Response to March 4th Letter from CIRNAC RE: 2AM-LUP1520 – Review of Lupin Mines Incorporated (LMI) Water Licence Renewal and Amendment Application and Final Closure and Reclamation Plan

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| **GENERAL APPLICATION** | | If the licensee intends to use their plans that have been previously approved under their current licence, this should be stated and the plans submitted with the renewal application. If the licensee is aware of any changes to their operations arising from their intent to proceed with full reclamation of the site, these changes should be updated in the associated plans and submitted to the Nunavut Water Board. | CIRNAC notes in its review of the application that some management plans typical of any licence were not attached. These include, but are not limited to: Spill management Plan, Solid Waste management Plan, and Sewage Waste management Plan. | The licensee should submit either updated management plans for their site or the management plans that were previously approved under their current license as part of the water licence renewal application | Links to the Licence's current and applicable Management Plans were provided in Table A, referenced in Box 9 of the Application. In addition, Appendix B of the FCRP, concordance with Licence conditiions and land leases, includes links to the various plans and reports submitted. |
| **EXECUTIVE SUMMARY** | Section 5a | This section does not indicate permanent closure of the Access Ramp | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 5c | The reference for information on geochemical characterization needs to be corrected | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 5d.1 | Clarification required for what “treatment plant” is being referred to in paragraph two | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 5d.2 | Last paragraph indicates permanent closure spillways will be constructed through Dam 1A and J Dam. Further details should be provided for these structures in the report | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 5d.3 | Last sentence notes that if exposed tailings are encountered when pond water level is lowered, they will either be relocated and covered with 1 m of esker material. The rationale for this decision should be provided | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 5d.4/f(v) | Given that 67% of PAG waste rock, additional assessment of ARD potential of mill site, airstrip access roads, and dams is warranted in the FCRP | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 5f(viii) | This section should indicate that burning of residual fuel, and placing PHC impacted soils underground would need to be approved by the regulator. Furthermore, clear provisions should be discussed with respect to verification testing to confirm clean up. If an Human Health Environmental Risk Assessment (HHERA) is being done then it should be a DQHHERA and not a screening level RA as costed in the RECLAIM estimate | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| | Section 7 | Amending the post closure monitoring from the current 25 years in the KP RECLAIM estimate to five years post remediation requires acceptance by the NWB | Comments identify questions for clarity in the referred sections | The referenced sections require further clarification from LMI | This comment will be addressed during the FCRP Technical Review Period |
| **SECTION 2 PROJECT DESCRIPTION** | Section 2.1.2 | The discussion on Climate Change is limited to temperature rise of 1 degree Celsius over the next century | Ensuring climate change considerations are addressed in closure is critical to many aspects of the closure plan, particularly as it relates to ARD potential of the PAG waste rock distribution around the site and tailings system closure components | LMI should provide additional information to support 100 year Climate Change predictions | This comment will be addressed during the FCRP Technical Review Period |
| | Section 2.1.8 | States that 40% of seeps at mine/mill site complex sampled in 2005 were acidic (Morrow 2006). The section also indicates 67% of waste rock is PAG, and PAG samples were distributed throughout the site, direct measurement of groundwater and seepage water confirmed ARD occurring (Golder 2017a) | There is no information on general locations of these samples and elements of the site that were sampled; did they include roadways, dams, pipelines, airstrip, etc. | LMI should provide additional clarification on the extent of the sampling and confirm their strategy to manage PAG issues on parts of the site that are located away from the Mill area | The location and NAG/PAG status of historical (2006) and recent (2017) ARD sample locations are provided in Figures 3 and 8 respectively of the 2017 Lupin Phase I_II ESA Update Report . Link: ftp://ftp.nwb-oen.ca/registry/2%20MINING%20MILLING/2A/2AM%20-%20Mining/2AM-LUP1520%20LMI/3%20TECH/2%20SECURITY%20(C)/2017/. Comments related to the management of PAG will be addressed during the FCRP Technical Review Period. |
