City of Iqaluit Type A Water License Application
Submission to the Nunavut Water Board by the Department of Indian Affairs and Northern Development

Final Public Hearing Intervention

March 2006

EXECUTIVE SUMMARY

INAC has reviewed the City of Iqaluit's Type A water license application submitted to the Nunavut Water Board (NWB) to allow the city to use of water and deposit of waste into water. INAC's submission focuses on issues related to the environmental effects on or related to aquatic quality, spills and hazardous materials management, and waste management.

Water Supply

INAC recommends that the license require that the City of Iqaluit to monitor the reservoir levels and to develop estimates the outflows of Lake Geraldine, beginning in the spring of 2006 and through the period of time for construction and the expansion of the dam rise and saddle berms. Monitoring should continue until the city is confident in its estimates of inflow into the lake. The license should include and require the City of Iqaluit to measure and report flows downstream during periods of spills over the dam, so inflows can be better understood.

If the City determines that additional recharge of the reservoir is necessary, INAC recommends that the license require that the City submit potential locations of the recharge water to the NWB for review and to amend the licence.

Since the Lake Geraldine is located above the city of Iqaluit and the dam is considered in the high consequence category under the Canadian Dam Association guidelines, INAC recommends that the city of Iqaluit develop a dam safety program of inspection and an emergency preparedness plan for a number of scenarios up to the loss of the dam structure.

Wastewater

The City of Iqaluit has indicated the mechanical wastewater treatment plant will be phased-in. INAC recommends that the water licence staggers the discharge criteria for the wastewater treatment plant to be progressively more stringent over time to ensure that the City implements Phase 2 of the wastewater treatment plant in a timely manner.

INAC recommends that the city develops and implements an operation and maintenance manual and a training program for the wastewater treatment plant.

INAC agrees with the City's proposal to retain the lagoon as a back-up facility for the waste water treatment plant. However, INAC recommends that the license requires the City to implement the repairs for the sewage lagoon as recommended by their consultants.

INAC believes that the license should require the City to develop and submit an Abandonment and Reclamation Plan for the existing sewage lagoon for review within 90 days of the issuance of the license. The plan should be updated annually.

INAC recommends that the City should confirm whether it intends to implement the recommendations in the Sewage Sludge Management Plan. If the recommendations are adopted, INAC also recommends that the license require the City of Iqaluit to develop and submit for review, within 60 days of the issuance of the license, a plan to deal with sludge produced during the interim period when the waste water treatment plant is operational but the infrastructure required for sludge management is not available.

INAC recommends that the license require the establishment of monitoring stations to monitor the quality of the effluent from the final discharge point of the existing sewage lagoon, the waste water treatment plant and the sewage sludge management facility. INAC recommends that a quality assurance/quality control program for the waste water collection and treatment system, including the treatment plant, should also be submitted under the monitoring program within 90 days of license issuance and the program should be updated annually.

The Spill Contingency Plans for the wastewater treatment system should be updated to reflect current wastewater treatment operations and to better reflect the key areas of planning, preparedness, response and recovery.

Solid Waste

INAC recommends that the license require the City to control and collect any leachate generated from the landfill. The city should also test the leachate to determine its composition, and to treat the leachate prior to disposal. The amount of leachate collected and treated should be monitored and reported to the NWB with its annual reports.

INAC recommends that the license should require the City to design, construct and operate a surface water management plan for the landfill to reduce the volume of leachate created. The license should require the monitoring of leachate volumes and chemical constituents at the current landfill and at the new expanded cell (beginning at construction). INAC suggests that the city also monitor the volume and quality of leachate generated at the abandoned honey bag disposal site, below the Sylvia Grinnel banks, below the North 40 and at the abandoned solid waste disposal site in Apex.

INAC recommends that the water license require testing of contaminated soils before they are accepted into the landfill. The CCME Canadian Environmental Quality Guidelines for Industrial sites should be used as a guideline for storing contaminated soil in the landfill.

The City should develop and implement an Emergency Response Plan for the solid waste storage site, especially with the hazardous waste storage, in cooperation with the municipal agencies and the federal and territorial governments. This plan should be submitted to the NWB for review within 6 months of the issuance of the license and an

annual update provided.

Summary

This water license application illustrates the substantial progress that the City of Iqaluit has made in improving the quality of municipal waste management in Iqaluit. INAC appreciates the work that has been completed to date, and looks forward to continuing to work with the City of Iqaluit and the NWB to ensure best practices are implemented in managing municipal wastes in Nunavut. INAC appreciates the opportunity to participate in the review of the City of Iqaluit Type A Water License application and hopes that these comments will be useful to the NWB in their determinations.

INTRODUCTION

The INAC Nunavut Regional Office, on behalf of the Minister, will participate in the Nunavut Water Board's hearing on issuing a water licence under the Nunavut Water & Nunavut Surface Rights Tribunal Act, as well as administer and enforce the terms and conditions of the water license for the city of Iqaluit. INAC's Responsibilities and Mandate stem from the following legislation:

1. Department of Indian Affairs & Northern Development Act
2. Nunavut Land Claims Agreement Act
3. Canadian Environmental Assessment Act
4. Nunavut Water & Nunavut Surface Rights Tribunal Act

INAC is also committed to providing its best possible advice to the Board, especially in the areas of: cumulative effects assessment, water quality and quantity management, permafrost, hydrology, hydrogeoglogy, metal leaching, surficial and bedrock geology, geotechnical engineering, and abandonment and restoration. INAC hopes, by providing scientific expertise for incorporation into decisions, that all parties will work together with a good understanding of the alternatives and outcomes so minimal negative impacts will occur to the natural environment and to the economic, social, and cultural fabric of Nunavut.

INAC shares these responsibilities with other federal government agencies, the Institutes of Public Government, the Government of Nunavut and the City of Iqaluit. For example, the federal Department of the Environment has the responsibility for the administration and enforcement of the pollution prevention provisions dealing with the deposit of deleterious substances into water frequented by fish in the Fisheries Act. INAC, under the direction of the licences issue by the Nunavut Water Board, assists in meeting the provisions of the Fisheries Act by ensuring that effluents from wastewater systems are treated before being discharged to the Nunavut waters so as not to pose unacceptable risks to the ecosystem, including the fishery, and human health.

