February 2018 Environmental Update for SLEMA Board

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February 28, 2018

Outline

1. Mine Update
2. Inspection Update
3. Regulators' Update
4. Aboriginal Update
5. Stakeholders' Update
6. Agency's Activities
7. SLEMA Reviews

Acronyms

- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- ECCC – Environment and Climate Change Canada
- ECM – Extended Care and Maintenance
- ENR – Department of Environment and Natural Resources, GNWT
- EQC – Effluent Quality Criterion
- GNWT – Government of the Northwest Territories
- INAC – Indigenous and Northern Affairs Canada (formerly Aboriginal Affairs and Northern Development Canada [AANDC] or Department of Indian Affairs and Northern Development [DIAND])
- MVEIRB – Mackenzie Valley Environmental Impact Review Board
- MVLWB – Mackenzie Valley Land and Water Board
- PK – Processed Kimberlite
- SLEMA – Snap Lake Environmental Monitoring Agency
- SNP – Surveillance Network Program
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond

1.1 Mine Update – January 2018

- The Snap Lake Mine remained in suspended operations (Extended Care and Maintenance)
  - 187 m^3 of water withdrawn from Snap Lake
  - No treated water discharged into Snap Lake
- No reportable spills
- Water sampled in 2 monitoring stations
  - SNP 02-15 (water intake)
  - SNP 02-16i (treated sewage effluent)

1.2 Updated Financial Security Estimate

- Submitted on January 30, 2018
  - Prepared by Arktis Solutions using the RECLAIM V7 model developed by DIAND and adopted post devolution by GNWT
  - Based on the assumptions made prior to the decision to proceed with the closure of the Snap Lake Mine
    - To be updated while the Final Closure and Reclamation Plan is submitted in 2019

1.3 Updated North Pile Management Plan

- Submitted on January 30, 2018
  - Per the Board's letter of issuance for the Type A Land Use Permit of October 12, 2017

1.4 Notification of Main Water Treatment Plant Modification

- Dated February 2, 2018
  - De Beers will be commencing the preparatory work and installation of a new water treatment train on February 21, 2018

Authorization from the Inspector

- Dated February 7, 2018
  - Supported the installation of a new Reverse Osmosis (RO) water treatment component
    - For nutrients and metal loadings
  - The fate of the Brine waste by-product will ideally need to be determined, or an approved storage solution put in place, before the use of this new plant in freshet, 2018

Comments from the Environmental Analyst

- No concerns are raised for the installation of the RO system
- The cautionary note of the Inspector in his Authorization about the Brine by-product is considerate, and should be addressed

2. Inspection Update

- Inspector – Tracy Covey
- Water Licence Inspections
- Inspected on February 5, 2018, and reported on February 16

2.1 Water Licence Inspection on February 5, 2018

- Reported on February 12, 2018
  - North Pile, Sumps and ditches, Waste Transfer Area, Dam 1, all active fuel tanks, and site of newly discovered sewage spill inspected
  - No environmental risks noted
  - SNP queries remained outstanding

Aerial View of Recent Seepage into Sump 5

The Landfill facility is seeing very light use with the current low camp population

Snow-free Dam 1 of the Water Management Pond

Ice had been removed basically to sump 4 bottom (to maximize potential seepage capacity)

Snow/ice height vs. the staff gauge inside Sump 3

The frost line indicates that this tank still contains approximately 4 million litres of diesel. The three other large bulk tanks are currently empty

Diesel tanks at the Incinerators inside the Waste Management Area

Bulk bags of shotcrete currently staged in the Laydown near the 12 million litre Bulk Diesel Tank Farm

The Sewage Treatment Plant (STP 2) was being shut down/decommissioned on the day of the inspection. It had been in operation since the early years of the mine, circa 2008

Sewage Spill 18-034: the spill volume was only 1 cubic meter, near the Water Management Pond

3. Regulators' Update - ENR

- Issued a letter of Satisfactory Determination of the 2016 Snap Lake Environmental Agreement Annual Report, on February 13, 2018
  - The 2016 EAAR extended version will be satisfactory and in accordance with Article 10.1 once De Beers responds to the comments from the GNWT and SLEMA
  - The concise version is a welcome format that ENR hopes to receive in future years, pending improvements

