Environment Canada Environnement Canada

Environment Canada

The Canada Water Act

Annual Report

2000-2001

Canada

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Her Excellency
The Right Honourable Adrienne Clarkson, C.C., C.M.M., C.D.
Governor General of Canada
Rideau Hall
Ottawa ON K1A 0A1

Your Excellency:

I respectfully submit to Your Excellency and to the Parliament of Canada the annual report on operations under the *Canada Water Act* for the fiscal year 2000-2001.

Yours sincerely,

David Anderson, P.C., M.P.

Canada

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PREFACE

The *Canada Water Act* (proclaimed on September 30, 1970) provides the framework for cooperation with provinces and territories in the conservation, development, and utilization of Canada's water resources. Section 38 of the *Revised Statutes of Canada (1985*) requires that a report on the operations under the Act be laid before Parliament after the end of each fiscal year. The report describes a wide range of federal activities conducted under the authority of the Act, including significant water research, participation in federal–provincial agreements and undertakings, and a public information program. This, the 29th report, covers progress on these activities to March 31, 2001.

SUMMARY OF PROVISIONS:

Part I, Section 4, provides for the establishment of federal-provincial consultative arrangements for water resource matters. **Sections 5, 6, and 8** provide the vehicle for cooperative agreements with the provinces to develop and implement plans for the management of water resources. **Section 7** enables the Minister, directly, or in cooperation with any provincial government, institution, or person, to conduct research, collect data, and establish inventories associated with water resources.

Part II provides for federal-provincial management agreements where water quality has become a matter of urgent national concern. It permits the joint establishment and use of federal or provincial incorporated agencies to plan and implement approved water quality management programs. The application of alternative cooperative approaches and programs has resulted in Part II never having been used.

Part III, which provided for regulating the concentration of nutrients in cleaning agents and water conditioners, was incorporated into the *Canadian Environmental Protection Act* (CEPA) in 1988 and later into Sections 116–119 (Part VII, Division I) of the new *Canadian Environmental Protection Act*, 1999, which came into force March 31, 2000. (See the CEPA annual report to Parliament.)

Part IV contains provisions for the general administration of the Act. In addition, Part IV provides for inspection and enforcement, allows the Minister to establish advisory committees, and permits the Minister, either directly or in cooperation with any government, institution, or person, to undertake public information programs.

HIGHLIGHTS, 2000–2001

COMPREHENSIVE WATER RESOURCE MANAGEMENT
(Part I of the *Canada Water Act*)

1. Federal–Provincial Programs

1.1 Data Collection and Use

Collection of Water Quantity Data

Background

Under hydrometric agreements administered since 1975 with the provinces and territories, government agencies have gathered, analyzed, and interpreted water quantity data to meet a wide range of client needs in the hydrologic community.

Following modifications to the hydrometric network, a federal–provincial working group was established in 1997–98 to analyze the existing agreements against a set of principles for a renewed partnership. Administrators achieved consensus on most outstanding issues related to the equitable sharing of costs; access to data, information, and services; national standards; and the decommissioning of hydrometric stations.

In April 1999, a Memorandum of Understanding was signed by Environment Canada and Indian and Northern Affairs Canada to address field infrastructure issues. By year-end, modernization of the field infrastructure had been completed for all of New Brunswick, Prince Edward Island, Newfoundland, Nova Scotia, Quebec, Nunavut, and the Northwest Territories.

Progress (to March 31, 2001)

The Water Quantity Survey Agreements continued in force. The Administrators agreed that formal amendments to the Agreements were required to meet the objectives and needs of all parties. A small working group was given the task of assessing all options for presentation at the next annual meeting.

Hydrometric data were collected, interpreted, and disseminated to meet a variety of needs in the hydrologic community. The federal and provincial networks funded under the Agreements remained relatively stable with about 2300 stations. Work continued on the Red River Network Enhancement Project to improve flood-forecasting capabilities in Manitoba. Ten new or reactivated stations were added to the network and 12 stations were modernized and flood proofed.

Joint federal and provincial efforts continued to address infrastructure issues. During the year, 46 mercury manometers were removed from operation, 212 gauging sites were assessed for spilled mercury, and 159 sites were remediated. By year-end, modernization of the hydrometric gauging station equipment had been completed for New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, Quebec, Ontario, and the three territories.

Water Supply and Use Data

Background

In the fall of 2000, Environment Canada and the Province of Ontario initiated a joint federal–provincial water use and supply project for the Great Lakes basin. The primary objectives of this Canada–Ontario project are to gain baseline information, at the sub-basin level, on water supply, use, and demand; to identify the system's ecological sensitivities to water resources; and to make projections for the future, including the potential impacts of climate change.

Environment Canada and the Ontario Ministry of Natural Resources co-lead the project. The Project Management Team includes members from these two agencies along with the Ontario Ministry of Environment, Conservation Ontario, and Fisheries and Oceans Canada. There is an advisory committee made up of members from numerous agencies and organizations that have expressed an interest in the project. Three technical Work Groups conduct the work, which

commenced in November 2000 and will conclude on March 31, 2005. The projected timeline consists of the following:

- Year 1: Data acquisition and assembly.
- Year 2–3: Data analysis and interpretation.
- Year 3–4½: Assessment of future scenarios and findings.

Progress (to March 31, 2001)

The Project Management Team and three Working Groups (Water Use, Water Supply, and Ecological Needs) were established. Base mapping for the Great Lakes study area was established and compilation of data sources began.

Water Quality Monitoring Agreements

Background

Beginning in the early 1980s, federal–provincial agreements were negotiated with several provinces and territories, including British Columbia (1985), Manitoba (1988), New Brunswick (1988), Newfoundland (1986), the Northwest Territories (1995), Prince Edward Island (1989), Quebec (1983), and Yukon (1995).

The agreement with New Brunswick was modified in 1995 when the provincial government undertook to collect, analyze, and manage the data for the water quality monitoring program. The agreement with Quebec was terminated in 1995 because activities were similar to those in the St. Lawrence Action Plan. There was no monitoring in Yukon because of resource constraints. The agreement with Prince Edward Island was incorporated into the Canada-PEI Water Annex, signed in 1996 pursuant to the Federal–Provincial Framework Agreement for Environmental Cooperation in Atlantic Canada. Both the Framework Agreement and the Annex expired in 1999.

Environment Canada also participates in specific water quality (and quantity) monitoring arrangements. One of these focuses on transboundary rivers for the Prairie Provinces Water Board. Another is focused on impacts of land use change in the Pockwock–Bowater watershed, Nova-Scotia.

Progress (to March 31, 2001)

Water quality monitoring was conducted every two weeks by Environment Canada, in partnership with the British Columbia Ministry of Environment, Lands and Parks, at 29 stream or river sites in the province. A report on water quality trends at these sites and at additional sites monitored by the two agencies from 1985 to 1998 was released in July 2000. Sixty-eight water bodies were assessed and 59 percent of the surface water stations showed no observed changes in water quality, 31 percent had improving trends, and 10 percent had deteriorating trends. The groundwater data showed that 53 percent of the stations had no observed changes, 27 percent showed improving trends, and 20 percent had deteriorating trends. Causes of deteriorating trends ranged from elevated nitrates in the groundwater supply to elevated suspended solids, coliform bacteria, metals, or nutrients in some surface waterways.

Discussions continued with Manitoba on revisions to the Canada–Manitoba Water Quality Monitoring Agreement. Environment Canada now monitors five locations under the proposed new monitoring schedule. Negotiations to finalize the new arrangements were still ongoing.

In Prince Edward Island, the water quality monitoring program was maintained while an interim arrangement was developed to replace the Annex that had expired in 1999. Based on analyses of long-term water quality monitoring data in groundwater, streams, and estuaries, the PEI Water Quality Interpretive Report 1999 was released. A monitoring and toxicological project was initiated to develop a diagnostic tool that will be used to identify the presence of pesticide residues in fish tissue and help determine whether recent fish kills in rural PEI were related to commonly used pesticides.

In New Brunswick, 15 long-term surface water quality stations continued to be monitored in accordance with the federal–provincial agreement.

In Newfoundland, several water quality sites continued to be sampled under the federal–provincial agreement.

Active collaboration continued in various water quality monitoring projects as follows.

In Nova Scotia and in Newfoundland, lake monitoring sites serve as an information source for Environment Canada's ongoing LRTAP (Long Range Transport of Airborne Pollutants) effects program. An interactive CD-ROM of the LRTAP lakes monitoring data was produced. Water quality monitoring also continued in support of long-term multi-agency research projects on Catamaran Brook, in the Fundy Model Forest, and in constructed wetlands at River Hebert.

