



**Mackenzie Valley Land and Water Board**  
**7th Floor - 4922 48th Street**  
**P.O. Box 2130**  
**YELLOWKNIFE NT X1A 2P6**  
**Phone (867) 669-0506**  
**FAX (867) 873-6610**

**Staff Report**

<b>Applicant:</b> Department of Indian Affairs and Northern Development – Contaminants and Remediation Division (DIAND-CARD)	
<b>Location:</b> Gordon Lake, NT	<b>Application:</b> MV2016L8-0006
<b>Date Prepared:</b> March 19, 2018	<b>Meeting Date:</b> March 29, 2018
<b>Subject:</b> Tailings and Waste Rock Cover Design Plan – Gordon Lake Group Remediation Project	

**1. Purpose/Report Summary**

The purpose of this Report is to present to the Mackenzie Valley Land and Water Board (MVLWB/the Board) a Tailings and Waste Rock Cover Design Plan (Plan) for the Gordon Lake Group (GLG) Remediation Project, submitted by the Department of Indian Affairs and Northern Development – Contaminants and Remediation Division (DIAND-CARD), as required to fulfill Part D, condition 10 of Water Licence (Licence) MV2016L8-0006.

**2. Background**

- February 16, 2017 – Licence MV2016L8-0016 issued;
- February 27, 2018 – Plan received;
- February 27, 2018 – Review commenced;
- March 2, 2018 – Technical Memo received and added to review;
- March 13, 2018 – Reviewer comments and recommendations due and received;
- March 19, 2018 – Responses received;
- **March 29, 2018 – Tailings and Waste Rock Cover Design Plan presented to the Board for decision;** and
- December 18, 2023 – Licence MV2016L8-0006 expires.

**3. Discussion**

On February 27, 2018, DIAND-CARD submitted a Tailings and Waste Rock Cover Design Plan to the Board (attached). This Plan is required by Part D, condition 10 of Licence MV2016L8-0006, and Schedule 2, condition 2 outlines a list of information requirements to be included in the Plan. The purpose of this condition, as stated in the Board’s Reasons for Decision developed at issuance of Licence MV2016L8-0006 (attached), is to provide reviewers the opportunity to review and provide comments, recommendations and general feedback on all aspects of the of the selected cover design. The Plan is to describe a variety of different design considerations, and rationale as to why the selected cover design was chosen.

Part D, item 10 of Licence MV2016L8-0006 states the following:

*The Licensee shall submit to the Board, for approval, 90 days prior to cover Construction, a **Tailings and Waste Rock Cover Design Plan**. The Licensee shall not commence Construction until the Board has approved the Plan. The Plan shall be in accordance with Schedule 2, item 2.*

Schedule 2, item 2 of Licence MV2016L8-0006 states the following:

*The **Tailings and Waste Rock Cover Design Plan**, referred to in Part D, item 10 of this Licence shall include, but not be limited to, the following:*

- a) A cover design alternatives analysis;*
- b) A design, with supporting analysis, and description of the purpose of each component of the cover system;*
- c) For-Construction drawings stamped and signed by an Engineer;*
- d) The Construction and materials specifications for the cover system;*
- e) The Construction and materials quality assurance and quality control program for the cover;*
- f) The details for a monitoring program to assess cover performance, oxygen ingress into Tailings or Waste Rock, net infiltration into Tailings or Waste Rock, and solids and pore Water geochemistry and Seepage quality;*
- g) The details of how the monitoring program will assess cover settlement and performance;*
- h) The details of how the monitoring program will confirm design assumptions;*
- i) A contingency plan outlining measures to be implemented should cover failure occur and if final cover performance does not achieve cover performance criteria;*
- j) Identification of the source of cover materials; and*
- k) Design details of the borrow pit.*

#### **4. Comments**

The Board's February 13, 2018 decision letter regarding the Final Detailed Construction Plan for the Tailings and Soil Containment Area (attached) states the following:

*"...In addition, the Board acknowledges the submission of the [Final Detailed Construction] Plan on February 8, 2018. The Board reminds DIAND-CARD that borrow materials should not be used until the memo regarding the geotechnical results is submitted to the Board, as described in the Plan. Board staff will conduct a conformity check of the memo and will contact DIAND-CARD to confirm material acceptability, prior to its use."*

On March 2, 2018, shortly after the start of the review of the Tailings and Waste Rock Cover Design Plan, this information was submitted to the Board in the form of a Technical Memo (attached). This information is required by Part D, condition 6 of Licence MV2016L8-0006. The Technical Memo was added to the review of the Tailings and Waste Rock Cover Design Plan on March 2, 2018. It was added because some of the information provided is relevant to the Tailings and Waste Rock Cover Design Plan and therefore should be reviewed by stakeholders for comment and recommendation.

The Board should note that Board staff have not yet contacted DIAND-CARD to confirm material acceptability, as previously outlined in the February 13, 2018 decision letter to DIAND-CARD (attached).

## 5. Reviewer Comments

By March 13, 2018, comments and recommendations on the Plan were received from the following reviewers:

- Environment and Climate Change Canada (ECCC);
- Government of the Northwest Territories – Environment and Natural Resources (GNWT-ENR);
- Indigenous and Northern Affairs Canada – Inspector (INAC-Inspector); and
- Board staff.

DIAND-CARD responded on March 19, 2018. The Review Summary and Attachments (attached) present the concerns identified through the review of the Plan.

Many review comments requested additional information and/or clarification on cover selection, cover performance monitoring, and corrective actions/mitigations. DIAND-CARD responded to these comments by providing additional information and clarification, or by referencing the appropriate plans.