INAC has reviewed the Type A water license application submitted by the City of Iqaluit to the Nunavut Water Board (NWB) to allow for the use of water and deposit of waste into water. The licence application was initially submitted by the City of Iqaluit January 19, 2004, with subsequent additions and modifications. After a technical meeting and pre-hearing conference in August 2004, the NWB scheduled a final public hearing for this water license application for October 2004. However, because the city had failed to answer the information requests of the interveners and the Board, the hearing was postponed. Another technical meeting and pre-hearing conference were held in May 2005 and a final public hearing was scheduled for July 2005 in Iqaluit, Nunavut. Because the city's draft Sludge Management Plan remained outstanding, the NWB again postponed the hearing. The most recent pre-hearing teleconference was held on January 17, 2006, and the final public hearings on the water license application are scheduled for March 7-8, 2006 in Iqaluit, Nunavut.

INAC's submission focuses on those issues within INAC's mandate, especially under the *Nunavut Waters and Nunavut Surface Rights Tribunals Act*; including surface and permafrost disturbance, water quality and quantity, public safety and abandonment and reclamation cost estimates.

As agreed during the January 17, 2006 pre-hearing conference call, the scope of INAC's submission is divided into three distinct areas and a summary section. The three distinct areas are:

1. the drinking water supply, including the raising of the level in Lake Geraldine;
2. the waste water treatment and disposal, including the rehabilitation of the existing lagoon and the disposal of sludge; and
3. the operation and expansion of the existing solid waste storage site, termed the West 40.

During the pre-hearing, the city and the Board agreed that water licencing of the existing gravel source and former metal dump, also referred to as the North 40, would not be included in the Type A licence hearing. This submission mentions concerns with the North 40 but comments are not extensive.

BACKGROUND

The City of Iqaluit has applied for a Type A water license from the Nunavut Water Board under the Nunavut Surface Waters and Surface Rights Tribunal Act in order to allow for the use of water and deposit of waste into water. Since the proposed volume of water for use (approximately 1.29 million L/day), this application triggered a public hearing under the Northwest Territories Waters Regulations, which are attached to the Act. The infrastructure associated with the City of Iqaluit water license includes the operation and expansion of the Lake Geraldine raw water storage facility, the operation of the water treatment plant, the operation of a wastewater treatment system including a treatment plant, an existing sewage lagoon, which will be rehabilitated as serve as a backup, and sludge management facilities, and the operation and expansion of the West 40 solid waste storage site.

After Following a technical meeting and pre-hearing conference in August 2004, the NWB scheduled a final public hearing for this water license application for October 2004. However, due to outstanding information requests, the hearing was postponed. Upon submission of the majority of the outstanding information, a technical meeting and pre-hearing conference were held in May 2005. A final public hearing was again scheduled for July 4-5, 2005 in Iqaluit, NU, and was again postponed. Upon receipt of the outstanding draft Sludge Management Plan, the NWB conducted a pre-hearing conference by teleconference on January 17, 2006, and scheduled final public hearings on the water license application for March 7-8, 2006 in Iqaluit, NU.

The Lake Geraldine raw water storage facility was constructed in the 1960's and has undergone several modifications over the years. The City of Iqaluit proposes to raise

the existing main and saddle dams to increase the storage capacity of the Lake Geraldine during the summer of 2006. The water treatment plant, commissioned in 2004, provides a high intensity ultraviolet light disinfection system, four additional filters and a larger intake pipe. Treatment and water quality is reported to be good to excellent with treatment including UV, chlorination, filtration, and caustic soda additions. The total water consumption is more than 1,300,000 L/day. Networks of pipes or trucks deliver the water to the City's residential and commercial customers. The water distribution system is constantly circulating and heated to prevent freezing.

The City of Iqaluit currently operates a facultive sewage lagoon (the lagoon has an aerobic or oxygen-rich upper layer and anaerobic or an oxygen-poor lower layer) as the primary wastewater treatment method. This lagoon provides between 6-14 days of treatment prior to decanted releases are made into Koojesse Inlet of Frobisher Bay. In 1998, the City of Iqaluit commissioned the construction of a membrane-based mechanical wastewater treatment plant to improve on capacity and treatment issues. However, the wastewater treatment plant never became operational and the City of Iqaluit continued to rely on the sewage lagoon for treatment of their wastewater. In 2004, the City of Iqaluit decided to convert the non-functioning waste water treatment plant into an activated sludge (oxygen enriched) treatment plant. These renovations are nearly complete and the City of Iqaluit plans to commission the plant in early 2006. The activated sludge treatment plant produce digested sludge and water. The City of Iqaluit plans to design, install and operate air drying beds, utilizing freeze-thaw technology, as well as composting, to assist with drying and stabilization of the sludge. The city of Iqaluit has proposed to use the stabilized sludge as cover material at the solid waste landfill.

After the waste water treatment plant is functioning, the City proposes to rehabilitate the existing sewage lagoon and use it as a back-up storage system when the waste water treatment plan stops operating, such as during an electrical power failure. During the rehabilitation of the existing lagoon, the berms will be stabilized and accumulated sludge removed.

The solid waste landfill facility is located in the area referred to as the West 40. The City of Iqaluit currently operates a 1.5 hectare facility, designed as a temporary storage site, and plans to expand the facility to another cell. Wastes are currently spread into lifts, compacted, and covered. Hazardous wastes are temporally stored at the landfill and shipped to a licensed disposal facility in the south during the annual sea lift.

The City of Iqaluit also has a number of solid waste storage sites within its municipal boundaries, including two adjacent to the present site, one in the Apex subdivision and historical sites along the Sylvia Grinnel valley and in the city’s gravel source, called the North 40. Although excluded from the Type A water licence application, INAC believes it has a responsibility to make the Nunavut Water Board aware of the other long-term solid waste containment area for present and future reference.