Cooperative Modelling in the St. Lawrence River and the Great Lakes Connecting Channels

(i) St. Lawrence River

Background

In 1997–98, Environment Canada's Meteorological Service of Canada (MSC–Quebec Region) and the Institut National de la Recherche Scientifique (INRS–Eau) concluded a cooperation agreement for two-dimensional hydrodynamic modelling of the St. Lawrence River between Cornwall, Ontario, and Trois-Rivières, Quebec. The modelling project is aimed at developing a capability to forecast the transport of pollutants (from oil spills and industrial and municipal sewers) as well as developing applications in other areas such as bank erosion, dredging, and shipping activities. The project is also designed to understand the physical processes present in the river and to establish the connection between these processes and the flora and fauna habitat. INRS–Eau is an internationally recognized research institute of the University of Quebec that specializes in hydrology and hydrodynamic modelling.

MSC–Quebec Region contributes to emergency responses in the event of accidental spills into the St. Lawrence River and models the distribution of currents in the fluvial portion of the St. Lawrence. It has concluded agreements with various governmental agencies (e.g., Hydro-Quebec) to facilitate hydrometric data exchange.

Progress (to March 31, 2001)

During 2000–01, MSC–Quebec Region and INRS–Eau continued to work under a cooperation agreement for the hydrodynamic modelling of the St. Lawrence River. The following aspects were developed.

- Possible approaches to, and the feasibility of, making automated ice effect corrections at the hydrometric station level were evaluated.
- A feasibility study was conducted on the introduction of new numerical models for safer estimation of flow.
- Work began on a model for two-dimensional simulation of river temperatures.

(ii) Automated Control of Data

Background

The Meteorological Service of Canada, Quebec Region, is participating in the implementation of a pilot project involving the automated, real-time application of quality control algorithms to data from hydrometric and meteorological monitoring networks. Traditional methods of managing these data have also been reviewed and optimized in accordance with the most up-to-date concepts and technologies in the field.

Progress (to March 31, 2001)

A complete data model as well as a bank of suitable data was made available. Quality control algorithms for the following aspects were developed:

- domain of variation.
- temporal variability.
- spatial variability.
- inter-variable comparisons.

The first two algorithms were successfully applied for a selection of hydrometric and meteorological stations.

(iii) Great Lakes Connecting Channels

Background

In 1997, Environment Canada, the Ontario Ministry of Natural Resources, the U.S. Army Corps of Engineers, and local conservation authorities initiated a comprehensive study to analyze the impact of encroachments from

shoreline and in-channel projects on flows and levels in the St. Clair and Detroit Rivers.

Using a two-dimensional numeric model, the goal of the study was to develop a framework for determining whether future projects would have acceptable hydraulic impacts when considered in combination with other potential developments.

Progress (to March 31, 2001)

The encroachment analysis was completed during the year. In July 2000, the study participants released the final report entitled "The Comprehensive Encroachment Analysis of the Detroit and St. Clair Rivers". The findings will be used to provide guidance to a wide range of regulatory agencies in Canada and the United States with a role in reviewing shoreline and in-channel projects on the St. Clair and Detroit Rivers.

Petitcodiac River and Estuary Restoration and Rehabilitation project

Background

In 1968, a 1-kilometre long causeway and dam with five sluice gates were built across the Petitcodiac River estuary in southern New Brunswick. While beneficial as a crossing, the causeway is also a barrier that impedes freshets and tidal flows. Over the years, this condition has created ecological and other issues related to fish passage, levels of nutrients and dissolved oxygen, pollution, and channel sedimentation.

As part of efforts to rehabilitate the estuary, Environment Canada, Fisheries and Oceans Canada, and New Brunswick signed a Memorandum of Understanding in 1996 to conduct an experimental opening of the causeway gates. The purpose of the experiment was to evaluate a means of operating the gates that could restore the river to a more natural ecological state.

Progress (to March 31, 2001)

Water quality analysis, sediment sampling, and toxicology testing was conducted by the Moncton laboratory at various locations near the causeway on the Petitcodiac River and in the estuary near River Hebert. This produced the required background information for continuing the Petitcodiac River and Estuary Restoration and Rehabilitation project.

1.2 Interjurisdictional Boards

Ottawa River Basin Regulation

Background

In 1983, Canada, Quebec, and Ontario concluded an agreement respecting the Ottawa River Basin Regulation. Under its terms, a board was constituted to plan and recommend regulation criteria for the 13 principal reservoirs of the basin, taking into account flood protection, hydroelectric power production, and other interests. Supported by a Regulating Committee and a Secretariat, the Ottawa River Regulation Planning Board endeavours to ensure that the integrated management of the reservoirs provides protection against flooding along the Ottawa River and its tributaries and along its channels in the Montreal region.

During the spring freshet, hydrometric and meteorological data are collected daily and are used to develop inflow forecasts. A simulation model is used to evaluate the effects of sub-basin inflows and regulation decisions on flows and levels throughout the basin. The Secretariat provides information on flows and levels to the public. Since 1986, flood reserves have been implemented in three of the principal reservoirs (Quinze, Timiskaming, and Poisson Blanc) to improve downstream flood reduction. One of the main benefits of the reserves is to enable operation of the Grand Moulin dam to provide protection for residents along the Milles Iles River in the Montreal region.

Progress (to March 31, 2001)

In 2000, the freshet produced a series of low flood peaks during March, April, and May. The peaks occurred as a result of a number of thaw and precipitation events. All peak flows were well below the damage threshold. There was no flooding in the Ottawa River basin or the Montreal region, and the use of flood reserves for operation of the Grand Moulin dam in the Mille Iles River was not required.

Beginning with the present fiscal year, the Board decided to accelerate the program to replace

seven precipitation gauges in Quebec within a time frame of two years.

The Board held its third annual public meeting in Hawkesbury, Ontario, in September 2000. The meeting was well attended and the main concern of the residents appeared to be erosion problems and shore protection works upstream of the Carillon dam.

Prairie Provinces Water Board

Background

In 1969, Canada, Alberta, Manitoba, and Saskatchewan signed the Master Agreement on Apportionment, which provides for the equitable apportionment of eastward-flowing Prairie rivers and the consideration of water quality problems. Under Schedule C, the Prairie Provinces Water Board (PPWB) was reconstituted to administer the provisions of the Master Agreement.

The apportionment of the natural flow of Lodge, Middle, and Battle Creeks at the Alberta–Saskatchewan boundary is specified in Article 6, Schedule A, of the Master Agreement. Lodge and Battle Creeks are also subject to international apportionment under the 1909 Boundary Waters Treaty following the subsequent 1921 Order of the International Joint Commission. Since the inception of interprovincial apportionment monitoring in 1985, deficits in delivery to Saskatchewan have occurred in 1988, 1989, 1992, 1998, and 2000.

In 1992, the Master Agreement was amended to include a new Agreement on Water Quality (Schedule E) in response to concerns for protecting these water resources. Schedule E specified acceptable water quality objectives in each river reach and further defined the duties of the Board with respect to its water quality mandate.

In 1999, the Prairie Province Water Board approved changes to the natural flow computation procedure to improve the accuracy of apportionment monitoring. In March 2000, the Board further agreed to adjust the evaporation data.

Progress (to March 31, 2001)

During 2000-01, data from 88 hydrometric and 21 meteorologic stations were used to compute natural flows. The Committee on Hydrology (COH) reviewed the hydrometric network to ensure changing use patterns were appropriately monitored to allow accurate computation of natural flow.

Since 1985, the COH has sought ways to improve the effectiveness of apportionment monitoring of Lodge and Middle Creeks at the Alberta–Saskatchewan boundary. In 1999, the Board approved three changes to the natural flow computation procedure recommended by the COH to improve the accuracy of apportionment monitoring for these two interprovincial streams. In March 2001, the Board further agreed to adjust the evaporation data of upper reservoirs in Lodge and Middle Creeks.

The Committee on Groundwater (COG) finalized its report entitled “A Review of Transboundary Groundwater Apportionment” in November 2000. The COG will provide a proposal to the PPWB for a pilot project in 2001-02 as a further step toward development of interprovincial groundwater apportionment agreements for the Prairie provinces.

Nutrients cause excessive weed and algae growth. In 1999, the Committee on Water Quality (COWQ) completed an analysis of existing information on nutrient–plant relationships in Prairie rivers. In March 2001, COWQ received: the final recommendations of a report drafted to determine the feasibility of establishing nutrient water quality objectives; a review of information on planktonic algae and chlorophyll; and the final report of the PPWB Water Quality Monitoring Station Review, all prepared by the National Water Research Institute.