| | Section 2.3.2 | States that rip rap will be recovered and placed to stabilize dams and enhance embankment stability | The FCRP did not provide conceptual figures or further details on where the rip rap will be recovered from (quarry or from existing dams) or where it will be placed as part of the reclamation works | LMI9 should provide a conceptual plan for each location where rip rap is to be provided and detail the source of the rip rap so as to ascertain if there is a potential PAG concern that needs to be addressed before the design can be accepted | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2 | Table 14 is incomplete, not all activities have timelines for when they are expected to occur | Schedule of proposed work needs to be consistent and understood | LMI should update Table 14 with missing timelines | A revised Table 14 has been prepared and is attached to this document |
| | Section 4.3.2 Reclamation Objectives and Closure Criteria | States that technical specification for engineered cover will be established | Without detailed specification of cover, it cannot be assessed properly | LMI should provide cover specification details? | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.3 Synthesis of Preferred Activities into Reclamation Plan | 1. This section indicates that regrading of excavated depressions will be achieved by bringing in waste rock from perimeter areas | 1. Potential exists for the placement of PAG materials | 1. LMI should provide information on materials handling/management to avoid PAG materials | This comment will be addressed during the FCRP Technical Review Period |
| | | 2. States that HHERA will be completed during final closure planning to develop site specific soil quality remediation objectives (see also section 6.2 which says HHERA is underway and is expected ready for review in July 2018) | 2. There no clarity on the status of the report and if it is available for review? | 2. LMI should provide the HHERA assessment report | The HHERA study is planned to be conducted in the summer of 2019. |

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| SECTION 4 PERMANENT CLOSURE and RECLAMATION | Section 4.3.2.3 Management and Accountability Structure | States that a QA/QC document will be developed to verify remedial activities are implemented as planned | There are concerns on how the proponent will verify that the PHC soil clean-up work is done in accordance with the site-specific standards established for the site in the HHERA or using NU regulations, and what standards will be established for the management of PAG concerns in the waste rock | LMI should provide the QA/QC program (QA/QC document) that will be implemented during the implementation of the FCRP | The following QA/QC programs will be included in the final FCRP Report:<br>LMI will use a combination of field screening and confirmatory lab analysis to ensure that PHC soil remediation work is executed in accordance with applicable regulations and site specific criteria. Before excavation of PHC-impacted soil, test pits will be advanced and soil samples will be field-screened for combustible headspace vapors (CHVs) and volatile headspace vapors (VHVs) to ensure that the excavation is focused on all impacted areas. During excavation, soil samples will be collected and field-screened to determine when/where the limits of PHC impact have been reached. At the limits of impact, soil samples will also be collected and submitted to an accredited laboratory for analysis of BTEX, PHC F1-F4 and PAH and confirmation of field results. Duplicate samples will also be collected as part of the QA/QC process. The number of confirmatory samples collected will be in general accordance with the Association of Professional Geoscientists of Ontario's *Guidance for Environmental Site Assessments 153-04 - as Amended* (Association of Professional Geoscientists of Ontario, April 2011).<br>All mine rock (except that in the airstrip and roads to be kept in service) will be removed or covered. No attempt will be made to segregate PAG and NAG mine rock, therefore no further classification testing is required. The QA/QC program for mine rock removal will be visual inspection to confirm it has been removed or covered. |
| | Section 4.3.2.3 Uncertainties and Information Needs | States that HHERA results may affect final soil volumes | The uncertainties associated with soils needs to be reduced as per results of HHERA | LMI should incorporate results of HHERA | The HHERA study is planned to be conducted in the summer of 2019. |
| | Section 4.3.2.3 Monitoring, Maintenance, and Reporting Program | 1. States that the engineered cover (to risk manage arsenic impacted soils) will be monitored post closure and repairs made if and as needed | 1. No information is provided on nature of performance monitoring other than visual inspection | 1. LMI should provide additional details on monitoring program | This comment will be addressed during the FCRP Technical Review Period |
| | | 2. States Groundwater and seepage will be monitored on completion of remedial works | 2. There is no clear information provided on the nature of the groundwater and seepage monitoring | 2. LMI should provide additional details on the groundwater and seepage monitoring | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.3 Contingency Program | 1. This section states that if post-closure monitoring identifies significant deficiencies with the engineered cover a more robust cover could be implemented | 1. There is no clear information provided with respect to how this post closure robust cover activity will be carried out | 1. LMI should provide information on how this robust cover activity would be carried out post closure | This comment will be addressed during the FCRP Technical Review Period |