TECHNICAL REVIEW AND ISSUE IDENTIFICATION

INAC has reviewed the City of Iqaluit's Type A water license application to allow for the use of water and disposal of wastes into water. The application submitted by the City of Iqaluit consists primarily of a variety of plans and reports created by consultants for the City of Iqaluit over a number of years. For its water licence application, the City has not consolidated the reports into a cohesive plan for the municipality so shortfalls, overlaps and gaps can be identified. Also, the City does not clearly indicate in its application which recommendations have been or will be adopted. INAC and its technical reviewers had difficulty following the water license application and the intentions of the City.

The current application indicates that the City of Iqaluit has made an effort in answering requests for information and filling the gaps in its plans. However, INAC recommends that the Board request the City to provide a clear plan for managing its raw and treated water, wastewater and solid waste facilities in Iqaluit, including comprehensive contingency plans. INAC appreciates the City of Iqaluit's fiscal and human resource constraints but believes a clear and comprehensive plan would reduce the overall costs to the city by reducing overlaps and errors. An overall plan would also assist the City to implement best practices in the management of municipal water and wastes facilities to protect the receiving environment and the citizens of Iqaluit.

The City of Iqaluit should be advised that, notwithstanding any other regulatory or permitting requirements, any deposits, discharges and releases from City operations or activities must comply with all applicable federal Acts and regulations. Further, if the city of Iqaluit or the public hearing brings forward additional information, INAC will reexamine its submission and may request to modify its recommendations at that later date.

DISTINCT AREAS OF THE LICENCE APPLICATION

1. Water Supply, Treatment, Storage and Distribution

A. Expansion of Raw Water Storage

Issue: The March 2005 Trow Report, "Preliminary Design Report – Expansion of City of Iqaluit Raw Water Storage, City of Iqaluit, Nunavut" indicates that the City has decided to increase the storage capacity within Lake Geraldine by raising the existing dam and berms by 2.0 metres, and constructing a new saddle berm south of the existing dam.

Discussion: Silt fences and/or silt curtains should be used when operating near the banks of the lake. Materials used for the construction of the berms should be clean and free from fines. Further, during construction, these materials should be stockpiled above the high water mark and in such a manner as to prevent them from entering any water body frequented by fish.

Recommendation: INAC recommends that the license require that measures be taken to prevent erosion and the release of sediment into the water flowing from Lake Geraldine and into Lake Geraldine itself during the construction of the new south berm, and the expansion of the existing berms and dam.

B. Additional Recharge for Lake Geraldine Reservoir

Issue:
The Trow report "City of Iqaluit Raw Water Supply and Storage Review" (2002) indicates that the existing capacity of the Lake Geraldine Raw Water Storage Facility can be increased by raising the height of the existing dam and berms by 2.0 m. The report indicates that hydrological and meteorologic data is insufficient to determine the firm recharge rate of the lake's drainage basin but states that "The City of Iqaluit cannot delay actions required to address the recharge of the reservoir" (page 37). Trow identifies a withdrawal site along the Apex River as a pumping source to supplement the inflow into the lake.

Watershed yield calculations presented on Page 14, Section 4.1 of the Iqaluit Water and Sewer Study (Trow 2002) appear to use a watershed yield factor of 100%, meaning that all precipitation falling in the watershed enters Lake Geraldine without considering losses to evapotranspiration, evaporation and ground infiltration. An annual runoff coefficient of 100% is not probable even in a region of continuous permafrost. Water will remain in the active layer, snow will drift in or out of the watershed, evaporation will occur from ephemeral or temporary pond storage and plants will use moisture for survival. Trow (2002) notes that a yield of 30% is more characteristic of southern locations. INAC technical reviewers suggest an actual yield of closed to 50% a, which would suggest that the annual water re-supply may be overestimated by a factor of 2. At recent environmental assessment hearings, such as for the Doris Hinge project, basin yields varied between the high sixty percent to the low eighty percent.

Discussion:
The City of Iqaluit should ensure that Lake Geraldine has sufficient inflow to provide adequate reservoir storage for the 8-month winter period with little or no outflow. The water demand projections reported in Trow (2002) are based on limited data, (20 non-continuous months). More data would be desirable and efforts should be made to ensure routine collection of consumption data.

The City should determine if the inflow into Lake Geraldine (runoff from the existing basin plus precipitation onto the lake minus evaporation and other losses of water) will be sufficient to fill the reservoir. Little historic data has been provided from nearby areas to develop a proper water balance for Geraldine Lake. In INAC's opinion, this water balance calculation is a serious limitation and puts into question the ability of this reservoir to meet future demand, especially for successive dry years. If inflow is insufficient, the City of Iqaluit should determine how to recharge area Lake Geraldine and include the proposal in its water licence. A detailed hydrological study of the

watershed is required if the capability of Lake Geraldine to meet the City of Iqaluit's water supply needs into the future is to be understood. INAC has referenced the requirement of a detailed hydrological study in previous comments.

A hydrological study, including an observational period for flow measurement and data collection, would take one to three years to complete. Ideally, observations over three to five years should be available to provide a degree of confidence in the water balance parameters. In conclusion, Geraldine Lake has been operated as a reservoir for more than 20 years (near 50 years) without collection of fundamental information that is necessary to develop a reliable water balance. Without these data it is not possible to reliably predict how long the reservoir can meet the demand for raw water. An increase in storage capacity in the reservoir does not appear to provide sufficient supply.

Page 15, Section 4.3 of Trow (2002) notes that the usable volume of Lake Geraldine is 570,000 m^3, but factual data is not presented for this estimate. This volume, at the design average day demand of 4,000 m^3/day, would will only be 143 days supply, which is less than the 243 days winter period. The estimates of live storage in the reservoir also lack factual information and do not take into account the seasonal variability in surface ice thickness.

A discrepancy of 792 m^3 exists between the stated additional required treated water storage on Page 21, Section 6.4.5 of Trow (2002) and the value in the design brief. Including 720 m^3 of fire storage, the requirement would be estimated as 4,519 m^3 total storage, less 2,967 m^3 existing storage, or 1,512 m^3 of new storage. The design brief recommends a total of 4,811 m^3, less 2,967 m^3 existing storage, or 1,844 m^3 new storage.

