



August 2018 Environmental Update for SLEMA Board

August 31, 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])
- 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
- SSWQO – Site-Specific Water Quality Objective
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond



1.1 Mine Update – June 2018

- SNP June 2018 SNP Monthly Report submitted on August 10
 - The Snap Lake Mine remained in suspended operations (Extended Care and Maintenance)
 - 549 m³ of water withdrawn from Snap Lake
 - 24,301 m³ of water treated water discharged into Snap Lake (up to June 25)
 - Construction on the Reverse Osmosis Plant (RO) was completed in May 2018
 - No reportable spills
 - Water sampled in 14 monitoring stations
 - Due to internal restructuring, the labs were unable to provide complete sample results for the month of June. Available results have been included in this month's report for the interim until full results can be reconciled in the July report



Mine Update – July 2018

- SNP July 2018 SNP Monthly Report submitted on August 31
 - The Snap Lake Mine remained in suspended operations (Extended Care and Maintenance)
 - 532 m³ of water withdrawn from Snap Lake
 - No discharge into Snap Lake
 - No reportable spills
 - Water sampled in 5 monitoring stations
 - Available preliminary results for July – ALS explanation letter attached
 - June results included in the report



Quarterly Analysis for SNP Data

➤ Water Quantity

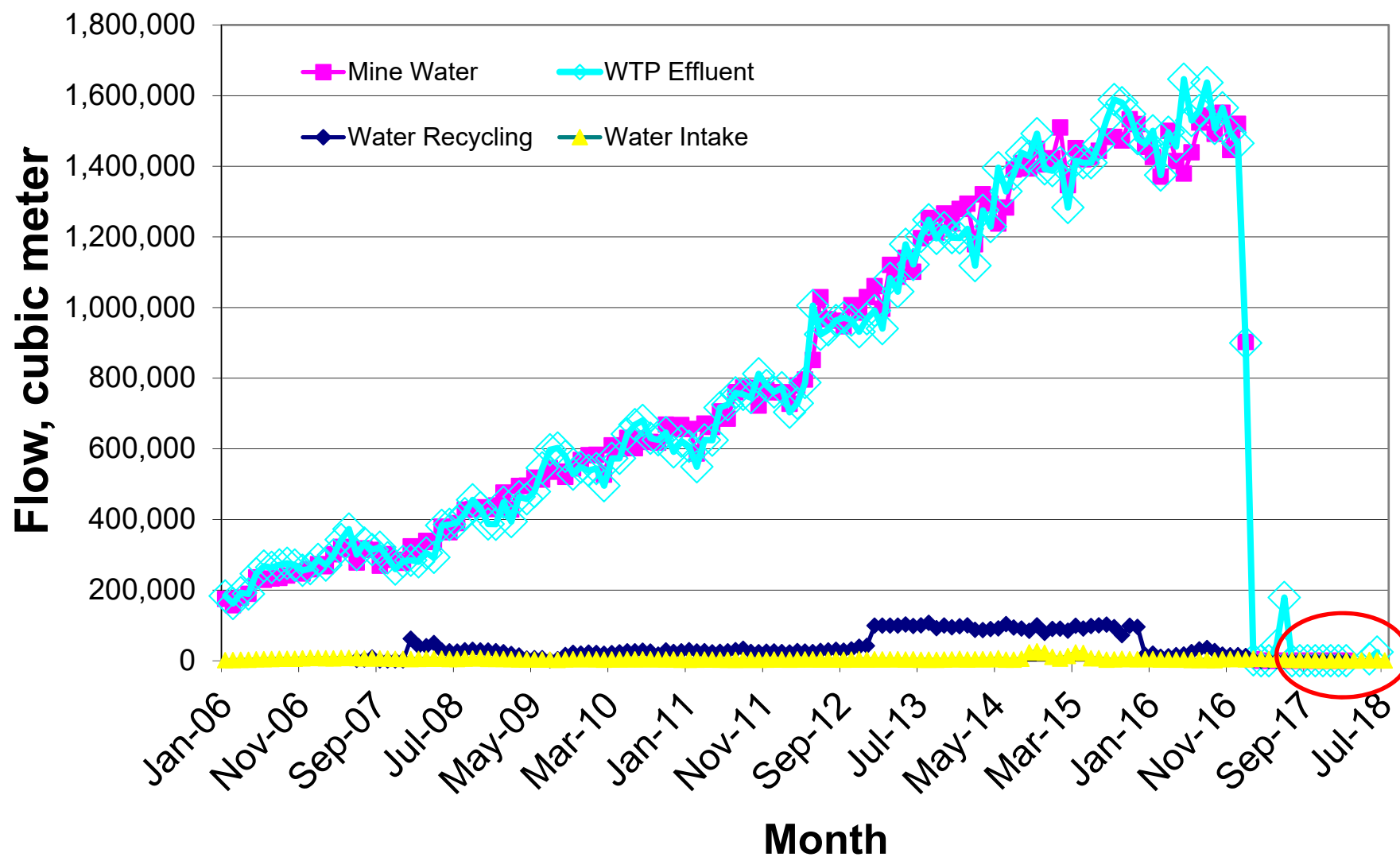
- Both water intake and discharge to Snap Lake are significantly less than three years ago
 - Discharge to Snap Lake has been insignificant since January 2017 (underground workings flooded)
 - No minewater after February 2017
 - Water Treatment Plant (WTP) only received seasonal (summer) runoff flows from the North Pile
 - Water intake from Snap Lake has been down to a few hundred cubic meters per day level due to much smaller number of staff at the mine site

