LUPIN MINES INCORPORATED
(A Wholly Owned Indirect Subsidiary of Mandalay Resources Corp.)

Richard Dwyer,
Manager of Licensing
Nunavut Water Board
PO Box 119
Gjoa Haven, NU X0B 1J0

3 January 2020

Re: LMI Final Submission (2AM-LUP1520)

Dear Mr. Dwyer,

In its enclosed responses, LMI has responded to all comments made by CIRNAC (submissions filed with the NWB on December 6 and December 18, 2019) and ECCC (submission filed with the NWB on December 13, 2019) and has provided further details to confirm that LMI has fulfilled all commitments required to date, outlined in the NWB Pre-hearing Conference Decision Report (NWB 2019).

It is our hope that the enclosed submission resolves any outstanding issues identified by intervenors. LMI believes any “unresolved” matters can be addressed in advance of or at the hearing, or through establishment of terms and conditions of a renewed/amended water licence. Renewal and amendment of LMI's water licence is essential to ensuring that the closure work at the Lupin Mine continues in a timely manner in accordance with the stringent requirements of the Nunavut Agreement and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA). It is not in the public interest to further delay or refuse the renewal and amendment of the licence which will permit the responsible closure and reclamation of the Lupin Mine to continue on schedule.

Progressive release of security is essential to support reclamation and closure and is consistent with the legal requirements of the NWNSTRA and its regulations. Per section 10 of the *Nunavut Waters Regulations*, the security to be fixed by the Board at any given time cannot exceed the aggregate of:

> For the purposes of subsection 76(1) of the Act, the Board may fix the amount of security required to be furnished by an applicant for a licence, a licensee or a prospective assignee in an amount not exceeding the aggregate of
>
> (a) the costs of the abandonment of the undertaking;
>
> (b) the costs of the restoration of the site of the undertaking;
>
> (c) the costs of any ongoing measures that may remain to be taken after the abandonment of the undertaking; and
>
> (d) the compensation that a person, including the designated Inuit organization, who is adversely affected by the use of waters or deposit of waste may be entitled to under section 13 of the Act.

In support of the important public policy goals that closure and reclamation of mine sites be carried out by mine owners and operators in a timely manner and that the security held by the Minister at any given time should not exceed the amounts permitted by Section 10 of the *Nunavut Waters Regulations*, Section 76(5) of the NWNRTA requires CIRNAC to return the funds "without delay":

> Where the Minister is satisfied that an appurtenant undertaking has been permanently closed or permanently abandoned or the licence has been assigned, any portion of the security that, in the Minister's opinion, will not be applied under subsection (2) shall be returned to the licensee without delay.

Consistent with the Mine Site Reclamation Policy for Nunavut (INAC 2002), LMI supports CIRNAC's assertions that:

- *Consideration should be given to alternate or innovative forms of security, such as mine reclamation trusts, provided they meet certain criteria that protect the governments interests and objectives.*
- *Mining operators should be credited for approved progressive reclamation, and the value of financial security required should be adjusted in a timely fashion.*
- *As reclamation work is performed, the environmental liability is reduced, and the financial security required may decrease proportionately.*
- *Credit for progressive reclamation works should be made in a timely fashion in accordance with authorities set out in the applicable legislation.*
- *As reclamation work is successfully completed and environmental liability is reduced, the amount of financial assurance required will be proportionately reduced and the surplus refunded.*

In this case, LMI has taken care to develop appropriate reclamation milestones which would ensure that CIRNAC will not incur reasonable costs under subsection 87(4) or 89(1) of the NWNSTRA. The release of security associated with these milestones takes into account the corresponding reduction in liability to the Crown under the NWNSRTA. It is our view that these milestones should be incorporated in the licence as part of the approved Final Closure and Reclamation Plan and once the specific activities included in the milestones are completed, the NWB should reduce the security required under the Licence and CIRNAC should release funds "without delay", per the requirements of section 76(5) of the NWNSRTA.

LMI and CIRNAC continue to work cooperatively on a framework for progressive release of security. After various telephone discussions with CIRNAC, LMI's initial draft framework submission was provided to CIRNAC on October 23, 2019 in response to Commitment No. 9, and filed with the NWB as Attachment C to the Draft Water Licence Framework (Golder 2019a) on November 15, 2019. CIRNAC provided comments to LMI on the initial draft framework on December 23, 2019. Ongoing discussions between LMI and CIRNAC were held on January 2, 2020 with further meetings tentatively proposed for January 6 and 7, 2020 and additional meeting potentially in advance of the public hearing, to achieve further resolution and clarification of security. LMI will provide a summary of resolution to the NWB in the form of exhibits prior to or at the public hearing.

As all parties are aware, the Lupin Mine has not been in operations or generated any financial benefits to LMI since Mandalay Resources acquired the property. Nonetheless, LMI takes its obligations as a responsible licensee very seriously. LMI is proud of the significant progress that has been achieved by LMI at the satisfaction of CIRNAC towards the full reclamation and closure of the Lupin Mine in recent years. LMI has entered into contractual commitments with a third party to complete its goal of full closure of the site in accordance with all legislative requirements. However, continued timely completion of the contractual requirements is dependent on progressive timely release of security by CIRNAC to LMI in acknowledgment of milestones completed. Delays in release of funds to LMI would cause serious delays in the completion of the work and extends the risk of potential liabilities associated with the Lupin Mine for all parties involved.

Given the importance of these issues LMI is confident that all parties can reach a consensus on how to proceed in a way that will provide a precedent on how responsible reclamation of mine sites can be undertaken in Nunavut through cooperation between proponents and the federal government and in full compliance with all legislative and licence requirements.

Yours truly,

"Karyn Lewis"

Karyn Lewis
Project Manager, Lupin Mine Incorporated

LUPIN MINES INCORPORATED

2018 Application for Water Licence Renewal/Amendment, and Final Closure and Reclamation Plan

Final Submission for Public Hearing, January 15-16, 2020

Submitted to:

Nunavut Water Board
PO Box 119
Gjoa Haven, NU X0B 1J0

Submitted by:

K. Lewis, Project Manager

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January 3, 2020

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1.0 INTRODUCTION

On March 29, 2019, the Nunavut Water Board (NWB or Board) issued correspondence indicating that the application submitted by Lupin Mines Incorporated (LMI) for the renewal and amendment of its current Water Licence 2AM-LUP1520, including the submission of a Final Closure and Reclamation Plan (Application), was deemed to be complete. A “Notice of Application” was issued and the NWB commenced its Technical Review of the Application.

The March 29, 2019 correspondence formally requested that interested parties complete a thorough technical assessment of the Application and provide submissions of technical review comments and representations to the Board on or prior to April 29, 2019.

Technical review submissions were received from Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) and Environment and Climate Change Canada (ECCC) on April 30, 2019 and April 29, 2019 respectively.

LMI provided a Technical Comment response package on May 17, 2019 to the NWB, which included the response from LMI to each of the comments as presented in both the CIRNAC and ECCC’s submissions, references and attachments where necessary.

NWB held a Pre-hearing Conference and Technical meeting in Kugluktuk on June 6-7, 2019, and subsequently issued a PHC/TM Decision on June 18, 2019. The Decision included a list of commitments to be addressed by LMI in advance of a Public Hearing on the Application. LMI fulfilled the commitments required per Appendix D of the Decision and the NWB issued confirmation and notice of public hearing on November 8, 2019.

This document represents LMI’s final written responses to submissions received from CIRNAC on December 6 and 18, 2019 and ECCC on December 13, 2019.

2.0 RESPONSES TO CIRNAC REVIEW OF DOCUMENTATION

Responses to CIRNAC memorandum dated December 6, 2019 *Re: 2AM-LUP1520 –Review of documentation from Lupin Mines Inc. (LMI) in response to commitments made at the technical meeting–Lupin Mine Property – Kitikmeot Region, Nunavut*

2.1 Human Health and Ecological Risk Assessment (HHERA)

Interested Party:	CIRNAC	**Initial Submission No:**	1
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

Required HHERA was not provided prior to the technical meeting.

Commitment:

HHERA would be provided on or before October 15, 2019.

CIRNAC Comment:

The objectives of the HHERA report were to evaluate the potential risks to human health and the environment from the contamination associated with the historical operation of the Lupin Mine Site (Site) as a gold mine in order to derive site-specific target levels (SSTLs) for any potential risks identified, and to use the SSTLs to define areas requiring remediation and/or risk management. The HHERA will also confirm that the measures outlined in the Final Closure and Reclamation Plan (FCRP) are sufficiently protective of human health and the environment. This included the proposal to consolidate much of the waste rock in the mill and camp area in a 'dome' and to cap it with an infiltration reduction cover comprising a one meter thick layer of esker sand and gravel.

The geographical extent of the assessment was limited to the Site defined as the parcel of land occupied by the mine and mill site only, and associated roads and water supply facilities at Contwoyto Lake; it is noted that the Tailings Containment Area (TCA) that could be subject to Acid Rock Drainage (ARD) was not part of the assessment. Risks resulting from historical operations were evaluated based on current environmental conditions (soil, groundwater, surface seepage).

Predictions from surface water quality modelling of receiving water bodies (i.e., Boot Lake, East Lake and Lower Sewage Lake) evaluated the performance of the proposed granular esker cover of the waste rock dome to assess risks associated with ARD-seepage from the covered dome based on expected conditions. The surface water quality model incorporated hydrologic inputs based on thermal-seepage modelling. The predictions in the water quality model were based on changes in contaminants of concern (COC) seepage loads resulting from changing runoff/infiltration conditions, and did not consider geochemical processes within the waste rock pile during infiltration that could also contribute to COC loads in the waste rock seepage.

Risks were evaluated within the risk assessment framework endorsed by federal and provincial regulatory agencies and followed sound methodology. The assessment included relevant COC, exposure pathways and receptors including ecological species at risk.

Risks to human health and ecological receptors were identified from several COC's in soil, plants and groundwater under current conditions. Exceedances of SSTLs were noted in areas where waste rock will be removed or covered, and the remediation and risk management measures outlined in the FCRP were considered sufficient to address these risks.

Moderate risks to aquatic life from low pH were identified for Boot Lake and East Lake under predicted future lake conditions, suggesting that proposed measures in the FCRP to manage waste rock may not be sufficient. Risks to

aquatic life were also identified from cadmium, cobalt and copper in Boot Lake, East Lake and Lower Sewage Lake under predicted future conditions but were classified as negligible based on the conservatism build into the water quality model. However, water quality monitoring of these lakes was recommended to assess current conditions and evaluate the conservatism of the water quality model in order to verify that these risks are negligible.

CIRNAC Conclusion:

The HHERA meets the objectives or purpose of the assessment. However, CIRNAC recommends the following for further discussions;

I. Updated monitoring plan, including duration and frequency, is required to ensure that the planned measures are adequate for the protection of the human health and the environment at closure and post-closure.

