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Canadian Council of Ministers of the Environment
Draft Canada-wide Strategy for the Management of Municipal Wastewater Effluent

Inuvialuit Settlement Region Impact Analysis

Prepared for Inuit Tapiriit Kanatami, and the Inuvialuit Settlement Region

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1 Introduction to the Region

The Inuvialuit Settlement Region (ISR) is located in northern Northwest Territories and the Yukon North Slope. The ISR was established through the signing on June 5, 1984 of the Inuvialuit Final Agreement (IFA) between the Government of Canada and the Committee for Original People's Entitlement (COPE) representing the Inuvialuit—Inuit of Canada's Western Arctic. Six Inuvialuit communities are recognized in the IFA—Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok (Holman). Five of these communities (Aklavik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok) are located within the boundaries of the ISR, and Inuit in the ISR make up the majority of the population. The municipality of Inuvik is located just outside of the boundaries of the ISR, in the Gwich'in Settlement Area, and Inuit comprise approximately 40% of the population.

FIG. 1. Inuvialuit Settlement Region relative to the rest of Canada (Joint Secretariat, 2004)

The IFA was approved as the *Western Arctic Claims Settlement Act*, and is a land claims agreement under subsection 35(3) of the *Constitution Act*. As such, it is protected under the Canadian Constitution and cannot be changed by Parliament without approval of the Inuvialuit.

The IFA grants Inuvialuit ownership of 90,649 km^2 of land in the ISR. This includes surface and subsurface rights to 13,000 km^2 of land, termed category 7(1)(a) lands, and surface and granular resource rights to 77,700 km^2 of land, termed category 7(1)(b) lands.

The three primary goals of the IFA are to:

1. Preserve Inuvialuit culture, identity and values.

2. Enable Inuvialuit to be equal and meaningful participants in the northern and national economy and society.

3. Protect and preserve the ecological integrity of the Arctic environment, and Arctic wildlife in particular.

2 Regional Response to the Strategy

2.1 CONSULTATION PROCESS

Pursuant to section 14(4) and 14(5) of the Inuvialuit Final Agreement, Inuvialuit must be integrated into all bodies, functions and decisions pertaining to wildlife management and land management in the ISR, the relevant knowledge and experience of both the Inuvialuit and scientific communities should be employed in order to achieve conservation, respectively. Under section 7(85)(c) of the IFA, the appropriate government has an obligation to consult with the Inuvialuit Land Administration with regard to the manner in which it manages community water supplies. Under section 14(3), there is also a duty to consult with regard to the application of legislation related to the protection of lands and wildlife.

Environment Canada held a consultation session on the Strategy in Yellowknife on Nov. 20, 2007, on behalf of CCME. One staff member from the ISR was in attendance, and no ISR community members, in particular Inuvialuit, were present. A representative from Inuit Tapiriit Kanatami attended the consultation, but attended in her capacity as a national representative, not a regional one (Soha Kneen, personal communication, Dec. 3, 2007). No travel or accommodation funds were allocated to properly consult with IFA community representatives, and information on the Strategy or the consultation was not communicated directly to communities. Environment Canada's efforts to consult with Inuvialuit communities and regional representatives have been wholly inadequate.

Inuit Tapiriit Kanatami (ITK), the Joint Secretariat (JS), and the Inuvialuit Regional Corporation (IRC) are providing feedback on the Strategy to the best of their ability given the limited funding and an extremely short time period provided by Environment Canada. However, the short timeframe prevented all three organizations from meeting internal consultation requirements, and precluded direct consultation with IFA communities. Therefore, the IFA communities and regional land claims organizations reserve the right to change conclusions at any time, particularly after the draft regulations have been made public.

This consultation approach illustrates a lack of consideration for the Northern context and the consultation requirements that the regional and national organizations must abide by. The current initiative can in no way be considered adequate consultation from an Inuvialuit perspective, and has not fulfilled the Crown's duty to consult.

2.2 ISR PERSPECTIVE ON THE STRATEGY

As demonstrated by the IFA, Inuvialuit have a desire to protect the lands and waters of their Arctic homeland from any contamination. The impact of municipal wastewater on human health and the environment is a concern among residents in the ISR, and in particular among Inuvialuit. In Inuvik, for example, some residents have in the past expressed worry that water from the lagoon is migrating to other water bodies and affecting fish, especially in spring (Richard Binder, personal communication, Jan. 4, 2008). Overall, 33% feel that there are times of the year when the water in the community is contaminated, while 16% of Inuit adults in Inuvialuit Settlement Region feel that drinking water at home is unsafe to drink (2001) (ITK 2007).

The IFA did not grant the JS and IRC jurisdiction over municipalities and their wastewater facilities, so these organizations are not in a position to dictate what management controls and regulations are appropriate for IFA communities. However, both organizations do have an interest in protecting Inuit-owned lands.

In the ISR, as in other Arctic regions, the stated outcomes of the Strategy will *only* be achievable if the particular social, environmental and economic conditions are fully considered and reflected in the Strategy and its associated regulatory framework. An effective wastewater management strategy for the ISR must be grounded in the realities of Northern life, developed in partnership with Northerners—particularly Inuvialuit—and stewardship-based as opposed to punitive. Regulations must be based on environmental and health risks, but it must also be recognized that the primary obstacles facing Northern communities in attempting to achieve goals such as those outlined in the Strategy relates to levels of funding and community capacity. Abiding by regulations depends on adequate funding, and while the Strategy acknowledges this, it is particularly critical for Inuit regions, where the challenges related to effective wastewater management are distinct from challenges experienced in Southern Canada. In short, it is necessary to establish a framework specific to the North.

3 Regional context

3.1 LEGISLATIVE CONTEXT OF REGION

TABLE 1. Legislation Relevant to Municipal Wastewater Treatment in the Inuvialuit Settlement Region

Level of Government	Legislation	Summary
Government of Canada	*Western Arctic Claims Settlement Act* (Inuvialuit Final Agreement - IFA)	• Establishes the Inuvialuit Settlement Region (ISR) • Grants Inuvialuit Land Corporation title to 90,649 square kilometres of land • Establishes the Environmental Impact Screening Committee and the Environmental Impact Review Board • Administered by the Inuvialuit Land Administration.
	Northwest Territories Waters Act	• An Act respecting the management of water resources in the Northwest Territories, including the ISR • Establishes NWT Water Board • Provides for the delegation of certain powers related to water management to the Government of the Northwest Territories (GNWT) • Administered by INAC
	Fisheries Act	• An Act respecting the management and control of fisheries • Regulates the conservation and protection of fish populations and fish habitats from pollution and other negative effects • Allows for the regulation and/or prohibition of the deposition of deleterious substances into fish-bearing waters, or watercourses that may eventually enter fish-bearing waters • Administered by Fisheries and

Level of Government	Legislation	Summary
		Oceans Canada (DFO) and Environment Canada (EC)
	Canada Water Act	• An Act respecting the management of Canadian water resources • Regulates the development, utilization, and conservation of these resources • Administered by EC
	Canadian Environmental Protection Act	• An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development • Governs the release of toxic substances into the environment, and enables regulations to control or eliminate use of these substances • Administered by EC
	Canadian Environmental Assessment Act	• An Act mandating that federal departments, agencies and crown corporations must conduct environmental assessments for proposed projects where the federal government is the proponent or where the project involves federal funding, permit, or license • Administered by EC
	Arctic Waters Pollution Prevention Act	• An Act respecting the prevention of pollution of waters adjacent to the mainland and islands of the Canadian Arctic • Governs the disposal of waste onshore and at sea in arctic waters • Administered by INAC, Transport Canada, and Natural Resources Canada
Government of the Northwest Territories	*NWT Public Health Act*	• An Act respecting the prevention and mitigation of disease and the promotion and preservation of health in the Territories

Level of Government	Legislation	Summary
		• Enables regulations concerning the construction, operation, and maintenance of sewage systems in the NWT, including the ISR • Protects against the pollution of waters • Enables regulations mandating the disposal of wastewater effluent in a manner that ensures the protection of all bodies of water in the area, minimizes the aesthetically unpleasant aspects of wastewater treatment systems, and protects drinking water supplies • The following regulations relating to wastewater management are provided for under the Public Health Act: o General Sanitation Regulations o Public Sewerage Systems Regulations • Administered by the Department of Municipal and Community Affairs (MACA), Department of Public Works and Services (PW&S), Department of Health and Social Services (H&SS)
	Hamlets Act	• Sets provisions for developing municipal by-laws in respect of sewage or drainage systems and water distribution systems • Mandates that all incorporated municipalities *must* provide for their inhabitants a system for the collection and disposal of human excreta that operates in such a manner as will prevent the spread of disease • Administered by MACA
	Cities, Towns and Villages Act	• Sets provisions for developing municipal by-laws in respect of sewage or drainage systems and water distribution systems

Level of Government	Legislation	Summary
		• Mandates that all incorporated municipalities *must* provide for their inhabitants a system for the collection and disposal of human excreta that operates in such a manner as will prevent the spread of disease • Administered by MACA
Municipalities	By-laws under the *Hamlets Act* and the *Cities, Towns and Villages Act*	• Give municipal councils authorities relating to the establishment, acquisition, operation, maintenance, or alteration of sewage and drainage systems

3.1.1 Brief Summary of relevant wastewater legislation

While the IFA grants land ownership rights to the Inuvialuit, represented by the Inuvialuit Regional Corporation, waters in the ISR remain under the ownership of the Crown. As such, the protection of water resources in the ISR remains the ultimate responsibility of the Government of Canada. Currently there is no federal legislation pertaining directly to the discharge of municipal wastewater effluent. However, the discharge of municipal wastewater effluent in the Inuvialuit Settlement Region falls under the jurisdiction of several pieces of federal legislation, variously administered by multiple federal government departments, particularly INAC, EC, and DFO.

The *Northwest Territories Waters Act* (NWTWA) and the *Northwest Territories Waters Regulations* govern the use of inland waters, disposal of waste to such waters, and physical alterations to inland water bodies. In order to conduct any of these activities, it is generally necessary to obtain a Water License. The NWT Water Board was established to grant licenses as legislated by the NWTWA, the *Canadian Environmental Assessment Act*, and the IFA. All IFA communities fall under the jurisdiction of the NWT Water Board with the exception of Inuvik, which falls under the jurisdiction of the Gwich'in Land and Water Board.

Environmental assessments in the ISR are legislated through the *Canadian Environmental Assessment Act*, which provides for the establishment of federal Environmental Review Panels, and the IFA, which establishes the Environmental Impact Screening Committee (EISC) and the Environmental Impact Review Board (EIRB), co-management bodies consisting of equal parts Inuvialuit and government (of both Canada and the Northwest Territories) representation. In a Memorandum of Understanding signed in March, 2000, the Government of Canada and the EIRB concluded an agreement outlining how the environmental assessment process of the EIRB under the IFA may be substituted for a panel review under the *Canadian Environmental Assessment Act*. This MOU respects both the environmental assessment requirements established for the EIRB under the IFA and those for panel reviews under the Act.

The NWT *Public Health Act* is the governing legislation for water and sewer utilities in the Northwest Territories. It establishes regulations for the operation and maintenance of sewer systems, and the protection of drinking water sources and the wider environment.

All Inuvialuit communities are municipal corporations with the status of hamlet under the *Hamlets Act*, with the exception of Inuvik, which is a town under the *Cities, Towns and Villages Act*. As either hamlets or towns, all IFA municipalities are granted full by-law making authority under the relevant territorial legislation, including the authority to pass by-laws relating to wastewater systems.

3.2 ADMINISTRATIVE CONTEXT OF REGION

3.2.1 Federal Governance

3.2.1.1 Northwest Territories Water Board

With the exception of the territories, water management in Canada is generally a provincial concern. In the territories, the Department of Indian and Northern Affairs Canada (INAC) is responsible for the administration and enforcement of water management systems.

The Northwest Territories Water Board (NWTWB) was established under Section 7 of the *Northern Inland Waters Act* (NIWA), which was proclaimed on February 28, 1972. In June 1992, NIWA was repealed and replaced with the current *Northwest Territories Waters Act* (NWTWA) and Regulations. Section 12 of the NWTWA describes the NWT Water Board's mandate as follows: To provide for the conservation, development and utilization of waters in a manner that will provide the optimum benefit there from for all Canadians and for the residents of the Northwest Territories in particular.

The Board is guided by *Canadian Environmental Assessment Act* (CEAA) and the *Inuvialuit Final Agreement* (IFA), and is currently supported by the Renewable Resources and Environment (RRE) Directorate of INAC. INAC provides the Board with financial and human resources, as well as technical advice through the Water Resources Division (WRD).

Before the Board issues a water license, the provisions of the IFA screening and review process must be satisfied. The Board must also assess the environmental and socio-economic impacts of the application, as laid out in CEAA. The Board uses the results of the assessment to decide whether the project may proceed through the licensing process and to determine what terms and conditions should be applied to the water licenses for the project (NWT Water Board, 2006).