➤ Water Quality (Total Dissolved Solids)

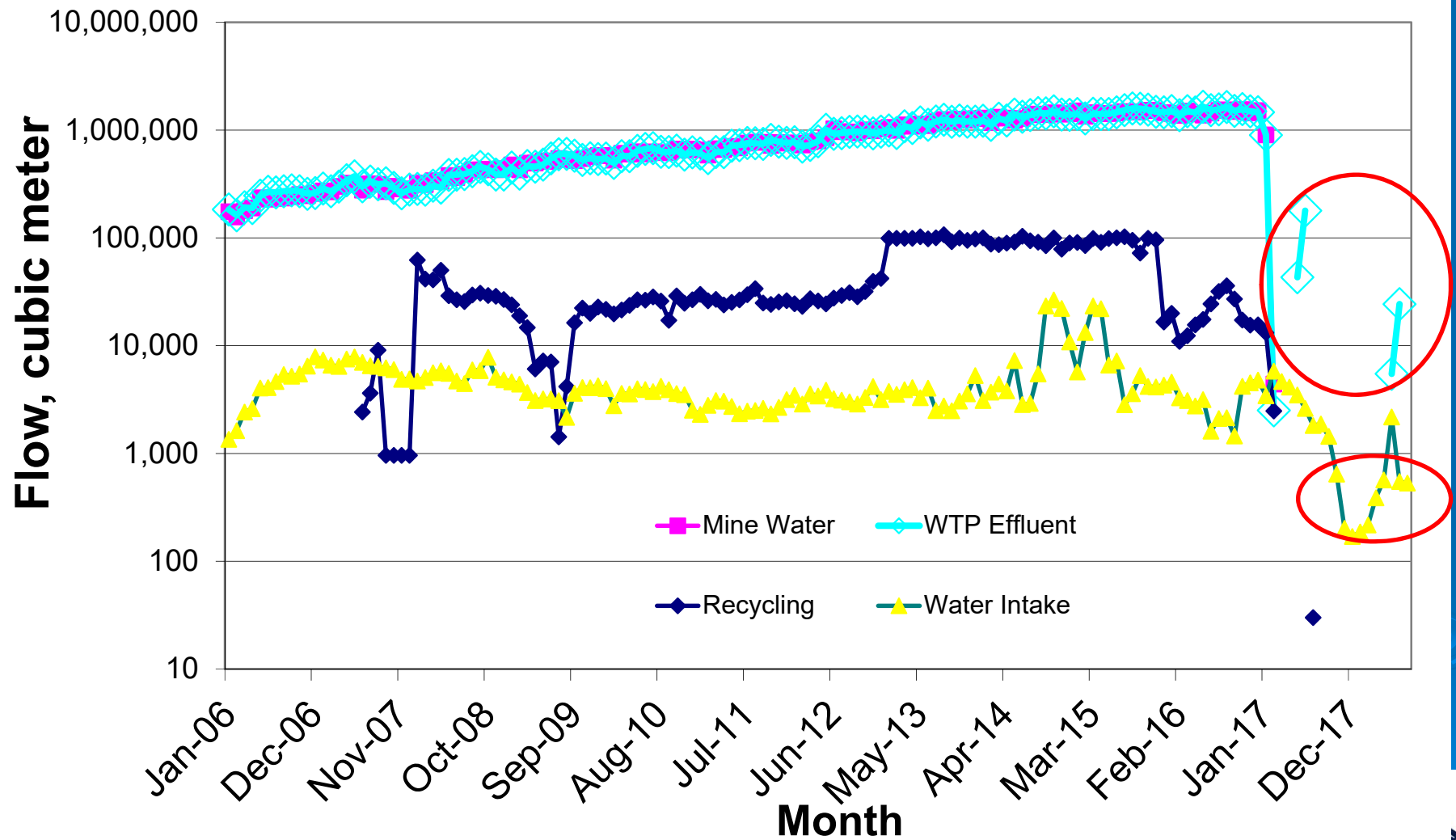
- TDS levels in the effluent of WTP are down to normal TDS level in runoff
- TDS levels in Snap Lake (water intake in the Northwest Arm) have been stable since 2016



