Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

NATIONAL ASSESSMENT OF WATER AND WASTEWATER SYSTEMS IN FIRST NATIONS COMMUNITIES

Summary Report

May 2003

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List of Acronyms

BWA	Boil Water Advisories
CRTP	Circuit Rider Training Program
IMAC	Interim Maximum Acceptable Concentration
MAC	Maximum Acceptable Concentration
AO	Aesthetic Objectives
INAC	Indian and Northern Affairs Canada
MTA	municipal-type-agreement
O&M	operation and maintenance
PWGSC	Public Works and Government Services Canada
HC	Health Canada
ABC	Association of Boards of Certification
GCDWQ	Guidelines for Canadian Drinking Water Quality

EXECUTIVE SUMMARY

In conjunction with First Nations, the Government of Canada is committed to ensuring provision of safe, clean water and effective wastewater services within First Nations communities. To assess the status of water and wastewater systems of First Nations communities, Indian and Northern Affairs Canada (INAC) undertook a comprehensive on-site assessment of on-reserve water and wastewater treatment facilities. The assessment considered performance, operating practices, operator qualifications, defined quality objectives and identified areas of improvement and required cost. The findings forms the basis of this report.

Responsibility for providing water and wastewater services to First Nations is shared among Band Councils, Health Canada and INAC. First Nations Band Councils have primary responsibility for the design, construction, operation and maintenance of water and wastewater systems. Systems are to be designed, built and operated in accordance with federal or provincial standards, whichever are more stringent. INAC provides funding to assist with the provision of water and wastewater services within reserve communities. Health Canada works in partnership with First Nations communities to monitor drinking water quality.

This assessment was based on an on-site inspection of each facility, and recent drinking water quality and wastewater effluent quality data. As the assessments were completed, the results were shared with individual communities so recommended improvements could be undertaken to reduce or mitigate potential water quality problems and minimize any health risks.

The assessment results indicated that, of the 740 community water systems assessed, about 29 percent (218) posed a potential high risk that could negatively impact water

quality. This does not mean existing water quality poses were an immediate health risk to water consumers. In situations where water is unsafe for drinking, Health Canada immediately advises Chiefs and

Councils to issue Boiling Water Advisories (BWAs). Another 46 percent (337) were classified as medium-risk systems. The remaining 25 percent (185) were in the low or no risk category.

Of the 462 community wastewater systems assessed, 16 percent (74) were classified at a potential high risk that could negatively impact wastewater effluent quality. About 44 percent (201) were in the medium-risk categories due mainly to operational problems. Another 40 percent (187) posed little or no risk but could require minor improvements.

During the assessment of water and wastewater systems, six major deficiency areas were identified. These are related to:

- design and treatment technology;
- operation and maintenance;
- operator skill levels;
- monitoring;
- operational equipment dysfunctions; and
- water source.

Mitigation measures are being implemented with a focus on high- and medium-risk water and wastewater systems. All regions, in co-operation with First Nations, are developing action plans to address deficiencies in all high- and medium-risk systems. Some initiatives, such as replacement or expansion of the facilities, will take time to implement. Remedial measures vary from improving operation and management practices to undertaking feasibility and engineering studies and design, upgrades of

existing systems, repair or replacement of equipment, provisions for backup equipment, supplies and electrical power. Some planned actions have already been completed, others are ongoing.

Expansion and enhancement of operator training programs are continuing. This includes the mandatory certification of all water and sewer facility operators. Beginning in the fall of 2000,

INAC took steps to expand its support of water system operators through the Circuit Rider Training Program (CRTP). INAC is also pursuing the development of other initiatives, such as
improvements in operation and maintenance practices, and establishment of a set of clear, enforceable water standards, based on the experience of different jurisdictions across North America.

The estimated cost of remedial actions was based on visual inspections and may not reflect actual costs. The capital cost to address deficiencies of the high- and medium-risk water and wastewater systems is estimated between $475 million and $560 million. The capital investment to provide basic water and wastewater services to about 5,300 houses, which do not now have basic water and sewer services, will cost roughly $185 million; and support for normal recapitalization and expansion for growth, is estimated to be $90 million to $100 million annually.