COWQ is developing a water quality index that could be employed to reduce the multi-variable nature of water quality data. This approach combined individual measures and provided a clear description of water quality on a use-by-use basis. A pilot study used the PPWB water quality monitoring data set and took advantage of similar work done by Alberta. It is anticipated that the Water Quality Index will be ready for use by 2003.

Mackenzie River Basin Transboundary Waters Master Agreement

Background

The governments of Canada, British Columbia, Alberta, Saskatchewan, Northwest Territories

and Yukon signed the Mackenzie River Basin Transboundary Waters Master Agreement (Master Agreement) in July 1997. The Master Agreement endorses the principle of managing water resources for future generations in a manner consistent with the maintenance of the ecological integrity of the aquatic ecosystem. It provides for early and effective consultation on potential developments and activities in the basin that could affect the integrity of the aquatic ecosystem. It also contains provisions for seven sets of bilateral agreements between adjacent jurisdictions in the basin. These bilateral agreements identify scientific criteria for water quality, water quantity, and seasonal timing of flows at boundary crossing points required to maintain the integrity of the aquatic ecosystem of transboundary water bodies.

The Mackenzie River Basin Board administers the Master Agreement. Its members are appointed and represent all parties: Canada, British Columbia, Alberta, Saskatchewan, the Northwest Territories, and Yukon. Federal members include representatives of Environment Canada, Indian and Northern Affairs Canada, and Health Canada. There are five Aboriginal Board members nominated by Aboriginal organizations in each of the jurisdictions.

Under the Master Agreement, Environment Canada is responsible for managing the expenditures of the Board, which are cost shared equally by the Parties. Shareable costs include, among other things, the staffing and operation of a secretariat to support the Board at the working level. An Executive Director of the Secretariat is hired within Environment Canada, Prairie and Northern Region, to plan, direct, and manage Board operations.

In 1998, the Board initiated a long-term strategic planning process. As a result of two workshops, including one held in June 1999 at Fort Smith, the Board developed a draft Strategic Plan that is now being vetted through a program of public communication and consultation. This consultation program will be an integral part of the Board's overall aim to inform and involve the people who live and work in the basin.

During 1999–2000, the Board made a decision to relocate the Secretariat from Edmonton to an Environment Canada facility in Fort Smith, Northwest Territories.

Progress (to March 31, 2001)

The Board sponsored a Mackenzie River Basin Water Forum held in Yellowknife on March 6 and 7, 2001, which brought together experts from across Canada to discuss major issues affecting the basin. This provided the first step in preparing the State of Aquatic Ecosystem Report (SOAER). The report is a major commitment under the Master Agreement, and must be completed every five years.

Work on the state of the aquatic ecosystem was undertaken through the formation of a SOAER Committee and five sub-basin teams reporting to the Board. A final report editor–writer was selected to work on the SOAER in 2001. The final report is scheduled for completion in spring 2003.

The Parties continued discussions on some of the seven bilateral water management agreements to be attached to the Master Agreement, and the Northwest Territories–Yukon bilateral agreement was nearing completion.

Working relations were maintained between the Mackenzie River Basin Board and the Northern Rivers Ecosystem Initiative (NREI).

1.3 Flood Damage Reduction Program

Background

In 1975, Environment Canada initiated the national Flood Damage Reduction Program. By 1989, cooperative agreements had been concluded with the governments of nine provinces and the Northwest Territories.

The mapping program was highly successful in mapping flood-risk areas in nearly 1 000 communities across Canada. The program also increased public awareness and fostered the development of improved policies, programs, and institutions by governments to deal with a variety of issues related to preventing flood damages.

Most of these agreements have now lapsed.

Progress (to March 31, 2001)

During 2000-01, agreements containing policy provisions remained in effect, for all or part of the

year, with Newfoundland, Quebec, Nova Scotia, and British Columbia, committing the parties not to engage in, or provide assistance to, undertakings vulnerable to flood damage in designated flood-risk areas. The agreements signed with Nova Scotia and Newfoundland expired on June 22, 2000, and March 31, 2001, respectively.

The Province of Quebec had initiated its own comprehensive program of flood-plain mapping after the Saguenay flooding of 1996 and decided to withdraw from the remaining term of the policy agreement effective March 31, 2001.

No new designations were approved under these agreements.

1.4 Ecosystem Initiatives: Watershed and Water-Related Activities

During the year, Environment Canada continued the development and implementation of its major ecosystem initiatives, covering a wide variety of sensitive marine and freshwater systems across Canada. A five-year $122.5 million funding authorization, which began in 1998–99, has supported the program.

Although each initiative has unique features, common management principles are observed throughout. These principles stress ecosystem and precautionary approaches to pollution prevention; citizen and community involvement in the design and implementation of initiatives; long-term stewardship through partnerships and governments working together; and sound science combined with local and traditional knowledge as the basis for identifying and resolving issues.

The ecosystem approach itself takes into consideration complex interrelationships among water, land, air, wildlife, and human activities. The focus of this report is primarily on water-related activities and their interjurisdictional arrangements.

Atlantic Coastal Action Program

Background

The Atlantic Coastal Action Program (ACAP) was initiated by Environment Canada in 1991. It is centred on community-based leadership and delivery to address environmental and sustainable development issues in ecosystems involving watersheds and coastal areas throughout Atlantic Canada. With broad local support, non-profit organizations have been incorporated at 14 sites across Atlantic Canada. At these sites, Environment Canada contributes funding, technical and scientific expertise, and direct staff support with respect to four broad categories of projects relevant to the *Canada Water Act*:

- clean water (e.g., domestic sewage)
- atmospheric emissions
- toxics
- natural habitat

Over the past decade, some 500 projects have been undertaken. These projects have already resulted in significant water quality improvements in several coastal river systems. For example, the Bluenose Oil Spill Response Program, in operation since 1996, has played an instrumental role in cleaning up several small spills in the region. During 1999–2000, Bluenose ACAP hosted an Atlantic Region Sewage Workshop in Lunenburg, Nova Scotia, that resulted in recommendations to forge a regional consensus on giving sewage treatment top priority in infrastructure programs.

St. John's Harbour ACAP in Newfoundland presented a state-of-the-harbour report outlining an "at-source control" proposal for municipal wastewater in the St. John's–Mount Pearl area. Saint John ACAP in New Brunswick implements "Creek Sweeps" projects to restore several urban streams degraded by litter, untreated sewage, and toxic compounds.

Progress (to March 31, 2001)

The third year of ACAP Phase II (1998/99–2002/03) continued its strong focus on water-related projects. Under the mandate of the *Canada Water Act*, the ACAP organizations identify and undertake projects that are most relevant at the local community and ecosystem level. This serves to validate federal priorities and communities' commitments in working toward better management of water resources.

Working through 14 community-based ACAP organizations and 3 larger regional ecosystem

initiatives (Gulf of Maine Council, Bay of Fundy Ecosystem Partnership, Southern Gulf of St. Lawrence Coalition on Sustainability), there was a diversity of activity undertaken in support of the *Canada Water Act* mandate. Ongoing volunteer water quality monitoring in the rivers and streams of Miramichi, New Brunswick, Annapolis, Nova Scotia, Montague, Prince Edward Island, and St. John's, Newfoundland, provided valuable long-term data and direct opportunities for community engagement and capacity building, as well as hands-on education of hundreds of community members.

ACAP Saint John in New Brunswick undertook a study of the financial and socio-economic benefits of improved water quality in this community and measured fish health as ecosystem health indicators. Restoration of aquatic habitat in the streams of Pictou, Nova Scotia, and St. Croix, New Brunswick, reflected tangible examples of what communities were willing to undertake. In Humber Arm, Newfoundland, water conservation and pollution prevention projects addressed up-stream sources of pollution. Efforts were aimed toward building the awareness of the personal impact on, and shared responsibility for, water resources.

Georgia Basin Ecosystem Initiative: Cooperative Arrangements in the Georgia Basin

Background

In December 1998, Environment Canada and the British Columbia Ministry of Environment, Lands and Parks announced their shared priorities of clean air, clean water, conserving and protecting habitat and species, and building sustainable communities, collectively known as the Georgia Basin Ecosystem Initiative (GBEI). The Georgia Basin Ecosystem encompasses most of the Georgia Strait, part of the Juan de Fuca Strait, and the waters that flow into these marine bodies.

Building on the success of earlier initiatives undertaken in the Fraser River and estuary,[*] GBEI provides an opportunity for community and watershed groups, Aboriginal peoples, industry, and business to participate with governmental agencies in stewardship projects to maintain the health of the ecosystem. The focus is on clean water and air, the conservation and protection of habitat and species, and the promotion of sustainable communities.

