June 28th, 2019

Salah Abouelnaga, Project Manager
Community & Government Services
Government of Nunavut
P.O. Box 379
Pond Inlet, NU X0A 0S0

Re: OTT-00220382-A0 - Engineering Services – Hall Beach Lagoon
June 2019 – Effluent Level Report

Dear Mr. Abouelnaga:

Introduction

EXP visited Hall Beach during the spring of 2018, at which point, the lagoon was in service and operating as intended. During a visit to the Hamlet in July 2018, observations of bubbles appearing near the centre of the lagoon were noted. After demobilizing, EXP was notified that the lagoon cell was completely drained by the end of July. In response to the events of July 2018, EXP re-mobilized to the site on August 24, 2018 to conduct a limited assessment of the lagoon in order to consider the possible cause(s) for the loss of service.

Summary of 2018 Repairs

Based on the observations from early July, a field screening assessment was conducted near the middle of the lagoon and within an area of significant depression identified in the initial walkthrough. Four areas in total were assessed, and all presented with similar sand and cover material thicknesses. Based on the limited visual assessment, no areas of concern or defect were observed.
Once the Hamlet stopped discharging into the lagoon, an assessment of the septic truck discharge areas was undertaken. Due to the significant erosion was observed at these locations, the field program then shifted to assess and provide temporary repair solutions to both discharge areas. The southern discharge area was assessed, and an improved erosion control structure was constructed at the lagoon bottom. The northern discharge area was also assessed, and the damage encountered was temporarily repaired using the available material. When EXP departed the site, the contractor was in the process of placing material to restore the north discharge area.

This limited intrusive assessment was complimented by a GPS survey, conducted by the contractor. The intent was for the survey data to be supplied while onsite to identify areas of concern that visually were not detected; however, this information was only provided by the contractor after leaving site.

Following the departure, EXP prepared a letter for the Government of Nunavut (GN) detailing the findings of the field investigation as well as possible causes of failure. Based on the conditions encountered at the site and the uncertainty that the repair work performed in August 2018 would adequately restore operation of the lagoon, future services forecasted for the Hall Beach Lagoon were not well defined. It was anticipated that the results of the 2018 remediation at the north discharge station would not be measurable until late July or August 2019 as temperatures increased allowing the lagoon subgrade to thaw.

2019 Findings

On June 26th, 2019, EXP received verbal notice from a GN Project Officer that the lagoon levels in Hall Beach had dropped by about 0.6 metres over the course of a few days. The elevation drop of 0.6 metres would roughly mean that a volume of 12,000m^3 of wastewater has exfiltrated from the lagoon. Thus, it appears the temporary repairs completed in 2018 were either unsuccessful or that there are additional problem areas within the liner which have not yet been identified and repaired.

Status of Contractual Obligations with the Contractor

Nunavut Excavating had previously achieved substantial completion on October 25th, 2016. There were a few minor deficiencies noted but the lagoon was deemed as safely functional for it's intended use. It is believed that the Hamlet started to use this new lagoon cell at some point in 2016. The contractor corrected there noted deficiencies and applied for final acceptance in 2018, at which point it was uncovered that the lagoon was not functioning properly. Currently the contractor has not been issued a final acceptance certificate. As part of the specifications regarding contractual warranties, specifically section 31 32 22 part 2.3 – "Provide the owner with a written guarantee against defects in installation and workmanship for a period of (5) years from the date of final acceptance, at no cost to the Owner".

Contractor Involvement

It is strongly suggested that the contractor, Nunavut Excavating, be notified of the status of the lagoon. Additionally, the contractor should be involved in the discussions on how to repair the lagoon which currently is not functioning as per design. If direction is provided to the contractor regarding how to execute these repairs, it opens the opportunity for the contractor to submit claims for "additional costs incurred". Thus, it is suggested that the question be directed to the contractor, how do you plan to repair the liner?

Moving Forward

The following are general comments for consideration moving forward. It is expected that a site visit would be required in the near future to assess the current condition of the lagoon; however, the visit would be best coordinated with personnel of the Contractor to be able to inspect areas of the lagoon, collect survey data, and view the seepage areas while onsite.

- The contractor, Nunavut Excavating, still has some heavy equipment in the Hamlet of Hall Beach. It is believed that a 30 ton excavator, a loader, 2- articulating rock trucks, and a compactor are still present.

- EXP contacted a local supplier of geosynthetic liners on June 27, 2019 regarding the availability of the materials for short-notice projects. The response provided to EXP was that they hold a small amount in inventory and rough lead time on manufacturing is approximately 3 to 4 weeks which does not consider freight time.

- The sealift departing for Hall Beach has a goods received cut-off date of late July.