Based on the findings from the facilities assessment, specific actions are being taken to:

- develop and implement action plans to address recommended improvements;

- establish plans for the design and construction of new facilities and upgrade existing substandard systems;
- improve water quality and wastewater effluent quality monitoring programs;
- ensure effective and efficient operation and maintenance practices, including emergency maintenance management plans;
- develop a training strategy for the mandatory certification of all water and wastewater system operators;
- establish water quality standards, regulations and policies that will ensure

- adherence to established best management practices;
- establish partnership to coordinate watershed management and water source protection measures;
- develop an extensive water awareness campaign in First Nations communities; and
- develop a nationwide database to store First Nations' water and wastewater-related information.

1. INTRODUCTION

Indian and Northern Affairs Canada (INAC) works in co-operation with First Nations and other federal partners to ensure safe, clean drinking water and improved wastewater services to the residents of First Nations communities. INAC mainly provides funding for planning, designing, constructing, operating and maintaining the water and wastewater systems; First Nations have assumed day-to-day responsibility for the delivery of these services.

First Nations contract with professional engineering firms to carry out studies, design water and wastewater systems, and oversee construction. First Nations hire private contractors and suppliers to build the systems and provide equipment. First Nations staff operates and maintains the systems.

Some First Nations have agreements with neighbouring municipalities for the provision of these services. INAC policy requires that water and sewage systems be designed and built to meet federal or provincial standards, whichever are more stringent.

To assess the state of water and wastewater, INAC undertook an on-site assessment of all on-reserve water and wastewater systems to determine conditions in terms of system performance, associated risk levels and operating practices. System performance was also assessed in terms of meeting the *Guidelines for Canadian Drinking Water Quality* and the *Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments*. Recent drinking water sampling results and available wastewater effluent sampling results as well as other operational data were used in examining drinking water quality and the quality of wastewater effluent.
The goal of this report is to summarize the overall results of these on-site assessments and to identify ongoing remedial action.

1.1 Objectives of Assessment

The overall objectives of the assessment of water and wastewater systems were to conduct a comprehensive assessment of the on-reserve systems and their operation, to identify deficiencies, assess potential risk areas and recommend improvements. Specifically, the assessment was to identify:

- the water and wastewater systems that were unable to meet the requirements of the *Guidelines for Canadian Drinking Water Quality* and the *Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments*;
- the physical and operational components of the facility;
- the level of training of water and wastewater treatment plant operators;
- the remedial actions necessary to address identified deficiencies; and
- the cost estimates for remedial actions.

1.2 Assessment Methodology

The on-site assessments were done by the INAC regions with the collaboration of First Nations, Health Canada and Public Works and Government Services Canada (PWGSC) Client Service Teams.

To ensure consistency in the assessment of each system, a national Terms of Reference was jointly developed by INAC and PWGSC, based on the Terms of Reference previously developed by the Ontario First Nation Technical Services Corporation and PWGSC.

Regions engaged professional engineering consultants to carry out the assessment studies.

To fulfill the study objectives, each system was assessed using a series of questions attached to the national Terms of Reference. The questions dealt with the following main areas:

- water source or wastewater effluent receiver;
- type and performance of the treatment systems;
- operational practices;
- reporting practices; and
- the qualifications of operators.

Each system was given a point rating based on the identified deficiencies in the above-mentioned areas and then ranked as, high, medium or low risk. Details of the risk description are given in Appendix-A.

1.3 Scope of Work

The scope of the work for the consultant included, but was not limited to:

- completing the national survey questionnaires, collecting and interpreting the data gathered, assessing levels of risk, providing recommendations and cost estimates to address identified deficiencies;
- assessing all systems serving five or more homes;
- obtaining information from INAC, Health Canada (HC) and the community on reported incidences of problems with individual systems; and
- providing sufficient information to classify all treatment facilities in accordance with the listed guidelines.

1.4 Assessment Limitations and Constraints

The following are some examples of the study limitations:

- Individual systems and those serving fewer than five homes were not assessed.
- Water quality and wastewater effluent quality results considered for the study were based on the sampling database available from HC and INAC. Specific physical sampling of water and wastewater was beyond the scope of this study.
- Considering the urgency of the study and the budget constraints, the on-site assessment was conducted within a limited time frame.
- Study results may need further verifications with the community or their technical advisers where there are any uncertainties.
- The cost estimates were based on visual inspections and may not reflect the actual cost of improvements. Also, these estimates did not consider costs for improving facilities to meet any new provincial regulatory requirements.