| | | 2. This section also states that the Nunavut industrial land clean up criteria will be used | 2. Not clear if this has been accepted by the NWB for this site or other sites in NU | 2. LMI should confirm the specific official standards that will be applied for the reclamation/remediation works | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.4 Underground Workings Contingency Program | 1. This section states that it may be necessary to pump water out of the crown pillars to the shaft. On page 13, it is noted that discharge to the environment may be considered as a contingency if water quality meets acceptable criteria | 1. It is unclear whether surface discharge is an option only if shaft discharge is not possible and water treatment is not needed | 1. LMI should clarify if surface discharge of treated mine water is considered an option | This comment will be addressed during the FCRP Technical Review Period |
| | | 2. In this section there is no mention of an ice plug or permafrost related issued within the underground workings, and if there is, what approach will be used for mitigation in order to allow for disposal of PAG waste rock and PHC impacted soils into the underground | 2. It is unclear whether there are ice related issues that could impact the placement of waste and PHC impacted soils within the underground | 2. LMI should clarify if ice/permafrost related issues have been investigated, and how any potential concerns will be mitigated in advance of the reclamation works | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.7 Waste Rock - Project Description | States 67% of 1,000,000 m3 are PAG and most of the WR was used for construction at Mill | The estimated PAG increase from less than 10% to 67% is a significant increase in PAG materials | Given the present high percentage of PAG, can LMI provide any estimates on potential waste rock distribution across the property (e.g. mill areas, roads, dams, airstrip, etc.) | The location and NAG/PAG status of historical (2006) and recent (2017) ARD sample locations are provided in Figures 3 and 8 respectively of the 2017 Lupin Phase I_II ESA Update Report . Link: ftp://ftp.nwb-oen.ca/registry/2%20MINING%20MILLING/2A/2AM%20-%20Mining/2AM-LUP1520%20LMI/3%20TECH/2%20SECURITY%20(C)/2017/. |
| | Section 4.3.2.7 Waste Rock – Possible Reclamation Options & Preferred Activities | This section states that contouring and covering with a 1 m esker cover will result in minimal contact between water and the waste rock. It also states that the 1m cover will be partially frozen during spring freshet and infiltration through the cover will be small | About 1 million cubic meters of waste rock (67% PAG) are proposed to be left in place, sloped and contoured for drainage using a nominal 1 m of esker cover | (1) LMI should provide geochemical model of the proposed mill pile, and other features constructed of PAG waste rock (e.g. the airstrip, dams, roads) for current conditions and long-term climate change conditions. (2) LMI should provide estimates of contaminant loads released to the environment under these conditions. (3) LMI should provide confirmation that the current thermal monitoring program is sufficient to address the issues relating to the waste rock, the TCA, and the proposed mill waste rock pile | This comment will be addressed during the FCRP Technical Review Period |

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| | | Figure 10 provides conceptual outline of materials to be excavated from perimeter and outline of central consolidated area | The illustration does not clearly indicate if the waste rock from roads and pipelines are being removed, and to what degree excavation will occur at the airstrip | LMI should clarify the nature and extent of the excavation proposed | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.7 Waste Rock – Contingency Program | Figure 10 provides surface plan of proposed excavation and placement areas. The notes indicate that Figure 10 is an estimate, and the actual boundary will be based on field conditions | The section does not provide conceptual cross-section or details on potential slopes | LMI should provide conceptual sections illustrating proposed height of central waste rock, typical details of cover placement and the means by which the loss of fine grained soils from the esker cap into the waste rock will be mitigated | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.8 Tailings Impoundment and Containment Systems - Project Description | This section notes that when natural drainage is re-established and water is drawn down, it is possible that spilled tailings presently under water may become "exposed" and these tailings will either be covered in place with esker material or relocated to the TMA and eventually covered | Tailings are known to be acid generating and seepage will be acidic. It is not acceptable to leave unconfined tailings outside of the tailings dams even if covered by esker materials | LMI should provide justification for leaving exposed tailings outside of the tailings basin | This comment will be addressed during the FCRP Technical Review Period |