In addition, a variety of reviewer comments requested further information on how the potentially acid generating (PAG) material and limestone are to be mixed to ensure the material is homogeneous and intimately mixed (ECCC 3; INAC-Inspector 5; MVLWB 2). The Plan indicated that 3-5 confirmatory samples will be taken after mixing to ensure a neutralization potential ratio greater than 2 (NPR > 2) has been achieved for all samples. DIAND-CARD committed to collect 5 samples, as recommended by Board staff, and if any of the results indicate a NPR < 2 *or* significant variability between samples, that additional mixing and an additional round of sampling be conducted prior to use of the material (MVLWB 1). Further to this, Board staff requested further detail on how the contractor will operationally mix in the limestone (MVLWB 2 and 3). DIAND-CARD's consultant (Stantec) responded stating that the specific procedure for mixing is the responsibility of the contractor and offered a detailed suggestion on how the mixing should take place (INAC Inspector 5; MVLWB 2 and 3). Board staff note that there are many different consultants and contractors involved with the Gordon Lake Group Remediation Project, and it is easy for miscommunication to occur. Therefore, the Board could require DIAND-CARD to ensure the contractor is adequately trained and informed on how to operationally achieve an intimate mix between the rock and limestone to significantly minimize any geochemical isolation. The operational method for mixing shall be determined by a Professional Engineer or other equivalent qualified professional with extensive professional knowledge and experience in geochemistry.

## 6. Security

As per section 94 of the *Mackenzie Valley Resource Management Act* (MVRMA) reclamation security was not applied to the Gordon Lake Group Remediation Project as the Licensee is the Federal Government.

## 7. Conclusion

Board staff conclude that further information was provided, and commitments were made by DIAND-CARD in their responses to reviewer comments.

Board staff suggest this submission is in conformity with the requirements of Licence MV2016L8-0006.

## 8. Recommendation

Board staff recommend the Board make a motion to approve the Tailings and Waste Rock Cover Design Plan, as submitted February 27, 2018, including the additional information included in the Technical Memo submitted March 2, 2018, to fulfill Part D, conditions 6 and 10 of Water Licence MV2016L8-0006.

A draft decision letter is attached for the Board's consideration and includes the following recommended text:

- The Board requires DIAND-CARD to collect a minimum of 5 samples after the initial preparation and mixing of potential cover material, and if any analytical results indicate a neutralization potential ratio value below 2 (NPR <2) **or** significant variability between samples, additional mixing and an additional round of sampling shall be conducted prior to use of the material. The material may be used only when sampling results of all 5 samples indicate a NPR > 2, and there is low variability between sample results (See Review comment MVLWB 1). These results shall be submitted to the Board and an Inspector.
- The Board requires DIAND-CARD to ensure the contractor is adequately trained and informed on how to operationally achieve an intimate mix between the rock and limestone to eliminate geochemical isolation. The operational method for mixing shall be determined by a Professional Engineer or other equivalent qualified professional with extensive professional knowledge and experience in geochemistry.

## 9. Attachments

- [Tailings and Waste Rock Cover Design Plan](#)
  - [Technical Memo](#)
- [Reasons for Decision – issuance of Licence MV2016L8-0006 – February 16, 2017](#)
- [February 13, 2018 Decision Letter on the Final Detailed Construction Plan](#)
- Review Summary and Attachments
- Draft Decision Letter from the Board

Respectfully submitted,



Kierney Leach  
Technical Regulatory Specialist

### Review Comment Table

<b>Board:</b>	MVLWB
<b>Review Item:</b>	INAC-CARD - Gordon Lake Remediation Project - Tailings and Waste Rock Cover Design Plan (MV2016L8-0006)
<b>File(s):</b>	<a href="#">MV2016L8-0006</a>
<b>Proponent:</b>	INAC - Contaminants and Remediation Directorate
<b>Document(s):</b>	<a href="#">Tailings and Waste Rock Cover Design Plan</a> (7.2 MB) <a href="#">Technical Memo</a> (3 MB)
<b>Item For Review Distributed On:</b>	Feb 27 at 12:28 <a href="#">Distribution List</a>
<b>Reviewer Comments Due By:</b>	Mar 13, 2018
<b>Proponent Responses Due By:</b>	Mar 19, 2018
<b>Item Description:</b>	<p><b>March 2, 2018 UPDATE: Reviewers should note that on March 2, 2018, a technical memo was attached to support this review, which includes additional details on the geochemistry of construction material. This memo was developed for the Final Detailed Construction Plan for the Tailings and Soil Containment Area, however it also contains information relevant to the Licence requirements for the Tailings and Waste Rock Cover Design Plan.</b></p> <hr/> <p>Indigenous and Northern Affairs Canada – Contaminants and Remediation Division (INAC-CARD) submitted a Tailings and Waste Rock Cover Design Plan for the Gordon Lake Group (GLG) Remediation Project on February 27, 2018. This Plan is required by Part D, item 10, and Schedule 2, item 2 of Licence MV2016L8-0006.</p> <p>Reviewers are invited to submit questions, comments, and recommendations on this submission using the Online Review System (ORS) by <b>Tuesday March 13, 2018 at 5pm MST.</b></p> <p>All documents that have been uploaded to this review are also available on our public registry. If you have any questions or comments regarding this Plan or using the Online Review System, please contact Kierney Leach at 867-766-7470 or <a href="mailto:kleach@mvlwb.com">kleach@mvlwb.com</a>.</p>