This assessment should not be considered as reflective of overall water quality in First Nations communities. Instead, it provides a snapshot of the status of water and wastewater systems and makes recommendations for improvements to ensure continuous safe drinking water and wastewater services.

2. ROLES AND RESPONSIBILITIES

Programs and services for the provision of potable water and wastewater services for on-reserve First Nations communities are provided through Band Councils, HC and INAC.

First Nation Band Councils have responsibilities for ensuring that water and wastewater facilities are designed, constructed, maintained and operated in accordance with established federal or provincial standards, whichever are the most stringent.

INAC provides funding to First Nations to assist them in the provision of water and wastewater services within the reserve communities and monitors the design, construction and maintenance of the facilities. Funding is provided for capital construction or upgrading, as well as for the
operation and maintenance (O&M) of water and wastewater facilities, which includes training plant operators. INAC also funds First Nations for sharing services, such as water with neighbouring municipalities through municipal-type agreements (MTAs) when this is a cost-effective and practical solution.
HC works in partnership with First Nations communities to ensure water quality sampling, monitoring and surveillance programs are in place on First Nations lands. Water sampling and analysis are done in accordance with the *Guidelines for Canadian Drinking Water Quality (GCDWQ)*. HC assists First Nations in identifying and resolving water quality issues.

A copy of INAC's directives on water and sewage systems are available on INAC's Web site: "http://www.ainc-inac.gc.ca/ps/hsg/cih/ci/pd_e.html"

3. CANADIAN GUIDELINES FOR DRINKING WATER AND WASTEWATER

3.1 Drinking Water Guidelines

Maximum Acceptable Concentrations

The *Guidelines for Canadian Drinking Water Quality (GCDWQ)* are developed in collaboration

with all provinces and territories through the Federal-Provincial Subcommittee on Drinking Water. These guidelines are periodically adjusted with the availability of new scientific information. In *GCDWQ*, Maximum Acceptable Concentrations (MACs) have been established for certain physical, chemical, radiological and microbiological parameters or substances that are known or suspected to cause adverse effects on health. For some parameters, Interim Maximum Acceptable Concentrations (IMACs) are also recommended in the guidelines.

Drinking water that continually has a substance at a greater concentration than the specified MACs will contribute significantly to consumer exposure to the substance and may, in some instances, produce harmful health effects. However, the short-term presence of substances above the MAC levels does not necessarily mean the water constitutes a risk to health.

Aesthetic Objectives

Aesthetic Objectives (AO) apply to certain substances or characteristics of drinking water that can affect its acceptance by consumers or interfere with the supply of good quality water. For certain parameters, both AOs and MACs have been specified. For the parameters where only AOs are specified, these values are below those considered to constitute a health hazard. However, if a concentration in drinking water is well above an AOs, there may be a possibility of a health hazard.

New water systems or upgrades to existing facilities funded by INAC are required to meet the relevant section of Health Canada's *GCDWQ*, Web site and the National Building Code. Water systems must also meet provincial/territorial standards, except where these are less stringent than federal guidelines.

(For more information on *GCDWQ*, refer to HCs Web site, "http://www.hc-sc.gc.ca/ehp/ehd/catalogue/bch_pubs/dwgsup_doc/dwgsup_doc.htm)"

3.2 Wastewater Effluent Quality Guidelines

On-reserve wastewater treatment systems are designed and operated in such a manner that the effluent quality should meet the parameters of the latest edition of *Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments* established by Environment Canada and other applicable provincial/territorial requirements, if these are more stringent than the federal guidelines.

4.0 ASSESSMENT RESULTS

4.1 General Findings

Nationally, there are 761 water and 482 wastewater systems servicing five or more homes in First Nations communities. In addition, there municipal-type-agreements (MTAs) in place through which First Nations can buy water and wastewater services from neighbouring municipalities. Systems under MTAs have to meet provincial regulatory requirements and, therefore, were not considered for this study. Nationally, there are about 95 water and 91 wastewater MTAs between municipalities, First Nations and INAC.

Study results indicate that a large percentage of water and wastewater systems were considered to be Class I or II according to the system classification developed by the Association of Boards of Certification (ABC). The purpose of classifying these systems is to identify and standardize the complexity of the facility so appropriately qualified people are assigned to its operation and maintenance.