GBEI Clean Water focuses on reducing the impacts of urban growth and agricultural activities on stormwater, municipal sewage, and shellfish harvesting areas, and includes the following priorities:

- identification and management of toxic substances
- management of sewage treatment operations, biosolids, and urban stormwater
- practices to reduce pollution from vessels and marine facilities (including pleasure craft)
- management practices to reduce agricultural non-point source pollution
- water conservation practices and protection of drinking water sources
- pollution prevention programs for municipalities and small businesses
- management practices to maintain and restore shellfish harvesting areas

In order to meet these priorities, a number of projects have been undertaken. For example, agreements were signed with Cowichan First Nations and Snuneymuxw First Nations to determine sources and levels of contamination in shellfish harvesting areas. Samples to determine benthic community structure were collected from the Fraser Valley and Greater Vancouver area in the fall of 1998 and 1999; sampling continued in 2000.

A Liquid Waste Management Plan (LWMP) has been developed to address wastewater pollution. In addition, the Urban Watershed Management CD-ROM was developed to serve as the textbook for a comprehensive Internet-based course on urban watershed management offered through the University of British Columbia's Continuing Studies Program.

[*] Fraser River Action Plan and Fraser River Estuary Management Program

Finally, in January 2000, the Joint Statement of Cooperation on the Georgia Basin and Puget Sound Ecosystem was signed to develop annual plans and report progress to the public.

Progress (to March 31, 2001)

Studies continued in the Lower Fraser Valley on the effects of agricultural and urban non-point source pollution on groundwater and surface water quality and organisms living in the streams. Groundwater sampling in the Chilliwack area showed very few water quality problems; one site had coliform bacteria and a few sites had elevated metals (mainly iron and manganese). Benthic community sampling in streams indicated that streams in urban areas were under greater stress than those in agricultural areas. Investigations in this area of the Georgia basin will continue until March 2003.

A compilation of Environmental Quality Benchmarks from around the world has been developed into a CD-ROM. This collection of guidelines, criteria, and standards for safe chemical concentration levels has been compared to the concentrations measured in water, sediment, and biological tissue from marine, fresh, and estuarine waters in the Georgia basin. Comparing environmental measurements with respective values in the compendium have allowed researchers to assess possible risks to the health of aquatic species and wildlife, as well those to humans.

In May 2000, 14 new British Columbia water bodies were designated as no-discharge zones under the Pleasure Craft Sewage Pollution Prevention Regulations. These no-discharge zones provide a guaranteed method to protect public health from boating sewage discharge and to preserve the quality of water in shellfish-growing areas. In order to address boaters' concerns over the lack of public pump-out stations, the Pleasure Craft Sewage Pump-Out Station Program was initiated. Since 1998, six stations have been constructed in Comox, Deep Bay, Gibsons, Madeira Park, Ganges Harbour, and Cowichan Bay. There are also plans to construct an additional station in Saanich Inlet.

In collaboration with the Georgia Strait Alliance, results from a household pesticide use and inventory survey conducted in 1999 were obtained. Over 400 households responded and were given educational materials on using and finding alternatives to pesticides and other household toxic chemicals. The data was used to establish priorities for pesticide monitoring, pesticide use in integrated pest management, and the possible development of other management options for selected pesticide active ingredients.

The shared waters of Semiahmoo Bay (Canada) and Drayton Harbor (U.S.) have been the focus of an international round table to develop an action plan to remediate these waters for shellfish growing. The round table was developed as a result of years of closures and as a follow-up to a fecal coliform bacteria-monitoring survey conducted by the South Fraser Valley Health Unit. In February 2001, over 75 scientific, technical and ENGO participants shared information about water quality, pollution source investigations, and remedial projects taking place on both sides of the border. The Canadian report, "Semiahmoo Bay Water Quality Project", was presented at the workshop. It suggested that water quality was degraded during heavy rains. Shellfish growing water standards were exceeded at all stations but one, and at some stations the recreational bathing standards were also exceeded. From the workshop the Semiahmoo Shared Waters Round Table was formed with members representing all levels of government, First Nations and local non-government organizations. This international round table has become a focal point for water quality restoration efforts on both sides of the border.

The first Canadian Onsite Wastewater Training Centre was developed at Royal Roads University in Victoria. The centre was designed for industry installers, designers, and regulators on the principles and requirements for proper on-site sewage treatment and disposal. To date, three courses have been developed: Introduction to Onsite Sewage Treatment and Disposal, Introduction to Onsite Assessment and Design, and Operation and Maintenance: Basic Systems.

Great Lakes Action Plan – Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem

Background

The Great Lakes 2000 Program was the second phase of Environment Canada's 1989 Great Lakes Action Plan (GLAP) initiative to manage and improve the ecosystem of the Great Lakes

basin. Great Lakes 2000 was a cooperative effort among other federal ministries, First Nations, communities, organizations, industry, and citizens in partnership to help Canada fulfil its obligations under the Canada–United States Great Lakes Water Quality Agreement (GLWQA). The 1994 Canada–Ontario Agreement respecting the Great Lakes Basin Ecosystem (COA) builds on this partnership by establishing a cooperative framework between the two governments to work toward restoring and protecting the Great Lakes ecosystem.

The 1994 COA identified more than 50 targets to be achieved during the six-year term of the agreement. These targets address the three primary objectives of COA, namely to (1) restore and protect ecosystem health and beneficial uses in degraded areas, (2) prevent and control pollution by working toward the virtual elimination of persistent, bio-accumulative and toxic substances of greatest concern with a philosophy of zero discharge, and (3) conserve and protect human and ecosystem health by determining the impacts of contaminants on the basin and use this information to address significant ecosystem health issues.

In 2000, the Government of Canada announced the third phase of the Great Lakes Action Plan 2001-2006, which replaced Great Lakes 2000. The GLAP brings together the activities and commitment of eight federal departments to deliver on Canada's commitments in relation to the protection of the Great Lakes basin ecosystem as defined by the Canada–United States Great Lakes Water Quality Agreement.

The GLAP reflects the need to meet the challenges that have been the focus of the Government of Canada's attention since the inception of the Great Lakes Program in 1989. In addition, the GLAP also addresses challenges of increasing importance, including the introduction of exotic species and the impacts of human health and development. Finally, the GLAP will address environment stresses and human health in the Great Lakes basin ecosystem through tangible progress on sustainable development.

The efforts undertaken by the GLAP are organized in relation to three main goals: Healthy Environment, Healthy Citizens, and Sustainable Communities. These goals will be addressed with seven main objectives: Restore Areas of Concern, Conserve Ecologically Important Areas, Control Introduction of Exotic Species, Assess and Manage Ecosystem Health, Protect and Promote Human Health, Reduce Harmful Pollutants, and Advance Sustainable Use.

Progress (to March 31, 2001)

The Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) has expired and the Parties are currently preparing for the negotiation of a new Agreement. Federal–provincial actions are still being maintained and coordinated in a “business as usual” approach. These efforts refer to three dominant areas: restoration of beneficial uses in Areas of Concern, virtual elimination of persistent toxic substances, and the continued development and implementation of Lakewide Management Plans.

During this fiscal year, the federal and provincial governments have focused on Remedial Action Programs (RAPs), Lakewide Management Plans (LaMPs), and Toxics, as well as relevant commitments under the 1994 COA. Areas that required COA management decisions have been identified in order to ensure COA commitments have been met.

The following list highlights some of the key accomplishments during the 2000–01 year

- Development of new and innovative technology for sewage treatment plants, which has resulted in a potential savings of $33 million in Windsor, Ontario.
- Improvements in treating combined sewer overflows (CSOs) resulted in beaches remaining open for longer periods of time in Toronto, Hamilton, and other lakefront communities.
- Successful full-scale remediation of sediment at Atlas Steels in the Niagara River AOC.
- Overall reduction of 71 percent in the use, generation, and release of seven priority toxic chemicals.
- Confirmed elimination of five banned pesticides from commercial sectors on the Canadian side of the basin.
- Destruction of more than 50 percent of the high-level PCBs that were in storage, exceeding the year 2000 target.

- An 82 percent reduction in discharges of chlorinated toxic substances, as well as the virtual elimination of aqueous emissions of dioxin and furans to the Great Lakes through federal and provincial pulp and paper regulations.

- A 99 percent reduction in the point source loads of 18 priority toxics identified through the Niagara River Toxics Management Plan.

- Documentation of the source of toxic chemicals reaching the Great Lakes through the atmosphere from outside the Great Lakes basin.

- Restoration of lake trout populations in Lake Superior.

- Development of health-related indicators for the Great Lakes basin population.