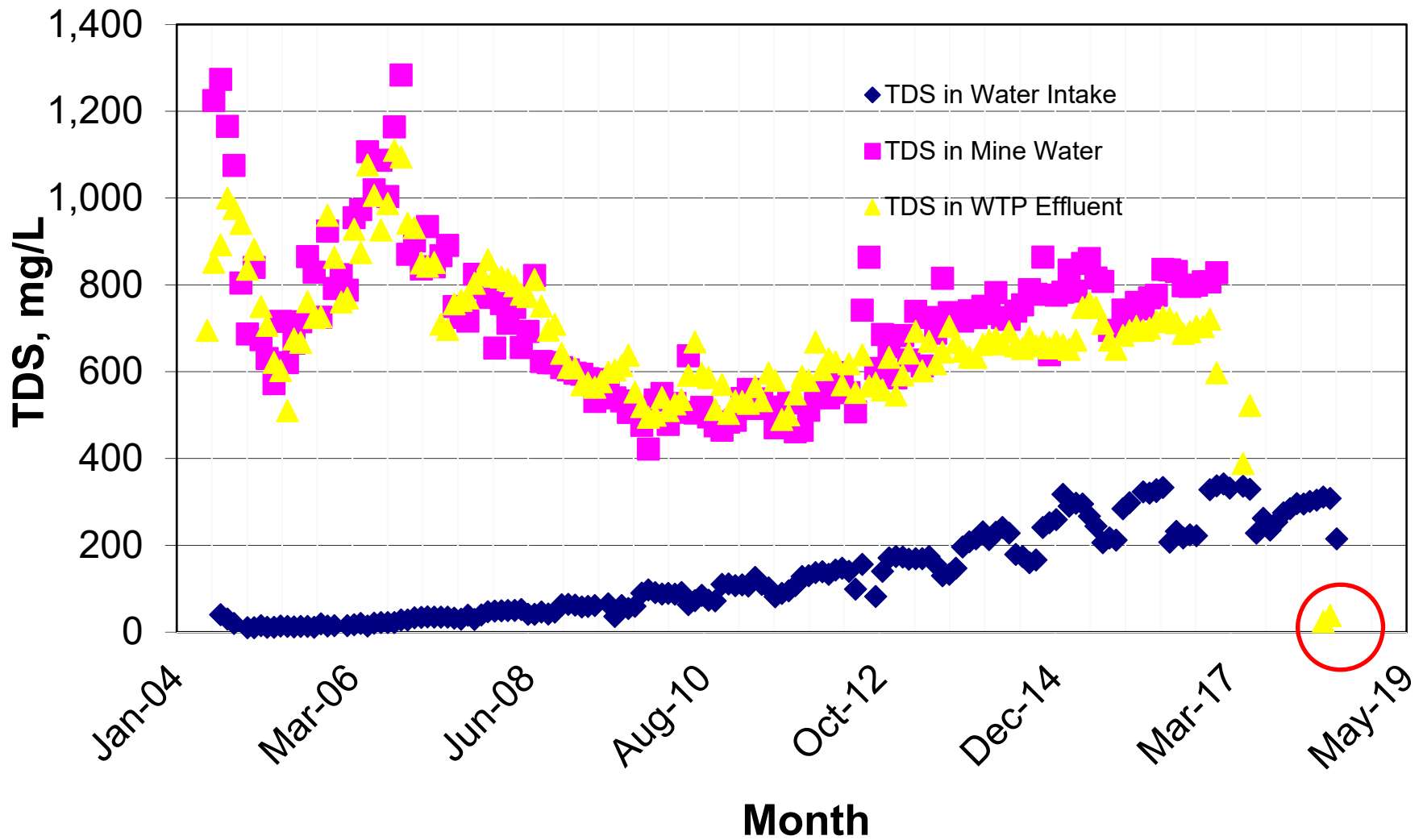
Water Flows at the Mine



Water Flows at the Mine (logarithmic scale)



Yearly TDS Analysis



1.2 Environmental Agreement Security

- Submitted on July 6, 2018 and addressed to the Government of Northwest Territories
 - The Government of the Northwest Territories currently holds \$80,401,918 in Irrevocable Letters of Credit (ILOCs) including \$21,335,671 for the Land Use Permit, \$39,066,247 under the Water License and \$20,000,000 for the Environmental Agreement. This security is greater than the total detailed under section 12.1 of the Environmental Agreement of \$77,500,000 to be held by end of Mine Life under the Water License, Land Use Permit and Environmental Agreement together
 - Therefore, because De Beers will not be constructing the west cell, and because the security held currently exceeds the total amount stipulated in the Environmental Agreement already, De Beers will not be posting additional security (\$3,500,000 for the West Cell liability) in year 15. The security requirements have already been met



1.3 Request to Initiate the Review of Snap Lake Environmental Agreement Securities

➤ Submitted on August 14, 2018

- The objective of this Review would be to eliminate duplication of posted security between those held for the land use permit (LUP) and water licence (WL), and the Environmental Agreement as well as to eliminate the requirement to post additional securities against activities that will not be pursued (i.e. construction of west cell). It is also necessary to define the activities the Additional Security Deposit covers and to define the process for return of those securities



2. Inspection Update

- Inspector – Tracy Covey
- Water Licence Inspection
 - Inspected the Mine on August 3, 2018, and reported on August 14



