

## **Manager's Annual Report Related to Red Chris Mine Independent Tailings Review Board Activities for 2017**

### **Stipulations per HSRC Section 10.4.4**

- (c) a report of the activities of the Independent Tailings Review Board established under section 10.4.2 (1) (c) of this code that describes the following:
- (i) a summary of the reviews conducted that year, including the number of meetings and attendees;
  - (ii) whether the work reviewed that year meets the Board's expectations of reasonably good practice;
  - (iii) any conditions that compromise tailings storage facility integrity or occurrences of non-compliance with recommendations from the engineer of record;
  - (iv) signed acknowledgement by the members of the Board, confirming that the report is a true and accurate representation of their reviews;

### **General**

1. RCDC established an Independent Engineering Review Panel (IERP) for the Red Chris Mine Tailings Storage Facility (TSF / TIA) in early 2015 per agreed Terms of Reference for the IERP as of March 19, 2015 with the following panel members:

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Terry Eldridge, P.Eng.	Principal, Golder Associates Ltd.	Geotechnical Engineer
Christoph Wels, P.Geo.	Principal, Robertson GeoConsultants Inc.	Hydrogeologist
Shannon Shaw, P.Geo.	President, pHase Geochemistry Inc.	Geochemist
Daryl Hockley, P.Eng.	Corporate Consultant, SRK Consulting Inc.	Civil Engineer

2. The agreed process for conducting Red Chris Mine TSF reviews by the IERP is as follows:
  - Related technical review documents for the construction and operation of the TSF are submitted to the IERP members preferably two weeks before the intended review meeting.
  - Format of meetings is generally one or two day meetings in Vancouver where RCDC and RCDC's retained consultants make a series of technical presentations. This is generally followed by a site visit for overall site inspection with a special focus on the TIA. Before concluding the site visit, the IERP conducts a site wrap up meeting. The site

visit including travel and the wrap up meeting is usually over a period of three days. The wrap up meeting briefly highlights the IERP's observed key concerns and recommendations. The IERP follows up with their Review Reports with observed concerns and recommendations for RCDC's follow-up.

- The following review meetings have been conducted since 2015:
  - Review Meeting #1 and Review Meeting #2 held in 2015
  - Review Meeting #3 and Review Meeting #4 held in 2016
  - Review Meeting #5 and Review Meeting #6 held in 2017

3. The Terms of Reference for the IERP were revised in 2016 post HSRC revisions of July 20, 2016. A copy of the Revised Terms of Reference for the IERP was attached for ready reference to the last year's summary report. The Members of the IERP continue to be as established in 2015.

#### 10.4.4 (c) (i) Summary of IERP Review Meetings of 2017 and Attendees

4. Review Meeting #5 was held on June 05 and June 06, 2017 in Vancouver followed by a site visit from June 07 to June 09, 2017 with an on site wrap up meeting on June 09, 2017.
5. Review Meeting #6 was held on November 14 and November 15, 2017. The site visit was deferred to the next review meeting in spring 2018 and the wrap up meeting was conducted on November 15, 2017.
6. Attendees for the above two meetings are listed below:

Review Meeting #5 June 05 to June 09, 2017	
Vancouver	<b>IERP Members</b> <b>RCDC:</b> Raj Anand, Eamon Mauer, Tim Fisch, Russel Shedden, Jack Love, Don Parsons, Steve Robertson <b>BGC:</b> D. Dufault, Clint Logue, Roy Mayfield, Michael Henderson, Annie Ruksys, Hamish Weatherly, Carl Mendoza, Jessica Worley, Trevor Crozier <b>SRK:</b> Steve Day, Soren Jensen (both part time) <b>Tahltan:</b> Nalaine Morin <b>Emerson:</b> Dan Emerson, Joann Bessler
Site Wrap Up	In person: IERP members + Tim Fisch, Tim Nehring, Eamon Mauer, Jack Love and Dave Archibald, BGC Clint Logue and Trevor Crozier. On the phone: Brian Kynoch, Steve Robertson, Don Parsons, Raj Anand and Nalaine Morin
Review Meeting #6 Nov 14 and Nov 15, 2017 (no site visit for this review)	
Vancouver	<b>IERP Members</b> <b>RCDC:</b> Raj Anand, Luke Moger, Eamon Mauer, Tim Fisch, Russel Shedden, Jack Love, Don Parsons

	BGC : D. Dufault, Clint Logue, Roy Mayfield, Michael Henderson, Annie Ruksys, Carl Mendoza, Jessica Worley SRK: Steve Day, Soren Jensen (both part time) Tahltan: Nalaine Morin Emerson: Dan Emerson, Joann Bessler Swiftwater: Cameron McCarthy Hydrologica: August Ustare
Vancouver Wrap Up	IERP Members; Tim Fisch, Eamon Mauer, Jack Love, Brian Kynoch, Steve Robertson, Don Parsons, Raj Anand and Nalaine Morin. Wrap Up Presentation was shared with all participants.

## 7. Summary of the Reviews from Meeting #5

Background information for the above review:

1. At the time of this meeting, RCDC was operating with the use of the North TIA, within the bounds of the North Dam and the Temporary Saddle Dam.
2. The permit for the construction of the South Reclaim Dam was received in July 2016 and the permit for the construction of the South Dam was received in August 2016.
3. During the North Dam (ND) construction season the crest elevation was raised to 1122.5 m, including the advanced construction of the El.1130 m downstream shell to El. 1122.5 m.
4. The South Starter Dam SSD) construction was completed from approved native foundation (approximately El. 1095 m) to 1122.5 m, including the construction of the downstream buttress to El. 1102 m.
5. The Temporary Saddle Dam (TSD) crest was raised by 3.9 m to El. 1120 m including the construction of an emergency spillway with an invert level at 1119.1 m.
6. The South Reclaim Dam (SRD) construction was constructed from approved native foundation (approximately El. 1079 m) to a final crest El. of 1087 m, including the construction of an emergency spillway.
7. 2017 construction activities were commenced.
8. The permit for NAG tails discharge into the south basin was received in late February 2017 but actual use of the south basin was not commenced at the date of Meeting #5.

List of Related Technical Review Documents Submitted for IERP's Review

The following page shows the list of items submitted to the IERP for their review before the meeting.

- 2016 Construction Records Report
- Hydrogeology Numerical Modeling
- South Area Groundwater Modeling Report
- Water Balance and Water Quality Model Report
- 📎 2017 02 28 PERMIT M-240 Approving Mine Plan and Reclamation Program.pdf
- 📎 2017-05-10 PE-105017.pdf
- 📎 105017 Annual Rpt.pdf
- 📎 Contaminants of Concern.pdf
- 📎 DM-0866004.0084 - Design Modifications - SRD and SRD Emergency Spillway Realignment.pdf
- 📎 ER-0866004.0051 - 2016 Geotechnical Site Investigation Report.pdf
- 📎 ER-0866004.0062 - Red Chris 2016 Hydrogeological Site Investigation Report.pdf
- 📎 ER-0866004.0063 - Red Chris 2016 Hydraulic Aquifer Testing at SPW16-1S&D.pdf
- 📎 ER-0866004.0064 - Red Chris 2016 Hydraulic Aquifer Testing at SPW13-3.pdf
- 📎 ER-0866004.0079 - Red Chris South Dam SIS Design Report.pdf
- 📎 ER-0866004.0085 - Red Chris 2016 DSI Report.pdf
- 📎 ER-0866004.0086 - Red Chris South Valley CHM Report.pdf
- 📎 ER-0866006.0091 - Red Chris 2016 Groundwater Monitoring Report.pdf
- 📎 LT-0866004.0058 - 2016 Construction of the SRD and SSD.pdf
- 📎 LT-0866004.0074 - Response to MEM - TSD Raise to El. 1120 m IFCs.pdf
- 📎 LT-0866004.0091 - TSD Seepage.pdf
- 📎 LT-0866004-19-04 - LTC HGeo Assessment Workplan.pdf
- 📎 Memo\_Red\_Chris\_Water\_Balance\_Response\_Memo\_20170314\_SRJ\_FNL.PDF
- 📎 PM-0866004.0076 - TIA Storage Capacity Assessment and IDF Management Strategy.pdf
- 📎 PM-0866004.0077 - 2016 IFC Drawings South Reclaim Dam.pdf
- 📎 PM-0866004.0078 - Stability Assessment of the TSD raise El. 1120 m.pdf
- 📎 PM-0866004.0083 - East Diversion Channel System Update.pdf
- 📎 PM-0866004.0087 - 2016 IFC Drawings - Upper East Diversion Channel Rev 1.pdf
- 📎 PM-0866004.0089 - Red Chris TIA Tailings Deposition June to September 2017 - Rev 1.pdf
- 📎 PM-0866006.0093 - Red Chris South Dam SIS Commissioning Framework Memo.pdf
- 📎 PM-0866006.0094 - Red Chris South Dam SIS Seepage Rates Memo.pdf
- 📎 RCDC Independent Tailings Review Board Report 2016 tfra May 13 2017.pdf
- 📎 RCDC\_Trigger\_Response\_Plan\_2016Oct26 ATTACHMENT 4.pdf
- 📎 SiteWideESC Plan 31MAR\_17.pdf
- 📎 WTP Planning\_PAG\_BAT\_24MAR\_17.pdf
- 📎 WTP\_TIA\_BAT 24MAR\_17.pdf



## Key Findings of Significant Concern

The items identified as being of greater concern or significance than others are listed below.

- Geotechnical Considerations
  - Sand supply (2017-2019 volume requirements)
  - South Dam earth dam (LOM) consideration
  - Site geological model
- Hydrogeological Considerations
  - Integration of hydrogeological studies
  - North Dam seepage
  - South Dam SIS
  - Update to site-wide 3D groundwater model
  - Lower Trail Creek hydrogeological study
- Geochemical Considerations
  - Cycloned sand as a geochemical source term
  - NAG tailings
- Water Management Considerations
  - Water supply during South Dam start up
  - Water balance and water supply (longer term)
  - Advanced planning for water management problems
  - Tailings and water manager/superintendent

## The IERP Report Format for Review #5

The report received on July 27, 2017 provides key observations and recommendations for each of the following considerations. Included at the end of this report is a tracking sheet of follow-up progress on all recommendations from the beginning of the IERP review process

1. Geotechnical Considerations
  1. Cycloned Sand Production 2017
  2. North Dam
  3. South Dam and South Reclaim Dam
  4. Dam Foundation Characterization
2. Hydrogeological Considerations
  1. Integration of Hydrogeological Studies
  2. North Dam Seepage
  3. South Dam SIS
  4. Update on Site Wide 3D Groundwater Model
3. Geochemical Considerations
  1. NAG Tailings and Cycloned Sand Geochemistry
  2. PAG Tailings
4. Water Management Considerations
  1. Water Management During South Pond Start-up
  2. Long Term Water Supply
  3. Advanced Planning for Water Problems
  4. Tailings and Water Management Superintendent

5. Observations of East Diversion Ditch
5. Other Considerations
  1. IERP Activities Update Community Meeting in Iskut
  2. FMEA
  3. Permitting
  4. IERP Review #6

#### Follow up on Recommendations












A separate tracking sheet is provided for follow up status of all recommendations from IERP activities.

#### 8. Summary of the Reviews at Meeting #6

Background information for the above review:

1. At the time of this meeting, RCDC was operating with the use of the North TIA and the South TIA.
2. NAG tailings deposition in the South TIA started in mid June 2017 and PAG tailings deposition started in late August 2017.
3. Construction activities were stopped owing to winter conditions having set-in.
4. The North Dam construction activities included a 5.5 m raise of the North Dam crest to El.1128 m including the advanced construction of a portion of the El. 1135 m underdrain system at the west (left) abutment.
5. The South Dam construction included a 6 m raise of the South Dam to El. 1128.5 m including the construction of the upstream shell to El. 1118 m, and the completion of the downstream Butress to El. 1102 m.

#### List of Technical Review Documents Submitted for IERP's Review

-  1657612-2017-021-L-Rev0-2040-TRP Response Letter 12JUN\_17.pdf
-  1657612-2017-037-R-Rev0-2100-Adaptive\_Management\_Plan\_01SEP\_17.pdf
-  Digital Appendices to Hydromet.zip
-  ER-0866006.0096 - South Dam SIS - Installation and Testing.pdf
-  ER-0866006.0116 - LTC 2017 Hgeo SI\_FINAL.pdf
-  RCDC\_Trigger\_Response\_Plan\_2016Oct26.pdf
-  Red Chris - Site Water Management Plan - Sept 2017 - V1.pdf
-  Red Chris Surface and Ground water Monitoring Program Update V1 October 31, 2017.pdf
-  Swifwater - Red Chris Hydrometeorological Characterization Report\_Rev0.pdf
-  TIA Water Quality Characterization Memorandum Sept 30 2017 Final.pdf
-  TOR\_Water\_Load\_Balance\_20171004\_RA\_SRJ\_FNL2.pdf

#### **Key Findings of Significant Concern**

The items identified as being of greater concern or significance than others are listed below.