II. LMI should include the tailings containment area in the assessment or justify why it is not necessary.

LMI Response:

I. As confirmed by the NWB in the Pre-hearing Conference Decision Report, LMI is committed to provide a post-closure monitoring plan, following discussions with all stakeholders one year following the approval of the Licence (NWB 2019). As noted by CIRNAC, LMI will endeavour to ensure that the planned measures are adequate for the protection of human health and the environment.

II. The final closure assessment for the Tailings Containment Area (TCA) was completed as part of Licence renewal in 2014 and approved by the NWB per Licence 2AM-LUP1520 (Part I, Item b). At that time, LMI resubmitted the Ecological Risk Assessment (Golder 2004) for the Lupin Mine Tailings, which was also approved by the NWB (Part I, Item 1d). The objective of the risk assessment was to estimate the potential human and wildlife risks after closure of the mine. The NWB approved the Ecological Risk Assessment (Golder 2004) as part of the renewal licence approved by Minister in 2015 (Refer to Part I, Item 1d of Licence No. 2AM-LUP1520).

Status:

With its commitment confirming that LMI will submit an updated post closure monitoring plan and confirmation that the tailings containment area was included in the final closure assessment and approved by the NWB, LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520, Appendix D: List of Commitments; June 2019.
- Golder 2004. Final Report Ecological Risk Assessment for the Lupin Mine Tailings Containment Area. December 2004.

Attachments: n/a

2.2 Security

Interested Party:	CIRNAC	**Initial Submission No:**	2
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

Security to be updated and agreed upon by interested parties prior to Public Hearing.

Commitment:

Updated security estimate would be provided in advance of Public Hearing.

CIRNAC Comment:

The provided estimate has limited information to support the majority basis of costs.

I. Almost 40% of capital cost is “Contractor indirects”. Mobilization is ~80% of Indirect Cost, and is based on a series of Lump Sum (LS) items with no backup. Out of the total security held (approximately $23.3 million) about 16.5million (~71%) is either LS or indirect costs with limited backup. Clarity is required from LMI to provide additional description of the basis of the estimate.
II. LMI proposed Final Closure Plan (CP) estimate does not include for rip -rap armouring of the outer slopes of the dams. This is inconsistent with the approved 2005 Tailings Management Area (TMA) Closure Plan works.
III. LMI latest estimate provides for $999,674 for TMA closure. Review of prior estimates shows LMI values of $3.9 (2014) and $2.1 (2017) million. The accepted Knight Piesold 2016 estimate was $4.9million for the TMA.

Effective review of the estimate cannot be completed in a meaningful manner until further descriptions are provided for the various line items.

CIRNAC Conclusion:

CIRNAC recommends that LMI provide additional detail on the planned nature and extent of the work to be undertaken, as well further discussions may be warranted on the closure cost estimate to clarify and confirm the estimates.

Update on Security: CIRNAC has currently reviewed the documentation provided by LMI, however at this time CIRNAC has many questions for LMI and therefore has yet to produce an updated security cost estimate of its own.

For clarity CIRNAC is stating that it has not yet come to agreement on updated security closure cost and is requiring LMI to provide additional documentation as stated above and participate in further security discussions.

CIRNAC has also reviewed the security framework for the periodic release of security and will be providing LMI with our comments early next week.

LMI Response:

LMI's interpretation of CIRNAC's request that, "*LMI provide additional detail on the planned nature and extent of the work to be undertaken*" is that once further descriptions are provided by LMI for the specific line items I, II, and III summarized above, CIRNAC's information request would be fulfilled. Accordingly, LMI has provided the following additional information in order to satisfy CIRNAC's request for additional detail on the planned nature and extent of the work to be undertaken:

I. The current security estimate (Updated Security Estimate RECLAIM Model – Commitment No. 2. (Golder 2019c) and Attachment C to the Draft Water Licence Framework (DWLF) – Commitment No. 15 (Golder 2019a)) is derived from the signed contract between LMI and the Contractor. This estimate represents a firm price, which is inherently more accurate than estimates based on precedent unit rates (such as the Unit Cost database in RECLAIM 7.0). The security estimate reflects the way the contract itself is structured into direct costs and Contractor's indirects. LMI will work with the NWB and CIRNAC to establish a framework that spreads the lump sum costs appropriately over the closure construction period.

II. The Knight-Piésold (KP 2016) estimate included an allowance for placement of 90,000 m3 of rip rap to flatten the slopes of dams to 3H:1V. Stability analysis reported in the response to Commitment No. 6 (Stantec, 2019a) concluded that, aside from flattening the downstream slopes of Dam K and Dam M to 2.1H:1V, no other slope flattening was required to maintain adequate slope stability. As further described in response to CIRNAC Initial Submission No. 5 below, esker materials will be used for slope flattening. The current security estimate (Golder 2019a) already includes provisions for the flattening of the downstream slopes of Dam K and Dam M. As noted in the response to Commitment No. 6 (Stantec, 2019a) surface water management structures are being installed in Cell 5 and Cell 3 during cover placement to allow for closure surface water to flow passively away from the face of the dams and into engineered outflow structures. LMI will add an allowance for the placement of D_{50} = 260 mm esker boulder materials, underlain by non-woven geotextile, to construct the engineered outflow structures.

III. The amount cited for the Knight-Piésold (2016) estimate is obsolete, having been subsequently revised by the NWB in Water Licence Amendments Nos. 2 and 3, which took into account work that had been completed since 2015. The current amount in the amended Interim Closure and Reclamation Plan (ICRP) water licence attributable to the TCA is about $1.512 M. The amount attributable to the TCA in Appendix G of the FCRP is $2.075 M. The direct costs for the TCA have since been reduced to about $1.000 M (Golder 2019a, Golder 2019c) once lower unit costs in the Contractor bid were taken into account. It should however be noted that the $1.000 M figure is not directly comparable to the previous figures because it excludes fuel, equipment rental and other Contractor indirect costs that are accounted for separately in the overall estimate. In fact, the overall security amount proposed in the DWLF ($23,334,109) is higher than that in the FCRP ($20,263,210) (LMI 2018).

Ongoing discussion between LMI and CIRNAC were held on January 2, 2020 with further meetings tentatively proposed for January 6 and 7, 2020 and additional meeting potentially in advance of the public hearing, to achieve further resolution and clarification of security framework. LMI will provide a summary of resolution to the NWB in the form of exhibit(s) prior to or at the public hearing.

Status:

With its commitment to ongoing discussions to achieve further resolution and clarification on the security framework, LMI considers this item resolved.

References:

- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum. November 2019.
- Golder 2019c. Golder Technical Memorandum to support LMI Response to Commitment No. 2 – Updated Security Estimate Reclaim Model. November 2019.
- Stantec 2019a. Stantec Technical Memorandum to support LMI Response to Commitment No. 6 – Geotechnical Review on the Long-Term Stability of the TCA Dams. November 2019.
- KP 2016. Knight-Piésold Consulting – Third Part Technical Review of Reclamation Security Estimates for Lupin Gold Mine, prepared for Nunavut for Nunavut Water Board. December 2016.
- LMI 2018. Lupin Mines Incorporated – Lupin Mine Site: Final Closure and Reclamation Plan. July 2018.

Attachments: n/a

2.3 Historical Data

Interested Party:	CIRNAC	**Initial Submission No:**	3
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

CIRNAC requested confirmation of the ARD potential of the tailings dams, roadways as well as other built structures, and for LMI to indicate whether, based on the historical information, the additional study on ARD geochemical and pathway modeling will or not be provided.

Commitment:

LMI would go through records and provide historical data analysis regarding ARD potential of tailings dams and roadways, and so on.

CIRNAC Comment:

Brief memo by STANTEC dated August 14, 2019 for LMI presented results of URS Corporation 2005 Acid Base Accounting (ABA) work on 10 samples which concluded ARD was not an issue. This is based on one sample being Acid Generating (AG), 5 samples Potentially Acid Generating (PAG), and 4 samples Non-Potentially Acid Generating (NPAG). The submitted memo also estimated waste rock in dams at 100,000m3 based on an air photo estimate of 0.5m thickness of waste rock on TCA dams.

CIRNAC had requested reviews of the construction history to assess how much waste rock (which is now known to be much more acid generating than earlier predicted) was used in the construction of the dams, and then determine if additional characterization work would be beneficial.

LMI has not provided adequate historical information on the actual quantities of waste rock used in the construction of the dams. Such information is available in Kinross' Closure Plan for the TMA, Holubec, Jan 2005. For example, page 19 notes that Dam 3D constructed in 1986 had a final height of 9.5m, and due to sloughing of the down-stream face and need for more capacity, a 10m waste rock buttress was placed along the downstream side. Based on a length of 550m, this single structure alone accounts for more than 55,000m3 of waste rock. On that basis it is likely that the Stantec estimate of waste rock volume in the tailings dams are on the low side.

CIRNAC Conclusion:

CIRNAC recommends that LMI thoroughly review the historical data available (i.e. Kinross Closure plan for the TMA, Holubec Jan 2005) to be able to provide a more accurate account of the ARD potential at site given that waste rock was used and that the waste rock is now known to be much more acid generating then previously predicted.

LMI Response:

LMI has thoroughly reviewed the historical data available (including the Kinross Closure plan for the TMA, Holubec Jan 2005 and for all of the reasons below, are of the view that an accurate account of the ARD potential at site is reflected in the closure plan.

The original commitment required LMI to go through records and provide historical data analysis regarding ARD potential of waste rock used in tailings dams (Stantec 2019b). To fulfill this commitment, historical information (including Holubec 2005) was thoroughly reviewed to determine the estimated volumes of surficial waste rock used as armoring for tailings dams. The estimated volumes did not consider deeper waste rock used as a structural component of the dams, as that material is currently encapsulated in permafrost and therefore not a potential risk for ARD.

To further support the response conclusions, Stantec reviewed and analyzed the tailings dam cross-sections provided in Stantec's response to Commitment No. 6 (Stantec 2019a) to confirm the volumetric calculations of waste rock with ARD potential. These cross-sections were not available for the original TCA waste rock response given the respective submittal dates for the two responses. The volume of waste rock estimated from the cross-sections is considered more accurate than Holubec (2005) and to be most representative of current conditions since it is based on observations made during annual tailings dam inspections.

Based on the developed cross-sections and historical data, if the deeper structural waste rock volumes are included, approximately 375,000 metric tonnes of waste rock are estimated to be in the TCA dams in total. However, excluding the deeper waste rock (>2m deep) which is encapsulated in permafrost (supported by site thermistor reading data), the total waste rock mass decreases to 185,000 metric tonnes. This estimate is conservative because it includes waste rock on the upstream faces of some dams that are covered with tailings. Any waste rock in these dams would be contained in the tailings cells. Of the 185,000 metric tonnes, more than 100,000 metric tonnes (nearly 60%) is located in J Dam and Dam 3D. It is important to note that the estimate for N Dam, which accounts for nearly 25,000 metric tonnes (nearly 15%) of the surficial (<2m deep) waste rock estimate, is conservative since the estimate uses the schematic from Holubec (2005) which indicates that the entire downstream slope of N Dam is composed of waste rock. This composition has not been observed during annual inspections of existing conditions.