2.1 Water Licence Inspection on August 3, 2018

- Reported on August 14, 2018
 - Inspected the North Pile, Sumps and ditches, Dam 1 of the Water Management Pond, all active fuel tanks
 - No environmental risks noted

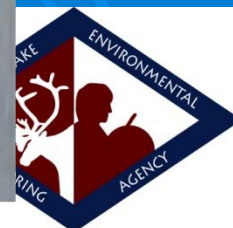


Elevated Aluminum and Copper Concentrations in Runoff Samples (SNP June 2018 Monthly Report)

- The significance of these elevated Aluminum and Copper sources is unclear. The Inspector requested that De Beers confirm reported data for the above noted stations/dates, and provide an analysis of the possible impact/if any of these exceedances (with a submission date of September 30, 2018)



East Cell of the North Pile



Ponding in Cell 2 and 3 (left photo) and Cell 5, East Cell



Construction of access roads to new instrumentation Pads, Cell 4, Ease Cell



Two access roads to
instrumentation pads
(under construction).

08/03/2018



Sites of future test pad in Cell 4 of the East Cell



Landfill in Cell 1 of the East Cell



Starter Cell (overall view, looking east)



Landfarm (left) and Quarry



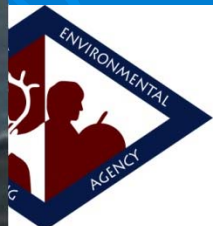
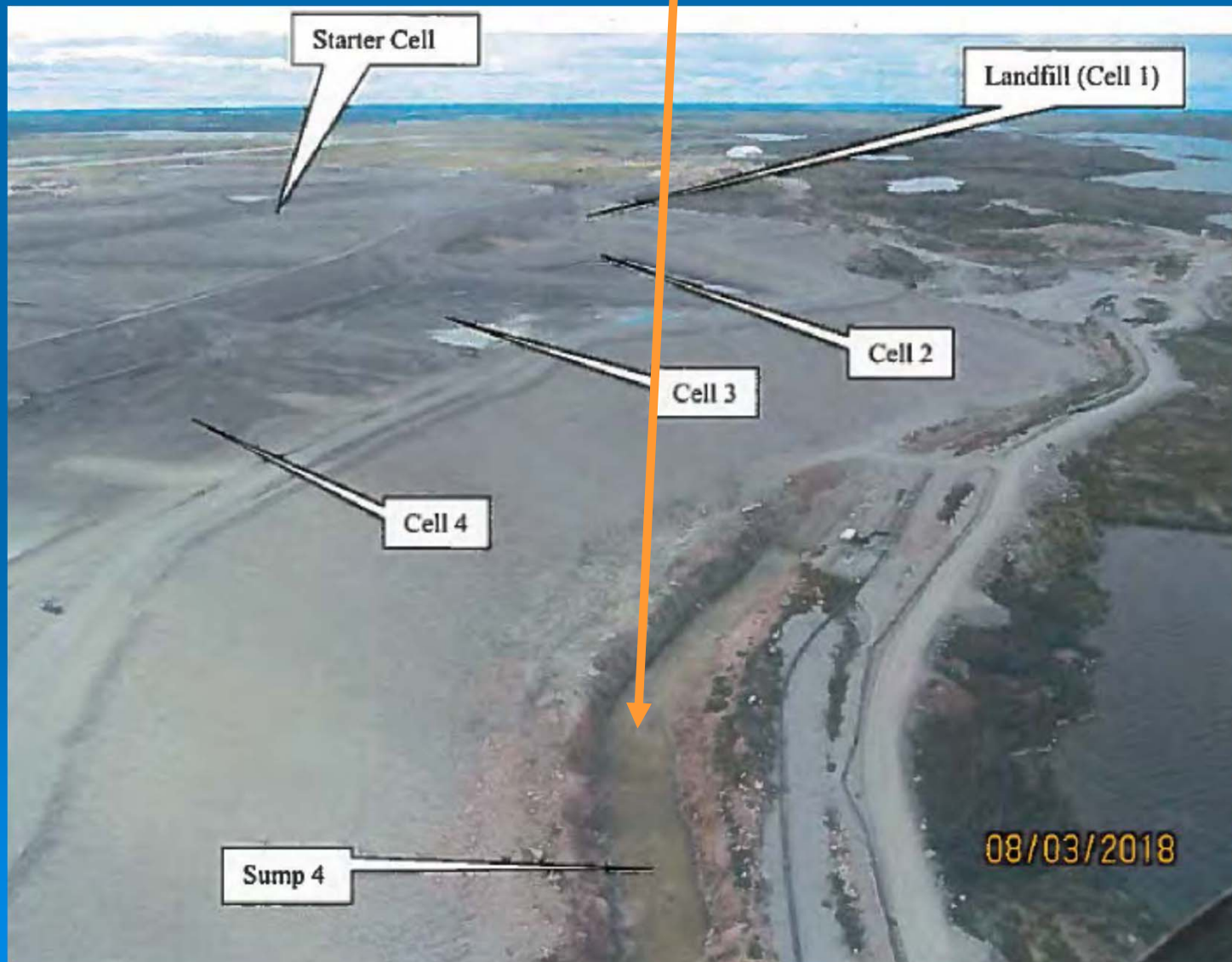
Water level in the Water Management Pond was reported to be low (south end)



Sump 3 was essentially dry



Water level in Sump 4 was low



Water level in Sump 5 was low



Test Pit sample location (17-440 Diesel Spill)

Analysis of the soil in the area surrounding Day Tank I showed the presence of a diesel plume at two pits dug in the area shown above.