There are typically four water and wastewater system classifications. The classification of those systems is based on the population serviced and the complexity of the system. A community well supplying drinking water to First Nation residents can be an example of a simple Class I water plant. An example of a complex Class IV water plant would be an automatic package filtration plant with additional pre-treatment steps. The approximate percentage breakdown for facilities assessed according to the classification is shown in Table 1.

Table 1 - Classification of Water and Wastewater Facilities

	Class I %	Class II %	Class III %	Class IV %
Water Plants	73	23	3	1
Wastewater Plants	87	12	1	0

Community water systems at First Nations use a variety of treatment methods. The type of treatment applied varies with the source and characteristics of the raw water entering the system. The most commonly used method includes coagulation, filtration, flocculation and disinfection. Sometimes, a series of processes are applied in sequence to treat the water. Chlorine is the most common disinfectant used in First Nations water systems.

Various methods are used to treat community wastewater. A lagoon is the most common method of treatment. Mechanical systems such as Rotating Biological Contactors (RBCs) and Sequencing Batch Reactors (SBRs) and community septic systems are also used.

System operators play an important role in the operation and maintenance of water and wastewater facilities. Having qualified operators enhances the operational performance of the facilities and the quality of the water and wastewater effluent. During the assessment, data were collected on facility operational parameters, which included operator training, certification and experience.

About 1,200 people work in First Nations water and wastewater facilities. Approximately 10 percent of the operators met industry certification requirements. While some operators work in a water or wastewater facility, a number are engaged in the operation and maintenance of both water and wastewater facilities. Information gathered during the assessment indicates that approximately 65 percent of the operators received some form of training to operate the systems.

4.2 Community Water Systems

The study assessed 740 community water systems in 691 First Nations communities. The analyses of data for the 740 water treatment systems showed that approximately 70 percent of the assessed systems were meeting the *GCDWQ*, 30 percent of systems exceeded one or more parameters specified. Some systems exceeded parameters occasionally, others failed to meet the MACs or IMACs on a frequent or continuous basis. Those parameters most frequently exceeded included turbidity, trihalomethanes (THMs) and microbiological parameters, such as faecal coliform. In some instances, selenium, uranium and gross alpha concentrations were also exceeded.

About 39 percent (288) of the total assessed systems exceeded one or more of the AO parameters occasionally or continuously. The common parameters that were exceeded included iron, manganese, total dissolved solids, chloride, sodium, sulphate and turbidity.

Of the 740 community water systems assessed, about 29 percent (218) were classified in Category C, as posing a potential high risk that could negatively impact water quality. This does not mean that water is not drinkable at all times. In situations where water is considered unsafe for drinking, HC advises Chiefs and Councils to issue Boiling Water Advisories (BWAs) in those communities. Those advisories are lifted only when water is safe for consumption. Based on the recent reports from HC, less than 10 percent of the total water systems in First Nations communities are under BWAs for various reasons. Apart from repetitive failure to meet one or more MACs parameters as outlined in *GCDWQ*, the other reasons for potential high-risk systems included the combination of various factors, such as the lack of operator knowledge to run the water system, a poor raw water source, inadequate treatment in place and the lack of regular testing procedures and maintenance of records. Improvements or mitigation measures have or are being implemented to reduce or minimize potential risk areas. Examples of remedial actions are presented in Section 6.

An additional 46 percent (337) of the systems were classified in Category B and were considered to pose potential medium water quality risks. At this level, risks can be attributed to a combination of deficiencies including equipment failure, the absence of backup equipment or power sources, and the lack of emergency procedures, safety equipment and operating manuals in the facilities. Although these systems would not pose an immediate risk related to water quality, improvements to these facilities are required to ensure standards are met and potential water quality risks minimized. Almost 62 percent of the water systems did not have a formal emergency response plan in place.

Of the remaining systems, about 25 percent (185) were classified in Category A, posing essentially low or no risk to water quality. Commonly, these systems were having problems with inadequate lighting in the plant, unavailability of backup parts, and insufficient data reporting.

These systems could also need minor repairs to non-essential components, such as the interior walls of the plants.

The distribution of community water systems according to the potential risk is shown in Table 2.