Based on the sampling guidelines by Price (2009), the next highest sampling guidance is 26 samples for one million metric tonnes of waste rock, which the TCA is well short of. Ten samples have been collected from the TCA waste rock, which exceeds the lower guidance for 100,000 metric tonnes of eight samples (Price 2009), but is below the higher guidance for one million metric tonnes. Although the estimated total mass of waste rock is above 100,000 metric tonnes, LMI contends that the ten samples are sufficient and the conclusions regarding additional sampling in the original commitment response are still valid.

In response to the related Commitment No. 4 ARD geochemical and pathway modeling request, recent studies (Updated Phase I and II Environmental Site Assessment; Golder, 2017) have observed that in shallow waste rock at Lupin, the majority of the sulfur is presently in the form of sulfate, indicating the waste rock has already weathered and oxidized. This oxidation was not observed in earlier waste rock sampling in similar areas (Morrow 2006), where the majority of sulfur was present as sulfide. Deeper waste rock (>2m), which is less weathered and may contain higher levels of sulfide, is encapsulated in permafrost. Golder (2017) concluded that "Given the duration of exposure of waste rock at the Site (greater than 30 years), direct measurement of pH in seepage and groundwater is the best method for confirming the acid generation potential suggested by the results of ABA." Accordingly, it is suggested that monitoring be used in place of additional geochemical modeling.

As confirmed by the NWB in the Pre-hearing Conference Decision Report, LMI is committed to providing a post-closure monitoring plan, following discussions with all stakeholders one year following the approval of the Licence (NWB 2019).

Errata: Correction to 2AM-LUP1520 Technical Meeting Commitment Nos 3 and 4 Responses; waste rock density should have been reported in units of metric tonnes/m^3 not kg/m^3. Numerical density values do not change.

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520, Appendix D: List of Commitments; June 2019.
- Golder 2017. Updated Phase I and II Environmental Site Assessment, Lupin Mine, Nunavut. Report No. 1663416-6000, October 2017.
- Holubec 2005. Closure Plan for Tailings Containment Area, I. Holubec Consulting Inc. January 2005.
- Stantec 2019a. Stantec Technical Memorandum to support LMI Response to Commitment No. 6 – Geotechnical Review on the Long-Term Stability of the TCA Dams. November 2019.
- Stantec 2019b. Stantec Technical Memorandum to support LMI Response to Commitment Nos. 3 and 4 – Waste Rock Information from Lupin Mine Tailings Containment Area. August 2019.
- Price 2009. Predication manual for Drainage Chemistry from Sulphidic Geologic Materials: MEND Report 1.20.1, Natural Resources Canada.

Attachments: n/a

2.4 ARD Geochemical and Pathway Modelling

Interested Party:	CIRNAC	**Initial Submission No:**	4
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

ARD geochemical and pathway modeling would be required depending on the results from #3 commitment above

Commitment:

Based on the results of #3 above, if required ARD Potential (rock characterization, and potentially including geochemical and pathway analysis) to be conducted at the TCA dams.

CIRNAC Comment:

Based on a Memo from Stantec dated august 14, 2019 addressing commitment #3, Stantec concluded that ARD geochemical and pathway modelling is not needed for waste rock at TCA area. CIRNAC notes that the Golder review and assessment of acid potential of waste rock, including URS2005 data set found that 68% of the waste rock can be considered potentially acid generating.

In terms of potential waste rock volumes at the TCA, in addition to the 0.5m depth of waste rock cover on the dams as assumed by Stantec, CIRNAC suggests that significantly more waste rock exists in the TCA/Tailings Management Area (TMA) based on review of the approved TMA closure plan which found that:

- waste rock was used to construct J Dam (~250m long, ~5m deep),
- a waste rock embankment was on the downstream side of 3D (10m w, 10+m h, 550m l)

CIRNAC Conclusion:

CIRNAC disagrees that there is no need for an ARD Geochemical and pathway modeling for the waste rock at the TCA dams. Based on the CIRNAC comments on #3 and #4 above CIRNAC is requesting that further documentation and/or discussions be presented to support the claim that there is no need for any additional ARD geochemical and pathway modeling.

LMI Response:

Refer to LMI response to CIRNAC Initial Submission No. 3 above.

Status:

LMI considers this item resolved.

References: n/a

Attachments: n/a

2.5 Geotechnical Details

Interested Party:	CIRNAC	**Initial Submission No:**	5
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

CIRNAC requested that LMI provide geotechnical analysis to provide confirmation of dam stability and erosion control

Commitment:

Geotechnical details of engineered structures (e.g. which dams will the rip-rap material be taken from to change slope and which dams will be enhanced, cross sections and details) to ensure long term stability and erosion control.

CIRNAC Comment:

The Stantec memo report, dated November 14, 2019 provides stability analysis of dams in existing conditions and stability analysis of re-sloped K and M dams. Results are consistent with earlier analysis from Holubec 2005. The analysis does not include an assessment of the structures in thawed conditions. Dam cross sections were provided in the stability analysis, but no dimensions or slope information was provided in these figures.

Note that in the approved 2005 TMA Closure Plan, Section 7.4, Lupin made a commitment to “a minimum factor of safety equal to or greater than 1.5 for long term stability of earth structures, such as the 3D,K,M,and N dams”. The 2005 closure plan assessed 2 scenarios (frozen dam, thawed dam with different Ground Water Level. Based on the results and consistent with 2005 commitments to ensure stability, Lupin committed to rip rap stabilizing structures at M and K dams and re-sloping the outer WR face of Dam 3D.

The LMI submission provided plan views for cell 4 and 5 surface water flow along with a cross- section detail for a typical outflow structure, but no details on how it would be located in place across the dams. No details were provided with respect to the shallow surface drainage feature on tailings covers (e.g. it is not clear whether is it a lined ditch of simply a graded sloped in the tailings cover.

CIRNAC Conclusion:

CIRNAC recommends LMI provide more specific information on the location where embankment stabilization work would be carried out and design details (including final design cross sections showing existing and proposed conditions including construction materials). LMI should also provide reviews to confirm the location and extent of surface stabilization and erosion protection works.

CIRNAC recommends that LMI provide the missing details/information to better evaluate the stability of the dams at the tailings containment facility.

LMI Response:

The full thaw analysis was completed for Dam 3D and Dam 4 as part of LMI’s original response to Commitment No. 12 (Stantec 2019c). The thawed stability results are comparable to the results for existing conditions.

As indicated in the stability results outlined in response to Commitment No. 6 (Stantec 2019a), only Dam M and Dam K require the downstream slopes of the dams to be re-sloped to 2.1H:1V in order to satisfy the stability criteria using esker material. The re-sloping will apply to areas where the downstream slopes of the dams are steeper than 2.1H:1V, currently assumed to be the entire length of Dam K, and Dam M up to the abutment to Dam N.

Rip rap will not be removed or relocated from any dams. Engineered surface channels have been designed to mitigate the impact from uncontrolled surface water flow across the surface of the dams, reducing the risk of erosion on the dam slopes. The shallow surface water channel designs for the to-be-completed Cell 3 and 5 cover were provided in the response to Commitment No. 6 (Refer to Stantec 2019a, Appendix A Figure 2 and Figure 3) and are intended to be constructed on graded esker tailings covers. The channels are not anticipated to be lined. Short sections of the channels near the outflow might be armored with riprap as needed based on as-built conditions. The outflow structures as shown in the original figures will be constructed into the existing dams (Stantec 2019a).

Appendix A and Figures referenced above, included in Stantec 2019a.

Status:

LMI considers this item resolved.

References:

- Stantec 2019a. Stantec Technical Memorandum to support LMI Response to Commitment No. 6 – Geotechnical Review on the Long-Term Stability of the TCA Dams. November 2019.
- Stantec 2019c. Stantec Technical Memorandum to support LMI Response to Commitment No. 12 – Risk Assessment on Two Dams in the Lupin Tailings Containment Area. November 2019.

Attachments: n/a

2.6 Dome Design

Interested Party:	CIRNAC	**Initial Submission No:**	6
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

CIRNAC requested more details on the design of the “dome” which will encapsulate materials remaining on site.

Commitment:

Preliminary design level explanation of waste rock storage “Dome” design (including typical cross section, seepage, topography, geochemistry and storm water drainage estimates, etc.)

CIRNAC Comment:

The memo by Golder, dated October 15, 2019 repeated what was presented in the technical meeting. It provided some information on consolidation of waste rock area (from 54.5 to 23.2ha) and provided conceptual comments on slopes (1.55% over most area, 10% from 1.4m depth waste rock to grade, conceptual drainage), but did not provide a typical design cross section through proposed dome, nor any design details/specification on proposed drainage systems, cover stabilization, etc.

This response provides little in the way of general engineering or specification of these features, and makes it difficult to assess and cost these features. The memo does not address any potential cover performance risks such as subsidence / consolidation issues that may occur in the crown pillar areas where open cuts will be filled or at the shaft which is now planned to be filled, not capped. How can LMI ensure that 1 m esker cover will not be affected by subsidence in these areas over time?

The Golder memo notes that current seepage have exceedances of Canadian Environmental Quality Guidelines (CEQG) criteria and estimates that the cover will reduce infiltration to about 23% of 2019 value and 36% of 2100 value.

CIRNAC would like to note that ICRP concept would have removed much of the waste rock to the tailings system and thus reduced impacted flows from the mill site dramatically. The current proposed plan for the waste rock to be consolidated in the “dome” and covered is of higher risk to the environment than what was proposed in the ICRP.

CIRNAC Conclusion:

CIRNAC recommends provision of preliminary design cross sections and design details/specification on proposed drainage systems and cover stabilization of proposed dome, in order to provide the confidence that the covered “dome” is protective of the environment.

LMI Response:

The attachments to Golder’s Technical Memo addressing Commitment No. 5 (Golder 2019b) included a typical cross-section for the “dome”. A detailed grading plan will be prepared by Q1 2021, after the mill area has been demolished and the cleared site has been surveyed. (The relocation of the waste rock and the construction of the dome and cover is scheduled for the summer of 2021.) The detailed grading plan will conform to the typical cross-

section that was provided. It will also include details showing the proposed channelization of surface runoff off of the esker cover.

Technical Specifications will also be provided by Q1 2021. The only imported fill material used will be the esker cover material. A gradation specification will be provided which will follow the gradation of material that has been used to date to construct the TCA cover. The gradation specifications will include a requirement for a minimum content of gravel sized material to enhance resistance to erosion.

The detailed grading plan and the Technical Specifications will be consistent with the assumptions that were made for the modelling; therefore, it is expected that the thermal and seepage performance of the "dome" will be consistent with the model results.

If post closure settlement is anticipated in the shafts or crown pillar areas, the waste rock will be mounded up to compensate.

The post-closure impacts of the waste rock seeps are addressed in the Human Health and Ecological Risk Assessment Report (Golder 2019b) submitted in response to Commitment Nos. 1 and 7. In addition, refer to LMI commitment for ongoing general monitoring provided in ECCC Final Submission No. 6.