3. Regulators' Update – MVLWB (I)

- Invited reviewers to submit comments on Snap Lake – North Pile Management Plan on February 1, 2018
  - Comments due on February 27
- Invited reviewers to submit comments on Snap Lake – Financial Security Estimate / RECLAIM update (MV2011L2-0004 & MV2017D0032), on February 1
  - Comments due on March 6

3. Regulators' Update – MVLWB (II)

- Invited reviewers to submit comments on the Notification of Main Water Treatment Plant Modification on February 5, 2018
  - Comments due on February 12
- Acknowledged and accepted the proposed Modification to the Main Water Treatment Plant, on February 13

3. Regulators' Update – MVLWB (III)

- Deferred the decision on the Extended Care and Maintenance Plan (ECMP) Version 2, and associated Management Plans, as well as the request to not file the Interim Closure and Reclamation Plan (ICRP) Version 4, until De Beers applies to amend Conditions 52 ("Check for Leaks") and 71 ("Interim Closure and Reclamation Plan") of Permit 2017D0032, on February 22, 2018

3.1 MVLWB Staff Comments on the North Pile Management Plan

- It is not clear whether the Revision History Table content is indicative of the 2018 Plan updates, or if it includes updates from previous versions/iterations of the Plan, as there is no reference to submission dates or versions numbers in the Table. In addition, there are some inconsistencies throughout the Plan. For example, page 2 of the Plan states, "The North Pile will be kept in a stable state that will allow for the re-start of operations of the mine." It is Board staff's understanding that the Snap Lake Mine is heading into final closure and is not considering options for the re-start of mining operations
  - Please update the Plan to provide clarity

4. Aboriginal Update

- No comments received in February 2018

5. Stakeholders' Update

- ECCC commented on the North Pile Management Plan on February 23, 2018
- The Inspector commented on the North Pile Management Plan on February 26
- ENR commented on the North Pile Management Plan on February 27

5.1 ECCC Comments on the North Pile Management Plan

- ECCC recommends that the Proponent provide clarification on how PK dust will be managed in the event that it occurs on the North Pile
- ECCC recommends that the Proponent identify any changes to the quality of water in the flooded underground works which may result from disposal of the brine waste stream to the underground works
- ECCC recommends that the Proponent clarify frequency of inspections of the North Pile f[illegible]

5.2 Inspector Comments on the North Pile Management Plan (I)

- Add some form of permanent visual elevation pole to sumps 1 and 5. Also add a permanent visual elevation marker(s) of some sort identifying the critical level of Sump 4 (which identifies the elevation/level which the sump must remain below if flow direction from Snap Lake is to be assured)

5.2 Inspector Comments on the North Pile Management Plan (II)

- Define what form surveillance will take, the aspects of facility status and stability which will be inspected, the expectations which will demonstrate that facility operational and stability performance are being met, and action levels which clearly define the action(s) which will be taken as different observed operational or stability-related outcomes are encountered. Provision of these definitions in a table for quick reference/clarity would be appreciated

5.2 Inspector Comments on the North Pile Management Plan (III)

- Define "managed appropriately“ for release of fine PK dust from a drying surface within the inactive North Pile, set measurable criteria which will define when this has been accomplished (so the Inspector can determine whether or not compliance has been attained based on pre-established criteria, and report on that)

5.2 Inspector Comments on the North Pile Management Plan (IV)

- Provide the Inspector with a summary of additional sensor installation (if and when the decision to deploy comes to fruition). Include a map illustrating where these installations are as soon as they have been deployed (an as built drawing will be fine)

5.2 Inspector Comments on the North Pile Management Plan (V)

- The Inspector has concerns about the potential inflow of large volumes of water which may be trapped inside the North Pile from previous input of water during mining operations. History at this facility shows that large volumes of processed water can and do get trapped in the embankments/tailings & that such processed water can move without warning in very short periods of time (hours, not weeks). To be prudent/pro-actively managing the facility, the Inspector recommends a human presence to inspect the sumps in a manner which would detect such large additions of water in time to mount appropriate containment action (before freeboard is breached, not after...potentially weeks after). This would seem to require some sort of visual observation by a human on a time interval in the range of hours (not weeks or months). To do otherwise is an avoidable risk

5.2 Inspector Comments on the North Pile Management Plan (VI)

- De Beers freshet analysis suggests that freshet design criteria will encounter an estimated an inflow during freshet of about 27,000 m3 *per day* for a 10 day period which would need to be accounted for, with a total expected ingress of about 420,000 m3 over 10 days. Intended storage capacity (as per design intent) thus seems precarious (but adequate?)