The Board issues Type A and Type B water licenses. In general, Type A are for large and Type B are for small projects. The Board currently issues water licenses primarily to two groups of proponents in the Inuvialuit Settlement Region (ISR): municipalities and oil and gas exploration and development companies. Municipalities have either Type A or Type B license, depending on the volume of their water use. The Board's Type A and Type B Licensing and Regulatory Process may consist of as much as a five part process that involves the NWT Water Board, the Environmental Impact Screening Committee (EISC), National Energy Board (NEB), Canadian Environmental Assessment Agency (CEAA), Water Resources Division of INAC, and INAC's Technical Advisory Committee (TAC).

While the NWT Water Board grants licenses, responsibility for compliance remains with INAC.

3.2.1.1.1 Technical Advisory Committee

The Technical Advisory Committee (TAC) was established by the NWT Water Board on October 17, 1973 as a forum for the discussion of technical matters relating to the Board's mandate, and is comprised of representatives from industry, government, Aboriginal organizations and non-governmental organizations. TAC is responsible for the technical review of A- and B-type license applications and providing recommendations or advice to the NWT Water Board based on their professional expertise and organization's mandate. TAC is also responsible for reviewing technical plans that are submitted by licensees as a requirement of their water license.

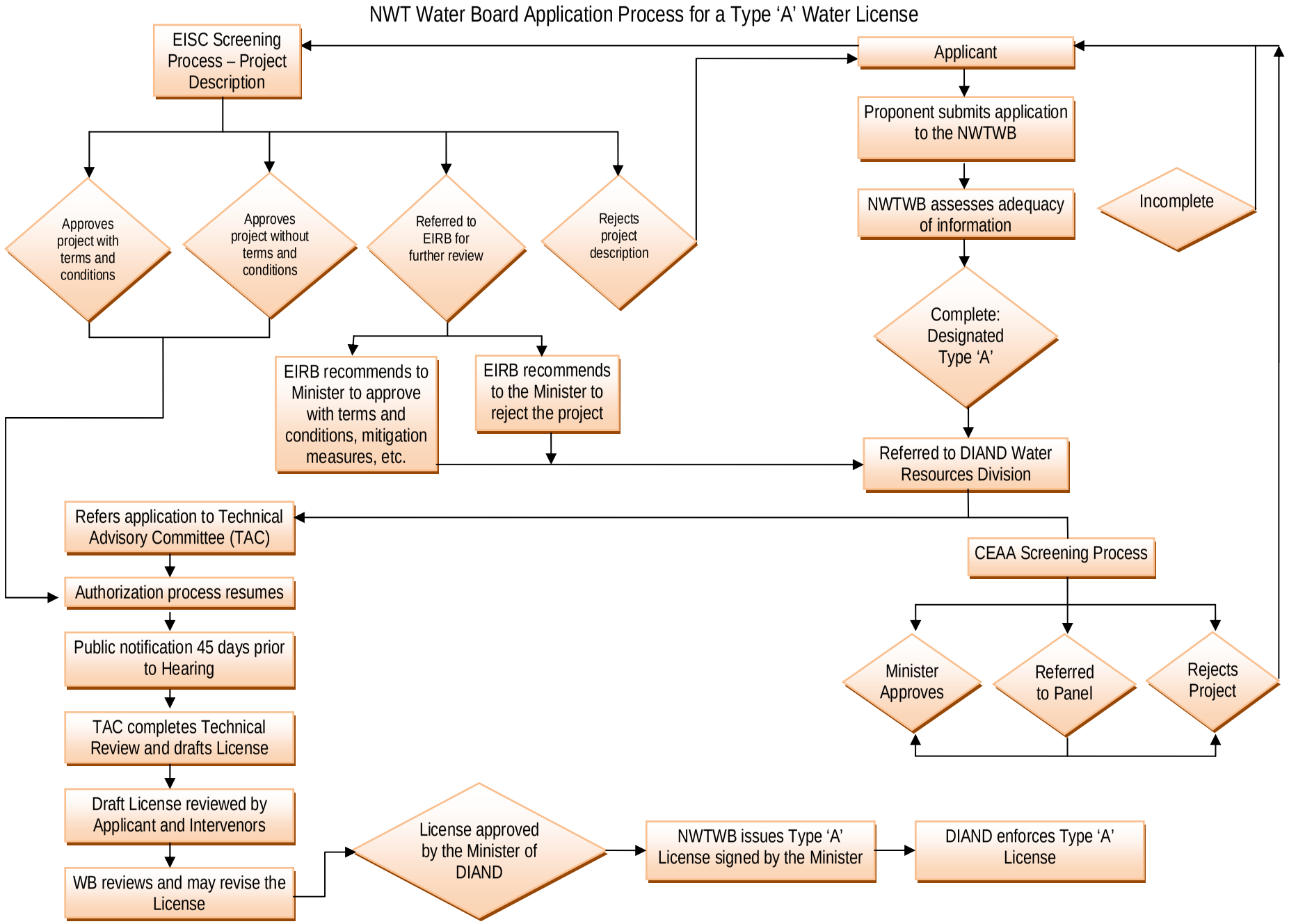

FIG. 2. The NWT Water Board license A process (NWT Water Board, 2003; Richard Binder, personal communication, Jan. 22, 2008)

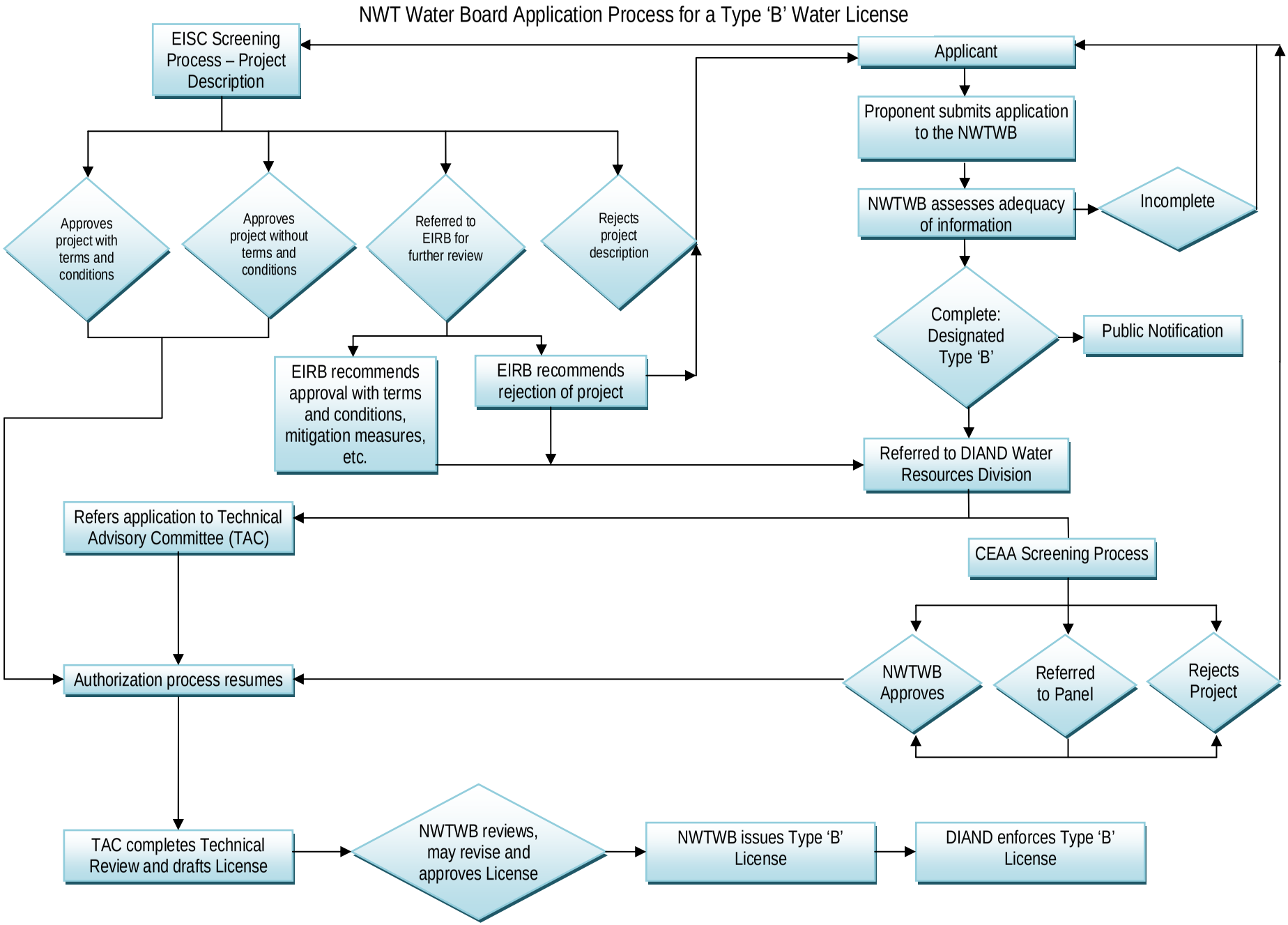

FIG. 3. The NWT Water Board license B process (NWT Water Board, 2003; Richard Binder, personal communication, Jan. 22, 2008)

3.2.1.2 Gwich'in Land and Water Board

Water use licenses for the town of Inuvik, the largest community included in the IFA, are granted by the Gwich'in Land and Water Board (GLWB). Established under the *Gwich'in Comprehensive Land Claim Agreement*, the Board regulates the use of water by issuing, amending, renewing, and suspending water licenses throughout the Gwich'in Settlement Area, which includes all Crown, Gwich'in and private lands.

3.2.2 Territorial governance

3.2.2.1 Department of Municipal and Community Affairs

The administration and management of waters in the ISR is the responsibility of the GNWT Department of Municipal and Community Affairs (MACA). MACA provides funding, research, and policy development in water and wastewater, and allows communities to provide water delivery services through enabling legislation.

In 2004, MACA announced its intent to move forward with the New Deal for NWT Community Governments, a major shift in MACA policy. Under the New Deal, community governments will assume full responsibility for infrastructure planning, development, maintenance and replacement, starting in 2007/2008 (GNWT, 2007).

The New Deal has 6 key elements:

1. Work with community governments to implement the expanded authorities and accountabilities that came into force with new municipal legislation on April 1, 2004.
2. Work with community governments and regional bodies where appropriate, to support implementation of self-government arrangements where municipal jurisdiction resides under new governance structures.
3. Transfer full authority for the acquisition and development of Community Public Infrastructure (CPI) to community governments.
4. Expand municipal taxation authority to all community governments.
5. Work in partnership with community governments and the Northwest Territories Association of Communities (NWTAC) to identify innovative approaches to infrastructure financing, and to leverage funding from other sources.
6. Work in partnership with community governments, the NWTAC and regional bodies established under self-government agreements to identify innovative approaches to capital issues at the community level.

To implement the New Deal, the legislative framework was changed for community governments. On April 1, 2004, the Municipal Statutes Replacement Act took effect, and brought the *Cities, Towns and Villages Act*, the *Hamlets Act*, and the *Charter Communities Act* in line with municipal legislation across Canada (Treff and Perry, 2005, p. 13). The scope of authority for community governments was broadened, including allowing hamlets to borrow for infrastructure financing (MACA, 2006, p. 2). On April 1, 2007, the New Deal for NWT Community Governments was formally implemented and community governments assumed full

authority for community public infrastructure (GNWT, 2007). Ownership of assets that communities use for municipal programs and services will be transferred from GNWT to the community government (GNWT, 2004). Training and certification of water and wastewater facility operators is primarily a MACA function.

3.2.2.2 Department of Public Works and Services

The Department of Public Works and Services (PW&S) provides technical expertise, training and operational assistance for water supply infrastructure. Through the Technical Support Services Division (previously delivered through the Water and Sanitation Section), PW&S provides technical support in the following areas related to sanitation (Department of Public Works and Services, 2007, p. 7):

- Reviewing design of water and sewage projects
- Inspections and operational reviews of water supply systems
- Pilot studies for evaluating potential water treatment process upgrades
- Updating and developing technical standards and guidelines
- Commissioning water and sewage systems
- Technical assistance during construction
- Training of water treatment plant operators
- Water sampling and testing
- Reviewing new or improved construction material and equipment

PW&S provides asset management services to GNWT departments, boards and agencies throughout the full life cycle of assets.

Additionally, while MACA is primarily responsible for training water and wastewater operators, PW&S provides support for developing course material and giving assistance in course delivery, such as hands-on training (Department of Public Works and Services, 2007, p. 7).

3.2.3 Inuvialuit Regional Corporation

The IFA, which was legislated under the Western Arctic (Inuvialuit) Claims Settlement Act [S.C. 32-33 Elizabeth II C.24.] in 1984, enables the Inuvialuit to participate and be meaningful partners in all decision-making processes dealing with the management of the environment and wildlife within the ISR. Under the IFA, Inuvialuit own 90,649 km^2 of land in the ISR, which includes surface and subsurface title to 13,000 km^2 of land adjacent to Aklavik, Ulukhaktok, Inuvik, Paulatuk, Sachs Harbour and Tuktoyaktuk, and 2,070 km^2 in the Cape Bathurst area (known as 7(1)(a) lands), and surface rights on another 77,700 km^2 of lands (known as 7(1)(b) lands) (IRC, 2007).

The IRC was established through the IFA with the overall responsibility of managing the affairs of the Settlement. The mandate of the IRC is to continually improve the economic, social and cultural well-being of the Inuvialuit through implementation of the IFA, and by any other means available. The IRC is controlled by IFA beneficiaries; each IFA community has a community

corporation with elected directors, which together form the IRC Board of Directors. A Chair/CEO is elected by the community corporation directors (IRC, 2007).