The approved ICRP (dated October 2017) stated that:

"The waste rock pads will be dealt with in a combination of two measures:

- *In some areas, the waste rock will be excavated, transported and disposed of in the open crown pillars, in the adit or in the TAC (sic) under the esker cover.*
- *waste rock which is not removed will be left in place, contoured to drain freely and then capped with 1.0 m of esker material."*

The current plan for the waste rock in the FCRP (LMI 2018) is generally consistent with the ICRP approach. It has however been deemed impracticable to stow waste rock underground through the adit. It is no longer proposed to relocate waste rock into the TCA, as the storage volume available in the tailings cells is relatively limited. In addition, the current FCRP approach to consolidate all waste rock in a singe "dome" will result in a smaller surface area than if some of the waste rock was removed to the TCA. This will reduce the potential interaction between the covered waste rock and surface runoff.

Status:

LMI considers this item resolved.

References:

- Golder 2019b. Golder Report: Human Health and Ecological Risk Assessment. Submitted in support of LMI Response to Commitments Nos. 1 and 7. October 2019.
- LMI 2018. Lupin Mine Site – Final Closure and Reclamation Plan. July 2018 .

Attachments: n/a

2.7 Possible Dome Seepage

Interested Party:	CIRNAC	**Initial Submission No:**	7
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

Seepage Quality and Loading from the “Dome”

Commitment:

LMI to provide a geochemical source term and load model for seepage from the waste rock “Dome.”

CIRNAC Comment:

Geochemical source term inputs were developed for natural runoff, cover runoff, waste rock seepage, and unreclaimed facilities (i.e., airport strip) using surface water quality, seepage water quality and short-term leach test results, including seepage data collected in August 2019. Source terms were calculated for expected conditions (50th percentile) and upset conditions (75th percentile). These geochemical source terms along with hydrologic inputs developed based on thermal-seepage modelling were used to predict receiving water quality (Boot Lake, East Lake, Lower Sewage Lake) to evaluate the performance of the proposed waste rock dome in reducing chemical loading to the environment.

Water quality modelling for the open-water season (June to September) was performed using PHREEQC and consisted of mixing contact water from cover runoff and waste rock seepage with natural runoff. As such, the model did not rely on mixing with a stored reservoir volume and no time-lag was included to account for progressive changes in water quality resulting from monthly loading differences. The model conservatively assumed that all runoff from each runoff type reached the prediction node (receiving water body) within each catchment area.

Variations noted in receiving water quality were attributable to whether precipitation and snow melt on top of the waste rock dome runs off (only interacting with cover materials) or infiltrates (primarily interacting with waste rock) producing seepage from the toe of the dome (runoff from natural ground or the airport strip was kept constant in the model).

The water quality model results indicated that seasonal effects (i.e., freezing) on the waste rock dome are a controlling factor on water quality. In June, all contact water occurs as runoff from the cover materials, producing the lowest predicted concentrations. Conversely, the greatest monthly concentrations of metals are predicted for August and September when all water seeps through the cover into the waste rock dome. Higher metal concentrations were generally predicted for East Lake and Lower Sewage Lake due to their relatively smaller watersheds compared to Boot Lake. Model results for expected conditions (50th percentile) indicated moderately acidic to neutral pH conditions in the receiving water bodies, ranging from 5.6 to 6.9. Environmental effects resulting from the predicted water quality under expected conditions (50th percentile) were assessed in the HHERA.

Under future climatic conditions (to the year 2100), the same range of metal concentrations was predicted in receiving waters but the number of months with 100% seepage increased from two (August and September under current climatic conditions) to four (July through October). The results of the thermal-seepage modelling (provided

as a separate supporting technical memo to the HHERA) indicated that infiltration though the esker layer would increase over time when considerations of climate change are incorporated with an average increase of 4.95 degrees C in air temperature. In this case the esker would thaw earlier in the year and more precipitation would fall as rain, leading to an increase in percolation rates at the base of the esker from 16% to between 22% and 25%.

We note that changes to the waste rock seepage geochemical source term due to re-working of the waste rock in construction of the dome and increased interactions of infiltrating water with more waste rock and flushing of stored acidity within the pile are not considered in the water quality predictions. Golder on behalf of LMI indicated that additional static and kinetic geochemical laboratory tests are currently being conducted on waste rock samples that were collected in 2019, the results of which may help refine the geochemical source terms.

CIRNAC Conclusion:

CIRNAC considers the documentation provided by LMI to be a seepage model rather than a source term model. However, CIRNAC is satisfied with the response with the condition that seepage samples are collected and modeling is updated periodically.

LMI Response:

As confirmed by the NWB in the Pre-hearing Conference Decision Report, LMI is committed to provide a post-closure monitoring plan, following discussions with all stakeholders, one year following the approval of the Licence (NWB 2019) (see also LMI response to CIRNAC Initial Submission No. 1). As part of the post-closure monitoring plan, LMI proposes to develop and implement a detailed surface water monitoring program for the adjacent lakes (East, Boot, and Lower Sewage) and seepage from the waste rock area.

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520, Appendix D: List of Commitments; June 2019.

Attachments: n/a

2.8 Decision Tree/Matrix

Interested Party:	CIRNAC	**Initial Submission No:**	8
Reference:	CIRNAC Document Review Response dated December 6, 2019		

Issue:

Possibility of exposed tailings in the dewatered pond portions of the tailings containment area after the water level has been lowered.

Commitment:

Decision matrix/tree that determines how exposed tailings will be handled on a case by case basis when lowering the water level in the TCA.

CIRNAC Comment:

In CIRNAC's view, the information provided in the Stantec memo, dated October 15, 2019 does not provide a "decision matrix" for how it would be decided as to whether or not, on a case by case basis in the field, exposed tailings would be left in place or removed and placed within the tailings cell.

CIRNAC Conclusion:

It is CIRNAC's opinion that no material amount of tailings should remain outside of the defined containment cells at closure. Placement of 1m esker cover on any exposed tailings within the dewatered former pond areas, will not be effective in reducing ARD/ML from these tailings and result in impacted seepage from these areas. It is recommended that LMI provide an adaptive management decision matrix clearly outlining how the potentially exposed tailings would be managed.

LMI Response:

Refer to Attachment 1 - Contingency Contaminants Management Decision Matrix

The presented information is a contingency decision matrix to be used if exposed contaminants are encountered after the ponds are lowered to the closure levels. At this time there is no indication that contaminants or tailings will be exposed after the water levels are lowered. The currently approved Closure Plan for the Tailings Containment Area (Kinross 2005) uses an esker cover to reduce ARD/ML potential from placed tailings. In addition, subsequent to the TCA closure plan's approval, a TCA ecological risk assessment was conducted in 2004 (Golder 2004) and determined that covering the exposed tailings with esker sand is effective in mitigating offsite environmental impacts and was approved under the water licence renewal in 2016.

The contingency decision matrix was requested by CIRNAC and uses an engineering risk-based approach to determine how potentially exposed contaminants will be handled on a case by case basis. The contingency decision matrix provides the mechanism to mitigate the risks to the environment from exposed contaminants by either covering in place with sufficient esker sand materials (Option 1) or excavating the contaminants and consolidating them in Tailings Cells 3 and/or 5 (Option 2). Monitoring data from the TCA, collected and monitored over the last 25-30 years, and reconfirmed in response to Commitment No. 10, indicates that covering in place is an effective method of reducing the risk of ARD/ML.

LMI has entered into an agreement with a contractor to execute the closure works in a two-year timeframe. As noted in the contingency decision matrix, northern climatic considerations will limit the timing and duration of activities and there is a related risk to the contactor's schedule if flexibility in mitigation measures is not allowed. As currently planned, the effectiveness of esker cover on any exposed contaminants within the dewatered former pond areas will be monitored to ensure that there is no significant detriment to the environment prior to breaching the TCA to allow for passive drainage.

Status:

LMI considers this item resolved.

References:

- Golder 2004. Final Report Ecological Risk Assessment for the Lupin Mine Tailings Containment Area. December 2004.
- Kinross 2005. Closure Plan for Tailings Containment Area. January 2005.

Attachments:

- Attachment 1 – Contingency Contaminants Management Decision Matrix

3.0 RESPONSES TO CIRNAC FINAL SUBMISSION TO THE NUNAVUT WATER BOARD

Responses to CIRNAC *Final Submission for the Renewal and Amendment Application of Lupin Mines Inc.'s Water Licence 2AM-LUP1520* dated December 18, 2019

3.1 Term of Renewed Licence

Interested Party:	CIRNAC	**Final Submission No:**	1
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

LMI has requested a 7-year licence term. CIRNAC has no comment.

LMI Response:

LMI confirmed on November 15, 2019 (Golder 2019a) that a request for a change to the Application for the purpose of clarification to the "Term of Licence", LMI requested a 12-year Licence Term to allow for adequate post-closure monitoring and facilitate typically a one year licence renewal process.

The NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including: *Term of Renewal Licence – 7 years to cover closure activities and the first 5 years of post-closure monitoring*. In addition, the NWB reconfirmed in its Decision, *Changes to the Application for the Purpose of Clarification* included LMI request to add to the original 7 year term of the amended and renewed water licence to reflect longer-term post closure monitoring.

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type "A" Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum. November 2019.

Attachments: n/a

3.2 Water Use Requirements

Interested Party:	CIRNAC	**Final Submission No:**	2
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

LMI is requesting the use of 685 m^3/day from Contwoyto Lake. CIRNAC has no comment.

LMI Response:

The NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including: *Water Use Requirements – increases during active closure & reclamation; and reductions over course of term.* For the purpose of clarification, LMI in the Draft Water Licence Framework (Golder 2019a), consistent with the current water licence 2AM-LUP1520 (Part D) proposed the use of water from Contwoyto Lake at distinct volumes for the Phase(s) of reclamation. LMI acknowledges CIRNAC has no comment on water use requirements proposed and therefore considers information requests and associated technical comments (if any) resolved and refers the NWB to the proposed DWLF (Golder 2019a).

Volumes proposed are:

- Active Closure: 250,025 cubic metres annually
- Care and Maintenance and/or Passive Post Closure: 5,000 cubic metres annually

As per the DWLF, Part D, Item 1 proposes The Licensee shall obtain all fresh Water from Contwoyto Lake, at monitoring station LUP-01 using the Water Supply Facility or as otherwise approved by the Board in writing.

In addition Part D, The Licensee shall obtain water, for industrial purpose including dust suppression from ponded water (against the road), or ponds or lakes proximal to the road.

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum. November 2019.

Attachments: n/a

3.3 Waste Disposal

Interested Party:	CIRNAC	**Final Submission No:**	3
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

CIRNAC has no comment on waste disposal measures proposed.

LMI Response:

The NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including: *Waste Disposal – hazardous waste; waste rock with elevated Arsenic content; PHC Contaminated Soil; Asbestos; and Surface Infrastructure and On-site Equipment.* For the purpose of clarification, LMI acknowledges CIRNAC has no comment on *waste disposal measures proposed* and therefore considers information requests and associated technical comments (if any) resolved and refers the NWB to the proposed DWLF (Golder 2019a).