5.2 Inspector Comments on the North Pile Management Plan (VII)

- Did De Beers consider other disposal options for the brine and, if so,
- What were the other disposal options looked at & why were they discounted?
- Are there any environmental concerns associated with storage of Brine into the underground, and if so, how will they be mitigated?
- Is the disposal of RO brine an approved method of disposal (approved through the MVLWB review process)? If so, please describe when that approval was granted

5.2 Inspector Comments on the North Pile Management Plan (VIII)

- Describe in detail how De Beers proposes to conduct the daily and weekly inspections throughout the calendar year. If De Beers wishes to change this, then a letter from the Engineer in Charge indicating that they approve any proposed reduction in inspections and specifying what sampling regime would suffice should accompany any De Beers response

5.3 ENR Comments on the North Pile Management Plan (I)

- CIMP, ENR recommends that De Beers Canada should submit water quality data associated with their Annual Water Use Report to the public registry in an accessible format (e.g., csv or spreadsheet file)
- CIMP, ENR recommends that De Beers Canada complete the attached metadata template annually in the same spreadsheet as the associated water quality data and submit it to the public registry in an accessible format (e.g., csv or spreadsheet file)

5.3 ENR Comments on the North Pile Management Plan (II)

- CIMP ENR recommends that the Board require the use of the attached Metadata Template to ensure consistency of reporting of data
- ENR recommends that De Beers review the response action triggers for water levels in the sumps and set more reasonable actions levels that will keep water levels in the sumps as low as possible

5.3 ENR Comments on the North Pile Management Plan (III)

- ENR recommends that the legislative reference be updated (Waters Act)
- ENR recommends that the definitions from the previous Northwest Territories Waters Act (1992) that are quoted in Section 2.0 be updated with wording from the current legislation

5.3 ENR Comments on the North Pile Management Plan (IV)

- ENR recommends that De Beers confirm the acceptable levels of treatment through the North Pile embankments

6. Agency's Activities

- The Environmental Analyst visited the Mine site on February 6, 2018
- The following comments were submitted to the MVLWB online review system
  - Notification of Main Water Treatment Plant Modification, on February 12
  - North Pile Management Plan on February 27

