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**SEWAGE LAGOON
DAM SAFETY INSPECTION
Iqaluit, Nunavut**

PREPARED FOR:
THE CITY OF IQALUIT

PREPARED BY:
CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

CONCENTRIC REFERENCE NUMBER:
13-5021-B

DATE:
September 9, 2013



EXECUTIVE SUMMARY

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon. The scope of work for the assignment has been undertaken in accordance with Concentric's proposal to the City.

The site inspection was conducted on August 28, 2013, by Allan Murray, P.Eng., of Concentric. It is recommended that the next DSI be conducted prior to October, 2014.

OBSERVATIONS:

No significant changes in condition of the lagoon and retention berms were observed since the previous DSI which was conducted in 2011.

Representative existing conditions have been documented by photographs in Appendix A.

The required documentation (discussed further below) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

RECOMMENDATIONS:

1. Updating of the required Operation & Safety Manual, Logbook, and Permanent Record File was completed in 2012; however, the documents require updating for 2013.
2. The capacity of the sewage lagoon should be confirmed.
3. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration (pending the capacity check recommended in Item 3, above) should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a “leaky dam”, and its use may be prohibited at any time in the future.
4. A Dam Safety Inspection (DSI) is required prior to October, 2014.



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1. INTRODUCTION

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon located in Iqaluit, Nunavut.

This assignment and the scope of work described herein have been undertaken in accordance with Concentric's proposal to the City.

The site visit was conducted on August 28, 2013.

This report summarizes our terms of reference for the assignment, observations, conclusions and recommended action.



2. BACKGROUND

The Canadian Dam Safety Guidelines (DSG) requires that most structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals.

A DSR is a formal review process that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

Based on interpretation of the current (2007) DSG, the sewage lagoon does not require a DSR.

It is required in the DSG document that a Dam Safety Inspection (DSI) be performed on an annual basis. The DSI comprises a visual inspection to identify any changes in condition, or any observed concerns.

A detailed historical perspective may be referenced in the DSR on file with the City of Iqaluit.



3. SCOPE OF SERVICES

Our directive has been to undertake a Dam Safety Inspection (DSI) in accordance with the DSG, for the sewage lagoon. The inspection consisted of an on-site visual assessment, notation of any significant changes in condition since the last available DSI, preparation of a written report in a format compatible with the DSR, and a photographic record.

The following is a summary of the scope of work for this assignment. The DSI report is the primary deliverable, and has been prepared in accordance with the DSG document.

- ❑ Review available record documentation.
- ❑ Conduct a visual on-site assessment of the sewage lagoon
- ❑ Prepare a photographic record documenting general and representative conditions
- ❑ Identify, characterize, and risk-assess any actual or potential concerns
- ❑ Prepare a written report summarizing our observations, items of concern, and recommendations
- ❑ Indicate any recommended repairs
- ❑ Prioritize action items
- ❑ Submit final documents in electronic format and hard copy

Limitations

The DSI is based on visual assessment; no invasive inspection/assessment was done.

This report has been prepared for the sole use of The City of Iqaluit.



4. SUMMARY OF PREVIOUS DSI's

The following is a summary of observations and recommendations made from past DSI's conducted since the 2001 DSR:

4.1 2002 DSI

A DSI was conducted by Trow Consulting Engineers (now exp) (Report MA15882A, dated January 7, 2003) in October 2002. The DSI was termed "...an interim step prior to the implementation of remedial measures..." recommended in the 2001 DSR.

The DSI noted no significant changes since the 2001 DSR, but highlighted the seepage concerns of the east berm and the threat of overtopping in the spring.

The DSI reiterated the recommendations of the 2001 DSR, as follows:

- There is inadequate information concerning the as-built conditions of the berms.
- The berms may not be safe in their current condition and may be non-compliant with the design and performance standards of the DSG.
- Remedial measures include three (3) options - an impermeable liner; buttressing the berms; and building a new lagoon.

Not stated in the 2002 DSI, but recommended in the 2001 DSR, were the following additional requirements:

- Complete the remaining outstanding non-compliance requirements of Section Nos. 3 and 4 of the DSG, as follows:
 - Permanent file
 - Operation, Maintenance and Surveillance Manual
 - Logbook
 - Emergency Preparedness Plan

4.2 2003 DSI

Based on our discussions with the City of Iqaluit Engineering Department, there is no 2003 DSI on file. However, a geotechnical investigation was conducted by Trow Associates Inc. (Report OTGE00016794A, dated October 8, 2003) in 2003.