<b>General Reviewer Information:</b>	In addition to the email distribution list, the following organizations received review materials by fax:  Fort Resolution Métis Council - Trudy King (867) 394-3322  Hay River Metis Council - Trevor Beck, President (867) 874-4472  NWT Metis Nation - Tim Heron, NWTMN IMA Coordinator (867) 872-3586
<b>Contact Information:</b>	Jen Potten 867-766-7468 Kierney Leach 867-766-7470

### Comment Summary

Environment and Climate Change Canada: Melissa Pinto				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Analysis
1	General File	<b>Comment</b> ( <a href="#">doc</a> ) ECCC Cover Letter  <b>Recommendation</b>		Noted.
2	Technical Memo in support of Final Detailed Construction Plan, Methods	<b>Comment</b> Indigenous and Northern Affairs Canada - Contaminant and Remediation Division (the Proponent) states that "The preliminary ML/ARD [metal leaching/acid rock drainage] assessment of the 2" minus stockpile material is consistent with the Mine Environment Neutral Drainage (MEND) Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials (Price 2009). Three samples were collected from the stockpile. The number of rock samples is based on the tonnage of material to be exported and provides sufficient information to screen sites for the ML/ARD potential according to Price (2009)." The Proponent then goes on	<b>Mar 19:</b> Each of the three composite samples were taken from five separate locations (15 locations in total) shown on photographs (Appendix 1 of Appendix D). Photograph 1 shows that the base of the stockpile is well sampled. The methodology was deemed acceptable by an independent reviewer (Mark Lodgson - Support Memo was appended with Technical memo on 2"). Potential uncertainty related to a depletion of sulfides at the surface is also addressed by adding more limestone than theoretically required based on measured values (see response below).	INAC-CARD's response addresses the comment.

		<p>to state: "Three composite rock samples were collected with a shovel in a clean, three-gallon bucket secured with a lid. The composite sample was composed by collecting 0.5-kilogram portions of the material at five random locations in an approximate five metre area within the stockpile." It is also stated that the Shake Flask Extraction (SFE) is similar to the MEND test but on "as it is" material. The size of the area covered by the rock pile is not clear. Strictly using the MEND number of samples based on tonnage is correct in most cases; however, it may not adequately represent the entire rock pile that is spread out over a larger area especially when dealing with a remediation project. In addition, given that the pile has been in the location for a long time (legacy mine), the near surface part of the pile or samples would have been altered or weathered and its metal and sulphide content may have been depleted, so sampling near surface or shallow holes may not be an adequate representation of the true nature of the pile; samples taken deeper in the pile would be a better representation. The Proponent did not indicate how deep the samples were taken from the pile by using a shovel. It is also not readily clear what is meant by SFE similar to the MEND test but</p>		
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		<p>on "as it is" material.</p> <p><b>Recommendation</b> ECCC recommends that the Proponent indicate the area covered by the waste rock pile, and explain how the three samples adequately cover the sampled materials area and depth wise.</p>		
3	<p>Technical Memo in support of Final Detailed Construction Plan, Discussion - Stockpile Characterization</p>	<p><b>Comment</b> The Proponent states that "All three samples of the stockpile show elevated content of sulphide sulphur (average value is 1 wt%) that result in NPR [net potential ratios] values (1.0 to 1.3) that fall within the uncertain range of ARD potential (see Table 1). This uncertainty will be mitigated through mixing of this uncertain PAG [potentially acid-generating] material with limestone (CaCO<sub>3</sub>). The blending of PAG rock with limestone and other neutralizing materials is common practice in mining (MEND 1998). This method is referred to as pacification in this memorandum. The required amount of limestone (CaCO<sub>3</sub>) is discussed in the ML/ARD Pacification and Confirmation section." ECCC acknowledges that the classifications of the samples are uncertain based on the acid base accounting method, however, the NPR values that range from 1.0 to 1.3 are very close to the NPR&lt;1 which identifies PAG materials, therefore it would be prudent to assume that the samples are PAG. ECCC also agrees that blending or</p>	<p><b>Mar 19:</b> ARD should not occur if NPR &gt; 2. This NPR will be achieved through mixing the 1 tonne of stockpile material with 30 kg limestone and is based on the equations presented in the memorandum as well as on stoichiometry of pyrite oxidation and calcite dissolution (Price 2009). An independent reviewer (M. Logsdon) suggested to increase limestone amount to 50 kg/tonne of stockpile material to provide an additional safety buffer and Stantec agrees with this recommendation. Furthermore, water monitoring is outlined throughout the approved Construction and Post Construction Monitoring Plan (includes SNP monitoring for water quality). If concentrations exceed expectations, corrective actions will be taken if deemed necessary. Additional monitoring, if deemed necessary after Post Construction Monitoring is complete, will be included in a Long Term Monitoring Plan.</p>	<p>INAC-CARD's response addresses the comment.</p> <p>See Board staff Analysis to MVLWB-1.</p>