- In 2018 there was no sand stockpile present. Some remnants of the previous pile (or potentially a stockpile of the hamlet) was present near the lagoon, but with a total volume estimated as less than 2 truck loads.

- It is suggested that another topographical survey of the lagoon be conducted in 2019 to determine if there were any notable changes since the survey conducted in 2018. This could aid in determining an area to investigate. The recommended maximum dimension for the survey grid is less than 5 metres.

The following table details potential repair alternatives that could be considered, along with the risk and challenges associated with each alternative. The is provided for preliminary discussion purposes only, as it is recommended that the contractor select the remediation course of action.

Potential Repair Options	Rough Work Scope	Risks and Challenges
Localized Assessment and Repair Program	- In localized areas, excavate approximately 0.4m of material above the liner and salvage for re-use as cover material - Remove remaining 0.05m of sand by hand to mitigate risk of not further damaging the liner - Repair liner as required - Reinstate material - Potentially conduct test with water to confirm liner integrity	- Likelihood of uncovering the problematic areas is low - Time consuming, and no guarantee all problems are resolved - Repair work has a high risk of causing additional damage to the liner - Will require additional sand for re-instatement, which will require crushing new material - Minor risk of further degradation of the permafrost - Will not be able to visualize the under-liner conditions - Logistical challenges - Quantity of new liner and sand required is unknown - Moderate costs, high uncertainty, low probability of success

Complete Intrusive Assessment and Repair	- Over the entire lagoon, excavate approximately 0.4m of material above the liner and salvage for re-use as cover material - Remove remaining 0.05m of sand by hand to mitigate the risk of not further damaging the liner - Repair liner as required - Reinstate with fresh sand and cover material - Potentially conduct test with water to confirm liner integrity	- Time consuming, rough estimate on duration is 12-14 weeks dependent on resources, equipment, and time of work - There is a high likelihood that this activity would create further damage the existing liner - Will require that a significant amount of additional sand be produced - Significant costs - Further degradation of the permafrost - Logistically very challenging - Quantity of new liner required is unknown - High costs, moderate uncertainty, Moderate to high probability of success
Installation of a New Liner	- Remove 0.3m of cover material to expose underlying sand, salvage cover material - Re-grade sand, and remove any stones or sharp objects - Proof roll the entire liner to identify possible defects - Possibly install sand for liner support - Install new liner - Install sand layer - Install cover material - Raise berms as well to ensure capacity is matched	- Would raise overall site by 6” - Time consuming, rough estimate on duration is 10-12 weeks dependent on resources and time of work - Issues with previous liner will not be resolved - Significant costs - Logistically very challenging - Large quantity of new liner and sand is required - High costs, moderate uncertainty, Moderate to high probability of success
Leak Detection Consultant	- Hire a 3rd party consultant to conduct leak detection services - Complete patch repairs on leaks identified by consultant - Potentially conduct test with water to confirm liner integrity	- No level of certainty that it will provide accurate results, not sure if the technology is successful in permafrost - Potential damage to other areas will conducting repairs - Quantity of liner and sand needed is unknown - Timeline to have fully operational lagoon is unknown - Unknown costs, high uncertainty, Moderate to low probability of success

Key Dates

There is limited amount of time available for the contractor to procure and deliver material or equipment to the port for shipment on the 2019 sea lift. The schedule is tight but plausible, however, the extent of the equipment, labour and materials required cannot be confirmed at this moment. Below is a rough timeline of key dates moving forward:

- June/July 2019: Assess the data provided / will be provided by the GN.
- July 2019: GN to communicate (potentially with EXP) to contractor. Wait for contractor's action plan / work schedule.
- *End of July 2019: Sealift loading date. Critical date to determine if work will be completed in 2019 or 2020*
- July/August 2019: Mobilize to Hall Beach to monitor Contractor's assessment of the lagoon, assess the discharge stations to optimize repair options, review the areas of discharge on the outside of the lagoon, and assess local sources for material to minimize duration of crushing operation.
- July/August/September 2019: Review contractor's proposed scope with GN personnel, provide comments as needed.
- 2019/2020: EXP to provide QA inspection services during repair/assessment work.

Conclusion

As highlighted in the above table, EXP provided four potential strategies which could be undertaken to resolve the leakage issues at the Hall Beach sewage lagoon. Each option is associated with different probabilities of success, level of risk, logistical challenges, and costs. Input and agreeance from all parties associated will lead to determining the preferred course of action.

It is our opinion that the best course of action moving forward, in the immediate future, would be to involve the contractor to assist in preparing an action plan for the remediation of leakage from the lagoon.

Sincerely,
EXP Services Inc.

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