1. Geotechnical Considerations
  - Cycloned sand supply (2017-2019 volume requirements)
2. Hydrogeological Considerations
  - North Dam seepage
  - South Dam SIS
3. South Dam SIS Geochemical Considerations
  - Cycloned sand as a geochemical source term
  - NAG tailings
4. Water Management Considerations
  - Risk of water shortage this winter
  - Predicting future water balance and water quality

#### The IERP Report Format for Review #6

The report received on February 22, 2018 provides key observations, advice and recommendations for each of the following considerations. The report in the end also provides tracking of follow-up progress on all recommendations from the beginning of the IERP review process.

1. Geotechnical Considerations
  1. Cycloned Sand Supply
  2. Dam Construction
  3. Annual Dam Safety Inspection
  4. Surficial Geology
2. Hydrogeological Considerations
  1. Integration of Hydrogeological Studies
  2. North Dam Seepage
  3. South Dam SIS
  4. LTC Study
  5. Site-wide 3D Groundwater Modelling
3. Geochemical Considerations
  1. NAG Tailings Cycloned Sand Geochemistry
  2. PAG Tailings
4. Water Management Considerations
  1. Hydro-meteorological Characterization
  2. Operational Water Balance
  3. Water Balance / Water Quality Modelling
  4. Permit M-240 Reports
  5. Tailings and Water Management Team
  6. Water Management Plan
5. IERP Review #7 (May 14 – May 18, 2018)
6. Tahltan Questions

During the review meeting #6, the IERP was provided with a set of questions from the Tahltan as documented below (N. Morin, email dated Nov. 14, 2017). Given the truncated duration of the meeting and receipt of the questions only during that time, the IERP hasn't had the opportunity to discuss the questions with various parties to any length. It is suggested here, that the questions are to be carried over to the next meeting with time in the agenda allocated to the topics such that there can be adequate discussion with RCDC and their consultants at that time.

*Questions provided:*

*A. There are three main issues of concern:*

- supernatant water quality in the PAG line and how that is affecting pond water quality suitability for discharge (especially if that becomes necessary in the next 1-3 years)?*
- PAG tails deposition that leaves the solids exposed to the air - is there a risk of sulphide oxidation leading to deteriorated pond water quality? Over what time period/duration of exposure?*
- NAG tails characteristics and how the higher than expected sulphide content may influence beach and sand dam runoff quality in the long term vs what was expected for the EA and original permits?*

*Does SRK's current testing program adequately address these issues? Will appropriate updates to these source terms be available in time to support the upcoming Site-wide Water Quality Model? What would be an appropriate timeline for a subsequent update to the model to be able to incorporate the revised source terms (assuming they won't be ready by January 2018).*

- B The total groundwater pumping rate from the north and south ends of the TSF is in the order of 1 million cubic meters per month. Given that the TSF has not discharged to surface to this point it would appear that a discharge to ground is occurring. Considering that the pond is not accruing much free water inventory and discounting the natural runoff to the pond the TSF seepage to ground is in the order of 1 million cubic meters per month. What are the implications of this pumping and seepage discharge to the local aquifers? How sustainable is this rate of pumping? What is the fate of this seepage in terms of the local aquifers and where might the seepage be daylighting? If the TSF continues to discharge to ground at this rate is there any risk to the local drinking water or receiving environment? Are the current monitoring programs at site capable of detecting and tracking the seepage plume to ensure that the risks to local consumption and receiving environment land use are adequately managed?*

Follow up on Recommendations

A separate tracking sheet is provided for follow up status of all recommendations from IERP activities. This sheet tracks recommendations from Review Report #1 to Review Report #5. Report #6 was received in late February 2018. Advice and Recommendations for this report are listed for due consideration in 2018.

**10.4.4 (c) (ii) Does the Work Reviewed in 2017 meet the Board's Expectations of Reasonably Good Practice?**

Manager's Assessment: Yes.

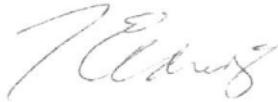
**10.4.4 (c) (iii) Any Conditions that Compromise Tailings Storage Facility Integrity or Occurrences of Non-compliance with Recommendations from the Engineer of Record**

Manager's Assessment: No.

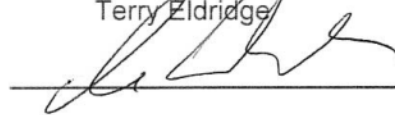
Engineer of Record's DSI for 2017 was submitted on February 21, 2018.

**10.4.4 (c) (iv) Signed Acknowledgement by the Members of the Board, Confirming that the Report is a True and Accurate Representation of their Reviews**

Signed and Acknowledgment by the IERP Members:



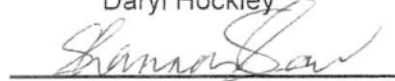
Terry Eldridge



Christoph Wels



Daryl Hockley



Shannon Shaw

## **Manager's Annual Report Related to Red Chris Mine Independent Tailings Review Board Activities for 2018 as of March 20, 2019**

### **Stipulations per HSRC Section 10.4.4**

- (c) a report of the activities of the Independent Tailings Review Board established under section 10.4.2 (1) (c) of this code that describes the following:
- (i) a summary of the reviews conducted that year, including the number of meetings and attendees;
  - (ii) whether the work reviewed that year meets the Board's expectations of reasonably good practice;
  - (iii) any conditions that compromise tailings storage facility integrity or occurrences of non-compliance with recommendations from the engineer of record;
  - (iv) signed acknowledgement by the members of the Board, confirming that the report is a true and accurate representation of their reviews;

### **General**

1. RCDC established an Independent Engineering Review Panel (IERP) for the Red Chris Mine Tailings Storage Facility (TSF / TIA) in early 2015 per agreed Terms of Reference for the IERP as of March 19, 2015 with the following panel members:

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Terry Eldridge, P.Eng.	Principal, Golder Associates Ltd.	Geotechnical Engineer
Christoph Wels, P.Geo.	Principal, Robertson GeoConsultants Inc.	Hydrogeologist
Shannon Shaw, P.Geo.	President, pHase Geochemistry Inc.	Geochemist
Daryl Hockley, P.Eng.	Corporate Consultant, SRK Consulting Inc.	Civil Engineer

The IERP provides an independent review of all aspects of the design, construction, operation, closure, and post-closure planning for the Red Chris Mine TIA with consideration of Best Available Technology (BAT) / Best Applicable Practice (BAP) and to provide recommendations and guidance to RCDC.

The IERP provides non-binding opinion on:

- whether the design, construction and operation of the TIA have given consideration to BAT / BAP;

- whether design and construction have been performed in accordance with the IERP's expectation of best management practices;
  - whether safety and operation of the TIA conform to the IERP's expectation of best management practices;
  - and whether there are weaknesses that would reasonably be expected to have a material adverse effect on the integrity of the TIA, human health, safety, or successful operation of the facility for its intended purpose.
2. The agreed process for conducting Red Chris Mine Tailings Impoundment Area (TIA) reviews by the IERP is as follows:
- Related technical review documents for the construction and operation of the TIA are submitted to the IERP members two weeks or more before the intended review meeting.
  - Format of meetings is generally one or two day meetings in Vancouver where RCDC and RCDC's retained consultants make a series of technical presentations. This is generally followed by a site visit for overall site inspection with a special focus on the TIA. Before concluding the site visit, the IERP conducts a site wrap up meeting. The site visit including travel and the wrap up meeting is usually over a period of three days. The wrap up meeting briefly highlights the IERP's observed key concerns and recommendations. The IERP follows up with their Review Reports with observed concerns and recommendations for RCDC's follow-up.
  - The following review meetings have been conducted since 2015:
    - Review Meeting #1 and Review Meeting #2 held in 2015
    - Review Meeting #3 and Review Meeting #4 held in 2016
    - Review Meeting #5 and Review Meeting #6 held in 2017
    - Review Meeting #7 held in 2018.
3. The Terms of Reference (TOR) for the IERP were revised in 2016 after Health Safety and Reclamation Code (HSRC) revisions of July 20, 2016. A copy of the Revised Terms of Reference for the IERP was attached for ready reference to the earlier year's summary report. The Members of the IERP continue to be as established in 2015.
- The TOR are under revision in reference to number meetings each year.

#### **10.4.4 (c) (i) Summary of IERP Review Meetings of 2018 and Attendees**

- Review Meeting #7 was held on May 14, 2018 and May 15, 2018 in Vancouver followed by a site visit from May 16, 2018 to May 18, 2018 with an on site wrap up meeting on May 18, 2018.
- Review Meeting #8 will be in Vancouver on April 24, 2019 and April 25, 2019. The site visit will be after the next review meeting in 2019.
- Attendees for the above meeting are listed below:

Review Meeting #7 May 14, 2018 to May 18, 2018	
Vancouver: May 14 to May 15, 2018	<p><b>Day 1 (May 14, 2018)</b>  <b>IERP Members</b>  <b>RCDC:</b> Raj Anand, Tim Fisch, Russel Shedden, Jack Love, Luke Moger, Steve Guan.  <b>BGC:</b> D. Dufault, Clint Logue, Jessica Worley, Carl Mendoza (Carl left by Lunch)  <b>Tahltan:</b> Nalaine Morin (On Telephone) (Nalaine left by Lunch)  <b>Emerson:</b> Dan Emerson, Joann Bessler  <b>On Telephone:</b> Don Parsons, Roy Mayfield.</p> <p><b>Day 2 (May 15, 2018)</b>  <b>IERP Members</b>  <b>RCDC:</b> Raj Anand, Tim Fisch, Russel Shedden, Jack Love, Luke Moger, Steve Guan.  <b>BGC:</b> D. Dufault, Clint Logue, Jessica Worley, Rob Millar joined for Jack's presentation)  <b>SRK:</b> Steve Day, Eduardo Marquez, Soren Jensen (Soren left after his presentation)  <b>Emerson:</b> Dan Emerson, Joann Bessler  <b>On Telephone:</b> Don Parsons (intermittently up to Lunch).</p>
Site Visit and Wrap Up: May 16 to May 18, 2018.	<p>In person: IERP members + Tim Fisch, Brian Kynoch, Tim Nehring, Russell Shedden, BGC Clint Logue and Daryl Dufault and Christine Creyke representing Tahltan.  On the phone: Don Parsons, Raj Anand and Nalaine Morin</p>

#### 4. Summary of the Reviews from Meeting #7














Background information for the above review:

1. At the time of this meeting, RCDC was operating with the use of the North TIA and the South TIA.
2. NAG tailings deposition in the South TIA started in mid June 2017 and PAG tailings deposition started in late August 2017.
3. The 2018 construction season activities were to include;
  - a. The North Dam (ND) cap raise to 1131.5m, downstream buttress raise, and upstream shell construction using cycloned sand cells.
  - b. The South Dam (SD) cap raise to 1132.0m.



## 5 List of Related Technical Review Documents Submitted for IERP's Review

The following shows the list of documents submitted to the IERP for their review before the IERP Meeting # 7.

-  2017 Construction Records Report
-  2017 Dam Safety Inspection Report
-  2017 Groundwater Monitoring Report
-  2017 Instrumentation Report
-  compare pmts
-  Hydromet Characterization Report
-  MLARD Update Memo
-  OMS 2018 Update
-  Red Chris 2018 SWWBWQ Model Report
-  RedChris
-  Site Wide Groundwater Flow Model
-  2017 08 25 PERMIT M-240 Approving Mine Plan and Reclamation Program (002).pdf
-  2017-05-10 PE-105017.pdf
-  PM-0866006.0130 2018 Issued for Construction Drawings and Specifications.pdf
-  Red Chris Annual Report 2017\_FinalDraft\_March 29 2018.pdf

## Key Findings

The items identified as being of greater concern or significance are listed below.

