Drinking Water Safety in Newfoundland and Labrador

Annual Report 2006

Newfoundland Labrador

Drinking Water Safety
in
Newfoundland and Labrador

Annual Report 2006

For additional copies, please contact:

Water Resources Management Division
Department of Environment and Conservation
Government of Newfoundland and Labrador
PO Box 8700
St. John's NL A1B 4J6
Telephone: (709) 729-2563
Fax: (709) 729-0320

This documents is also available electronically at:
http://www.gov.nl.ca/env/water

Printed on paper with recycled content.

On the cover:
Photo courtesy of Tina Coffey, Department of Environment and Conservation.

Message from the Minister

As the Minister of Environment and Conservation I am pleased to introduce the fifth annual report on drinking water safety in Newfoundland and Labrador. The outline of this report follows the steps of the Multi-barrier Strategic Action Plan, which in turn follows government's mandate to ensure drinking water safety. This report describes the many activities that contribute towards ensuring safe drinking water. It outlines progress made over the reporting year from April 1, 2005 to March 31, 2006 and the path forward for 2006/ 7 and beyond. This report features many inserts that highlight points of interest about drinking water and showcase many of the diverse activities that are being carried out by all the people concerned.

A key objective for this government is to prevent contamination of our water resources and to restore the wholesomeness of water where quality concerns exist. Drinking water originates from ponds, rivers and groundwater aquifers, is treated to varying degrees and is pumped through distribution systems to the taps in our homes and businesses. Because water passes through several steps, there are many things that can happen to affect the cleanliness, safety and security of drinking water. Therefore it is paramount to implement processes at each stage of the water system to ensure there are multiple safeguards in place at all times.

This multi-barrier approach to protecting drinking water takes a collaborative effort involving several departments and their staff with many diverse areas of specialized technical expertise. Reliable access to good quality water is extremely important to the people of this province and therefore government remains committed to building on the success of the Multi-barrier Strategic Action Plan and to taking necessary steps to ensure and improve drinking water safety. In cases where there are difficult water quality issues, it may take a concerted effort to find the ideal solution, and it may take time to get past interim measures such as boil water advisories. However government pledges to continue to work hard on behalf of the people of Newfoundland and Labrador to ensure clean, safe and secure drinking water.

I acknowledge and extend thanks to my staff of the Water Resources Management Division for their commitment and hard work to drinking water safety. Congratulations on being awarded the ESRI Canada Award of Excellence for the innovative GIS application that was developed for drinking water. I also recognize the efforts of the front-line staff and management of the departments of Government Services, Municipal Affairs, and Health and Community Services as well as the Regional Integrated Health Boards, municipal governments and the Public Health Laboratory for their collaborative roles in the implementation of the Multi-barrier Strategic Action Plan for drinking water safety. My thanks are extended to the members of the Safe Drinking Water - Technical Working Group for their valuable work coordinating drinking water issues.

Clyde Jackman
Minister

Executive Summary

This fifth annual report on drinking water safety in Newfoundland and Labrador outlines accomplishments and activities for 2005/6 under the Multi-Barrier Strategic Action Plan (MBSAP) for drinking water safety. Chapter 1 of the report explains what the MBSAP entails and outlines the contents of the other chapters of this report.

Source water, whether it is a pond, brook or well, water treatment systems and the distribution system are the physical components where the first level of the MBSAP is applied. Source protection of surface or groundwater water supplies, of which there were 522 in the province, is an important way to protect the original natural quality of water from impacts due to land use activities. Water treatment comprised of 459 chlorination systems, 14 water treatment plants and several other systems with filtration or other treatments, are operated to remove or inactivate microbiological contamination, remove chemical substances or to improve upon aesthetic parameters. The water distribution itself is an important determinant of water safety, but there are many challenges with this component as there are 551 water supply systems serving all types of communities from cities to small local service districts. Ageing infrastructure is again being cited as one of the main issues that government addressed in 2005/6 by investing $35 million for water related projects.

The second level of the MBSAP includes chemical, physical and bacteriological water quality monitoring as well as, reporting, inspection and operator training. Statistics in Chapter 3 show that there were 2,465 tap water samples and 587 source water samples analyzed for over 30 parameters including THMs and HAAs as well as 20,993 samples for bacteriological water quality. New data management systems and reporting tools were being developed to help mange this data. Whenever test results exceeded provincial standards appropriate action was taken. The number of boil advisories on public water supplies, of which there were 222 as of March 31, 2006, continues to draw attention but this number declined compared to the previous year. Apart from direct infrastructure improvements, inspections, issuing of construction and operating permits, and operator training are all helping to make continuous improvements to public water supplies.

The third and last level of the MBSAP deals with legislative and policy frameworks, public involvement and awareness, setting guidelines, standards and water quality objectives, and research and development. Some of the highlights in this area include enforcement of the Water Resources Act, as well as other applicable legislation. Government continues to make significant strides in providing information to the public about drinking water at the community level. For example, the Department of Environment and Conservation has released a new map showing potential fluoride concentrations and helped publish a booklet about caring for private drinking water wells. Government is working with other federal agencies in areas such as drinking water quality guidelines.

In conclusion, government is committed to ensuring drinking water safety by following a Multi-Barrier Strategic Action Plan. This plan will involve activities to be undertaken by four line departments; Environment and Conservation, Municipal Affairs, Health and Community Services and Government Services; each contributing uniquely to the plan by means of their respective mandates and programs. Coordination between the departments is ensured by a Technical Working Group which meets frequently and which reports to a committee of senior government officials.

Table of Contents

Table of Contents

List of Figures

List of Tables

Glossary of Terms

Bacteria:
Microscopic unicellular organisms having a rigid cell wall structure.

Chlorination:
An oxidation process that is initiated through the addition of chlorine to water. Chlorine oxidizes microbiological material, organic compounds and inorganic compounds.

Chlorine:
A chemical used as a disinfectant and oxidizing agent for drinking water.

Coliform:
A group of bacteria commonly found in the environment and also in the intestinal tract of mammals, including humans, whose presence in water may indicate contamination by disease-causing microorganisms.

Colour:
A physical characteristic of water attributed to the presence of coloured organic substances, or metals.

Disinfection:
The process of inactivating pathogenic organisms (disease causing bacteria, viruses, fungi and protozoa) by either a chemical or physical means.

Geographic Information System (GIS):
An information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records.

Haloacetic acids (HAAs):
A group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation).The haloacetic acids most commonly found in drinking water are monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), monobromoacetic acid (MBA) and dibromoacetic acid (DBA).

Inorganic:
Relating or belonging to the class of chemical compounds that do not contain carbon as the principal element and are of mineral origins such as salt and iron.

Glossary of Terms

Organic:

Relating or belonging to the class of chemical compounds having a carbon basis such as hydrocarbons.

pH:

A measure on a scale from 0 to 14 of the acidity or alkalinity of a solution where 7 is neutral, greater than 7 is more basic and less than 7 is more acidic.

Protected Water Supply Area:

An area surrounding a public water supply source, either surface water or groundwater, which has the activities that take place in the area regulated by government. The area is protected under Section 39(1) of the Water Resources Act.

Public Water Supply System:

A water supply system operated by a community.

Trihalomethanes (THMs):

A group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation). The trihalomethanes most commonly found in drinking water are chloroform, bromodichloromethane (BDCM), dibromochloromethane (DBCM) and bromoform.

Turbidity:

A measure of the cloudiness of water.

Water Supply System:

Term to describe the entire network (i.e. pumps, pipes, valves, water treatment units etc.) used to transport water from a water supply source to the consumer.

Water Treatment Plant:

The portion of a public water system which is designed to alter the physical, chemical, biological or radiological quality of the water or to remove any contaminants.

List of Acronyms

BCDM	Bromodichloromethane
BWA	Boil Water Advisory
CFS	Canadian Forestry Service
DBP	Disinfection byproduct
DWIMS	Drinking Water Information Management System
DWQ	Drinking Water Quality
ENVC	Department of Environment and Conservation
GCDWQ	*Guidelines for Canadian Drinking Water Quality*
GIS	Geographic Information System
GS	Department of Government Services
HAA	Haloacetic Acid
HCS	Department of Health and Community Services
ILUC	Interdepartmental Land Use Committee
IMAC	Interim Maximum Acceptable Concentration
LTD	Less Than Detection Limit
MA	Department of Municipal Affairs
MAC	Maximum Acceptable Limit
MBSAP	Multi-Barrier Strategic Action Plan
MTU	Mobile Training Unit
OETC	Operator Education Training and Certification
QA/QC	Quality Assurance/Quality Control
SDW-TWG	Safe Drinking Water Technical Working Group
UV	Ultraviolet

1 Introduction

1.1 Overview

This is the fifth annual report on the safety and quality of drinking water in the province of Newfoundland and Labrador. It provides information about the progress and accomplishments that were made to ensure drinking-water safety during the 2005/6 fiscal year.

The Government of Newfoundland and Labrador provides the public with clean and safe drinking water by applying the Multi-Barrier Strategic Action Plan (MBSAP). The multi-barrier approach is considered to be the most effective way to manage drinking-water systems. It recognizes that health and environmental issues are inter-related, and thus helps integrate efforts to improve public health and to protect the natural environment.

Simply put, the MBSAP uses three multi-component levels of protection to safeguard the quality of drinking water. The levels and their components (shown in Figure 1) are:

Level 1

- source-water protection
- drinking-water treatment
- drinking-water distribution system

Level 2

- monitoring
- inspection and enforcement
- data management and reporting
- operator education, training, and certification

Level 3

- legislative and policy frameworks
- public involvement and awareness
- guidelines, standards, and objectives
- research and development

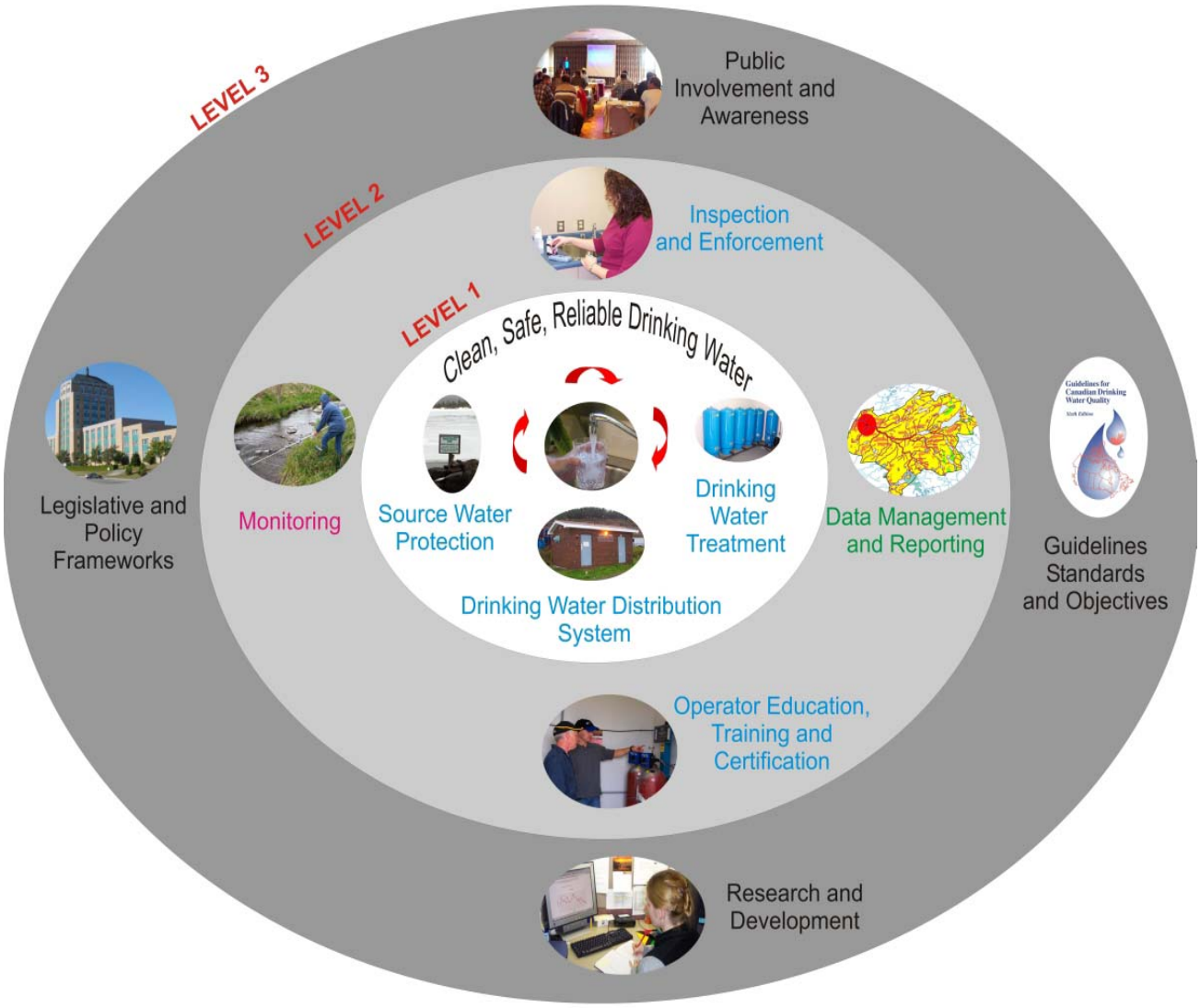
The three components in Level 1—source-water protection, drinking-water treatment, and the water-distribution system—are the main elements of the MBSAP. These three major elements are supported in an integrated manner by applying the procedures and tools in Levels 2 and 3 of the MBSAP.

The main goal of the MBSAP is to put adequate safeguards in place at each stage of the water supply system so that the possibility of pathogens or other contaminants entering it is minimized. Secondary goals include: providing public access to drinking-water-quality data, ensuring open and transparent communication with the public on all drinking-water-quality issues, increasing public confidence in the quality of drinking water, and ensuring long-term sustainability of our water-supply systems.

Four government departments work together to implement the MBSAP. Each department (listed in Figure 1) is responsible for one or more key elements of the MBSAP. A committee of Deputy Ministers deals with drinking-water safety on a proactive basis. The committee, chaired by the Deputy Minister of Environment and Conservation (ENVC), includes the Deputy Ministers of: Health and Community Services (HCS), Municipal Affairs (MA), and Government Services (GS).

The Deputy Ministers' committee is supported by the inter-departmental "Safe Drinking Water - Technical Working Group" (SDW-TWG). Its members are drawn from the same four departments: Environment and Conservation, Health and Community Services, Municipal Affairs, and Government Services. In addition, representatives from the Public Health Laboratory plus the Medical Officers of Health from each of the province's regional Health Authorities belong to the Working Group. The SDW-TWG is chaired by the Department of Environment and Conservation.

Figure 1 : The Components of the Multi-Barrier Strategic Action Plan (MBSAP)



PARTICIPATING AGENCIES

Agencies in four provincial government departments oversee the implementation of the MBSAP. Their participation in the various components is denoted by the following colour coding:

Department of Environment and Conservation

Departments of Environment and Conservation / Health and Community Services / Government Services / Municipal Affairs / Federal Government

Departments of Environment and Conservation / Government Services

Departments of Environment and Conservation / Municipal Affairs

Led by the Deputy Ministers' committee, the four government departments continue to make progress in implementing the MBSAP for drinking-water safety. This report is part of their regular efforts to inform the public of the status of drinking-water quality in the province.

As in previous years, the structure of this annual report reflects the key elements of the MBSAP. Primarily it reports on progress made in implementing the MBSAP, using available data from the fiscal year 2005/6 (from April 1, 2005 up to and including March 31, 2006). This year's report includes several success stories and details about various elements of the MBSAP. Information boxes throughout the report highlight and complement the main text.

1.2 Objectives

The main objective of this report is to provide an overview of activities undertaken to advance the MBSAP, and present the progress made toward ensuring drinking-water safety. The highlights include:

Section 2: the progress and accomplishments made through activities in Level 1 of the MBSAP: source-water protection; water treatment; the water distribution system

Section 3: the progress and accomplishments made through activities in Level 2 of the MBSAP: monitoring; inspection and enforcement; data management and reporting; operator education, training, and certification

Section 4: the progress and accomplishments made through activities in Level 3 of the MBSAP: legislative and policy frameworks; public involvement and awareness; guidelines, standards, and objectives; research and development

Section 5: a summary of the progress and accomplishments made through activities in all levels of the MBSAP

Section 6: the proposed activities of the path forward for the next fiscal year (2006-07) that will provide clean, safe, and secure drinking water in the province

2 Level 1 of the MBSAP

2.1 Source Water Protection

"Source-water protection" means taking action to prevent contaminants from reaching sources of drinking water. Sources can be surface water or groundwater. Surface-water sources include rivers, lakes, ponds, and reservoirs. Groundwater sources include both dug and drilled wells.