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum; November 2019.

Attachments: n/a

3.4 Tailings and Waste Rock

Interested Party:	CIRNAC	**Final Submission No:**	4
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

Status of commitments pertaining to tailings and waste rock

Commitment #	Issue	Status
3	Historical data review for ARD potential in dams, roadways, etc.	Unresolved
4	Geochemical modelling and pathway analysis for ARD potential	Unresolved
5	"Dome" design	Unresolved
7	"Dome" seepage source term and load model	Resolved
8	Decision matrix/tree for exposed tailings	Unresolved

CIRNAC technical comments on section 4.3.2.7 identified uncertainty in potential waste rock distribution across the property, including in mill areas, roads, dams and the airstrip. Commitment #3 from the technical meeting was for LMI to provide a summary of historical data. LMI presented a Stantec memo (August 14, 2019) reviewing results of 2005 acid-base accounting studies and estimating the volume of waste rock in dams based on an air photo. As detailed in section 3 of our December 6, 2019 letter, CIRNAC is of the opinion that historical construction data available with more accurate waste rock volumes have not been reviewed. The memo provided by LMI is therefore insufficient and we have requested:

> *CIRNAC recommends that LMI thoroughly review the historical data available (i.e. Kinross Closure plan for the TMA (tailings management area), Holubec Jan 2005) to be able to provide a more accurate account of the ARD (acid rock drainage) potential at site given that waste rock was used and that the waste rock is now known to be much more acid generating then previously predicted.*

Commitment #4, geochemical modelling and pathway analysis for ARD potential, was dependent on the findings of commitment #3, the review of potential waste rock volume distribution across the site. As the Stantec memo provided does not satisfy CIRNAC's request for commitment #3, we disagree with its conclusion that there is no need for ARD geochemical and pathway modelling. As stated in section 4 of our December 6, 2019 letter:

> *CIRNAC is requesting that further documentation and/or discussions be presented to support the claim that there is no need for any additional ARD geochemical and pathway modelling.*

Additional CIRNAC technical comments on section 4.3.2.7 requested details on the proposed waste rock excavation and placement. At the technical, commitment #5 by LMI was to provide preliminary design level

explanations of their proposed “dome” including typical cross sections, and information on seepage, topography, geochemistry and storm water drainage. As a response, LMI provided a Golder memo (October 15, 2019) that repeated what was shared at the technical meeting. Further details were requested at the technical meeting because the information was insufficient, and since it is still missing, this comment is unresolved. Section 6 of our December 6, 2019 covers this topic in detail and requests:

> *CIRNAC recommends provision of preliminary design cross sections and design details/specification on proposed drainage systems and cover stabilization of proposed dome, in order to provide the confidence that the covered “dome” is protective of the environment.*

To allow assessment of the potential impact on water of seepage from the newly proposed “dome” structure, LMI made commitment #7 to provide a geochemical source term and load model for seepage from the waste rock storage “dome”. As stated in CIRNAC’s December 6, 2019 letter:

> *CIRNAC considers the documentation provided by LMI to be a seepage model rather than a source term model. However, CIRNAC is satisfied with the response with the condition that seepage samples are collected and modeling is updated periodically.*

We therefore consider this issue resolved.

Tailings at the mine site are known to be acid generating so it is not acceptable to leave exposed tailings outside a containment area, even if they are covered with esker material. This concern was raised in CIRNAC’s technical comments on section 4.3.2.8 and resulted in commitment #8, for LMI to provide a decision tree or matrix explaining how tailings will be handled, as they are exposed when water levels in the TMA are lowered. Our December 6, 2019 letter states we are not satisfied with the information provided in the Stantec memo (October 15, 2019) provided by LMI and conclude:

> *It is CIRNAC’s opinion that no material amount of tailings should remain outside of the defined containment cells at closure. Placement of 1m esker cover on any exposed tailings within the dewatered former pond areas, will not be effective in reducing ARD/ML from these tailings and result in impacted seepage from these areas. It is recommended that LMI provide an adaptive management decision matrix clearly outlining how the potentially exposed tailings would be managed.*

LMI Response:

The NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including: *Tailings and Waste Rock – Cover design for waste rock storage “dome”; Acid Rock Drainage and Metal Leaching (ARD/ML) potential; and Water Management - Potential for waste rock contact water; potential for seepage from waste rock; and potential for seepage form TCA.*

For the purpose of clarification, LMI refers CIRNAC to the detailed responses provided by LMI as cross referenced in the table below and further refers CIRNAC to the proposed DWLF (Golder 2019a).

Commitment No.	Description	Cross Reference Refer to Initial Submission CIRNAC No.
3	Historical data review for ARD potential in dams, roadways, etc.	3 (Section 2.3)
4	Geochemical modelling and pathway analysis for ARD potential	4 (Section 2.4)
5	Dome Design	6 (Section 2.6)
7	Dome Seepage Source Term and Load Model	7 (Section 2.7)
8	Decision Matrix/Tree for exposed tailings	8 (Section 2.8)

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum; November 2019.

Attachments: n/a

3.5 Amendments to Terms and Conditions

Interested Party:	CIRNAC	**Final Submission No:**	5
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

CIRNAC has no comment on the amendments to terms and conditions proposed.

LMI Response:

The NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including:

- Amendments to terms and conditions
  - *Draft Water Licence Framework;*
  - *Changes to reflect change in status of the site from temporary care and maintenance to permanent closure and reclamation;*
  - *Amendment to reflect activities completed under the existing Licence and progressive reclamation that has taken place and will be taking place in 2019;*
  - *Amendments to reflect post-closure environmental and site conidiations (e.g. changes to monitoring and reporting frequency).*

For the purpose of clarification, LMI acknowledges CIRNAC has no comment on *Amendments to terms and conditions* proposed and therefore considers information requests and associated technical comments (if any) resolved and refers the NWB to the proposed DWLF (Golder 2019a).

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum; November 2019.

Attachments: n/a

3.6 Management Plans and Reports

Interested Party:	CIRNAC	**Final Submission No:**	6
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

CIRNAC has no comment on management plans and reports that are not raised under other sections of this document.

LMI Response:

The NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including: *Management Plans and Reports – Updates to plans; and Timing/Approval of plans.* For the purpose of clarification, LMI acknowledges CIRNAC has no comment on *Management Plans and Reports* proposed and therefore considers information requests and associated technical comments (if any) resolved and refers the NWB to the proposed DWLF (Golder 2019a).

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum; November 2019.

Attachments: n/a

3.7 Monitoring Program

Interested Party:	CIRNAC	**Final Submission No:**	7
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

A follow-up of CIRNAC's comment in section 8 below on commitment #1, is the need to update the monitoring plan to incorporate the findings of the human health ecological risk assessment (HHERA).

LMI Response:

Refer to LMI response to CIRNAC:

- Initial Submission No. 1 (Section 2.1)
- Final Submission No .8 (Section 3.8)

LMI also acknowledges the NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including:

- *Monitoring Plans and Reports*
  - *Plans for monitoring during active closure & reclamation through to mine closure*
  - *Post closure monitoring requirements (including term of monitoring)*

For the purpose of clarification, LMI reconfirms commitments related to *Monitoring Plans and Reports* and refers the NWB to the proposed DWLF (Golder 2019a).

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type "A" Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum; November 2019.

3.8 Closure and Reclamation Planning

Interested Party:	CIRNAC	**Final Submission No:**	8
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

Status of commitments pertaining to closure and reclamation planning

Commitment #	Issue	Status
1	Human Health Ecological Risk Assessment	Unresolved
6	Geotechnical details of engineered structures	Unresolved

During the information request and technical stages, CIRNAC requested that LMI provide a HHERA report, which was to be completed following a study in summer 2019. Commitment #1 captured this outstanding information request. As detailed in comment #1 of our December 6, 2019 submission, the HHERA report provided generates two follow-up actions:

I. *Updated monitoring plan, including duration and frequency, is required to ensure that the planned measures are adequate for the protection of the human health and the environment at closure and post-closure.*
II. *LMI should include the tailings containment area in the assessment or justify why it is not necessary.*

CIRNAC technical comment on section 2.3.2 requested a conceptual plan for locations where rip rap was to be used to stabilize dams and enhance embankment stability, as well as information on where rip rap was to be sourced. Commitment #6 from the technical meeting was for LMI to provide the geotechnical details of engineered structures. LMI submitted a Stantec report (November 14, 2019) that provides some information, but most of what was requested is still missing. Comment #5 in CIRNAC's December 6, 2019 letter details what is incomplete and concludes:

> *CIRNAC recommends LMI provide more specific information on the location where embankment stabilization work would be carried out and design details (including final design cross sections showing existing and proposed conditions including construction materials). LMI should also provide reviews to confirm the location and extent of surface stabilization and erosion protection works. CIRNAC recommends that LMI provide the missing details/information to better evaluate the stability of the dams at the tailings containment facility.*

LMI Response:

Consistent with LMI's response to CIRNAC Initial Submission No. 1, regarding Commitment No.1 provided in Appendix D of the NWB in the Pre-hearing Conference Decision Report (NWB 2019):

- LMI is committed to provide a post-closure monitoring plan, following discussions with all stakeholders one year following the approval of the Licence (NWB 2019). As noted by CIRNAC, LMI will endeavour to ensure that the planned measures are adequate for the protection of human health and the environment.
- The final closure assessment for the Tailing Containment Area (TCA) was completed as part of the Licence renewal in 2014. LMI resubmitted at that time the Ecological Risk Assessment (Golder 2004) for the Lupin Mine Tailings. The objective of the risk assessment was to estimate the potential human and wildlife risks after closure of the mine. The NWB approved the Ecological Risk Assessment (Golder 2004) as part of the renewal licence approved by Minister in 2015. (Refer to Part I, Item 1d of Licence No. 2AM-LUP1520).

Regarding geotechnical details (Commitment No. 6) refer to LMI response to CIRNAC Initial Submission No. 5 (Section 2.5 above).

In addition, LMI also acknowledges the NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including:

- *Closure and Reclamation Planning*
  - *Additional studied/analysis (ARD, geochemical and pathways)*
  - *Human Health Ecological Risk Assessment (HHERA)*
  - *Climate Change Models/scenarios and potential effects on closure & reclamation*
  - *Geotechnical stability and erosion control*
  - *Timing, phases and scheduling*
  - *Final Closure and Reclamation Plan*

For the purpose of clarification, LMI reconfirms commitments related to *Closure and Reclamation Planning* outlined above and thorough out our final submission and refers the NWB to the proposed DWLF (Golder 2019a).

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520, Appendix D: List of Commitments; June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum. November 2019.
- Golder 2004. Final Report Ecological Risk Assessment for the Lupin Mine Tailings Containment Area. December 2004.