- Trail Creek sensitivity and implications for the South Dam area
  - RCDC has provided fish habitat compensation for the upper and middle reaches of Trail Creek but Lower Trail Creek (LTC) below Weir 64 remains fish habitat, and the project is required to maintain productive fish use.
    - Environmental Management Act (EMA) Permit PE-105017 requires that selenium concentrations in Lower Trail Creek remain below 2.0 µg/L. Background sources in Camp Creek may cause selenium concentrations in Trail Creek to approach that criterion. Rough calculations by the IERP indicate that inputs of tailings process water through seepage at flowrates as low as 1 L/s could cause this criterion to be exceeded. Therefore, Camp Creek and supernatant seepage will continue to need close management under any reasonable criterion.
    - Productive fish use of the lower reaches of Trail Creek also requires a base flow of water that has largely been cut off by the South Dam, leaving Camp Creek, the East Diversion Ditch and seepage below the South Dam as the only significant water sources. This situation further compounds the concerns about Camp Creek and seepage water quality. Therefore, any options that reduces risks of low water

flow, contamination or other damage to LTC should be given serious consideration.

- South dam seepage management
  - A liner was installed to elevation 1118 m on the dam and 300 m upstream of the dam to control seepage from the tailings to be deposited upstream of the South Dam. At the time of the site visit in May 2018 the tailings had reached a meter or two below the top of this liner. The expectation was that the tailings and water would overtop the liner edge in a few months. The IERP observed large areas of clean sand and gravel exposed in the borrow pits just upstream of the west abutment of the dam and in a large excavation made downstream of the center line of the dam on the west abutment. As the level of saturation of the natural soils within the TIA rises the seepage into the west valley side will be carried over a wider zone across the valley, which could reduce the capture efficiency of the seepage collection system.
  - The IERP recommends that RCDC review the decision on the extent of the liner on the dam and valley sides and consider extending the liner to the elevation of the tailings that will be reached when construction of the South Dam changes from earthfill to sand.

Considering recent trends in Trail Creek water quality (elevated selenium) and overall sensitivity of the Trail Creek reach the Phase 2 work of the LTC study is recommended to be executed as originally proposed.

The IERP also reiterated its earlier recommendation (from Review #5 and #6) that the results of the LTC field program should be used to update the 3D numerical model of the TIA to allow an assessment of the effects of surface water diversion and groundwater interception on streamflow and stream water quality in the LTC Creek.

- Cycloned sand production, deposition and geochemistry
  - Cycloned sand was not used for construction in 2017. The tailings operating plan now considers that up to 1.5 Mm<sup>3</sup> of sand will be placed during the construction seasons 2018 and 2019 (implying a large volume).
  - An assessment of the cycloned sand system in March 2018 by Golder indicated that the primary cyclones discharging into the sand cells were likely to meet the sand production requirements, but the biggest risk for meeting the sand dam construction schedule is the availability of non acid-generating (NAG) tailings.
    - There are occasions when the rougher tailings NPR is <2. The IERP does not believe that discharge of rougher tailings with NPR<2 on either the north or south beach of the TIA poses a concern with respect to acid generation during the operational life of the facility.
    - The IERP therefore recommends that RCDC and their consultants initiate a testing program to better define a site specific NPR for the definition of a low capacity PAG (or whatever appropriate terminology is developed) that differentiates the off-specification rougher tailings and the PAG cleaner scavenger tailings with respect to management of these two streams. Included in that work should be an assessment of the effects from limited duration exposure of tailings on a beach and the development of a deposition management plan for the rougher tailings when NPR values are less than 2.

- North Dam seepage
  - Seepage from the TIA has impacted the shallow aquifer between the North Dam and the North Reclaim Dam (NRD). Recent groundwater monitoring data presented during this IERP meeting indicated that sulphate concentrations in the shallow aquifer have continued to increase in 2018, and sulphate concentrations observed in MW13-22S in early 2018 exceeded the first trigger threshold for sulphate in the North Dam reach (i.e. 320 mg/L SO<sub>4</sub>). The IERP recommends that design and implementation of a SIS for the shallow aquifer downstream of the NRD be expedited. The IERP also advises that the causes for the significant changes in toe seepage rates from the North Dam should be evaluated.
  - More recent monitoring data have also confirmed the continued breakthrough of sulphate in the deeper aquifer (e.g. 160 mg/L SO<sub>4</sub> observed in MW13-22D in early 2018). The IERP reiterates earlier recommendations to assess the potential interaction between the shallow and the deep aquifer, specifically the potential to “draw” impacted shallow groundwater into the deep aquifer.
  
- Groundwater modeling
  - In the IERP’s opinion, more effort is warranted in the next phase of groundwater modeling to attempt calibration of the model using the recharge estimates developed in the hydrology study.
  - The present model predictions should be viewed as a sensitivity analysis illustrating potential outcomes rather than a definitive model prediction. The present model runs indicated, that the deep aquifer would be impacted significantly over the course of the project and that pumping from the deep aquifer, both at the North and South Dam, may be required post-closure. The IERP believes that this finding, if correct, could have significant implications for future water management during active operations and post-closure and should be further investigated in future updates of the groundwater model. The IERP recommends that the 3D TIA groundwater flow and transport model be rebuilt and calibrated (for flow and sulphate) using the first three years of TIA operation.
  
- Water balance and water balance/quality modeling
  - The updated “Site-Wide Water Balance and Water Quality Model 2018 Report” represents a significant improvement over previous work on integrated water balance / water quality modeling.
    - The report also shows that, despite the uncertainties, there are some very clear conclusions. Noteworthy examples include that the TIA water balance is likely to be negative during most years of operation, but discharge could be necessary in the next few years when storage capacity is limited and natural attenuation is critical to meeting downstream water quality objectives, especially for selenium.
    - One significant uncertainties in the TIA water balance is the loss to groundwater. Recommendations related this uncertainty include continued groundwater monitoring, annual updates of the operational water balance as an independent check on groundwater calculations, and quarterly sampling of the deep supply wells as a check on how much TIA water is entering the aquifer.

- A second uncertainty relates to the attenuation mechanism. Recommendations include continued tracking of loadings into the TIA, annual reviews of the extent of attenuation, and studies to characterize the attenuation mechanisms.

The IERP makes the following recommendations:

- Continue to monitor the free water inventory in 2018. If estimated free water volumes remain low by September 2018, initiate a survey and sampling program to better define the mudline.
  - Add to the next IERP meeting agenda an update regarding status of the meteorological and hydrometric monitoring changes recommended in the “2017 Hydrometeorological Characterization Report”.
  - Address the recommendations presented in the May 2018 meeting related to resolving water balance and water quality uncertainties.
  - Translate the uncertainties identified in the “Site-Wide Water Balance and Water Quality Model 2018 Report” into the operational water balance to show uncertainties in the predictions used to manage TIA water.
  - Complete annual reviews of the site wide water balance / water quality model, and comprehensive updates when significant new information is available.
- Tailings management team
    - The organization chart presented to the panel has significantly more personnel than previous versions. When all positions are filled, the department should have sufficient staff to meet the ongoing needs of the operation.
  - Tahltan questions
    - The IERP was provided with a set of questions from the Tahltan in November 2017. The May 2018 site visit allowed time for the IERP to consider these questions, as well as supplemental information provided in emails from RCDC staff. Questions related to regarding Tailings Water Quality and Geochemistry, Groundwater Pumping Rates, Pit and Waste Rock Storage Area Seepage. IERP provided and discussed responses to all questions provided in the Review Report.
  - Terms of Reference.
    - Given that the site has now made it through start-up and is approaching more steady state operations the need for two full reviews each year per existing Terms of Reference was discussed. The protocol to date has been to hold week-long reviews twice per year. Going forward, the IERP believes it can perform its role effectively with less time. The minimum requirement is one full review per year, including presentations in Vancouver and a site visit. However, rather than specifying only one review per year, the IERP believes it would be prudent to continue to plan for an abbreviated second review each year, and canceling the latter if RCDC, the Tahltan and the IERP agree it is unnecessary. The Terms of Reference will be revised accordingly.

**10.4.4 (c) (ii) Does the Work Reviewed in 2018 meet the Board's Expectations of Reasonably Good Practice?**

Manager's Assessment: Yes.

**10.4.4 (c) (iii) Any Conditions that Compromise Tailings Storage Facility Integrity or Occurrences of Non-compliance with Recommendations from the Engineer of Record**

Manager's Assessment: No.


Engineer of Record's DSI for 2018 was conducted in October 2018 and will be submitted by March 31, 2019 and the Manager's Assessment continues to be as above.

**10.4.4 (c) (iv) Signed Acknowledgement by the Members of the Board, Confirming that the Report is a True and Accurate Representation of their Reviews**

Signed and Acknowledgment by the IERP Members:



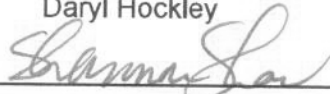
Terry Eldridge



Christoph Wels



Daryl Hockley



Shannon Shaw

**Activity Report of the Red Chris TIA Independent Engineering Review Panel (IERP) for 2019 – under Health, Safety and Reclamation Code for Mines in British Columbia Section 10.4.4 (c) – Summary of Reviews Conducted**

**Following Red Chris TIA Independent Engineering Review Panel (IERP) Meetings were held in 2019:**

**IERP Meeting # 8 – Held from 24 April – 25 April 2019 in Vancouver**

**IERP Members present at Meeting #8**

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Terry Eldridge, P.Eng.	Senior Mine Waste Consultant, Golder Associates Ltd.	Geotechnical Engineer
Christoph Wels, P.Geo.	Principal, Robertson GeoConsultants Inc.	Hydrogeologist
Shannon Shaw, P.Geo.	President, pHase Geochemistry Inc.	Geochemist
Daryl Hockley, P.Eng.	Corporate Consultant, SRK Consulting Inc.	Civil Engineer

**IERP Meeting Attendees**

<b>Name</b>	<b>Company</b>
Brian Kynoch	Imperial Metals
Don Parsons	Imperial Metals
Chris Fleming	RCDC
Greg Naus	RCDC
Russel Shedden	RCDC
Nalaine Morin	Tahltan Representative
Clint Logue (EOR)	BGC
Daryl Dufault	BGC
Brienna Shaw	BGC
Jordan Vizirtzoglou	BGC
Rob Millar	BGC

**Key Items/Findings which were discussed:**

- 1. IERP Scope re. Environmental Performance**
- 2. Geotechnical Considerations**
  - Sand Production
  - 2018 Dam Safety Inspections
  - 2018 Construction Summary

- 2019 Construction Plan
- Tailings Deposition
- March 2019 OMS Manual
- North Dam Design Update
- Recommendations and Advice

### **3. Hydrological Considerations**

- TIA Pond Water Monitoring
- Groundwater Monitoring-North Dam
- Groundwater Monitoring-South Dam
- Groundwater Modeling
- Recommendations and Advice

### **4. Geochemical Considerations**

- Proposed Revision to the NPR Classification
- Cyclone Sand Operations
- TIA Water Quality
- Recommendations and Advice

### **5. Water Management Considerations**

- Hydrometeorological Characterization
- Operational Water Balance
- Water and Load balance Modeling
- Recommendations and Advice

### **6. Terms of Reference**

- Recommendations and Advice

**IERP Meeting # 9 – Held from 16 September – 20 September 2019 (16-17 September 2019 in Vancouver, 18-20 September 2019 at the Red Chris Mine)**

**IERP Members present at Meeting #9**

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Terry Eldridge, P.Eng.	Senior Mine Waste Consultant, Golder Associates Ltd.	Geotechnical Engineer
Christoph Wels, P.Geo.	Principal, Robertson GeoConsultants Inc.	Hydrogeologist
Shannon Shaw, P.Geo.	President, pHase Geochemistry Inc.	Geochemist

**IERP Meeting Attendees**

<b>Name</b>	<b>Company</b>
Greg Naus	Newcrest
Chris Fleming	Newcrest
Max Oddie	Newcrest
Scott Paddington	Newcrest
Ben Withers	Newcrest
Marina Bravo Foster	Newcrest
Raj Anand	Imperial Metals
Nalaine Morin	Tahltan Representative
Clint Logue (EOR)	BGC
Daryl Dufault	BGC
Trevor Crozier	BGC
Karl Mendoza (Skype)	BGC
Jessica Worley	BGC
Kate Robey	BGC
Andrea Chong	BGC
Anna Ackerman	BGC
Brienna Shaw	BGC
Jordan Vizirtzoglou	BGC
Rob Millar	BGC

Daryl Hockley of the IERP was unable to attend the meeting

**Key Items/Findings which were discussed:**

- 1. Terms of Reference**
- 2. Geotechnical Considerations**



- Construction and Tailings Deposition Status
- Sand Production
- 2018 Instrumentation Report
- North Dam Design Update
- Dam Construction Materials
- Recommendations and Advice

### **3. Hydrogeological Considerations**

- Groundwater Impact to Shallow and Deep Aquifer – North Dam
- Lateral Seepage
- Lateral Seepage Mitigation – Geotechnical
- Groundwater Modeling
- Recommendations and Advice

### **4. Geochemical Considerations**

- Cycloned Sands
- ML/ARD Management and Geochemistry
- Recommendations and Actions

### **5. Water Management Considerations**

- Lower Trail Creek
- Operational Water Balance
- Water and Load Balance Modeling
- Recommendations and Advice

The 2019 recommendations of the IERP were mainly related to improving the understanding of the hydrogeologic conditions of the TIA and particularly on identifying and implementing measures to control seepage from the pond into the soil formations along the valley walls as well as implementing measures to control and collect seepage downstream of the seepage collection dams and to further the understanding of the site wide water balance. NRCM have implemented site based investigation programs and office based analyses in response to these recommendations.