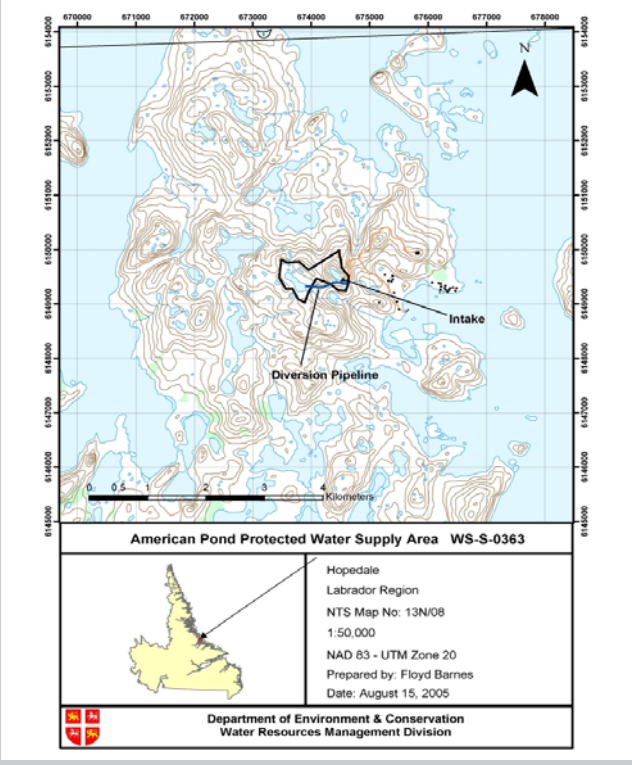
Protecting drinking water at the source can both protect public health and reduce the challenges involved in water treatment. The *Water Resources Act* is used to designate and protect drinking-water sources as Protected Public Water Supply Areas**.**

Every water supply that is considered for designation as a Protected Public Water Supply Area goes through a specific designation process. First, information about its ownership, drainage patterns, watershed area, nearby land-use activities, and surrounding topography is submitted to the Interdepartmental Land Use Committee (ILUC). After ILUC reviews and releases the information, the water supply is ready to be legally designated a Protected Public Water Supply Area. Once this is done, all activities within the protected area are controlled, and high-risk activities that could impair water quality are restricted.

Interdepartmental Land Use Committee (ILUC)

Cabinet approved the formation of the Interdepartmental Land Use Committee (ILUC) in August 1983. Under the Memorandum of Council that was issued, ILUC became the body that coordinates Government's resource-development activities. Since 1983, any government department's legislation, regulations, policies, plans, etc., that involve the use of Crown or public lands must be referred to ILUC before being approved and implemented. In circumstances where ILUC is unable to resolve the land-use conflicts, the issue is referred to the responsible Minister. If an issue is so unusual or exceptional that it cannot be resolved by the responsible Minister, the proposal is referred to Cabinet.

When a new or existing public water supply is being considered for designation as a Protected Public Water Supply Area, information about it is reviewed by ILUC. The purpose of the process is to bring any land-use conflicts to the attention of those involved at the *beginning* of the planning process, to avoid controversy once a project has commenced. During the ILUC review process, government departments have the opportunity to identify and address existing or potential land-use conflicts. When issues are resolved, the water supply can then be designated as a Protected Public Water Supply Area.



Newfoundland and Labrador has one of the most widely adopted and well-established source-water protection programs in the country. Approximately 91% of the population of this province that receives drinking water from public water supplies is getting that water from protected surface and groundwater supplies. There are 335 active Protected Public Water Supply Areas in the province (see Figure 2).

The source-water protection program is considered highly successful because most of our major water supply areas have been designated as protected areas. Even so, ENVC continues its efforts to give protected designation to the remaining unprotected areas. Because requests to protect a water supply must come from a community, ENVC encourages communities to commence the protection process.

On average, it takes about seven months for a request to designate a protected water supply to complete through the ILUC process. During the 2005/6 fiscal year, 14 potential water supply sources were considered for protection. Of these, 12 are now completed and approved (10 groundwater and two surface water), and two are still in review. Of the 12 that were approved during 2005/6, 11 were new Protected Water Supply Areas (see Table 1), and one was an amendment to an existing protected area. In the latter case, the Town of Whitbourne asked that the Hodge's River Protected Public Water Supply Area be amended to have the entire natural drainage area protected.

Table 1: Water Supplies Protected in the 2005/6 Fiscal Year

Community	Supply Name	Notice Type	ILUC Start	ILUC Complete	Days in Process
Whitbourne	Hodges River	Amendment	Oct 24, 2003	Apr 29, 2005	553
Holyrood	Main Line (3 Wells)	New	Aug 11, 2004	May 24, 2005	286
Holyrood	O'Connell's Well	New	Aug 11, 2004	May 24, 2005	286
Holyrood	Woodford Station – Quinlan's Well & Healey's Well	New	Aug 11, 2004	May 24, 2005	286
Avondale	Lee's Pond	New	Dec 07, 2004	Jan 11, 2006	400
Hopedale	American Pond	New	Mar 10, 2005	Oct 11, 2005	215
Norman's Cove - Long Cove	John Newhooks Pond	New	Apr 29, 2005	Aug 18, 2005	111
Millertown	Drilled Wells #1 & #2	New	Jul 21, 2005	Jan 11, 2006	174
St. Lunaire-Griquet - Gunners Cove	Lookout Brook	New	Jul 21, 2005	Jan 31, 2006	194
Port au Choix	Wellfield	New	Aug 16, 2005	Jan 11, 2006	148
Port aux Port East	Drilled Well / Berry Head Watershed	New	Aug 16, 2005	Jan 11, 2006	148
Pollard's Point	George Rick's Pond	New	Aug 22, 2005	Jan 31, 2006	162
Lumsden	Gull Pond	Amendment	Jan 20, 2006	In progress	
Bryants Cove	Bryants Cove Wellfield	New	Feb 21, 2006	In progress	
				Average	212

Avondale Switches to a Surface-water Supply System

Avondale, a community of about 700 people, is located on the central Avalon Peninsula. Until recently, its drinking water came from two drilled groundwater wells: the Mason Road Well and the Mill Road Well. The quality of the water in these wells came into question in 2001, when the Department of Environment and Conservation undertook a new drinking-water sampling program for all public drinking water. The sampling program revealed that arsenic levels in Avondale's two public groundwater wells were above the recommended guideline (0.025mg/L).

Three options were considered to deal with the high levels of arsenic: drilling new groundwater wells, installing filters on the existing wells, and changing the drinking-water supply to surface water. The community opted to switch to a surface-based source and to decommission the Mason Road and Mill Road groundwater wells.

Once this decision was made, potential surface-water supplies in the area were considered. Water quality, hydrology, yield, and land and water uses were all assessed. Lee's Pond was chosen as the best source for meeting the community's drinking-water needs. The town submitted an application to the Department of Environment and Conservation to have this new supply protected under the *Water Resources Act*. The Department of Municipal Affairs provided funding for the installation of the water-supply intake and chlorination system. Avondale switched to their new surface-water supply in the spring of 2004. It now provides residents with a clean and safe source of drinking water.

Avondale chlorination building with Lee's Pond supply pond in the background.

As of March 31, 2006, the public water-supply database for the province listed 599 communities with 551 public water supply systems (see Figure 2). Of the 551 public water-supply systems, 308 are public surface-water sources (which service the majority of the province's population) and 214 are public groundwater sources. The remaining 29 drinking-water sources are shared by one or more communities.

Many communities have more than one water-supply system, and 223 communities have no public water-supply system. The residents of these communities use private wells or other sources to meet their water needs.

Watershed management committees have been established for some Protected Public Water Supply Areas in the province. These committees bring together stakeholders to deal with land-management and development issues in their protected area.

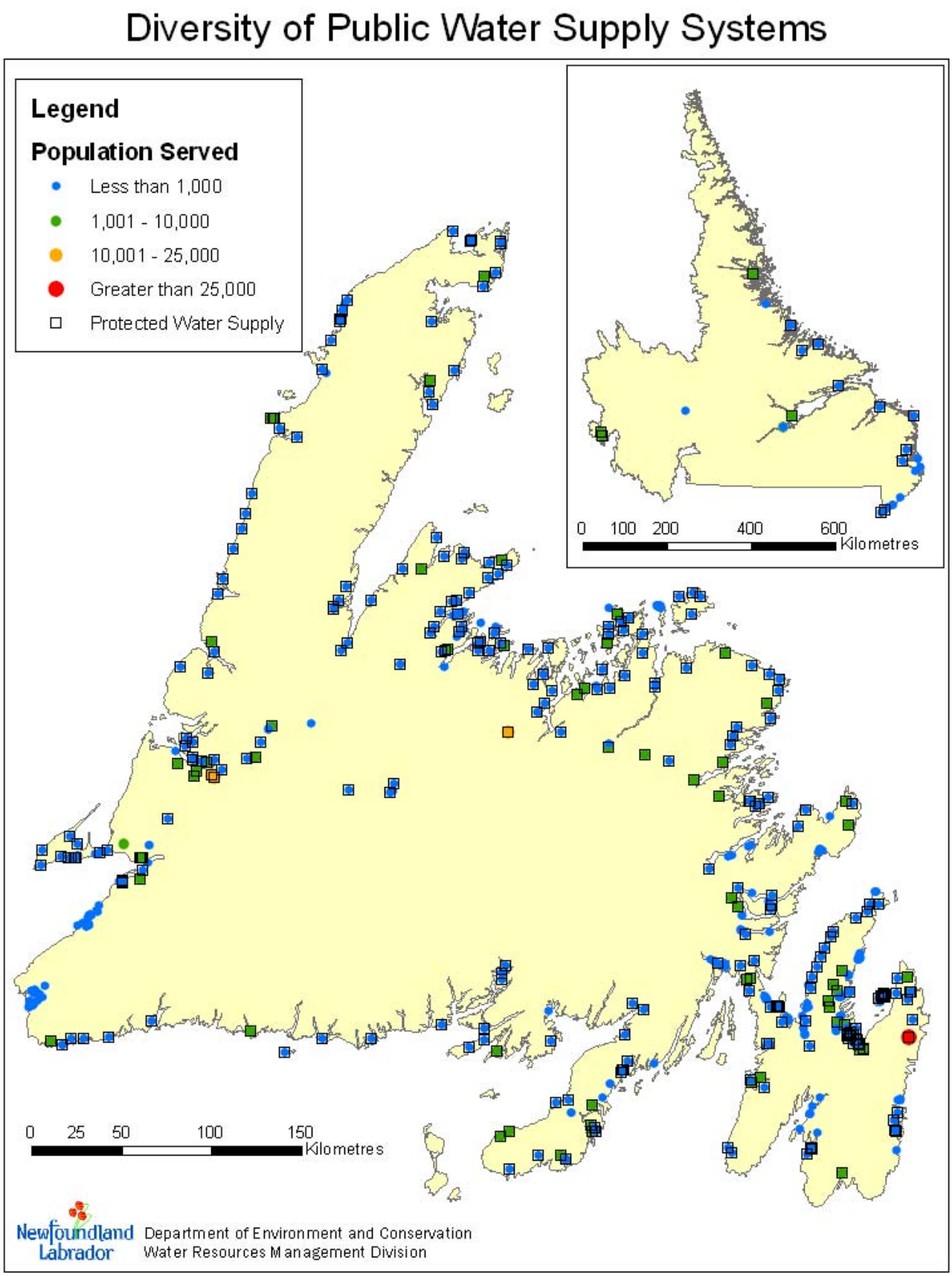
Currently there are five active watershed management committees in the province, one fewer than the number recorded in 2004/5 annual report. This is because the Peter's River Watershed Management Committee was dissolved when the towns of Botwood and Peterview were connected to the Exploits Regional Water Supply System.

The five active watershed management committees are:

- Shoal Harbour Watershed Management Committee
- Steady Brook Watershed Management Committee
- Corner Brook Watershed Management Committee
- Gander Watershed Management Committee
- Northern Arm Lake Watershed Management Committee (Exploits Regional Services Board)

Heart's Content, Southern Cove Pond protected water supply area.

Figure 2: Map Showing Diversity of Public Water Supplies



As conflict over development activity arises, additional watershed monitoring committees will be established.

2.2 Drinking-water Treatment

Water treatment involves all the processes, techniques, and systems used to clean and disinfect water before it is distributed for use.

Chlorination (adding small amounts of chlorine to water) is the most widely used method of water treatment—both in this province and worldwide. Chlorination not only destroys and renders harmless disease-causing micro-organisms; it also helps protect the water-distribution system from microbial growth. Chlorine used for disinfection can be in the form of liquid, powder, or gas.

The number of chlorine disinfection systems in the province continues to increase (see Table 2, which also details the types of systems in use).

In addition to chlorination, 14 conventional water-treatment plants operate in the province. Conventional water treatment plants use coagulation, flocculation, sedimentation and filtration or some combination of these processes to improve raw source water quality. There are also a number of communities using infiltration galleries and filtration units to deal with site-specific water-quality problems such as high colour or the presence of iron, manganese, and arsenic.

Table 2: Chlorine Disinfection Systems Operating in the Province

Fiscal Year	Type and Number of Disinfection Systems			
	Gas	Liquid (Hypo-chlorination)	Powder	Total Number of Systems
2005/6	153	295	11	459
2004/5	162	284	10	456

Steady Brook Watershed Management Committee meeting (right to left) Matt Churchill (Corner Brook Pulp and Paper), Leah Soper (Department of Natural Resources), Ken Jenkins (Marble Mountain Development Corporation), Calvin Vincent (Deputy Mayor of Steady Brook), Ron Austin (Councilor), Fraser Dwyer (Resident), Kerry Hutchings (Corner Brook Pulp and Paper)

Steady Brook Watershed Management Plan

Steady Brook is in western Newfoundland's magnificent Humber Valley, an area known for its pristine natural beauty. Recently, the Town of Steady Brook became concerned that increasing development in the area might lead to a decrease in the quality of its drinking water obtained from Steady Brook.

As a first step to better protecting its drinking-water quality, the Town established (in 2000) the Steady Brook Watershed Monitoring Committee. In 2003, the Western Newfoundland Model Forest offered to coordinate the development of a related Watershed Management Plan. The committee embraced this opportunity. Later the same year, the Steady Brook Watershed Monitoring Committee became the Steady Brook Watershed Management Planning Committee, and new members were added.

What is a watershed management plan? It is a framework consisting of a range of approaches that preserve, protect, or restore the water resources in a watershed. The framework also helps protect the health of the related ecosystem.

The Steady Brook Watershed Management Plan was organized into four sections:

1. watershed characterization
2. potential contaminants and risk assessment
3. a management plan
4. implementation

The watershed characterization section considered the location and physical characteristics of the watershed, its natural and historic resources, and the activities that were taking place within it. In addition, who had jurisdictional authority over its protection and use was determined.

In the second section, potential contaminants from a variety of watershed uses were assessed, as well as a risk assessment of possible contaminants. A sensitivity analysis was conducted, and a Forest Water Quality Index (FWQI) was applied.

Section three outlines the recommended regulatory and non-regulatory management guidelines and the monitoring and reporting processes.

The implementation step considered how to put the management plan into action and established a timeframe for reviewing the plan.

This watershed management plan is a tool that provides direction on how to deal with activity in the watershed while protecting water quality and ecosystem health.

In addition to providing a framework for better protection of local drinking water, the development of the Steady Brook Watershed Management Plan has provided an added benefit: its comprehensive integrated watershed-management planning methodology can be used by other municipalities in the province to develop similar plans for their water supply areas.

The Steady Brook Watershed Management Plan can be viewed at:
www.env.gov.nl.ca/env/Env/waterres/Surfacewater/Watershed_Protection/Printing%20Copy%20of%20MANAGEMENT%20PLANv6.pdf

For communities that have problems with source-water quality, water treatment goes beyond simple chlorination. Using a water-treatment plant is one way to correct water-quality problems. When source-water quality problems are identified, the Department of Environment and Conservation, in consultation with the Department of Municipal Affairs, assess the water-treatment needs of the affected communities. It then provides recommendations for funding and for the type of treatment facility that is required. The recommendations are based on a review of water-quality data, the extent and nature of the water-quality problems, and the economic viability of various treatment options.