Under the IFA, Inuvialuit corporations were created to manage benefits stemming from the Agreement, including the Inuvialuit Regional Corporation, Inuvialuit Development Corporation, Inuvialuit Petroleum Corporation, and Inuvialuit Land Corporation.

3.2.3.1 Inuvialuit Land Administration

The Inuvialuit Land Administration (ILA) owns 7(1)(a) and 7(1)(b) lands on behalf of IFA beneficiaries, and is responsible for the management and administration of these lands. Remaining lands and subsurface title to 7(1)(b) lands remains under the control of the federal Crown, apart from Hamlet lands which are controlled by GNWT. However, Inuvialuit have the right to negotiate participation agreements with developers for the lands on which there are existing rights, including establishing rent and negotiating other benefits. Under the Agreement, Inuvialuit also own the beds of lakes, rivers and waterbodies of Inuvialiut owned private lands. The Crown owns all waters in every case, and has the right to protect community water supplies.

3.2.4 Joint Secretariat and Inuvialuit Co-Management Boards

To help meet the goals of the Inuvialuit Final Agreement, a co-operative management system was developed between the Inuvialuit, the Government of the Northwest Territories, and the Government of Canada. Five co-management groups were established:

1. Environmental Impact Screening Committee
2. Environmental Impact Review Board
3. Wildlife Management Advisory Council (Northwest Territories)
4. Wildlife Management Advisory Council (North Slope)
5. Fisheries Joint Management Committee

The Joint Secretariat (JS) was established in 1986 to provide technical, administrative, and financial support to four co-management groups and the Inuvialuit Game Council. The Wildlife Management Advisory Council (North Slope) has a separate secretariat based in Whitehorse. Government agencies and the Inuvialuit Game Council (IGC) each appoint 50% of the members to the co-management groups. The membership of the IGC is composed of elected members from Hunters and Trappers Committees in each IFA community. The co-management bodies have an important role advising Federal and Territorial Ministers on all environmental and wildlife management issues in the ISR (Richard Binder, personal communication, Jan. 2008).

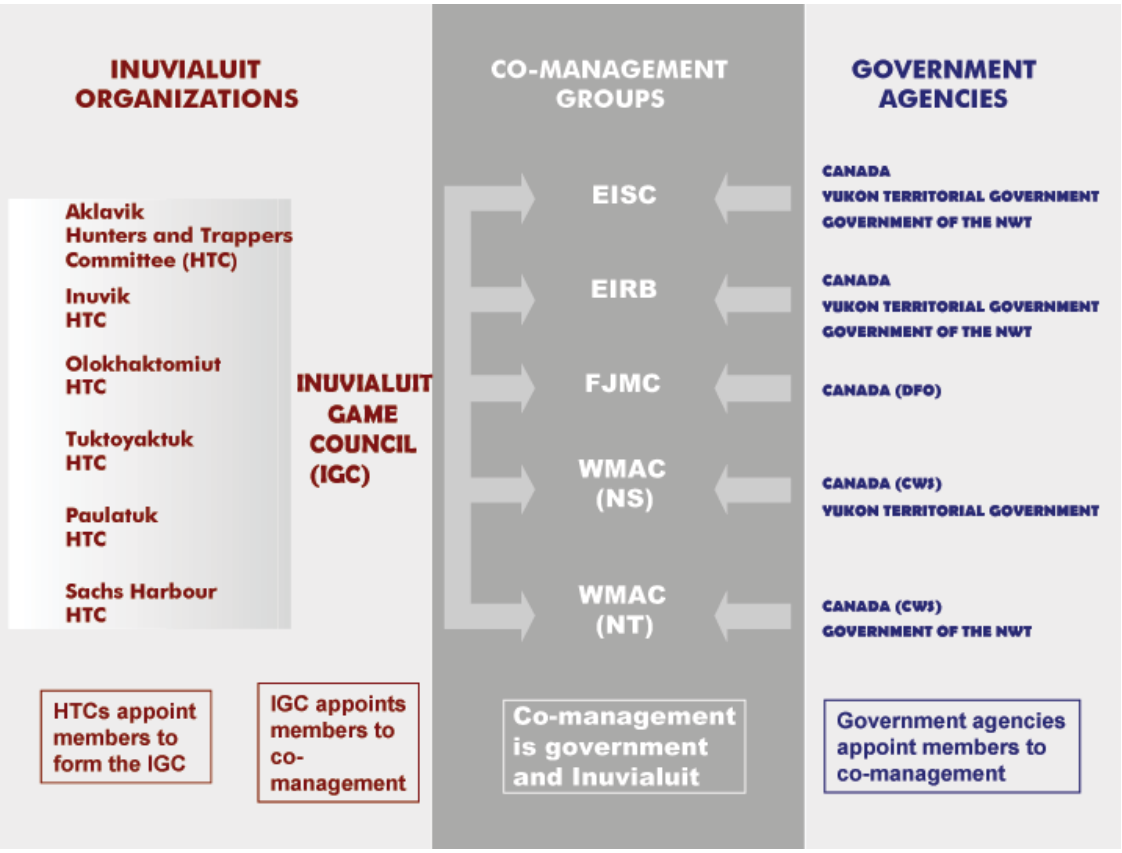

FIG. 4. Joint Secretariat Co-Management System (Joint Secretariat, 2007)

3.2.4.1 Environment Impact Screening Committee

The Environmental Impact Screening Committee (EISC) participates in the water license process in the ISR. The EISC screens the project as a whole to determine whether proposed developments could have a significant negative environmental impact on the Inuvialuit Settlement Region, or a significant negative impact on present or future Inuvialuit wildlife harvesting (IFA). The EISC may recommend terms and conditions to reduce any potential significant impact of a project on the environment or on wildlife harvesting (Richard Binder, personal communication, Jan. 22, 2008). The Water Board cannot issue a license without EISC screening first taking place (IFA section 11.36). In some cases, the EISC will refer a project to the Environmental Impact Review Board (EIRB) for further review (NWTWB, 2003)

The EISC is made up of three members appointed by the Inuvialuit Game Council, and three members appointed by the Government of Canada. Of the Government of Canada appointees, the Governments of the NWT and Yukon nominate one representative each. The Chair is appointed by the Government of Canada with the consent of the Inuvialuit (Richard Binder, personal communication, Jan. 22, 2008).

3.2.4.2 Environmental Impact Review Board

The Environmental Impact Review Board (EIRB) carries out environmental impact assessments of projects referred to it by the EISC, including determining the terms and conditions under which a project should proceed, including the need for compensation, mitigation, and remedial measures.

Similarly to the EISC, the EIRB is made up of three members appointed by the Inuvialuit Game Council, and three members appointed by the Government of Canada. Of the Government of Canada appointees, the Governments of the NWT and Yukon nominate one representative each. The Chair is appointed by the Government of Canada with the consent of the Inuvialuit (Richard Binder, personal communication, Jan. 22, 2008).

3.2.4.3 Fisheries Joint Management Committee

The Fisheries Joint Management Committee (FJMC) assists Canada and IFA beneficiaries with administering the rights and obligations related to fisheries under the Agreement, and to guide government policy on the management of fisheries and marine mammals in the ISR. Fisheries and Oceans Canada is required to consult with the FJMC before making policies that can impact Inuvialuit rights under the IFA (Richard Binder, personal communication, Jan. 2008). The FJMC ensures that marine and freshwater resources are managed and conserved so that present and future IFA beneficiaries can use and benefit from these resources.

The FJMC has two members from the Inuvialuit Game Council, two members from the Government of Canada, and a chairperson appointed by the members.

3.2.5 Inuvialuit self-government

In 1996, the IRC and the Gwich'in Tribal Council began to jointly negotiate Gwich'in and Inuvialuit Self-Government Agreement with the GNWT and the Government of Canada, and reached an Agreement-in-Principle in 2003. A Process and Schedule Agreement, outlining the timeline and work plan for the negotiators, was signed in May 2007. Currently, the emphasis of the negotiations is to negotiate jurisdiction for Inuvialuit in areas such as education, social services, policing, and so on (Gail Gruben, personal communication, Dec. 20, 2007). While it is too early in the process to anticipate impacts from the Agreement on wastewater management, the administration of municipal services is not a key priority in the negotiations at this time (Gail Gruben, personal communication, Dec. 20, 2007).

3.2.6 Municipal governance

Each Inuvialuit community is incorporated as a municipality with the status of hamlet under the *Hamlets Act*, with the exception of Inuvik, which is a town under the *Cities, Towns and Villages Act*. Under the *Hamlets Act*, hamlets have full by-law authority. According to MACA Water and Sewage Funding Policy, community governments exercise full authority and responsibility for the provision of water and sewer services in their communities.

3.3 FINANCIAL CONTEXT OF REGION

3.3.1 Sources of infrastructure funding

3.3.1.1 Government of Northwest Territories New Deal

MACA began using the Community Government Funding Policy (CGFP) as the basis for providing funding allocations starting in 2001/2002. The CGFP provides the overall policy framework for funding to community governments and reflects several departmental policies—extraordinary funding, municipal infrastructure funding, formula based funding water and sewer services policy (GNWT, 2007).

In 2005, the funding for community public infrastructure was removed from the overall GNWT capital planning process as part of the implementation of the New Deal. A separate budget was established that provides stable public infrastructure funding, starting at $28 million per year in 2006/2007—an increase of $11 million over the historic annual average (MACA, 2006, p. 3). On April 1, 2007, the New Deal for NWT Community Governments was formally implemented and community governments assumed full authority for community public infrastructure planning, development, maintenance and replacement (GNWT, 2007).

TABLE 2. Capital funding formula projections from MACA for IFA communities (adapted from GNWT, 2007, p. 5)

	2008-2009	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*Five Year Total*
Community	*($000)*	*($000)*	*($000)*	*($000)*	*($000)*	*($000)*
Aklavik	823	823	823	823	823	4,115
Inuvik	1,231	1,231	1,231	1,231	1,231	6,155
Paulatuk	740	740	740	740	740	3,700
Sachs Harbour	668	668	668	668	668	3,340
Tuktoyaktuk	899	899	899	899	899	4,495
Ulukhaktok	772	772	772	772	772	3,860
Total IFA communities	5,133	5,133	5,133	5,133	5,133	25,665
Total NWT	28,000	28,000	28,000	28,000	28,000	140,000

3.3.1.2 Municipal Rural Infrastructure Fund

Federal capital funding is available through the Municipal Rural Infrastructure Fund Agreement, totaling $19.2 million over 5 years (2005-2006 to 2009-2010). The breakdown of the fund is as follows:

- 1% is allocated for capacity building = $192,000
- 2% for administration = $384,000
- 55% for non-tax-based communities = $10.56 million
- 45% for tax-based communities = $8.64 million

For tax-based communities such as Inuvik, projects will be funded 33-33-33 by the federal, provincial and municipal governments, while for non-taxed based communities such as the 5 IFA hamlets, projects will be funded 50-50 between the federal and territorial governments. 80% of the funds are for water, wastewater or solid waste projects, and 20% are for innovative projects. GNWT's capital planning process helps manage projects in non-tax based communities, while tax-based communities enter into contribution agreements (GNWT, 2007).

3.3.1.3 Gas Tax Agreement

$37.5 million is available over 5 years (2005-2006 to 2009-2010), and of the total amount $750,000 is allocated for capacity building (2%) and $375,000 is allocated for administration (1%). Every community will receive a 1% base allocation, and the remaining funds are distributed on a per capita basis. To enter into a contribution agreement, a community government has to complete a capital investment plan and an integrated community sustainability plan. Funding can be spent on capital infrastructure projects, including wastewater infrastructure (GNWT, 2007).

3.3.2 Infrastructure Funding Challenges

While many municipalities in Canada face an infrastructure deficit, Northern communities have unique challenges. Small, dispersed populations mean that assets cannot generally be shared and economies of scale cannot be reached. Costs for construction and materials are high and the building season is short, while remoteness leads to high transportation and power costs. Infrastructure also degrades faster in the Arctic climate. Many municipalities have been established relatively recently, and are still developing their infrastructure base (GNWT, 2004). The infrastructure deficit in NWT is illustrated in Fig. 5 and 6.