- Development of Lakewide Management Plans for Lakes Ontario, Superior, and Erie.

St. Lawrence Vision 2000 Program

Background

Originally launched in 1988, the St. Lawrence Action Plan is a Canada–Quebec initiative to protect, preserve, and restore the St. Lawrence River ecosystem. This five-year program has been renewed twice since 1988 and has achieved concrete results through concerted efforts on the part of federal and provincial departments aided by the private sector, universities, research centres, non-government agencies, Priority Intervention Zone (ZIP) committees, as well as riverside communities. Efforts are focused on most reaches of the St. Lawrence River and its major tributaries, extending from Lake Saint-François at the Quebec–Ontario boundary to the eastern extremity of the Gulf of St. Lawrence.

Phase III of the St. Lawrence Vision 2000 Action Plan (SLV 2000) was initiated in 1998 and carries out the efforts of the past ten years, in particular reduction of industrial and agricultural pollution, protection and conservation of biodiversity, protection of human health, and involvement of communities located along the St. Lawrence. A new component, related to shipping, was added to this third phase of SLV 2000.

Progress (to March 31, 2001)

The first 13 years of the plan have contributed to a 96 percent reduction in toxic effluent discharges from 106 major plants, as well as to the improvement of water and sediment quality, and the reduction of contaminant concentrations in plants and fish. In addition, 112,712 hectares of wildlife habitat were protected and 27 recovery plans were implemented for over 20 endangered species.

Established to promote local initiatives and public participation, the ZIP committees, of which there are now 14, made significant progress in implementing their Ecological Rehabilitation Action Plans (ERAPs).

In addition, these ZIP committees and other agencies, thanks to funding from the Community Interactions Program, implemented some thirty local projects throughout the year. For example, the Québec et Chaudière-Appalaches ZIP Committee implemented a plan to improve the quality of the natural landscape and the productivity of wildlife habitats in Beauport Bay through clean-up and restoration of the shoreline and littoral zone.

Other water-related SLV 2000 activities associated with the industrial and urban sectors and with navigation and human health should be mentioned.

- **Industrial and urban sectors**: Toxic potential of effluent from 15 municipal treatment plants was evaluated and corrective measures were formulated.

- **Navigation**: Based on studies inventorying sensitive riverbanks and sectors subject to wave action from passing ships in the Sorel-Verchères stretch, the shipping industry adopted voluntary measures to reduce vessel speeds. These measures were introduced in the context of establishing a sustainable shipping strategy.

- **Human health**: A study of drinking water treatment plants along the Yamaska and L'Assomption Rivers revealed that toxins produced by cyanobacteria did not pose a significant risk to the health of people living in these areas. In addition, a campaign launched by the Rive nord de l'Estuaire, Baie des

Chaleurs, and Îles-de-la-Madeleine ZIP committees, in collaboration with stakeholders in the health sector, raised public awareness of the health risks associated with eating molluscan shellfish.

Work on numerical modeling of the St. Lawrence River was accelerated to cover the corridor from Cornwall to Trois-Rivières and began focusing on wildlife and plant habitats.

Detailed reports of these and other achievements frequently appear in the newsletter *Le Fleuve* (http://www.slv2000.qc.ec.gc.ca/bibliotheque/lefleuve/accueil_a.htm).

Northern Ecosystem Initiative

Background

The Northern Ecosystem Initiative (NEI) was launched in 1998 and supports partnership-based efforts to improve our understanding of how northern ecosystems respond to climate change, contaminants, and resource use activities. At the same time, NEI supports the development of indicators and a network to monitor ecosystem changes. The NEI projects address science and capacity-building needs throughout the Canadian North, including the Yukon, Northwest Territories, Nunavut, lowlands of northern Manitoba and Ontario, northern Quebec, and Labrador.

The initiative is guided by the principle of sustainable development and follows an interdisciplinary scientific approach that also seeks to assimilate local and traditional knowledge.

Environment Canada began development of a federal Northern Sustainable Development Strategy, which will be useful in guiding the initiative. In the mid-1990s, the Arctic Borderlands Ecological Knowledge Cooperative developed a community-based contaminants monitoring program in Yukon and the western Northwest Territories.

Progress (to March 31, 2001)

Activities in 2000–01 continued to focus on priority setting and partnership building in preparation for the full implementation of the program next fiscal year. A small number of focus projects were supported to test and demonstrate innovative partnerships and community-based approaches to knowledge acquisition and management.

NEI continued supporting activities of the Arctic Borderlands Ecological Knowledge Co-op, a community-level monitoring program for the northern Yukon. Arctic Borderlands focused on climate change, regional development, and contaminants. The program brought together science, local and traditional knowledge, and opportunities to develop and share information about ecosystems, including water resources.

Work began on the development of a Cumulative Effects Assessment and Management Framework (CEAMF) for implementation in areas of the Canadian North experiencing rapid resource development. At a conceptual level, the development and implementation of CEAMF supports a multi-disciplinary, partnership-based approach to environmental management involving government, Aboriginal organizations, industry, regulators, communities, and ENGOs. Key objectives of the framework included setting regional environmental thresholds, carrying capacities, and acceptable levels of change in terrestrial and aquatic systems.

The Labrador Ashkui Project received support from the NEI in efforts to explore and develop innovative ways of understanding northern ecosystems through the use of Cultural Landscape Units. This project initiated during 1999-2000 was a collaborative effort between Environment Canada, the Innu Nation, and the Gorsebrook Research Institute of Saint Mary's University. The approach connected western science to indigenous Aboriginal knowledge held by the Innu peoples. Ashkui are areas of early or permanently open water in the spring and are especially important to local biota and the Innu peoples. Project activities included water quality characterization of 15 Ashkui sites and analysis for major ions, metals, and nutrients through the season and the study of site productivity, sensitivity to acid rain and heavy metal concentrations.

A comprehensive contaminants inventory database for Labrador was developed. This was a collaborative project between Environment Canada, the Labrador Innuit Association, and the Royal Military College.

Northern Rivers Ecosystem Initiative: Follow-up Activities to the Northern River Basins Study Agreement

Background

Undertaken pursuant to an agreement signed by Canada, Alberta, and the Northwest Territories in 1991, the Northern River Basins Study assessed the cumulative effects of industrial, agricultural, municipal, and other developments on the aquatic ecosystems of the Peace, Athabasca, and Slave River systems. The final report, with key findings and recommendations, was completed and transmitted to ministers in June 1996.

A joint governmental response to the recommendations was released in November 1997. In the response, a number of federal departments (Fisheries and Oceans Canada, Indian and Northern Affairs Canada, Health Canada, Heritage Canada, and Environment Canada), as well as Alberta and the Northwest Territories, made commitments to undertake follow-up activities. These activities included research to improve the understanding of the effects of nutrients and contaminants on the river system and work to understand the interrelationships of hydrology and climate on northern deltas.

Follow-up activities have been cooperatively undertaken by Canada, Alberta, and the Northwest Territories through the Northern Rivers Ecosystem Initiative (NREI). This five-year initiative began in April 1998 under the direction of a steering committee co-chaired by Environment Canada and Alberta Environment. The NREI is scheduled to conclude in 2003. A newsletter, “River News”, has been created to share progress with the public.

Progress (to March 31, 2001)

Approximately 15 research projects were under way during 2000–01. These projects focused on pollution prevention, drinking water, and research into contaminants, nutrients, endocrine disruption effects in fish, dissolved oxygen, and hydrology. Reporting on NREI activities is done through progress reports. The first progress report was released in November 1999 and a second report was under production and scheduled for release during the summer of 2001. In many instances, initiatives undertaken by industry also help to address the recommendations. Where possible, the results of these other initiatives will be included in future progress reports.

2. Water Research

2.1 National Water Research Institute

Background

The National Water Research Institute (NWRI) is Canada's largest freshwater research facility with two main centres, the larger at the Canada Centre for Inland Waters in Burlington, Ontario; the other at the National Hydrology Research Centre in Saskatoon, Saskatchewan. NWRI also has staff located at Gatineau, QC, Fredericton, NB and Victoria, BC, working with other government departments, universities and research organizations to address a variety of water-related issues. With partners in the Canadian and international science communities, NWRI conducts a comprehensive program of ecosystem-based research and development in the aquatic sciences, generating and disseminating scientific knowledge needed to resolve environmental issues of regional, national, or international significance to Canada and to sustain our natural resources and freshwater ecosystems.