The number of water-treatment facilities across the province is gradually increasing every year as water-quality problems are identified and remedied. Several communities are currently evaluating, installing, or commissioning new water-treatment plants. Botwood and Peterview were connected to the Exploits Regional Water Supply System to mitigate their ongoing issues with drinking-water quality. New treatment plants in Conne River, Pasadena, Isle aux Morts, and Lourdes are now completed and operational. The construction of a treatment plant in Gander is continuing and will be completed in the next fiscal year. The water-treatment plant in Burgeo is still not operational, however, due to legal issues. A tender was awarded for the construction of a new treatment plant for Shoal Harbour and construction has started. Baie Verte has completed a feasibility study for the installation of a new water-treatment plant, and funding has been approved. Planning for this treatment plant will continue into the next fiscal year.

Most small communities that are experiencing problems with drinking-water quality do not have the option of building a large conventional water-treatment plant—their limited tax base makes it economically and technically unfeasible. In these instances, as is done in other provinces, Newfoundland and Labrador has begun providing them with small-scale treatment. These units are connected to the source water that is already used by the community. Small quantities of water are taken from the intake pond or the distribution system, and treated by the small-scale treatment unit. The unit is placed in the community in a location that is convenient for consumers to access. Consumers can fill containers as required with high-quality drinking water—the treatment removes both aesthetic and health-related contaminants. These small-scale treatment units make treated drinking water available to all consumers at no extra charge to them. Several pilot projects with these units have been carried out successfully to date in the province.

Small-scale treatment unit in the central Newfoundland town of Buchans.

A treatment option for drinking-water disinfection that is now being used more widely in the province is ultraviolet irradiation (UV). In this process, water flows through an ultraviolet irradiation chamber, which inactivates any micro-organisms it may contain. Micro-organisms in the water are inactivated when the UV light is absorbed by them.

Ultraviolet irradiation has one drawback: UV light leaves no residual disinfectant, so some form of secondary chlorine disinfection must also be applied to provide residual disinfection in the water distribution system. The UV light disinfection process has several advantages, however. It does not require chemicals, it inactivates micro-organisms, it disinfects water faster than chlorine, and it eliminates the need for retention tanks (which are used when water is disinfected by chlorination). In addition, UV is more effective in treating water with low turbidity and colour**.** It can be used as a primary disinfectant for surface-based water-supply systems that have low turbidity. It is also well suited for treating groundwater-based drinking-water sources, which typically have low turbidity and colour.

Communities such as Colliers on Newfoundland's east coast and Bay St. George South on its west coast use UV technology for their groundwater drinking-water supply systems.

UV disinfection system (silver tube in center of picture) in the western Newfoundland town of Bay St. George South.

2.3 Drinking-water Distribution System

The water distribution system is the final physical barrier in the MBSAP. A water-distribution system is the network of pipes, valves, service lines, pumping stations, fire hydrants, and storage facilities that deliver water for drinking (and other purposes) to homes, businesses, and industries.

Water distribution systems are designed and installed based on community needs. As a result, every community's distribution system has a unique configuration. (See Figure 2.) Water distribution systems are classified according to a community's population. Table 3 shows the classification types used in this province and the number of communities belonging to each. (This water-classification system was developed by the Association of Boards of Certification.)

The majority of the water-supply systems in this province are classified as "very small"—they service populations of 150 to 500 people. Operating and maintaining water-supply systems properly in smaller communities can be challenging due to the difficulty of employing and retaining qualified and trained operators. The large number of communities and a rela-

Table 3: Classification of Water Distribution Systems in Newfoundland and Labrador for the 2005/6 Fiscal Year

Water Distribution System Classification	Number of Systems
Systems serving unknown population numbers	21
Very small systems	391
Small systems	69
Medium systems	65
Large systems	4
Very large system	1
Total number of Systems	551

tively small population spread over a large geographical area also makes administering public water-supply systems and providing safe drinking water challenging tasks. To address these challenges, government continues to encourage the concept of regional water systems and regional water operators.

The biggest issue for water-distribution systems in communities large and small, however, is aging infrastructure. The distribution systems for many of the province's communities were installed more than half a century ago. These systems are now suffering the effects of their age: they frequently break, they have high leakage rates, they are causing water quality to deteriorate, and they have reduced hydraulic capacity. The increased maintenance required to repair leaks and breaks has more than just financial implications—the quality of drinking water can be compromised. Water may enter the distribution system with good quality, yet be degraded by the intrusion of contaminant material introduced by repair work.

Problems do not usually occur when an underground water system is pressurized, but they can occur when maintenance crews clean out a system or close valves (which can cause the pressure in the piping system to drop). When water pressure drops and is negative inside the distribution pipes, contaminants can be sucked into the system. Best management practices and operational procedures must be followed in order to minimize the possibility of contamination from entering the system.

Government is addressing the issue of aging infrastructure by investing in infrastructure replacement. Distribution systems represent the largest component of a water supply's physical infrastructure—consequently their repair and replacement can pose enormous financial costs. Government continues to invest heavily in upgrading existing infrastructure and in constructing new water and sewer distribution systems. In the 2005/6 fiscal year, the Department of Municipal Affairs awarded contracts in the amount of $35.2 million dollars for water and sewer related infrastructure.

Government is also addressing the challenge of aging infrastructure through its Operator Education, Training, and Certification Program (discussed in more detail in Section 3.4). This program provides training in the operation and maintenance of water distribution systems as well as other skills. Specifically, the training covers techniques for inspecting infrastructure using the latest technology, for identifying areas requiring immediate repairs, for conducting routine maintenance, and for controlling corrosion. In the long term, a proactive approach to operating and maintaining distribution systems will help identify and mitigate problems before they occur. This can save communities money, and protect public health by maintaining water quality in the distribution system.

Annual Expenditure on Infrastructure and Drinking Water Safety

Government is ensuring drinking water safety by investing in infrastructure replacement, drinking water monitoring, testing and reporting, operator education, training and certification, source protection and regulatory permits, policy development and public awareness, and research and development. Annual expenditure on infrastructure upgrades and drinking water safety is $31,673,288.

Distribution systems and water treatment facilities represent the largest component of a water supply's physical infrastructure - consequently their repair and replacement can pose enormous financial costs. Government continues to invest heavily in upgrading existing infrastructure and in constructing new water distribution systems and water treatment facilities.

Government is also addressing the challenge of aging infrastructure through its Operator Education, Training, and Certification Program. This program provides training in the operation and maintenance of water distribution systems as well as other skills. Specifically, the training covers techniques for inspecting infrastructure using the latest technology, for identifying areas requiring immediate repairs, for conducting routine maintenance, and for controlling corrosion. In the long term, a proactive approach to operating and maintaining distribution systems will help identify and mitigate problems before they occur. This can save communities money, and protect public health by maintaining clean and safe water quality in the distribution system and consumers tap.

Activity	Expenditure in 2005/06	Department/Agency
Infrastructure Upgrades	$27,755,697	Municipal Affairs
Physical/Chemical Drinking Water Testing	$250,000	Environment and Conservation
Physical/Chemical Water Quality Monitoring and Reporting	$300,500	Environment and Conservation
Bacteriological Water Testing	$415,900	Public Health Laboratory
Bacteriological Water Monitoring and Reporting	$708,550	Government Services
Operator Education, Training and Certification	$335,000 $60,000	Environment and Conservation Municipal Affairs
Source Protection and Regulatory Permits	$215,000	Environment and Conservation
Research and Development (Studies, GIS, Databases, Webportals, etc.)	$105,000 $567,000	Environment and Conservation Municipal Affairs
Policy Development and Public Awareness	$57,000 $55,000	Health and Community Services Environment and Conservation
Administration and Overhead	$85,000 $10,000 $747,141 $6,500	Environment and Conservation, Government Services, Municipal Affairs Health and Community Services
Total	$31,673,288	

Towns of Botwood and Peterview Connect to the Exploits Regional Water Supply System

Prior to 2005, the towns of Botwood and Peterview used Peter's River for their drinking water supply, which caused them frequent water-quality and system problems. Consequently, a study was commissioned (in 2001) to review options for securing an adequate quantity of high-quality drinking water for Botwood, Peterview, and possibly, eventually, Northern Arm.

Undertaken by Newfoundland and Labrador Consulting Engineers Limited, the study considered various options. They included: treatment options for the original source (Peter's River), drilling groundwater wells, developing an alternate surface-water source, and connecting to the Exploits Regional Water Supply System. Its recommendation—based mainly on a life-cycle cost analysis—was connecting to the Exploits Regional Water Supply System. Although this option involved higher capital costs, it offered significantly lower year-to-year operational costs.

The project was tendered in three phases and the first water was delivered in September, 2005. This successful project is a testament to the concept of integrating regional services within feasible geographic boundaries. Transitional problems did have to be mitigated (including numerous and significant leaks in the pre-1940 distribution systems and adjustment of pressure and flow). However, the Botwood and Peterview distribution systems are now stable, and residents are enjoying high-quality treated drinking water from the Exploits Regional Water Supply System.

It is anticipated that this regional supply system will satisfy the needs of its consumers for many years to come.

Plaque announcing the new regional supply with *the storage reservoir in the background.*

The interior of the storage reservoir.

3 Level 2 of the MBSAP

3.1 Monitoring

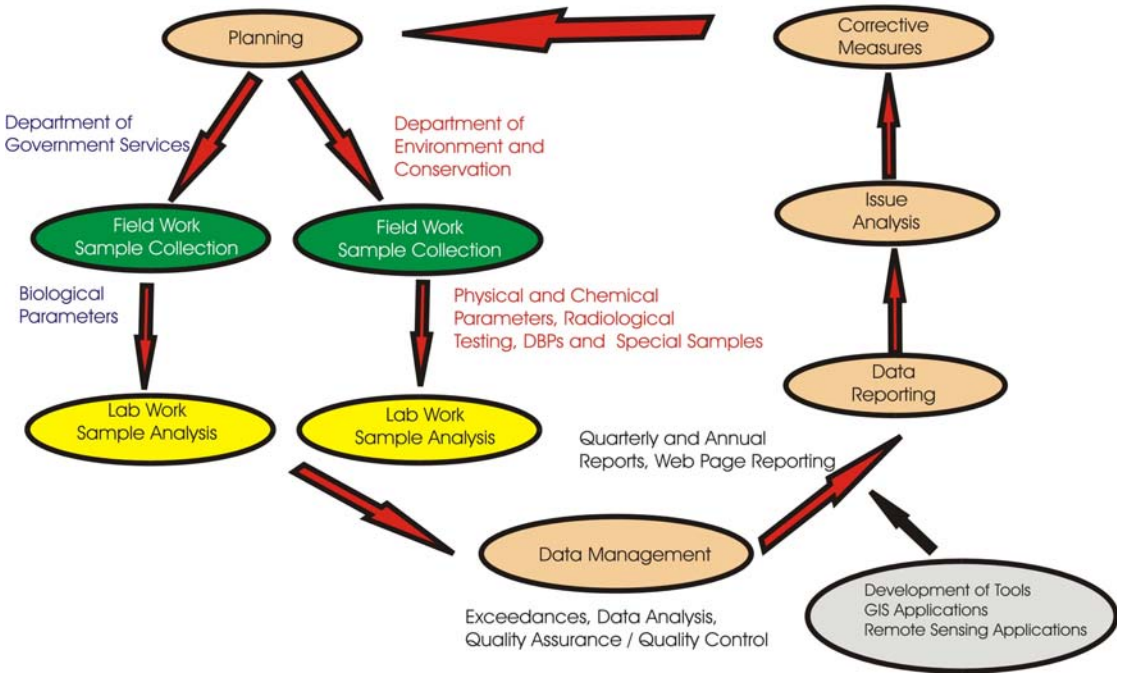
Monitoring drinking-water quality is a key element in Level 2 of the MBSAP. Government monitors the drinking-water quality of all public water supplies in the province. Monitoring is conducted by the Departments of Environment and Conservation and Government Services. ENVC is responsible for monitoring chemical and physical elements of source- and tap-water quality; GS is responsible for monitoring bacteriological tap-water quality and residual chlorine amounts.

The departments use the Drinking Water Information Management System (DWIMS) to organize their drinking-water-quality monitoring program (see Figure 3). As the figure shows, work in one component of the DWIMS leads into the next component of the cycle.

Planning is the first component of the DWIMS. Prior to each fiscal year, ENVC employees engage in intensive planning sessions to prepare the drinking-water-quality sampling schedule for the upcoming year. These sessions provide an opportunity for staff to discuss changes, updates, or additions made to any public drinking-water supply system in the previous year. Any deviations from the sampling schedule must be noted in order that discrepancies in sample totals at the end of the fiscal year can be explained. The schedule for samples collected between April 1, 2005, and March 31, 2006, was established during planning sessions held in March and April, 2005.

The design of the annual drinking-water-quality sampling schedule is based on monitoring guidelines and issue analyses conducted on previous sampling data. The sampling program has been designed so that source- and tap-water samples for inorganic parameters are collected semi-annually. In some circumstances, however, source- and tap-water samples are collected quarterly. Samples for disinfection byproducts (DBPs) are collected quarterly and bacteriological samples are collected according to community populations.

Figure 3 : Drinking Water Information Management System



Ensuring safe drinking water involves measuring water quality by collecting and testing samples that can then be analyzed and compared with the Guidelines for Canadian Drinking Water Quality (GCDWQ). Whether they are taken from the water-supply source (e.g., pond, river, or groundwater well) or from the tap, the samples can be tested for a variety of physical, chemical, and biological parameters. Samples are sent to a laboratory for complex chemical analyses-for metals or nutrients, for example. Biological testing is also conducted to determine the presence of microbiological pathogens (such as bacteria), viruses, and other microscopic life forms that can cause disease and illness. The types of analyses performed vary depending on the goals of the monitoring program or the type of information sought. ENVC uses the monitoring information to determine if substances found in water samples are at safe levels according to the water-quality guidelines.

Once sample analysis is completed, the laboratory sends the data back to ENVC, which stores it in an enterprise-level Oracle data-management system. From here the data is integrated into the geographic information system (GIS) database, allowing it to be viewed in spatial layers and to be used to generate quarterly drinking-water-quality reports and an annual report. The reports are sent to all the communities in which sampling was conducted. They contain the results for tap and source water, and the levels of trihalomethanes (THMs) and haloacetic acids (HAAs). In addition to the water-quality data, the Drinking Water Quality Index (DWQI) and the Langlier Index are used in the reports. These plain-language reporting tools help the public understand their drinking-water quality data, and help operators address corrosion issues. Drinking-water quality data is also available to the public on the ENVC departmental website (and updated quarterly).

Issue analysis is the process through which drinking-water quality data is reviewed and problem areas identified. Any exceedances (results that are above the GCDWQ) are identified and assessed. When problems are identified, corrective measures can be implemented. Monitoring conducted over months or years can show if water quality is improving or deteriorating and long-term trends or changes can be tracked. Thus it can help government determine if source-protection or corrective measures are functioning as they should.

Watershed Management Specialist Kent Slaney conducting source water sampling at the Musgrave Harbour water supply.

3.1.1 Sample Collection

3.1.1.1 Chemical and Physical Water-quality Parameters

ENVC is responsible for collecting samples for analysis of chemical and physical parameters in drinking water. The parameters include:

- inorganics
- trihalomethanes (THMs)
- haloacetic acids (HAAs)
- emerging or special parameters

To analyze for inorganic parameters, samples are collected from the distribution system (i.e., the tap) at least biannually. The frequency of tap sampling may be increased if site-specific conditions (e.g., large populations) warrant it. The sampling location should be significantly beyond the point where treated water enters the distribution system. In addition, samples may also be collected from the source-water supply, as close to the intake as possible. Decisions about how often source samples need to be collected are made yearly.

To analyze for THMs, samples are collected on a quarterly basis from drinking-water supplies that use chlorination for disinfection. Samples collected to analyze for HAAs, another disinfection byproduct, are collected from water supplies based on site-specific conditions (e.g., high THM levels and where data gaps exist). This sampling is scheduled every year. THM and HAA samples are collected from the distribution system at a site significantly beyond the point of chlorination.

Every year, emerging or special parameters are also identified for sample collection and analysis. These parameters are normally selected to provide background data for emerging concerns. Communities are chosen according to site-specific conditions. Collection of special samples is scheduled to coordinate with the collection of tap samples for inorganic parameters.

The provincial "Standards for Chemical and Physical Monitoring of Drinking Water" outlines the minimum parameters that should be monitored as part of the drinking-water-quality program. As well, these standards provide information about required sampling frequency and the location at which the sample is taken. These standards can be accessed at:

www.gov.nl.ca/env/Env/waterres/Policies/WQ-Standard-PhysicalChemical.asp

Table 4 provides an overview of the sampling conducted from April 1, 2005, to March 31, 2006. It shows that approximately 3,375 inorganic tap, inorganic source, THM, and HAA samples were scheduled for collection. The total number of inorganic tap, inorganic source, THM, and HAA samples actually collected was 2,996. The difference in the scheduled and actual numbers is a result of some site-specific situations, including:

- THM and HAA samples that were not collected because the system was not chlorinating at the time of sampling
- source waters were inaccessible at the time of sampling due to weather and/or adverse conditions
- sample bottles were broken during shipment to the laboratory

All samples for special or emerging parameters were collected as scheduled.

