrate to Port Metro Vancouver, for which the transportation routes travel through the RSA.

KGHM indicates that it will implement measures to reduce the Project traffic volumes along the access road networks during the Operations phase, such as employing bus and carpooling initiatives. However, we suggest that these initiatives should apply to the Construction phase as well given that the number of employees, material and equipment deliveries accessing the site will be approximately 400% higher than during the Operations phase. KGHM in the Environmental Assessment Application has identified three sites for commuter lots and bussing programs however 2 of the 3 sites are on First Nations lands who have stated opposition to the Project. KGHM needs to further explore the range of potential mitigation options to minimize potential traffic volume impacts and develop a plan that can be implemented, monitored and enforced.

A key component to the management of traffic impacts for the Project will be a robust communications plan that, through the use of roadside signage, media outlets, social media, Project website, and direct communications with the City of Kamloops, local businesses and residents, provides advance notification of anticipated traffic impacts or delays due to road construction, road closures, detours, or oversize vehicle movements.

### **5.9.1 Recommended Conditions of Project Certification**

1. It is recommended that the BCEAO as a condition of Project Certification and prior to the start of any Construction phase activities including site preparation, have KGHM, in consultation with the City of Kamloops, as a component of the Transportation Management Plan conduct more detailed investigations of the road networks to be used for the Project including road condition assessments, road improvements, roadside safety needs or rehabilitation requirements, maintenance requirements, and restoration standards and that KGHM and the City of Kamloops develop an agreement with respect to the accountabilities, including costs, for any required road improvements, maintenance or restoration resulting from the Project.
2. It is recommended that the BCEAO as a condition of Project Certification and prior to the start of any Construction phase activities including site preparation, have KGHM, in consultation with the City of Kamloops, develop clear transportation commitments to be implemented that will detail how KGHM will restrict and enforce the number of vehicles accessing the site during the Construction and Operations phases, restrict Project vehicle parking along the mine access road networks, restrict Project vehicles to traveling only on designated mine access road networks to access the Project, maintain public access to all recreational resources in the Project area, and minimize the potential for Project vehicles to negatively affect the level of service and safety of existing and future public road users.
3. It is recommended that the BCEAO as a condition of Project Certification and prior to the start of any Construction phase activities including site preparation, have KGHM, in consultation with the City of Kamloops, develop and implement a traffic management communications plan as a component of the Transportation Management Plan.

## 6.0 BENEFITS OF THE PROJECT

Anticipated beneficial effects of the Project may be realized by the City of Kamloops during the approximately 25-year Construction and Operational phases of the Project. The Project will or has the potential to:

1. Contribute to the maintenance of the social structure and stability of the City of Kamloops and the other municipalities within the Thompson-Nicola Regional District and serve as a positive contributor to population growth in these areas;
2. Create new apprenticeship opportunities serving the mining and other industries that will generate new certified trades people available for the Project itself and/or British Columbia's labour market subsequently;
3. Serve to maintain the skilled employment base of the construction, mining and support sectors throughout the short term and contribute to the expansion of the skills base over the long term;
4. Stimulate increased enrolment in post-secondary educational programs that provide mining related degrees or certificates and other training programs that support certification in a professional or skilled trade;
5. Be a catalyst for increased local and regional economic development during each of the Project's phases through the potential establishment of new business operations and/or the expansion of existing business operations in the City of Kamloops that are involved in the mining service industry;
6. Create new direct, indirect and induced employment opportunities for the existing labour market in the City of Kamloops and potential in-movers to the City of Kamloops and other Thompson-Nicola Regional District municipalities and positively influence employment growth. The Project is anticipated to require 1800 employees during the initial years of construction and 500 employees during operational years;
7. Create new indirect business activity and opportunities due to increased spending associated with Project employment, and expenditures on goods and services;
8. Contribute to increased total household income throughout the Region including the City of Kamloops;
9. Serve as a catalyst for the initiation of new housing developments in the City of Kamloops and other communities within the Thompson-Nicola Regional District;
10. Contribute in whole or in part to the tax bases of the City of Kamloops and the Thompson-Nicola Regional District.