Progress (to March 31, 2001)

Identifying Threats to Water Quality

In 2000–01, NWRI worked with other government departments and research facilities to identify major threats to water quality. They produced a list of 15 major threats and prepared a report that described each issue, identified critical questions to be answered, and set out the challenges researchers and governments will face in trying to resolve them. Overall, four major conclusions were listed in the report:

1. The quality of water resources was threatened by a wide range of contaminants.

2. Sources of contaminants included agricultural and forestry practices, municipal wastewater effluents, industrial

discharges, urban runoff, landfill and disposal sites, and natural sources.

3. Emerging global trends (e.g., climate change and pollution) will increase impacts on Canada's water quality and quantity.

4. Impacts on water quality were projected to increase without renewed efforts to understand threats, monitor occurrences and trends, and adopt guidelines and practices to mitigate or eliminate problems.

Research on Nutrients in Canadian Rivers, Lakes and Wetlands

NWRI led a comprehensive assessment of the effects of nutrients on the Canadian environment from human activities. The review painted a clear picture of the extent of the damage. For example, there has been an accelerated eutrophication of certain rivers, lakes, and wetlands, resulting in loss of habitat, changes in biodiversity, and loss of recreational potential. Also, drinking water guidelines for nitrate in groundwaters have been exceeded more frequently across the country.

NWRI is working with water quality managers and researchers in provincial departments, conservation authorities, and universities to gather data on nutrient concentrations, aquatic plant biomass, and related parameters such as water clarity, for Ontario streams and rivers. These data will be analyzed and the information used to propose nutrient guidelines to protect water quality. A similar project is in progress for rivers in western and northern Canada.

Improving Urban Water Management

Research to develop best management practices for controlling storm water has taken place. NWRI investigated chemical speciation of trace metals in storm water ponds and wetlands and showed that significant fractions of metal burdens were in potentially mobile forms and could be released into the overlaying water column. Regular maintenance of management facilities, with removal of contaminated sediments, is important for sustained protection of receiving waters. Research continued on the impacts of urban wastewater on sediment toxicity and benthic communities at nine field sites in Hamilton, Kingston, Ottawa, and Toronto.

Water Supply and Use in the Great Lakes Basin

NWRI researchers co-led a component of a five-year study of water supply and use in the Great Lakes basin. With a focus on climate change issues, the study assessed current and future water use within each of the sub-basins of the Great Lakes relative to groundwater and surface water supplies and ecological requirements. Research began in the Lake Erie sub-basin and progressed in sequence through Ontario, Huron, and Superior sub-basins.

Trends in Contamination of the Great Lakes

Comprehensive spatial and temporal evaluations of sediment contamination in Lake Erie were completed in 2000–01, confirming that trends in critical pollutants such as PCBs showed marked decreases over the period 1971–97. This study also produced information on levels of new and emerging pollutants of concern, including toxaphene, dioxins, and furans. Work in 2001–02 will include analyses of sediment samples from the 1998 Lake Ontario survey and a survey in Lake St. Clair.

Developing New Techniques to Remediate Groundwater

NWRI scientists began a study of biobarriers—a method based on injection of nutrients to stimulate bacterial populations and form an in situ barrier to contaminants in groundwater. Laboratory investigations to simulate the formation of a biobarrier in a fractured bedrock environment were in progress. This method used a large glass fracture table modified to quantitatively measure the formation and stability of the biofilm and is equipped with in situ probes to follow the redox potential of the modified environment.

Research at NWRI showed that a solution of vitamin B_{12} and titanium citrate injected into a laboratory model of an aquifer and well system effectively dechlorinated contaminants. Field trials were in progress at a site where groundwater was contaminated with chlorinated solvents.

Research on Genetically Modified Organisms (GMOs)

NWRI expanded its capacity to research the impacts of genetically modified organisms (GMOs) on aquatic ecosystems and to provide scientific expertise on regulatory implications. Investigations on the effects of GMOs in terrestrial and aquatic ecosystems began. Researchers were developing molecular techniques to monitor transgene movement, exploring methods for extracting DNA from environmental samples and developing a DNA microarray as a research tool.

Persistent Organic Pollutants (POPs)

Measurements of chlorinated paraffins in Lake Ontario water and air were completed in the fall of 2000, adding to previous work from the summer of 1999. Persistence hexa- and heptachloro congeners dominated the toxaphene pattern in water and invertebrates, while more bioaccumulative octa- and nonachloro congeners predominated in lake trout. Lake trout, rainbow smelt, and lake herring were found to metabolize several of the hepta- and octachlorobornanes enantioselectively, indicating that toxaphene is slowly being transformed to less bioaccumulative compounds in the aquatic food web. Data on chlorinated paraffins were contributed to the Commercial Chemicals Evaluation Branch (CCEB) assessment.

In studies of haloacetic acids (HAAs), NWRI conducted research at sites across the country and found higher HAA levels in lakes associated with industrial activities. Lake Superior, which has some industry and low population, had trifluoroacetic acid (TFA) concentrations of about 18 nanograms per litre. This figure increased through the Great Lakes system, with Lake Ontario having TFA concentrations of approximately 150 nanograms per litre. Chloroacetic acid concentration levels were reasonably constant throughout the Great Lakes at approximately 450 nanograms per litre. Lake Winnipeg situated downstream from possible urban sources contained high concentrations, while the lakes in more isolated regions contained the lowest HAA concentrations.

Work continued to increase knowledge of sources and pathways of toxic chemicals in the high Arctic environments through collaborative studies on contaminants in Arctic fish and on deposition of POPs to Arctic glaciers.

Taste and Odour Problems

The Niagara River and the area near Port Credit in Lake Ontario were monitored weekly. Production of geosmin occurred with reduced magnitude in 2000 compared to 1999, and a lake-wide survey in September found geosmin largely in the west end, consistent with the hypothesis that some control may be exerted by lowered nutrient loads. This work was conducted as part of a consortium of researchers with the Ontario Ministry of the Environment and interested municipalities.

Impacts of Endocrine-Disrupting Substances—Agricultural and Municipal

Field studies at several sites in southwestern Ontario were conducted to investigate the potential for animal wastes used in intensive agriculture to enter Great Lakes waterways and expose fish to estrogenic compounds. Trends in the concentration of selected estrogens in tile drains and stream water were determined.

Researchers successfully applied toxic identification evaluation methods to isolate and identify chemicals with potential to alter endocrine systems. Seventeen ß-estradiol and estrone were identified as major estrogenic compounds in several municipal effluents, and a number of androgenic compounds were isolated, including testosterone. Alkylphenols were also identified as possible causative agents in municipal effluents.

Industrial Discharge Impacts on Freshwater Ecosystems

NWRI is developing new tools and frameworks for assessing the cumulative effects of anthropogenic and natural stressors on aquatic biodiversity. Researchers completed the second year of a three-year study examining the effects of effluents from metal mining and pulp mills on the St. John and Little Rivers. Assessment of the impact of nutrient-contaminant interactions on water quality and aquatic biota in northern rivers continued. Investigations into the interactive effects of low dissolved oxygen and pulp effluent

concentrations on aquatic organisms were carried out. This work will assist in determining the adequacy of CCME guidelines for dissolved oxygen.

Impacts of Agriculture on Water Quality and Quantity

NWRI completed a study of water quantity and quality within prairie pothole wetlands surrounded by land farmed by zero and conventional tillage systems. Findings suggested that although zero tillage significantly increased herbicide and fertilizer use, wetland water quality was not significantly affected. However, there was some evidence that changes in soil structure resulting from zero tillage may improve infiltration of snowmelt and reduce recharge of water in the wetlands. Researchers recommended further studies on the impacts of the zero tillage system on wetland hydrology.

Climate Change and Northern Water Resources

A series of studies in the Mackenzie basin on snow, ice, and permafrost have produced more knowledge on the redistribution of blowing snow, the effectiveness of forests at intercepting snowfall, and sublimation rates of snow back into the atmosphere. It was determined that water from melting snow infiltrated easily into frozen organic soils, but not into ice-rich mineral soils, and that slopes with permafrost were efficient at moving water into streams, but those without permafrost often yield no runoff. These results will be used to modify hydrologic models for predicting the effects of climate changes on northern water resources.

NWRI researchers completed a scientific assessment examining the impacts of climate change on river ice jams as part of *Contributions to IHP-V by Canadian Experts* published by the Canadian National Committee (CNC) for the International Hydrological Programme (IHP). Results will assist federal and provincial departments concerned with aquatic ecosystems and climate impacts/adaptations, as well as designers and planners in the hydropower and transportation industries.

Researchers began a compilation of hydro-climatic records from selected river sites that will be used to develop a database for quantifying the frequency of extreme flood events resulting from ice jams. This will allow identification of changes, trends, and variability in the severity of such events over the record period—information needed when planning adaptation strategies to address impacts of climate change.