Table 2. Number of Community Water Systems According to Potential Risk Category.

Name of Region	Number of Assessed Water System	Category A	Category B	Category C
Atlantic	17	0	4	13
Quebec and Cree	37	20	15	2
Ontario	131	35	35	61
Manitoba	66	28	32	6
Saskatchewan	98	31	51	16
Alberta	73	30	29	14
British Columbia	290	41	155	94
Yukon	28	0	16	12
Total	740	185	337	218
% of Total	100%	25%	46%	29%

Notes:

Category A - Water systems experiencing minimal problems or without any problems.

Category B - Water systems requiring some repairs.

Category C - Water systems with potential health and safety concerns.

4.3 Community Wastewater Systems

The study assessed 462 wastewater systems in 459 First Nations communities. Where available, wastewater effluent sampling results were verified to determine compliance with the Canadian "*Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments"*. The analyses of data for 462 community wastewater systems indicated that about 78 percent (360) of the total systems were able to meet these guidelines. The remaining 22 percent (102) of the systems failed to meet the criteria of one or more effluent parameters occasionally or continuously. The parameters exceeded most frequently were Biological Oxygen Demand (BOD), Total Suspended Solids (TSS) and Faecal Coliform.

Of the total systems assessed, about 16 percent (74) were classified under Category C and were considered to pose potential high risks that could negatively impact wastewater effluent quality. In addition, 44 percent (201) of the wastewater systems were classified under Category B as posing medium risks, and experiencing operational problems such as the need for minor repairs or upgrades. The remaining 40 percent (187) of wastewater systems were classified in Category A, posing little or no risk to the community.

The distribution of wastewater treatment systems according to the risk categories is shown in Table 3.

Table 3. Number of Community Wastewater Systems According to Potential Risk Category

Name of Region	Number of Assessed Wastewater System	Category A	Category B	Category C
Atlantic	16	1	9	6
Quebec and Cree	37	23	11	3
Ontario	58	21	15	22
Manitoba	67	37	25	5
Saskatchewan	97	33	59	5
Alberta	64	40	12	12
British Columbia	112	25	68	19
Yukon	11	7	2	2
Total	462	187	201	74
% of Total	100%	40%	44%	16%

Notes:

Category A - Wastewater systems experiencing minimal problems or without any problems.

Category B - Wastewater systems requiring some repairs.

Category C - Wastewater systems with potential health and safety concerns.

4.4 Common Deficiencies

In spite of INAC's continuous efforts to support the provision of safe, clean drinking water and effective wastewater services for First Nations communities, the assessment identified a variety of problems with respect to design, operation and maintenance of water and wastewater systems. Each system was given a weighting factor based on the identified deficiencies and potential health

and safety impacts. The study findings have revealed that a combination of deficiencies, as well as potential health and safety impacts determined the risk category of each system. For example, systems with a large number of deficiencies with high health and safety concerns were classified as Category C.

Common deficiencies have been grouped into six major areas and summarized below (not in order of prevalence or magnitude).

1. Design and Treatment Technology
    - inappropriate treatment technology;
    - no treatment in place; and
    - system does not meet community needs.

2. Operation and Maintenance
    - lack of adequate equipment;
    - lack of maintenance equipment;
    - poor record keeping;
    - absence of O&M manuals;
    - inadequate cleaning program for water reservoir & water delivery truck;
    - lack of regular maintenance; and
    - the absence of emergency plans.

3. Monitoring
    - insufficient monitoring and recording of results

4. Operator Status and Training

- lack of certified operator;
- inadequacies in operator training programs; and
- unavailability of backup operators.

5. Operational Equipment Dysfunctions

- recurring operational problems with automatic control systems;
- operational problems with the chlorine pump and well pump;
- lack of backup equipment and power supply; and
- the absence of replacement parts/supplies.

6. Water Source

- absence of source water protection; and
- potential contaminants affecting raw water quality.

5. ISSUES AND CHALLENGES

The assessment of water and wastewater systems in First Nations communities provided some insights of issues and challenges related to the provision of clean potable water and efficient wastewater treatment services. Some observed challenges and hurdles that contributed to the poor performance of water and wastewater systems were:

- variations in the quality and quantity of source water;
- increased design requirements;
- premature ageing of the systems;
- the lack of water source protection;
- inadequate operator training and qualifications.