Notwithstanding the potential benefits of the Project outlined above, the City of Kamloops will be in competition for these benefits such as employment opportunities, business development, economic growth of local businesses, and residential growth. Should the Project receive Environmental Assessment Certification, it is recommended that the City of Kamloops continue to work with KGHM to identify opportunities for these and other additional direct benefits of the Project to accrue to the City of Kamloops. It is also recommended that the City of Kamloops develop an internal program and strategies to maximize the benefit potential of the Project for the City of Kamloops.

## 7.0 MONITORING AND ADAPTIVE MANAGEMENT

In the individual technical peer review sections elsewhere in this report, we have provided technically-specific monitoring recommendations based on our peer review findings. In this section, we are providing for the City of Kamloops' consideration recommended monitoring and adaptive management conditions of a more general nature that, should the Project receive Environmental Assessment Act Certification to proceed, such Certification should be conditional upon undertaking and completing the following general conditions.

### 7.1 RECOMMENDED CONDITIONS OF PROJECT CERTIFICATION

1. KGHM must retain an Independent Environmental Monitor (IEM), the qualifications of which are subject to the approval of the BCEAO and the City of Kamloops, to report to the BCEAO and the City of Kamloops on compliance or non-compliance with the terms and conditions of all Project permits and approvals, with all conditions of an Environmental Assessment Certificate, and with all Project commitments to environmental mitigation. KGHM must not start Construction, including Site Preparation, until the selection of the IEM and the terms of engagement have been approved by EAO and the City of Kamloops. The IEM must report directly to the BCEAO and the City of Kamloops prior to KGHM receiving such reporting. The IEM must be retained throughout all Construction (including Site Preparation), Operations and Decommissioning and Reclamation years.

The IEM must have a team of qualified technical specialists that can monitor compliance or non-compliance with all environmental permits, approvals and Certificate terms and conditions and the effectiveness of KGHM's commitments to mitigation applicable to the Project including but not limited to air quality, acoustics and vibration, human health, groundwater, surface water, water quality, sediment and erosion control, aquatic species and habitat, terrestrial species and habitat, vegetation species and habitat, species at risk, invasive species, slope stability, solid and hazardous waste management, tailings facilities and mine waste management, and spill investigation and remediation. The IEM must be able to identify where any environmental impact predictions, negative, neutral or positive, made in the Environmental Assessment Application are inconsistent with the monitored impacts during all phases of the Project and must be able to identify and recommend corrective measures to KGHM to support the implementation of the Adaptive Management plan.

The IEM must have the authority to stop part of or all work on the Project at any time where the IEM reasonably believes that KGHM has not been or is not in compliance with the terms and conditions of any permit or approval or the Environmental Application Certificate conditions, or where the IEM reasonably believes that stopping work is necessary to prevent or reduce Project-related adverse effects as determined by the IEM or any IEM technical support.

2. The BCEAO shall direct KGHM to develop and implement an Environmental Monitoring Plan (EMP) in consultation with and to the satisfaction of the City of Kamloops. The EMP shall clearly describe KGHM's commitments and methodologies by which all predicted Project impacts, negative, neutral or positive, identified in the Environmental Assessment Application and any new or revised predicted Project impacts, negative, neutral or positive, identified prior to or during Construction, Operations and

Decommissioning shall be monitored and verified during Construction, Operations and Decommissioning.

KGHM must provide the final, accepted version of the EMP to the City of Kamloops and the BCEAO a minimum of 120 days prior to the actual commencement of any Construction, Operations and Decommissioning and Reclamation activities. KGHM must identify a Qualified Professional (QP) with a minimum of 15 years of relevant EMP experience to be accountable for the development, implementation, amendments to, compliance with, and non-compliance with the EMP during all Construction, Operation and Decommissioning and Reclamation years to the satisfaction of the City of Kamloops and the BCEAO.

