

**City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection**

October 29, 2009

REPORT



Produced For:
THE CITY OF IQALUIT

Produced By:
CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

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City of Iqaluit Sewage Lagoon Dam Safety Inspection

1. 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 09-2930 dated October 15 2009.

The site inspection was conducted on October 22, 2009, by Allan Murray, P.Eng., of Concentric. It is recommended that the next DSI be conducted prior to October 2010.

OBSERVATIONS:

No significant changes in condition of the lagoon and retention berms were observed since the previous DSI which was conducted in 2006.

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. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.
2. 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.
3. The capacity of the sewage lagoon should be confirmed.
4. 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.
5. Complete the next DSI prior to October 2010.



2. 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 has been undertaken in accordance with Concentric's proposal 09-2930 submitted on October 15, 2009.

The site visit was conducted on October 22, 2009.

Allan Murray, P.Eng., of Concentric, met with the following personnel at the City of Iqaluit:

➤ Paul Clow, Director of Engineering, City of Iqaluit

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



3. BACKGROUND

The Canadian Dam Safety Guidelines (DSG) requires that all 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 comprehensive, 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.

The sewage lagoon requires a DSR every ten (10) years. The current DSR for the sewage lagoon was conducted in 2001.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection only 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.



4. 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.



5. SUMMARY OF PREVIOUS DSI'S

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

January 7, 2003 (2002) DSI

A DSI was conducted by Trow Consulting Engineers (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

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.



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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

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.

2005 DSI

A 2005 DSI was not conducted.

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.



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- 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.

Overall, the condition of the structure did not changed significantly since the previous DSI.



6. COMMENTARY ON DAM SAFETY GUIDELINES

The Canadian Dam Association publication, Dam Safety Guidelines (DSG), governs the nature and frequency of inspection and review activities for structures which fall under its umbrella criteria.

The DSG applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their “consequence category”, that is, the consequence of dam failure in terms of life safety, and socio-economic impact. The category assigned may range from very low to very high. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, 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.

The frequency of DSR’s varies depending on consequence category. For structures where significant life safety and/or socio-economic consequence exist, the DSR is usually conducted every five (5) to ten (10) years. The sewage lagoon requires a DSR every ten (10) years. The initial DSR for the sewage lagoon was conducted in 2001; therefore, the sewage lagoon is due for an updated DSR in 2011. If significant alterations (not including repairs that do not change the height or volume of the structure) to the structure take place before this date, an updated DSR would be required.

It is required in the DSG document that in the interval between DSR’s, a Dam Safety Inspection (DSI) would be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns. The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.



7. 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 2006.
- 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.



8. RECOMMENDATIONS

The following actions are recommended:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.
2. 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.
3. The capacity of the sewage lagoon should be confirmed.
4. 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.
5. Complete the next DSI prior to October 2010.

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.,
Project Manager



APPENDIX A

Photographs



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Photograph 1
Overview looking East.



Photograph 2
Overview looking West



Photograph 3
East Berm, North segment; no change since 2006



Photograph 4
East Berm, South segment; no change since 2006



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Photograph 5
West Berm, no change since 2006



Photograph 6
Discharge from Sewage Treatment Plant