Due to safety concerns (buried power lines, permanent power-generation related infrastructure and overhead lines) the Inspector has approved delaying the complete clean-up of this spill until the power generating facility is de-commissioned and demolished (likely in the summer of 2020)



Absorbent pads are under the machinery,
but the loader in the background does not
have a drip tray underneath it



3. Regulators' Update – ENR (I)

- ENR Responded to De Beers' intention to not post final Additional Security Deposit (ASD) payment of \$3,500,000.00 in year 15 (2019), on August 3, 2018
 - At this time, ENR does not support a departure from the current payment schedule
 - Deviation from the payment schedule and amount would require a review under the Environmental Agreement
 - De Beers is required to continue as per the current schedule



3. Regulators' Update – ENR (II)

- ENR Responded to De Beers request to initiate a review of the Additional Security Deposit (ASD), on August 30, 2018
 - The ASD Review will not impact the amount of security required by the Water Licence and or Land Use Permit
 - De Beers to continue to prepare for final payment of their ASD under clause 12.1(c)(i)(D) of the Environmental Agreement
- ENR framed the review process and detailed the next steps forward
 - Opening Meeting – De Beers to provide supporting information
 - ENR Desktop Review – itemized breakdown of the ASD
 - De Beers Comment/Discussion
 - Next Steps



3. Regulators' Update – MVLWB (I)

- The Board, on August 2, 2018, approved the AEMP Response Plan - Plankton as submitted May 29, 2018, with the corrected Figure 8 submitted July 20, 2018
 - The Board directs De Beers to set a medium action level for nutrient enrichment in the plankton community while all action levels are being re-evaluated for the forthcoming AEMP Design Plan submission (early 2019)
 - The monitoring results from 2018 shall be compared to the low and medium action levels for discussion in the 2018 AEMP Annual Report submission due May 1, 2019



3. Regulators' Update – MVLWB (II)

- The Board approved the 2017 AEMP Annual Report as submitted, on August 2, 2018
- The Board approved the Technical Memo (June 11, 2018), the Extended Care and Maintenance Plan, Version 3 (March 13, 2018) and the associated management plans, on August 16
 - Water Management Plan, Waste Management Plan, Spill Contingency Plan and Emergency Response Plan



3. Regulators' Update – MVLWB (III)

- Board staff, on August 29, 2018, seek input on potential dates for the technical workshop for final closure, to be held in Yellowknife at the end of October or in the beginning of November, and an estimated number of attendees
 - De Beers will be submitting a Final Closure and Reclamation Plan by January 30, 2019
 - De Beers will submit an updated draft Closure “Objectives, Criteria & Research” table in September 2018
 - Responses due on September 14



4. Aboriginal Update

- No comments received in August 2018



5. Stakeholders' Update

- No comments received in August 2018



6. Agency's Activities

- Zhong Liu resigned from SLEMA after 11 years of service
- Sonia Aredes was hired as the Environmental Analyst of SLEMA in August 2018
 - She will take over the position in October



7. SLEMA Reviews

- Water Management during Extended Care and Maintenance



7.1 Water Management during Extended Care and Maintenance

- Extended Care and Maintenance Water Management Plan (December 2017), page 5 states that De Beers will continue to monitor and investigate passive water treatment options and ways to install remote equipment once water quality objectives are achieved to re-establish natural flow regimes prior to restarting operations



Water Treatment: Active vs. Passive

- There are a number of different treatment technologies available to clean contaminated water; these technologies can be described as either active or passive
 - Active treatment technologies require the input of energy and chemicals, and
 - Passive treatment uses only natural processes such as gravity, microorganisms, and/or plants in a system, any one of which requires infrequent but regular maintenance

<http://www.miningfacts.org/Environment/How-is-water-managed-and-treated-in-mining/>



Active Water Treatment

- Active water treatment is the most common form of water treatment at working mines
 - **pH adjustment, Coagulation, Water Recycling**
 - Ion exchangers, membrane filters, and reverse osmosis