The watersheds of Lake Geraldine and the Apex River are adjacent to the city of Iqaluit and the areas are frequently used for recreation, especially by people using motorized machines. These activities could cause contamination of the water use for Iqaluit’s drinking supply.

<u>Recommendations:</u>
INAC recommends that more water use and consumption data is desirable, therefore the city should implement a routine collection of pumpage and consumption data.

INAC recommends an in-depth review of the water supply capability of Lake Geraldine and its ability to meet future needs should be done. INAC also recommends that the license require the City of Iqaluit to monitor the level of the reservoir and calculate the outflows over the life of the licence so the water balance of the reservoir can be better understood. INAC recommends to the Board that these measurements begin this spring and that the data should be provided to the Board. INAC believes that this constitutes a serious deficiency in the application and a new licence should be conditional on development of an effective water supply plan, which will include surveys to improve the estimates of total and live reservoir storage.

INAC recommends that the City clarifies whether the recharge location on the Apex River identified by Trow is to be developed. If the recharge location is to be developed, INAC recommends that the Board requires the City submit potential locations of the recharge water to the NWB for review and to determine if the licence is to be amended.

INAC recommends that the Board encourages the City to consider implementing a plan to protect not only the Lake Geraldine watershed but also the watershed upstream of the identified recharge locations form pollution.

C. Water Treatment

Issue:
The report “Municipality of Iqaluit Water Treatment Plant Pre-Design Brief” by Earth Tech (Canada) Inc., March 2002 noted (Page 25) that "based on treatability studies, it is recommended that 40 minutes be provided for this system, unless treatability analysis shows otherwise."

Discussion:
INAC reviewer could not confirm whether the treatability studies were undertaken and what the results indicated.

Recommendation:
INAC believes that the city should indicate if the treatability studies were undertaken, what the results indicated and what procedures and treatment options were implemented based on the treatability studies.

D. Dam Safety

Issue:
City of Iqaluit Dam Safety Review for Lake Geraldine Dam, Trow Consulting Engineers, is undated, but INAC inferred from the text that an inspection was undertaken in October 2001. The dam is a concrete gravity structure constructed on a bedrock foundation with a central overflow weir that controls the normal operating level while providing a freeboard against overtopping of 0.95 m. The dam has been raised three times in the past by the addition of a cast-in-place concrete sill tied to the existing structure with dowels. A section with a low vertical concrete key wall was added to lengthen one abutment. The vertical key wall is stabilized with granular fill on both sides. The last raise included installation of rock anchors to improve stability but information was not provided on the frequency or design of the rock anchors.

Discussion:
The dam safety report concludes that the concrete gravity portions of the dam are fully serviceable and no safety improvements are necessary. The earthfill abutment extension, however, does not meet the minimum factors of safety under the Dam Safety Guidelines published by the Canadian Dam Association (1999). Construction works are recommended, but information is not provided in the application to indicate if the City intends to implement these recommendations. Also documented operating procedures for the dam with designated responsible individuals was not included in the water licence application. The information included in the Trow report seems appropriate and their conclusions on dam safety are considered to be realistic. However, details which may be important to understanding the safety of a structure of this type have not been addressed by Trow.

Recommendation:
INAC suggests that the City provide a more comprehensive summary of construction and operation of this dam that includes the following:

- A summary of the as-built conditions, repairs and raises condensed from available records
- geo-technical summary of site conditions
- reservoir operating history including water levels (heights above the spillway)
- a description of spillway behaviour during freshet, especially when floating ice could jam the uncontrolled overflow
- Ice cover duration and thickness information for the reservoir
- A monitoring plan and procedures for documenting annual performance

Issue:
An emergency preparedness plan is required for every dam in the Moderate Consequence Category or higher. The City of Iqaluit has identified the dam on Lake Geraldine as in the high consequence category, especially since it is situated immediately above populated areas of the municipality and the location of the emergency response groups (hospital, fire hall, ambulance).

Discussion:
An emergency preparedness plan would set out the procedures to be followed for the protection of persons and property upstream or downstream of the dam in the event of an actual or imminent dam failure and to mitigate the effects of the disaster. The plan should include a list of the conditions that could lead to a dam failure, a description of the area that would be inundated including inundation maps and warning and response procedures. This plan must be kept up to date, provided and advertised to responders, citizens of the municipality, the Government of Nunavut and the Nunavut Water Board. An emergency preparedness pan should be drafted before the dam is raised.

Recommendation:
INAC recommends that the Board encourages the city of Iqaluit to develop a dam safety program of inspection and an emergency preparedness plan for a number of

scenarios up to the loss of the dam structure. The emergency preparedness plan should be developed immediately and modified after the existing dam has been raised. The Board should require, as part of the licence, that a plan be provided to the Board. The results of the dam safety inspections program should also be provided to the Board.

2. Wastewater Treatment

A. Sewage Disposal

Issue: The water licence application provided by the City of Iqaluit suggests that the lagoon has few operating problems. However, the lagoon dam (berm) safety report of 2002 prepared by Trow Consulting Engineers (Trow 2002) reports that the dykes do not meet current Canadian dam safety standards and a number of mitigation measures are recommended.

Discussion: The application does not summarizes what actions the City has taken following receipt of the Trow report. The INAC inspection letter of March 11, 2004 also discusses the concern of the number of sewage discharges that occur from the collection system.

Recommendation: INAC concurs that the City should continue to expedite the implementation of proposed improvements and upgrades to the Iqaluit Wastewater Treatment Plant as outlined in Earth Tech's Preliminary Design Report (Earth Tech 2004), and to comment upon and address the sewage collection system shortfalls to address sewer bypasses, pipe failures, and system upgrades. INAC believes that these system maintenance areas should not be ignored pending completion of major facilities.

B. Sewage Lagoon

Issue: In the Water and Sewer Study (Trow 2002), restrictions in the City sewer collection and, potentially, at pump station would limit growth. The City should indicate what changes, if any, have been made to allow current growth beyond these limiting capacities. The Summary Section of Trow's report, Section 13 Summary, provides an excellent point form reference for action items that should be updated as to the status of the recommendations provided in the Trow 2002 report.