The table for tracking NRCM responses to the 2019 IERP recommendations is appended to this report.

**10.4.4 (c) (ii) Does The Work Reviewed in 2019 meet the Board's Expectations of Reasonably Good Practice?**

Managers Assessment: Yes

**10.4.4 (c) (iii) Any Conditions that Compromise Tailings Storage Facility Integrity or Occurrences of Non-Compliance with recommendations from the Engineer of Record**

Managers Assessment: No

Engineer of Record's DSI for 2019 was conducted in October 2019 and will be submitted by March 31, 2020 and the Manager's Assessment continues to be as above.

**10.4.4 (c) (iv) Signed Acknowledgment by the Members of the Board, confirming that the Report is a True and Accurate Representation of their Reviews**

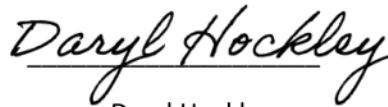
Signed and Acknowledgment by the IERP Members: \_\_\_\_\_



Terry Eldridge



Christoph Wels



Daryl Hockley



Shannon Shaw

**APPENDIX A**  
**SUMMARY OF IERP RECOMMENDATIONS AND CURRENT STATUS**  
**MEETING #8**

Section Reference*	Advice and Recommendation (summarized from IERP Report #8)	Current Status/Response
<b>2.2.6 March 2019 OMS Manual</b>	IERP advises: The CDA Dam Safety Reviews Technical Bulletin (2016) should be used as the guidance document for the DSR to be carried out in 2019	2019 DSR by Golder Associates Ltd. was carried out in consideration of the CDA 2016 Dam Safety Reviews Technical Bulletin (2016). The OMS has also been updated to reference the 2016 DSR technical bulletin.
<b>2.2.7 North Dam Design Update</b>	The IERP reiterates the recommendation from meeting #5 that inclinometers be installed within the foundation materials of the North Dam so that the deformation of the lacustrine and glaciolacustrine soil layers that control the stability and deformation of the North Dam can be measured and compared to the movements considered in the design.	Deformation monitoring instruments are planned to be installed during the 2020 Geotechnical Site Investigation within foundation materials of both the North Dam and South Dam.
	The IERP recommends RCDC develop an optimized North Dam section that uses mechanically placed sand and compare the cost, construction schedule and risk to achieving downstream environmental compliance to that of the hydraulically placed sand North Dam section when making the decision on the life-of-mine North Dam section to be used.	
	IERP advises: The liquefaction assessment of the colluvial fan deposit beneath the North Dam must be thorough and well documented and present the uncertainties inherent in the state-of-the-practice analysis methods. Even if liquefaction is shown to not be triggered during the design earthquake, the assessment should include a stability analysis using post-liquefaction strength parameters to demonstrate that the dam is unlikely to collapse if liquefaction is triggered.	Foundation liquefaction assessment will be completed following 2020 Geotechnical Site Investigation
	IERP advises: The IERP reiterates the advice from meeting #5 that consideration be given to a valley bottom buttress configuration to reduce the life-of-mine sand requirement for the North Dam.	
	The IERP supports the decision to construct the South Dam with earth fill in 2019 and 2020 and only begin construction with cycloned tailings sand in 2021 because this will reduce the amount	

	of water that must be managed downstream of the dam.	
	The IERP would support a decision to construct the South Dam using mechanically placed cycloned tailings sand obtained from a stockpile of sand developed upstream of the dam because this will eliminate the requirement to manage the slimes produced during hydraulic sand placement downstream of the dam and will reduce any potential environmental impacts due to seepage of construction water.	
<b>2.3.2 Groundwater Monitoring - North Dam</b>	IERP advises: Assess the source of elevated nitrate in the shallow aquifer (drain rock versus TIA pond water, etc.)	Crushed rock around well likely responsible for elevated nitrate.
	IERP recommends: Cyclone tailings (sic: <i>hydraulic</i> ) placement downstream of the ND should be delayed until it can be reasonably demonstrated that a shallow SIS can achieve the required capture efficiency to protect Quarry Creek water quality. The IERP proposes that: - the capture efficiency of the shallow SIS be evaluated for both wet and dry placed cycloned tailings, considering current source terms and hydrogeology - complete field trials (for example using pumping tests in shallow pumping wells and/or trenches) that demonstrate that the required capture efficiency in the shallow aquifer can be achieved.	Options are to be evaluated in 2020
	The IERP recommends assessing the potential interaction between the shallow and the deep aquifer in the ND and NDR area, specifically the potential to “draw” impacted shallow groundwater into the deep aquifer.	Future testing of the aquifers in the north TIA is anticipated when operational constraints permit an extended period of time when the pumps can be turned off and responses can be observed. This did not happen in spring 2019.
	Assess the influence of pumping on the deep aquifer downstream of the NRD on seepage by-pass and develop a pumping strategy that integrates the objectives of water supply and seepage interception.	At this time, dialing back pumping is not an option, with pumping required at full capacity to keep up with production water needs
<b>2.3.3 Groundwater Monitoring - South Dam</b>	Further assess and demonstrate capture efficiency of SD SIS (see Review #7for details).	
	Increase frequency of sampling to quarterly in monitoring wells downstream of the SRD to improve trend analysis	This is being done.

	Assess the potential causes of of sulphate breakthrough in the shallow and deep aquifer downstream of the SRD.	The first step was to confirm sulphate concentrations were elevated in the monitoring wells downstream of the SRD, which has been done.
	The Phase 2 LTC work should be completed as originally proposed (see Review #7 for details)	
<b>2.3.4 Groundwater Modelling</b>	The IERP recommends that the 3D TIA groundwater flow and transport model be rebuilt and calibrated (for flow and sulphate) using the first three years of TIA operation (see Review #7 for details).	In progress
	The IERP recommends that the schedule of groundwater modeling should be accelerated to inform groundwater related management decisions (e.g. water supply, SIS design, placement of sand in downstream shell) as soon as practical.	
<b>2.4.1 Proposed Revision to the NPR Classification</b>	Without a demonstrated ability to capture shallow seepage (see hydrogeology section), the IERP would not recommend lowering the NPR for sands placed downstream of the ND or SD	
	The IERP agrees with a lower NPR for sands and tailings placed on beaches upstream of the ND and SD to provide some operational flexibility for times when NPR excursions below 2 are seen	
<b>2.5.1 Hydrometeorological Characterization</b>	The IERP recommends that RCDC address recommendations made in the "2017 Hydrometeorological Characterization Report".	
<b>2.5.3 Water and Load Balance Modeling</b>	The IERP recommends that RCDC address recommendation made in the "Red Chris Project Site-Wide Water Balance and Water Quality Model 2018 Report" and in the May 2018 presentation.	In progress. BGC is reviewing all recommendations made about previous SWWBWQM in advance of beginning the SWWBM.
	The IERP recommends that RCDC prepare detailed contingency plans for water shortages.	Based on the updated site wide water management plan and using the results of the SWWBM, this recommendation will be revisited after Q3 2020.
	The IERP recommends that RCDC prepare conceptual contingency plans for water excesses.	Based on the updated site wide water management plan and using the results of the SWWBM, this recommendation will be revisited after Q3 2020.

**APPENDIX B**  
**SUMMARY OF IERP RECOMMENDATIONS AND CURRENT STATUS**  
**MEETING #9**

General Topic	Section Reference*	Advice and Recommendation (summarized from IERP Report #9)	Current Status/Response
Geotechnical Considerations	<b>2.2.3 2018 Instrumentation Report</b>	IERP recommends: At least one line of inclinometers be installed along the axis of the valley (roughly perpendicular to the dam crest) so that the progression (if any) of deformation along the glaciolacustrine soil layers from beneath the dam crest to beyond the dam toe can be observed	Instrumentation Program started in March 2020 which includes the installation of inclinometers
	<b>2.2.4 North Dam Design Update</b>	IERP recommends: If possible, install inclinometers within some of the holes during the October 2019 North Dam foundation investigation	See 2.2.3
	<b>2.2.5 Dam Construction Materials</b>	IERP recommends: If borrow materials will continue to be extensively used in the downstream section of the North Dam in 2020 and later, review the design and specification to determine how more of the materials available in the borrows can be accommodated in the dam section.	Intensive Borrow Pit investigation completed Feb 2020
Hydrogeological Considerations	<b>2.3.2 Lateral Seepage</b>	<p>IERP recommends: Advance the conceptual hydrogeological model for the TIA, specifically</p> <ul style="list-style-type: none"> <li>Estimate the total volume of groundwater in the shallow and deep aquifer and estimate the sustainable yields for the deep aquifer (for North Dam and South Dam reaches)</li> <li>Complete a quantitative water and load balance analysis for the aquifer system to explain the observed yields and associated contaminant loads extracted from the shallow and deep aquifer</li> </ul> <p>• Based on the above, provide plausible ranges of vertical and lateral seepage rates for current and future conditions</p>	<p>NRCM agrees this is a priority; in 2019 and 2020 significant headway is being made in order to evaluate the first of these items by BGC through both development of the conceptual hydrogeological model, development of the numerical model, and in designing hydrogeological investigation work to further develop understanding about capacity and yield of the confined (deep) aquifer. The second two points require additional input from both the source term work and site wide water balance modeling, the majority of which will be completed in 2020.</p> <p>BGC will consider using the numerical model to estimate the sustainable yields for the deep aquifer, and consider methods to complete a water and load balance analysis to explain deep aquifer yields and observed contaminant loads in the shallow and deep aquifers.</p>



	<b>2.3.3 Lateral Seepage Mitigation - Geotechnical</b>	IERP recommends: Install a "fit-for-purpose" line in the North Basin as soon as practical to reduce lateral seepage	NRCM agrees that lateral seepage mitigation is a priority and has engaged a team to evaluate effectiveness for such "fit-for-purpose" mitigation measures. NRCM will implement these as early as possible.
	<b>2.3.4 Groundwater Modeling</b>	IERP recommends: Evaluate the longer-term effects of increasing contaminant concentrations in the deep aquifer on the water quality in the receiving environment (specifically Quarry Creek and Trail Creek). To this end, complete additional field investigations as well as conceptual modeling to assess the potential pathways of deep groundwater to the receiving environment and associated contaminant loading	NRCM has an extensive receiving environment monitoring program in both Quarry and Trail Creeks that includes baseline monitoring, routine monitoring, and additional field investigations in order to better understand such and effluent plume migration. These are in support of environmental effects monitoring program (EEM/AEMP) programs, and are not part of the scope of work currently presented to the IERP. The groundwater model and the site-wide water balance model remain in development, however, once these are calibrated, outputs can be used to help understand potential pathways of deep groundwater to the receiving environment. Subsequent updates to the water quality model can evaluate contaminant loading to the receiving environment. Conceptual modelling is already underway, and two field programs are planned that will provide additional insight: 1) the 2020 NV SIS study includes geophysics and drilling; 2) continuation of the LTC site investigation work to understand surface water - groundwater interactions in this area includes aquifer testing.
		The IERP advises: Consideration should be given to reducing the model domain of the numerical model currently under development, or alternatively, developing a separate "local" numerical model for the TIA to address specific issues relevant to the TIA, such as assessing seepage and associated contaminant loading to the local receiving environment, and designing seepage interception systems for the TIA.	The domain size of the current groundwater numerical model was chosen to encompass the spatial extent of anticipated impacts and to consider a 'watershed' model approach. Separate sub-models for local areas of the model domain will be developed if greater resolution is considered beneficial to future modelling objectives and is supported by the data necessary to do so. The site-wide groundwater model is still a work-in-progress and therefore, necessity for local

			modeling has not yet been confirmed.
Geochemical Considerations	2.4.1 Cycloned Sands	The IERP reiterates previous recommendations that cycloned sands should not be placed on the downstream shell of the ND until the effectiveness of a shallow interception system can be demonstrated.	NRCM agrees that a shallow seepage interception system in the North TIA Valley is a priority, and has engaged BGC to carry out this program as soon as possible. The North Valley seepage interception system scoping study and site investigation work plan has been drafted. The site investigation is anticipated to take place Q1/Q2 2020, followed by feasibility-level design of an appropriate shallow seepage interception system and construction.
		The IERP further reiterates previous recommendations that cycloned sands should not be placed on the downstream shell of the SD (hydraulically or mechanically) until the potential effects to water quality are better understood and the effectiveness of a shallow interception system is demonstrated.	A month-long pumping test at SPW17-2S is planned for 2020 (see item 2.5.1). Further, NRCM does not plan to place cyclone sands on the downstream shell of the SD in the 2020 construction season
	2.4.2 ML/ARD Management and Geochemistry	IERP advises: It is understood that the NPR criterion of 2 for classification of NAG tailings is less constraining to operations now that there is both a 100m NAG tailings beach in the north basin and a 300m NAG tailings beach in the south basin. The IERP is of the opinion that NRCML should consider seeking a lower NPR criterion for NAG definition of tailings placement on the upstream side of the ND and SD. It is the IERP's experience that revision of these specifications can sometimes take time and advise that having	NRCM is taking this under advisement and working to answer numerous questions about materials balance prior to seeking regulatory approval for changes to ML/ARD management strategy.