Attachments: n/a

3.9 Reclamation Security Cost Estimate

Interested Party:	CIRNAC	**Final Submission No:**	9
Reference:	CIRNAC Final Submission dated December 18, 2019		

CIRNAC Comment:

Status of commitment pertaining to reclamation security cost estimate

Commitment #	Issue	Status
2	Updated security estimate RECLAIM model	Unresolved
9	Framework for progressive release of security	Unresolved

CIRNAC submitted the same questions in both our information requests and technical comments for more details on the reclamation cost estimate. Full answers have not yet been provided, so effective review of the estimate cannot be completed in a meaningful manner. Due to these uncertainties, CIRNAC has not created a cost estimate. We are still working with costs from the accepted 2016 Knight Piesold until further information is provided by LMI.

As stated in comment #2 of CIRNAC's December 6, 2019 letter, items we are looking for are:

I. *Almost 40% of capital cost is "Contractor indirects". Mobilization is ~80% of Indirect Cost, and is based on a series of Lump Sum (LS) items with no backup. Out of the total security held (approximately $23.3 million) about 16.5million (~71%) is either LS or indirect costs with limited backup. Clarity is required from LMI to provide additional description of the basis of the estimate.*
II. *LMI proposed Final Closure Plan (CP) estimate does not include for rip -rap armouring of the outer slopes of the dams. This is inconsistent with the approved 2005 Tailings Management Area (TMA) Closure Plan works.*
III. *LMI latest estimate provides for $999,674 for TMA closure. Review of prior estimates shows LMI values of $3.9 (2014) and $2.1 (2017) million. The accepted Knight Piesold 2016 estimate was $4.9million for the TMA.*

LMI has requested that a renewed licence include a mechanism for progressively reducing security as reclamation activities are conducted. At the technical meeting, CIRNAC and LMI agreed to a joint submission of framework for this release as commitment #9. LMI has shared their proposal with CIRNAC. However, CIRNAC is still working to define how a framework could be defined while still respecting the Minister's discretion, and as a result, we have not yet shared our proposal with LMI or the NWB.

LMI Response:

Refer to LMI response to CIRNAC Initial Submission No. 2 (Section 2.2 above) and CIRNAC Final Submission No.8 (Section 3.8, above) in response to Commitment No. 2 (Golder 2019c).

LMI acknowledges the NWB in the Pre-hearing Conference Decision Report (NWB 2019), outlined the *List of Issues* to be brought forward for discussion at the Public Hearing including:

- *Reclamation Security Cost Estimate:*
  - *Update to total cost estimate to reflect updated final closure and reclamation*
  - *Mechanism for/agreement with respect to progressive release of security (e.g. periodic reductions in security over term of Licence to reflect progressive reclamation and completion of site remediation)*

For the purpose of clarification, LMI submitted an updated total cost estimate to reflect the updated final closure and reclamation costs in fulfillment of Commitment No. 9 on November 3, 2019 and further refers the NWB to the proposed DWLF (Golder 2019a), Attachment C, Security Framework Agreement of that submission, for clarification regarding progressive release of security.

Ongoing discussion between LMI and CIRNAC were held on January 2, 2020 with further meetings tentatively proposed for January 6 and 7, 2020 and additional meeting potentially in advance of the public hearing, to achieve further resolution and clarification of security framework. LMI will provide a summary of resolution to the NWB in the form of exhibit(s) prior to or at the public hearing.

Status:

With its commitment to ongoing discussions to achieve further resolution and clarification on the security framework, LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.
- Golder 2019a. Draft Water Licence Framework Rev0. Technical Memorandum; November 2019.
- Golder 2019c. Golder Technical Memorandum to support LMI Response to Commitment No. 2 – Updated Security Estimate Reclaim Model. November 2019.

Attachments: n/a

4.0 RESPONSES TO ECCC FINAL SUBMISSION

4.1 Climate Change Modeling

Interested Party:	ECCC	**Final Submission No:**	1
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

The proponent indicates that the thermal modeling results they provided for the end of the century Low Emission Scenario (LES) or for the Average Emission Scenario (AES) are more realistic than the High Emission Scenario (HES) result:

> *"The LES scenario uses a MAAT* [mean annual air temperature] *increase of 2.2°C from 1995 to 2100. CCCR, 2019, states that the warming trend observed in Canada from 1948 to 1996 was 1.2°C, representing an average warming rate of 0.025°/yr. Accordingly, the LES is considered to be more realistic than the HES."* p. 6

and

> *"The thermal modelling conducted by Stantec found that the LES and AES did not result in long- term progressive permafrost thaw within the Lupin Mine TCA dams. The LES and AES are considered to be more realistic climate warming emission scenarios compared to the HES, based on reported observations of temperature changes in the latter half of the 20th century in Canada."* p. 10

The similarity in the warming rates between the observational record and that of the LES cannot be used as a basis to conclude that the LES is more realistic than higher emission scenarios. The rate of warming observed from the past cannot be extrapolated or used as a guide to gauge the range of potential future climate change because:

1) the observed or historic rates of warming and trends do not necessarily represent regional/local climate response to global warming, because other factors, such as natural variations of the climate, may come into play; and
2) past greenhouse gases emissions may not represent potential future emissions and related changes in the climate system.

Climate projections from multiple climate models for a range of plausible future emission scenarios (low to high future forcing) are required to reflect uncertainty in future climate projections, and to ensure that the range of potential future climate change is considered. It is not possible to assign a likelihood for a particular future forcing scenario. The scenarios are not predictions. Instead, they represent possible future conditions based on global scale socio-economic considerations. The low emission (RCP2.6) scenario is consistent with limiting global temperature increase to roughly 2˚C above the pre-industrial value. The lower emission scenario requires rapid cuts in human emissions globally (Flato et al., 2019). Scenarios with limited warming will only occur if global carbon emissions are reduced to near zero early in the second half of the current century, and if emissions of other greenhouse gases are reduced substantially (Bush and Lemmen, 2019).

The projections used by the proponent for the HES show a mean annual air temperature increase of 7.8˚C by 2081 to 2100. The proponent's subsequent thermal modeling suggested a possible thaw depth of 14 m by 2081 to

2100. For the LES, the proponent indicates that projected temperature may increase by 2.1˚C (by 2081 to 2100). This resulted in a modelled thaw depth of 3 m.

ECCC Recommendation:

ECCC recommends that, given projection uncertainties described, both LES and HES along with the AES should be considered for the Lupin Mine site. All implications for closure should be considered, and contingency plans based on these scenarios should be developed.

ECCC recommends that the proponent consider the high emission scenarios along with the low emission scenario for thermal modelling, and develop contingency plans for post closure of the Lupin mine site that considers both possible scenarios.

LMI Response:

The performed TCA thermal modeling considered the end of the century Low Emission Scenario (LES), the Average Emission Scenario (AES) and the High Emission Scenario (HES). An opinion that the LES is more realistic than higher emission scenario was provided, however our risk assessment provided for the TCA dams (Response to Commitment No. 12) considered the impacts from all three scenarios and provided risk assessment for the highest risk based on the HES.

LMI has been actively implementing and monitoring the approved TCA closure plan activities for close to 30 years. Numerous studies (on the public record, including Holubec 2006a and Holubec 2006b) were completed as part of the approved Closure Plan for Tailings Containment Area (Kinross 2005). In summary, these studies concluded that under a full thaw scenario under the HES (considered equivalent to the thermal modeling suggested possible thaw depth of 14 m by 2081 to 2100, as outlined in the response to Commitment No.13) detrimental environmental impacts would be unlikely. These conclusions, along with our most recent risk assessment and thermal modeling results, consider the implications for closure under the HES with the highest risks and indicate that the Lupin TCA will perform as intended, and therefore does not require contingency planning under the proposed climate risk scenarios.

Status:

LMI considers this item resolved.

References:

- Holubec 2006a. Holubec Consulting Inc. Water Management After Closure Volume II of Seepage and Water Quality for Reclaimed Tailings Containment Area. March 2006.
- Holubec 2006b. Holubec Consulting Inc. Geotechnical, Seepage and Water Balance Volume I of Seepage and Water Quality for Reclaimed Tailings Containment Area. March 2006.
- EcoMetrix 2006. EcoMetrix Incorporated. Geochemistry and Water Quality Volume III of Seepage and Water Quality for Reclaimed Tailings Containment Area. April 2006.

Attachments: n/a

4.2 Tailings Closure Approach and Monitoring

Interested Party:	ECCC	**Final Submission No:**	2 & 5
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

ECCC's Technical Comment Submission noted that the proposed Tailings Containment Area (TCA) monitoring in the post-closure phase will not pick up any changes below the cover surface, because only visual inspections are proposed for the post closure phase. ECCC's Technical Comments also noted that conducting an evaluation of the tailings areas that have been covered the longest would provide a supporting indication of performance of the proposed 1 m esker cover and saturated cover design.

ECCC recommended that the proponent conduct field investigations during the closure phase to obtain updated data on the behaviour and effectiveness of the tailings saturated cover design. The proponent committed to excavate a test pit in Cell 1 to conduct a visual inspection of the cover and evaluate its performance. The test pit data would supplement data from the thermistors and moisture meters in place. The proponent also stated that transducers would also be installed within existing stand pipes to collect data on water level variations within the cover for performance evaluation purposes. Field investigations were completed in summer 2019 and a report submitted Oct.15, 2019. Two test pits were excavated, in Cell 1 and Cell 2, and standpipe water quality was sampled. The engineer concluded:

> *"The test pit observations and standpipe water level measurements indicate that there is a saturated layer of cover above the tailings in the cells that were studied. Oxidized tailings were not observed within the test pits. In general, the water quality results from 2002 and 2019 are comparable. Based on these observations and measurements, the cover appears to be functioning as permitted."*

Monitoring in the post-closure phase (passive closure period) will need to be sufficiently robust to identify any changes to the performance of the tailings cover system. The current proposal is for monitoring during the passive closure period that includes monthly site inspections during the open water period for 5 years. Thermistors and soil moisture and temperature probes will be used to monitor the tailings cover during this phase. The proponent proposes gradually decreasing the frequency of site inspections and or specific monitoring requirements, based on test results confirming predictions of chemical and physical stability. If results are not as predicted, then additional monitoring and/or remediation works will be undertaken by the proponent.

ECCC considers the request for field investigations to be resolved.

ECCC Recommendation:

ECCC recommends that the details of the TCA monitoring should be included in the post-closure monitoring plan that is to be submitted within one year of licence approval by the Minister.

LMI Response:

As confirmed by the NWB in the Pre-hearing Conference Decision Report, LMI is committed to provide a post-closure monitoring plan, following discussions with all stakeholders one year following the approval of the Licence. (NWB 2019). As noted by ECCC, LMI will include details of the TCA Monitoring.

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520. June 2019.

Attachments: n/a

4.3 Perimeter Dams

Interested Party:	ECCC	**Final Submission No:**	3
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

ECCC' Technical Comment Submission had recommended that the proponent provide an assessment on the stability and potential for seepage for perimeter dams, because of the likelihood of the frozen cores thawing due to climate change. ECCC and CIRNAC requested that a report of the survey of the frozen cores of the dams be provided and that it include discussion of any implications for closure.