		<p>mixing PAG and non-PAG rock will produce enough neutralization to avoid acid potential in the interim and in the future; this mixture however, should be in a ratio that ensures that ARD is neutralized properly not just in the short term but long term as well. It is acknowledged that mixing PAG rock with limestone will neutralise ARD in the short term and extend the lag time before ARD sets in, but it should be noted that limestone CaCO<sub>3</sub> is very reactive and will react quicker than the PAG material and perhaps will be depleted before the PAG material exhaust its sulphide content. In addition, as noted by the Proponent, the CaCO<sub>3</sub> reaction will result in a coating of limestone with a poorly soluble sulphate that could prevent further reaction. If this happens, the reactive CaCO<sub>3</sub> is rendered ineffective and will not prevent ARD/ML.</p> <p><b>Recommendation</b> ECCC recommends that the Proponent explain how mixing the PAG material with limestone will ensure that there will be no incidence of ML/ARD in the long-term.</p>		
4	Tailings and Waste Rock Cover Design Plan “ Version 1, 6.3 Design Details	<p><b>Comment</b> The Proponent states that "It is expected that after placement of the BGM [bituminous geomembrane] cover with time, the groundwater will gradually dissipate and any residual groundwater will</p>	<p><b>Mar 19:</b> The site geology comprises bedrock outcrops or shallow bedrock below thin up to 0.5 m of overburden (sand and gravel). The exposed bedrock was observed to be sound and not fractured in most</p>	<p>INAC-CARD’s response addresses the comment.</p>

		<p>eventually seep out through the toe drains. In the long term, there will be no groundwater contained within the TSCA [tailings and soil containment area]. It should be noted that the volumes of leachate and discharge water will be dependent on the quality of BGM installation and landfill performance with regards to settlement and possible tears within the BGM liner." ECCC notes that the statement above is a bit confusing. It should be noted that having a BGM or a cap over the TSCA cannot prevent shallow or deep groundwater flow. The BGM will prevent or reduce infiltration of water through the TSCA to the groundwater and groundwater would no longer be recharged through the capped TSCA. However, groundwater could be recharged in a location away from the TSCA and yet continue to flow (shallow or deeper) underneath the facility. The BGM will reduce or prevent infiltration of water from above into the TSCA but it will not dissipate groundwater flow below the TSCA.</p> <p><b>Recommendation</b> ECCC recommends that the Proponent provide explanation on how the cover will dissipate groundwater flow.</p>	<p>areas. In this setup, the majority of runoff will follow bedrock topography as a surface runoff, with limited subsurface periodical flow contained in overburden. The bedrock is considered an aquitard and is not expected to convey any groundwater. The BGM will be sealed to bedrock around the perimeter to prevent any surface runoff to enter TSCA, except the low areas only where existing TSCA pore water will be allowed to seep out. Furthermore, the monitoring of groundwater is outlined throughout the approved Construction and Post Construction Monitoring Plan (includes water elevation and quality). If groundwater elevations do not dissipate over time as expected, corrective actions will be taken if deemed necessary. Additional monitoring, if deemed necessary after Post Construction Monitoring is complete, will be included in a Long Term Monitoring Plan.</p>	
5	Tailings and Waste Rock Cover Design Plan "â€"	<p><b>Comment</b> The Proponent states that "If groundwater level trends within the containment area, having</p>	<p><b>Mar 19:</b> The frequency of monitoring is outlined in Tables B-3 and B-4 of the approved Construction and</p>	Appropriate response.

	<p>Version 1, 7.2.1 Groundwater Monitoring</p>	<p>achieved steady-state, are observed to be increasing for three consecutive monitoring events after construction, this will constitute a trigger for action and review and/or modification of the monitoring frequency and/or remedial design components may be required." Furthermore that "If contaminant concentrations, having achieved steady-state (including non-increasing trend of containment area groundwater levels), are observed to be increasing for three consecutive monitoring events, this will constitute a trigger for action and review and/or modification of the monitoring frequency and/or remedial design components may be required." Also in 7.2.2 Surface Water Sampling, the Proponent also states that "If trends in CoC [contaminants of concern] concentrations, having achieved steady state (including non-increasing trend of containment area groundwater levels), are observed to be increasing for three consecutive monitoring events, this will constitute a trigger for action and review and/or modification of monitoring frequency and/or the remedial design components may be required." ECCC is of the view that the Proponent did not indicate the frequency of monitoring. If the time between samplings is far apart, then waiting for 3</p>	<p>Post Construction Monitoring Plan. Section 7.2.1 (referred to in this comment) describes contingency monitoring (as outlined in the approved Geochemical Verification Plan), which will dependent on specific site conditions and as necessary.</p>	
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		<p>consecutive increases may be too late. For example if the frequency is annually, this would mean that they have to wait over three years before any corrective action is taken.</p> <p><b>Recommendation</b> ECCC recommends that the Proponent provide clarification and indicate the proposed monitoring frequency that would trigger for action and review.</p>		
6	<p>Tailings and Waste Rock Cover Design Plan “ Version 1, Proponent drawing #C-CAM-08 Camlaren Plan View “ Foundation Preparation</p>	<p><b>Comment</b> The diagram shows the proposed ditch line on the west side of the proposed TSCA, however on the east side of the TSCA there is no proposed ditch. The east side of the TSCA is only about 20m from Gordon Lake. It is possible that any infiltration into the TSCA will drain toward Gordon Lake, and in some cases may infiltrate into the soil and migrate as groundwater into the lake. It is not readily clear why there are no proposed ditches along the east side of the TSCA to capture any seepage that is likely to drain into Gordon Lake.</p> <p><b>Recommendation</b> ECCC recommends that the Proponent clarify why there are no drainage ditches proposed along the east side of the TSCA (side closest to Gordon Lake).</p>	<p><b>Mar 19:</b> There is no more than 10m between the TSCA dam toe and the lake and it would be difficult to construct an effective drainage system on the east side. Therefore a drainage system has been designed for the remainder of the perimeter of the TSCA on the north, west, and south sides. The toe drain system is designed to drain to the eastern exterior location. It is expected that after BGM installation there will be little or no infiltration through the BGM and minor imperfections. It is expected that the seepage rates on the east side will be negligible such that any seepage collection through the ditches would be impractical or not possible.</p>	<p>INAC-CARD’s response addresses the comment.</p>
7	<p>Tailings and Waste Rock Cover Design Plan “ Version 1, 6.2</p>	<p><b>Comment</b> Section 6.2 suggests that there is an expected volume of over 19,000 m<sup>3</sup> of impacted material being handled. Table 4.2 indicates that the</p>	<p><b>Mar 19:</b> Potential sources of dust and associated dust control measures are outlined throughout the approved Sediment and Erosion Control Plan.</p>	<p>Appropriate response.</p>