3.1.1.2 Bacteriological Water-quality Parameters

Collecting samples from public drinking-water supplies so that they can be analyzed for bacteriological parameters is the responsibility of the Department of Government Services. Samples are collected from a location within the distribution system. The frequency of bacteriological sample collection is based on the population serviced by the water supply (see Table 5).

From April 1, 2005, to March 31, 2006, 20,993 bacteriological samples were collected from public drinking-water supplies across Newfoundland and Labrador.

Table 4: Overview of Chemical/Physical Sampling Activity from April 1, 2005, to March 31, 2006

Parameter	Number of Source Samples			Number of Tap Samples		
	Surface	Ground	Total	Surface	Ground	Total
Inorganic Parameters	232	355	587	655	310	965
THMs	N/A: THMs are a result of chlorination, thus are not found in source water samples			996	18	1014
HAAs	N/A: HAAs are a result of chlorination, thus are not found in source water samples			407	13	420
Special or Emerging Parameters	--	--	--	52	14	66

(Note: Some communities were removed from public water-supply status during the fiscal year and 10 samples for these communities are not included in this table including three tap, one source, five THM, and one HAA.)

Table 5: Frequency of Bacteriological Sampling

Population Serviced (# of people)	Sampling Frequency (per month)
Fewer than 100 or No Distribution System	one sample
Fewer than 5,000	four samples
5,000 to 90,000	one sample per 1,000 population
More than 90,000	90 samples plus one sample per additional 10,000 population

(Note: The above sampling frequency is taken from the provincial "Standards for Bacteriological Quality of Drinking Water" and can be accessed at www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standards-Microbiological.asp.)

3.1.2 Sample Analysis

3.1.2.1 Analyses for Chemical and Physical Water-quality Parameters

Table 6 lists the accredited laboratories that performed analyses on samples collected for chemical and physical water-quality parameters during the 2005/6 fiscal year.

As its revised objectives, the province of Newfoundland and Labrador has adopted the chemical and physical guidelines for safe drinking water that are outlined in the Guidelines for Canadian Drinking Water Quality 6th Edition, 1996 (GCDWQ). The GCDWQ is published by Health Canada. A summary of it is available at:

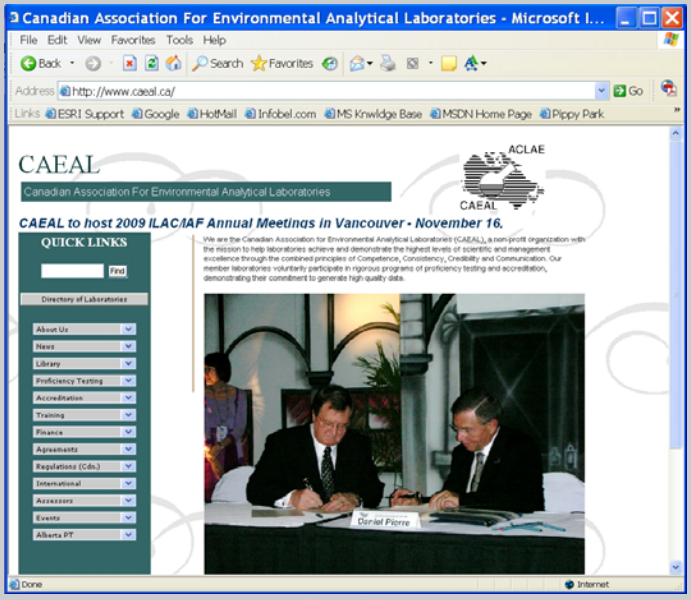
www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/doc-sup-appui/sum_guide-res_recom/summary-sommaire_e.pdf

Table 6: Summary of Analytical Laboratories

Parameter		Laboratory
Regular Sampling	Inorganic	Accutest Laboratories Ltd.
	THM	Accutest Laboratories Ltd.
	HAA	Accutest Laboratories Ltd.
Special	Dichloromethane	Accutest Laboratories Ltd.
	Chlorite and Chlorate	Maxxam Analytics Inc.
	Radiological	Accutest Laboratories Ltd.

Analytical Laboratory Certification

All laboratories that perform analysis as part of the Department of Environment and Conservation's drinking-water-quality sampling program are required to be accredited with the Canadian Association for Environmental Analytical Laboratories (CAEAL). CAEAL is a non-profit organization. Its mission is to help laboratories achieve and demonstrate the highest levels of scientific and management excellence through the combined principles of competence, consistency, credibility, and communication. Member laboratories voluntarily participate in rigorous proficiency testing and accreditation programs, demonstrating their commitment to generating high-quality data.



3.1.2.2 Analysis for Bacteriological Water-quality Parameters

Analysis of bacteriological samples is conducted by the provincial Public Health Laboratory (PHL); regional testing sites operate under its direction. The PHL tests for the presence of total coliform and E. coli. The current provincial standards for bacteriological parameters (as outlined in "Standards for Bacteriological Quality of Drinking Water") are based on the GCDWQ. They can be accessed at this website:

www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standards-Microbiological.asp

3.1.3 Water-quality Monitoring Results

3.1.3.1 Chemical and Physical Parameters

Some exceedances over the levels given in the GCDWQ were noted in the tap-water-quality data from the 2005/6 fiscal (listed in Table 7). Each of these parameters will be discussed in the following sub-sections.

3.1.3.1.1 Aesthetic Parameters

Aesthetic parameters reflect characteristics of drinking water (such as taste or appearance) that do not pose direct health or safety concerns but can negatively affect consumers' opinions of the drinking water. Some common aesthetic parameters with values that exceeded the GCDWQ during the 2005/6 fiscal year include: pH, colour, copper, iron, manganese, and TDS. Table 8 outlines the number of tap samples in which there were exceedances for aesthetic parameters in 2005/6.

Of these parameters, pH and colour exceedances were the most common and widespread in the province in 2005/6. Figure 4 illustrates the extent and location of the exceedances that occurred between April 1, 2005, and March 31, 2006. Aesthetic exceedances are not reported to the public because they do not cause health effects.

Table 7: Parameters that Exceeded the GCDWQ in the 2005/6 Fiscal Year

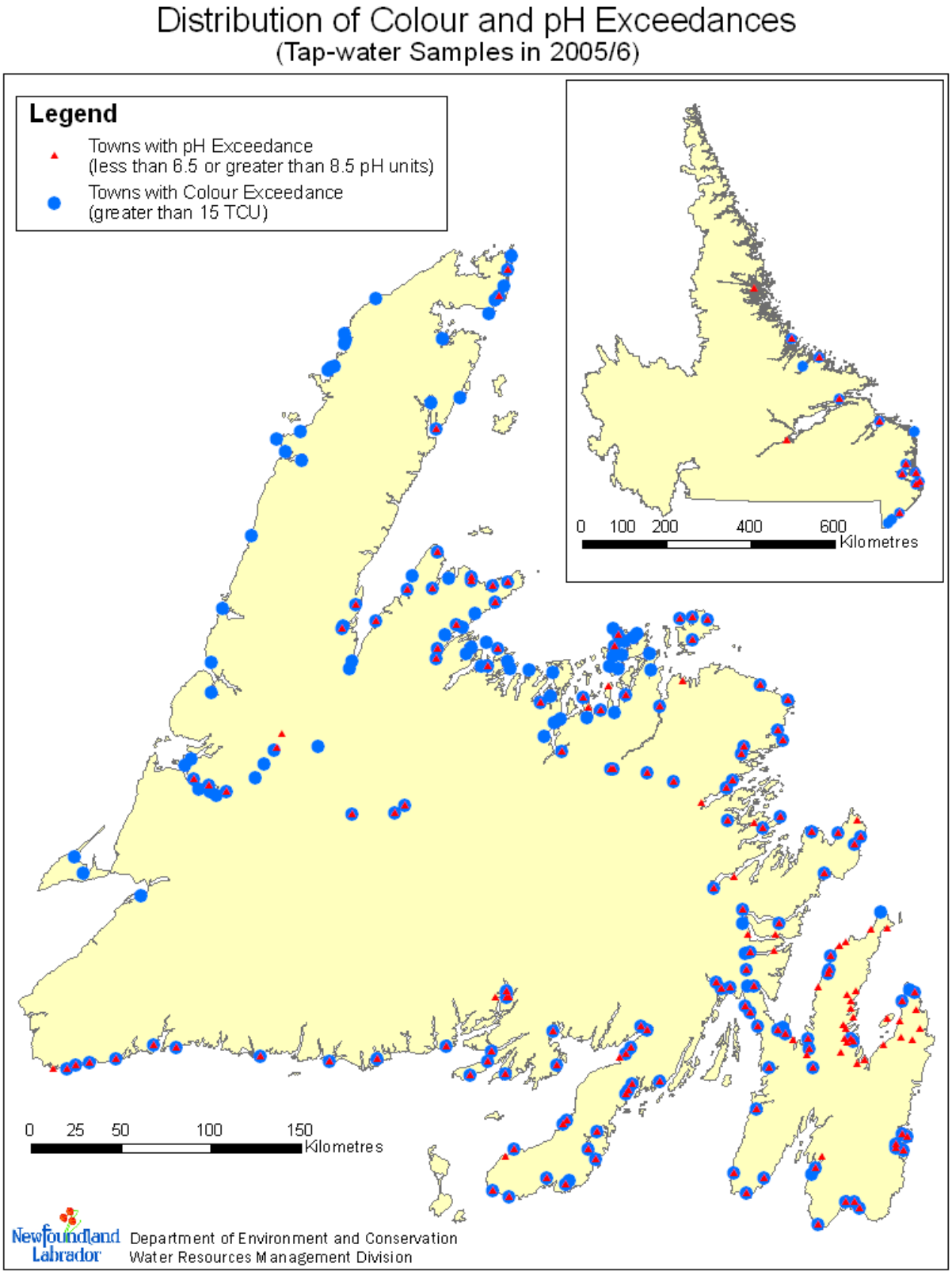
Aesthetic Parameter	Contaminant Parameter
pH	Barium
Colour	Lead
Copper	Turbidity
Iron	Trihalomethanes (THMs)
Manganese	
Total Dissolved Solids (TDS)	

Table 8: Summary of Chemical and Physical Parameter Exceedances in Tap Samples

Aesthetic Parameter	**GCDWQ Aesthetic Objective (AO)**		**Number of Exceedances (# of Tap Samples)**
pH[1]	6.5 – 8.5	≤ 6.5	293
		≥ 8.5	21
Colour	≤ 15 TCU[2]		390
Copper	≤ 1.0 mg/L		8
Iron	≤ 0.3 mg/L		98
Manganese	≤ 0.05 mg/L		66
TDS	≤ 500 mg/L		5

[1]No units
[2]TCU refers to True Colour Units

Figure 3 : Location of Colour and pH Exceedances



pH - The pH value measures the acidity of water. Although pH has no direct health implications, a low pH accelerates the corrosion of pipes and fittings and a high pH encourages scaling in the distribution system. Low pH levels are common in many areas of the province, mostly where source water originates in watersheds that have a high percentage of bogs. Water in a bog environment typically has a pH value between 3 and 4.

Colour - Colour in drinking water is generally due to the presence of coloured organic substances or metals (such as organic debris, leaves, iron, manganese, copper, etc.). In addition, drinking-water supplies that are fed by water from bogs or peatlands may have increased colour because of the presence of humic acids, tannins, and lignins. Activities that take place in the watershed of the water-supply as well as watershed land-cover characteristics influence the level of colour in source water. Although colour is an aesthetic parameter, elevated levels in source water can be a concern because the substances causing the colour have the potential to contribute to THM formation.

Copper - The presence of copper in drinking water is generally a result of the corrosion of the copper in piping systems. Elevated levels of copper can result in blue-green staining on fixtures and may cause a bad taste.

Iron - Iron is a naturally occurring element that is often found in drinking-water source supplies. Elevated iron levels may also be caused by the dissolution of iron piping in the distribution system. The presence of high levels of iron in drinking water may cause brown staining on plumbing fixtures and other household items. It can also adversely affect the taste of the drinking water.

Manganese - Manganese is a naturally occurring element that is common to both surface and groundwaters. Elevated levels of manganese can stain plumbing fixtures and other household items, and can adversely affect the taste of drinking water.

TDS - "Total dissolved solids" are mainly inorganic substances that are dissolved in water. This parameter can affect the taste of drinking water. As well, high levels of TDS may cause excessive water hardness, mineral deposits, and corrosion.

3.1.3.1.2 Contaminants

Contaminants are substances that are known or suspected to cause adverse health effects when they occur in concentrations greater than the established maximum acceptable concentration (MAC) or the interim maximum acceptable concentration (IMAC) set in the GCDWQ. From April 1, 2005, to March 31, 2006, contaminant exceedances in tap samples were detected for barium, lead, turbidity, and THMs (as outlined in Table 9).

The following paragraphs discuss the contaminant exceedances that were identified in the 2005/6 fiscal year:

Table 9: Number of Tap Samples with Contaminant Exceedances

Contaminant Parameter	GCDWQ Health-based Guideline	Number of Exceedances (# of Tap Samples)
Barium	1.0 mg/L	2
Lead	0.010 mg/L	2
Turbidity	1.0 NTU[1]	132
THMs	100 µg/L	390[2]

[1] NTU refers to Nephelometric Unit

[2] The THM guideline is based on quarterly averages for communities and not on individual samples.

Barium - The presence of barium in drinking water is generally caused by the dissolution of naturally occurring ore resources. The two barium exceedances detected during the 2005/6 sampling year were from a groundwater-based water supply system in the community of Chance Cove. Residents who are serviced by the Eugene Smith Well have been notified not to drink the water.

Lead - The corrosion of plumbing fixtures that contain lead (in pipes, solder, or service connections) usually accounts for elevated levels of lead in drinking water. Naturally occurring sources may also contribute to its presence. Two lead exceedances were detected in samples collected during the 2005/6 sampling year in the Town of Gaultois. They occurred in tap samples collected from the distribution system for Piccaire Pond, which has a history of low pH levels. One sample was from the routine water-quality monitoring program, the other was a resample to confirm the presence of lead. As a result, further investigation into the issue was conducted: 16 additional tap samples were taken for lead analysis from various locations in the distri-

Arsenic filter unit (cylinders in center of picture) on Southside Well in Harbour Grace has been successful in removing arsenic from source water so that drinking water is now in compliance with GCDWQ.

Exceedance Reporting Procedure

When a drinking-water-quality parameter exceeds the *Guidelines for Canadian Drinking Water Quality,* an established procedure is followed for notifying stakeholders who are involved.

Any time a parameter exceeds a maximum acceptable concentration or an interim maximum acceptable concentration, the testing laboratory notifies the Water Resources Management Division (WRMD) by fax. WRMD is required to acknowledge receipt of the exceedance information by signing the fax and returning it to the lab. It then communicates a preliminary Contaminant Exceedance Report to the affected community by telephone (and fax, if available). In cases where fax access is not available to the community, the report will sent by mail.

The Contaminant Exceedance Report indicates the parameter value, the current guideline, the date of sampling, and the type of sampling. It also indicates whether re-sampling will be conducted according to departmental protocol. An acknowledgement of receipt must be signed by the community representative and sent to the Division by fax or mail.

The Contaminant Exceedance Report is also communicated to the regional Medical Officer of Health, the Department of Health and Community Services, Department of Municipal Affairs, and the Department of Government Services. The Water Resources Management Division and the other government departments involved provide further information and guidance to the affected community regarding the exceedance.

bution system. Four of these samples had lead values above the guideline (which is 0.010 mg/L). Water in the town distribution system also had pH values between 3 and 4. Water with pH values in that range can cause corrosion of piping, fixtures, and/or solder, which can contribute lead to tap water.

Turbidity - Turbidity is a measure of water's inability to transmit light-or the "cloudiness" of water. Turbidity in source waters is generally a result of suspended solids and materials such as clay, silt, or micro-organisms. When found in a tap sample, turbidity can reflect source-water characteristics or conditions in the distribution system. High turbidity alone is not considered a harmful condition, but its presence can reduce the effectiveness of disinfection treatments. Incorporating source-protection methods and treatment alternatives may help reduce turbidity levels. Elevated turbidity levels are very common in surface-based public water supplies throughout the province. There were 132 tap samples collected during the 2005/6 sampling period that exceeded the limit outlined in the GCDWQ.