		that revision in place for future operations may be of value (for example, if NRCML considers the option of thickened tailings placement).	
Water Management Considerations	2.5.1 Lower Trail Creek	IERP recommends: Review potential effects of seepage from the TIA south basin on Trail Creek water quality and assess mitigation measures if required (e.g. improvement of seepage capture and/or lining of basin sides).	Potential effects of poor quality water relate to impacts to fisheries, wildlife and portability. The potential for seepage water quality to continue to degrade as seepage plumes fully develop in the ground is a concern. Uncertainty still exists in LTC and lower Quarry Creek. A month-long pumping test is planned for seepage interception well SPW17-2S in the South Valley to demonstrate seepage capture. Lower Trail Creek can be monitored for quantity and quality during this time. Data review will consider if follow up actions to protect Lower Trail Creek may be needed.
		IERP recommends: Evaluate the potential mine influence on Camp Creek WQ and flow.	Water quality is monitored in Camp Creek at several stations: two in the upper reaches, and one near the confluence of Trail Creek. Potential sources of contact water to Camp Creek are being evaluated, and mitigation measures are currently being designed, as will be
	2.5.3 Water and Load Balance Modeling	IERP recommends: Re-calibrate the water balance model using all previous years and assess the effects on seepage loss estimates.	NRCM agrees this is a priority and has engaged BGC to build a GoldSIM-based water balance model that will fulfill these and additional operational objectives. The site water balance model will be rebuilt to incorporate the latest hydrogeological understanding, improved representation of recharge to the deep aquifer, assessed sensitivity to runoff sensitivity and calibration / verification of inputs and assumptions using hydrometeorological, hydrogeological and geochemical

		characterization data available from the site. The site water balance model will be updated in Q2 2020 and a report documenting the modifications will be generated in Q3 2020.
	IERP recommends: Update or re-build prior contaminant mass balances and create a combined water and load balance.	NRCM agrees that the updates to the source terms and water balance model should be priority. Following completion of these components, the water quality model will be developed combining these in order to improve the predictive capabilities of the water quality model onsite. This model will be completed and documented in Q3 2021.
	IERP recommends: Complete a comprehensive sensitivity analysis of the (re-calibrated) water balance and (updated or re-built) load balance, including all input uncertainties, and determine if significant concerns or mitigation measures (e.g. water shortages, water treatment) become more urgent under any reasonable scenarios.	NRCM agrees this is a priority and will ensure this advice is taken into consideration when re-building the water quality model.
	Considerations for improving capture efficiency of the East Diversion Ditch were provided in the IERP Close-Out for meeting #6 (e.g. a 6-inch pipe to deliver low flows over riprap reaches and directly to LTC etc.).	NRCM will engage a hydrotechnical engineer in Q1 2020 to initiate the site investigation to support an updated ditch design, then request a technical breakout with ENV, EMPR, DFO, and TCG in Q2 2020 to discuss and determine the overall objectives of the East Diversion Ditch and associated fisheries considerations. NRCM will then implement a work plan to support agreed upon objectives for the redesign of the East Diversion Ditch.
	Advice to consider using deep groundwater to augment flows in Lower Trail Creek was provided in IERP Review #5.	NRCM will implement additional water management strategies in Lower Trail Creek only after reaching agreement with ENV, EMPR, DFO, and TCG about both

			objectives and design strategies, as above.
	<b>2.6 IERP Review #9</b>	To minimize misunderstandings about ongoing and future work related to water management, the IERP advises RCDC to document responses to the above recommendation in an “action plan” (see Section 2.7).	
		The next meeting of the IERP will be scheduled after the ToR have been confirmed and the make-up of the panel is decided. The IERP suggests that a meeting in April 2020 that uses the information developed for the regulatory reports that must be submitted in March 2020 would be productive.	The next IERP meeting is scheduled for 12-14 May 2020 and will include annual reporting data (e.g. water quality reporting) as well as updates to the TIA OMS, am Safety Review 2019, Dam Safety Inspection 2019 as submitted in March 2020.

**10.4.4 (c) (i) Summary of the reviews conducted that year, including the number of meetings and attendees.**

For the 2020 calendar year two IERP meetings were held:

- IERP#10 conducted between May 13 – 15, 2020
- IERP #11 conducted between November 23 – 27, 2020

A summary of board members, attendants and key items and findings are provided for each meeting. Recommendations from each meeting with commentary from Newcrest is provided in Appendix A and B respectively.

**10.4.4 (c) (ii) Does The Work Reviewed in 2020 meet the Board's Expectations of Reasonably Good Practice?**

Managers Assessment: Yes

**10.4.4 (c) (iii) Any Conditions that Compromise Tailings Storage Facility Integrity or Occurrences of Non-Compliance with recommendations from the Engineer of Record**

Managers Assessment: No

Engineer of Record's DSI for 2020 was conducted in October 2020 and will be submitted by March 31, 2020 and the Manager's Assessment continues to be as above.

**10.4.4 (c) (iv) Signed Acknowledgment by the Members of the Board, Confirming that the Report is a True and Accurate Representation of their Reviews**

Signed and Acknowledgment by the IERP Members:



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Terry Eldridge, P.Eng.  
Geotechnical Engineer



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Dr. Christoph Wels, P.Geo (BC, AB)  
Hydrogeologist



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Daryl Hockley, P.Eng.  
Civil Engineer  
**IERP # 11 – Held from November 23 – 27, 2020**



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Shannon Shaw, P.Geo. (BC,NWT)  
Geochemist

No changes were made to the IERP board, which consisted of the following members:

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Terry Eldridge, P.Eng.	Senior Mine Waste Consultant, Golder Associates Ltd.	Geotechnical Engineer
Christoph Wels, P.Geo.	Principal, Robertson GeoConsultants Inc.	Hydrogeologist
Shannon Shaw, P.Geo.	President, pHase Geochemistry Inc.	Geochemist
Daryl Hockley, P.Eng.	Corporate Consultant, SRK Consulting Inc.	Civil Engineer

The meeting was attended by the following people:

<b>Company</b>	<b>Name</b>	<b>Name</b>
<b>IERP Members</b>	Terry Eldridge Christoph Wels	Shannon Shaw Daryl Hockley
<b>Newcrest</b>	Ben Wither Bryant Schwengler Chris Fleming David Hamilton	Greg Naus Marina Bravo Foster Mark Adams Justine Walker Lachlan Gibbins
<b>Tahltan Representative</b>	Nalaine Morin	
<b>BGC</b>	Daryl Dufault Anna Akkerman Carl Mendoza Jessica Worley Roy Mayfield Trevor Crozier Brienna Shaw Madeleine Sauve Andrea Walsh Victor Fasullo Alan Chou	Habib Shahnazari Dylan Maxwell Shelby DeMars Alexandra Hughes Sharon Blackmore John Mosquera Rob Millar Jordan Vizirtzoglou Shelby DeMars Hilary Shirra

**IERP# 11 – Key Items/Findings which were discussed:****1. General Comments**

- Governance and IEPR role
- Environmental Scope of the IERP

**2. Geotechnical Consideration**

- 2020 Construction
- 2020 Dam Safety Inspections
- Geotechnical condition
- Cyclone sand placement 2021
- Recommendation and advise

**3. Hydrogeological Considerations**

- Deep aquifer recovery test
- Lateral seepage update
- North Dam shallow seepage interception system
- Site-wider ground water model
- Recommendation and advise

**4. Geochemical Consideration**

- Geochemistry of cyclone sand
- Water chemistry
- Recommendation and advise

**5. Water Management Considerations**

- Advances on meteorological and hydrometric monitoring
- Water balance model
- Lateral seepage control
- Recommendation and advise

Recommendations in Appendix A



## IERP #10 – Held from May 13 – 15 2020 in Vancouver

No changes were made to the IERP board, which consisted of the following members:

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Terry Eldridge, P.Eng.	Senior Mine Waste Consultant, Golder Associates Ltd.	Geotechnical Engineer
Christoph Wels, P.Geo.	Principal, Robertson GeoConsultants Inc.	Hydrogeologist
Shannon Shaw, P.Geo.	President, pHase Geochemistry Inc.	Geochemist
Daryl Hockley, P.Eng.	Corporate Consultant, SRK Consulting Inc.	Civil Engineer

The meeting was attended by the following people:

<b>Company</b>	<b>Name</b>	<b>Name</b>
<b>IERP Members</b>	Terry Eldridge Christoph Wels	Shannon Shaw Daryl Hockley
<b>Newcrest</b>	Mark Adams Eric Strom Mike Jacobs	Chris Fleming Marina Bravo Foster Greg Naus
<b>Tahltan Representative</b>	Nalaine Morin	
<b>BGC</b>	Clint Logue Daryl Dufault Trevor Crozier Carl Mendoza Jessica Worley Kate Robey Andrea Chong Anna Akerman Brienna Shaw	Rob Millar Sharon Blackmore Mike Henderson Roy Mayfield Jordan Vizirtzoglou John Mosquera Shelby DeMars Kristin Pouw
<b>Golder</b>	Bar Wernick	Liz Ashby

## **IERP #10 – Key Items/Findings which were discussed:**

### **1. IERP Scope re. Environmental Performance**

#### **2. Geotechnical Considerations**

- 2019 Dam Safety Inspection
- 2019 Dam Safety Review
- 2019/2020 Geotechnical Investigations
- 2019 Construction Records Report
- 2020 Construction Plan
- Cyclone Sand Placement 2020 and 2021
- Recommendations and Advice

#### **3. Hydrological Considerations**

- Lateral seepage mitigation
- North shallow interception system
- Site-wide ground water model
- Recommendations and Advice
  - I. Support lining the borrows and placing low permeability material in West Gravel Borrow to mitigate lateral seepage
  - II. Present the concerns of the proposed locations of North Shallow Seepage Interception System as well as the engineering aspects of the design concept and recommend the tasks to address the concerns
  - III. Sensitivity analyses to illustrate uncertainty in future model predictions.
  - IV. Provide more detailed review comments/recommendations after review of the modeling report.

#### **3. Geochemical Considerations**

- Geochemistry of cyclone sands
- Selenium attenuation study
- Recommendations and Advice
  - I. Weir 2 in the program to assess selenium speciation
  - II. Estimation of the nitrate concentration above which the available carbon in the TIA may become limited for continued reduction of nitrate and selenium.

