Concentric Associates International

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

February 16, 2005
REPORT

Produced For:
THE CITY OF IQALUIT, NUNAVUT

Produced By:
CONCENTRIC ASSOCIATES INTERNATIONAL

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04-1166

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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 04-1166, dated November 19, 2004.

The site inspection and reporting were conducted on February 9, 10 and 11, 2005, by Allan Murray, P.Eng., of Concentric. Snow and ice cover did not allow adequate assessment of the structures. It is strongly recommended that the next DSI be conducted prior to October 2005.

OBSERVATIONS:

- No significant changes in condition were observed since the previous DSI
- City of Iqaluit Engineering staff reported no maintenance/repair works since the last DSI was conducted in 2002.

RECOMMENDATIONS:

1. Preparation of the required Operation & Safety Manual, Emergency Preparedness Plan, Logbook, and Permanent File, remains delinquent, despite initial identification for compliance in 2001, and repeated non-compliance in 2002, 2003, and 2004. Steps should be taken to address this issue in 2005, as continued non-compliance negates the purpose, and validity, of the entire process, that began in 2001 with the Dam Safety Review (DSR).

2. Undertake the next DSI prior to October 2005.

3. Based on record documents and discussion with the City of Iqaluit Engineering Department, the lagoon may be in service for perhaps another two (2) or three (3) years. If this is indeed the case, best practices would seem the best approach for ongoing safety and serviceability of the berms. Unfortunately, the safety/stability recommendations from the 2003 geotechnical report (discussed herein) have not been implemented. This work should have been undertaken in 2004. It is strongly recommended that the recommended measures (adequate protection against overtopping, and adequate erosion protection installed on downstream portions of the berms) be implemented in 2005. Design and analysis would be required prior to construction.

4. If the sewage lagoon is to remain in service significantly longer than indicated in item 1, above, it is strongly recommended that the lagoon be either redesigned and rebuilt; or, that an impervious liner be installed with erosion measures applied to downstream faces of berms. Either option will likely require a new DSR.

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 04-1166, dated November 19, 2004.

The site visit and reporting were conducted on February 9, 10 and 11, 2005.

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

- Brad Sokach, Director of Engineering, City of Iqaluit
- Geoff Baker, Project Manager, City of Iqaluit Department of Engineering

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 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, to be provided by the City;
- Review, in particular, reports and/or repairs/upgrades conducted since the 2001 DSR;
- Interview and/or solicit input from maintenance personnel and City Administration regarding operating performance, concerns, incidents, repairs, and any notable concerns;
- 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, and;
- Submit final documents in electronic format and hard copy.

Limitations

At the time of the inspections, visual acuity of the site was difficult due to snow and ice accumulation. Snow and ice cover did not allow adequate assessment of the structure. It is strongly recommended that the next DSI be conducted prior to October 2005.

5. SUMMARY OF PREVIOUS DSI'S

The following is a summary of observations and recommendations made from the previous DSI's:

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 are not considered safe in their current condition and are 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, which are believed to be still outstanding:

- 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.

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

The report also notes that it is Trow's understanding that the lagoon will remain operational for perhaps four (4) more years, (2007) until the new sewage treatment plant is complete.

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 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

Sewage Lagoon

The sewage lagoon was accessed on foot. The review was hampered by considerable accumulation of snow and ice. Based on our limited visual assessment we have the following comments:

- Seepage was not observed downstream of the east berm. Seepage was observed in previous inspections by others.
- The majority of the lagoon was frozen, with small areas of open effluent near the inflow.
- Considerable constant flow was observed at the outflow.
- No evidence of repair/maintenance/upgrade work was evident

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

We note that the safety (berm stability) issues identified in the 2001 DSR and 2002 DSI have had a solution proposed in the 2003 geotechnical report.

Unfortunately, the recommended measures to ensure safety and stability have not been implemented.

8. RECOMMENDATIONS

The following actions are recommended:

1. Preparation of the required Operation & Safety Manual, Emergency Preparedness Plan, Logbook, and Permanent File, remains delinquent, despite initial identification for compliance in 2001, and repeated non-compliance in 2002, 2003, and 2004. Steps should be taken to address this issue in 2005, as continued non-compliance negates the purpose, and validity, of the entire process, that began in 2001 with the Dam Safety Review (DSR).

2. Undertake the next DSI prior to October 2005.

3. Based on record documents and discussion with the City of Iqaluit Engineering Department, the lagoon may be in service for perhaps another two (2) or three (3) years. If this is indeed the case, best practices would seem the best approach for ongoing safety and serviceability of the berms. Unfortunately, the safety/stability recommendations from the 2003 geotechnical report (discussed above) have not been implemented. This work should have been undertaken in 2004. It is strongly recommended that the recommended measures (adequate protection against overtopping, and adequate erosion protection installed on downstream portions of the berms) be implemented in 2005. Design and analysis would be required prior to construction.

4. If the sewage lagoon is to remain in service significantly longer than indicated in item 1, above, it is strongly recommended that the lagoon be either redesigned and rebuilt; or, that an impervious liner be installed with erosion measures applied to downstream faces of berms. Either option will likely require a new DSR.

9. GENERAL LIMITATIONS

The services performed and outlined herein were based in part, upon visual observations of the Site. Our opinion cannot be extended to portions of the Site that were unavailable for direct observation by objects or coverings at the time of our observations. It should that at the time of the inspections, visual acuity of the site was difficult due to snow and ice accumulation. As such, it is possible that certain conditions may exist that would not have been visible during our assessment. Should such an event occur, Concentric should be notified in order that we may determine if modifications to our conclusions are necessary.

The conclusions of this report are based, in part, on the information provided by others as described in the report.

This report has been prepared in accordance with generally accepted engineering practices. No other warranties, expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.

Concentric has prepared this report for the sole benefit of the City of Iqaluit. The material in it reflects Concentric's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Concentric accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

We would be pleased to discuss this report with you.

Should there be any questions, please contact the undersigned.

Yours truly,

Concentric Associates International Inc.,

Allan D. Murray, P.Eng.,
Project Manager

APPENDIX A
Photographs