Passive Water Treatment

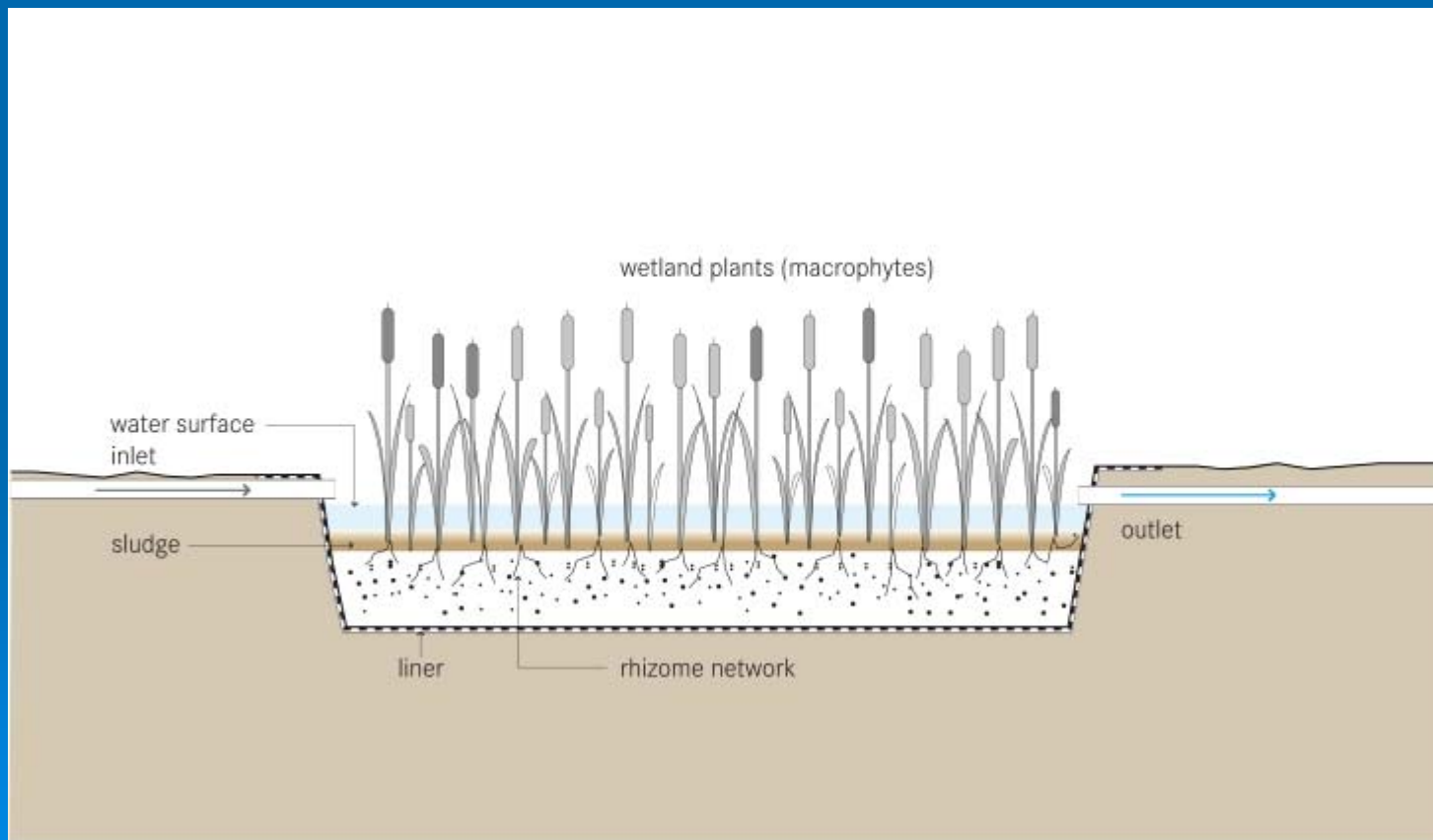
- Passive water treatment is usually combined with water monitoring programs, and takes advantage of natural physical, chemical, and biological processes that remove water contaminants without additional physical or chemical inputs
 - Bacteria-controlled metal precipitation, contaminate uptake by plants, and filtration through soil and sediments
 - Constructed wetlands are the most common form of passive water technology

Shallow, vegetated systems that fill and drain in a controlled manner



Schematic of a free-water surface constructed wetland: It aims to replicate the naturally occurring processes, where particles settle, pathogens are destroyed, and organisms and plants utilize the nutrients.

https://en.wikipedia.org/wiki/Constructed_wetland



Constructed Wetlands

- Constructed wetlands act as natural purification systems which are capable of filtering and removing many contaminants before they are transported into marine or freshwater environments. However, it is difficult to achieve ideal contaminate removal conditions, and passive water treatment currently requires ongoing maintenance and treatment

Mining Phase	Active Water Treatment	Passive Water Treatment
Operation	✓	
Closure and Reclamation	✓	✓
Post-Closure	✓	✓