The scope of the geotechnical investigation was to undertake a topographic survey of the lagoon and conduct a slope stability analysis of the berms. A separate hydrologic report is referenced, but was not provided to us. It would appear that the geotechnical investigation was attempting to address some of the as-built issues discussed in the 2002 DSI.

Salient points from the geotechnical investigation include:

- Adequate (satisfying the Dan Safety Guidelines) factors of safety exist for steady state seepage and rapid drawdown scenarios.
- The berm slopes should remain stable provided they are protected against overtopping and adequate erosion protection is installed on downstream faces.
- Catastrophic failure is unlikely with the above provisos, however, localized failures or seeps are expected until such time as the lagoon is lined with an impervious material, or rebuilt.

4.3 2004 DSI

A 2004 DSI was commissioned, however, it was not authorized by the City of Iqaluit until February 2005. The DSI was conducted by Concentric.

Much of the site was snow covered at the time of the 2004 DSI so the report was limited in nature and basically reiterated previous concerns and items that remained outstanding.

4.4 2005 DSI

A 2005 DSI was not conducted.

4.5 2006 DSI

The following is a summary of observations and recommendations from the 2006 DSI prepared by Concentric:

- The lagoon is not in use and sewage is being processed at the sewage treatment plant.
- The lagoon has been drawn down by the outflow with some sludge accumulation.
- The recommended repairs to the west berm have been completed.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- Preparation of the required Operation & Safety Manual, Logbook, Permanent File, and Emergency Preparedness Plan remains incomplete.



- The capacity of the sewage lagoon should be confirmed.
- It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a “leaky dam”, and its use may be prohibited at any time in the future.

4.6 2009 DSI

The following is a summary of observations and recommendations from the 2009 DSI prepared by Concentric:

- There were no significant changes in use, or the lagoon/berm structures since the previous DSI.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- To our knowledge, the sewage lagoon capacity has not been confirmed; this should be done as inactivity and sludge/sediment accumulation may have reduced the effective capacity significantly.
- To our knowledge, the required documentation (discussed previously) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.
- Update the Operation & Safety Manual, Logbook, and Permanent File.
- The Emergency Preparedness Plan has not been completed; it is suggested that the relevance of this document be assessed and a decision made regarding its requirement to exist.
- It is understood that the intent of the City is to retain the sewage lagoon as a back-up facility only. Localized failures and/or seeps are to be expected. The lagoon operates on old technology; it is essentially a “leaky dam”, and its use may be prohibited at any time in the future.
- Complete the next DSI prior to October 2010.

4.7 2011 DSI

The following is a summary of observations and recommendations from the 2011 DSI prepared by Concentric:

- There were no significant changes in the lagoon or berm structures since the previous DSI, which was conducted in 2009.



- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- To our knowledge, the sewage lagoon capacity has not been confirmed; this should be done as inactivity and sludge/sediment accumulation may have reduced the effective capacity significantly.
- The Operation & Safety Manual, Logbook, and Permanent Record File were updated in 2012; however, the documents should be updated annually and as such requires updating for 2013.
- It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration (pending the capacity check recommended in Item 3, above) should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a “leaky dam”, and its use may be prohibited at any time in the future.
- A Dam Safety Inspection (DSI) is required prior to October 2012 (this was not done).



5. OBSERVATIONS

The sewage lagoon was accessed on foot. Based on our visual assessment we have the following comments:

- There were no significant changes in the lagoon or berm structures since the previous DSI, which was conducted in 2009.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- To our knowledge, the sewage lagoon capacity has not been confirmed; this should be done as inactivity and sludge/sediment accumulation may have reduced the effective capacity significantly.
- The Permanent Record File requires updating.



7. RECOMMENDATIONS

The following actions are recommended:

1. The Operation & Safety Manual, Logbook, and Permanent Record File were updated in 2012; however, the documents require updating for 2013.
2. The capacity of the sewage lagoon should be confirmed.
3. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a “leaky dam”, and its use may be prohibited at any time in the future.
4. A Dam Safety Inspection (DSI) is required prior to October 2014.

We would be pleased to discuss this report with you.

Should there be any questions, please contact the undersigned.

Yours truly,

Concentric Associates International Incorporated

Allan Murray, P.Eng.,
Partner



APPENDIX A

Site Photographs



Photo 1: Overview of west berm.



Photo 2: Overview of south berm.



Photo 3: Overview of east berm.