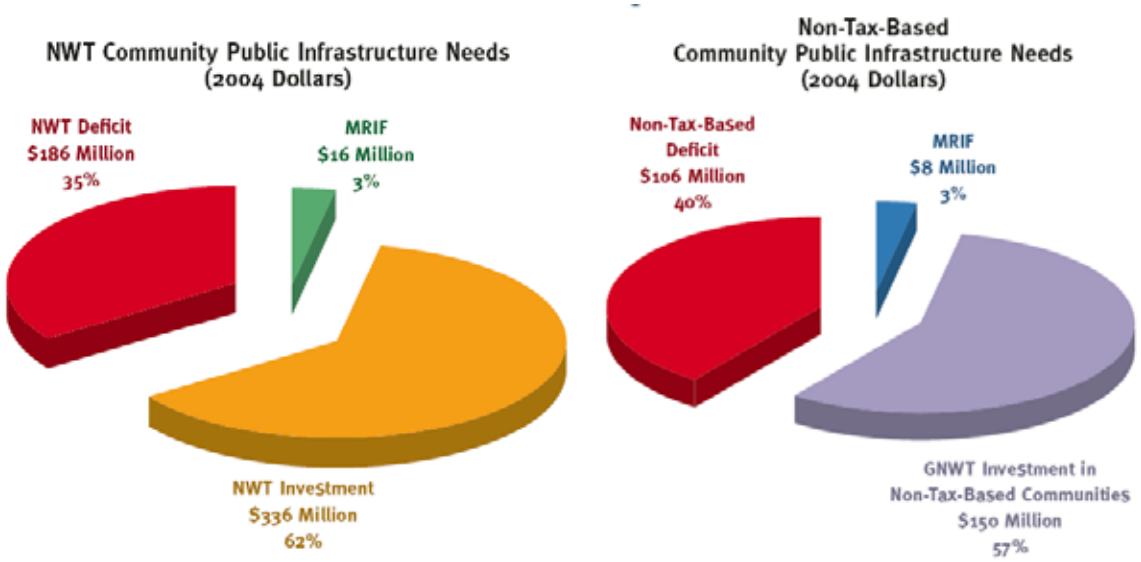

FIG. 5. NWT community infrastructure deficit for all communities including non-taxed based communities (GNWT, 2004)

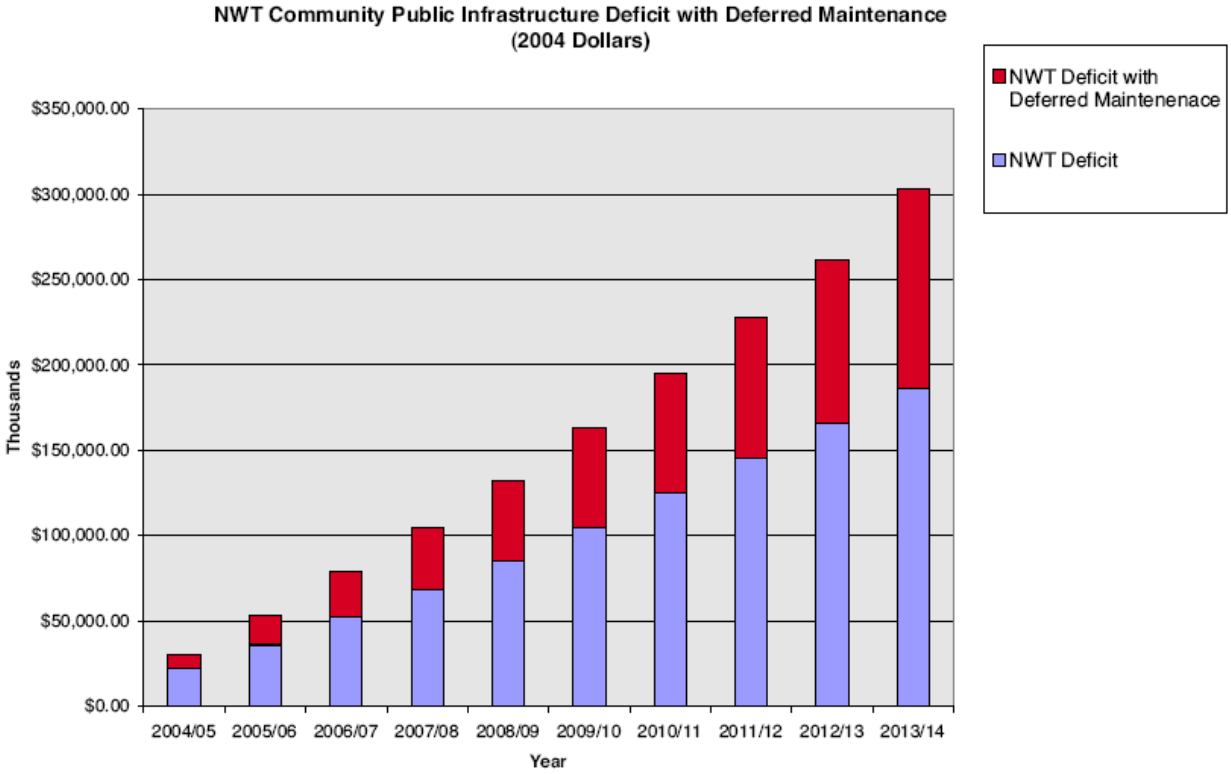

FIG. 6. NWT public infrastructure deficit with deferred maintenance (GNWT, 2004)

4 Region and Communities

4.1 COMMUNITY POPULATIONS AND GROWTH

By 2017, the Inuit population in NWT is projected to increase from the 2001 population of 4,300 to between 6,200 and 6,600, an increase of up to 54% (Statistics Canada, 2005: 62). Growth is projected to be particularly significant for Inuvik if the Mackenzie Gas Pipeline proceeds. In this case, Inuvik's permanent growth may be 10 to 15%, and while short term growth is unclear, the peak of combined camp populations during the tree successive winters of construction would be 1600 (Town of Inuvik, 2005, p. 26). The median age in IFA communities is 10 to 15 years younger than the Canadian average.

TABLE 3. Population statistics for IFA communities (Statistics Canada, 2006)

	Population in 2006	*Population in 2001*	*2001 to 2006 population change (%)*	*Median age of population*	*% of the population aged 15 and over*
Aklavik	594	632	-6.0	29.0	74.8
Ulukhaktok	398	398	0.0	25.8	68.8
Paulatuk	294	286	2.8	23.8	71.2
Sachs Harbour	122	114[a]	7.0[a]	28.5	75.0
Tuktoyaktuk	870	930	-6.5	26.5	72.4
Inuvik	3484	2894[a]	20.4[a]	29.8	75.2

[a]Use with caution

4.2 MAP OF INUVIALUIT SETTLEMENT REGION COMMUNITIES

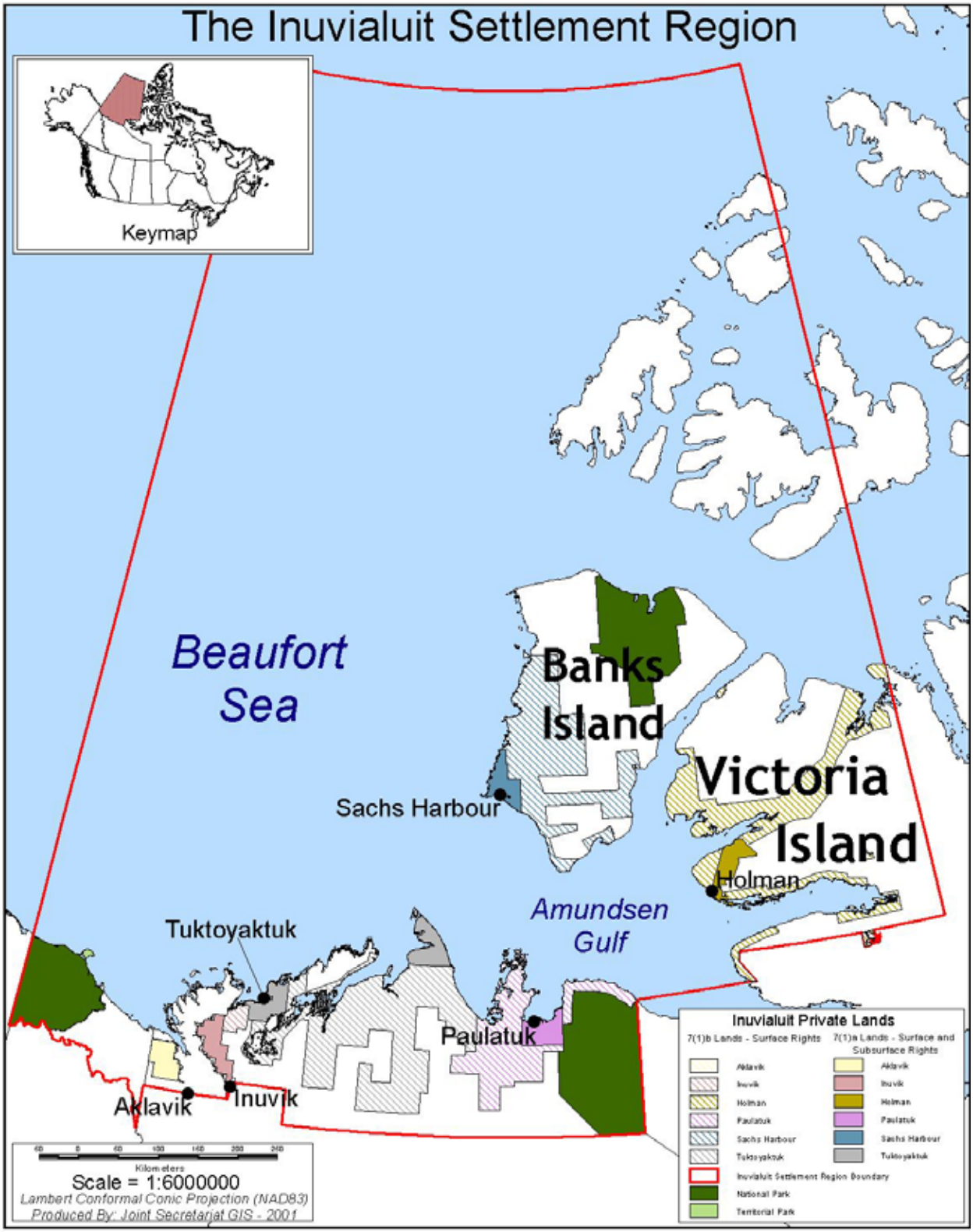

FIG. 7. Map of communities in the Inuvialuit Settlement Region (Joint Secretariat, 2004)

4.3 BUILT ENVIRONMENT OF COMMUNITIES

The 5 IFA hamlets have similar community infrastructure, with airports, inns, town halls, general stores, post offices and churches. All communities have trucked potable water delivery and sewage pickup apart from Inuvik, which has an above-ground, gravity-flow piped system. Inuvik is the transportation hub for the region and it a tax-based municipality, so has some additional services.

4.4 NATURAL ENVIRONMENT OF THE REGION

There is continuous permafrost throughout the ISR, with a majority of ground being high ice content, with an adjacent area of known subsea permafrost (Geological Survey of Canada, 1995). According to historical climate data (1971-2000), the average daily temperature in Inuvik is -8.8 C, and there are 208.9 days annually below freezing.

4.5 SOCIO-ECONOMICS OF THE REGION

TABLE 4. Unemployment rates for Inuit and non-Inuit adults, 2001 (adapted from ITK 2007)

	Inuit		*Non-Inuit*	
	Male (%)	*Female (%)*	*Male (%)*	*Female (%)*
Inuvialuit Region	23.1	17.1	5.4	4.8
Canada	24.7	19.4	7.6	7.2

TABLE 5. Average and median individual incomes ($) for adults in selected provinces and territories, 2007 (adapted from ITK 2007)

	All Canadian adults		*Inuit adults*	
	Average ($)	*Median ($)*	*Average ($)*	*Median ($)*
NWT	21,459	15,104	35,012	29,030
Canada	19,878	13,699	29,769	22,120

4.6 TRANSPORTATION

There are no paved highways in the Inuvialuit Settlement Region. There is a gravel highway linking Inuvik to Fort McPherson and Tsiigehtchic (the Dempster Highway). There is also a winter road (ice road) connecting Inuvik to Tuktoyaktuk (187 km) and Aklavik (86 km), which opens Dec, Jan or Feb and closes April or May, depending on weather conditions. There is no road access (winter or gravel) to Ulukhaktok, Paulatuk, or Sachs Harbour (Department of Transportation, 2006). Sealift (marine shipping) is an important means of shipping cargo during the ice-free season, and is the only way to transport large or heavy items. Air transportation operates year-round in the ISR, and is an important link to the rest of NWT and Canada for people and cargo.

5 Wastewater Infrastructure

5.1 EXISTING WASTEWATER TECHNOLOGIES

Existing wastewater treatment technologies and water license requirements are listed in Table 6. Sources for the data are listed in the References section by community.

TABLE 6.[1]	**Aklavik**	**Ulukhaktok**	**Paulatuk**	**Sachs Harbour**	**Tuktoyaktuk**	**Inuvik**
Latitude	68°13'9"N	70°44'1"N	69°21'0"N	71°59'1"N	69°27'14"N	68°21'34"N
Longitude	135°0'29"W	117°45'8"W	124°4'8"W	125°14'35"W	133°2'4"W	133°43'29"W
Population in 2006	594	398	294	122	870	3484
Total private dwellings	254	152	87	54	348	1542
Licensing body	NWT Water Board	NWT Water Board	NWT Water Board	NWT Water Board	NWT Water Board	Gwich'in Land and Water Board
Wastewater License #	N3L3-0570	N7L3-1525	N7L3-1619	N7L3-1531	N7L3-0714	G06L3-001
License type	B	B	B	B	B	A
Effective date of license	June 30, 1999	Dec. 15, 2003	Dec. 1, 2006	July 1, 1999	June 28, 2005	July 1, 2006
Date license expiry	June 30, 2009	Dec. 31, 2008	Nov. 30, 2009	June 30, 2009	June 27, 2009	June 30, 2016
Water source	Peel Channel of the Mackenzie River	RCAF Lake	New Water Lake	Water (MOT) Lake	Kudlak Lake	Hidden Lake reservoir. Source summer: Lake B (Three Mile Lake). Winter: East Channel of the Mackenzie River in winter.
Annual quantity of water use licensed	150,000 m^3	35,000 m^3	11,000 m^3	4,400 m^3	100,000 m^3	1,000,000 m^3
Quantity water used	33,186 m^3	13,490 to 34,000 m^3	8,000 m^3	4,277 m^3	~34,800 m^3 (2000)	581,000 m^3
Annual quantity of wastewater	22,430 m^3; 36,509 m^3 (1998)	13,062 m^3 (2006); 15,680 m^3 (2006)	8,000 m^3 (2004); 11,210 m^3 (2007)	4016 m^3	26,000 m^3 (2002); 40,000 m^3 (2005); 39,927 m^3 (2006)	Not measured

[1] Please refer to the References section for a list of sources by community.