	Further Design Considerations	<p>material may contain hazardous materials. Section 4.0 states that the tailings deposits are composed mostly of fine sand and silt. This fine material is easily subject to wind erosion, potentially transferring the hazardous materials off site. While dust control is mentioned in the Cover Design Plan, potential fugitive dust sources have not been identified and an adaptive management plan for fugitive dust was not provided.</p> <p><b>Recommendation</b> ECCC recommends that for all phases of the project, potential sources of fugitive dust be identified and characterized. ECCC also recommends that an adaptive management plan for fugitive dust be developed for all phases of the project. The plan should describe the emission sources and the associated control methodologies and mitigation measures to be applied.</p>	Furthermore, major excavations were primarily complete during winter months, which is considered an additional mitigative measure for fugitive dust.	
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**GNWT - ENR: Central Email GNWT**

ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Analysis
5	General File	<p><b>Comment</b> (<a href="#">doc</a>) ENR Letter with Comments and Recommendations</p> <p><b>Recommendation</b></p>		Noted.
1	Topic 1: Groundwater Impacts	<p><b>Comment</b> Section 4 notes that currently water percolates through the tailings into deeper groundwater and discharges into Gordon Lake. While the current plan to install a cover</p>	<p><b>Mar 19:</b> Minimal and unreliable groundwater monitoring was conducted during historical assessment programs. As part of the construction phase, proper groundwater monitoring</p>	Appropriate response.

		<p>on the expanded Tailings Storage Containment Area will reduce or eliminate water from infiltrating this waste area in future, there may be some existing legacy contamination. ENR is concerned that any contamination existing in groundwater prior to installation of the cover may make it difficult to determine if future sampling results were related to a failure of the cover or from historic contamination.</p> <p><b>Recommendation 1)</b> ENR recommends that CARD outline whether results of groundwater monitoring currently show any contamination in the area of the TSCA and how monitoring results in future will be used to assess cover performance if historic contamination does exist.</p>	<p>wells will be installed to assess contamination in the area of the TSCA. Directly following the installation of the wells, baseline sampling will be conducted and subsequent monitoring will be in comparison to baseline conditions. Furthermore, the monitoring of groundwater is outlined throughout the approved Construction and Post Construction Monitoring Plan (includes water elevation and quality). If groundwater concentrations do not remain at baseline levels over time as expected, corrective actions will be taken if deemed necessary. Additional monitoring, if deemed necessary after Post Construction Monitoring is complete, will be included in a Long Term Monitoring Plan.</p>	
2	Topic 2: Risk Classification	<p><b>Comment</b> Table 4.2 outlines the risk classification for the various waste materials to be placed in the TSCA. It is not clear how these risk classifications were determined.</p> <p><b>Recommendation 1)</b> ENR requests that CARD provide a reference which includes the rationales for the risk classifications outlined in Table 4.2</p>	<p><b>Mar 19:</b> As referenced in the paragraph that precedes Table 4.2, please refer to the Section 7.10.10 of the Geochemical Verification Plan for details and rationale associated with risk classification.</p>	Appropriate response.
3	Topic 3: Liner Material	<p><b>Comment</b> Section 6.1 outlines the need for tear resistance and flexibility of the cover liner to accommodate settling and prevent punctures. Of note, the liner has been changed</p>	<p><b>Mar 19:</b> This plan was reviewed by an Independent Peer Review Panel (IPRP) comprised of foremost experts in the field. This issue was raised by the IPRP during the review and the BGM was</p>	Acceptable response.

		<p>from Polyethylene Geomembranes (high density or low density polyethylene [HDPE]/LLDPE) to Bituminous Geomembrane (BGM). It is noted that BGM liner will have less flexibility than LLDPE and is also more permeable.</p> <p><b>Recommendation 1)</b> ENR requests that CARD quantify any additional risk to the environment as a result of the liner change related to flexibility and permeability.</p>	<p>deemed acceptable. As the potential risk is understood and a level of settlement is expected, mitigative measures and monitoring will be complete. Mitigative measures include the proper placement of materials and additional material on-site in case repairs are required. A small stockpile of material will be left adjacent to the TSCA for potential future cover repairs. The approved Construction and Post-Construction Monitoring Plan includes detail pertaining to settlement monitoring. Additional monitoring, if deemed necessary after Post Construction Monitoring is complete, will be included in a Long Term Monitoring Plan.</p>	
4	Topic 4: Consolidation of Tailings	<p><b>Comment</b> In Section 6.3 of the Design Plan, it is noted "there will be a risk that settlement may develop due to consolidation of the underlying tailings. The consolidation of tailings may continue after BGM installation. The magnitude of this consolidation is difficult to predict due to unknown tailings properties." What specific monitoring is anticipated to monitor for shifts or tears to the cover as a result of potential consolidation in future and what corrective actions will be undertaken should this be observed?</p> <p><b>Recommendation 1)</b> ENR requests that CARD summarize specific monitoring to ensure cap</p>	<p><b>Mar 19:</b> The approved Construction and Post-Construction Monitoring Plan includes detail pertaining to settlement monitoring and action levels. Monitoring will include inspections to assess consolidation and potential settlement, as well as water quality and elevation. Corrective actions will include repairs (with additional material on-site) and increased monitoring as needed. Minor repairs would be expected to require heli-portable equipment as major repairs requiring heavy equipment are considered unlikely. The JV road is available for the foreseeable future, which minimizes cost risk.</p>	INAC-CARD's response addresses the comment.