#### **4. Water Management Considerations**

- Advance on hydrometric monitoring
- Water balance
- Recommendations and Advice

Recommendations in Appendix B

## **APPENDIX A**

### **SUMMARY OF IERP RECOMMENDATIONS AND CURRENT STATUS MEETING #11**

Section Reference*	Advice and Recommendation (summarized from IERP Report #11)	Current Status/Response
2.2.1 2020 Construction	The IERP recommends that planned borrow investigations be progressed diligently and that contingency plans be developed to address possible shortfalls in cyclone sand production for whatever reason.	Borrow investigation 2020 completed and identify additional Zone 3C material in Beaver Creek area
2.2.3 Geotechnical Conditions	The IERP considers that carrying out a comprehensive suite of sensitivity analyses is a very important step in defining the characteristics of the foundation sections to be used for design and recommends that this be documented in the update of the Dam Site Characterization Report that is currently in progress by BGC.	Ongoing discussion between BGC and Newcrest around stated sensitivity analyses
	The IERP also recommends that consideration be given to the factor of safety to be used for the design as this value will influence the decision on selection of the strengths to be used in the design.	Ongoing discussion between BGC and Newcrest around design factor of safety.
	The IERP has previously recommended consideration of a “buttress” configuration for the North Dam to address the difference in foundation conditions in the 3 sectors.	Ongoing discussion between BGC and Newcrest regarding planned dam geometry optimization.
	A FMEA was recently carried out for the TIA and the IERP recommends that this be revised to consider the potential for static liquefaction of these contractive glaciofluvial deposits.	
2.3.1 Deep Aquifer Recovery Test	The IERP recommends that start-up of pumping in the North Dam area in the deep aquifer be delayed as long as possible into winter (preferably at least until Feb 2021) to allow further monitoring of water level and water quality trends during winter flow recession period, preferably at increased frequency during this period.	Operational necessity for clean processing water required starting pumping in November 27, 2020.
	The IERP further recommends that the time trends in groundwater levels, weir flows and water quality observed during this test period be carefully examined to assess the potential interaction between the different aquifer units (shallow, intermediate and deep aquifer). Furthermore, the observed response in the aquifer system should be used to recalibrate the transient groundwater flow model for the Tailings Area (see section 2.3.4).	Newcrest evaluation ongoing.
2.3.3 North Dam Shallow Seepage Interception System	The IERP recommends that the shallow SIS be installed as soon as possible to intercept seepage in the shallow aquifer. The monitoring program of the shallow SIS should include monitoring of groundwater levels and groundwater quality in the intermediate and deep aquifer to assess the potential need for (future) seepage interception in those deeper aquifer units.	Detailed design ongoing with planned installation during 2020.
2.3.4 Site-wide Groundwater Model	The IERP recommends the following tasks to advance the conceptual model of seepage and its impact on the aquifer system: <ul style="list-style-type: none"> <li>Operational flows and water quality data should be re-evaluated to constrain seepage losses from the tailings impoundment (using mixing calculations, travel times)</li> <li>Multiple seepage mechanisms should be evaluated conceptually (using operational data and simple Darcy calculations) <ul style="list-style-type: none"> <li>Vertical seepage through tailings deposit</li> <li>Lateral seepage from free pond water</li> <li>Seepage from tailings beach, and</li> <li>Seepage from upstream cycloned sand beach</li> </ul> </li> </ul>	Newcrest and BGC discussions ongoing.
	The IERP further recommends the following improvements to the numerical model: <ul style="list-style-type: none"> <li>The spatial representation of hydrostratigraphic units should be updated to reflect latest geological and hydrogeological interpretation, including improved representation of cycloned sands and dam elements, and</li> <li>The model should be recalibrated using the operational period 2018 to early 2021 (including recent extended pump shutdown).</li> </ul> Once updated, the improved model should be used to <ul style="list-style-type: none"> <li>Assess whether the model can be successfully calibrated to different TIA seepage mechanisms (“scenario analysis”); if so, these different seepage scenarios should be carried forward to predictive modeling.</li> <li>Assess risk of potential contamination of deep aquifer over life-of-mine for different pumping scenarios.</li> <li>Predict post-closure ND and SD seepage rates and time required to “flush” shallow and deep aquifer.</li> </ul>	Newcrest and BGC discussions ongoing.
2.4.1 Geochemistry of Cyclone Sand	The IERP requests regular updates of kinetic testing and field barrel monitoring of the cycloned sand tailings as well as water chemistry of the supernatant during IERP meetings to provide an improved understanding of the points listed above over time.	
2.4.2 Water Chemistry	The Board recommends that this information be considered a key input and tool that should be intimately connected to the conceptual and numerical models iteratively in the context of all the evaluation tools. Further the Board requests regular updates of key water monitoring at key locations related to the TIA at every IERP meeting.	
2.5.1 Advances in Meteorological and Hydrometric Monitoring	The IERP recommends that Red Chris consider how testing carried out using components of the monitoring system could address the significant uncertainties in the TIA water balance.	Newcrest and BGC discussions ongoing.
2.5.2 Water Balance Modeling	The IERP recommends supplementing the site-wide modeling with a more directed approach to the critical water balance uncertainties.	Newcrest and BGC discussions ongoing.
	The IERP review of the BGC report “2020 Site Wide Water Balance Model” found a number of details that warrant further consideration in the combined water balance and water chemistry modeling planned for 2021	Newcrest and BGC discussions ongoing.
2.5.3 Lateral Seepage Control	The IERP recommends the following actions to minimize, to the extent practicable, lateral seepage from Borrow Area 4: <ul style="list-style-type: none"> <li>Push down or otherwise reconfigure side slopes of the borrow area to facilitate lining in 2021.</li> <li>Deposit whole tailings around any part of the borrow area that is below the limit of future lining and develop a beach sloping towards a water collection point. This may require multiple discharge points or spigots.</li> <li>Collect free water from the Borrow Area and pump it into the main pond.</li> <li>Continue to remove free water until the surface of Borrow Area 4 is completely blinded and/or lined.</li> <li>Line upper slopes of Borrow Area 4 in 2021 and future years, ahead of the rising tailings and water</li> </ul>	Newcrest and BGC discussions ongoing.

## **APPENDIX B**

### **SUMMARY OF IERP RECOMMENDATIONS AND CURRENT STATUS MEETING #10**

Section Reference*	Advice and Recommendation (summarized from IERP Report #10)	Current Status/Response
2.2.5 2020 Construction Plan	The IERP was advised that Mr. Logue will continue to support the project as a technical advisor.	
2.2.5 2020 Construction Plan	Evaluate the impact of potential construction delays of various periods and construction shutdowns of various periods due to COVID-19 restrictions and move any non-critical construction to the end of the construction season.	
	Review the specification of the Zone 3C material for the North Dam with the view to reduce wastage in the borrow pits and the effort required for blending materials in the borrow. The 3C material is placed in a part of the dam that was originally designed to be constructed with cyclone sand and the intent in 2020 is to mechanically place cyclone sand in some areas rather than the Zone 3C borrow material. Opening the 3C specification to the fine side for fill placed higher in the dam, even to the point of overlapping the cyclone sand specification, could improve the construction schedule and reduce cost without affecting the stability of the dam.	BGC and Newcrest discussion ongoing.
	Consider installing passive vertical drains (sand and gravel filled boreholes) to relieve artesian pressure within the North Dam aquitard be evaluated for cost and schedule improvement relative to toe fill placement, if suitable drills are available on site.	BGC and Newcrest discussion ongoing.
	Evaluate methods to leave rockfill placed as downstream toe fill to mitigate artesian foundation pressures. Rockfill has high permeability and may provide adequate drainage for the dam. Alternatively, finger drains could be placed concurrently with the rockfill or trenched through the rockfill in 2021.	BGC and Newcrest discussion ongoing.
2.2.6 Cyclone Sand Placement in 2020 and 2021	the IERP considers that Best Practice would be to have an operating shallow aquifer seepage interception system downstream of the NRD that could minimize migration of process affected water along the Quarry Creek valley prior to placing sand downstream of the ND core. The IERP considers that Acceptable Practice would be to have a commitment to install a seepage interception system prior to significant placement of cyclone sand in the downstream shell of the North Dam, and to only mechanically place cyclone sand until operation of the seepage interception system has been demonstrated.	Newcrest is planning to have seepage interception system installed during the 2020 year.
	The IERP further recommends that sand only be placed above the drain, that the areal extent of sand be minimized within the ND footprint and that in 2020 sand not be placed in the 50 m downstream toe extension	As part of the 2021 dam construction cycloned sand will only be implemented above elevation 1120.0 m in the 1140m shell.
2.3.1 Lateral Seepage Mitigation	The IERP suggests that consideration be given to using total tailings rather than cyclone sand as total tailings have a much lower permeability than cyclone sand. Potentially total tailings could be excavated from the south beach area	Newcrest evaluating infrastructure costs and timelines to allow for total tailings deposition to complete lateral sealing in the impoundment.
	The IERP suggests that a reduced height of mitigation measure (e.g. liner) be considered and that some of the alternative methods of seepage reduction that had been evaluated in the workshop be re-examined, for example a spray-on-liner using asphalt emulsion rather than a polymer.	BGC and Newcrest discussion ongoing regarding locations, extents and timelines for installation of liners.
2.3.2 North Shallow Interception System	Based on the current information, the IERP does not support the proposed location or design of the shallow SIS downstream of the NRD and the associated field investigation program. The IERP recommends the following steps: <ul style="list-style-type: none"> <li>Develop design basis for the shallow NRD SIS (i.e. time horizon, % allowable by-pass)</li> <li>Urgently complete and document a more rigorous options analysis considering alternative alignments and alternative options (including cutoff walls)</li> <li>Expand geophysics program to cover alternative alignments (e.g. just d/s of the NRD) and revise (possibly reduce) scope of drilling/testing program after completion of the options analysis recommended above</li> </ul> The IERP also advises that only the current (permitted) footprint of the North Dam complex should be considered for design of the shallow SIS.	Comments used for relocation and re-evaluation of seepage interception alignment. Revised alignment was selected, drilled, and instrumented – Data was presented as part of IERP#11.
2.3.3 Site-wide Groundwater Model	The IERP recommends that flux targets (such as Weir 2 flows) be given more weight during model calibration. It also recommends that emphasis be placed on sensitivity analyses to illustrate uncertainty in future model predictions.	Comments will be taken into consideration for further model calibrations.
2.4.1 Geochemistry of Cyclone Sands	the IERP continues to recommend NRCML construct a shallow interception system as discussed in Section 2.3.2.	
2.4.2 Selenium Attenuation Study	The IERP recommends that SRK considers including the following in their program: <ul style="list-style-type: none"> <li>Weir 2 in the program to assess selenium speciation.</li> <li>Estimation of the nitrate concentration above which the available carbon in the TIA may become limited for continued reduction of nitrate and selenium.</li> </ul>	
2.5.2 Water balance	The IERP recommends that the SRK (2018) report be reviewed in detail and the plans for additional modeling be revised accordingly. The 2018 report was simplified for presentation to regulators, so it might also be advisable to ask the report authors for a brief presentation regarding key learnings and advice for future model development.	



March 30, 2022

Hermanus Henning  
Chief Inspector of Mines  
Ministry of Energy, Mines and Low Carbon Innovation  
PO Box 9395 STN PROV GOVT  
Victoria, BC V8W 9M9

**Re: Submission of the 2021 IERP Activity Report (Red Chris Mine)**

Please find attached the document, "Activity Report of the Red Chris TIA Independent Engineering Review Panel for 2021".

An electronic copy of the report has been uploaded to the "MineSpace" document upload portal.

Please do not hesitate to contact me if you have any questions.

Sincerely,

DocuSigned by:  
  
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**Bing Wang**  
Tailings Impoundment Manager  
Newcrest Red Chris Mining Limited  
Office – 604-800-9200 ext 527  
Cell – 250-975-1636  
Email – [bing.wang@newcrest.com.au](mailto:bing.wang@newcrest.com.au)

**10.4.4 (c) (i) Summary of the reviews conducted that year, including the number of meetings and attendees.**

For the 2021 calendar year two, IERP (Independent Engineering Review Panel) meetings were held:

- IERP #12 conducted between June 14 – 16, 2021
- IERP #13 conducted between October 4 – 8, 2021.

A summary of board members, attendants and key items and findings are provided for each meeting. Recommendations from each meeting are provided in Appendices A and B, respectively.

**10.4.4 (c) (ii) Does the Work Reviewed in 2021 meet the Board's Expectations of Reasonably Good Practice?**

Based on the work reviewed by the ITRB in 2021, the ITRB considers that the technical aspects of the work (design, quality control, dam stability and performance monitoring, and reporting) follow reasonably good practice. Improvements in the tailings system framework components of communication, planning, risk management and coordination are works-in-progress which have been given serious attention in 2021 and will continue to require improvement for best practice management of the overall facility as an integrated part of the mine operations and in order to comply with topic IV – Management and Governance of the GISTM and ICMM Tailings Governance Framework commitments.

**10.4.4 (c) (iii) Any Conditions that Compromise Tailings Storage Facility Integrity or Occurrences of Non-Compliance with recommendations from the Engineer of Record**

Managers Assessment: **No**

Engineer of Record's DSI for 2021 was conducted in September 2021 and will be submitted by March 31, 2022 and the Manager's Assessment continues to be as above.