| | | States that "stability of all dams will continue to be assessed, and where required, for example on the downstream side of Dam 4, minor grading , rip rap placement, and backfilling may occur in response to recommendations provided by the TCA engineer of record | The ICRP in Section 6.5.3 stated that "a major program of dam enhancement is planned during closure activities. The sides of all dams will be brought to at least a 2.5:1 slope by the addition of quarried waste rock. This will significantly enhance both stability of the dam and erosion protection of all dams." The current closure plan is a departure from the ICRP commitment | LMI should provide information supporting this material departure from the previous commitment to rip rap armor all dams to enhance stability and erosion protection | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.10 Transportation and Infrastructure Support | No other significant concerns with this section aside from issues previously raised with respect to waste rock being used in the construction of site access roads and the airstrip as it relates to potential PAG waste rock having been used in their construction | | | |
| | Section 4.3.2.12 Landfarm | No significant concerns with the FCRP, however the RECLAIM estimate does not appear to have a cost to decommission the landfarm once PHC impacted soils have been successfully treated or the material is placed underground | | | |
| | Section 4.3.2.13 Waste Management Systems - Project Description | Missing Project Description Section | Inconsistency with other sections | LMI to add Project Description Section | This section addresses the Water Management Systems for the Tailings Impoundment and Containment Systems (TCA), for which a joint project description is provided in the preceding Section 4.3.2.8. |
| | Section 4.3.2.13 Waste Management Systems – Synthesis of Preferred Activities into a Reclamation Plan | This section notes that to achieve natural drainage, two engineered riprap spillways will be constructed, along with a swale consisting of riprap on geotextile | No information is provided on the design of the spillways | LMI should provide the design basis for the spillways and conceptual designs of the spillways | This comment will be addressed during the FCRP Technical Review Period |
| | Section 4.3.2.13 Waste Management Systems –Contingency Program | This section states that if water quality fails, construction of spillways will be deferred | Table 14 indicates spillways will be constructed in 2025. It is unclear if implications of deferring spillway construction beyond the stated period are considered with respect to final closure of the site | LMI should confirm timing of planned spillway construction, and consideration of the deferral in its cost estimate | A revised Table 14 is attached to this document. The implications of deferring spillway construction beyond the stated period have been considered and discussions related to the exact timing will be discussed during the FCRP Technical Review Period |
| | Section 4.4 Material Balance | No significant concerns. However on Table 17 the volume of demolition rubble (30,000 m3) does not match what is described earlier in the FCRP document (55,290 m3). | Inconsistency in the reported numbers | The volume of demolition waste, including the waste being generated from the local bone yards, should be consistent in all reports and clearly outlined in Table 17 | The volumes and breakdown provided in FCRP Table 17 are correct. The statement on page vi of the FCRP Executive Summary will be restated for clarity to read, "....55,290 m3 (including 24,640 m3 of waste rock and esker material used for infilling, contouring and capping)." |
| | Section 4.5 Schedule | On the Table 14, some only activities have timelines for when they are expected to occur | Schedule of all proposed work on the Table 14 should have timelines | LMI should update Table 14 with missing timelines | A revised Table 14 has been prepared and is attached to this document |
| **SECTION 5 MONITORING** | SECTION 5 MONITORING | The Phase 3 Passive Closure Period Monitoring is stated to be for a period of 5 years | The ICRP anticipated a closure phase annual monitoring period of ten (10) years, and post closure monitoring every three (3) years thereafter to the 25 year mark | LMI should explain the basis for their proposed reduced monitoring period | This comment will be addressed during the FCRP Technical Review Period |
| **SECTION 6 POST REMEDIATION SITE AND ENVIRONMENTAL CONDITIONS** | Section 6.1 Post Remediation Site Conditions | LMI has not included any commitments to monitor site conditions, post remediation. These include, but are not limited to, water quality, waste rock seepage and Acid Rock Drainage (ARD), stability of esker cover, etc. | | LMI to provide information on post closure monitoring of site | This comment will be addressed during the FCRP Technical Review Period |
| | Section 6.2 Post Remediation Environment Conditions /Post Remediation Risks to Human Health and Environmental Health | Notes commitment to HHERA being carried out | The HHERA document has not been provided | LMI should provide the HHERA document | The HHERA study is planned to be conducted in the summer of 2019 |