5.1 Variation in Quality and Quantity of Source Water

Challenges

Generally, First Nations communities draw their source water from surface water (rivers, lakes, etc.) and groundwater sources (wells). Due to the temporal variations of raw water quantity (e.g., reduction during dry periods) and quality (e.g., variation of turbidity, natural organic matter), some water systems may not be able to meet water quality guidelines continuously. Moreover, due to economic development and population growth in communities, some water systems are under strain to meet water quantity demands.

Improvements Required

More engineering study at the pre-design stage of the system will help alleviate water quantity and quality problems. It will also be necessary to investigate alternate sources of supply, and further

improvements of existing systems will be required to meet the water quality guidelines.

5.2 Increased Design Requirements

Challenges

Water quality guidelines in Canada are evolving, and most provinces are developing more stringent rules and regulations to protect public health. For example, in December 1993, the

Canadian drinking water quality guideline for total Trihalomethanes (THMs) was revised by the federal government from 0.35 mg/l to an interim maximum acceptable concentration of 0.1 mg/l. Many existing community water systems failed to meet the revised guidelines. In some cases, the systems were not designed to treat new contaminants not previously identified.

Wastewater treatment systems were often not capable of accepting additional sewage, which resulted in treatment difficulties. Consequently, these systems were exceeding federal effluent quality guidelines and required further upgrades.

Improvements Required

When surface water is being used as a source, which has a potential for contamination and is only being treated by chlorination, additional treatment steps have to be implemented to treat the possible occurrence of giardia and cryptosporidium.

It should be recognized that the overall increase in contaminants will lead to further changes in standards and regulations. To comply with the new standards and regulations, future upgrades of existing facilities will be an ongoing requirement. Wastewater treatment systems, which experienced treatment difficulties due to additional wastewater quantities beyond their current capacity and those exceeding federal effluent quality guidelines, will require further upgrades.

5.3 Premature Ageing of Systems

Challenges

Premature ageing of the water and wastewater infrastructure poses a significant challenge in providing safe water and wastewater services. Inadequate operation and maintenance practices or improper operation by poorly equipped technicians have resulted in premature replacement of equipment or system components, and service interruptions

Improvements Required

Adequate monitoring coupled with improved O&M practices and qualified operators can significantly reduce the premature ageing of systems.

5.4 Lack of Source Water Protection

Challenges

Both surface water and groundwater sources are vulnerable to potential contamination. Potential sources of contamination that were observed include infiltration in wells, agricultural run-off resulting from the use of farm fertilizers and pesticides, contamination from recreational use of lakes, oil and gas activities around lakes and drainage areas.

Improvements Required

The safety of drinking water can be protected significantly by adopting watershed management and wellhead protection plans. These still need to be developed and implemented in First Nations communities. Given that the sources of much of the contamination may occur off-reserve, there is a need to co-ordinate efforts with local municipalities and provincial agencies to ensure source water protection plans are in place.

5.5 Inadequate Operator Training and Qualifications

Challenges

Proper operation and maintenance of water and wastewater treatment and distribution systems depend largely on the qualifications of the operators. Although training of First Nations water and wastewater system operators has been enhanced, there is still a great need for additional training. A high-turnover rate of the trained and experienced operators also poses a major challenge to retain qualified and experienced operators.

Improvements Required

Specific training is required to operate the systems using a modern treatment technology, such as Reverse Osmosis (RO), Ultraviolet (UV) disinfection to treat the water. Special skills are required to operate the complex mechanical wastewater treatment systems.

6. ACTION TAKEN TO DATE

6.1 Examples of Activities

As soon as the assessments were completed, results were shared with the individual First Nations. Where potential risks were identified, the communities were contacted, and necessary precautions or corrective measures were taken. Remedial work is under way or planned by INAC regional offices for each community system categorized as a potential high- and medium-risk. Mitigation measures are being adopted that consider the specific nature of the problem. HC works in partnership with First Nations communities to ensure that water surveillance programs are in place. If water is unsafe for drinking, HC advises First Nations Chiefs and Councils to issue Boiling Water Advisories. Some deficiencies are being addressed immediately and others will need to be included in ongoing capital plans. The nature of the work to address the deficiencies may vary from improvement of O&M practices and the need for feasibility studies, design, new construction and system upgrades to equipment replacement.