3. The BCEAO shall direct KGHM to develop and implement an Adaptive Management Plan (AMP) in consultation with and to the satisfaction of the City of Kamloops. The AMP shall clearly describe KGHM's commitments and methodologies by which all predicted Project impacts, negative, neutral or positive, identified in the Environmental Assessment Application and any new or revised predicted Project impacts, negative, neutral or positive, identified prior to or during Construction, Operations and Decommissioning shall be managed during Construction, Operations and Decommissioning where it is identified that any prescribed mitigation measure implemented for the Project fails to achieve compliance with any term or condition of any Project permit or approval, the Environmental Assessment Certificate, or any commitment to mitigation agreed to by KGHM.

KGHM must provide the final, accepted version of the AMP to the City of Kamloops and the BCEAO a minimum of 120 days prior to the actual commencement of any Construction, Operations and Decommissioning and Reclamation activities. KGHM must identify a QP with a minimum of 15 years of relevant EMP experience to be accountable for the development, implementation, amendments to, compliance with, and non-compliance with the AMP during all Construction, Operation and Decommissioning and Reclamation years to the satisfaction of the City of Kamloops and the BCEAO.



## 8.0 GENERAL RECOMMENDED CONDITIONS OF PROJECT CERTIFICATION

In the individual technical peer review sections, elsewhere in this report, we have provided technically-specific recommendations based on our peer review findings in each of the technical sections. In this section, we are providing for the City of Kamloops' consideration recommended conditions of a more general nature that, should the proposed Ajax Mine project receive an Environmental Assessment Act Certification to proceed, such Certification should be conditional upon undertaking and completing the following general conditions.

1. Prior to commencing Construction, it is recommended that as a condition of Project Certification, the BCEAO shall require KGHM to establish an Inter-Agency Working Group (IAWG), of which the City of Kamloops shall be a member, under an Inter-Agency Working Group Terms of Reference to be established by the BCEAO. KGHM shall be required to implement and maintain the IAWG prior to and throughout Construction, Operations and Decommissioning and Reclamation phases.

The BCEAO shall develop a Terms of Reference for the IAWG to the satisfaction of the City of Kamloops that directs KGHM to solicit and incorporate input from the City of Kamloops prior to and during any and all permitting and approval requirements for the Project, prior to and during the implementation of all mitigation measures, prior to and during the development and implementation of all Construction, Operations and Decommissioning and Reclamation environmental management plans including but not limited to those identified in Section 11 of the Environmental Assessment Application, and prior to and during the development and implementation of all Construction, Post-Construction, Operations, and Decommissioning and Reclamation environmental monitoring and adaptive management plans. KGHM must remedy concerns, issues or matters raised by the City of Kamloops, as a member of the IAWG, to the satisfaction of the City of Kamloops and the BCEAO.

2. It is recommended that as a condition of Project Certification, the BCEAO shall require KGHM to develop and implement a Construction Environmental Management Plan (CEMP) in consultation with and to the satisfaction of the City of Kamloops. The CEMP shall clearly describe KGHM's commitments by which all potential Project impacts identified in the Environmental Assessment Application and any new potential Project impacts identified prior to or during Construction shall be mitigated during Construction and the means by which KGHM shall achieve full compliance with the CEMP, in addition to any and all terms and conditions of any Project approvals or permits that are applicable to the Construction phase.

KGHM must provide the final, accepted version of the CEMP to the City of Kamloops and the BCEAO a minimum of 120 days prior to the actual commencement of any Construction activities. KGHM must identify a QP with a minimum of 15 years of relevant CEMP experience to be accountable for the development, implementation, amendments to, monitoring of and compliance with the CEMP during all Construction years to the satisfaction of the City of Kamloops and the BCEAO.