		integrity related to waste consolidation and shifting and outline any corrective actions that may be required and their practicality of implementation.		
<b>INAC - NWT Inspectors: Devin Penney</b>				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Analysis
1	Tailings and Waste Rock Cover Design Plan - V1 page Section 7.1.1 Settlement.	<p><b>Comment</b> The original design of the TSCA called for the two seasons construction, so that major consolidation and resulting settlement within the TSCA could be repaired at the second year prior to the liner installation. With an adjustment of the construction schedule to one year, there will be an increased risk of excessive settlement and associated potential breakage of the BGM To mitigate the risk, it is important that fill material is compacted in accordance with specifications prior to the BGM placement. It is understood that the contractor plans to place the fill during the winter in freezing temperature, which can further increase the risk of settlement. The following are the recommendations to mitigate the risk: Mitigation One - Imported fill that contains ice, snow, or any frozen material should not be accepted for use. Select the material with minimum in-situ moisture to prevent ice development.</p> <p><b>Recommendation</b> How does the Contractor plan to meet this mitigation criteria</p>	<p><b>Mar 19:</b> The approved Construction and Post-Construction Monitoring Plan as well as the TSCA Construction Plan outlines monitoring and mitigation measures associated with consolidation. Monitoring will include inspections (involving geotechnical engineer) and QA/QC procedures during placement/consolidation (e.g. rejection of material containing snow/ice). Mitigation will be include careful placement and proper compaction of material. Contingency material will be available on-site in the event of settlement.</p>	INAC-CARD's response addresses the comment.



2	<p>Tailings and Waste Rock Cover Design Plan - V1 page Section 7.1.1 Settlement.</p>	<p><b>Comment</b> Mitigation Two - The placement of all fill material should be monitored on a full time basis by qualified and experienced geotechnical personnel under the supervision of a geotechnical engineer, with the authority to stop the placement of fill at any time when conditions are considered to be unacceptable.</p> <p><b>Recommendation</b> Who is the Geotechnical Engineer that will be on site to carry out this mitigation.</p>	<p><b>Mar 19:</b> The design engineer, Kris Hojka, is a senior geotechnical engineer with over 25 years of experience and is heavily involved with oversight of the work. A qualified and experienced geotechnical technician, Rob McCullough, conducted weekly inspections of the fill placement in the TSCA. At the time of cover construction, a qualified full-time geotechnical engineer will be on-site for compaction supervision and liner installation. A qualified and experienced geotechnical engineer will conduct on-site inspections annually during the summer months as per the requirements of the Water Licence. Kris will also be on-site for design/supervision purposes as needed. As per the Water Licence, weekly inspections will be conducted on-site however do not require a geotechnical engineer.</p>	<p>INAC-CARD's response addresses the comment.</p>
3	<p>Tailings and Waste Rock Cover Design Plan - V1 page Section 7.1.1 Settlement.</p>	<p><b>Comment</b> In addition, there will always be a risk that settlements may develop due to consolidation of the underlying tailings. As explained above, the tailings consolidation is a very slow process, and will not likely be completed within one season of construction.</p> <p><b>Recommendation</b> How will the contractor address settlement issues if they occur?</p>	<p><b>Mar 19:</b> Please refer to previous responses. Furthermore, minor settlements may be acceptable if overall drainage is maintained. In the event of major settlements that results in pooling of water, the settled areas shall be repaired locally by removing the cover with BGM in the settled area, filling the depression and placing new BGM locally with new cover. However, based on the design, pooling of water in settled areas is not likely to</p>	<p>INAC-CARD's response addresses the comment.</p>

			occur, as the design of the TSCA cover incorporates 4.6% slope that should accommodate most settlement.	
4	Tailings and Waste Rock Cover Design Plan - V1 page Section 7.1.1 Settlement.	<p><b>Comment</b> Additional TSCA field investigation was recommended prior to construction to assess the in-situ properties of tailings and potential settlement. This would allow for more precise settlement predictions and support planning to mitigate the settlement problem during construction. A preliminary proposal was provided on December 15, 2017 and a meeting was held on December 18, 2017. Although the Crown decided not to undergo the assessment, it is important to understand the potential implications in the absence of an understanding of the in-situ tailings geotechnical characteristics. The potential for settlement in response to waste and cover loads has not been predicted, which could lead to unanticipated repair requirements that could in turn impact overall expected project schedule and/or budget. During discussion the Crown felt that this risk was not sufficient to warrant the additional recommended investigation. The inspection of the final TSCA to be performed following construction as part of the Long-term Monitoring Plan should include measurement of cover elevation for identification of</p>	<p><b>Mar 19:</b> Please refer to previous responses. The approved Construction and Post-Construction Monitoring Plan as well as the TSCA Construction Plan outlines monitoring and mitigation measures associated with consolidation. Monitoring will include inspections (involving geotechnical engineer) and QA/QC procedures during placement/consolidation (e.g. rejection of material containing snow/ice). Monitoring will also include water quality testing and elevation records. Mitigation will be include careful placement and proper compaction of material. Contingency material will be available on-site in the event of settlement. Corrective actions will include repairs (with additional material on-site) and increased monitoring as needed to proactively avoid risk of environmental contamination. Furthermore, as per the Water Licence, weekly inspections will be conducted on-site and a geotechnical engineer will conduct inspections annually during the summer months.</p>	Appropriate response. Board staff note that the Inspector will also have an opportunity to review and provide comments and recommendations on the Long-Term Monitoring Plan prior to approval and implementation.