Examples of remedial actions include:

- planning for construction of new water and wastewater systems;
- improvements to existing water and wastewater treatment systems;
- enhancement of operator training (CRTP and other) leading to certification; and
- replacement of equipments.

INAC is constantly working to ensure the provision of clean, safe drinking water and better wastewater services to the residents of First Nations communities. Since the assessment, action has been taken in a number of areas, such as additional investments in water and wastewater

facilities, enhancement of operator training and certification, improvements to operation and maintenance practices, the development of standards and protocols, creation of public awareness and the creation of regional water teams to oversee First Nation water and wastewater-related issues.

Investments in Water and Wastewater Facilities

Since 1995, INAC has committed over $560 million to address the upgrade and expansion of water and sewer services in First Nations communities. This is in addition to the $100 million to $125 million normally allocated for water and sewer services annually. Additional investments in 2002-2003 include $50 million from the Gathering Strength initiative, and a large portion of $43.4 million from the government-wide Rust Out initiative, for upgrades and the construction of new water and wastewater facilities. In addition, approximately $3.8 million was made available in 2002-03 from the Infrastructure Canada Program for improvements in water, wastewater and other "green" infrastructure.

Operator Training and Certification

Water and wastewater system operators play an important role in providing clean water services and safe wastewater disposal in First Nations communities. INAC allocates about $2 million - $3 million annually to support training of First Nations on-reserve system operators. INAC provides support for operator training through the Circuit Rider Training Program (a key component of training and enhancing the skills of operators), for participation in relevant courses and workshops and preparation for certification exams. The CRTP program was introduced in the mid-1990's to provide on-site, hands-on training to operators. Under the CRTP, a qualified instructor trains the operators on-site using the equipment they will be operating. In 2000-2001, INAC took measures to expand the CRTP to improve operation and maintenance of water facilities on reserves. This expansion has continued with additional funding, of roughly $5 million to

include all operators who had not yet received the CRTP or equivalent training. INAC, in consultation with First Nations and other partners, is developing a strategy for the training and certification of operators of water and wastewater systems. The target is to have all operators certified within the next three years.

Operation and Maintenance (O&M)

On a national basis, INAC provides about $40 million annually to First Nations for the operation and maintenance of water and wastewater systems. In 2001, a team of regional and Headquarters representatives undertook a study to review current water and wastewater systems, O&M practices and funding levels. The report, will include recommendations of the best O&M practices and further improvements to the current funding methodology.

Development of Standard and Protocols

A working group composed of Headquarters and regional staff from INAC, PWGSC, HC and Environment Canada, as well as representatives from First Nations, has undertaken a review of health risk monitoring and intervention protocols being used or proposed by provincial, territorial, municipal and other jurisdictions. This includes the frequency of testing, reporting of test results, required procedures in instances where potential unsafe conditions occur, including urgent and emergency response protocols and contingency plans.

INAC has also initiated a study to develop a comprehensive set of standards and compliance mechanisms for small and rural systems that will be suitable for systems in First Nations communities.

In addition, INAC and HC are exploring the possibility of sharing information needed to monitor facility conditions and water quality to allow for the early detection of potential problems.

Public Awareness

INAC, in consultation with other departments, developed a document entitled "*Safe Drinking Water on First Nation Reserves - Roles and Responsibilities*" aimed at informing First Nations decision makers (Chiefs, Councillors and Administrators) of their roles and responsibilities in ensuring the safety of water supplies within their community (This document is available at the INAC Web site, http: www.ainc-inac.gc.ca/ps/hsg/cih/ci/ic/wq/wqr_e.html). More awareness materials related to water quality are being developed. This includes, effective maintenance and the role of plant operators, water management, and private septic and cistern maintenance. A variety of mechanisms are being discussed for delivering the awareness information to First Nations including workshops, information sessions, brochures, posters, CDs, videos and the Internet.

Regional Water Teams

Due to the significant issues related to water and wastewater systems in First Nations communities, INAC has been setting up regional water teams to oversee the implementation of regional water and wastewater remedial action plans. In addition to INAC officials, representatives from First Nations and Health Canada are included on the teams.