3. It is recommended that as a condition of Project Certification, the BCEAO shall require KGHM to develop and implement an Operations Environmental Management Plan (OEMP) in consultation with and to the satisfaction of the City of Kamloops. The OEMP shall clearly describe KGHM's commitments by which all potential Project impacts identified in the Environmental Assessment Application and any new potential Project

impacts identified prior to or during Operations shall be mitigated during Operations and the means by which KGHM shall achieve full compliance with the OEMP, in addition to any and all terms and conditions of any Project approvals or permits that are applicable to the Operations phase.

KGHM must provide the final, accepted version of the OEMP to the City of Kamloops and the BCEAO a minimum of 120 days prior to the actual commencement of any Operations activities. KGHM must identify a QP with a minimum of 15 years of relevant OEMP experience to be accountable for the development, implementation, amendments to, monitoring of and compliance with the OEMP during all Operations years to the satisfaction of the City of Kamloops and the BCEAO.

4. It is recommended that as a condition of Project Certification, the BCEAO shall require KGHM to develop and implement a Decommissioning Environmental Management Plan (DEMP) in consultation with and to the satisfaction of the City of Kamloops. The DEMP shall clearly describe KGHM's commitments by which all potential Project impacts identified in the Environmental Assessment Application and any new potential Project impacts identified prior to or during Decommissioning and Reclamation shall be mitigated during Decommissioning and Reclamation and the means by which KGHM shall achieve full compliance with the DEMP, in addition to any and all terms and conditions of any Project approvals or permits that are applicable to the Decommissioning phase and Reclamation.

KGHM must provide the final, accepted version of the DEMP to the City of Kamloops and the BCEAO a minimum of 120 days prior to the actual commencement of any Decommissioning or Reclamation activities. KGHM must identify a QP with a minimum of 15 years of relevant DEMP experience to be accountable for the development, implementation, amendments to, monitoring of and compliance with the DEMP during all Decommissioning and Reclamation years to the satisfaction of the City of Kamloops and the BCEAO.

5. At least 120 days prior to commencing any activities in or within 500 metres of Jacko Lake, it is recommended that as a condition of Project Certification, the BCEAO shall require KGHM to establish a Multi-Stakeholder Jacko Lake Users Group (JLUG), of which the City of Kamloops shall be a member, under a Jacko Lake Users Group Terms of Reference to be established by the BCEAO. KGHM shall be required to implement and maintain the JLUG prior to and throughout Construction, Operations and Decommissioning and Reclamation phases as Jacko Lake is an important recreational amenity to the residents of the City of Kamloops.

The BCEAO shall develop a Terms of Reference for the JLUG to the satisfaction of the City of Kamloops and user/rec groups that directs KGHM to solicit and incorporate input from the City of Kamloops prior to and during any and all permitting and approval requirements for the Project that are relevant to Jacko Lake, prior to and during any impacts to the use of or access to Jacko Lake, prior to and during the implementation of all mitigation measures, prior to and during the development and implementation of all Construction, Operations and Decommissioning and Reclamation environmental management plans including but not limited to those identified in Section 11 of the Environmental Assessment Application, and prior to and during the development and implementation of all Construction, Post-Construction, Operations, and Decommissioning and Reclamation environmental management, monitoring and

adaptive management plans. KGHM must remedy concerns, issues or matters raised by the City of Kamloops, as a member of the JLUG to the satisfaction of the City of Kamloops and the BCEAO.

6. While this is not a recommendation for a condition to be imposed should the Project receive an Environmental Assessment Certificate, it is a general recommendation to ensure that the City of Kamloops' unabridged formal Project determination and rationale, as a member of the BCEAO Working Group assessing this proposed Project, is received by the Ministers charged with dispositioning the Project Environmental Assessment Application.