TABLE 6.[1]	**Aklavik**	**Ulukhaktok**	**Paulatuk**	**Sachs Harbour**	**Tuktoyaktuk**	**Inuvik**
Sewage collection	Trucked; 3 households with honey bags[2]	Trucked	Trucked	Trucked	Trucked	Gravity-flow above-ground piped sewage collection for most buildings; some trucked.
Treatment system	Natural primary lagoon and wetland; a segregated cell for honey bags in solid waste disposal area	Engineered pond and wetland	Natural lake and natural treatment wetland; a few honey bags deposited in the solid waste disposal area	Natural lake	Natural lake (aerobic retention lagoon)	Multi-cell sewage lagoon
Number of cells	One	One	One	One	One	Two sludge cells, two primary cells, one large secondary cell
Discharge type	Continuous	Continuous exfiltration from June to October	Continuous	No discharge from lake (although as lagoon is increasing in size may be continuous in future)	Annual with temporary pump; discharge in early fall	Continuous
Lagoon retention time	Unconfirmed	8 months; discharge once lagoon is full	Unconfirmed	Continuous retention	365 days	In winter: 2 primary cells, 11 days retention; large secondary cell, 37 days retention. In summer: 2 primary cells, 22

[2] Honey bag refers to a plastic or heavy paper bag that fits into a bucket toilet used to collect toilet waste.

TABLE 6.[1]	Aklavik	Ulukhaktok	Paulatuk	Sachs Harbour	Tuktoyaktuk	Inuvik
						days; secondary cell, 144 days
Lagoon name	Clearing Lake Sewage Lagoon		Dead Lake	Sewage Lake		
Lagoon capacity	160,000 m^3	14,000 m^3	103,083 m3	250,000 m^3	Unconfirmed (equivalent of 1900 people)	Unconfirmed
Lagoon dimensions			250 m (L) x 350 m (W) x 4 to 5 m (D)	6 m (D)	5.9 hectare area	~1 km (L) x ~300 m (W)
Lagoon location		3.4 km N of community; 3 km NW water supply; 900 m NW airport	2 km SW of community		5.8 km S Hamlet Office; 1.5 km SW Reindeer Point Subdivision; 3.9 km S airport; 3.0 km SE ocean	2.4 km N of East Channel (wintertime intake)
Length of wetland	Unconfirmed	2 km	500 m	Unconfirmed	No wetland; saltwater inlet leads to ocean (length 6.5 km, depth 1 to 4 m)	No wetland; <200 m discharge creek
Receiving body	Peel River; final discharge unknown	Ocean	Darnel Bay	Unknown	Salt water inlet that flows to Kugmallit Bay	East Channel of Mackenzie River, northwest of developed townsite
Maximum effluent faecal coliform	10^4 CFU/100 mL	10^6 CFU/100 mL		10^6 CFU/100 mL		10^6 CFU/100 mL

TABLE 6.[1]	Aklavik	Ulukhaktok	Paulatuk	Sachs Harbour	Tuktoyaktuk	Inuvik
Maximum effluent BOD_5	Not specified	120 mg/L	360 mg/L	120 mg/L	120 mg/L	150 mg/L; also, total mass of BOD discharged to the receiving water annually < 80 tonnes
Maximum effluent TSS	Not specified	180 mg/L	300 mg/L	180 mg/L	180 mg/L	70 mg/L
Maximum effluent pH	Not specified	6 to 9	6 to 9	6 to 9	6 to 9	6 and 9
Minimum Freeboard	Not specified	0.5 m	1.0 m	n/a	0.5 m	1.0 m
Oil and grease	Not specified	No visible sheen	No visible sheen	No visible sheen	Unconfirmed	No visible sheen
Effluent quality monitoring locations	570-3, point of outflow of Clearing Lake sewage lagoon	1525-2, outlet of lagoon effluent	1619-2, outlet of lagoon before entering Darnley Bay	1531-2, sewage disposal facilities	0714-2, effluent discharge structure at the sewage disposal facilities.	0036-3, decant structure at discharge point; 0036-6, pond near the SW corner of the sewage facilities; 0036-7, pond near NW corner of sewage facilities; 0036-8, background for 0036-6 and 0036-7
Sampling frequency requirements	570-3, immediately after breakup of lagoon, and once prior to freeze-up	1525-2, at least 4 times during each decant and monthly inspections for oil and sheen	1619-2, biweekly during periods of flow	1531-2, 4 times during decant	0714-2, 4 times during each decant, monthly inspection for oily sheen	0036-3, monthly, and 10 days before batch decant, once at beginning, once in middle, and once at end of decant; 0036-6, 0036-7, 0036-8, annually

TABLE 6.[1]	**Aklavik**	**Ulukhaktok**	**Paulatuk**	**Sachs Harbour**	**Tuktoyaktuk**	**Inuvik**
						during periods of flow; monthly inspection for oily sheen.
Parameters to be analyzed	BOD_5, pH, TSS, FC	BOD_5, pH, TSS, FC, ammonia-nitrogen	BOD_5, pH, TSS, FC, ammonia-nitrogen	BOD_5, pH, TSS, FC, ammonia-nitrogen	BOD_5, pH, TSS, FC, ammonia-nitrogen	BOD_5, pH, TSS, FC, ammonia-nitrogen
Location of analysis	Lab approved by the board	Lab approved by Analyst	Lab approved by Analyst	Unconfirmed	Lab approved by Analyst	Lab approved by Analyst
Volume monitoring requirements	Measure and record the monthly quantity of sewage discharged into lagoon	Raw water pumped has to be recorded monthly	Record number of truckloads and estimate volume in each truckload	Unconfirmed	Unconfirmed	Monthly and annual sewage volume discharged
Reporting requirements	Annual reports	Annual reports	Annual reports	Unconfirmed	Unconfirmed	Annual reports and quarterly monitoring reports

6 Operations and Maintenance

6.1 OPERATION AND MAINTENANCE COSTS

Sewer operation and maintenance costs are generally high in the Arctic. The most expensive municipal water and sewer service per capita is in Grise Fiord, Nunavut, at $2240 per person (6.4 cents per litre), of which $670 per person is the portion for sewer services (2002) (Ken Johnson, personal communication). This rate is approximately ten times greater than average costs in southern Canada. A number of factors contribute to high operation costs, including high fuel prices, infrastructure degradation and breakdown due to climate, economies of scale, local conditions, etc. User fees often are still insufficient to cover fixed costs, let alone operating costs (GNWT, 2004).

To help communities provide water and sewer service, MACA funds part of the operation and maintenance costs of municipalities. MACA recently changed their water and sewer funding policy, to move from a subsidy approach to a standard cost allocation. The new funding formula is based on the sum of the fixed and variable costs of providing water and sewer service in each community, minus customer charges that municipalities can collect. Municipalities are expected to operate water and sewer services on a cost-recovery basis. For 2008-2009, MACA will be funding $1,945,938 in water and sewer operations and maintenance costs for IFA communities (Table 7).

TABLE 7. Operations and maintenance funding from MACA for IFA communities (adapted from GNWT, 2007, p. 2-3)

	Approved OM funding 2007-2008	*Proposed OM funding 2008-2009*		*Proposed OM funding 2009-2010*
	Total ($)	Water and sewer ($)	*Total ($)*	*Total ($)*
Aklavik	1,217,000	463,220	1,217,000	1,217,000
Inuvik	2,120,000	410,256	2,120,000	2,120,000
Paulatuk	1,283,000	242,466	1,283,000	1,283,000
Sachs Harbour	1,157,000	207,942	1,157,000	1,157,000
Tuktoyaktuk	1,400,000	404,118	1,400,000	1,400,000
Ulukhaktok	1,241,000	217,936	1,241,000	1,241,000
Total IFA communities	8,418,000	1,945,938	8,418,000	8,418,000
Total NWT	37,071,000	9,597,755	37,364,000	37,364,000

6.2 DESCRIPTION OF OPERATION AND MAINTENANCE ACTIVITIES AND CHALLENGES

Table 8 summarizes some of the operation and maintenance challenges that have been noted in INAC inspections of the facilities in IFA communities. While maintenance activities for lagoons tend to be minimal, such as clearing algae mats from the lagoon surface, decanting, or maintaining adequate signage, all of the necessary maintenance for the sewage treatment systems was not consistently completed for each IFA community. At least half of the IFA communities have prepared operation and maintenance manuals, as required by water licenses.

TABLE 8. Operation and maintenance plans, activities and challenges by community[3]

	Wastewater treatment facility O&M manual in place	*Wastewater treatment facility O&M activities and challenges*
Aklavik	The O&M plan due 1999 not received by 2007; the last one is from 1985	Not specified
Ulukhaktok	O&M plan submitted to the NWTWB in 2004	Sewage lagoon shoot was damaged and algae mats were forming in lagoon in 2005
Paulatuk	O&M plan submitted to NWTWB in 2004	SNP signs not posted in 2004
Sachs Harbour	O&M plan not submitted to NWTWB as of 2004; not required by license	No posting for sewage lagoon in 2004, although not a condition of the license
Tuktoyaktuk	O&M plan submitted to NWTWB in 2005 for sewage lagoon	Visible erosion of the southside of the lagoon in 2007. Sewage lagoon decanted in 2004, 2005, 2006
Inuvik	O&M plan required by Feb. 2007 by GLWB; unknown if submitted.	Slumping of berm, freeboard exceeded, and deciduous vegetation growth on berms in 2005 (maintenance work planned in 2005 to address this)

7 Monitoring, Performance and Compliance

[3] Please refer to the References section for a list of sources by community.

7.1 CURRENT MONITORING AND REPORTING ACTIVITIES AND CHALLENGES

While effluent quality monitoring is required by water licenses issues by the NWTWB and Gwich'in Land and Water Board (GLWB), most municipalities in the IFA do not monitor effluent quality, instead relying on compliance monitoring to alert them to treatment problems. Annual reporting is inconsistent in the region, and most annual reports only contain data on volumes of water collected and sewage discharged (Table 9).

TABLE 9. Monitoring and reporting activities by municipalities and compliance monitoring activities[4]

	Municipal monitoring activities	*Annual reporting by municipality*	*INAC compliance sampling*
Aklavik	No monitoring reported in 2003 annual report. In 2004, SAO indicated that samples were being taken, but no results were reported in 2004, 2005 or 2006	2004, 2005 and 2006 Annual Reports not received; 2003 Annual Report received but deemed incomplete because did not include SNP data	No samples collected during the 2005 inspection period. Other years unconfirmed
Ulukhaktok	Not confirmed	Annual report filed for 2004, 2005, 2006, but sample results not included (required for 2006 report)	No samples collected in 2004, but samples collected in 2005. Other years unconfirmed
Paulatuk	No sampling done in 2004 or prior (not required before 2002). Hamlet planned to begin sampling in 2005 during peak flow periods—unknown if monitoring has been implemented	2001, 2002 annual reports not received by board. 2003 annual report deemed incomplete. Other years unconfirmed	No samples taken during inspection period in 2004 because of winter conditions. 2002 compliance sampling reported. Other years unconfirmed
Sachs Harbour	Not confirmed	Not confirmed	2004 compliance sampling reported, other years unconfirmed

[4] Please refer to the References section for a list of sources by community.

Tuktoyaktuk	Samples collected in 2004	2001, 2002, 2003, 2004, 2005, 2006 Annual Reports not submitted	2004 compliance sampling reported. Other years unconfirmed
Inuvik	In 2000, all 12 samples taken; in 2001, 2002, 2003, 2004, and 2005, 11 samples taken. Aug. 2004 sample broken in transit.	2004 Annual Report filed, and assessment of sewage disposal facilities submitted. Other years unconfirmed	Compliance sampling done in 2005. Other years unconfirmed

Limited resources and capacity, including local technical expertise, is one of the main reasons that monitoring is a challenge for most IFA communities. Further, the technology that is most appropriate for small Arctic communities—lagoons and treatment wetlands—have some characteristics that make monitoring difficult, such as finding the outflow (Philippe di Pizzo, personal communication, Jan. 4, 2008).