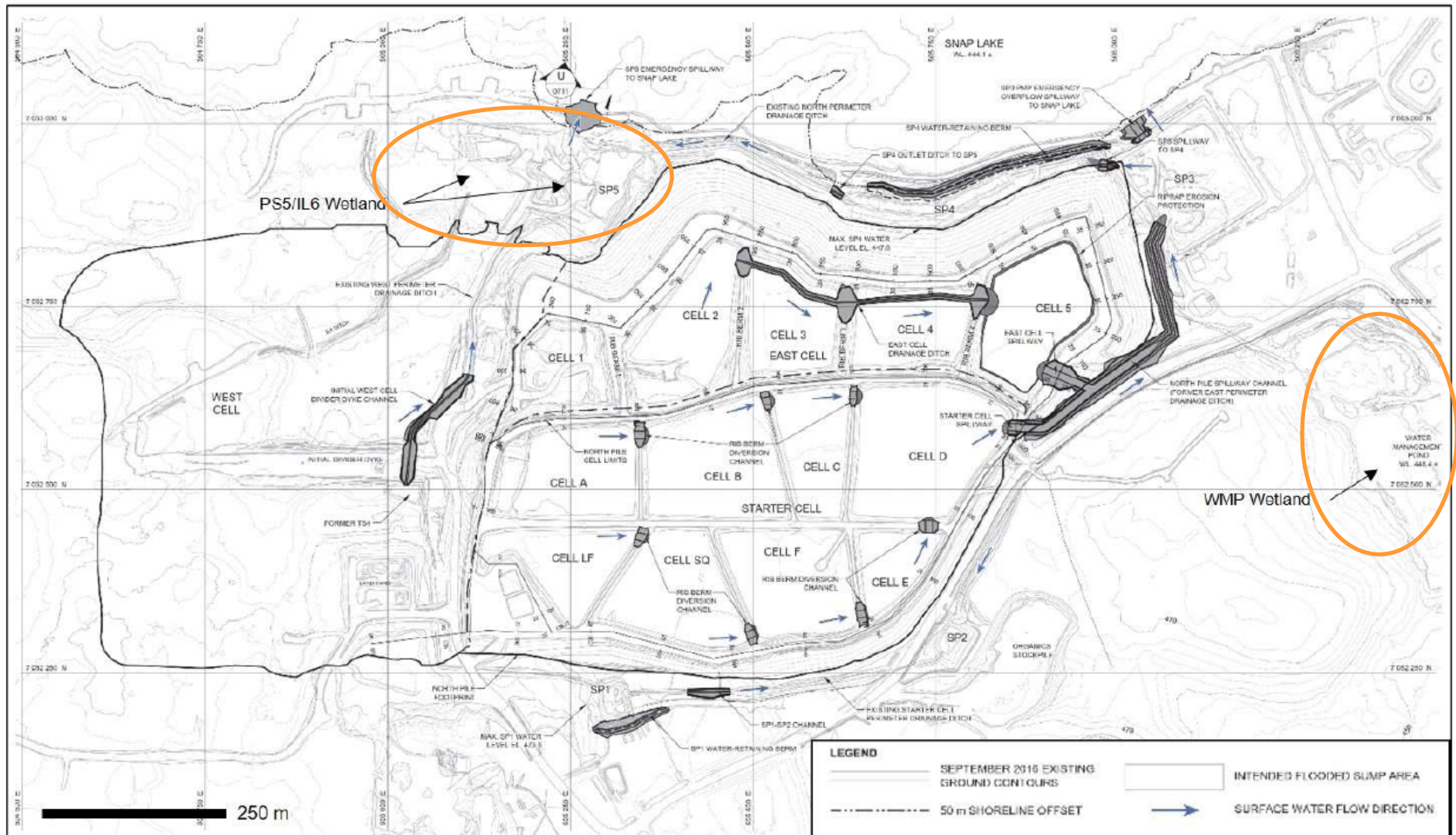


De Beers' Initial Proposal

- It is stated in the 2018 Reclaim Financial Security Estimate (page 6) that after three years of active treatment (Extended Care and Maintenance), seepage and contact water will be allowed to flow naturally through a constructed wetland passive treatment system in the area of Permanent Sump 5/Inland Lake 6 and the Water Management Pond before entering into the aquatic environment
- The passive treatment system will continue for three years



Locations of Proposed Wetlands (Passive Water Treatment Systems)



Comments from the Environmental Analyst (I)

- The majority of water to be treated is currently from the North Pile within a short period of time – freshet period
- The pollutants are mainly from the seepage of the North Pile, with limited amount
 - Seepage will be diluted during freshet period and heavy rainfall events; during other time of ice-free season it may be a concern



Comments from the Environmental Analyst (II)

- The large amount of freshet water within a very short period could not be treated in the two Wetlands!
 - The quality of freshet water may meet the Effluent Quality Criteria
 - Seepage water quality appears to be improving
 - Limited amount of seepage diluted by large volume of freshet water
 - If applicable, the freshet water may be allowed for overland flow to Snap Lake if the quality of freshet water meet EQCs
 - Overland flow is also a land application for wastewater treatment