**10.4.4 (c) (iv) Signed Acknowledgment by the Members of the Board, confirming that the Report is a True and Accurate Representation of their Reviews**

Signed and Acknowledgment by the IERP Members:

DocuSigned by:



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Bill Chin, M.Eng., P.Eng.  
Senior Geotechnical Engineer

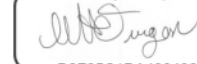
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Henri Sangam, Ph.D., P.Eng.  
Senior Geo-Environmental Engineer

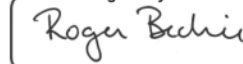
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Marie-Hélène Turgeon, M.Env.  
Environment, Social, Governance  
Advisor, Water & Tailings Management

DocuSigned by:



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Roger D. Beckie, Ph.D., P.Eng.  
Geological Engineer / Hydrogeologist

## IERP #12

IERP #12 was conducted between June 14 – 16, 2021 as a virtual meeting due to Covid-19 related restrictions. This was the inaugural meeting for the new IERP consisting of the following members:

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Bill Chin, M.Eng., P.Eng.	Principal, Klohn Crippen Berger	Chair, Geotechnical Engineer
Henri Sangam, Ph.D., P.Eng.	President & Principal, GeoMiNo Geo-Environmental Services	Geo-Environmental Engineer
Marie-Hélène Turgeon, M.Env.	Tailings Governance Advisor, Consultant	Environment, Social, Governance Advisor
Roger D. Beckie, Ph.D., P.Eng.	Professor, University of British Columbia	Geological Engineer / Hydrogeologist

<b>Name</b>	<b>Affiliation</b>
Nalaine Morin	Tahltan Central Government
Mike Jacobs	Newcrest Corporate
Mark Adams	Newcrest Red Chris Mine
Bing Wang	Newcrest Red Chris Mine
Greg Naus	Newcrest Red Chris Mine
David Hamilton	Newcrest Red Chris Mine
Marina Bravo Foster	Newcrest Red Chris Mine
Daryl Dufault	BGC Engineering
Roy Mayfield	BGC Engineering
Brienna Shaw	BGC Engineering
Carl Mendoza	BGC Engineering
Clint Logue	BGC Engineering
Jessica Worley	BGC Engineering
Trevor Crozier	BGC Engineering
Rebecca Lee	BGC Engineering
Jordan Vizirtzoglou	BGC Engineering
Madeleine Sauve	BGC Engineering
John Mosquera	BGC Engineering
Dylan Maxwell	BGC Engineering
Rob Millar	BGC Engineering
Andrea Chong	BGC Engineering
Cameron McCarthy	Swiftwater Consulting
Shauna Litke	SRK Consulting
Stephen Day	SRK Consulting
Henri Sangam	IERP
Marie-Hélène Turgeon	IERP
Roger Beckie	IERP
Shannon Shaw	IERP
Bill Chin	IERP

Note: Not all of the presenters attended the entire series of IERP meetings.

**IERP #12 – Items and topics discussed:**

- a) Tahlitan update
- b) Newcrest corporate governance update
- c) TIA virtual tour
- d) North & South Dams construction update
- e) Cyclone sand update
- f) 2020 Dam Safety Inspection summary
- g) Geology model update
- h) Conceptual hydrogeological model update
- i) Instrumentation update
- j) Dam stability update
- k) Liquefaction assessment update
- l) Hydrology and climate
- m) Site-wide groundwater model update
- n) Site-wide water balance update
- o) Water quality model
- p) ML/ARD Management
- q) Groundwater plume mapping
- r) Se attenuation study
- s) South Valley seepage interception system
- t) North Valley seepage interception system
- u) North Valley pumping well recovery test
- v) Block Cave PSF
- w) Previous IERP Comments

A summary of key comments and recommendations can be found in Appendix A.

### IERP #13

IERP #13 was held in two components. A site visit was held between October 4 -6, and an off-site virtual meeting was held between October 7 – 8.

No changes were made to the IERP board, which consisted of the following members:

<b>Name</b>	<b>Title, Affiliation</b>	<b>IERP Role</b>
Bill Chin, M.Eng., P.Eng.	Principal, Klohn Crippen Berger	Chair, Geotechnical Engineer
Henri Sangam, Ph.D., P.Eng.	President & Principal, GeoMiNo Geo-Environmental Services	Geo-Environmental Engineer
Marie-Hélène Turgeon, M.Env.	Tailings Governance Advisor, Consultant	Environment, Social, Governance Advisor
Roger D. Beckie, Ph.D., P.Eng.	Professor, University of British Columbia	Geological Engineer / Hydrogeologist

<b>Name</b>	<b>Affiliation</b>
Roger Beckie	IERP
Marie-Helene Turgeon	IERP
Henri Sangam	IERP
Bill Chin	IERP
Nalaine Morin	Tahltan Central Government
Mike Jacobs	Newcrest Red Chris Mine
Mark Adams	Newcrest Red Chris Mine
Bing Wang	Newcrest Red Chris Mine
Greg Naus	Newcrest Red Chris Mine
Bryant Schwengler	Newcrest Red Chris Mine
David Hamilton	Newcrest Red Chris Mine
Marina Bravo Foster	Newcrest Red Chris Mine
Milos Vojvodic	Newcrest Red Chris Mine
Brad Dillen	Newcrest Red Chris Mine
Daryl Dufault	BGC Engineering
Brienna Shaw	BGC Engineering
Dylan Maxwell	BGC Engineering
Jordan Vizirtoglou	BGC Engineering
Jessica Worley	BGC Engineering
Roy Mayfield	BGC Engineering
Simon Dickenson	BGC Engineering
Rebecca Lee	BGC Engineering
Rob Millar	BGC Engineering
Andrea Chong	BGC Engineering

**IERP #13 – Items and topics discussed:**

- a) Construction
- b) North Reclaim Dam Stability Update
- c) Site Investigation and Lab Data Review
- d) Liquefaction Assessment Update
- e) Seismic Hazard Update
- f) Dam Safety Inspection Update
- g) Planned Data Collection
- h) Instrumentation
- i) Observational Method
- j) Operational Water Balance
- k) Groundwater Quality Update
- l) North Valley Seepage Interception System

A summary of key comments and recommendations can be found in Appendix B.



## **APPENDIX A**

### **SUMMARY OF IERP RECOMMENDATIONS AND CURRENT STATUS MEETING #12**

Number	Report Section	Key Comments, Observations and Recommendations
IERP 12.1	3.1	At this stage of the project, the IERP considers it will be prudent to incorporate a greater than normal “margin of error” into the planning process and apply a heightened level of stewardship to the TIA operations. This would include adopting more conservative design, planning and operation assumptions, to provide assurance that the TIA will have sufficient flexibility to safely manage the higher risks of upset conditions and assumption deviations.
IERP 12.2	3.2	If not already done, NRCM and the EOR should prioritize the allocation of available resources (both financial and manpower). The IERP understands that a risk assessment was recently completed. The results of the risk assessment, updated if required, could be used to guide the prioritization process.
IERP 12.3	3.2	The TIA Manager and the EOR should ensure all of the studies are integrated and the results are evaluated holistically from an overall project perspective. For certain activities, the TIA Manager and the EOR should consider the benefits of having a short term (say 3 to 6 months) planning group and a longer term (say 6 to 24 months) planning group. An example would be tailings deposition planning.
IERP 12.4	4.2	The IERP recommends a retention and succession plan be developed to ensure continuity and manage the risk of turnover of key personnel.
IERP 12.5	4.2	The IERP recommends that consideration be given to establishing a GIS-based data management system
IERP 12.6	4.4	BGC is currently providing both QA and QC construction services. . It will be important to ensure proper documentation and firewalls are in place to demonstrate independence between the QA and QC teams in the event of an audit.
IERP 12.7	4.4	NRCM is carrying out an options study for management of construction water when hydraulic sand placement is used for dam construction. Given that hydraulic sand construction will use the paddock or cell methodology, the IERP notes that “slimes” management will likely be an important consideration and, therefore, should also be considered in the option studies
IERP 12.8	4.4	The IERP commented that if archaeological assessments are required at this site, then these activities should be incorporated into the overall TIA construction schedule to avoid potential conflicts
IERP 12.9	4.5	When assessing cyclone sand production, the IERP advises NRCM to also consider the potential impacts of percent utilization during winter months to ensure cyclone sand demand can be met.
IERP 12.10	4.7	The IERP recommends that additional data be collected to help reduce uncertainties regarding the continuity of the key stratigraphy units (especially U-GLU and L-GLU). Sensitivity analyses of key parameters may be required to help target the appropriate areas to investigate.
IERP 12.11	4.8	The IERP recommends that the geochemical data should be integrated into the hydrogeological models, if not already being done
IERP 12.12	4.8	Future data collection / characterization efforts and conceptual hydrogeological model refinements should be targeted at specific questions associated with project design and management decisions. (In decision analysis, data has economic worth if it could potentially change a decision, or if it could potentially reduce the cost of a design by more than the cost of the data collection.)
IERP 12.13	4.8	The IERP requests that the planned data-collection activities and their rationales be provided at each meeting, either summarized in a short report in the information package, as a presentation at the meeting, or as a component of each disciplinary team’s presentation. It would also be useful if the EOR and the Tailing Operation Manager would describe the workflow and processes that they employ to coordinate and facilitate data / information transfer across the project teams
IERP 12.14	4.9	Not explicitly presented during this meeting was whether or not the Observational Method (Peck 1969 ) has been adopted as part of the design and construction of the North and South Dams. The IERP requests a clarification on this matter at the next meeting
IERP 12.15	4.9	It is considered good practice to include a sufficient number of instruments in the dam fill. For cyclone sand dams, it is important to demonstrate that the underdrainage system continues to function effectively and that the phreatic surface remains very low within the downstream shells of the dams. Monitoring deformations of the dam fill is also beneficial to provide information for stress-deformation modeling. Therefore, some of the inclinometer readings should extend up into the dam fill
IERP 12.16	4.9	The materials in which the piezometer tips are installed are classified in terms of hydrostratigraphic units. The IERP recommends that a companion or secondary geologic descriptor be assigned to the piezometers, so that those units controlling dam stability are easily identified
IERP 12.17	4.9	The IERP emphasizes the importance of reviewing all instrument data (whether geotechnical, hydrogeological, geochemical, hydrology, etc.) in an integrated and holistic way, in order to assess the overall TIA performance.
IERP 12.18	4.9	The IERP notes that, where the GLU controls stability and is subject to progressively increasing loads from centerline construction, the inclinometer program should be designed to include a line of “sentinel” inclinometers strategically installed at locations where first movement in the GLU is expected to occur during construction, with additional inclinometers downstream of the sentinels to monitor the potential for migration of GLU movements in the downstream direction as the dam height increases. Deformation modeling (see IERP 12.21) can guide the location of the sentinel and downstream inclinometers. Early installation is important to provide a history of deformation response to embankment loading
IERP 12.19	4.10	The GLU undrained strength is based on the SHANSEP model, where the undrained strength ratio is expressed as a function of the over-consolidation ratio (OCR). Consideration should be given to conducting the strength tests by first consolidating the sample under stresses well beyond its interpreted pre-consolidation pressure, and then reducing the cell pressure prior to shearing. The IERP recommends consolidating the samples to high stresses (2 to 4MPa), to provide a reasonable assurance of measuring the behaviour of the sample in its normally consolidated state and also under varying predetermined OCRs
IERP 12.20	4.10	The IERP recommends that the assumed strengths of the materials in the passive wedge area of the slip surface should be critically reviewed to ensure that they are representative of the expected failure mode. If necessary, triaxial extension tests should be conducted to support the strength selection.