Discussion: This portion of the review comprised the following documents:
1. Water and Sewage Study, Trow, May 2002
2. Completion Study for the Iqaluit Wastewater Treatment Plant, CH2M Hill, October 2003
3. Preliminary Draft Report, Iqaluit WWTP Conversion and Expansion, Earth Tech, May 2004
4. Reference to a UMA Engineering Ltd. Sewage Treatment Facilities document;

5. Final Report City of Iqaluit Dam Safety Review for Sewage Lagoon, Trow, October 2002, provides background to the site.

The current lagoon system provides only primary treatment through a dyked lagoon. Over the years (since 1978) there have been numerous investigations to address the berm construction and failures and subsequent discharges of untreated waste to Koojesse Inlet. Although effluent quality is within licensed parameters, recent correspondence tied to the review and re-design of the non-commissioned wastewater treatment plant indicate that effluent criteria is changing and that the City will need to address these changes (Earth Tech, March 29, 2004).

A number of recommendations were previously made regarding improvements to the berms, outlets, and piping structures of the current sewage lagoon. The City's application is unclear on the their actions to address the operational problems. The city should provide before the hearing comments on the current operation and a list of actions taken to repair the lagoon and avoid spills.

Trow has completed a safety assessment of the dyke system comprising the sewage lagoon (Trow 2002) following Dam Safety Guidelines. The dykes were constructed from coarse, granular material and are semi-pervious. Water from the lagoon exfiltrates continuously through the dyke at an undetermined rate. Trow concludes that the dykes do not meet the general requirements for dam safety and a number of options are suggested for mitigation. The City of Iqaluit has not confirmed if the mitigation options were or will be implemented.

Little information is available on design or as-built condition of the dykes. Historically, the dyke have failed a number of times (1980s and 1991) and allowed direct and uncontrolled discharge of contaminated water into Koojesse Inlet. Analyses by Trow of dyke stability have assumed that there is intimate contact between the dyke and the underlying bedrock. There is no definitive information provided that the dykes are on a bedrock foundation. This assumption is not supported and may lead to factors of safety higher than actual. The effect of the arctic climate and potential permafrost foundation soils on dyke performance has not been fully considered. It is EBA's opinion that seasonal frost buildup in the downstream slope of the filter dykes can result in high pore pressures at freshet, further decreasing dyke stability.
The conclusion from this review is that the dykes may in fact be a greater risk of failure than indicated by Trow. There have been unexplained failures in the past and no reason to believe that the risk of failure has diminished significantly. This conclusion appears to be in conflict with the application that suggests there are no operational issues currently or foreseen with this facility. The Trow report does not support that conclusion, nor is there any information provided in the application to suggest any mitigating action has been taken since 2002 or is planned for future operations.
As to the review of the Completion Study (CH2M 2002) and Conversion and Expansion Study (Earth Tech 2004), we will address the latter, as both studies have addressed the changes needed to the wastewater plant to bring it into operation.

Overall, the Earth Tech Conversion and Expansion document takes a pragmatic approach to bringing the system on line with minimal alterations to process and with the view to making use of as much of the currently available equipment as possible.
The question of capacity is generally always an issue. The Phase I design capacity is noted as 8,000 population, while the current population is 6,000 based upon census data (no year given).

This seems to be a marginal increase in capacity for the first stage; however, there are no indications of the potential development plans for the community or timing.
The approach and recommendations on effluent quality are the right approach based upon discussions with Environment Canada and Nunavut Department of Health and Social Services. Based on our own review of the proposed process in comparison to similar Waste water treatment plants, the effluent criteria is achievable and the design objectives are realistic.
Process and equipment modifications are reasonable and we agree with the selection of Option 2 for the plant rebuild. The following comments are provided on the report (Earth Tech, May 2004); however, these may be answered during the design stage, as well.
• Raw Wastewater Pumping: There is an issue identified with large material debris coming to the lift station at the plant site from trucked waste. This will need to be addressed in the design and in the daily maintenance and operational requirements.
• Also, if the lagoons are to be used as backup, what repairs will be required to bring them into compliance for this use (i.e., repair leakage areas and areas that may create bypass)?

C. Screening of Grit

Issue: The Waste water treatment plant does not have potable water source with the exception of a storage tank for washroom, laboratory, and other miscellaneous uses. A recycling of effluent water for some processes is proposed. Reuse of effluent water for plant processes is an effective approach.

D. Secondary Effluent Disinfection

Issue: Although the correspondence from the regulators has not specified disinfection for the effluent quality criteria and none has been proposed for the Phase I expansion, disinfection of effluent should be considered at the onset of the Phase I implementation. Waiting until the community doubles in population before implementing disinfection may cause irreparable damage to the aquatic environment. UV disinfection would be a preferred method.

E. Timing of Waste water treatment plant Design and Construction

Issue: Historical issues around sewage breaks and lagoon berm/piping failures has kept

the operation of the Iqaluit waste water treatment system in view of the public and regulators.

Recommendation: INAC recommends that the waste water treatment plant be completed and commissioned as quickly as possible. In the interim, measures to strengthen and provide security against failures of the lagoon, pump stations, and piping systems are important to the environment and should not be ignored because of the pending waste water treatment plant improvements. All systems need to be operated to optimal performance and with the highest regard to the environmental health of the region.

F. Effluent Discharge Criteria

The City of Iqaluit has stated its intention to commission the waste water treatment plant in phases. Phase 1 would consist of primary screening, which would result in effluent of similar quality to primary effluent from a conventional primary sedimentation tank or primary clarifier (EarthTech letter dated March 7, 2005). Phase 2 would include the commissioning of the remainder of the Waste water treatment plant, such that the waste activated sludge plant is fully operational. The final phase would provide an increase in overall capacity to address population growth projections.