2.2 St. Lawrence Centre

Background

The St. Lawrence Centre (SLC) has carried out a number of major studies since 1993 on the state of the St. Lawrence River ecosystem, including water quality monitoring and a mass balance study of chemical contaminants. In December 1998, a new strategic plan for research was approved and implemented.

Progress (to March 31, 2001)

Ongoing and new research programs include the following activities:

Impacts of Water Level Fluctuations

- Effects on the biodiversity and biological productivity of ecosystems.
- Effects of area and distribution of wetlands.
- Effects on different uses, including recreational boating.
- Effects on zebra mussel colonization.
- Effects on migration duration and fish recruitment.
- Effects on the physical dynamics of the river, including erosion.
- Effects on contaminant transport.

State of the St. Lawrence River

- Analysis of the short-term and long-term variation in the diversity and the structure of fish communities in the St. Lawrence River.
- Analysis of the introduction, assessment and transfer of exotic species between the Great Lakes and the St. Lawrence River.

- Chemical contamination levels in biota, sediments, and water.
- Development of bioindicators using biomarker responses.
- Presence and impacts of parasites.
- Chemical characterization and study of the transport and deposition of suspended matter in the Cornwall–Massena region.
- Study of the evolution of water bodies in the Montreal area and the impact on urban pollution.

Urban pollution

- Toxicological aspects of urban sewage effluents.
- Impacts of urban sewage on fish and molluscs.
- Source, transport, and fate of endocrine-disrupting chemicals.
- Geochemical behaviour of metals in the plume of dispersion found in urban effluents.

Long-Range Transport of Airborne Pollutants

- Study of the rehabilitation of water courses and lakes damaged by acid precipitation in order to verify the effectiveness of programs to counter acid precipitation.
- Monitoring of water quality in approximately 40 lakes in Quebec and the assessment of acid deposition and its effects.

Partnerships

Biochemical, physiological, immunological, and genotoxicological measurements were performed on the tissue of bivalve molluscs from the Saguenay fjord in order to gain a better understanding of the impact of anthropogenic contaminants on water quality in the fjord and their impact on intertidal biota. SLC, the University of Quebec at Rimouski (UQAR), and the Berlin University of Technology carried out the project under a bilateral agreement between Canada and the Federal Republic of Germany. It culminated in 1998–99 with the publication of a scientific article summarizing four years of field studies. The study appraised the health of the Saguenay fjord and enabled the three partners to develop and validate new biomarker measurements (e.g., those relating to endocrine disruption). One result indicated that impacts on clam populations at upstream stations were generally higher than those at downstream stations, probably due to contaminant discharges linked to industrial activities.

Since 2000, research undertaken with intertidal zone soft shell clams in the Saguenay fjord demonstrated anomalies linked to reproduction, thus indicating the presence and influence of (anti)estrogenic compounds. For example, the results from a joint SLC/UQAR study undertaken in a region of the Saguenay in May 2001 demonstrated a masculinization effect associated with the presence of anti-fouling agents found on the hulls of ships.

In general, the studies undertaken in partnerships have demonstrated that the water of the Saguenay is influenced by diffuse and varied pollution and that certain contaminants are capable of inducing effects that disrupt the hormonal system in bivalves. Other research in partnership are planned to better evaluate the long-term consequences of this type of contamination.

Under a program on the impacts of water level fluctuations, research projects were undertaken with the Quebec provincial government (Societé de la faune et des parcs du Québec), universities (University of Montreal and the University of Quebec at Montreal), and regional components of Environment Canada (Meteorological Service of Canada and the Canadian Wildlife Service).

The structure and diversity of the fish community at a reference site in the St. Lawrence River were analyzed in collaboration with the Aquarium du Québec. Tagging studies were performed in order to describe the migratory movements and the spatial distribution of fish species within the St. Lawrence River corridor.

A model to assess the effects of pesticides on amphibian physiology was validated. This project studied the effects of pesticides on development, enodcrine function, immune response, and parasitism in frogs. The project was funded by the Toxic Substances Research Initiative (TSRI) and involved partners from l'Institut National de Recherche Scientifique–

Institut Armand Frappier and Concordia University.

The toxicity of municipal sewage effluents was determined as part of regional environmental protection activities. The urban effluent discharge program carried out at the St. Lawrence Centre included projects that were related to emerging environmental problems. This program occurred in collaboration with the Communauté urbaine de Montréal, the Institut national de recherche scientifique–Institut Armand Frappier, and the Quebec government (Ministère de l'environnement du Québec and Societé de la faune et des parcs du Québec).

2.3 Other Research Highlights

Environment Canada conducts many water-related investigations in addition to the research undertaken at the two major institutes. Inter-disciplinary endeavours are often fostered in partnership with educational institutions or with the institutes or agencies of other governments and federal departments.

This section highlights examples of water research activities not reported elsewhere in the text. Although not comprehensive, the selections are representative of some of these activities.

Atlantic Environmental Science Network—Freshwater and Estuarine Ecosystems

Background

Early in 2000, Environment Canada initiated the development of an Atlantic Environmental Science Network (AESN) in association with universities located in Atlantic Canada. Based on the successful model of the Atlantic Cooperative Wildlife Ecology Research Network (ACWERN), the broad focus of this research network is to increase the environmental science capacity in the Atlantic Region.

The AESN has three major themes; one is directly related to water research, with its focus on freshwater and estuarine ecosystems. The other themes target climate change and wildlife/biodiversity.

Progress (to March 31, 2001)

The growth of AESN continued during 2000–01. New research capabilities were developed in the region by NWRI. The Freshwater and Estuaries nodes of AESN have been developed and delivered through the Canadian Rivers Institute and University of New Brunswick, and the Estuarine Research Centre at Acadia University, respectively. Three additional nodes with direct water linkages are in development: Environment and Human Health, Climate Change, and Environmental Technologies.

Integrated Modelling of the St. Lawrence River

Background

Since 1997, the Hydrology Section of the Meteorological Service of Canada, Quebec Region (MSC–Quebec Region), has been working with partners on numerical modelling of the St. Lawrence River between Cornwall and Trois-Rivières. The models are designed to provide a better understanding of the physical and biotic environment of the river and how it is used. This work is part of an effort to understand the interactions that exist among:

- Pressures resulting from climate change and from natural and anthropogenic changes (export of fresh water, construction of port infrastructures, etc.).
- Physical characteristics of the river environment (flows, levels, currents, temperatures, substrates, and banks).
- Chemical characteristics of the water (turbidity, colour, and presence of pollutants).
- Life in the river environment, whether it be human (social, economic, or recreational use), plant (aquatic or emergent vegetation), or animal (aquatic and riparian wildlife).

In the context of this approach, the physical environment of the river is considered the focal point of exchanges within the ecosystem. The

approach lends itself well to quantification of the impacts of fluctuating flow and water levels on the various ecosystem components in the St. Lawrence River.

MSC–Quebec Region-Hydrology collaborates with several organizations during research and development of the St. Lawrence River ecosystem including: the Société de la Faune et des Parcs du Québec; the Direction du milieu Hydrique du Ministère de l'Environnement du Québec; the regional branches of Environment Canada (Canadian Wildlife Service, Environmental Protection Branch, St. Lawrence Centre); the Canadian Coast Guard; universities (UQTR, INRS–Eau, Ecole Polytechnique); and the International Joint Commission.

Progress (to March 31, 2001)

Examples of integrated modelling activities carried out include the following:

- Modelling of habitat in spawning areas used by northern pike.
- Modelling of spatial distribution and growth of aquatic plants.
- Modelling of aquatic plant beds.
- Modelling of St. Lawrence River flood plains.

Hydrologic Modelling of the St. John River Basin

Background / Progress (to March 31, 2001)

A coupled atmosphere–hydrology model was developed at Recherche en Prévision Numérique (RPN) by coupling an atmospheric model with the WATFLOOD hydrological model in a project sponsored by B.C. Hydro. In a follow-up study, results were obtained for a case in southern Ontario experiencing heavy precipitation. The WATFLOOD hydrological model contained data from the precipitation forecast of a high-resolution atmospheric model, as well as from precipitation deduced from the King City radar observations. Comparing the resulting streamflows produced by WATFLOOD against the corresponding observed streamflows showed that WATFLOOD was able to produce very realistic streamflows when fed by either the forecast precipitation or the observed radar precipitation.

The comparisons from this coupled atmosphere–hydrology experiment gave much clearer results than are usually obtained from conventional comparisons between forecast precipitation and conventional rain-gauge data, demonstrating the utility of the coupled atmosphere–hydrology system.