Number	Report Section	Key Comments, Observations and Recommendations
IERP 12.21	4.13	The IERP recommends that the project team consider performing stress-deformation modeling to supplement the limit equilibrium results. Some of the significant benefits and advantages of stress-deformation modeling are listed in Section 4.10 of the report.
IERP 12.22	4.13	The IERP has posed a number of questions throughout this section regarding the site-wide groundwater model, for NRCM and the EOR team to consider.
IERP 12.23	4.13	Consider plotting pumping-test drawdowns from all piezometers / observation wells (From Figure 20, pdf p 82 ER-0866008.0190, BGC 2020) on a single t/r <sup>2</sup> Cooper-Jacob semi-log plot. These diagnostic plots are a very effective way to identify anomalous behaviors
IERP 12.24	4.13	The simulations predict that seepage from the rock storage area will enter Red Rock Canyon Creek (From Figure 29, pdf p 91 ER-0866008.0190, BGC 2020). Is there sufficient monitoring and characterization to constrain the SWGM and better assess that flow path and potential management options?
IERP 12.25	4.14	The groundwater and water balance models need to be reconciled to ensure recharge and seepage rates assumptions correlate between both models and be calibrated using all monitoring data (physical and chemical).
IERP 12.26	4.14	NRCM has purchased a Muck 3D license and intends to run tailings deposition scenarios in house. The IERP supports this inhouse operational control approach, but recommends QA of the assumptions and results by the EOR.
IERP 12.27	4.14	<p>If not already in place, the IERP recommends that the responsibility for maintaining the TIA water balance model should be assigned to a single qualified individual. Key tasks for that individual should include the following as a minimum:</p> <ul style="list-style-type: none"><li>· Developing a comprehensive data collection of all inflow and outflow parameters, including hydrogeological influences.</li><li>· Carry out monthly (minimum) reconciliations to validate the water balance.</li><li>· Regular updating of the water balance model, data collection program and reconciliatory validations of the model.</li><li>· The TIA water balance model should be used as a tool to forecast future pond levels to ensure operating and flood storage requirements (including freeboard and beach width criteria) are always maintained.</li></ul>
IERP 12.28	4.15	The IERP believes that the water quality model could be better linked to the site wide water balance, even if indirectly, to help bound uncertainty in flows (e.g. lateral seepage vs run-off) by way of tracking loads.
IERP 12.29	4.17	The IERP recommends that vertical plume mapping be conducted to better inform the seepage interception systems
IERP 12.30	4.17	The IERP recommends that monitoring of the intermediate aquifer and review of the monitoring location should continue, as it is likely this aquifer will also show signs of contamination. This monitoring data can be used to refine the conceptual hydrological model over time which assume continuity of the intermediate aquifer
IERP 12.31	4.17	As the preferential seepage path does not appear to be clearly understood, monitoring in dam fill and drains is also recommended to be able to separate the dam seepage from valley and floor seepage contributions and target interception efforts.
IERP 12.32	4.19	The IERP has posed a number of questions throughout this section regarding the South Valley Seepage Interception System, for NRCM and the EOR team to consider.
IERP 12.33	4.20	<p>Regarding the North Valley Seepage Interception System, the IERP provides the following recommendations and suggestions:</p> <ul style="list-style-type: none"><li>· The deep groundwater needs to be monitored and assessed to identify any presence of contamination.</li><li>· Due to the complexity of the subsurface conditions, it will be prudent to plan for requirement to have contaminant control for all aquifers, and then adjust as appropriate based on performance monitoring.</li><li>· The SIS should be designed and operate in adaptive approach: design, operate, monitor, update, etc.</li><li>· Consider the integration of contaminant control system with other preventive measures (e.g. sealing of granular exposures along valley walls, borrow areas, etc.) to reduce the pumping requirement of the SIS.</li><li>· There are wells downstream of the proposed SIS location that supply make-up water to the plant. It will be beneficial to decouple make-up water needs from contaminant control management.</li></ul>
IERP 12.34	4.21	For an improved understanding of flow paths and connectivity and conductivity between aquifers, the IERP would like to see data reconciliation of TIA pond water quality, groundwater well quality, as vertical gradient between aquifer for the period pre, during and post pump test. In addition, the IERP suggests sampling at the barge location be carried out during periods when pumping of make-up water into the TIA was stopped, to see if there is a difference in water chemistry compared to periods when make-up water is being pumped.
IERP 12.35	4.21	For calibration and operational risk management, it may be advantageous to have separate infrastructure and location for seepage interception and process water supply outside of their respective areas of influence. This will allow better control of variables in future pump tests and avoid conflicting objectives and triggers for pumping well operation.





## **APPENDIX B**

### **SUMMARY OF IERP RECOMMENDATIONS AND CURRENT STATUS MEETING #13**

Number	Report Section	Key Comments, Observations and Recommendations
IERP 13.1	2.1	The IERP would like to have a better understanding of NRCM's overall risk management process (in particular, the process by which the approval, prioritization and implementation of identified risk reduction measures and/or EOR recommendations are carried out in a timely manner) and requests that a session be dedicated to this topic at the next meeting.
IERP 13.2	2.2.1	Commence sand and gravel borrow source investigations as soon as possible, including additional sources beyond Borrow 4. Identifying additional sources sooner rather than later is consistent with the philosophy of providing a greater-than-normal "margin of error" into the planning process. This is important since the reliability of the new cyclopic upon start-up is not assured.
IERP 13.3	2.2.1	If not already being done, prepare a resource loading (personnel and equipment) and construction schedule plan for the 2022 construction season to accommodate the significant increase in fill placement volume (approximately double the 2021 placed volume). The reliability of this plan should be stress tested for potential adverse conditions such as wetter-than-normal weather, earlier-than-normal onset of winter weather, availability of resources, further COVID wave, etc.
IERP 13.4	2.2.1	The IERP understands that a lessons learned debrief was conducted for the 2020 construction season; the results of which were applied to the 2021 construction plan. The IERP recommends that a similar lessons learned debrief be carried out for the 2021 construction season, and incorporate them into the 2022 construction plan.
IERP 13.5	2.2.1	Short circuit the timeline to complete the options study for slimes and construction water management at the North Dam, by convening a working session with experienced personnel and key decision makers, to identify the preferred option as soon as possible. Detailed design and permit application (if determined to be necessary) processes should immediately follow in earnest as a matter of urgency. <ul style="list-style-type: none"> <li>• If regulatory approval is necessary for the slimes and construction water management facilities at the North Dam, NRCM should proactively engage the regulators in advance to provide updates of the proposed plan, as a way of accelerating the approval process.</li> </ul>
IERP 13.6	2.2.1	Test various hydraulic cell layout, drain point location and placement methodology during the winter (location to be selected with minimal pipe freezing risk) to determine the optimal approach in achieving design specifications.
IERP 13.7	2.2.1	Review alternate options to stockpile cyclone sand for dam construction, to eliminate the loss of materials currently being experienced at the west gravel borrow stockpile locations due to rising pond levels.
IERP 13.8	2.2.1	The IERP understood from the previous meeting that the forecasted cyclone sand production of 2.9 Mm <sup>3</sup> for the next five-year dam raises will meet the ND construction needs of 2.1 Mm <sup>3</sup> . Therefore, the South Dam will continue to be constructed using borrow materials in the foreseeable future, the cost of which will inevitably increase once Borrow 4 is exhausted. As such, a review of the South Dam cross-section should be initiated to evaluate the feasibility of modifying the fill zonation to maximize the use of materials available nearby. The intent is to reduce/eliminate the need to haul sand and gravel from more distant sources.
IERP 13.9	2.2.1	Identify and initiate works which can be completed during the winter months in preparation for the 2022 construction season.
IERP 13.10	2.2.1	The IERP was informed that the rate of dam raise and associated fill volumes may be conservative due to assumptions made in the deposition and water balance models. The assumptions should be clearly expressed for management to understand the overall risk level associated with not achieving elevation milestones.
IERP 13.11	2.2.2	If the predicted seismic deformations based on the updated seismic hazard study are small and if there are no constructability constraints, then it is likely possible to justify a reduced filter width going forward. The IERP recommends that the feasibility of reducing the filter width should be reviewed.
IERP 13.12	2.2.2	The cyclone sand being produced is known to be a good filter material for the glacial till core. However, the IERP was informed that a decision was made to not use the cyclone sand because of a potential geochemical concern raised in a draft PowerPoint presentation by SRK (2018), which has not been finalized. In particular, the inference is that the dolomite content in the tailings sand could eventually lead to partial dissolution and re-cementation or interlocking of grains due to pressure-solution, which renders the material cohesive and capable of sustaining open cracks or erosion tunnels. Given the significant consequences associated with the decision of not relying on the cyclone sand as filter for the core, the IERP recommends that a more rigorous evaluation of the level of risk posed by this potential concern should be completed.
IERP 13.13	2.3	The IERP believes there is an opportunity to improve the working relationship between NCRM and the EOR towards solving issues more expeditiously and effectively. In this respect, the IERP understands that a new Mine-Mill coordination working group has been formed within NRCM, which will be a great benefit towards integrating the process, but would recommend that the EOR team be added to the working group as well in order to cultivate an overall "One Team" culture.
IERP 13.14	2.4	The IERP recommends that the risks associated with the high foundation seepage be assessed by the project team, in the context of the various questions posed by the IERP in its previous report.
IERP 13.15	2.4	The IERP would also request information on: <ul style="list-style-type: none"> <li>• Any comparative risk assessment that has been conducted to inform the decision of either eliminating the lateral seepage losses around the impoundment perimeter, or to effectively manage the risk with pre-identified contingencies if lateral seepage losses are allowed to continue.</li> <li>• Procedures developed for tracking and implementing BGC's recommendations listed above.</li> </ul>

Number	Report Section	Key Comments, Observations and Recommendations
IERP 13.16	2.5.2	Given the ongoing migration of contaminated groundwater in the North Valley shallow aquifer, NRCM should prioritize the installation and assessment of the NVSIS.
IERP 13.17	2.5.2	In the NVSIS, the IERP recommends monitoring locations be biased downstream of the collection trench, and if recognized, in high-permeability zones where flow will channel. It may be possible to identify these zones during trenching.
IERP 13.18	2.5.2	The IERP recommends that due attention be given to the Rock Storage Area (RSA) as a longterm source of contamination.
IERP 13.19	2.5.2	The IERP recommends NRCM to begin field trials, “learning by doing”, to better understand the relative merits of the options to reduce seepage losses from the pond, as described in Table 3 of the Seepage Management Plan
IERP 13.20	2.7	The IERP recommends that the communications and decision-making protocols be reviewed, and if not already in place, that a systematic work flow be developed to effectively address quality non-conformances, especially those that can have significant cost and safety implications.
IERP 13.21	2.8	The IERP understands that all of the piezometers are fully grouted-in. As a matter of due diligence, the IERP suggests that the mix design be tested for compressibility, strength and permeability to confirm its compatibility with the surrounding soils. The latter property is important to ensure that the grout permeability is not higher than the permeability of the soil unit being monitored, which could then create a drainage path for excess pore pressure dissipation. This potential issue is discussed in Scott et al (2021).
IERP 13.22	2.10	The IERP recommends that Section 9.5.7.2 of the OMS Manual should be expanded so that the capabilities and requirements for pond drawdown are quantified for added clarity as to when to action the various responses listed in the OMS.
IERP 13.23	2.11	The IERP requests information on how steps 4 to 6 of the Observational Method (Peck 1969) will be applied to the design and construction of the TIA going forward.
IERP 13.24	3.2	For completeness of documentation, the IERP recommends that the seismic hazard update report should also indicate whether or not induced seismicity (e.g., oil and gas activity, blasting, etc.) is a design consideration for this site.
IERP 13.25	3.5	Threshold exceedance alarms should also be sent to specified individuals on NCRM’s team; in particular, Mr. Bing Wang (TIA Manager) and other key senior personnel involved in the execution of the dam safety management program.
IERP 13.26	3.5	A designated alternate to the EOR should be formally declared and communicated to the entire project team, and documented in the OMS Manual. While the IERP was informed there are several different BGC staff allocated to act on behalf of the EOR in the event the EOR is inaccessible, the process is informal and unstructured, and is prone misunderstandings and miscommunications especially in potentially emergency situations. For the same reason, a designated alternate to the TIA Manager should also be formally declared.
IERP 13.27	3.6	In addition to the recommendations provided in IERP Meeting #12, the IERP recommends that consideration be given to providing an independent estimate of the seepage loss calculated to match measured pond volume, by using mass loading from surface and groundwater monitoring data, formation permeability, tailings changing thickness in the TIA and flow data from Weir 2. It is recognized that the flow data quality has been poor as stated previously in this report, which will need to be improved going forward.
IERP 13.28	3.7	The IERP understand that the deep aquifer SIS is separate from the North Valley SIS that is currently planned for construction in 2022. The IERP suggests that the project team consider potential interaction and optimization that could be incorporated into the North Valley SIS, to account for future deep aquifer interception requirements.
IERP 13.29	3.7	For future meetings, the IERP recommends that cross-sections of assumed seepage and groundwater plumes be generated to complement the plan views developed which are currently bounded at the dam toe.
IERP 13.30	3.7	The IERP recommends that consideration be given to the applicability of geophysical surveys to support plume mapping
IERP 13.31	4.0	The IERP was advised that a feasibility study is starting for a mine expansion using block cave technology, which includes increasing the size of the TIA. The IERP expressed a concern that the feasibility study could be a distraction to the EOR team and dilute the resources available to focus on the significant and high priority challenges that are currently facing the design and operations of the existing TIA. The IERP recommends that NRCM and BGC jointly develop a resource loading and prioritization plan to ensure that the focus on maintaining the safety and safe operations of the existing TIA is never jeopardized.