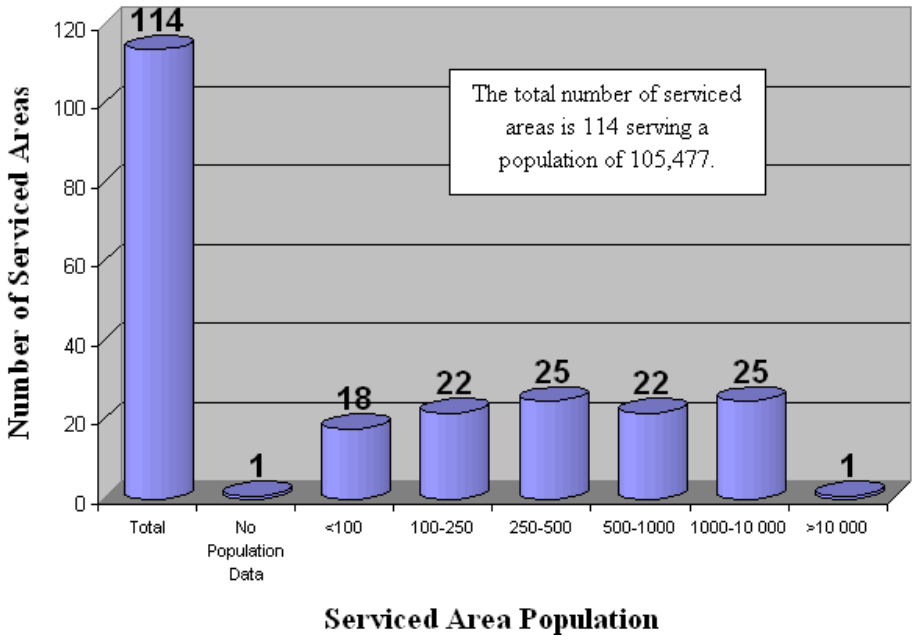
THMs - THM is a disinfection byproduct that forms when chlorine is added to water that contains elevated levels of natural organic matter. Consequently, elevated THM levels are very common for surface-based public water supplies in Newfoundland and Labrador because so many of them contain high levels of natural organic matter. From April 1, 2005, to March 31, 2006, THMs levels were above the recommended guideline (100µg/L annual running average) in 114 serviced areas affecting 105 communities. The total population exposed to THM levels that were above the recommended guideline was 105,477. Figure 5 shows the number of communities affected by elevated THM levels, arranged by population numbers in the affected serviced area.

3.1.3.1.3 Special Sampling

From April 1, 2005, to March 31, 2006, a special sampling program was conducted for emerging parameters of concern. The parameters analyzed under this program include:

- Dichloromethane
- Chlorite and Chlorate
- Radiological Parameters (Gross Alpha, Gross Beta and Tritium)

Figure 5 : Population Exposed to Trihalomethanes Levels Above Guideline



Note: One serviced area with THM sampling results above the recommended guideline has no associated population data.

Controlling THMs through Chlorine Demand Management

A high percentage of the province's surface drinking-water sources are predisposed to have significant THM-formation potential because of naturally occurring precursors in the water (such as colour and dissolved organic carbon). However, because most communities in Newfoundland and Labrador are small, using conventional water treatment to remove these precursors is not economically feasible. In such circumstances, the only factors that contribute to THM formation that can be readily controlled are chlorine dosage and water retention time. Consequently, ENVC has undertaken a Chlorine Demand Management Study to investigate how these two factors can best be managed. The study is focused on infrastructure and operational measures. Various options are being investigated through the use of EPANET, a widely used drinking-water distribution-system model.

To date, several distribution system models for communities with high THMs have been developed. These models reflect:

- different sizes of water-distribution systems (all serving populations of less than 10,000) from different regions of the province
- generic types of water distribution systems—long linear systems, T-shaped systems, branched systems, systems with fish plants or a large water demand, systems with storage tanks, systems with operational problems

Various scenarios can be run on each model to see which operational options work best in specific conditions. The results from the models can then be used as a baseline to develop generic chlorine dosage and retention-time best management practices to reduce disinfection byproducts.

Distribution system models have been developed for the communities of Brighton, Burlington, Cartwright, Ferryland, and St. Paul's. Models for Marystown and Summerford are under development. The scenarios being examined include:

- changing the first point of chlorination
- changing chlorine dosage
- single-point chlorination versus multiple-point chlorination (i.e., booster units)
- water main renovation (i.e., reducing pipe size, cleaning, lining pipes, installing new pipes)
- network configuration (i.e., system looping, changing the length of system to first user)
- regular flushing at dead ends
- water usage ranges
- modifying tank operation and configuration (i.e., amount of storage, multiple smaller tanks)
- re-routing or re-circulation of flow
- treatment upgrades

The final technical report and the development of chlorine demand management guidelines are expected to be released during the 2006/7 fiscal year.

3.1.3.1.3.1 Dichloromethane

Dichloromethane is a highly volatile colourless liquid that is used extensively as an industrial solvent for paint stripping and as a degreasing agent. The maximum acceptable concentration for dichloromethane in drinking water, according to the GCDWQ, is 0.05 mg/L.

Tap samples were collected from five drinking-water-supply distribution systems during May and June, 2005. Sites were chosen based on location and proximity to potential contamination sources. Table 10 summarizes the sampling locations and sample results.

3.1.3.1.3.2 Chlorite and Chlorate

Chlorite and chlorate are disinfection byproducts that are primarily found in drinking water that is disinfected with chlorine dioxide. The chlorine dioxide generation process, along with various water-distribution and handling practices, cause these ions to form. At this time, no public drinking-water systems in Newfoundland and Labrador use chlorine dioxide as a form of disinfection.

However, chlorate can also form in drinking water that is disinfected with hypo-chlorite or calcium hypo-chlorite (that is, liquid chlorination). Storage conditions such as pH, temperature, storage time, the presence of ultraviolet light, the concentration of the solution,

Table 10: Summary of Dichloromethane Analysis

Community	Water Supply	Result
Gaskiers – Point La Haye	Big Hare Hill Pond	LTD
Southern Harbour	Brigades Pond	LTD
St. John's	Bay Bulls Big Pond	LTD
St. John's	Windsor Lake	LTD
Trinity Bay North	Whirl Pond	LTD

*LTD means less than detection limit (0.004 mg/L).

and the presence of transition metals can influence the formation of chlorate from hypochlorite solutions. Approximately 300 public drinking-water systems in Newfoundland and Labrador use hypo-chlorination for disinfection purposes. Based on a review conducted by Health Canada, the Federal-Provincial-Territorial Committee on Drinking Water has proposed a maximum acceptable concentration of 1.0 mg/L for both chlorite and chlorate.

During the summer of 2005 (August 1 to October 3), a drinking-water sampling program for chlorite and chlorate was undertaken in 24 public drinking-water systems in the province. Communities that used hypo-chlorination and also had a history of high THM and HAA levels were chosen as sampling locations. Details and results of the study include:

- 23 of the systems used hypo-chlorination in their disinfection process; the remaining system was disinfected with gas chlorination
- four systems had chlorite levels that were less than the detection limit (0.1 mg/L)
- 20 systems had chlorite levels ranging from 49.6 mg/L to 403 mg/L
- six systems had chlorate levels that were less than the detection limit (0.1 mg/L)
- 18 systems had chlorate levels ranging from 0.1 mg/L to 2.0 mg/L

A follow-up drinking-water sampling program was undertaken from January 25, 2006, to March 2, 2006. During this Winter 2006 program, 23 public drinking-water systems were sampled for chlorite and chlorate. With the exception of three sampling sites, sampling locations were repeated. This will provide data during a different season to determine if there are seasonally variations. Details and results of this study include:

- all systems used hypo-chlorination for disinfection purposes

- all systems had a detectable level of chlorite ranging from 42.4 mg/L to 371 mg/L
- eight of the systems had chlorate levels that were less than the detection limit (0.1 mg/L)
- 15 systems had a chlorate levels ranging from 0.1 mg/L to 0.6 mg/L

The special sampling program for chlorite and chlorate will continue into the next fiscal year. It will be expanded to include sampling sites in Labrador, as well as additional sites in the western region of Newfoundland. This special sampling program is providing background data that will be very useful when the anticipated new maximum acceptable concentration levels are established in the GCDWQ.

3.1.3.1.3.3 Radionuclides

Radionuclides are naturally occurring radioactive elements that are sometimes found in bedrock, soil, and water. They make their way into drinking water from groundwater-based sources if the groundwater moves through fractures in the bedrock that contain radionuclide elements-over time the water can dissolve and absorb these elements.

A radionuclide sampling program was initiated in May, 2005, to test selected public groundwater supplies in the province. According to the GCDWQ, water samples can be initially screened for radioactivity using techniques to determine gross alpha and gross beta activity. The samples comply with the guidelines if the measurements are less than 0.1 Bq/L for gross alpha activity, and less than 1 Bq/L for gross beta activity.

Gross alpha/beta measurements record the total radionuclide activity from the emission of alpha and beta particles. However, they do not identify the specific radionuclide. To determine specific radionuclide parameters, samples with results above the recommended screening levels for gross alpha and beta activity should be further tested. The most common radionuclides found in Canadian drinking water are radium-226, radium-228, and lead-210.

During the 2005/6 fiscal year, 14 groundwater systems were selected for sampling. They were chosen based on previous uranium-concentration sampling results and on a uranium risk map produced in 2003 by the Department of Natural Resources and the Department of Environment and Conservation. Sampling was conducted for gross alpha, gross beta, and tritium. Table 11 summarizes the results.

Of the 14 wells sampled, eight had gross alpha activities equal to or greater than the 0.1 Bq/L screening guideline. There were no gross beta activities equal to or greater than the 1Bq/L guideline, and no tritium exceedances above the 7,000 Bq/L guideline.

In accordance with the screening guidelines, the eight wells that had gross alpha activities will be re-sampled during the next fiscal year. Sampling will also be conducted to determine the concentration of the most common radionuclides: radium-226, radium-228, and lead-210.

Becquerel (BQ) – Radionuclide Unit of Measurement

A Becquerel (Bq) is the unit of measurement for the activity of a radioactive substance. In other words, it is the rate at which transformations (the decay of an atom that causes radiation) occur in the substance. One Becquerel is equal to one transformation per second.

$$1\,\text{Becquerel}\,(Bq) = \frac{1\,\text{Transformation}}{\text{second}}$$

Table 11: Radionuclide Sampling Results

Community	Water Supply	Gross Alpha (Bq/L)	Gross Beta (Bq/L)	Tritium[1] (Bq/L)
Benoit's Siding	Drilled Well	LTD	0.2	LTD
Chance Cove	Angus Brace Well	0.4	0.3	LTD
Chance Cove	Edgar Crann Well	0.3	0.2	LTD
Deep Bight	Well Field	0.2	LTD	LTD
Flat Bay	#1 Well	LTD	LTD	LTD
Harbour Grace	#2 Thickett New Well	0.1	LTD	LTD
Holyrood	O'Connell's Well	LTD	LTD	LTD
McCallum	Drilled well	0.5	0.4	LTD
Sheppardville	Drilled well	LTD	LTD	LTD
Ship Cove-Lower Cove-Jerry's Nose	#1 Well – PJs Variety Well	LTD	LTD	LTD
Small Point-Adam's Cove-Blackhead-Broad Cove	#8 – Effie Flight Wells	0.4	0.1	LTD
St. Lunaire-Griquet	Drilled Well	LTD	LTD	LTD
Swift Current	Drilled Well	LTD	LTD	LTD
Winterland	Well Field	0.1	0.1	LTD

[1]According to GCDWQ, the maximum acceptable concentration for Tritium is 7,000 Bq/L.

3.1.3.2 Bacteriological Parameters

During the 2005/6 fiscal year, 20,993 bacteriological samples were collected by the Department of Government Services from public drinking-water systems throughout the province. Of these samples, 4.7% (987 samples) had unsatisfactory total coliform levels, and 0.6% (135 samples) had unsatisfactory *E. coli* readings. Table 12 provides further details about these samples.

Boil Water Advisory Status for 2005/6

At the end of the 2005/6 fiscal year:

- 222 public water supplies were under Boil Water Advisories. The reasons were:
  - 32.9% had no disinfection system
  - 32.4% had insufficient residual disinfectant
  - 15.8% had a broken disinfection system
  - 9.5% had a disinfection system that had been turned off by the operator
  - 5.9% failed microbiological tests
- 145 communities were affected (a population of 39,731 people)

No outbreaks of waterborne disease were experienced during the year.

Note: These figures do not include water supplies that were placed on a Boil Water Advisory during the course of the year and were later removed because problems were corrected.

For information on current Boil Water Advisories, see this website:

www.env.gov.nl.ca/Env/env/waterres/CWWS/Microbiological/BoilWaterAdvisories.asp

Table 12: Bacteriological Test Results from Public Water Supplies for the 2005/6 Fiscal Year

	Department of Government Service Region					Totals
	Avalon	East	Central	West	Labrador	
Number of Samples Tested	5,167	5,042	5,153	3,265	2,366	20,993
Number of Samples Positive for Total Coliforms	104 (2%)	139 (2.8%)	285 (5.5%)	170 (5.2%)	289 (12.2%)	987 (4.7%)
Number of Samples Positive for *E. coli*	0 (0%)	30 (0.6%)	34 (0.7%)	48 (1.5%)	23 (1.0%)	135 (0.6%)

Boil Water Advisories

A Boil Water Advisory (BWA) is a notice given to all consumers who use a water system that its drinking water may be contaminated or of questionable quality. A BWA warns that, to be safe, the water must be brought to a rigorous rolling boil (for at least one minute) before it is consumed.

The Department of Government Services and the Department of Health and Community Services are jointly responsible for monitoring the bacteriological quality of public water supplies in the province. Environmental Health Officers throughout the province perform sampling on a regular basis. BWAs are issued when the sampling and testing detects the presence of *E. coli*, higher-than-accepted levels of total coliforms, or if there are deficiencies with regard to disinfection. When the Environmental Health Officers receive unacceptable readings from the sampling, the community is immediately informed of the problem and it issues a BWA.

Specifically, BWAs are issued in the following situations:

- no disinfection system is in place
- insufficient residual disinfectant is detected
- the water has unsatisfactory bacteriological quality
- the disinfection system has not been operated properly
- an illness associated with drinking water has been reported
- the water supply system is undergoing repairs
- unusual occurrences such as flooding are affecting water quality

BWAs are usually temporary; they are necessary to protect human health. If they are issued repeatedly, modifications to a community's drinking-water system and/or to related operation and maintenance activities may be called for. The Government of Newfoundland and Labrador continuously works with municipalities to solve these challenges.

Further information on the Standards for Bacteriological Quality for Drinking Water can be found at this website:

www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standards-Microbiological.asp

Total Coliforms – Coliform bacteria are widely used as an indicator organism in water sampling because the analysis required is relatively simple and they can be detected in small quantities. If total coliforms are present in concentrations greater than the guidelines, it can indicate one of two things: the water treatment is inadequate or the bacteria is infiltrating or re-growing in the distribution system.

Coliform bacteria do not necessarily indicate the presence of fecal contamination. If the analysis result for total coliform is positive but no *E. coli* is detected, then the pollution has been caused by soil or vegetable contamination. Whether or not there is *E. coli*, the presence of coliform bacteria requires immediate investigation.

E. coli – *E. coli* lives naturally in the lower intestines of humans and animals. Its presence in a water sample is a definite indicator of fecal contamination. A positive result for *E. coli* indicates that there is a deficiency in the water-treatment process, or that there has been post-treatment contamination. The situation must be investigated immediately.

3.2 Inspection and Enforcement

The baseline minimum standards that govern the operation of drinking-water systems are established through permits issued by the Department of Environment and Conservation under the *Water Resources Act*. These permits establish the conditions that will ensure that clean and safe drinking water is delivered to

Water Distribution System Permit to Operate

In this province, the majority of municipalities that own and operate a public drinking-water system have been issued a Water Distribution System Permit to Operate. A Permit to Operate is part of the regulatory process. It focuses the owner/operator of a municipal water (and/or sewer) system on essential activities that pertain to preventive maintenance, ongoing operational requirements, and best practices for the efficient operation, reliable delivery, and extended life of these systems. The permitting process is one of several aspects of the MBSAP used to consistently provide and maintain the safest water of the highest quality for the consumer.

The next step in the process to ensure continued delivery and improved water quality is to require a minimum operator certification of Level I for each water-system operator, and a back-up operator for all systems. The long-term goal is to have all municipal water-treatment and distribution systems in the province operated or supervised at all times by at least one Level I-certified operator. Some systems, depending on their complexity and classification level, may require or be eligible for an operator with a higher level of certification. As a minimum initial requirement, however, revised Permits will be issued with a Level I certification requirement.