Laboratory access is another major issue for all IFA municipalities. The closest accredited laboratory (CAEAL) is in Yellowknife—Taiga Environmental Laboratory—and the ISR is the furthest region from Yellowknife in NWT. Monitoring has to be coordinated with flight schedules, and not all hamlets have direct or frequent flights. Further, analysis is costly compared to typical prices in urban centres in southern Canada. The price for a routine analysis of sewage lagoon discharge (including pH, oil and grease, fecal coliforms, total phosphorus, ammonia, total suspended solids, BOD) is $160 per sample (Taiga Environmental Laboratory, 2007). In addition, the municipality must pay for flying samples to the laboratory. Depending on the scope of effluent quality monitoring, costs can range from $5-10K per year (Ken Johnson, personal communication).

7.2 PERFORMANCE OF EXISTING WASTEWATER PROCESSES

There is very little scientific, peer-reviewed literature on performance of lagoons and wetlands in the Arctic. Monitoring and compliance results suggest that lagoons and wetlands can treat effluent to desirable levels, but detailed data on performance across seasons is not available (Table 10).

TABLE 10. Monitoring and compliance results for treated wastewater effluent for select IFA communities[5]

	Paulatuk (2004)	*Tuktoyaktuk (2002; 2004)*
pH	8.18	9.34; not tested
Total Suspended Solids	88 mg/L	46 mg/L; 50 mg/L
Ammonia	0.152 mg/L	2.86 mg/L; 1.2 mg/L
BOD_5	105 mg/L	not tested; 39 mg/L
Nitrate and Nitrite as N	<0.008 mg/L	0.37 mg/L; not tested
Total Phosphorus	2.5 mg/L	not tested
Faecal Coliforms	200 CFU/dL	not tested; <4 to 400 CFU/mL
Conductivity	Not tested	631

7.3 COMPLIANCE OF EXISTING WASTEWATER PROCESSES WITH CURRENT REGULATIONS

All IFA communities currently have a water license (Table 6). It is unknown if the treated effluent meets the regulated parameter requirements at all times, particularly during the spring freshet, as compliance sampling is generally carried out in the summer.

[5] Please see References section for a list of sources by community.

8 Resource Needs and Availability

8.1 TRAINING RESOURCES AND NEEDS

The GNWT MACA School of Community and Government (SCG) is the only agency in NWT that offers courses and certification for wastewater operators. The SCG wastewater management courses consist of Small Systems Wastewater Treatment, Class 1 Wastewater Treatment, and Small Wastewater Collection System. Participants may apply to write a certification exam in Water and Wastewater Management after successful course completion; certification is offered through MACA, in partnership with the Association of Boards of Certification (ABC). However, certification is strictly voluntary—no legislation requires it in NWT (Melanie Edwards, personal communication, Jan. 8, 2008).

Small Systems Wastewater Treatment provides training in the basic operating and maintenance techniques with lagoons and wetlands, as well as sampling and regulatory requirements. Class 1 Wastewater Treatment is still in development, but it will expand on topics from the Small Systems course, and provide instruction on mechanical wastewater treatment options. The Small Wastewater Collection System course covers basics of trucked wastewater collection, including wastewater characteristics, regulatory requirements, and health and safety. Class 1 Wastewater Collection Systems expands on the Small Collection System course, and covers piped wastewater collection systems, valves, pumps, sewage system maintenance (Edward Hardy, personal communication, Jan. 21, 2008). Out of the 16 water and wastewater operators in the 6 IFA communities, none have wastewater certification in any of the courses offered as of May 2007 (Edward Hardy, personal communication, Jan. 21, 2008).

In 2005/2006, MACA also began offering a Circuit Rider Training Program with on-site training and technical assistance in 11 communities in NWT, but the program is only for drinking water treatment and there are currently no discussions to expand to wastewater (Olivia Lee, personal communication, Jan. 2008).

In past years, the GNWT Department of Public Works and Services (PW&S) provided support for MACA's water and wastewater operator training and certification program and the Circuit Rider program, but the PW&S Water and Sanitation Section was dissolved in April 2007 (Department of Public Works and Services, 2007). Two positions from the section have been transferred to MACA, and one has been moved to the PW&S Technical Support Section. Other partners for program development and delivery include the GNWT Departments of Environment & Natural Resources and Health & Social Services, as well as the Association of Boards of Certification.

The MACA SCG identifies training needs in the community by collecting annual training needs information from communities, and anticipating impacts on training needs from new initiatives or regulations (Yvonne Carpenter, personal communication, Jan. 7, 2008). The three committees that are responsible for anticipating training needs and other wastewater-related issues are the Interdepartmental Drinking Water & Wastewater Management Committee (DMs Committee),

Drinking Water and Wastewater Technical Committee, and the GNWT Water and Wastewater Certification Committee.

SCG Water and Wastewater course development and delivery for the NWT is currently funded by the capacity building portion of the Municipal Rural Infrastructure Program, at $64,000 annually for 5 years, which is matched by GNWT. The base funding for the wastewater program area is $21,000 per year (Edward Hardy, personal communication, Jan. 21, 2008).

All of the IFA communities are located in the Beaufort Delta region, along with 2 other communities, and training services are for this area delivered through the Beaufort Delta SCG office. The Beaufort Delta MACA SCG office has a very limited annual training budget of $198,000, or approximately $25,000 per community, which is insufficient to meet all the training needs that communities identify (Yvonne Carpenter, personal communication, Jan. 7, 2008). For instance, offering training to one person from Sachs Harbour in Inuvik can cost $4,000—almost 1/8 of the annual training budget allocated for the hamlet (Yvonne Carpenter, personal communication, Jan. 7, 2008).

8.2 COMMUNITY CAPACITY AND TRAINING CHALLENGES

Time and travelling are the two major challenges that communities face with participating in training (Yvonne Carpenter, personal communication, Jan. 7, 2008). Scheduled flights do not take place every day from each community, and weather delays are frequent, so travelling for training is a substantial time commitment. Often, communities do not have enough qualified staff to maintain their operations in the community while a staff person is attending training.

Further, poor staff retention means that training must be frequently redelivered. A recent human resources survey in NWT revealed that most communities, regardless of size, are having little success in attracting and retaining staff, with the primary reason being the inability to pay competitive wages and salaries (Local Government Administrators of the Northwest Territories [LGANT], 2007). The job market is competitive for skilled occupations in NWT, as illustrated by 2005 employment rates: approximately 93% for persons with a university degree, 88% for persons with a certificate or diploma, 79% for persons with a high school diploma, but only 37% for persons with less than a Grade 9 education level (LGANT, 2007). Municipal operations staff often leave positions with the municipality to higher paying private sector jobs.

In a 2006 MACA client survey, 35.5% of respondents said that inadequacy of funding was the most important challenge facing communities in the NWT, while 23.1% said that lack of skills and abilities was the most important challenge (NWT Bureau of Statistics, 2006). Infrastructure, communication, and community relations were also identified as challenges. Any increase in the demands on municipalities to meet regulations will have to address these financial and human resource limitations.

9 Analysis of Draft Strategy and Impacts on IFA Communities

Elements of Draft Strategy	*Details of Objectives/Deliverables/Timelines*	*Impacts or Significance to Region*
1.2 National Performance Standards	NPS do not apply to Arctic conditions	NPS do not apply but how much of the rest of the framework applies?
	NPS will be incorporated into each jurisdiction's regulatory framework.	How will NPS be incorporated into the unique jurisdictional make-up for IFA communities?
	Standards will be in a regulation developed under the Fisheries Act.	How will these regulations under the Fisheries Act be enforced? Who will do the enforcing?
	Timelines: All new and upgraded facilities will meet NPS immediately.	Will IFA communities be exempt from this for new facilities?
	Low risk facilities must meet NPS within 30 years. Medium Risk within 20 years and High Risk within 10 years.	All IFA facilities are currently "very small" or <500m^3/day with the exception of Inuvik which is "small" or 500-2,500 m^3/day and at 3% increase per year will become medium within 15 years. Less than 5% of total dry weather flow is estimated to be industrial or landfill leachate. Most if not all communities are likely to score as low risk facilities but because of the weight given to CBOD/TSS and Ammonia levels, all communities could score anywhere from low-to high risk. Not until thorough effluent characterizations are done will risk be known. Also, the point of measurement for final discharge will have a very significant impact on scoring of risk.
	Implementation of NPS will be based on risk, available funding, and financial sustainability of municipalities/communities.	How will these implementation mitigating factors be evaluated?
	NWT, NT, and federal government will undertake research to develop NPS within 5 years.	How will this be done? How will it adequately and thoroughly address all systems in all communities? How can this possibly be done in time for implementation if done concurrently?

Elements of Draft Strategy	*Details of Objectives/Deliverables/Timelines*	*Impacts or Significance to Region*
1.2.1 Considerations for Arctic Conditions	Because of extreme climate and remoteness of Canada's Arctic, alternative performance standards for Arctic conditions will be proposed within five years. This will allow further investigation of the constraints associated with meeting NPS. Definition of Arctic is under discussion by the Development Committee. Consideration to date in defining Arctic include number of growing degree days, mean annual near surface ground temperature, temperature and number of ice-free days.	What will be the process for proposing Arctic NPS? What are the terms of reference? Who will determine the Arctic NPS and how? What constraints will be considered? Who is the Development Committee? What is the process for defining Arctic? If both climate and remoteness are reasons for Arctic NPS why are only climatic definitions considered? Will political or jurisdictional boundaries be considered? Having two performance standards would pose significant challenges and unnecessarily complicate management and compliance.
1.3 Site-Specific Effluent Discharge Objectives (EDOs)	Site-specific environmental risk assessments of the receiving environment, where municipal wastewater effluent is discharged will guide the development of site-specific EDOs for substances in wastewater effluent, including those not covered by the NPS. Jurisdictions will use the results of these assessments to set more stringent discharge requirements for those parameters already covered by NPS. Jurisdictions will manage their own EDOs. **Timelines:** All risk assessments will be complete within 5 years. A one year initial characterization will be completed as part of the environmental risk assessment.	If Arctic specific NPS are developed and are less stringent than 25/25/0.02 (CBOD; TSS; TRC) how will EDOs be developed in such a way that does not circumvent the purpose of Arctic specific NPS? Will there be Arctic specific EDOs that reflect not only site-specific environment risk factors but also climatic and remoteness factors that constrain treatment efficacy? Who will be responsible for setting, managing, and enforcing EDOs in the region? Timeline is not realistic for IFA communities given financial and logistical limitations.
1.4 Combined Sewer Overflows and Sanitary Sewer Overflows	Combined sewer overflows pose risks during overflows caused by storm events.	There are no known CSOs in the region.
1.5 Monitoring	All wastewater facilities are required to monitor their effluent discharge according to Technical Supplement 2.	Monitoring activities in IFA communities are currently limited due to limited human resource and financial capacity. Immediate monitoring is not realistic for all IFA communities.

Elements of Draft Strategy	*Details of Objectives/Deliverables/Timelines*	*Impacts or Significance to Region*
	Are there accredited facilities in the territory?	Taiga Environmental Lab (INAC) is fully accredited under CAEAL. ALS is Proficiency accredited under CAEAL for TSS but not BOD5/CBOD5 or TRC. Taiga claims to have capacity to do all BOD and TSS monitoring requirements for NWT as samples can be received within 48 hours under normal circumstances.
	Timelines: Monitoring of wastewater effluent quality and reporting is to be implemented immediately. Standards in current permits will be retained.	Capacity is limited in some communities, particularly hamlets.
	In the draft strategy it indicates that in Canada's Arctic, "monitoring will be implemented immediately". However in the monitoring section for the rest of Canada it states that 'within one year all facilities will begin to monitor effluent quality" and that all samples monitoring for NPS and EDOs must be sent to an accredited laboratory.	Is there a more stringent monitoring requirement for Arctic communities? Arctic communities should have at least a year to begin monitoring, as non-Arctic communities do. What is the definition of "accredited"? Does this mean CAEAL accreditation? Is PT accreditation sufficient as it is some provinces?
	Monitoring for impacts in the receiving environment required within five years.	Will this be a requirement for IFA communities?
	Toxicity monitoring.	Will this be a requirement for IFA communities? The toxicity test proposed would be onerous and there may be opposition from community members to using a non-native fish species for toxicity tests.
1.6 Toxicity	All medium, large, and very large wastewater facilities are required to complete whole effluent acute and chronic toxicity testing in accordance with Technical Supplement 2. Toxicity testing may be required on a site-specific basis for small and very small facilities where a risk has been identified by the jurisdiction or owner.	There are no known medium or larger facilities among the IFA communities but it is unclear whether any community has industrial inputs (including landfill leachate) greater than 5% of total dry weather flow. It is unknown whether or not there are any small or very small facilities that may be identified as requiring toxicity testing.