An article entitled "Towards the Use of Coupled Atmospheric and Hydrologic Models at Regional Scale" has been published in the *Monthly Weather Review*.

Conditions for the southern Ontario study were almost ideal because of a relatively simple topography. WATFLOOD has been thoroughly tested in the region, with good radar, rain-gauge, and streamflow measurements. More recently, attention has turned to a region in the St. John River basin where the topography is more challenging to model. This work has involved the Maritimes Weather Centre, the Ontario Weather Centre, RPN, and the Atlantic Environmental Prediction Research Initiative (AEPRI).

Progress was made on validating the atmosphere-radar-hydrology system for the Tobique River basin. In order to calibrate the system, the next step involves a more detailed examination of an unregulated basin. This work has progressed gradually since it relied on opportunistic funding.

WATER QUALITY MANAGEMENT
(Part II of the *Canada Water Act*)

Background / Progress (to March 31, 2001)

No activities were conducted during the year pursuant to Part II of the *Canada Water Act.* Part II has never been used. (See summary of provisions, page v.)

PUBLIC INFORMATION PROGRAM
(Part IV of the *Canada Water Act*)

Background / Progress (to March 31, 2001)

The public education program continued to expand its presence on the Internet. The Freshwater Website, part of Environment Canada's Green Lane, provides basic information on a wide range of water-related topics, comprehensive educational materials (e.g., *A Primer on Fresh Water, Water Fact Sheets)*, and the full text of key water publications (e.g., *Federal Water Policy*, *Canada Water Act, and the Canada Water Act Annual Report*). Links to specific issues at other governmental and non-governmental sites across the country are regularly updated and expanded. This year saw the addition of a new section on Bulk Water Removal and Water Export, a page of Frequently Asked Questions, a Subject Index, and links to eGroups and Listserves. *Every Drop Counts! A Speaker's Kit on Water Conservation and Water Efficiency* was also revised, converted to a PowerPoint presentation, and offered for downloading on the Website. The Freshwater Website can be accessed at *http://www.ec.gc.ca/water.*

A third edition of the publication *Water: No Time to Waste—A Consumer's Guide to Water Conservation* was produced on a printer-ready diskette. These diskettes are loaned, free of charge, to organizations (municipalities, community groups, etc.) wanting to produce large quantities of the publication to distribute as part of their own public awareness campaigns.

APPENDIX A

AGREEMENTS

Canada Water Act Agreements* Ongoing During 2000–2001

Apportionment and Monitoring Programs

- Agreements on water quantity surveys with all provinces and with Indian and Northern Affairs Canada for Yukon and the Northwest Territories
- Canada–Quebec Protocol on Administrative Arrangements under the Canada–Quebec Agreement on Hydrometric and Sedimentological Networks in Quebec
- Master Agreement on Water Apportionment in the Prairie Provinces (Prairie Provinces Water Board)
- Water quality monitoring agreements with British Columbia, Newfoundland, New Brunswick, Manitoba, Prince Edward Island, Yukon, and the Northwest Territories
- Agreement Respecting Ottawa River Basin Regulation

Water Management Programs

- Agreement Respecting Water Resource Management and Information Exchange in the Yukon and Alsek River Basins
- Mackenzie River Basin Transboundary Waters Master Agreement

Flood Damage Reduction Program

- Agreements on policies in designated flood-risk areas with British Columbia, Newfoundland,** Nova Scotia,** and Quebec.**

* For which *Canada Water Act* authority exists (in most cases, by Order in Council).
** Expired by March 31, 2001.

APPENDIX B

SUMMARY OF FLOOD DAMAGE REDUCTION PROGRAM

Designation of Flood-Risk Areas Under the Flood Damage Reduction Program, by Province/Territory*

Province/Territory	Communities	Designations
Alberta**	20	18
British Columbia	211	81
Manitoba**	24	17
New Brunswick**	88	13
Newfoundland	43	35
Northwest Territories**	9	9
Nova Scotia	20	5
Ontario**	273	102
Quebec	274	44
Saskatchewan**	20	17
Total	982	341

*No change during 2000–01; the numbers are approximate. Prince Edward Island and Yukon did not join the program. One designation can cover one or more communities in a flood-risk area. Although the procedure of designation was not part of the arrangement for the mapping of flood risks on Aboriginal lands, approximately 40 reserves or communities were mapped with the full cooperation of band councils.

** No policy agreement on designations during 2000–01.

APPENDIX C

FOR MORE INFORMATION

Selected Web Sites

Environment Canada

Freshwater Site (including *Canada Water Act* Annual Report)
www.ec.gc.ca/water

Clean Water
www.ec.gc.ca/envpriorities/cleanwater_e.htm

Weather and Meteorology
www2.ec.gc.ca/weath_e.html

Ottawa River Regulation Planning Board
www.ottawariver.ca

Research Institutes

National Water Research Institute
www.cciw.ca/nwri/nwri.html

St. Lawrence Centre
www.qc.ec.gc.ca/csl/index_en.html

Ecosystem Initiatives

Atlantic Coastal Action Program
www.atl.ec.gc.ca/community/acap/index_e.html

Georgia Basin Ecosystem Initiative
www.pyr.ec.gc.ca/GeorgiaBasin

Great Lakes 2000 Program
www.on.ec.gc.ca/glimr

Northern Ecosystem Initiative
www.mb.ec.gc.ca/nature/ecosystems/nei-ien/dh00s00.en.html

Northern Rivers Ecosystem Initiative
www.pnr-rpn.ec.gc.ca/nature/ecosystems/nrei-iern/index.en.html

St. Lawrence Vision 2000 Program
www.slv2000.qc.ec.gc.ca/index_a.htm
Newsletter: *www.slv2000.qc.ec.gc.ca/bibliotheque/lefleuve/accueil_a.htm*

Other Federal Departments

Agriculture and Agri-Food Canada
www.agr.ca

Fisheries and Oceans Canada
www.dfo-mpo.gc.ca

Health Canada
www.hc-sc.gc.ca

Indian and Northern Affairs Canada
www.ainc-inac.gc.ca

Natural Resources Canada
www.NRCan-RNCan.gc.ca

Federal–Provincial

Canadian Council of Ministers of the Environment (CCME)
www.ccme.ca/

Interprovincial Rivers

Mackenzie River Basin Board
www.MRBB.ca

Ottawa River Regulation Planning Board
www.ottawariver.ca

Prairie Provinces Basin board
www.mb.ec.gc.ca/water/fa01/index.en.hyml

International

Arctic Council
www.arctic-council.org/

International Joint Commission
www.ijc.org

United Nations Environment Programme: GEMS/Water Global Environment Monitoring System
www.cciw.ca/gems/gems.html

United Nations University: International Network on Water, Environment and Health
www.inweh.unu.edu/inweh

Associations, Networks, and Journals

Canadian Water Resources Association
www.cwra.org

Canadian Water and Wastewater Association
www.cwwa.ca

Ecological Monitoring and Assessment Network (EMAN)
www.cciw.ca/eman/intro.html

Federation of Canadian Municipalities
www.fcm.ca

Great Lakes Information Network (GLIN)
www.great-lakes.net/

Water Quality Research Journal of Canada (Canadian Association on Water Quality)
www.cciw.ca/wqrjc/intro.html

WaterCan
www.watercan.com

Enquiries

General Information

Watershed Management and Governance Branch
Water Policy and Coordination Directorate
Environmental Conservation Service
Environment Canada
Ottawa, ON K1A 0H3
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Fax: (819) 994-0237

Publications (Public Information Program)

Inquiry Centre
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Fax: (819) 953-2225
E-mail: enviroinfo@ec.gc.ca

National Water Research Institute

Science Liaison
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867 Lakeshore Road P.0. Box 550
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Fax: (905) 336-6444

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National Hydrology Research Centre
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Fax: (306) 975-5143

Regional Offices

Environmental Conservation Branch
Environment Canada
Atlantic Region
17 Waterfowl Lane
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Fax: (506) 364-5062

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Meteorological Service of Canada
Environment Canada
Ontario Region
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Fax: (905) 336-8901

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Fax: (604) 664-9126

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Environment Canada
Quebec Region
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Fax: (514) 283-9451

Environmental Conservation Branch
Environment Canada
Prairie and Northern Region
4999-48 Avenue, Room 200
Edmonton, AB T6B 2X3
Tel.: (780) 951-8700
Fax: (780) 495-2615

Prairie Provinces Water Board

Transboundary Waters Unit
Environment Canada
Prairie and Northern Region
2365 Albert Street, Room 300
Regina, SK S4P 4K1
Tel.: (306) 780-6042
Fax: (306) 780-6810