Schematic of Some Overland Application Systems

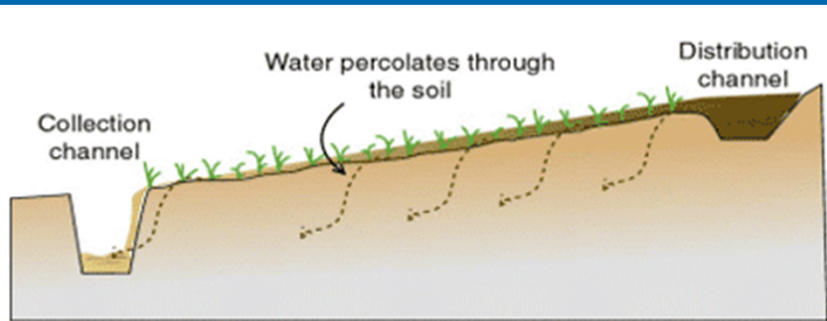
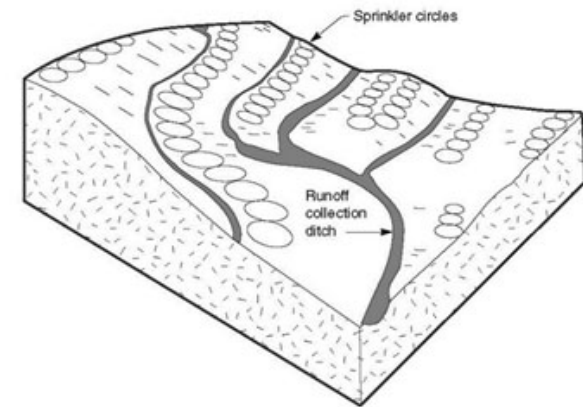
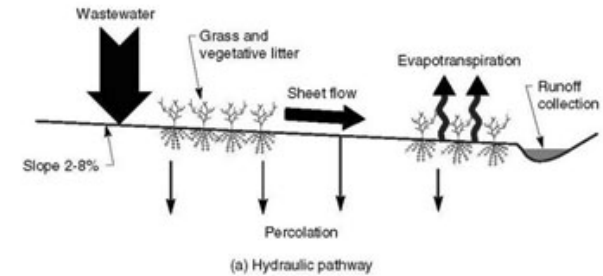


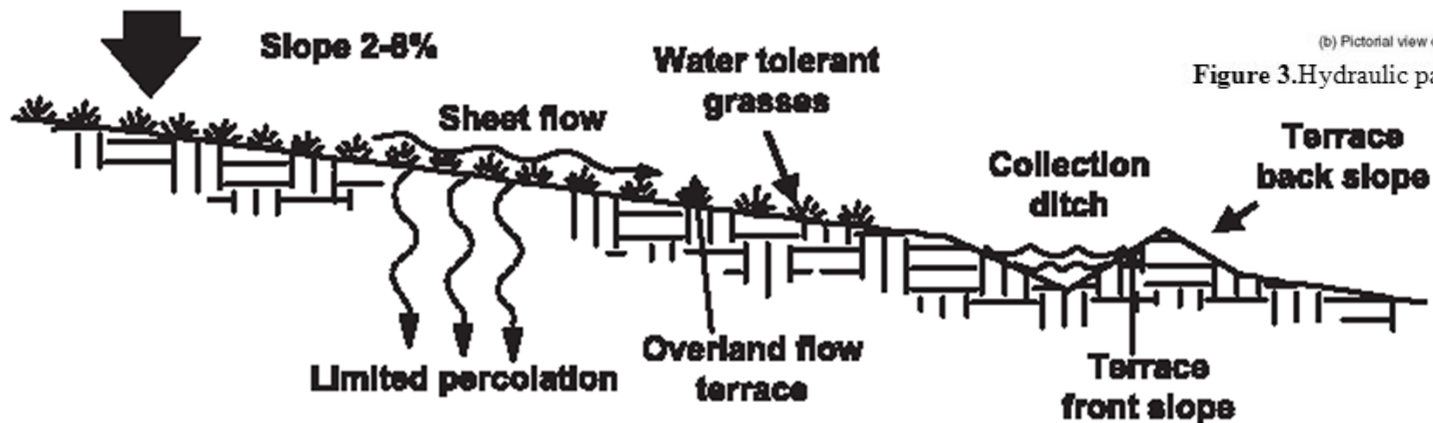
Figure 2.29: Slow-rate land application system



(b) Pictorial view of sprinkler application

Figure 3. Hydraulic pathways for overland flow (OF)⁸

**Wastewater
application by
surface spray or
sprinkler methods**



Comments from the Environmental Analyst (III)

- Constructed Wetlands may target the seepage flow during open water season, except freshet period
 - Limited amount of seepage with relatively high concentrations of pollutants
 - Bypass of runoff during freshet and heavy rainfall events may be required for the design of the Constructed Wetlands



Comments from the Environmental Analyst (IV)

- Passive treatment such as constructed wetlands might meet the need for the transition from active treatment to direct discharge
 - Active Treatment -> Passive Treatment -> Direct Discharge
 - The influent quality of the passive treatment system should marginally meet the EQCs
 - Concentrations of TSS, nutrients and TDS may be reduced after passive treatment
 - Lower cost and maintenance