The proponent provided the results of a one-time geophysical survey conducted in August 2019 for dam 3D and dam 4 to confirm the condition of frozen cores.

The risk assessment report concluded that:

> *"Based on the existing instrumentation and survey data, the dams have a continuous frozen core and are deemed to be performing as licensed. Further evaluation indicated that in the event of the HES scenario where the frozen cores would thaw due to climate change, the dams will remain geotechnically stable. Based on previous work completed (Holubec 2006 and EcoMetrix 2006) as part of the TCA closure plan, the potential water quality impacts to the downstream receiving environment due to TCA seepage was generally estimated to be low, as the predicted increase in concentration in the discharge is estimated to be very low based on small unsaturated areas and the overall runoff dilution. The overall risks to Dam 3D and 4 associated with the HES thermal model are deemed low, and in turn, the risks associated with the LES thermal model are deemed very low."*

Further analysis was done on slope stability and necessary actions were identified for dam M and dam K. The remainder of the dams at the mine site were evaluated and determined to be stable.

The Final Closure and Reclamation Plan (FCRP) notes that as a part of closure activities the QA/QC program will include *"Inspection and monitoring of the existing instruments to ensure the tailings dams are performing according to the Final TCA ARP"*. This would include thermistors in the dams, as listed in Table 20 of the FCRP. The proponent is currently proposing a five-year passive closure period monitoring program. The proponent will submit a post-closure monitoring plan, which would provide details of existing and future instrumentation monitoring.

ECCC notes that the proponent has responded to the commitments that they made during the technical meeting and has provided to ECCC the required information about the dams.

ECCC Recommendation:

ECCC recommends that

- The time frame for ongoing monitoring of the dams extend beyond the 5 year passive closure period, and reflect the full duration of monitoring for the site; and
- Dam stability monitoring be included in the post closure monitoring plan.

LMI Response:

LMI has been actively performing TCA dam stability monitoring and inspections for 25-30 years and is committed to continue monitoring these dams in accordance with industry standard monitoring practices. The frequency and duration will be determined during the development of the post-closure monitoring plan, following discussions with all stakeholders one year following the approval of the Licence (Refer also to ECCC Final Submission No. 1).

Status:

LMI considers this item resolved.

References: n/a

Attachments: n/a

4.4 Duration of Permanent Monitoring and Timing Clarification

Interested Party:	ECCC	**Final Submission No:**	4
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

ECCC and other interveners identified the need for monitoring of sufficient duration to confirm effectiveness of the remediation measures *before* the monitoring program ends. The closure plans and the Draft Water Licence Framework (Schedule J Table 1) show the passive closure stage monitoring ending after 5 years (2026). A longer duration of monitoring is needed to account for any lag time in geochemical processes which affect water quality or for any lag time in thermal conditions. A longer duration of monitoring may allow the proponent to gather sufficient monitoring information to indicate the successful establishment of stable conditions. Thresholds may be identified that allow monitoring to be done on a reduced frequency during the post-closure period.

In their response to ECCC-TC4 regarding monitoring duration, the proponent noted that:

> *"LMI proposes to submit within one year of approval of the renewed/amended licence a Post Closure Monitoring Plan that incorporates where appropriate, regulatory review comments, ongoing field work, HHERA results and any other direction from the NWB."*

ECCC concurs with development of this plan, and notes that it should extend beyond the previously proposed five year passive closure period.

The approach outlined in the October 2017 Interim Closure and Reclamation Plan (ICRP) presented a longer-term monitoring process than what was outlined in the FCRP, which would form a reasonable basis for making decisions that are based on data. The ICRP states that:

> *"The post closure monitoring will provide the means of assessing when the stated goal of the reclamation measures has been reached…This closure phase of monitoring is anticipated to last for 10 years after site closure and reclamation and every three years after that to the 25 year mark."* and that *"post-closure monitoring activities are separated into two phases; Phase 1 – Annual Monitoring (years 1 through 10) and Phase 2 – Decreasing Frequency with monitoring during years 12, 15, 21 and 24 for a total of 14 years of monitoring over a 25 year period."*

With respect to the TCA, ongoing physical and chemical monitoring of the cover conditions and performance should continue until there is substantiated confidence that long-term stability and quality of the saturated tailings has been accomplished. The duration of monitoring would require that it be long enough to demonstrate that the performance of closure measures is as predicted.

ECCC Recommendation:

ECCC recommends that:

- The proponent include thresholds for water quality and tailings cover performance that would trigger moving to reduced monitoring frequency or intensity in the proposed post-closure monitoring plan.

- Monitoring of the TCA cover and water quality be done over a duration that is sufficient to demonstrate physical and chemical stability and acceptable quality for the long term.

LMI Response:

Thresholds for water quality and tailings cover performance that would trigger moving to reduced monitoring frequency or intensity will be included in the post-closure monitoring plan.

- As confirmed by the NWB in the Pre-hearing Conference Decision Report, LMI is committed to providing a post-closure monitoring plan, following discussions with all stakeholders, one year following the approval of the Licence (NWB 2019; see also response to CIRNAC Initial Submission No. 1 in Section 2.1).
- As part of the post-closure monitoring plan, LMI will develop and implement a detailed surface water monitoring program for the adjacent lakes (East, Boot, and Lower Sewage) and seepage from the waste rock, as described in ECCC Final Response No. 6 below (Section 4.5). These monitoring programs will be initiated in 2020 to establish pre-closure (current) conditions and will continue for a minimum 5-year period during the post-closure phase (2022 to 2026).
- Consistent with the objectives for final closure outlined in the FCRP and established guidelines for reclamation closure of mine sites, LMI concurs that water quality monitoring will be undertaken until physical and chemical stability is achieved. If water quality results demonstrate that chemical stability has been achieved (based on pH and metals concentrations), confirmatory monitoring will be conducted. If chemical stability is not achieved, annual monitoring will continue as described below in Section 4.5. The final duration of monitoring will be dependent on the water quality results.
- As described in the monitoring program below, water quality will be screened against MDMER limits and CCME guidelines for the protection of aquatic life. These limits/guidelines will be used as metrics for determining long-term chemical stability (see description of monitoring program in Section 4.5 below).

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520, Appendix D: List of Commitments; June 2019.

Attachments: n/a

4.5 Waste Rock Tailings and Acid Rock Drainage/Metal Leaching

Interested Party:	ECCC	**Final Submission No:**	6
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

The proponent has provided a conceptual design document for the consolidation and covering of the waste rock into a "dome" of about 23.2 ha at the mill and camp area. As noted in the Golder Technical Memo, *"The mine/mill/camp/airstrip complex is located on a local topographic high. As illustrated in Figure 1, runoff and seepage from the complex currently reports to multiple sub-watersheds as follows: -Upper Sewage Lake; Boot Lake; East lake & Contwoyto Lake."* Permafrost underlies the site, and precipitation tends to flow laterally (across the waste rock) and emerge as toe seeps from existing waste rock piles.

The consolidated rock dome will be capped with a 1.0 m thick layer of esker sand and gravel to limit infiltration and seepage and to reduce the exposed surface area of the waste rock. Expected seepage and runoff was predicted for under current climate conditions and for predicted 2081 to 2100 intermediate climate conditions. The predicted seepage volume as a percentage of annual precipitation was 15.8% for current conditions and 25% in the 2081 to 2100 conditions.

An updated Human Health and Ecological Risk Assessment (HHERA) was done to evaluate potential effects associated with the "dome's" seepage. Exposure pathways were identified for contaminants of potential concern coming from waste rock. The report concluded that *"The ARD-impacted seepage may result in long-term impacts to surface water quality in receiving surface water bodies (Boot Lake, East Lake and Lower Sewage Lake). Impacts to surface water quality in Contwoyto Lake are expected to be negligible"*. The analysis was done using 50th percentile mass loading inputs from the waste rock, and identified cobalt, copper and pH as the potential contaminants of concern in Boot Lake, East Lake, and Lower Sewage Lake. The HHERA recommended that water quality monitoring be conducted in Boot Lake, East Lake, and Lower Sewage Lake, to assess current conditions, to subsequently track behaviour in comparison to predictions, and to identify any issues (Section 6.3).

ECCC notes that the HHERA analysis uses only the median mass loading inputs; therefore the analysis may not be conservative. Monitoring should to be done to confirm predicted contaminant concentrations and duration of peak concentrations / loadings, as well as to indicate the need for any remedial measures.

ECCC Recommendation:

ECCC recommends that:

- The proponent sample the adjacent lakes – East, Boot and Lower Sewage –prior to waste rock dome construction and continue periodic monitoring for a full suite of metals and pH to confirm the predicted seepage quality and behavior.
- The Proponent monitor water quality of visible seeps or flows existing the waste rock pile.
- The proponent identify thresholds that would require remedial measures for seepage quality in monitored flow or seeps.

LMI Response:

As part of the post-closure monitoring plan, LMI will develop and implement a detailed surface water monitoring program for the adjacent lakes (East, Boot, and Lower Sewage) and seepage from the waste rock area (NWB 2019; see also response to CIRNAC Initial Submission No. 1 in Section 2.1 and ECCC Final Submission No. 4 in Section 4.4). The monitoring program will include pre-closure, post-closure, and seepage monitoring programs, as outlined in Attachment 2. Pre-closure results will be used to establish current conditions and a draft seepage pre-closure monitoring plan will be submitted in Q2 2020 so that monitoring can begin while the final plan for post-closure conditions is being developed. It is anticipated that water quality in adjacent lakes will improve after waste rock dome construction, but this will be evaluated using results from the post-closure monitoring program.

Receiving environment water quality results will be screened against CCME chronic guidelines for the protection of aquatic life and limits for deleterious substances in the MDMER. If water quality does not meet MDMER limits or CCME chronic guidelines, additional investigation may be warranted. An adaptive approach to the seepage and lake monitoring program will enable the implementation of additional remedial options if required to mitigate seepage discharge to the adjacent lakes.

Status:

LMI considers this item resolved.

References:

- NWB 2019. Nunavut Water Board Pre-Hearing Conference Decision Report Regarding an Application for Amendment and Renewal of Type “A” Water Licence No: 2AM-LUP1520, Appendix D: List of Commitments; June 2019.

Attachments:

- Attachment 2 – Proposed General Monitoring Table Changes

4.6 Asbestos Disposal

Interested Party:	ECCC	**Final Submission No:**	7
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

The proponent has indicated that they will be following appropriate guidelines for the disposal of asbestos containing materials.

ECCC considers this issue resolved.

LMI Response:

LMI reconfirms asbestos material handling and disposal will be undertaken as described in LMI ECCC Technical Comment No. 7 (i.e. as per ECCC recommendation in the underground and/or as per the FCRP to the Landfill) in accordance with WSCC Northwest Territories & Nunavut *Codes of Practice – Asbestos Abatement* (2018); and Department of Environment, Government of Nunavut *Guideline: Waste Asbestos* (2011).