In a letter dated March 29, 2004, EarthTech Canada Inc. put forward proposed effluent quality for the Iqaluit wastewater treatment discharge (45 mg/L BOD5, 45 mg/L Total Suspended Solids (TSS), 10 mg/L Ammonia). These effluent quality discharge criteria are a significant improvement over the effluent quality guidelines for marine bayed areas that are currently being followed in Nunavut (120 mg/L BOD5, 180 mg/L TSS)

Discussion:
The *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories (1992)* states that the effluent must meet the following criteria:

- Total Suspended Solids – 100 mg/L pH – 6 to 9
- BOD – 80 mg/L Oil and Grease – no visible sheen
- Total Coliforms – 10,000 CFU/100 ml. Ammonia – monitor only

In addition, in anticipation of eventual conversion of the Iqaluit wastewater treatment system to a Primary Treatment Plant, consideration should be given to analyzing the effluent for the more complete suite of parameters previously tested by Taiga Environmental Laboratory. These included: conductivity; nitrate & nitrite as N; phosphate; sulphate; mayor ions (calcium, chloride, magnesium, potassium, sodium); and the standard metals scan. These data serve to more fully characterize the nature of the existing effluent stream and will assist in evaluating the effectiveness of the future new wastewater treatment plant.

Recommendation:

Consistent with the phased implementation of the WTTP, INAC recommends that discharge criteria established for the Waste water treatment plant in the water license be phased in, such that they become increasingly stringent over time. Establishing more protective discharge criteria to be implemented over a period of time will ensure that the City implements Phase 2 of the Waste water treatment plant in a timely manner. INAC also strongly recommends that an Operation and Maintenance Manual and training program be developed and implemented for the Waste water treatment plant.

G. Decommissioning of the Sewage Lagoon

With the decision to commission and operate the waste water treatment plant, long term plans for the existing sewage lagoon need to be identified and developed.

Discussion:
In a letter to the NWB dated June 1, 2005, the City of Iqaluit states that the existing sewage lagoon will continue to be used until the first phase of the Waste water treatment plant is commissioned. Once the waste water treatment plant is operational, the City intends to use the lagoon only in the event of a catastrophic failure of the waste water treatment plant. As such, the City has stated its intention to develop and submit closure and reclamation plans for the lagoon, including any sludge contained therein. However, no plan has been submitted to date, and this aspect of the application remains outstanding. The June 1, 2005 letter also states that subject to approval by the City Council, a number of repairs will be completed on the lagoon berms. The February 2005 Dam Safety Inspection carried out by Concentric Associates International indicates that the safety/stability recommendations outlined in the 2003 geotechnical report have not been implemented. Given that the report indicates that “localized failures or seeps are expected until such a time as the lagoon is lined with an impervious material, or rebuilt”, it is essential that these repairs be completed to ensure the integrity of the lagoon.

Recommendation:
INAC strongly recommends that the license require the City to implement the repairs outlined in the February 2005 Dam Safety Inspection carried out by Concentric Associates International. Given the concerns regarding the inadequate sizing of the lagoon, the insufficient retention time, and the stability of the berms, INAC does not recommend using the lagoon for purposes other than as a back-up facility for the waste water treatment plant. As such, once Phase 1 of the waste water treatment plant is operational, the license should restrict the use of the lagoon to those situations where emergency back-up for the waste water treatment plant is required. INAC also recommends that the license require the City of Iqaluit to develop and submit an Abandonment and Reclamation Plan for the existing sewage lagoon for review and approval within 3 months of the issuance of the license.

H. Sludge Management

The EarthTech (Canada) Inc. Sewage Sludge Management Plan submitted in December 2005 provides a framework for dealing with the sewage sludge that will be produced from the waste water treatment plant. However, no indication is given as to whether or not the City of Iqaluit has accepted the recommendations put forth by EarthTech (Canada) Inc. in the report. 13

Discussion:
Confirmation is required regarding the preferred sludge management technology, including stabilization techniques, as well as the final disposal location. Information is also required regarding sludge management plans during the interim period between the commissioning of the waste water treatment plant and the generation of sludge and the development of the infrastructure required for the preferred sludge management plan.

Recommendation:
INAC recommends that the City clearly indicate whether or not they intend to implement the recommendations put forth by EarthTech (Canada) Inc. in the Sewage Sludge Management Plan. If the recommendations put forth by EarthTech (Canada) Inc. are adopted, INAC also recommends that the license require the City of Iqaluit to develop and submit for review, within 30 days of the issuance of the license, a plan to deal with sludge produced during the interim period when the waste water treatment plant is operational but the infrastructure required for sludge management is not available.

I. Inspection and Monitoring

Issue: The information provided on the Monitoring Program appears to be confusing and perhaps contradictory. The comments in the original application dated January 2004 have been superseded by inspections in March 2004 and responding correspondence in April 2004.

Discussion: The City of Iqaluit indicates that water sampling and analysis is done, but does not indicate if monitoring is done for wastewater effluent and leachate. The City should also indicate if Surveillance Network Program to monitor water quality will be implemented..

Recommendation: The City should inform the NWB whether the Sewage Lift Station Spill Contingency Plan dated May 29, 2003 has this been implemented and updated. The water licence should require the City submit plans for a Surveillance Network Program to the Board and provide the information gathered The licence should also require the city to implement, maintain and report on a Spill Contingency Plan.

J. Public Concerns

Some of the documents provided with the application indicates public concerns. In the supplementary information Section IV, modifications, (item 2):

> "Yes, in general the public may perceive that the retention time and treatment of sewage is not accurate, i.e. that the quality of discharge could be improved. The lagoon was designed to provide only primary treatment. The new facility will address these concerns".

INAC inspection reports and comments also indicate public concerns.

K. Monitoring

The current license application does not appear to address the issue of ongoing monitoring at the sewage lagoon, the waste water treatment plant, or the sludge management facility.

Discussion:
Wastewater systems should be monitored by means of sampling and analytical procedures that are in accordance with the latest edition of Standard Methods for the Examination of Water and wastewater1 and EC's reference methods for acute lethality tests. Sampling and analysis of the effluent may indicate whether or not the effluent is deleterious. It is the owner/operator's responsibility to ensure that the parameters they are sampling and analyzing at the discharge point are sufficient for determining the deleteriousness or non-deleteriousness of the effluent. The choice of parameters for testing may depend on facility design criteria, characteristics of the influent, and sensitivity of the receiving environment. It is critical that discharge from the sewage lagoon, the waste water treatment plant and the sludge management facility be monitored to ensure compliance with the license limits and the *Fisheries Act*. Results from the monitoring program should also be used as a feedback mechanism to ensure that the waste water treatment plant and sludge management facility are operating according to design parameters/standards.