		<p>settlement, and any settlement areas should be repaired. Contingency has been incorporated into the construction material volumes to account for potential repair requirements (limited to assumptions based on current understanding for TSCA tailings characteristics as noted above).</p> <p><b>Recommendation</b> What Testing will be done to verify if the integrity of the liner has been compromised in the event of settling.</p>		
5	<p>Gordon Lake Group Remediation Project - Technical Memo in support of Final Detailed Construction Plan. ML/ARD Pacification and Confirmation</p>	<p><b>Comment</b> The stockpile material will be blended with limestone (CaCO<sub>3</sub>), provided by Lafarge (sourced from the Exshaw Limestone Quarry in Alberta), to provide neutralization capacity to achieve a non-PAG blend (NPR &gt; 2). To achieve this blend, conservative stoichiometry calculations determined at least 26.50 kg of pure limestone per tonne of stockpile material (CaCO<sub>3</sub>/tonne) is required to mitigate for the uncertain ARD classification of the stockpile material. The addition of limestone will increase the NP of the material, creating a non-PAG blend that will prevent possible development of ARD conditions and therefore maintaining a low potential for metal leaching. The amount of limestone required to add to each tonne of stockpile material to achieve an NPR = 2 was</p>	<p><b>Mar 19:</b> Stantec agrees that random testing should be completed over the surface area of the placed material to test for potential hot spots. This sampling event can be complete prior to official construction completion. Following construction, monitoring of receiving environments will be conducted as outlined throughout the approved Construction and Post Construction Monitoring Plan (includes SNP monitoring for water quality). If concentrations exceed expectations, corrective actions will be taken if deemed necessary. Additional monitoring, if deemed necessary after Post Construction Monitoring is complete, will be included in a Long Term Monitoring Plan.</p>	<p>See Board staff response to MVLWB-1.</p>

		<p>estimated as follows: Quality control measures to account for possible mixing errors or uncertainty will include: . Visual inspection of each material to confirm material types and homogeneity of the non-PAG blend . Static testing of blended material to confirm a non-PAG blend is achieved by taking 3-5 samples from the non-PAG mixture stockpile prior material placement . Quality control measures will be supervised, recorded and reported by Stantec.</p> <p><b>Recommendation</b> To achieve proper NP it is imperative that the blending of the NPAG material with the PAG material be consistent and homogeneous. The inspector recommends that random testing be done over the surface area of the cover to ensure that no hot spots are present.</p>		
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**MVLWB: Kierney Leach**

<b>ID</b>	<b>Topic</b>	<b>Reviewer Comment/Recommendation</b>	<b>Proponent Response</b>	<b>Board Staff Analysis</b>
1	Technical Memo - Quality Control Measures	<p><b>Comment</b> The Technical Memo outlines quality control measures to account for possible mixing errors or uncertainty. Board Staff recommend that 5 samples are taken, and that if significant variability is present between samples, that an additional round of sampling be conducted.</p> <p><b>Recommendation</b> Can INAC-CARD collect 5 samples and revise the Technical Memo to include a practice that, based</p>	<p><b>Mar 19:</b> Stantec agrees to collect 5 samples after the initial mixing. Stantec also agrees with the Board recommendation for the additional round of sampling if any sample shows NPR below 2 and if significant variability is present between samples. If any sample has NPR below 2, Stantec will also recommend an additional mixing before the additional sampling.</p>	<p>Acceptable response.</p> <p>Board staff recommend the Board reminds INAC-CARD of its responsibility as the Licensee to collect a minimum of 5 samples after the initial mixing, and that if any results indicate a NPR below 2 <b>or</b></p>

		on sample variability, would trigger an additional round of sampling to be conducted?		significant variability between samples, that additional mixing and an additional round of sampling be conducted prior to use of the material.
2	Technical Memo - Mixing	<p><b>Comment</b> Board Staff note that the intent of the sampling is not only to confirm expected geochemistry, but also to assess the degree of mixing in of limestone that will be achieved. Board Staff also note that an important aspect of the mitigation is to provide an intimate mix between the rock and limestone.</p> <p><b>Recommendation</b> Please provide greater detail on how the contractor will mix in the limestone on an operational level.</p>	<p><b>Mar 19:</b> The specific procedure for mixing is the responsibility of the contractor. Stantec's initial suggestion is to mix rock and limestone in 100 m3 batches. Each batch will be spread as 1 m thick layer of rock a with ~0.05 m of limestone is spread over the rock. Front loader or backhoe will be mixing each batch flipping this layer for 2-3 hours. Then the mixed batch is moved to "blended" stockpile wich will be sampled prior placement as described in response above (cell 19G).</p>	<p>Board staff recommend the Board require INAC-CARD to ensure the contractor is adequately trained and informed on how to operationally achieve an intimate mix between the rock and limestone to significantly minimize any geochemical isolation. The operational method for mixing shall be determined by a Professional Engineer or other equivalent qualified professional with extensive professional knowledge and experience in geochemistry.</p>
3	See above topic	<p><b>Comment</b> None</p> <p><b>Recommendation</b> Please provide greater detail on how the contractor will ensure that mixing is sufficient in</p>	<p><b>Mar 19:</b> Please see responses above (cells 18G and 19G).</p>	<p>Noted.</p>

		meeting the pacification objectives.		
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Environmental Protection Operations Directorate  
Prairie & Northern Region  
9250 – 49<sup>th</sup> Street NW  
Edmonton, AB  
T6B 1K5