6.1 Mine Site Visit

- February 6, 2018
  - Site orientation
  - Site field tour
  - Site camp tour

East Cell, Seepage and Sump #5

Excavated Snow from Sump #4

Refuge Station for Monthly Site Inspection during Remote Monitoring

Shack for Geo-technical Data Collection

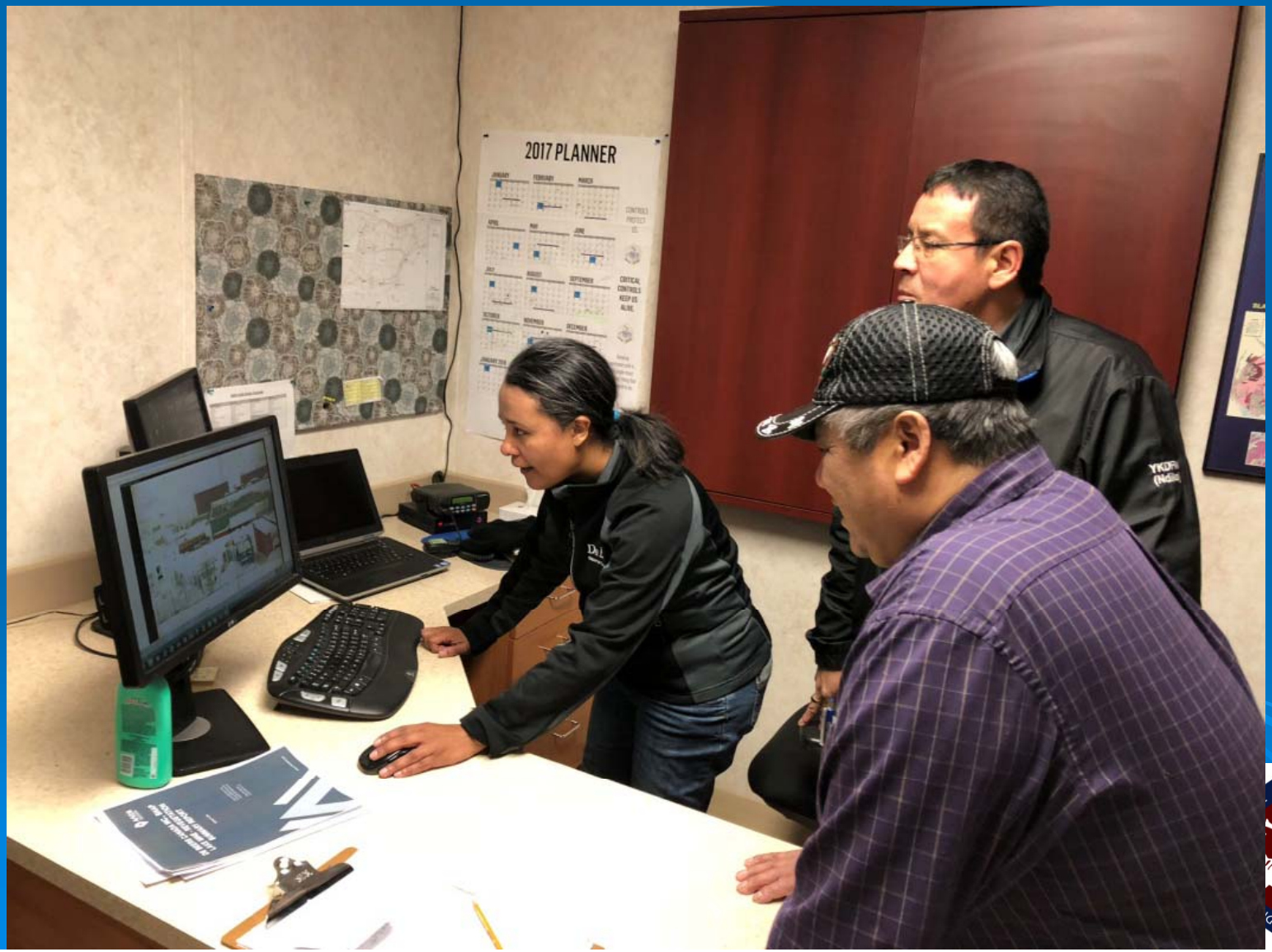
Incinerators within the Waste Management Area

Laydown Area

Downsized Drinking Water Treatment Unit and Sewage Treatment Unit

Waste Segregation

Mine Site Surveillance System



7. SLEMA Reviews

- North Pile Management Plan
- Financial Security Estimate / RECLAIM update (MV2011L2-0004 & MV2017D0032)

7.1 North Pile Management Plan

- Submitted on January 30, 2018
  - Based on Snap Lake's Extended Care and Maintenance phase and future plans for reclamation and closure of the North Pile