Recommendations:
INAC recommends that the license require the establishment of SNP stations to monitor effluent discharge from the final discharge point of the waste water treatment plant and the existing sewage lagoon. The components of an effective effluent monitoring program should include effluent testing of relevant parameters, effluent quantity monitoring and a monitoring schedule. At a minimum, the effluent quality monitoring program should include biochemical oxygen demand, chemical oxygen demand, total suspended solids, pH, ammonia, total nitrogen, total phosphorus, metals (including mercury), oil and grease, phenols, total and fecal coliforms, and *Escherichia*
1 Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998: American Public Health Association, American Water Works Association, Water Environment Federation, ISBN 0-87553- 235-7.coli (E.coli). Additionally, bioassay testing should be required from both SNP stations four times annually. The license

should also require the establishment of a SNP station at the sewage sludge management facility. This station should be monitored annually during periods of thaw for those constituents found to be present in the sludge during characterization. Parameters to be monitored should be based on the results of the characterization of the sludge, and should include, at a minimum, BOD5, TSS, pH, heavy metals (including mercury), oil and grease, nutrients and total and faecal coliform. INAC recommends that a quality assurance/quality control program should also be submitted under the SNP program within 3 months of license issuance.

L. Spill Contingency Planning

The application currently includes a Sewage Lift Station Spill Plan, dated 2003, as well as a more general Spill Contingency Plan dated November 2004. While the Spill Contingency Plan is dated November 2004 on the cover, it is noted that the footer text indicates that the contents of the Plan were created in May 1998.

Discussion:
The spill contingency plans relating to wastewater should provide a clear path of response in the event of a spill, and address the key elements of prevention, preparedness, response and recovery. Deposits out of the normal course of events are covered in subsection 38(4) of the Fisheries Act. This includes overflows, spills, leaks, by-passes and regulatory exceedences or other deposits out of compliance. Paragraphs 38(4)*(a)* and (4)*(b)* and subsection 38(5) of the

Fisheries Act require any person who owns, manages or controls the deleterious substance or causes or contributes to the abnormal deposit to report such occurrence to a fishery inspector. For this reason, it is recommended that environmental emergency plans to prevent, prepare for, respond to and correct environmental damage from abnormal deposits be developed by project proponents and owners/operators of wastewater systems. The *Canadian Environmental Protection Act* (1999) also advocates the prevention of pollution as opposed to managing pollution after it is created, and as such, the development and implementation of Spill Contingency Plans can play a critical role both in preventing pollution through proper storage of hazardous materials, and the timely response to accidents and malfunctions that may occur. The City should ensure that the plans are up-to-date, and reflect current operations at wastewater treatment facilities.

Recommendations:
INAC recommends that the following items be included in the Spill Contingency Plans developed by the City of Iqaluit:.

- The list of personnel included in the plan should be updated to reflect current contact information.
- Overview of the reporting structure, including first responders and secondary contacts.

- Reporting methodolgy to indicates the effectiveness of the plan.
- Training program.

The City of Iqaluit should note that all spills, regardless of size, are to be documented and reported to the 24 hour Spill Line at (867) 920-8130. The City of Iqaluit Spill Contingency Plan should also provide contact information for INAC personnel in Iqaluit.

3. Solid Waste Storage Facility (West 40)

A. Solid Waste Disposal

Issue: The response provided by the Applicant under the heading of Waste Reduction (item 1), indicates that the municipality no longer burns any garbage. However, INAC and its technical reviewer are aware that waste is burned at the current municipal waste disposal site, as indicated in UMA Figure 1 provided in Section 5: Drawings, of the additional information provided by the City.

Recommendation: The City should clarify this aspect of the water licence application.

B. Commercial, Industrial and/or Hazardous Waste Disposal Area

Issue: Under this heading, point 2, Hazardous Waste Disposal Area, the city indicates use of a hazardous waste area located inside the solid waste site. Comments in the March 2004 INAC inspection report express grave concern that the materials (batteries, barrels, etc.) are not stored in a safe manner. Additionally, the infiltration of water into the area is creating a concern over potential discharge of leachate to Frobisher Bay. A follow-up letter from the City dated April 7, 2004, indicates that a number of projects are proposed in the summer 2004; however, details have not been provided on the extent or progress of these improvements.

Recommendation: A follow-up status report should be provide before the hearing to clarify the works in progress and to determine if issues are being addressed.

C. Leachate Containment

Issue: The solid waste storage area is experiencing surface drainage issues, which have led to the creation of leachate from within the landfill. Analytical results from July 2004 indicate that copper, iron, lead, selenium and zinc levels all exceed CCME guidelines for the protection of aquatic marine life. The analytical results also indicate that benzene, toluene, ethyl benzene, and xylene (BTEX constituents) are present in the leachate.

Discussion: The City of Iqaluit plans to control and collect any water that has come into

contact with the solid waste within the cell. The plan outlined in the application is for any water collected in the waste cell to be periodically pumped into a truck and disposed of at either the sewage lagoon or sewage treatment plant. Section 3.9 “Runoff Monitoring Program” of the Operation and Maintenance Manual (2005) for the waste storage area does not reference the chemistry of the runoff prior to “dumping it in the sewage lagoon”. While this section of the Operation and Maintenance Plan makes reference to a leachate control system, few details are provided.

Recommendations:
INAC recommends that the City of Iqaluit ensure water movement is monitored and controlled over, through and under the solid storage area. The amount of leachate collected and treated should be monitored and reported to the NWB via annual reports.

D. Contaminated Soils

The Operations and Maintenance Plan states that contaminated soils may be accepted at the solid waste storage site.

Discussion:
Further information is required regarding the acceptance of contaminated soils at the solid waste storage site. The city should provide details on the quantities of soil and the concentrations of parameters within that soil that will be accepted.