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| SECTION 7 FINACIAL SECURITY | Underground | Costs associated with the relocation of waste rock to complete a 3 m thick cover are too low as the material to be used in the construction of the cap will likely need to be excavated, hauled, placed and graded rather than simply dozed into place. This is particularly true if PAG rock issues are identified in the waste rock immediately adjacent the crown pillar.<br>- It is unclear where any ice or water management costs are included as may be required in advance of the PHC impacted soil and PAG waste rock placement into the underground workings | Clarification is needed with respect to the basis for the costing | LMI should provide additional information on the basis for the costing | This comment will be addressed during the FCRP Financial Security review period |
| | Tailings | How was the volume of 15,000 m3 derived for the riprap to be placed on the M Dam?<br>- The time being allotted here seems low for the amount of work to be done however in the absence of a conceptual plan it is difficult to comments on this work item. How was the quantity of time derived for the grading of the M Dam?<br>- There is little clarity on how the basis for the cost is related to the Cell 4 allowance.<br>- What is the basis for the number of thermal units to be installed and monitored? More information is required to confirm the count.<br>- It would help if there was a plan in the FCRP to help the reviewer understand if there is sufficient number of thermistors on site to address future monitoring requirements for both the TCA and the PAG waste rock areas | Clarification is needed with respect to basis for costing | LMI should provide additional information for clarity on the basis for the costing | This comment will be addressed during the FCRP Financial Security review period |
| | Waste Rock | There is a lack of clarity on the basis for the volume of esker material required to cap the consolidated PAG waste rock.<br>- The rate for the relocation of the waste rock is relatively low given the amount of work required. May consider using the rate for SC4L ($9.30/m3).<br>- How has the volume of PAG waste rock in the access roads and airstrip been accounted for?<br>- The rate for the load, haul, dump/doze the impacted PAG waste rock should include for an additional $1.05/m3 as the current rate only accounts for the load, haul and tip with no allowance for grading. | Clarification is needed with respect to basis for costing | LMI should provide additional information for clarity on the basis for the costing. | This comment will be addressed during the FCRP Financial Security review period |
| | Chemical | The rational for the decontamination costs for the oil, fuel and glycol systems is unknown. The cost seems low especially for the large diesel fuel tanks.<br>- The asbestos abatement rates for the floor tile seem low given the level of effort, typically greater for the tile as compared to the vinyl sheeting. Would use the same rate for both pieces of work.<br>- No costs provided for the burning of waste oil and/or residual fuel as the costs provided are for off-site removal. Also, the rate for the removal of waste oil and fuel should be the same given the level of effort required to consolidate, containerize, and ship off site for recycling or disposal.<br>- The cost to complete the HHERA seems low given the need to complete a Detailed Quantitative HHERA.<br>- It is unclear where the verification sampling costs have been accounted for in the estimate.<br>- Where is the cost to manage the 500 m3 of PHC impacted soil currently in the landfarm?<br>- Where is the cost to decommission the landfarm?<br>- It is unclear where the costs are for the decontamination and decommissioning of above ground equipment has been included | Clarification is needed with respect to basis for costing | LMI should provide additional information for clarity on the basis for the costing | This comment will be addressed during the FCRP Financial Security review period |
| | Buildings | The production rate for the hoe ram to break the concrete floor seems high. What is the basis for the production rate?<br>- What is the basis for the consolidation of the boneyard cost?<br>- It is unclear where the Non-PAG waste rock that will be used in the capping of demolition waste will come from?<br>- The volume (30,000 m3) of demolition waste does not align with the FCRP indicated volume of 55,290 m3.<br>- What is the basis for the cost allowance to operate the landfill? | Clarification is needed with respect to basis for costing | LMI should provide additional information for clarity on the basis for the costing | This comment will be addressed during the FCRP Financial Security review period |
| | Interim Care and Maintenance | The time period for ICM should be five years. LMI should update their closure cost estimate to include a time period of five years for their ICM | | | This comment will be addressed during the FCRP Financial Security review period |
| | Post Closure Monitoring & Maintenance | The use of a discounted rate is not appropriate as the discounted rate is effectively equivalent to CPI and as such the two net out | | | This comment will be addressed during the FCRP Financial Security review period |
| | Mobilization | Not clear why no cost has been assigned for the worker cross shift travel time and any associated costs with accommodations related to worker cross shifts (i.e. hotels in Edmonton or Yellowknife). | | These costs should be included in any closure cost estimate | This comment will be addressed during the FCRP Financial Security review period |