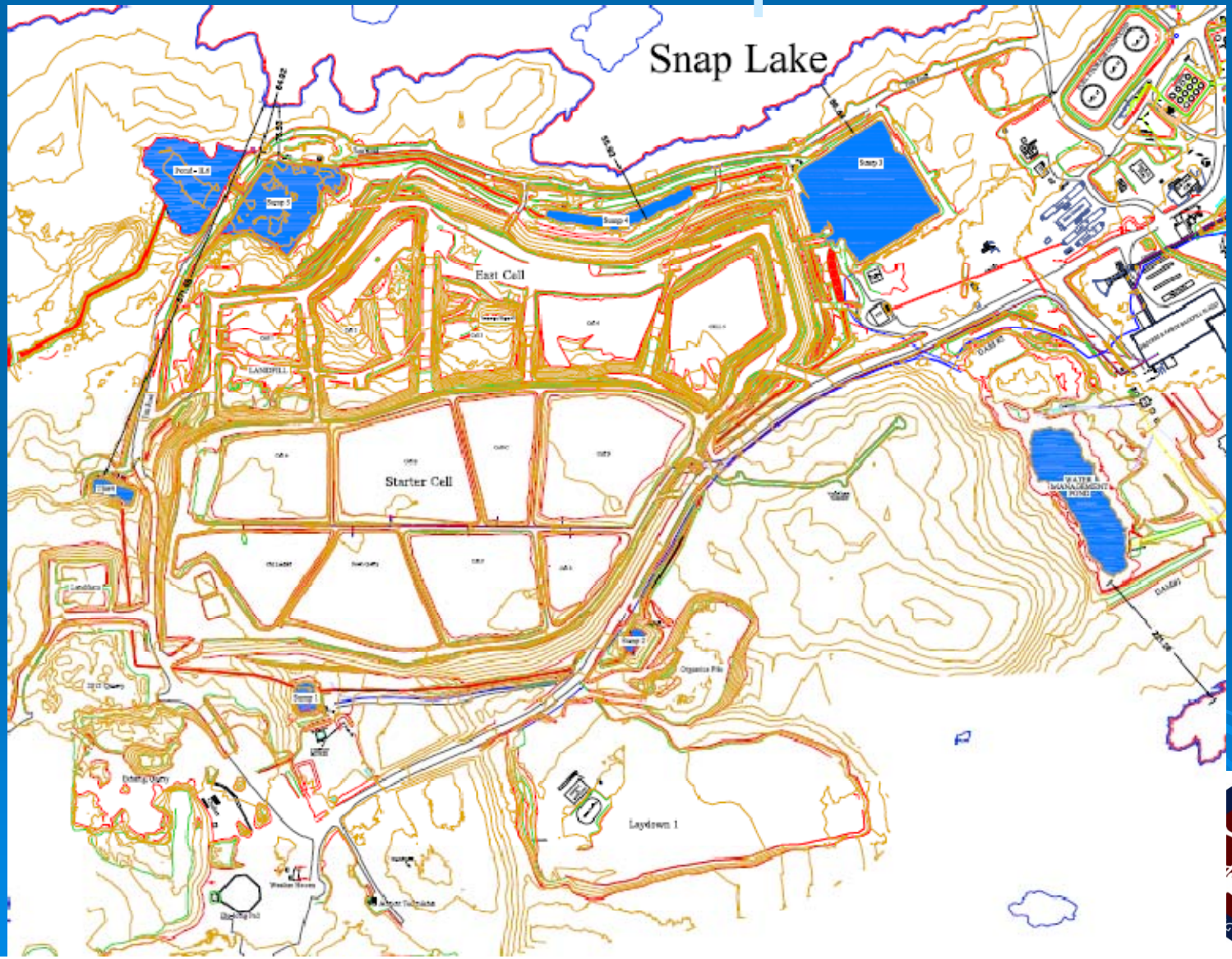
Main Contents

- Waste Streams of the North Pile Facility
- Operational Procedures and Geometric Sequencing
- Geochemical Criteria for Management and Placement of Potential Acid-Generating
- Operational Procedures for Deposition
- Water Management
- The North Pile Facility infrastructure and Performance
  - Response Framework and Action Level

North Pile Development

- The North Pile is being developed in three cells in the following order:
  1. Starter Cell (construction in 2005, PK deposition from 2007 to 2014) , storage capacity - approximately 3.2M m^3
  2. East Cell (construction in 2010, PK deposition from 2014 to 2015), storage capacity - approximately 2.6 M m^3
  3. West Cell (construction in 2014, no slurry PK deposition)
- Each of these cells is considered a separate phase of the North Pile development. Due to the discontinuation of operation at Snap Lake in December of 2015, the completion of both the East Cell and West Cell was never completed

Starter Cell, East Cell, Ditches and Sumps



Comments from the Environmental Analyst (I)

- The Plan appears not to be proofread
  - There are lots of typo errors and editing issues
    - Tables and figures are poorly organized in Revision History, Table of Contents, and in various sections
  - Resubmission is requested

Comments from the Environmental Analyst (II)

- It is stated in page 1 that the information outlined in this Plan is based on Snap Lake's Extended Care and Maintenance phase and future plans for reclamation and closure of the North Pile. However, the Plan does not provide specific description for "zero occupancy" remote monitoring
  - During the site visit on February 6, 2018, site security surveillance system was demonstrated. However, it might not help the environmental monitoring, especially water monitoring
  - More and consistent information about "zero occupancy" remote monitoring is requested

Comments from the Environmental Analyst (III)