The City of Kamloops' formal submission and supporting rationale concerning the Environmental Assessment Application will be submitted to the BCEAO and the CEA Agency to, in turn, be incorporated by both the BCEAO and the CEA Agency into their Joint Assessment Report which will be provided to both the provincial and federal Ministers. The BCEAO however may not be able to fully incorporate all text and accompanying documentation into the body of the Joint Assessment Report to be provided to the Ministers. Accordingly, SLR Consulting (Canada) Ltd. recommends that the City of Kamloops along with providing their formal input as requested as a member of the BCEAO Working Group, request that all documentation provided to the BCEAO as part of the City of Kamloops' formal submission be included in the Joint Assessment Report as an Appendix so that the Ministers will have access to the full and final submission of the City of Kamloops, which may include the findings of the technical peer review.

## **9.0 LIMITATION OF USE**

This report has been prepared pursuant to a contract with the City of Kamloops and is for the sole use of the City of Kamloops for the sole purpose of conducting a peer review of the Environmental Assessment Application and Technical Support Documents for the development of the Project by KGHM to identify potential impacts to the City of Kamloops, including its residents, and to conduct an analysis of the sufficiency of the measures proposed to mitigate potential impacts to the City of Kamloops. SLR Consulting (Canada) Ltd., its servants, employees, officers, or agents accepts no responsibility of any kind to any person, entity or KGHM other than the municipal corporation of the City of Kamloops regarding the content of this report.

SLR Consulting (Canada) Ltd. has conducted this peer review of the Environmental Assessment Application and Technical Support Documents for the development of the Project using documentation of the date and version provided by KGHM and/or its consultants and the BCEAO. SLR Consulting (Canada) Ltd., its servants, employees, officers, or agents accepts no responsibility to any person or entity including the City of Kamloops for information, documented or otherwise, developed by KGHM and/or its consultants that differs in date or version from the documentation provided, for documentation not provided to SLR Consulting (Canada) Ltd., or for documentation provided but not reviewed by SLR Consulting (Canada) Ltd. under the terms of reference for this peer review contract.

SLR Consulting (Canada) Ltd., its servants, employees, officers, or agents accepts no responsibility to any person or entity including the City of Kamloops for the use of this report in conjunction with any other Project process including but not limited to any review, negotiation, agreement, endorsement, approval, or litigation, that SLR Consulting (Canada) Ltd. has not participated in fully, received full disclosure and has not provided its express written consent.

## 10.0 CLOSING

SLR Consulting (Canada) Ltd. has appreciated the opportunity to be able to complete this peer review of the Environmental Assessment Application and Technical Support Documents on the proposed Ajax Mine project on behalf of the City of Kamloops and is hopeful that this process has benefitted the City of Kamloops through the transfer of technical knowledge in the participation on the BCEAO's Working Group engagement process.

In our opinion, as the formal comments and dispositions demonstrate, KGHM has gained additional insight into the proposed Ajax Mine project from the thorough review undertaken by the City of Kamloops and SLR Consulting (Canada) Ltd. The Environmental Assessment Application has benefited from the detailed analysis provided through this process, as evidenced by the many comments, questions, technical contributions, revisions and additions to the Environmental Assessment Application technical information and methodologies. Notwithstanding that this phase of the proposed Project is complete, should this Project be certified by the BCEAO, there is a requirement for continued involvement by the City of Kamloops during the detailed design phase, the permitting and approvals phase, the operations and monitoring phase, and the decommissioning and reclamation phase to ensure that the City's concerns and requirements are both communicated and dispositioned.

The peer review process between the SLR Consulting (Canada) Ltd. peer review team, the City of Kamloops and the BCEAO Working Group was transparent throughout and the results achieved are a testament to the professional and collegial approach exhibited by all involved.

Accordingly, and subject to the limitations of the peer review and the recommendations contained herein, the Technical Peer Review, conducted by SLR Consulting (Canada) Ltd. on behalf of the City of Kamloops of the Environmental Assessment Application undertaken by KGHM for the Project, is closed.

Respectfully submitted on June 9, 2017 by;



**Paul Draycott, JD., LLB., Esq., EP**  
Project Manager and Lead Technical Expert

PD/ijk

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