Status:

LMI considers this item resolved.

References:

- WSCC Northwest Territories & Nunavut 2018. Codes of Practice – Asbestos Abatement. September 2018.
- Department of Environment Government of Nunavut 2011. Guideline: Waste Asbestos. January 2011.

Attachments: n/a

4.7 Draft Water Licence

Interested Party:	ECCC	**Final Submission No:**	8
Reference:	ECCC Final Written Submission dated December 13, 2019		

ECCC Comment:

The proponent has provided a draft Water Licence Framework which includes proposed effluent quality limits (Section E.5), and a list of definitions which includes the "Recognized Closed Mine" under the MDMER. ECCC notes that:

1. Schedule J Table 1 of the draft Framework identifies the anticipated discharge timing for each phase. During the Closure Phase (2020 to 2021) there will be discharge in 2020 from the Pond 2 station (LUP-10), which is the regulated discharge point for the water licence and the MDMER. By the post-closure phase (2022 to 2026) there will be passive discharge during open water, assuming that the spillway is in place.
2. Effluent quality limits proposed in Section E.5 are equal to or less than the current MDMER discharge limits. Moreover, these discharge limits will be changing as of June 1, 2021. At that time, MDMER limits for arsenic will be reduced to 0.3 mg/L average or 0.6 mg/L maximum grab. Similarly, limits for cyanide will drop to 0.5mg/L average and 1.0 mg/L maximum grab concentration. A limit for un-ionized ammonia will also come into effect; this limit will be 0.5 mg/L average or 1.0 mg/L maximum grab concentration. Until the proponent meets the requirements to become a Recognized Closed Mine under Section 32(2) of the MDMER, which takes at least 3 years to reach, there may be discharges from the TCA which could be subject to these new limits.
3. With respect to the definition of "Recognized Closed Mine" in Schedule A Definitions, this is defined by the proponent as being found under Section 1 of the MDMER. This definition was repealed in June 2018 and it may be more appropriate to refer to a Recognized Closed Mine as meeting the conditions of Section 32 of the MDMER.

ECCC notes that any effluent discharges from the TCA will be subject to the MDMER until Recognised Closed Mine status is attained. During this time, any water in the TCA will have to be retained or discharged in compliance with the MDMER. ECCC reminds the proponent that when the closed mine status is attained any seepage or discharges from the site must comply with the general prohibitions of subsection 36(3) of the *Fisheries Act*.

ECCC Recommendation:

ECCC recommends

- The proponent note the proposed effluent quality criteria under Schedule 4 that come into force June 1, 2021 in the event that there will be discharges after June 1, 2021.
- The proponent update the definition of "Recognized Closed Mine".

LMI Response:

LMI acknowledge that discharge from the Tailings Containment Area after June 2021 will be subject to more stringent limits provided in Table 2, Schedule 4 of the MDMER (Amendments not in Force). These limits will apply

until Recognized Closed Mine status is attained for Lupin Mine. The revised MDMER limits for total arsenic and cyanide, along with the new limits for un-ionized ammonia. Proposed Water Licence limits for all other parameters are equal to or lower than the new MDMER limits as of June 2021.

The DWLF should reflect the following:

> Part E, Item 5. Tailings Containment Area at monitoring program station LUP-10, shall not exceed the following effluent quality limits subject to Part E, Item 5(i):

Parameter	**Maximum Average Concentration (mg/L)**	**Maximum Concentration of Any Grab Sample (mg/L)**
Total Arsenic	0.50	1.00
Total Copper	0.15	0.30
Total Cyanide	0.80	1.60
Total Lead	0.10	0.20
Total Nickel	0.20	0.40
Total Zinc	0.40	0.80
Total Suspended Solids	15	30
Oil and Grease	No visible sheen	
The effluent discharged shall have a pH between 6.0 and 9.5		

> In addition to the limits above, Part E, Item 5(i) Any discharge occurring between June 2021 and the date that Lupin Mine attains Recognized Closed Mine Status will be subject to the following limits:

Parameter	**Maximum Average Concentration (mg/L)**	**Maximum Concentration of Any Grab Sample (mg/L)**
Total Arsenic	0.30	0.60
Total Cyanide	0.50	1.00

Parameter	**Maximum Average Concentration (mg/N-L)**	**Maximum Concentration of Any Grab Sample (mg/N-L)**
Un-ionized Ammonia	0.50	1.00

The following definition of a Recognized Closed Mine was provided in Schedule A of the draft Water Licence framework:

> Recognized Closed Mine means a recognized closed mine as defined by section (1) of the Metal and Diamond Mining Effluent Regulations SOR/2002-222 (last amended June 1, 2018).

LMI acknowledges any water licence issued by the NWB should include updated definition as follows:

> Recognized Closed Mine means a recognized closed mine per the conditions defined in Part 4, Section 32(1) of the Metal and Diamond Mining Effluent Regulations SOR/2002-222 (last amended June 25, 2019).

LMI notes any reference in a water licence to MDMER amendments/updates should be revised from June 1, 2018 to June 25, 2019.

Status:

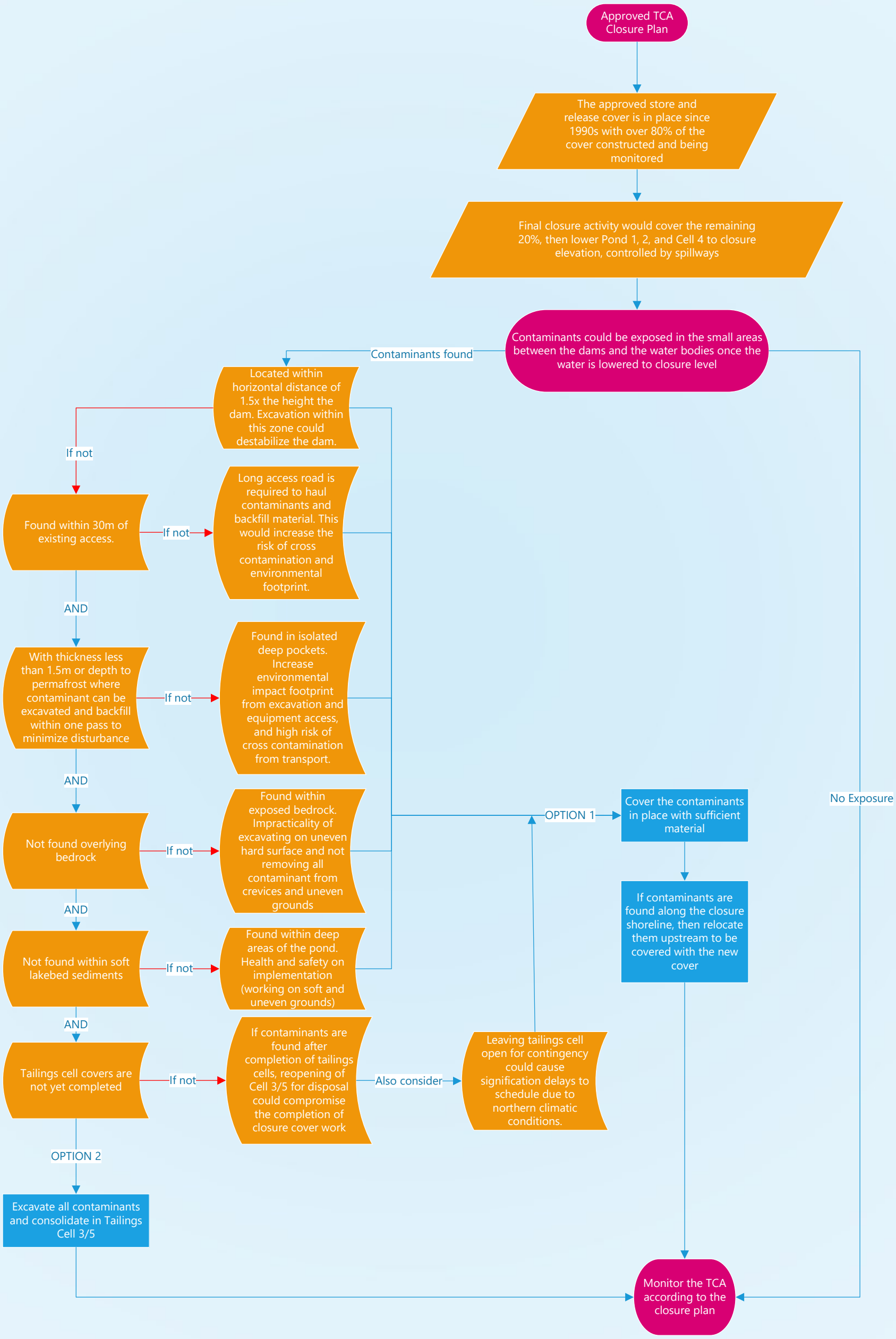
LMI considers this item resolved.

References: n/a

Attachments: n/a

ATTACHMENT 1 – CONTINGENCY CONTAMINANTS MANAGEMENT DECISION MATRIX (REFER TO CIRNAC INITIAL SUBMISSION NO.8)

Contingency Contaminants Management Decision Matrix



ATTACHMENT 2 – PROPOSED GENERAL MONITORING CHANGES TABLE

Proposed Changes – Adjacent Lakes and Seep Monitoring Program for Waste Rock												
Station ID	**Location**	**Frequency**	**Parameter**	**Parameter Group Code (See Table J.2)**	**Preparatory Work**	**Closure Phase**		**Post-Closure Phase**				**LMI Notes**
					2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
						Active Stage		**Passive Stage**				
LUP-EL-01	East Lake near shoreline near the potential seepage inputs	Twice-yearly: Once in freshet and once in late open-water season	pH, temperature, conductivity, dissolved oxygen (lakes only), total suspended solids, alkalinity, hardness, total metals	Field, conventionals, metals,	Yes	Yes	Yes	Yes				Pre- and post-closure monitoring programs include sampling at East, Boot, and Lower Sewage Lakes. Yearly monitoring to occur to 2026 (post-closure phase), with ongoing monitoring beyond this 5-year period if chemical stability is not achieved at this time. At least one confirmatory sampling program will be conducted at Year 10 (2031).
LUP-BL-01	Boot Lake near shoreline near the potential seepage inputs											
LUP-LSL-01	Lower Sewage Lake near shoreline near the potential seepage inputs											
LUP-SP-01 to LUP-SP-XX[(a)]	Locations of observed seepage or flow from waste rock pile											The rock pile boundaries will be surveyed on foot to look for any seepage or active flows exiting the waste rock pile. The location (GPS coordinates) of each seep will be recorded along with visual estimates of flow. During each subsequent monitoring program, seeps that had been identified previously will be revisited and sampled if still flowing; any changes in flow will be documented. Yearly monitoring to occur to 2026 (post-closure phase), with ongoing monitoring beyond this 5-year period if chemical stability is not achieved at this time. At least one confirmatory sampling program will be conducted at Year 10 (2031).

Notes:

(a) Seep sampling locations will be added to the post-closure monitoring program as new seeps are documented.