Currently, if a municipal system does not have a certified operator, the municipality is expected to have their operators pursue training and achieve Level I certification within a reasonable timeframe. When certification becomes a requirement, the policy in this province will be similar to existing requirements in other provinces and jurisdictions in the water-delivery sector.

Municipalities will be assisted in achieving compliance through the Operator, Education, Training and Certification program offered by the Department of Environment and Conservation. It is clear that municipal leaders and operators are serious about their responsibilities. They are showing excellent leadership in following suggested methods and best practices in the operation and maintenance of their systems. It is important to be ever-vigilant to ensure that public water systems are operated and maintained at the highest standard possible for the delivery of reliable, high-quality drinking water.

consumers. Compliance with permit conditions is supported by inspections and enforcement.

3.2.1 Inspection

The Department of Environment and Conservation requires that all public waterworks be maintained and operated in a manner that provides safe and clean drinking water for the benefit of present and future generations of Newfoundlanders and Labradorians. As a first step to ensuring that this occurs, informal site visits of public water supplies are conducted. If problems are reported or noted, a formal inspection is undertaken. During the fiscal year 2005/6, 121 water- and sewer-related inspections were carried out.

Public groundwater wells and other selected wells are also regularly inspected in order to ensure that they are constructed according to the requirements of the *Water Resources Act*. In 2005/6, 35 inspections of public groundwater supplies were carried out. In addition, 25 inspections were carried out on protected public surface water supplies in response to public concerns regarding development activities, to update land-use inventories or support the need for watershed management plans.

3.2.2 Enforcement

All public water-supply and sewer systems in the province are regulated under the *Water Resources Act*. During the past fiscal year, 182 permits were issued that deal with various components of water-supply and sewer systems (such as construction and operation). Issuing permits is an integral part of how the MBSAP for drinking-water safety is applied. Regular inspections of water-supply systems are conducted to ensure that they comply with the terms and conditions of permits.

Bob Lethbridge, Groundwater Management Specialist with Department of Environment and Conservation (center) conducting a well casing inspection utilizing a video scope on a well in Bunyan's Cove with Brad Penney, Regional Water & Wastewater Systems Specialist (right), Department of Municipal Affairs and Operator Randell Myles (left), looking on.

In addition, ENVC also issued 83 permits dealing with development activities within protected public water-supply areas. Two of these permits were for development activities in protected groundwater supply areas. Some of the various activities that these permits were issued for include cottage developments, quarries, and forestry activities. These permits were issued under Section 39 of the *Water Resources Act*. They regulate how activities in Protected Public Water Supply Areas should be conducted in order to ensure the integrity of drinking-water sources.

The *Water Resources Act* governs the licensing of water-well drillers in the province. It sets minimum standards of training and experience for those who construct drilled wells. Drilling or digging any non-domestic wells requires a permit from the ENVC before construction begins. During the 2005/6 fiscal year, 18 non-domestic well permits were issued.

ENVC maintains a database of records about domestic wells. Each record has up to 50 items of information about the well, including assessment of its water quality. There are 16,891 records in the database; 450 well records were added during the 2005/6 fiscal year. In that same period, approximately 70 requests for information on well records were processed. Requests came from:

- well owners
- communities that were interested in drilling a well and needed information on groundwater resources
- real estate agents needing information for real-estate transactions
- well drillers
- pump installers
- other government departments

Requested information was efficiently accessed and delivered using an upgraded well-database program. Water-well records are also available on compact disk.

Permits for Developments in Protected Public Water Supply Areas

Any proposed development activity that is planned to take place in a protected public water supply area requires approval from the Department of Environment and Conservation. A "development activity" is defined by ENVC as:

> the carrying out of any activity or operations on, over, or under land or water for social or economic benefits, or any change in the use or the intensity of use, of any land, water, building or premises.

Examples of development activities include quarries, commercial forest harvesting, and recreational cottage developments. Proponents of these developments must apply for a permit using the "*Permit for a Development Activity in a Protected Public Water Supply Area*" application form obtained from ENVC. Once the application form is completed, it can be submitted to the nearest regional office of ENVC.

The municipal authority responsible for the protected public water supply area is informed when a development permit application is received by ENVC. This provides an opportunity for the municipal authority to present any objections it has to the proposal. The municipal authority can also suggest conditions under which the proposed development might be able to proceed (which can be incorporated into the permit). After the municipal authority's input is received, the permit is either denied or generated with specific conditions that govern how the development activity should proceed. The conditions are designed to ensure that the development activity occurs without affecting the quality of drinking water.

3.3 Data Management and Reporting

3.3.1 Data Management

The ENVC drinking-water quality (DWQ) database and reporting system continues to be used successfully for managing and reporting drinking-water data. A single provincial database in ENVC stores the results from all chemical analyses from surface-water, groundwater, and tap-water samples (organic, inorganic, THMs, HAAs) taken as part of the provincial chemical monitoring program.

Prior to the start of each quarterly sampling period, the DWQ sampling schedule is reviewed and updated so that it can reflect the latest changes in the public water-supply list. Customized bottle labels, field sheets, and the new schedule are then printed and sent to staff. One month after the end of each season, the laboratory supplies ENVC with sample analysis reports in both electronic and printed formats. This data, along with information collected by staff on the field sheets, is imported into the DWQ databases.

The data then goes through a comprehensive Quality Assurance/Quality Control (QA/QC) procedure. This process usually takes about three to six weeks depending on the number of QA/QC issues that occur and the size of the dataset. When the QA/QC procedure is complete, reports are printed and mailed to each community, and summary reports are posted on the department's web page.

The enterprise-level Oracle database-management system is a critical component in the management of drinking-water-quality data. Data can be used in both tabular and geographic information system (GIS) formats, and shared more effectively between software applications. It also allows links to be created between spatial data (such as public water-supply boundaries) and tabular-attribute data (such as water-quality sampling results).

To improve data sharing and program delivery further, ENVC has continued to migrate to new web-based applications that are tied into the enterprise-level Oracle database system. During the 2005/6 fiscal year, an internal web portal with a departmental home page was set up to access these applications. Web applications in development during 2005/6 include:

- The revised Drinking Water Quality Search Engine (deployed). After review, several features were added such as: access to new tables for the DWQI, Langelier Index, and BWA tables, a Community Summary report, a custom query tool, and a "search for related samples" tool. Also, a user manual was created for use in training seminars.
- Phase 1 of an enhanced version of the DWQ Sampling Schedule Application (developed). The new version of the application provides ENVC staff with improved access to drinking-water-quality data summaries, which helps them determine sampling requirements and makes the planning and scheduling processes more efficient. Development of Phase 2 of the Sampling Schedule Application will continue during the coming fiscal years. It will add the ability to reconcile scheduled sampling against completed sampling. The work on Phase 2 that has been completed to date includes:
    - analysis and development of database structures and relations
    - application design and the addition of summary reports
    - deployment and testing (March, 2006, during the sampling planning meetings for 2006/7)
- A web application for the management of the Operator Education Training and Certification program (developed). Development tasks included:
    - analysis, cleanup, and re-organization of existing data
    - development of database structures and migration of historical data
    - design of applications for equipment inventory, on-site training, and community infrastructure
    - adding tools, forms, and summary reports for community and training information

- A web application for the Dam Inventory Database (developed). This database contains information on water supply, hydropower, and other dams in the province. Development tasks included:
    - analysis, cleanup, and re-organization of existing data
    - development of database structures and transfer of historical data
    - application design with the addition of new tools for uploading and storing related photos, diagrams, and reports for each dam
    - linking this database to a GIS layer that displays dam locations and documents
- A web application for the Drilled Well Database (developed). This inventory of drilled water wells in the province has more than 16,000 entries. The information has been compiled from water-well records submitted by water-well drilling firms since the Well Drilling Regulations were proclaimed in 1981. Before that date, information had to be obtained from the files of each well-drilling firm. Development tasks included:
    - analysis, cleanup, and re-organization of existing data
    - development of database structures and migration of data
    - application design
    - adding summary reports and functionality to create files used in the CD-ROM publication "Water Well Data for Newfoundland and Labrador"
- 18 spreadsheets were converted into Microsoft Excel format. The staff of the Community Water and Wastewater Section (ENVC) uses the spreadsheets for design analysis. A web page was also created.

The Department of Environment and Conservation also continues to use a number of existing applications in the DWQ program. As the program evolves, additions to these applications are required. In 2005/6 the application updates included:

- modification of the protocol for calculating THM annual running averages from THM sample data. The modification provides a better representation of sample results.
- modifications to the THM, HAA, DWQI, and Langelier Index tables in order to better retain historical data and assist in analyzing data
- updates to the community and web page reports to accommodate the above changes

In addition, in preparation for changes to the arsenic guideline and the introduction of a bromodichloromethane guideline that will occur in the 2006/7 fiscal year, all DWQ applications and databases were reviewed and updated.

In 2002, in order to make it easier for government departments to share water-supply and water-quality information, the Municipal Information Management System (MIMS) was created. MIMS is managed by the Department of Municipal Affairs. It is a database with several modules that has basic information on the province's municipalities and their waste management facilities, capital works, financial details, municipal profiles, and water supplies. The database provides essential information including: the area(s) serviced, the type of water supply, types of treatment, watershed or wellhead protection status, Boil Water Advisory status, bacteriological testing results, chemical testing results, and details about who is responsible for the system. MIMS continues to be enhanced as needed improvements are identified.

Data Management staff (ENVC) are fully involved in the designation of Protected Public Water Supply Areas. They prepare much of the documentation required for the ILUC process including the initial boundary map for the watershed or wellhead, the legal description of the area, and a digital file of the new boundary (this file is an ILUC GIS layer that ENVC maintains for the use of ILUC members).

During the ILUC review process, changes to a watershed or wellhead boundary may be made. After the protected-area designation process is completed, a notice is published in the *Newfoundland Gazette* and the digital file of the final boundary is moved from the ILUC GIS layer to the Protected Supplies GIS layer, which is available to all departments and agencies on the internal government network. Stand-alone shape files are made available to the public on the web page. This year, the stand-alone shape files on the public web page were improved by the addition of an automated process that now updates their content every day.

The drinking-water-quality web-based GIS application that was developed and deployed (for internal use) in the Department of Environment and Conservation in the 2003/4 fiscal year continues to be used to analyze water-quality records and the spatial aspects of water supplies. Currently, the application is still only available to government users. A budget request has been made to the Office of the Chief Information Officer, however, asking that resources be allocated to allow it to be made available to the public.

ESRI Award

In November 2005, the Water Resources Management Division was named the recipient of the 2005 ESRI Canada Award of Excellence for the Atlantic region. ESRI Canada is the leading geographic information systems (GIS) provider in Canada. The ESRI Canada Award of Excellence is presented annually to one organization in each of five regions across the country; it honors innovation in the application of GIS technology.

ENVC was named a winner for the Water Resources Management Division's drinking-water-quality GIS Internet application. This application has been widely recognized as being "state of the art" by federal agencies and other provincial jurisdictions. It allows drinking-water-quality data sharing between the four government departments that are involved in ensuring safe drinking water under the province's Multi-Barrier Strategic Action Plan.

The Water Resources Division also provides training to other government departments on how to use the GIS Internet application. It is currently only available to government users, but there are plans to include a public portal.

Left to right: Alex Miller, President, ESRI Canada, Ali Khan and Paul Neary, ENVC, Eric Melanson, Atlantic Regional Manager, ESRI Canada

3.3.2 Reporting

Interpretive annual and quarterly community water-quality reports were first introduced in the 2001/2 fiscal year. Still in use, they have been updated as required. This year, the reports generated and mailed include:

- 281 quarterly reports in the spring of 2005
- 342 quarterly reports in the summer of 2005
- 481 quarterly and annual reports in the fall of 2005
- 361 quarterly reports in the winter of 2006

The exceedance reporting protocol that was implemented in 2001/2 continues to be used successfully. Its function is to inform communities of any contaminant exceedances found in DWQ samples as soon as the laboratory tests detect them. In 2005/6 the protocol was used to report the following to affected communities:

- one tap sample exceedance in the spring of 2005
- two tap sample exceedances in the summer of 2005
- one tap sample exceedance in the fall of 2005

The department's public web page (www.gov.nl.ca/Env/water) continues to be an important tool for communicating with the public. It provides:

- historical drinking-water-quality data
- proposed sampling schedules
- Boil Water Advisories
- operator education, training, and certification schedules reports and publications

ENVC's public web page is updated regularly. New information on drinking-water quality and related topics is added throughout the year. Posts for 2005/6 included:

- DWQ quarterly water-quality reports:
  - Spring 2005 – posted September 14, 2005
  - Summer 2005 – posted December 12, 2005
  - Fall 2005 – posted March 15, 2006
  - Winter 2006 – posted May 24, 2006
- workshop presentations from:
  - Clean and Safe Drinking Water Workshop – "Water System Operation & Maintenance: Management to Operation"
  - Wastewater Workshop 2005 – "Municipal Wastewater Management – Theory and Practices"
- new and updated products:
  - Drinking Water Quality Index reports
  - Langelier Index reports
- documents:
  - "Guidelines for the Design, Construction and Operation of Water and Sewerage Systems"
  - the booklet "Well Aware: A guide to caring for your well and protecting your family's health"
  - forms that communities must use to meet their obligations under their Permit to Operate. The forms allow communities to keep reliable operational and maintenance records of their water and sewerage systems.
  - information on the risks of fluoride in well water
  - training seminar schedules for the Operator Education Training and Certification program
  - "Steady Brook Watershed Management Plan"
  - "Drinking Water Safety Annual Report 2004"
- a new dedicated email address (water@gov.nl.ca) that the public can use to communicate with ENVC on water-resources issues

3.4 Operator Education, Training And Certification (OETC)

3.4.1 Operator Education

To ensure the safe and sustainable operation of municipal water-supply systems, ENVC is continuing its strong commitment to municipal water-system operators through the Operator Education, Training, and Certification program (OETC). The program's education seminars provide water-system operators with operational knowledge and water-quality theory. They also provide facilities to practice this knowledge in hands-on training. Competency-based operator education and training is the principle that has made this program successful. ENVC's OETC program model has been used to develop a similar program in Ontario.

The classroom-style seminars also provide operators and municipal officials with information about the *Guidelines for Canadian Drinking Water Quality*, operation and maintenance techniques, record keeping, public relations, and management issues. The operator education component has two functions: it prepares operators to be certified, and it provides them with knowledge that is relevant to conditions in Newfoundland and Labrador.

During the 2005/6 fiscal year, Module V of the Water Distribution Program was delivered under the OETC program. Module V is a pre-certification exam review and math refresher. The effort involved 14 one-day classroom seminars in seven locations throughout Newfoundland and Labrador. Ninety-six people attended these seminars, representing 38 municipal and one non-municipal water-supply systems (the non-municipal system is in Gros Morne National Park). Topics covered included regulations and guidelines, chemical and bacteriological water quality, sampling protocols, cross-connection control devices, operator math skills, and controllers for chlorination systems.

Educational seminars are open to employees of municipalities, industry, and parks and campgrounds, as well as commercial/industrial water-system operators and interested individuals. No registration fee is charged—the only costs for participants are for travel and meals. Seminars are held in approximately 20 locations from Labrador City to St. John's, so most operators can find train-

Water Treatment level II Classroom training session conducted in Corner Brook.

ing sessions within a reasonable driving distance. The Department of Municipal Affairs provides financial assistance for travel and meals to municipalities on the coast of Labrador to help their employees attend the seminars.

In addition to the preparation of presentation and handout materials for the classroom seminars, OETC also prepared these documents during 2005/6:

- Control Valve curriculum
- operator education schedules
- revision and updates to web page information for OETC
- wastewater workshop report
- annual "Clean and Safe Drinking Water Workshop Report"
- "A New Approach to Municipal Water System Operator Training," an article for the Atlantic Canada Water Works Association newsletter on the OETC program
- Clean and Safe Drinking Water Workshop brochures and agendas

Additional presentations that were prepared and given during the year include:

- water and wastewater issues in Newfoundland and Labrador
- drinking-water quality and the GCDWQ
- water distribution module 5-R
- cross-control devices
- certification exam preparation for operators
- water treatment level 2
- control valves operation and maintenance

ENVC participated in the Newfoundland and Labrador Federation of Municipalities Trade Show. Presence here gave mayors and councilors an opportunity to look at the products the OETC program has to offer. Elected officials of communities that are served by the OETC program do not have many opportunities to see these products and equipment of this program. Information on the Operator Education segment of the program was also available, including sample course handouts and training manuals. One of the Mobile Training Units (MTU) was on display—it showed attendees the type of equipment and training that ENVC provides to water-system operators.