Recommendations:
INAC recommends that the water license require that, prior to any known contaminated soils being accepted into the solid waste storage site, the soils be tested for heavy metals (full metals ICP scan), polychlorinated biphenyls (PCBs), and hydrocarbons, including BTEX parameters (benzene, toluene, ethyl benzene, and xylene) and a record of the tests be kept by the City and available during inspections under the water licence or the NW&NSRTA.

4.0 SUMMARY OF RECOMMENDATIONS

WATER SUPPLY

- INAC recommends that the license require that measures be taken to prevent the release of sediment into the water flowing from Lake Geraldine and into Lake Geraldine itself during the construction of the new south berm, and the expansion of the existing berms and dam.

- INAC recommends that the license require the City of Iqaluit to set up a monitoring program whereby the level fluctuations in the reservoir are monitored, so that inflows can be better estimated. If the City intends to develop a recharge

location to pump water into the reservoir, INAC recommends that license require that the City submit potential recharge locations to the NWB for review prior to development and amend the licence.

- Since the Lake Geraldine is located above the city of Iqaluit and the dam is considered in the high consequence category under the Canadian Dam Association guidelines, INAC also recommends that the license require the City of Iqaluit to develop a dam safety program of inspection and an emergency preparedness plan for a number of scenarios up to the loss of the dam structure.

WASTEWATER

- Consistent with the phased implementation of the WTTP, INAC recommends that discharge criteria established for the waste water treatment plant in the water license be phased in, such that they become increasingly stringent over time. Establishing more protective discharge criteria to be implemented over a period of time will ensure that the City implements Phase 2 of the waste water treatment plant in a timely manner. INAC also strongly recommends that an operation and maintenance manual and training program be developed and implemented for the waste water treatment plant.

- INAC strongly recommends that the license include a term requiring the City to implement the repairs for the sewage lagoon outlined in the February 2005 Dam Safety Inspection carried out by Concentric Associates International. Given the concerns regarding the inadequate sizing of the lagoon, the insufficient retention time, and the stability of the berms, INAC does not recommend using the lagoon for purposes other than as a back-up facility for the WTTP. As such, once Phase 1 of the waste water treatment plant is operational, the license should restrict the use of the lagoon to those situations where emergency back-up for the waste water treatment plant is required. INAC also recommends that the license require the City of Iqaluit to develop and submit an Abandonment and Reclamation Plan for the existing sewage lagoon for approval within 90 days of the issuance of the license.

- INAC recommends that the City clearly indicate whether or not they intend to implement the recommendations put forth by EarthTech (Canada) Inc. in the Sewage Sludge Management Plan. If the recommendations put forth by EarthTech (Canada) Inc. are adopted, INAC also recommends that the license require the City of Iqaluit to develop and submit for review, within 30 days of the issuance of the license, a plan to deal with sludge produced during the interim period when the waste water treatment plant is operational but the infrastructure required for sludge management is not available.

- INAC recommends that the license require the establishment of SNP stations to

monitor effluent discharge from the final discharge point of the existing sewage lagoon, the waste water treatment plant and the sewage sludge management facility. INAC recommends that a quality assurance/quality control program should also be submitted under the SNP program within 3 months of license issuance.

- The Spill Contingency Plans for the wastewater treatment system should be updated to reflect current wastewater treatment operations and better reflect the key areas of planning, preparedness, response and recovery. As previously stated, this water license application illustrates the substantial progress that the City of Iqaluit has made in improving the quality of municipal waste management in Iqaluit.

SOLID WASTE

- INAC recommends that the license require the City to collect, in a secure sump, any leachate generated from the solid waste storage site , to characterize the leachate to determine its composition, and to treat the leachate prior to disposal. The amount of leachate collected in the sump and the amount of leachate treated should be monitored and reported to the NWB via annual reports. It is recommended that the City of Iqaluit install and operate a treatment system to prevent the release of untreated leachate to the environment. Prior to disposal / release into the environment, INAC recommends that the leachate meet the criteria outlined in the CCME guidelines for the protection of marine life. Alternately, if on-site treatment is not implemented, any leachate generated should be collected and shipped south to an approved and licensed disposal facility. The license should also require the City to design, construct and operate a surface water management plan for the solid waste storage site to help prevent the creation of leachate.

- INAC recommends that the license establish Surveillance Network Program (SNP) stations at the current landfill and the new expanded cell (when created) in order to monitor leachate generated at the solid waste storage site . While INAC recognizes that this application does not include the West 40 dump site, monitoring requirements should also apply to the abandoned honey bag disposal site, and the abandoned solid waste disposal site in Apex. INAC recommends that a quality assurance/quality control program should also be submitted under the SNP program within 3 months of license issuance.

- The license should require the City of Iqaluit to submit an updated Operation and Maintenance Manual for the solid waste storage site for review and approval within 6 months of the issuance of the license. The updated plan should address types of cover material, frequency of covering, litter control, contaminated soil handling, and hazardous materials management, as well as any other items necessary for the successful operation of the facility.

- INAC recommends that the water license include a requirement that prior to any known contaminated soils being accepted into the solid waste storage site , the soils be tested for heavy metals (full metals ICP scan), polychlorinated biphenyls (PCBs), and hydrocarbons, including BTEX parameters (benzene, toluene, ethyl benzene, and xylene). Only those soils with concentrations of contaminants below the CCME CEQG for Industrial sites should be accepted in the landfill.

- INAC recommends that the Operation and Maintenance Manual set clear limits as to what types and quantities of wastes can be accepted at the solid waste storage site . The Manual should also clearly indicate when the hazardous wastes stored on site will be shipped south for disposal. The license should also require the City to develop and implement an Emergency Response Plan for the hazardous wastes storage area. This plan should be submitted to the NWB for review within 6 months of the issuance of the license.

Summary

INAC appreciates the work that has been completed to date, and looks forward to working with the City of Iqaluit and the NWB to continue to ensure best practices are implemented in managing municipal water supplies, wastewater and solid waste storage. INAC appreciates the opportunity to participate in the review of the City of Iqaluit Type A Water License application and hopes that these comments will be useful to the NWB in their determinations.