- In page 23, it is stated that all brine that is collected as a byproduct of the water treatment process will be collected and pumped through to the underground workings
  - Justification of doing so is requested

Comments from the Environmental Analyst (IV)

- Routine daily and weekly inspections are mentioned in page 26 the North Pile monitoring
  - This should be conducted when staff are on site
  - How will the inspections be conducted under the scenario of “zero occupancy” remote monitoring?
    - More information is requested

Comments from the Environmental Analyst (V)

- It is stated in page 27 that the objective of the third party inspections is to carry out a detailed review of the conditions of the facilities and facility operation during the spring freshet and prior to freeze up
  - There appears to be two third party inspections, i.e. one during the spring freshet and another one prior to freeze-up. However, only one geotechnical inspection was reviewed last year. Clarification is requested.

7.2 Financial Security Estimate / RECLAIM update (MV2011L2-0004 & MV2017D0032)

- Submitted on January 30, 2018
  - This estimate was prepared using the RECLAIM V7 model as developed by DIAND
  - This estimate update was prepared based on the assumptions made prior to the decision to proceed with the closure of the Snap Lake Mine
    - De Beers will update this financial security estimate based on the details that will be provided in the Final Closure and Reclamation Plan w[illegible] this plan is submitted in 2019

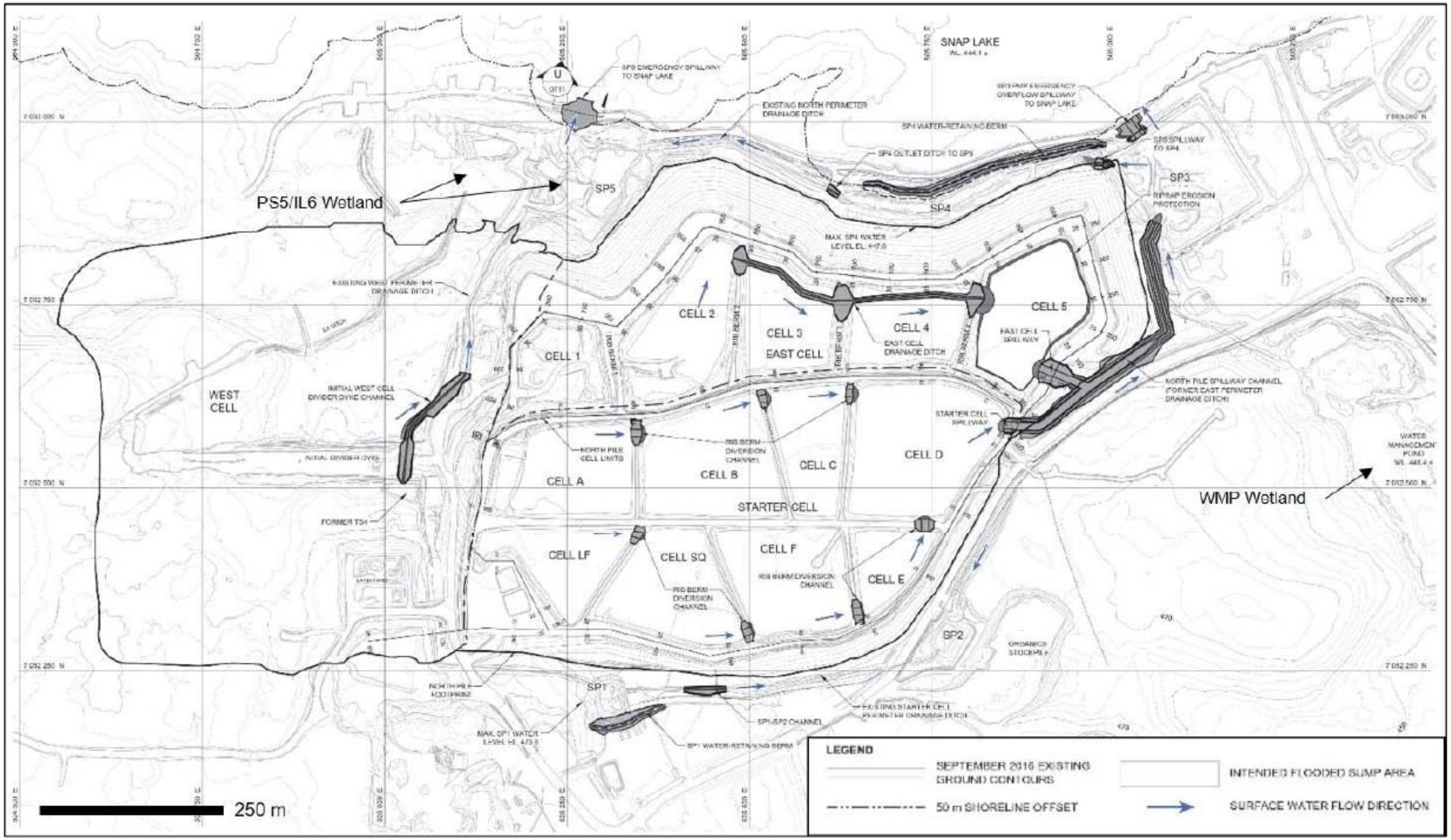
Direct Costs and Indirect Costs

- The reclamation security amount for the Project was calculated from the sum of direct costs and indirect costs associated with the Project
  - Direct costs ← reclamation components ← reclamation objectives ← reclamation actions ← quantity and unit cost
  - Indirect costs

Reclamation Components Related to Direct Costs

- Underground mine
- Tailings facility (North Pile)
- Buildings and equipment
- Chemicals and contaminated soil management
- Surface and groundwater management
- Interim care and maintenance

Conceptual North Pile Final Closure Footprint



Water Management and Treatment