ENVC hosted the annual Clean and Safe Drinking Water Workshop in Gander on March 21-23, 2006. This year's workshop, called "Water System Operation and Maintenance: Management to Operation," was well attended—281 delegates came from across the province. This workshop again included a trade show, which showcased equipment and technologies used in the supply and distribution of clean and safe drinking water. Eleven

Annual Drinking Water Conference held in Gander, March 21-23, 2006.

presenters from across Canada spoke on a variety of topics. One of the highlights was Bruce Davidson's moving and informative presentation "Lessons from Walkerton: Proactivity to Protection," which gave participants an inside look at the human impacts of the Walkerton tragedy. To help communities defray travel costs, the Department of Municipal Affairs allocated $300 per municipality in the island portion of the province and $600 per municipality in Labrador.

ENVC will host the 2007 Clean and Safe Drinking Water Workshop in Gander on March 20-22. Its theme is "Emergency Preparedness, Planning and Procedures for Small Water-distribution Systems." The workshop will again include a trade show.

3.4.2 Operator Training

This segment of the OETC program has evolved into an efficient and effective training tool for operators, and it continues to be very well received throughout the province. In the 2005/6 fiscal year, 359 training sessions were held in 218 communities through the use of mobile training units (MTUs).

Every MTU contains a wide variety of equipment, so operators can work and become more familiar with water-system equipment. Equipment is added to the MTUs each year. In 2005/6, clamp meters, digital multimeters, portable spectrophotometers, pocket colorimeters, water meters, paddle meters, and gas monitors were all added. This practice ensures that training is conducted with

Hydrant Maintenance Training

During 2005/6, the OETC Operator Trainers conducted 87 training sessions on Hydrant Maintenance in locations from Western Labrador to the Southeast Avalon Peninsula. During these sessions, municipal operators were able to work with a realistic model of a hydrant. The full-scale training hydrant incorporates all the working parts of a hydrant, as well as openings that allow operators to see and understand how it functions. It was particularly helpful in showing how a hydrant barrel drains and why a hydrant must be operated in a fully open position.

The adapted hydrant also helped reveal how easy it is to plug the drain holes, a practice that is necessary in high water-table areas so that hydrants do not flood and freeze in winter. Several operators indicated they would make use of the training to plug hydrants and eliminate freezing problems. It is anticipated that the unapproved practice of using antifreeze in hydrants will decrease significantly as a result of this training.

According to the Operator Trainers, one of the most significant skills that many operators learned through the training was how to disassemble a hydrant. Many operators have now either made their own tools for this job, or ordered the necessary wrenches from the supplier. In the words of one West Coast operator, "You have made an all-day chore into an easy one- or two-hour job."

Hydrant training in Northwest River with (left to right) Operators Pat Hibbs and Shannon Parsons and Operator Trainer Gerry Lahey, Department of Environment and Conservation.

Pressure-reducing Valve Training

During 2005/6, the OETC Operator Trainers began offering training on the maintenance and operation of pressure-reducing valves (PRVs) and control valves. This was particularly useful to the Town of Cox's Cove, which had been experiencing trouble with its chlorinator. During PRV maintenance training, it was discovered that the pressure-reducing valve in the lower level of the chlorination building was not opening and closing smoothly and was reacting too quickly to changes in water-system pressure. The over-sensitive reaction disrupted the flow through the flow meter, which in turn resulted in rapid meter changes and inaccuracies. Because the chlorinator is controlled by flow proportion, the end result was that chlorine doses jumped up and down.

Initially, maintenance staff in Cox's Cove thought the problem was with the disinfection equipment. Through the PRV maintenance training, the operator gained in-depth knowledge of how the valve operates, and learned about the importance of regular maintenance and keeping the valve clean. After the training, the top of the Cox's Cove valve was cleaned, releasing air, and immediately the valve started opening and closing properly. The surges disappeared, the flow meter was able to record flows accurately, and the chlorinator began to function properly again.

Table 13: Certification Exams Administered during the 2005/6 Fiscal Year

Certification Exam	Number of Exams Administered
Water Distribution Class I	34
Water Distribution Class II	6
Water Distribution Class III	0
Water Treatment Class I	4
Water Treatment Class II	10
Water Treatment Class III	0

current technology, which helps operators learn about new equipment and assess what is available to help them perform their work.

Information about the OETC is available on the departmental web site. It includes training schedules, curriculum, application forms, and presentations made during the annual Drinking Water Workshops. See:

www.env.gov.nl.ca/env/Env/waterres/Template_OTEC.asp#mark

3.4.3 Operator Certification

Certifying water-distribution operators and water-treatment plant operators is a natural extension of operator education seminars and the hands-on training offered by the OETC program. Certification demonstrates that operators have achieved a level of competence in the operation and maintenance of their water supply systems. Following training, more and more operators are demonstrating their professionalism by writing the certification exam. Table 13 lists the certification exams administered by the OETC program during the past fiscal year.

In this province, 115 municipalities now have certified operators, compared to 109 reported in the 2004/5 annual report. Additionally, there are eight certified operators (water and wastewater) with Parks Canada, four who work with federal facilities and three with Indian Bands.

ENVC will continue to facilitate the operator certification program. As in other jurisdictions in Canada, ENVC will be moving toward mandatory certification of all water-system operators to a minimum of Water Distribution Class I certification.

One benefit of participating in the education seminars and training provided by the Operator Trainers is the success rate for operators writing certification exams. Exam preparation materials often suggest that an average pass rate in North America is 50%. Numbers reported by the Association of Boards of Certification demonstrates that operators in Newfoundland and Labrador have higher levels of preparedness and success rates compared to the rest of North America (see Table 14).

Table 14: Operator Certification Exam Statistics for Newfoundland and Labrador and North American data from the Association of Boards of Certification (ABC)

Exam	ABC 2004			NL 2004			NL 2005		
	# of Exam Participants	# of Exam Participants with Passing Grade	% Pass	# of Exam Participants	# of Exam Participants with Passing Grade	%	# of Exam Participants	# of Exam Participants with Passing Grade	% Pass
WD I	1,354	909	67%	32	24	75%	87	79	91%
WD II	729	446	61%	16	11	69%	16	12	75%
WD III	253	129	51%	1	1	100%	0	---	---
WT I	822	562	68%	1	1	100%	0	---	---
WT II	807	377	47%	1	1	100%	2	1	50%
WT III	459	186	41%	2	2	100%	0	---	---

*WD is Water Distribution; WT is Water Treatment

Leak Detection Training

Leak detection training offered during the summer months continues to be an area of interest to municipalities and their water-system operators. The savings from having an operator knowledgeable in leak detection can be significant.

In one small community on the Baie Verte Peninsula, for example, water consumption was excessive and maintaining water pressure was problematic. After OETC disinfection training, the community was ready to begin disinfecting its water, but they wanted to try to reduce water usage first. Consequently, the operator attended leak detection training and learned how to start a leak detection program.

Because the distribution system in Cox's Cove has small-diameter plastic lines, conventional acoustic-pipe detection equipment could not be used. The ENVC Operator Trainer demonstrated the use of a hose bib pressure gauge to check pressures, as well as how to close valves to check pressures in different areas of the system. After the training session, seven leaks were found (and repaired) in the Cox's Cove distribution system. The community's water usage was cut in half—from 520 m^3/day to 245 m^3/day. In addition, water pressure in the system increased by an average of 35 psi.

Operator Michael Snooks practicing leak detection during a leak detection training session in Cape St. George.

4 Level 3 of the MBSAP

4.1 Legislative and Policy Frameworks

The Department of Environment and Conservation enforces sections 37, 38, and 39 of the *Water Resources Act*, as well as the Environmental Control Water and Sewage Regulation, Well Drilling Regulations, and policy directives under the Act that relate to drinking-water safety.

The Department of Municipal Affairs enforces the sections of the *Municipal Affairs Act* and the *Municipalities Act* concerning municipal infrastructure funding and administration of municipal infrastructure that relate to drinking-water safety.

4.2 Public Involvement and Awareness

The Department of Environment and Conservation is committed to ensuring public involvement and participation in safeguarding drinking-water safety. All drinking-water-quality data is publicly available: it is posted on the departmental web page, and quarterly drinking-water-quality reports are sent to communities. In addition, annual drinking-water-quality reports such as this one are available to the public.

The watershed management committees that exist in some areas of the province are additional forums for public participation. They allow the active involvement of concerned stakeholders and the general public in dealing with land-management and water-quality issues.

Each year, employees of the Water Resources Management Division are asked to make presentations on a range of issues to technical working groups, conferences, post-secondary education classes, municipalities, and interest groups. The presentations provide an opportunity to discuss topics that affect drinking water in the province. These are some of the many presentations conducted by the Water Resources Management Division in the 2005/6 fiscal year:

- Drinking Water Quality Standards, Marine Institute, February 2005
- Drinking Water Quality Regulatory Framework & Provincial Monitoring Program, Marine Institute, February 2005

A Salute to the Public Water Supply Volunteer

Volunteers make a difference to all our lives in many ways. They devote time and effort to the betterment of our communities for no personal gain or reward. It is important that their work be recognized and honoured. In this report, we particularly acknowledge the efforts of those who volunteer to operate and maintain their community's public water supplies through a Local Service Committee.

Two of the many volunteers whose efforts could be noted are Dennis Penney and Randell Myles. Dennis Penney has been chairperson of the Canning's Cove Local Service District for 14 years. He operates and maintains three public groundwater supply systems, none of which directly supply his home. Randell Myles has been chairperson of the neighboring Bunyan's Cove Local Service District for 18 years. He operates and maintains two public groundwater supply systems. Both Dennis and Randell, like many others, devote countless hours of their time to the regular maintenance, minor and major repairs, correspondence, accounting, bill collection, and the many other duties that are required to properly operate a public water supply. These volunteers make themselves available to deal with mechanical failures, leaks, and other problems, at any time of the day or night. The communities they serve are very fortunate to have such men, whose generous efforts provide home owners with clean and safe drinking water.

- Management of Water Resources in Newfoundland and Labrador, College of the North Atlantic, February 2005
- Newfoundland and Labrador's Drinking Water Quality Monitoring Program, Health Canada, November 2005
- Real-Time Water Quality Monitoring Network in Newfoundland and Labrador, Marine Institute, January 2006
- Watersheds in Newfoundland and Labrador, Agriculture and Agri-Food Canada Seminar, February 2006
- GIS training session for WRMD staff, September 2006
- Presentations at ESRI Canada Regional User Conferences in Halifax and St. John's, November 2006
- GIS training session for Department of Government Services and the Department of Natural Resources staff, November 2006

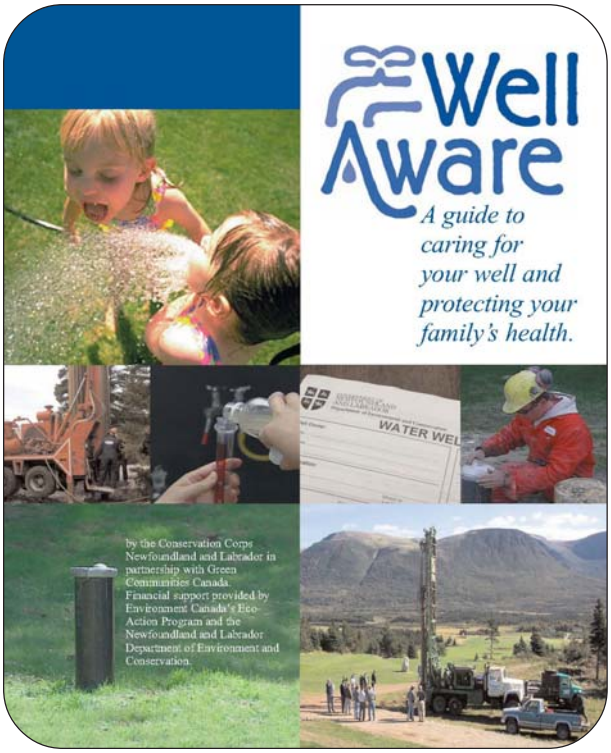
In partnership with Conservation Corps of Newfoundland and Labrador, and with technical input from all departments that have water-supply responsibilities, government published an information booklet in 2005/6 (see Figure 6). The booklet—"Well Aware: A guide to caring for your well and protecting your family's health" explains the basics of well maintenance and operation and describes how to keep water wells in safe running order. The topics it covers include a well's life cycle, water quality, and information on how to hire a well driller. The booklet is supported by the Newfoundland Groundwater Association, Green Communities Canada, Environment Canada Eco-Action Program, and the Climate Change Education Centre. It is available online on the Water Resources Management Division website or a copy can be obtained from Conservation Corps Newfoundland and Labrador. The web page can be visited at:

www.env.gov.nl.ca/env/Env/waterres/Groundwater/Well_Aware/Report.asp

In addition, the Conservation Corps of Newfoundland and Labrador presented several information sessions in 2005/6 regarding information from the booklet. These presentations were given to municipalities that rely on private wells for drinking water. ENVC staff gave presentations on water-well construction and maintenance at several of these sessions.

Deneen Spracklin, Watershed Management Specialist, Department of Environment and Conservation conducting a presentation at the Municipal Wastewater Conference in St. John's.

Figure 6: Well Aware booklet



The OETC program's range of activities ensures the involvement of municipal operators and administrators. The annual Drinking Water Safety Workshop is a particularly good forum for encouraging groups such as municipalities, consultants, and government officials to learn about drinking-water safety. It not only provides an opportunity for the public to discuss issues with water-industry professionals and government officials, but also to discuss issues with other municipalities. In this way, municipalities can learn from each other—they see what issues various communities are facing and how they are dealing with them.

4.3 Guidelines, Standards and Objectives

The Department of Environment and Conservation continuously works on developing or revising documents relating to drinking-water safety. These documents are an integral part of ENVC'S regulatory program, which is directed at ensuring public health and environmental protection.

In December 2005, ENVC released an updated version of the *Guidelines for the Design, Construction, Operation and Maintenance of Water and Sewer Works*. This document replaces the April 1980 version, which was developed by an external consultant. In 2004, the department began an intensive internal review of the original guidelines, as well as those of other jurisdictions. The goal was to include the most recent best-management practices and all relevant new information. Some of the main revisions and additions that are included in the new version of the guidelines are:

- Water Works – there is expanded coverage of source development and water-treatment technologies
- Disinfection of Drinking Water – a new section deals solely with disinfection of drinking water and includes information on alternative disinfection technologies (e.g., UV, chlorine dioxide, and chloramines)
- Sewerage Works – the treatment technologies section has been expanded to include information on sequencing batch reactors, Kikuth Bioreactor, BMS "Blivet," and Biogreen—and a sub-section on nutrient removal and tertiary treatment was also added
- Operator Training – references to the Permit to Operate and the Permit to Construct were added, as well as information on ENVC's educational seminars, on-site training sessions, and certification exams

The updated *Guidelines* are considered to be a "working document" and will be updated and/or revised as necessary. It can be found on the ENVC web page:

www.env.gov.nl.ca/Env/env/waterres/CWWS/Guidelines_Water_Sewerage/Report.asp

ENVC participates in the development of the *Canadian Guidelines for Drinking Water Quality* on an ongoing basis through the National Drinking Water Committee. The provincial standards for chemical and bacteriological drinking water are regularly updated. The "Drinking Water Quality

Monitoring Manual" and "Boil Water Advisory Guidelines" are also reviewed and updated as required.

4.4 Research and Development

The Department of Environment and Conservation constantly strives to improve all aspects of the MBSAP for drinking-water safety through research and the development of new tools and methodologies.

The Water Resources Management Division performs research that uses satellite imagery for water resource management. Based on Landsat 7 Enhanced Thematic Mapper data collected in 2000, the Canadian Forestry Service (CFS), in collaboration with the Canadian Space Agency, has produced a land-cover map of the forested areas of Canada. The spatial resolution of the Landsat imagery in this map is similar to the 1:50,000-scale mapping that the WRMD uses for its own primary mapping. The CFS land cover data is now available for the island of Newfoundland; the final product for Labrador is scheduled for completion in 2006.

Water-related Educational Initiatives

The Department of Engineering and Applied Science at Memorial University of Newfoundland often asks the Water Resources Management Division to submit research topics for engineering students completing the Master of Applied Science program. For one research project, four graduate students studied the problem of arsenic in small water supplies in Newfoundland and Labrador. Their report—"Arsenic Contamination in the Groundwater: Treatment Technologies and Risk Assessment for Newfoundland Small Water Supply Systems"—was made available to government departments that deal with water quality problems in the province's public water supplies.

Pictured below are the four graduate engineering students with Groundwater Resources Manager and project supervisor Keith Guzzwell (centre). The picture was taken in front the first arsenic removal equipment to be installed in the province, at the Angus Brace public water supply well in Chance Cove.