Data Management

The information collected from the facilities was stored in a specially designed database. Currently, this database is being enhanced to facilitate the effective and efficient collection and

collection and management of water quality information.

6.2 Estimated Cost of Remedial Action Over the Next Five Years

One purpose of the assessments was to identify deficiencies, suggest remedial measures and develop cost estimates to reduce or eliminate these deficiencies. All the regions have developed action plans to address the deficiencies of medium- and high-risk water and wastewater systems. The capital cost to address these deficiencies is estimated between $475 million and $560 million. This estimate is based on on-site visual inspections of water and wastewater systems and may not reflect the actual cost. In addition to the above-mentioned costs, approximately $185 million and $500 million would be required to address the backlog and provide water and wastewater services to new homes respectively. The estimated cost to improve O&M practices, enhance training, develop standards, monitor wastewater, create awareness and develop emergency plans is approximately $500 million.

7. CONCLUSIONS AND RECOMMENDATIONS

While community drinking water and wastewater services in First Nations communities have improved due to the initiatives taken by INAC, First Nations and other federal partners, many challenges remain. The following are the recommendations based on the findings from the facilities' assessments.

1. First Nations and INAC must develop and implement regional action plans to address the deficiencies which may pose a potential risk related to water quality and wastewater effluent quality.
2. With a priority on identified high- and medium-risk facilities, INAC, in co-operation with First Nations must develop and implement a plan to upgrade old and build new water and wastewater facilities to meet community needs. These facilities should comply with established design, construction and water quality standards.

3. An effective water quality and wastewater effluent monitoring program, combined with a comprehensive reporting system, should be developed to enhance the detection of drinking water and wastewater problems.
4. An effective O&M program applicable to small/rural systems should be developed that will include emergency and preventive maintenance practices for both water and wastewater systems. These improved O&M practices will increase the safety of communities and the protection of assets. A site-specific maintenance management plan should also be developed and implemented for all facilities.
5. A training strategy must be developed and implemented to continue the expansion of the existing CRTP, to ensure all water and wastewater treatment plant operators have the sufficient skills, knowledge and experience to accomplish their duties. A policy must be developed to introduce mandatory certification of operators. At a minimum, each operator should be certified to the level of facility he or she operates.
6. As source water protection is a key component of the multi-barrier approach of preventing contamination of water, watershed management and sourcewater (surface and ground) protection plans should be adopted in conjunction with federal, provincial and local programs.
7. Emergency response plans for both water and wastewater systems should be developed and implemented for all systems.
8. An extensive awareness campaign should be undertaken so First Nations become aware of their roles and responsibilities to protect community water and wastewater systems including privately owned systems.
9. A standard policy and protocols relating to water and wastewater systems should be developed to ensure safe, clean water and effective wastewater services.
10. A nationwide database for water and wastewater systems should be developed and maintained to assemble, update and store the essential water and wastewater-related information.

Significant progress has been achieved in improving water quality in First Nation communities over the last 10 years. For example, in 1991, less than 80 percent of on-reserve houses had basic water and sewer services; in 2001, about 98 percent of on-reserve houses had water and 94 percent had sewer services. During this time, First Nations have assumed a greater role in the management and delivery of services as part of their move toward self-government.

Although progress has been made in terms of the provision of water and wastewater services to First Nation communities, a significant amount of work still needs to be done to ensure sustainable, safe water supplies and wastewater services.

In future years, INAC will continue to place a priority on water and sewer investments.

APPENDIX-A

Risk Categories

Category A: These are systems that operate with minor deficiencies. Usually, the systems meet the parameters specified by the Canadian guidelines. Deficiencies under this category include inadequate lighting, an obstructed entrance to the building or the need to recondition interior walls.

Category B: These are systems with deficiencies, which, combined, pose a medium risk to the quality of water. These systems would not generally require immediate action, but the deficiencies could be more easily corrected to avoid future problems. The absence of backup equipment, the lack of operating manuals and insufficient operator training, are some examples of deficiencies under this category.

Category C: These are systems with major deficiencies which, combined, pose a high risk to the quality of water quality and may lead to potential health and safety concerns. This could result in BWAs, repetitive non-compliance with MACs parameters of the Canadian guidelines, and inadequate water supplies. Once systems are classified under this category, regions jointly with First Nations are to undertake immediate corrective action to minimize or eliminate deficiencies.