Elements of Draft Strategy	*Details of Objectives/Deliverables/Timelines*	*Impacts or Significance to Region*
		Do industrial inputs to facility automatically result in mandatory toxicity testing? Because of remoteness accredited toxicity tests are not available in NWT.
1.7 Reduction at Source	Reducing substances at source is an important aspect of the Strategy.	IFA communities vary in water consumption and wastewater production. Generally speaking, households with trucked water are already conservative in use. Opportunities for reduction at source will be limited. Communities that produce less wastewater but of higher concentrations of NPS may be under more pressure to meet higher treatment efficacies.
1.8 Regulatory Reporting	The results of monitoring activities will be reported to the jurisdiction. **Timelines:** Within 1 year, all facilities will begin to report the results of the monitoring requirements to jurisdictions.	Which jurisdiction(s) will that be for IFA communities? Will it continue as it currently is administered through the Water Boards, MACA, and INAC? Feasibility questionable considering existing monitoring and reporting capacity. Clarification needed on requirements in for IFA communities.
1.9 Science and Research	More research is needed and research will be disseminated through an independent national wastewater research coordination committee. **Timelines:** Within 2 years, EC will lead a process to engage a diversity of organizations to investigate and determine the feasibility of setting up an independent national wastewater research coordination committee.	How will research be done that addresses issues specific to the Arctic and specific to IFA lands and communities? Will Arctic research be included? Will IFA communities benefit from this process, and be included in determining research priorities, or will there be a continuing separate northern research process? Research on whether $CBOD_5$ and TSS are the most appropriate measures for the north (COD is an alternative).
2.1 Governance	Regulatory requirements for source controls and releases to surface waters to be harmonized.	

Elements of Draft Strategy	*Details of Objectives/Deliverables/Timelines*	*Impacts or Significance to Region*
	Timelines: Within 3 years, jurisdictions will establish bi-lateral federal-provincial and federal-territorial agreements. For NWT and NU, an agreement on governance issues in these territories will be developed among the jurisdictions, taking into account the regulatory role of the various water boards.	No other wording on this in the draft strategy so difficult to gage potential impacts of "harmonized" requirements and implementation.
2.2 Public Reporting	Within 5 years, all owners of facilities will report NPS and EDO performance results to the public on an annual basis.	Will the current mechanisms suffice (i.e., public registry on the NWTWB and GLWB websites)?
3.0 Funding	Funding principles include a consideration for sustainability at all levels, a consideration of territorial factors, (including fiscal and human resource capacity), the promotion of self-funding opportunities for municipalities, and a consideration of risk.	Environmental, economic, and social sustainability is important for IFA communities. Fiscal and human resource capacity and the ability to self-fund are very limited in the IFA communities. Environmental risk is projected to be low.
	Municipal-based funding approaches are prioritized.	Self-funding opportunities in IFA communities are extremely limited (see analysis of Technical Supplement 1).
	Senior government assistance is encouraged, with consideration for the financial capacity and constraints of owners of small facilities.	Financial assistance from senior levels of government for capital, non-capital (operation and maintenance), and compliance monitoring costs is critical for the successful implementation of the Strategy.
	Timelines: Within 6 years, jurisdictions will estimate the actual costs of implementing the Strategy and develop investment priorities based on this.	This may be difficult to complete in 1 year after the Arctic-specific Strategy elements are established. Municipalities will require technical assistance to carry out this requirement, as they have limited human resource capacity. Who will compile this information and how will it be used? Will it result in funding? Municipalities will already have incurred high costs for compliance monitoring. Will this be considered before year 6 as far as funding support?
	Within 3 years, jurisdictions will establish the requirements and provide the tools needed to implement the Strategy.	The Arctic-specific Strategy elements will be established in 5 years, and it is not clear what other elements of the Strategy will or will not apply to the Arctic, which impacts

Elements of Draft Strategy	*Details of Objectives/Deliverables/Timelines*	*Impacts or Significance to Region*
		on the capacity to fulfill this requirement.
	Within 1 year, senior levels of government should consider short-term funding for high-risk facilities (including for environmental risk assessment), and within 6 years, governments should consider other means of assistance to owners of small and very small facilities (e.g., planning, capacity building).	Communities in the IFA are projected to be low-risk; however, in order to carry out the compliance monitoring and risk assessment requirements within 5 years, funding from senior levels of government will be required before year 6.
	Owners should report accurately and publicly their current level of wastewater expenditure, the value of their asset base and the investment needed for their wastewater system.	GNWT Department of Public Works and Services provides full life cycle asset management services. Technical expertise from MACA will also be needed to report expenditures and infrastructure needs.

10 Analysis of Technical Supplement 1 and Impacts on IFA Communities

Element of Technical Supplement 1	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
3. Jurisdictional Costs	All orders of government—federal, provincial, territorial, municipal—must bear the capital and non-capital implementation costs of the Strategy. Operation and maintenance costs are not included. Administrative costs are not included.	Municipal and territorial governments rely primarily on outside funding for capital costs, and do not have the financial capacity to absorb additional non-capital costs. Operation and maintenance costs can be up to an order of magnitude higher in the Arctic, and should be considered when calculating costs. For example, in Grise Fiord in 2002, water and sewage service was $2240 per person or 6.4 cents per litre, of which the sewage portion was $670. (Ken Johnson, personal communication, Jan. 8, 2008). The majority of municipalities in the IFA do not have sufficient administrative capacity to implement the Strategy, particularly the requirements for risk assessment, monitoring, reporting, and capital planning. Costs to set up and expand these administrative support systems will be significant.
3.3 Summary of Costs	Capital costs will be $7.5 to 9.3 billion over 30 years, depending on inflation. Non-capital (compliance monitoring) costs will be $2.8 billion to $3.8 billion. Estimated total compliance monitoring costs are based on an assumption for small systems of a one-time initial characterization cost of $16,000, a one-time environmental risk assessment cost of $3,500, an annual monitoring cost of $4,000/year, and an environmental monitoring at the watershed level cost of $3,500/5 years.	Capital costs are relatively high in the Arctic due to the price of shipping materials, labour, fuel, etc. Constructing a lagoon treatment system can range from one to several million dollars, while basic mechanical systems may cost over $20 million. The estimates of compliance monitoring costs are low for the North. The actual potential range is $20-30K for initial characterization, $20-30K for the environmental risk assessment, $5-10K per year for annual monitoring, and $10-20K every 5 years for environmental monitoring at the watershed level (Ken Johnson, personal communication, Jan. 8, 2008). For all 6 communities in the IFA, the total range for compliance monitoring for a 5 year period would be $450,000 to $780,000, including the initial environmental assessment and environmental monitoring, and not considering inflation.
4. Funding Considerations	Capital costs will be loaded towards the early and mid-periods of implementation. High risk facilities	All IFA communities are likely to be low-risk, so would be considered low priority for capital funding.

Element of Technical Supplement 1	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
	will be dealt with in years 6-10 of the Strategy.	
4.1 Jurisdictional Considerations	The federal government has a small role with respect to responsibility for constructing and operating wastewater infrastructure. Territorial governments do not own the majority of facilities, but depending on the geography and size and distribution of the population, providing funding for facilities may be challenging. Municipalities own the majority of facilities, and self-funding/financing projects depends on the community size, potential to increase rate base, whether sustainable asset management practices are in place, financial position of the municipality, the growth prospects of the community, and the environmental risk ranking of the community.	Federal funding for NWT and municipalities in the IFA is critical for the success of the Strategy. The NWT recently transferred facility ownership to municipalities with the implementation of the New Deal. NWT already has a significant infrastructure funding shortfall. Most communities in NWT have a very limited tax base (although with the New Deal they can charge property tax). As communities are small and dispersed, many cost-saving options are not realistic (e.g., sharing infrastructure, public-private partnerships, etc.). Communities in the IFA are small, and in general do not have a strong financial position. Inuvik is the only tax-based community. Inuvik is also the only community with high growth projected, due to the Mackenzie Gas Pipeline. The IFA communities are expected to be low-risk, although Inuvik may become medium-risk in the next 15 years.
4.2 Funding Sources and Mechanisms	Funding options include transportation revenues/incentives (i.e., Gas Tax Fund), government service partnerships, strategic budget allocations, full cost recovery, debt financing, public private partnerships, and grants.	IFA municipalities receive Gas Tax and GNWT funding for capital expenses, but an infrastructure funding shortfall remains. Municipalities cannot achieve economies of scale as they are small and far from each other. In general in NWT, user fees are insufficient to cover fixed costs of water and sewage services because of the high service costs and limited tax base, therefore strategic budget allocations and full cost recovery are not realistic options. The New Deal provides municipalities with greater debt financing options; however, this is new and the actual borrowing potential of IFA communities is unknown. Public private partnerships are unrealistic in IFA communities. Inuvik may be able to make a short-term agreement during the several years of construction of the Mackenzie Gas Pipeline, if the project proceeds. Grants from the federal government and GNWT will be a critically important source of funding for IFA communities.
5.1 Recommendations		See above.

11 Analysis of Technical Supplement 2 and Impacts on IFA Communities

Element of Technical Supplement 2	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
2.1 National Performance Standards: Considerations for Canada's Arctic	Strategy recognizes that Canada's Arctic faces unique concerns due to its extreme climatic conditions and remoteness. Alternative National Performance Standards for Arctic facilities will be proposed within five years. A number of factors such as ice-free days are being explored to determine which ones may affect the achievement of any proposed NPS. Data availability is a limiting factor. Risk-based approach will continue to be used to manage municipal wastewater effluent. Standards in use in current permits in the Arctic will be retained. Further research will be conducted within the next five years to identify the factors that affect performance of lagoons and wetlands in Arctic conditions and how lagoons and wetlands can be improved. Once adequate information is available within the five year period, NPS for Arctic conditions will be developed.	The basis for NPS of 25mg/L $CBOD_5$, 25mg/L of TSS and 0.02mg/L of TRC is not specified and seems arbitrary and so it raises the question of how Arctic NPS will be developed or chosen. Current discharge standards in existing water licenses for IFA communities range from 120mg/L to 360mg/L for BOD_5, well above the 25mg/L proposed for southern Canada. For TSS the standards range from 70mg/L to 300mg/L. Performance data are rare and/or difficult to obtain but suggest the community of Paulatuk reported a BOD_5 of 105mg/L and TSS of 88mg/L. No IFA communities known to disinfect effluent with chlorine.
3.0 Environmental Risk Assessment – Single Discharge Approach	Environmental Risk Assessments are required under the strategy. EDOs are expressed as concentrations and/or loads of substances.	Only Inuvik has loads (80 tonnes of BOD annually to receiving waters) listed on water license. Regulating by loads is an added burden (need accurate discharge flows) but makes compliance more equitable because communities that use less water and have more concentrated effluent will be more at risk of violating regulations.

Element of Technical Supplement 2	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
3.1 Completing an Environmental Risk Assessment	Goals are to determine potential impact of wastewater effluent in receiving water and to help limit substance concentrations and loads "at the end of the discharge pipe" in order to protect all uses of receiving water.	"End of pipe" framework is problematic for at least four communities. Effluent from lagoons is discharged to wetlands in Aklavik, Ulukhaktok, and Paulatuk. Doing the risk assessment as outlined in the strategy will be difficult without directions on assessing diffuse discharges such as on to treatment wetlands. Particularly if the wetlands are considered part of the treatment.
3.2 Environmental Quality Objectives	EQOs must be defined by identifying all uses of a particular water body – derivation of EQOs is tied to these uses.	Uses of water bodies can readily be identified. Establishing and measuring EQOs will be difficult given resources and remoteness.
3.3 Mixing Zone and Dilution Assessment	Assessment of mixing zones required – defined as "the area contiguous with a point source (effluent discharge site) or a delimited non-point source where the discharge mixes with ambient water and where concentrations of some substances may not comply with water quality guidelines or objectives"	Aklavik, Ulukhaktok, Paulatuk, and Inuvik are continually discharged, year round or during summer months. Tuktoyaktuk is decanted once annually and Sachs Harbour lagoon will eventually be decanted annually. Effluent that is discharged onto a wetland which allows for more treatment must be considered. Mixing zone for Tuktoyaktuk has been studied and demonstrated no adverse environmental effects. Applying this provision to lagoons with wetlands will be difficult unless the wetlands are considered part of treatment system. How will delimitation points be established?
3.4 Determining the Need for Effluent Discharge Objectives and 3.5 Developing Effluent Discharge Objectives	EQOs are desired characteristics or benchmarks that if attained will protect all water uses for a particular water body. Effluent Discharge Objectives (EDOs) are implemented in situations where it is projected or calculated that EQOs may be exceeded at the edge of the mixing zone.	Arctic specific EQOs should be developing through science and research mandate. While some Arctic ecosystems are fragile, the massive potential for dilution and overall large assimilative capacity for nutrients may result in unique Arctic EQOs. 100m prescriptive mixing zone measurements do not reflect any objective science based criteria and in diffuse wetland based systems will be difficult to measure. Establishing background loads within existing natural wetlands used to treat lagoon effluent will also be difficult and surrogate studies done elsewhere should be considered as a basis for reasonable guidelines especially for communities that will have limited capacity for assessing and developing need for EDOs.