Groundwater Resources Manager and project supervisor Keith Guzzwell (centre) with the four graduate engineering students (left to right: Jayakumar Balakrishnan, Eleghasim Ndukauba Michael, Abiodun Abati and Trish Johnson). The picture was taken in front the first arsenic removal equipment to be installed in the province, at the Angus Brace public water supply well in Chance Cove.

Previously WRMD carried out smaller projects using similar Landsat data, but the CFS dataset provides a unique opportunity to have complete land cover information for large portions of the province. WRMD staff prepared a draft paper—"Analyzing Land Cover Statistics for Protected Water Supply Areas: A Case Study in Applying Canadian Forest Service Land Cover Data in Water Resource Management in Newfoundland and Labrador"—on how to use this data to generate more up-to-date land-cover data for use in managing the Protected Water Supply program.

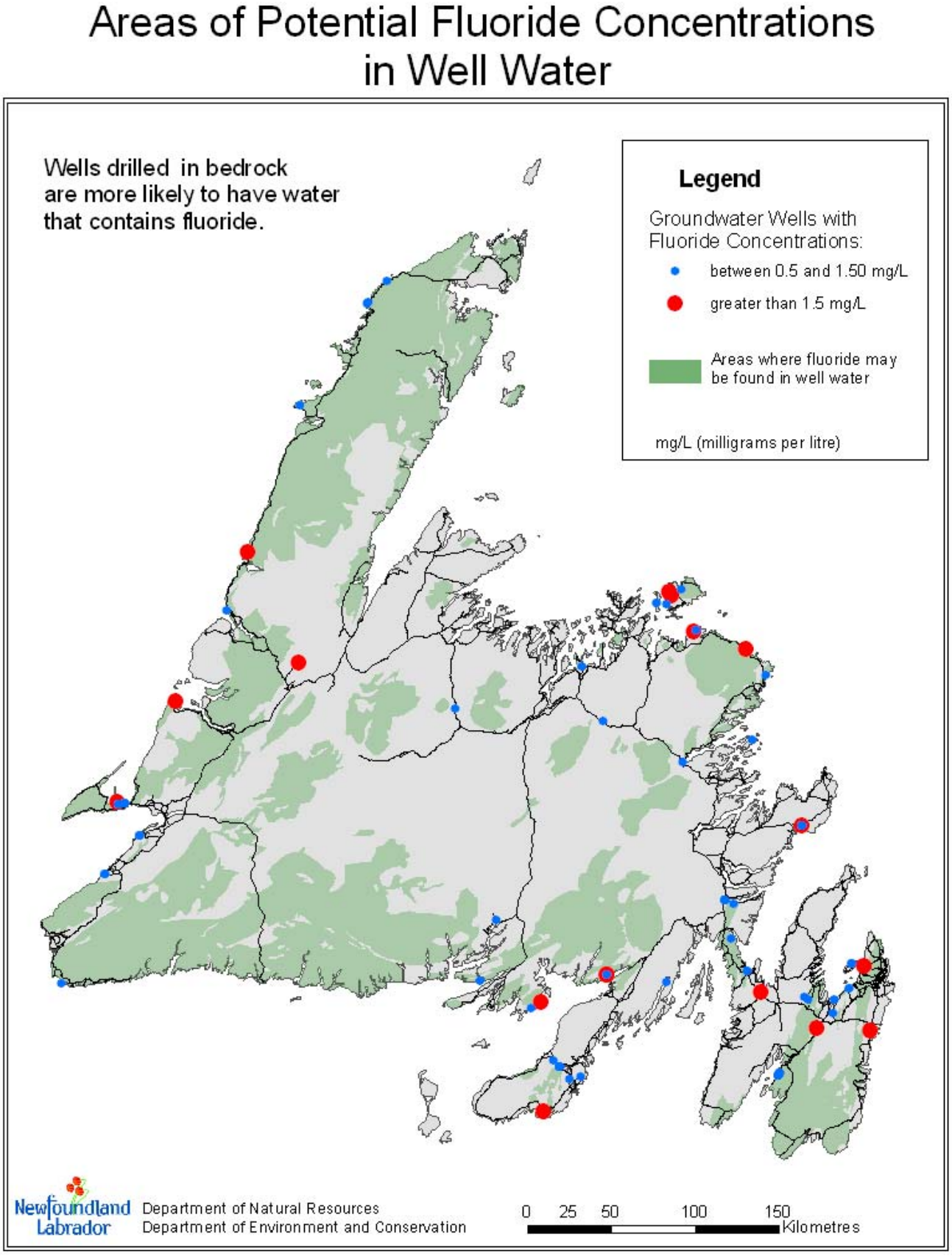
As part of the Steady Brook Watershed Management Plan, WRMD staff created a map of Sensitivity Zones for the Town of Steady Brook Public Water Supply Area. This involved many types of analysis including classifying watercourses by stream order, classifying slope zones, buffering intakes, and buffering streams based on stream order. Several maps were produced for the Steady Brook Watershed Management Plan, along with the final summary zones map that the plan uses. The zones were also supplied in digital format to Corner Brook Pulp and Paper for use in their forest management program.

WRMD staff is also involved in two federal-provincial projects: the National Hydrometric Network and National Wetlands Inventory. Both are national initiatives to improve baseline data for their respective subject areas. WRMD is taking an active role in these projects; staff members have contributed data and participated in pilot studies using provincial datasets. Because watersheds are strongly influenced by the water budget and the type and quantity of wetlands they contain, these projects can contribute to the effective management of water-supply sources and their associated watersheds.

Under a Memorandum of Agreement between ENVC and the Department of Natural Resources, a fluoride risk map of the island portion of the province was compiled during the fiscal year (Figure 7). The map indicates where elevated fluoride concentrations have been found in samples of public groundwater supplies and randomly selected private groundwater supplies. The map will serve as a reference tool and guidance document for developing new wells in the province. The green areas on the map are areas in which the likelihood of elevated fluoride concentrations in well water is greatest. (The fluoride is caused by the bedrock's natural composition.) Anyone who owns a private well should have the water sampled for a standard list of chemical parameters, one of which is fluoride. If the level of fluoride is above the GCDWQ, a treatment system can be installed to remove it from drinking water. Regular sampling should be conducted to ensure the treatment system is functioning properly. Information on fluoride in well water can be found on the ENVC web site:

www.env.gov.nl.ca/Env/env/waterres/Groundwater/Fluoride/GW&Fluoride.asp

Figure 7: Fluoride concentrations for the island portion of Newfoundland and Labrador.



5 Conclusions

The Government of Newfoundland and Labrador is committed to the safety of drinking water in this province. The MBSAP has been used successfully as a foundation for ensuring the safe delivery of drinking water to all consumers.

Every year, progress is made in several areas related to drinking-water safety. In the past fiscal year, 12 new Protected Public Water Supply Areas were designated, and infrastructure was improved through the addition of new treatment plants and new disinfection equipment. Distribution systems in many areas of the province were also upgraded.

Government continues to monitor of all public water supplies in the province. This activity includes routine monitoring for chemical, physical, and bacteriological parameters as well as special sampling for emerging parameters such as the presence of chlorate/ chlorite and radionuclides. In the 2005/6 fiscal year, 2,996 water samples were taken for chemical and physical parameters, and 20,993 bacteriological samples for were taken for bacteriological parameters as part of the drinking-water- quality sampling program. Sampling results were provided to the public through quarterly and annual reports. Sample data was also made available on the ENVC web page, which provides the public with open access to all sample data. Developments continue to improve the management and reporting of drinking-water-quality data and related information, including a revised Drinking Water Quality Search Engine, an enhanced version of the DWQ Sampling Schedule Application, and a web application for managing the Operator Education and Training Certification program information.

The OETC program continues to be a significant part of the MBSAP. In 2005/6, 14 one-day classroom seminars and 359 training sessions were delivered in 218 communities throughout the province. Another successful component of the OETC program was the annual Clean and Safe Drinking Water Workshop held in Gander March 21-23, 2006, which 281 delegates from across the province attended. The OETC program provides training and information on a variety of matters related to drinking water; it continues to contribute to a high success rate for operators writing certification exams.

Just as the province is diverse in many ways, so, too, are the issues related to drinking water. Government is committed to dealing with the issues and challenges in providing clean and safe drinking water for the residents of this province. New ideas and new technologies will help resolve drinking-water issues and build on past accomplishments. The following section provides a look ahead at MBSAP activities planned for the 2006/7 fiscal year.

6 Path Forward

6.1 Government Action Plans - 2005-2006

6.1.1 Department of Environment and Conservation

ENVC will develop and strengthen several areas of the MBSAP in the coming fiscal year. Traditional activities related to the MBSAP will continue and several new initiatives will be undertaken.

Because the protection of water supplies is an integral part of the MBSAP, communities will continue to be educated about its benefits and encouraged to pursue protection for their public drinking-water supplies. ENVC will designate water supplies as protected on an as-needed basis. In 2006/7, the Environment Application and Inspection Tracking System (ENTRACK) computer application will begin to be used to generate Permits for Development Activities in Protected Public Water Supply Areas. ENTRACK has been used successfully by other sections of the WRMD and will add consistency and improve the organization of the permit-generating process.

Monitoring in the 2006/7 fiscal year will be maintained at levels similar to previous years. Approximately 3,375 source, tap, THM, and HAA samples will be collected as part of the drinking-water-quality monitoring program. In addition, QA/QC sampling will be conducted in support of the monitoring program. Special sampling for chlorate/chlorite will be expanded, and further radionuclide sampling will also be conducted. When the sampling program identifies issues, steps will be taken to mitigate the problems. Drinking-water-quality areas of priority concern for 2006/7 are expected to be:

- aesthetic parameters – pH and colour
- contaminant parameters – arsenic, lead, barium, and turbidity
- THMs
- bacteriological parameters

The OETC program will continue to deliver education and training related to drinking-water matters throughout the province. It will consist of both classroom seminars and on-site training that uses the MTUs. The OETC web page will continue to be used to provide educational information and curriculum and seminar schedules for components of the OETC program. The annual Clean and Safe Drinking Water Workshop will be held in Gander on March 20-22, 2007. Its theme is "Emergency Preparedness, Planning and Procedures for Small Water-distribution Systems." The workshop will again include a tradeshow so that attendees can see and discuss equipment and technology with industry representatives.

In the 2006/7 fiscal year, ENVC will require technical drawings and project specifications for the Community Water and Wastewater Section to be submitted in digital format, in addition to submitting the regular paper format. Having data submitted in digital format will improve the review process and the processing time and also allow this technical information to be linked into the Division's GIS application. By having technical drawings and project specifications available through the GIS application, it will be easier to located and display technical information for a particular project when it is required.

On March 3, 2006, the WRMD signed a Memorandum of Understanding with Health Canada to develop a Source Water Quality Indicator (SWQI). The SWQI will be similar to the Drinking Water Quality Index now used in the province and will report on the quality of source waters nationally. The initial development of a SWQI calculator will be completed in the 2006/7 fiscal year.

To improve service delivery, WRMD will initiate pilot testing on implementing a Digital Document and Drawing Management System for the water and sewer permitting process. WRMD will also work with water-treatment

plant operators to gain real-time access to their Supervisory Control And Data Acquisition (SCADA) systems. SCADA systems are used to monitor and control the operation of water-treatment plants. This will allow our staff to remotely monitor the treatment plants operations.

To help staff better identify potential corrosion problems, WRMD will also be add another value-added index—the Ryznar Index—to its internal Drinking Water Quality Search Engine. Like the Langelier Index, the Ryznar Index summarizes the corrosion potential of a water supply.

6.1.2 Department of Municipal Affairs

The Department of Municipal Affairs will continue to financially support requests from communities for the provision of water related infrastructure. Appropriate water treatment technology to enable communities to meet the Canadian Drinking Water Guidelines continues to be a priority for capital funding assistance.

Cost effective approaches with regard to regionalization of operational and maintenance services will be encouraged in the way of both advisory and financial support. The Department will also continue to provide financial assistance to communities wishing to have representatives attend training, workshop and certification courses relating to drinking water safety.

6.1.3 Department of Health and Community Services

In 2006-2007 the Department of Health and Community Services and the four Regional Health Authorities will continue to work collaboratively with our drinking water partners to enhance health promotion and protection efforts, and disease prevention initiatives related to drinking water.

In 2006-2007 the Department of Health and Community Services, and/or the Regional Health Authorities will:

- Continue to provide policy and technical support to the Department of Government Services who carry out bacteriological water quality monitoring and the interpretation of bacteriological water quality test results.
- Review, and enhance drinking water safety promotional material and make the material more accessible by placing it on the Department's website.
- Continue to provide health related advice to municipal leaders and residents where public water supplies are identified to have unsatisfactory water quality.
- Partner with the Department of Government Services and the Canadian Institute of Public Health Inspectors (NL Branch) to provide drinking water related continuing professional development to public health inspectors.
- Continue to work at the national and inter-provincial levels on safe drinking water initiatives.

6.1.4 Department of Government Services

As was the case with the 2004/05 fiscal year, the number of public bacteriological water samples collected in 2005/06 increased from the previous year - by 6.4% for a total of 20,993 samples. The continued increase in public water sample collection over the last few years is an indication of the commitment of this department to a satisfactory level of bacteriological water monitoring and compliance with the levels currently recommended in the Provincial Standards and the *Guidelines for Canadian Drinking Water Quality*.

A country-wide shortage of qualified EHOs continues to negatively affect this province and some difficulty continues to be experienced in recruitment and retention for EHO positions. To help address this problem, the department will begin a bursary program in 2006-07 to fund the placement of three Environmental Health students at the University of Cape Breton. The goal of this program is to secure graduates for employment in rural areas of the province starting in the fall of 2008.

A Memorandum of Understanding between the City of St. John's, the Office of the Chief Information Officer and the Department of Government Services to permit access to a component of the MIMS system will be finalized in 2006-07. The document will enable the municipalities under the St. John's Water Authority to have real-time access to the results for water samples collected by their municipal workers. This accessibility removes the need for the Department of Government Services to be used as an intermediary between the Public Health Lab and the St. John's Water Authority. The Department of Government Services will provide support and training to the St. John's Water Authority in the implementation of this system.

The Department of Government Services will partner with the Newfoundland and Labrador Branch of the Canadian Institute for Public Health Inspectors in hosting a professional development conference on Environmental Health in October, 2006. Included in the 2-day session will be a half day dedicated to drinking water - quality guidelines, treatment methodologies and consumption patterns.

Through its bacteriological water monitoring program, the Department of Government Services helps ensure that public drinking water is protected from waterborne diseases and is safe for consumption. A review of the current sampling program will be undertaken as part of the department's workload analysis in the 2006-07 fiscal year with a view to determining whether additional improvements or efficiencies can be achieved. The department is also interested in improving surveillance of drinking water that may be accessible to the public other than through municipal/public water supplies, such as semi-public and institutional supplies, and will continue discussions with the Department of Environment and Conservation on this issue in the coming year.

6.2 Inter-Departmental Cooperation

An inter-departmental committee was formed in June 2000 to ensure that the participating departments are always appraised of all current events pertaining to drinking water safety and to work together to deal with emerging drinking water safety issues. The committee is called the Safe Drinking Water - Technical Working Group (SDWTWG). It consists of representatives from the four government departments which are responsible for keys aspects of providing clean and safe drinking water in accordance with the MBSAP. The departments are: Environment and Conservation, Health and Community Services, Municipal Affairs and Government Services. The committee includes representation from the Public Health Laboratory, the Medical Officers of Health and Executive Council.

The SDWTWG met four times in 2005/06 and its activities were reported to the Chair of the Steering Committee of Senior Government Officials who is the Deputy Minister, Department of Environment and Conservation. The SDWTWG is an effective networking mechanism and accomplished the following:

- Coordinate the implementation and improvement of the Municipal Information Management system in the area of data entry for water test results, recording of boil water advisories and maintaining a current record of water related infrastructure in the province.
- Prepare and review the Drinking Water Safety in Newfoundland and Labrador Annual Report 2005.
- Review proposed standards for drinking water safety for semi-public water supplies
- Review provincial boil water advisories and discuss ways to help communities to deal with the issues that bring about those advisories. Also coordinate with regional water committees.
- Keep committee members informed about the activities of the Federal, Provincial, Territorial - Committee on Drinking Water and solicit comments on revised drinking water guidelines.
- Review actions necessary to communicate new Health Canada arsenic guidelines to affected communities.
- Review the initiative to get private well owners to sample and test their own wells.
- Arrange for pre- and post construction meetings with contractors and consultants on water works construction projects.
- Review the Federal initiative to carry out water testing on federal property within the province.
- Review the testing of water samples at private laboratories in the province and to start the preparation of guidelines.
- Review notification of boil water advisories for communal handpump wells.