March 13, 2018

ECCC File: 5100 000 072/002  
MVLWB File: MV2016L8-0006

Kierney Leach  
Regulatory Officer  
Mackenzie Valley Land and Water Board  
7<sup>th</sup> Floor, 4922 48<sup>th</sup> Street  
P.O. Box 2130  
Yellowknife, NT X1A 2P6

Via online submission

**RE: MV2016L8-0006 - INAC-CARD – Gordon Lake Remediation Project - Tailings and Waste Rock Cover Design Plan**

Attention: Kierney Leach

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Mackenzie Valley Land and Water Board regarding the above-mentioned design plan. ECCC's specialist advice is provided based on our mandate, in the context of the *Canadian Environmental Protection Act*, the pollution prevention provisions of the *Fisheries Act*, the *Migratory Birds Convention Act*, and the *Species at Risk Act*.

Should you require further information, please do not hesitate to contact Petrel Liu at (780) 951-8851 or [petrel.liu@canada.ca](mailto:petrel.liu@canada.ca)

Sincerely,

*[original signed by]*

Melissa Pinto  
Senior Environmental Assessment Coordinator

Attachment(s): ECCC Comments Excel Sheet

cc: Georgina Williston, Head, Environmental Assessment North (NT and NU)  
ECCC Review Team



March 13, 2018

Jen Potten  
Regulatory Officer  
Mackenzie Valley Land and Water Board  
7<sup>th</sup> Floor – 4910 50<sup>th</sup> Avenue  
P.O. Box 2130  
Yellowknife, NT  
X1A 2P6

Dear Ms. Potten,

**Re: INAC CARD  
Water Licence – MV2016L8-0006  
Tailings and Waste Rock Cover Design Plan  
Request for Comments**

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories has reviewed the plan at reference based on its mandated responsibilities under the *Environmental Protection Act*, the *Forest Management Act*, the *Forest Protection Act*, the *Species at Risk (NWT) Act*, the *Waters Act* and the *Wildlife Act* and provides the following comments and recommendations for the consideration of the Board.

### **Topic 1: Groundwater Impacts**

#### **Comment(s):**

Section 4 notes that currently water percolates through the tailings into deeper groundwater and discharges into Gordon Lake. While the current plan to install a cover on the expanded Tailings Storage Containment Area will reduce or eliminate water from infiltrating this waste area in future, there may be some existing legacy contamination. ENR is concerned that any contamination existing in groundwater prior to installation of the cover may make it difficult to determine if future sampling results were related to a failure of the cover or from historic contamination.



### **Recommendation(s):**

- 1) ENR recommends that CARD outline whether results of groundwater monitoring currently show any contamination in the area of the TSCA and how monitoring results in future will be used to assess cover performance if historic contamination does exist.

### **Topic 2: Risk Classification**

#### **Comment(s):**

Table 4.2 outlines the risk classification for the various waste materials to be placed in the TSCA. It is not clear how these risk classifications were determined.

#### **Recommendation(s):**

- 1) ENR requests that CARD provide a reference which includes the rationales for the risk classifications outlined in Table 4.2

### **Topic 3: Liner Material**

#### **Comment(s):**

Section 6.1 outlines the need for tear resistance and flexibility of the cover liner to accommodate settling and prevent punctures. Of note, the liner has been changed from Polyethylene Geomembranes (high density or low density polyethylene [HDPE]/LLDPE) to Bituminous Geomembrane (BGM). It is noted that BGM liner will have less flexibility than LLDPE and is also more permeable.

#### **Recommendation(s):**

- 1) ENR requests that CARD quantify any additional risk to the environment as a result of the liner change related to flexibility and permeability.

### **Topic 4: Consolidation of Tailings**

#### **Comment(s):**

In Section 6.3 of the Design Plan, it is noted “there will be a risk that settlement may develop due to consolidation of the underlying tailings. The consolidation of tailings may continue after BGM installation. The magnitude of this consolidation is difficult to predict due to unknown tailings properties.” What specific monitoring is anticipated to monitor for shifts or tears to the cover as a result of potential

consolidation in future and what corrective actions will be undertaken should this be observed?

Recommendation(s):

- 1) ENR requests that CARD summarize specific monitoring to ensure cap integrity related to waste consolidation and shifting and outline any corrective actions that may be required and their practicality of implementation.

Comments and recommendations were provided by ENR technical experts in the Water Resources Division and the North Slave Region and were coordinated and collated by the Environmental Assessment and Monitoring Section (EAM), Conservation, Assessment and Monitoring Division (CAM).

Should you have any questions or concerns, please do not hesitate to contact Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email [patrick.clancy@gov.nt.ca](mailto:patrick.clancy@gov.nt.ca).

Sincerely,



Patrick Clancy  
Environmental Regulatory Analyst  
Environmental Assessment and Monitoring Section  
Conservation, Assessment and Monitoring Division  
Department of Environment and Natural Resources  
Government of the Northwest Territories