Element of Technical Supplement 2	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
3.6 Summary	1. Identify uses of receiving waters. 2. Determine EQOs for substances of concern. 3. Characterize effluent. Identify which substances have a reasonable potential to exceed EQOs at the edge of the mixing zone. 4. Establish EDOs for substances of concern.	Uses can be readily identified. EQOs can be developed but special considerations for Arctic conditions may be needed. Edge of mixing zone will be difficult or impossible to establish in some locations. EDOs could be established but if they cannot be met and source reduction is not possible and treatment efficacy cannot be improved what choices remain for community?
4.0 Environmental Risk Assessment – Watershed Approach	Identifying total loadings from all sources in a watershed.	In most cases, cumulative impacts within a watershed are not significant. Communities are sole source of municipal effluent. In some cases, landfill discharge may contribute to watershed loadings of some substances but water licenses already consider all sources within a hamlet or community.
5.0 Effluent Characterization and Monitoring	Effluent characterization will be broken down by facility size.	All IFA community facilities will be considered very small with the exception of Inuvik which will likely be classified as small but likely reclassified as medium within 15 years.
5.1 Initial Characterization of Effluent	A one year initial characterization of the effluent discharge will determine which substances are of concern for the particular wastewater facility and will therefore need EDOs. For Very Small Facilities, $CBOD_5$, TSS, Pathogens and Nutrients must be sampled monthly with 24 hour composite samples for continuous discharges. For Small Facilities, $CBOD_5$, TSS, Pathogens, and Nutrients must be sampled monthly with 24 hour composite samples for continuous discharges and Acute and Chronic Toxicity must be sampled quarterly.	Broad spectrum characterization of all parameters listed in strategy (e.g. organics, all metals, phenolics, etc.) is generally unwarranted given the cost and difficulty of sampling in the region unless landfill leachate or industrial inputs are also received into facility. The strategy does say that Very Small and Small Facilities "are not required to complete the series of tests required for larger facilities" but it does say that toxicity sampling is required for all but Very Small Facilities. Toxicity testing should therefore only be required at Inuvik. Composite samples will be difficult and expensive to acquire. Sampling locations must be well chosen – particularly for lagoons that discharge into treatment wetlands.
5.2 Compliance Monitoring of NPS	Effluent discharge characteristics must be compared with the NPS through effluent compliance monitoring. When NPS are not achieved, wastewater facilities must look for opportunities to reduce the discharge of substances at the source and/or improve the facility or its operation so the	These restrictions, if applicable to Arctic regions, are unfairly biased because per capita usage of water is usually significantly lower for "trucked" communities than it is for southern Canadian communities. This results in higher concentrations but not necessarily higher loadings. Final effluent diluted to average per capita water usage may result

Element of Technical Supplement 2	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
	standards can be achieved. Effluent may not be diluted to achieve NPS or any other discharge limit. All monitoring samples are taken at the discharge, before the effluent enters surface waters.	in NPS compliant discharges including for toxicity standards. Dilution, however, is usually not an option given the cost of water but where possible it may be an economic alternative for very small communities. The strict requirement to take samples "at the discharge" may be difficult to interpret for facilities that exfiltrate diffusively or that enter wetlands or wetland/lake/pond complexes.
5.2.1 Continuous Discharge Facilities	Flow monitoring should be accurate to within 15% of the measured flow.	This will be difficult or impossible for most communities to achieve.
5.2.2 Intermittent Discharge Lagoons	For lagoon systems that discharge only when lagoons are emptied, typically once or twice a year, one sample is required during each discharge period. The sample must be taken during the last half of the discharge period and analyzed for TSS, and $CBOD_5$. Where wastewater is trucked rather than piped, flow may be estimated using generally accepted engineering principles.	One of the difficulties with taking samples during "last half of the discharge period" is getting samples to the airport in time as flights generally only leave once a day or only a few times per week. This restricts when samples can be taken. "Generally accepted engineering principles" needs to be defined.
5.3 Monitoring of EDOs	Based on the initial characterization results and the risk assessment, EDOs are established for certain substances on a site-specific basis. When EDO substances are consistently below 80% of the EDO value monitoring is not required with the exception of phosphorus, ammonia, and pathogens where monitoring is always required if identified as an EDO.	Strategy says that "monitoring frequency would not necessarily be the same for all substances since some substances are very expensive to measure and/or analytical expertise may not be available locally". This phrase should be clearer especially in the context of the 80% rule.
5.4 Toxicity Testing	Very Small and Small Facilities with industrial inputs including landfill leachate greater than 5% of dry weather flow must be routinely monitored for acute and chronic toxicity.	Toxicity testing is not likely to be required by any community in the region but if it were required would constitute a significant additional burden. Samples would have to be flown to Yellowknife and may not reach the lab within required time.
5.5 Sampling and Analytical Testing Methods	All testing should be done in accordance with the most recent edition of *Standard Methods for the Examination of Water and Wastewater*. Appendix A, Sampling Preservation and Storage (in draft strategy) states:	Standard Methods states for BOD_5 ($CBOD_5$): "In no case start analysis more than 24 h after grab sample collection. When samples are to be used for regulatory purposes make every effort to deliver samples for analysis within 6 h of collection." Standard Methods states for TSS: "Refrigerate sample at 4°C up to the time of analysis to minimize microbiological decomposition of solids. Preferably do not

Element of Technical Supplement 2	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
	$CBOD_5$ can be stored for up to 7 days. TSS can be stored for up to 14 days. Strategy states that all testing should be done by an accredited laboratory (CAEAL or CAEAQ in Quebec).	hold samples more than 24 h. In no case hold sample more than 7 d." Where do the longer storage times in the draft strategy come from? Do they result in biased results if followed? CAEAL has Proficiency Testing certification program and a wastewater program which are far less stringent and costly than full accreditation. Some jurisdictions such as Ontario allow wastewater to be tested in PT only accredited labs. The difference in standards of accreditation could mean the difference in doing analyses in a community or regional centre and sending them south. This requirement should be clarified.
5.6 Toxicity Failures	Toxicity test failures result in stepwise repeat toxicity testing through a complex process.	The Toxicity Reduction Evaluation (TRE) may be overly onerous for communities that have limited resources to respond to a toxicity failure. Ability to respond quickly to over limit toxicants such as ammonia will be limited.
6.0 Risk Management Decision-Making and 6.1 Risk Management Decision Process	The draft strategy outlines a risk management decision making process for occurrences when EDOs are exceeded.	Any risk management decision-making process needs to be adapted to circumstances unique to northern communities.
6.2 Reduction at Source	Communities should make efforts to reduce at source.	Most IFA communities will have limited opportunities to reduce effluent at source. Growing communities will have even more difficulty reducing at source. Northern constraints must be taken into account and standards that will result in chronic failures to comply will not improve the situation. All agencies need to cooperate to find meaningful made in the north solutions to municipal wastewater effluent.
6.3 Municipal Wastewater Treatment	The draft strategy describes resources for optimizing municipal wastewater treatment for facilities in southern Canada.	Constraints and circumstances unique to the Arctic must be identified and wastewater treatment practices across Canada's Arctic need to be thoroughly researched and best practices disseminated.
7.0 Environmental Monitoring	Environmental monitoring program should implemented to confirm EDO modeled outcomes. Details will be provided within 5 years.	Environmental monitoring programs need to be adapted to constraints and circumstances in Arctic communities. No mention in strategy about how forthcoming environmental

Element of Technical Supplement 2	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
		monitoring guidelines will be adapted to the north.
8.0 Combined Sewer Overflows	Combined sewer carry both storm water and wastewater.	CSOs are not found in the region.
9.0 Implementation Timelines	Strategy has scoring system that ranks risk level.	Facilities could score anywhere from low to high risk depending on results of $CBOD_5$, TSS, and Ammonia levels. Facilities scoring high risk will be required to have an accelerated implementation timeline of 10 years.

12 Analysis of Technical Supplement 3 and Impacts on IFA Communities

Element of Technical Supplement 3	*Details on Objectives/Requirements*	*Impacts or Significance to Region*
1.2 Standard Method Objective and 1.3 A Step-by-Step Standard Method	The draft strategy has a standard method or methodology for implementing the requirements of the strategy.	A standard method should be developed for Arctic communities.
2.0 Substances of Potential Concern	Primary treatment is estimated to reduce CBOD5 and TSS by 30% and 60% respectively.	Primary treatment, through lagoon treatment is standard approach. Additional treatment is achieved through wetland treatment in some communities. 30% reduction in $CBOD_5$ is unlikely to meet NPS. The strategy imposes the measurement of $CBOD_5$ as the main sewage strength indicator. No explanation or justification for this parameter is provided other than it is a conventional parameter. Many wastewater researchers are leaning toward adoption of Chemical Oxygen Demand (COD) as a more consistent method of measuring sewage strength. BOD_5 originated as a method in England because maximum travel time of rivers in England is 5 days and can be highly inconsistent between samples because of biological activity and sample transport requirements. COD, however, can be adequately correlated with $CBOD_5$ and is far easier to analyze. CAEAL now accredits “test in the tube” methods for COD that can be done with only 20mL of sample and done with a benchtop heating block and spectrophotometer in less than 2 hours. Hamlet employees could be trained to measure COD in the community or could send samples to a regional municipal lab allowing for far more frequent monitoring that would also eliminate sample quality problems associated with transportation. $CBOD_5$, however, is sufficiently complicated to require dedicated commercial labs to perform the test but is in fact less reliable. TSS is more complicated than COD but could also be undertaken by a municipality with some upfront capital costs and employee training. A cost-benefit analysis should be undertaken to see if communities in ISR should

		establish a dedicated COD/TSS lab in the region for the purposes of municipal wastewater monitoring. It should be noted that this would only be feasible if CAEAL PT accreditation was sufficient. Requirements for full accreditation would be prohibitively expensive. Cost savings through combined in-house drinking water analyses would also be prohibitively expensive because of the extra requirements for drinking water lab accreditation.
3.0 Initial Characterization Program		See above.
3.1 Facility Categorization		See above.
3.2 Perform MWWE Characterization		Comments in strategy on assessing effects of weather conditions must be adapted to Arctic conditions and constraints. For example, the supplement recommends sampling during and after high precipitation events but this is the most probable time for fly delays and cancellations in the Arctic.
4.0 Implementation of Initial Characterization Program		See above.
5.0 Environmental Risk Assessment – Single Discharge Approach		See above.
6.0 Environmental Risk Assessment – Watershed Approach		See above.
7.0 Selection of Substances for Compliance Monitoring		See above.

13 Overview of Implications of Draft Strategy for Region

IFA communities recently became owners of their wastewater treatment system, and the majority of IFA communities have limited community capacity to meet current monitoring and reporting requirements. The capacity shortfall does not only exist at the community level—there is limited capacity within all levels of regulators in the Arctic to monitor, assess, interpret and enforce. Assessing whether or not new designs and proposed technologies would work to meet Environmental Discharge Objectives (EDOs) will be difficult for the relevant water boards (NWTWB and GLWB) and regulators.

A five year window has been created for researching treatment efficiencies of lagoons and wetlands in the Arctic, for the development of Alternate National Performance Standards (NPS). Within the same window, communities will be required to complete risk assessments, including initial characterization. The implementation timeline for this requirement is not realistic for IFA communities, based on current financial and human resource capacity. Further, short-term funding mechanisms prioritize high risk facilities; as IFA communities are likely to be low-risk, according to the Strategy, assistance from senior levels of government will not be available until after the 5-year window, when the risk assessment and initial characterization are to be completed. At the same time, the cost for completing a site-specific environmental risk assessment and initial characterization are much higher in the North than the Strategy suggests, at approximately $20 to 30K each (Ken Johnson, personal communication).

All but one IFA community has trucked delivery, which is associated with a much lower per capita water use than for piped—the NWT design values for per capita water consumption are 90 L/person/day for trucked water delivery, and 225 L/person/day for piped delivery. If the Alternate NPS are concentration-based, this could in effect penalize communities with trucked service for using less water than communities with piped delivery. Higher concentrated effluent could skew toxicity testing failure rates, and the appropriateness of using an exotic species such as rainbow trout for toxicity testing is problematic. Further, there may be difficulties identifying the final discharge point, particularly with systems that utilize treatment wetlands. Further technical issues are identified for each element of the Strategy in Section 10 to 12.

Taken together, these implications clearly point to the need for an alternate approach, grounded in Northern social, economic and environmental realities. An Arctic-specific wastewater management framework must be developed in collaboration with Northern partners, including Inuit, to ensure that the important goal of protecting the environment and human health from the impact of wastewater is achieved.

13.1 RECOMMENDATIONS

The National Position Paper presented by Inuit Tapiriit Kanatami to Environment Canada provides both general and specific comments and recommendations on the proposed framework and regulations. Specific recommendations pertaining to the Inuvialuit Settlement Region include:

1) More consultation should occur in every community in the IFA and the timeframe for rolling out the framework and regulations should be expanded significantly and in response to demonstrated capacity.
2) All of the proposed framework and regulations should be adapted to Arctic conditions and capacity – not solely the National Performance Standards. Consultation should occur on adapting the EQO and EDO framework to suit Arctic conditions and capacity. Other proposed requirements such as monitoring and risk assessments should be re-evaluated for the Arctic.
3) Research on wastewater treatment technologies as well as social science research should occur in each region including the ISR.
4) More research should be conducted on impacts from wastewater effluent in the ISR specifically on wildlife and humans (i.e. all varieties of country food not only aquatic species). Research priorities should be set in consultation with the Inuvialuit.
5) More funding is needed for training in the ISR (at least $500,000) and a realistic and achievable plan for infrastructure and operation and maintenance is needed for the ISR.
6) There should be a 5 year public education campaign for each region, including the ISR, designed with input from the communities regarding the content, target audiences and method of delivery.

This is not an exhaustive list of recommendations and the Joint Secretariat of the Inuvialuit Settlement Region reserves the right to make additional comments and recommendations pertaining to the proposed Canada-Wide Strategy for the Management of Municipal Wastewater Effluent.

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