- Following three years of active treatment of seepage and runoff water from the North Pile, the area of the Water Management Pond (WMP) and Permanent Sump 5 (PS5) and Inland Lake 6 (IL6) will be converted into wetlands to provide passive treatment for an additional three years, and then the seepage and runoff water will no longer be maintained and will be allowed to naturalize

Categories Related to Indirect Costs

- Mobilization / demobilization
- Post-closure monitoring and maintenance
- Engineering (5% of the direct costs)
- Project management (5%)
- Health and safety plans/ monitoring and quality assurance (QA)/ quality control (QC) (1%)
- Bonding / insurance (1%)
- Contingency (20%)

Timeline for Final Reclamation Phases

Phase	Completion Date
End of Care and Maintenance	Q2 2020
End of Active Reclamation and Decommissioning	Q2 2022
End of Post Reclamation Monitoring	Q4 2041

Capital Costs	Total Costs	Land Liability	Water Liability
Open pit	$0	$0	$0
Underground mine	$357,643	$357,643	$0
Tailings facility	$7,698,073	$6,612,779	$1,085,293
Rock pile	$0	$0	$0
Buildings and equipment	$19,023,846	$18,948,846	$75,000
Chemicals and contaminated soil management	$5,057,376	$2,528,688	$2,528,688
Surface and groundwater management	$3,543,769	-	$3,543,769
Interim care and maintenance	$8,263,107	-	$8,263,107
SUBTOTAL: Capital Costs	**$43,943,813**	**$28,447,956**	**$15,495,857**
PERCENT OF SUBTOTAL		**65%**	**35%**
Indirect Costs	**Total Costs**	**Land Liability**	**Water Liability**
Mobilization/demobilization	$9,260,135	$5,994,744	$3,265,391
Post-closure monitoring and maintenance	$12,097,800	$7,831,767	$4,266,033
Engineering (5%)	$2,197,191	$1,422,398	$774,793
Project management (5%)	$2,197,191	$1,422,398	$774,793
Health and safety plans/monitoring and quality assurance/quality control (1%)	$439,438	$284,480	$154,959
Bonding/insurance (1%)	$439,438	$284,480	$154,959
Contingency (20%)	$8,788,763	$5,689,591	$3,099,171
Market price factor adjustment (0%)	$0	$0	$0
SUBTOTAL: Indirect Costs	**$35,419,955**	**$22,929,857**	**$12,490,099**
TOTAL COSTS	**$79,363,768**	**$51,377,813**	**$27,985,956**

Comments from the Environmental Analyst

- Current security deposit held by the GNWT ($80,401,918)
  - Land Use Permit: $21,335,671
  - Water Licence: $39,066,247
  - Environmental Agreement: $20,000,000
- The Security Estimate is $79,363,768, which is less than the Amount held by the GNWT
- No concerns are raised